CIDCO Smart City
Navi Mumbai (South)
• Objective Area: Transit Oriented Development
• Objective Area: Quality of Life
• Project in Focus: Urban Transport Terminal
• Project in Focus: Khandeshwar Railway Station Precinct

Knowledge Lab
Knowledge Exchange @CIDCO

Data Sheet: Smart Cities
• Surat: Urban service delivery and financial sustainability
• Kochi: Leveraging water transport for effective multi-modal connectivity

Inclusive Planning
• Cities: An urban play-lab for children

Initiatives @ Smart City Lab
Value Capture from Infrastructure Investments for Smart Cities

Smart City Corner
• Transit oriented development: Curitiba-Transforming City with Bus Transit
• Conversation:
  • Urban Density
  • Enablers for TOD
• Emerging Ideas:
  #IndiahasathingwithBicycles
  • Innovation:
    • Designing for Diversity: Tools for optimised affordable housing for Indian cities
    • Valet EZ: Transforming the parking landscape one revolution at a time

CIDCO Smart City Lab @ NIUA

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National Smart Cities Mission
Smart Cities Challenge Round II
TOD under CIDCO Smart City Plan

CIDCO is one of the first organisations in India to support and experiment the concept of Transit Oriented Development (TOD) by exploiting the air space above railway stations. Vashi and Belapur stations developed in the late 90s demonstrate such developments. Among many characteristics of ‘Smart Cities’, one important aspect is that, in a Smart City, residents should be able to either walk to their work places or have access to quality public transport system, so they can reach their work places quickly. CIDCO has been developing the bus transport and railway transport systems in Navi Mumbai with such motive. CIDCO’s ground breaking concept of ‘Railway Station cum Commercial Complex’ makes it a major driving force behind the city’s economic development.

Under the head of TOD, in the CIDCO Smart City Plan, CIDCO has launched several rail projects in partnership with central railways, and has also ventured into metro development, improvement of bus transportation, alternative modes of transport including ropeway connectivity, and improvements in parking through smart parking.

CIDCO Navi Mumbai Metro

The metro is an upcoming smart transit connectivity project that connect the nodes Belapur, Kharghar, Taloja, Khandeshwar and proposed Navi Mumbai international airport. Owning to the pressure of increasing population on the modes of transportation, a need to establish connectivity between all the residential nodes with alternative transportation modes was felt. During CIDCO’s review of the master plan for transportation connectivity in view of proposed Navi Mumbai Special Economic Zone (NMSEZ) and Navi Mumbai International Airport (NMIA), internal deliberations with M/s DMRC and M/s LEA Associates South Asia Pvt. Ltd recommended metro rail in Navi Mumbai. Government of Maharashtra authorised CIDCO as the implementing agency for the Belapur- Pendhar-Kalamboli- Khandeshwar metro line, under the Indian Tramway Act 1886, on 30th September 2010.

The proposed Navi Mumbai metro corridor has been planned in order to provide efficient transportation to the fast growing population of Navi Mumbai. The metro system will provide rail connectivity between Central Railways’ existing network and the far flung spread out areas of Navi Mumbai which are fast developing as important business and residential nodes.

Suburban Rail Expansion

A suburban rail system runs across the Mumbai Metropolitan Region (MMR) and forms the backbone of the metropolitan area’s commuters transport system. Presently, this suburban rail system is one of the most crowded and overloaded suburban systems in the world. To meet the upcoming mobility requirements, Indian Railways (IR) and Government of Maharashtra (GoM) through Mumbai Railway Vikas Corporation (MRVC) Ltd., Metropolitan Regional Development Authority (MMRDA) and the World Bank (WB) planned a comprehensive investment scheme for improving and expanding the transportation network of Mumbai Metropolitan Region, through Mumbai Urban Transport Project (MUTP). Under the MUTP, CIDCO has taken up the Railway project work under cost sharing basis with Central Railway in the proportion of 2:1 for the following rail works:

- Doubling of Belapur-Panvel corridor
- Development of Belapur- Seawood- Uran corridor
- Development of Panvel- Karjat corridor
- Running of 12 EMU coaches on Harbour corridor
- Thane-Thurbe- Nerul- Vashi Corridor

Development of Urban Transport Terminals

Navi Mumbai sub-region is one of the fastest growing sub-region in Mumbai Metropolitan Region (MMR). It is estimated
that, the population of Navi-Mumbai will reach 4 million by 2031 (1.7 million in 2011) and the employment is expected to increase to 1.4 million by 2031 (0.6 million in 2011). Comprehensive Transportation Study (CTS), carried out by Mumbai Metropolitan Region Development Authority (MMRDA) for Mumbai Metropolitan Region (MMR) proposed extensive transport network for the travel needs of MMR for the horizon period up to 2031. CTS proposes urban and regional transport terminals-

- Development of greenfield interstate bus terminus (ISBT) at Panvel
- Development of bus terminus and depot at Kharghar
- Development of railway terminus station at Panvel
- Ropeway Connectivity at Vashi

Vashi Railway Station is the gateway to Navi Mumbai and it is one of the most populous railway stations with a large catchment area of up to 3 km radially. The railway station is connected to the Vashi Node through a major arterial road. There is a necessity for an alternative system having exclusive right of way, which will act as a feeder to the mass transport system. In the absence of this, roads are occupied with many vehicles thereby deteriorating the level of service of the major arterial road in Vashi.

With the concurrence of Government of Maharashtra, Tata Realty and Infrastructure Ltd. (TRIL), a subsidiary of Tata Sons operating in urban transport sector, has submitted a proposal to CIDCO to develop an Urban Ropeway System between Vashi Railway Station and Sector 28, Vashi, considering the high volume of commuter traffic crossing the Sion Panvel Highway to the residential sectors. This is part of a comprehensive proposal by TRIL to develop Ropeway Connectivity Projects in Mumbai and Navi Mumbai. CIDCO has been designated as the nodal agency for the project in Navi Mumbai. Accordingly, TRIL has been mandated by CIDCO to prepare a detailed project report and financial proposal under Swiss Challenge bid under PPP mode.

**Smart Parking**

CIDCO Smart Parking is an intelligent parking management system that automates the parking management functions by providing solutions such as access control, revenue management, parking enforcement and permit management, security and surveillance, automated parking, parking guidance and slot management. Smart parking management systems enable parking site operators to offer their customers various parking conveniences such as minimal time wastage, cashless payment options, enhanced vehicle security, and options for pre-booking parking spots. According to industry data, usage of smart parking management can prevent up to 30% of traffic congestion, and save up to 25% of the parking revenue loss due to employee pilferage and vehicle driver’s malpractices. The Corporation has developed many public parking spaces, mainly in the forecourt areas of the various Railway Stations on the Mankhurd-Panvel and the Thane-Turbhe railway line. At present the Corporation has appointed vendors for collection of parking charges. It is proposed that these parking spaces be taken up for implementing the smart parking solutions, so as to provide the citizens of Navi Mumbai a mobile app based Smart Parking solution which will not only solve the gruelling parking issues but will also be a huge step towards making the city a technology and citizen friendly smart city.

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Quality of Life under CIDCO Smart City Plan

CIDCO envisages that one of the key building blocks of a smart city is to develop Navi Mumbai as a city of choice for its residents by offering liveability and quality of life. Special projects such as Nature Park, Golf Course, Central Park, Riverfront development, are proposed to promote greenery and ensure environmental sustainability. These are conceptualised with a view to not only add value to the city and offer its citizens opportunity for recreation, but to also make water bodies more accessible to the people so that unscrupulous activities do not take place and degrade the environment.

As part of this initiative, CIDCO has undertaken a range of projects, namely riverfronts, water fronts, marina and open spaces among others. CIDCO has worked out a comprehensive model towards protecting and enriching open spaces and is investing Rs. 635 Crores by 2019 in these quality of life initiatives.

Development of Parks and Open Spaces

The development of open spaces and its accessibility to all is a part of the social infrastructure, which is an important index for development of Smart Cities. The open spaces of a city play an important part in the overall wellbeing of its residents. They are rightfully called the lungs of a city, and are a good measure of a city’s health quotient.

Marina is proposed in Belapur for an overall length of 1.8 km. The selected area may be divided into four stretches:

- Marina, garden, water recreation, plaza, skating rink and playground
- Mangrove area
- Divale village
- Promenade at Sector 11

It is proposed to join the different types of activities in the four stretches by a continuous ‘Water-Front Walkway’. It will include pathway on land, bridges to cross the water, boardwalk at mangroves and promenade at sector 11.

Gaadhi Riverfront

Navi Mumbai is bestowed with a generous water front in combination with hills. At the geographic centre of Navi Mumbai, the in-creek makes an interesting pattern with Gaadhi River, flowing from Panvel, curving to the north and running into the Creek. It is deemed necessary to conserve the river and hence handed over to Navi Mumbai Municipal Corporation for maintenance and upkeep. The Nodes to the East and South of Navi Mumbai are partially developed and still with CIDCO. Open spaces and parks are proposed in these nodes, viz. Kharghar, Panvel, Kalamboli, Kamothe, Ulwe, and Dronagiri.
increase the association of people with the river by developing and opening up the riverfront for public use.

The total stretch of river available for development is 2.2 km. This surrounding area is mostly developed as typical residential townships. The land available for riverfront development is the 15m mandatory green belt which is being designed as a promenade. Patches of land available in the form of open spaces will be integrated with the promenade.

The riverfront proposal was decided based on area available, river-bed depth, abutting land use, access, view points, existing plantation and terrain. The proposal also consists plots that are carved out for sale/lease purpose that would be given for shops and restaurants.

Station Area Development
Khandeshwar Plaza
Khandeshwar Railway Station Precinct is a site in Navi Mumbai that has the characteristics of potential development and change into a multi-activity hub. This location is proposed to be serviced by three different city level transportation systems – railways, metro and bus. This unique combination of transport options make this area one of the spots in the city with significant development anticipated around it. Undoubtedly, the precinct will witness a large flow of commuters accessing all modes of public transport. CIDCO Smart City Plan proposes to develop this station area to a vibrant hub. Connected possibilities of real estate development for revenue generation as well as provision of socio-cultural and recreational functions for residents and visitors of this part of the city is envisioned around Khandeshwar Railway Station.

Integrated Complex at Seawoods
An Integrated Complex at Seawoods is proposed on CIDCO owned land measuring 16.5 Ha. The site at Seawoods has a permissible FSI of 1.5 which will be translated into a development of approximately 25 lakh square feet. The project involves the development of a railway station and a commercial complex along with all the necessary ancillary infrastructure facilities (e.g. parking). Unlike other railway station projects by CIDCO, which have been developed by CIDCO using its own resources, at Seawoods, it is proposed to appoint a developer for the construction. For developing the facilities through a third-party, it was decided that the developer would be required to construct the railway station at its own cost as per the CIDCO’s specifications and thereafter handover the same to CIDCO.

Conservation of Belapur Fort
‘Belapur Fort’ is a monument of major historical reference in Navi Mumbai built in 1560-70 by Siddis of Janjira (known as shabaz). The fort was recaptured in 1682 by Portuguese to serve as an southern entry to Thane, and to strengthen the defence from Maratha forces. Later, the British captured the fort in 1817 and partially demolished the fort under the policy of razing any Maratha stronghold in the area. CIDCO has initiated the conservation of the fort to conserve the ruins and bring back the history to the fore. This project will add around 2 Ha land to recreational space of the city.

City Surveillance Project and Traffic Management

Navi Mumbai International Airport, CIDCO Exhibition Centre, SEZ, Navi Mumbai Metro Projects and other projects of international importance provide Navi Mumbai with ample opportunities in regards with trade and commerce. These make the city a potential target for inflicting maximum damage in terms of loss of life and property due to various anti-national/terrorism related and criminal activities. There is thus proposed to implement a comprehensive security management system for the city, which will improve the overall security cover and assist the Navi Mumbai Police in improving the law and order situation of Navi Mumbai. CCTV surveillance is proposed for this purpose.

The entry of new business and companies in Navi Mumbai will lead to increase in the number of job opportunities with further increase in population and increase in traffic on the roads. This leads to an induced demand for better road infrastructure. To keep up the standards of Navi Mumbai in terms of traffic flow and comfort for the commuters on the road, the need for an Intelligent Traffic Management System (ITS) is raised. CIDCO proposes ITS in the Navi Mumbai through-

- Area Traffic Control (ATC)
- Electronic Area/Road Pricing
- Smart Bus Stops

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Navi Mumbai sub-region is one of the fastest growing sub-region in Mumbai Metropolitan Region (MMR). It is estimated that, the population of Navi-Mumbai is expected to increase to 4 million by 2031 (1.7 million in 2011) and the employment is expected to increase to 1.4 million by 2031 (0.6 million in 2011). Comprehensive Transportation Study (CTS), carried out by Mumbai Metropolitan Region Development Authority (MMRDA) for Mumbai Metropolitan Region (MMR) proposed extensive transport network for the travel needs of MMR for the horizon period up to 2031. CTS proposes inter-city bus terminals, inter-state bus terminals, inter-city rail terminals, and others such as truck terminals, and passenger water transport terminals.

Development of greenfield interstate bus terminus (ISBT) at Panvel
CTS proposed an Inter-State Bus Terminal in Navi Mumbai. The project will develop a state-of-the-art transport infrastructure in the city. It will also control and regulate informal drop off/pick-up points being used on the Sion - Panvel expressway by private operators.

The proposed ISBT at Panvel will serve as the main boarding and alighting point in the city for all the passengers traveling outside city and state. Appreciating the need and demand for ISBT, it is proposed to appoint consultants for carrying out techno-economic and financial feasibility (TE&FS) including bid process management for selection of agency for the development of the ISBT. A budget of 100 Crore is set aside from the CIDCO Smart City Plan for this project which is proposed to be completed in 2018.

The ISBT proposed at Panvel will be the first Inter State Bus Terminus in the Mumbai region. The terminal will facilitate concentration of bus transport activities, improve level of service and safety to commuters and invite commuters from all parts of Navi Mumbai via shuttle services. The terminal will have facilities such as inter-state bus services, inter- city and intra- city bus services, tourism offices of all states, railway booking counters, ATMs, food courts, shopping complex, rest rooms, cloak rooms, cyber cafe, postal facilities etc.

Development of Bus Terminus and Depot at Kharghar
CIDCO Smart City Plan proposes a bus terminus and depot at Kharghar with an aim to decongest the sub-urban trains and provide alternative modes of transport with connectivity to all parts of Navi Mumbai. The bus depot is proposed over an area of 2.7 Ha in Kharghar node. Proposed facilities in the terminus include terminus building, canteen facilities, bus Q-shelters, parking and taxi/ auto stand. The depot along with the terminus is proposed to include maintenance/ docking pits, maintenance building, fuel station, parking, rest room facilities for drivers and washing bays.

Development of Terminus Station at Panvel
The Central Railway and Konkan Railway have their main line and sub-urban line passing through Navi Mumbai. But presently, only 6 terminals namely, Dadar, CST, LTT Kurla, Bandra and Mumbai Central are serving entire Mumbai Metropolitan region (MMR), which is inclusive of 7 Municipal Corporations of Greater Mumbai, Thane, Mira-Bhyandar, Kalyan-Dombivli, Ulhasnagae, Vasai- Virar and Navi Mumbai. The existing terminals are already overcrowded and not all these are well connected with Navi Mumbai. The nearest terminus LTT Kurla at a distance of 20 km, is not connected through direct suburban service from Navi Mumbai. The only existing terminal directly connected by suburban services with Navi Mumbai is Mumbai CST, which is already crowded and at a distance of 48 km from Panvel. Under these circumstances, it was deemed necessary to develop a coaching terminal for long distance trains in Navi Mumbai.

Panvel is identified as the most suitable location in view of its strategic location, having direct connectivity towards northern and western India via Diva-Vasai, to coastal Karnataka and Kerala via Konkan Railway, eastern part via Kalyan-Nashik and to Hyderabad, Bangalore and Chennai via Karjat-Pune. Panvel is already a main station in Navi Mumbai and is well connected by suburban train services as well as by road. Additionally, availability of Railway and CIDCO land at Panvel enables the terminus to be operational in phases with minimum work. The development of terminus at Panvel is proposed under cost sharing mechanism between Central Railway and Government of Maharashtra.

The project is significant also due to proposed Navi Mumbai International Airport in the vicinity. Apart from providing upgraded train transport facility, boarding of long distance trains, the aspects of commercial exploitation of land used for the railway facility is also explored under the principles of transit oriented development.
Railway precinct areas in Navi Mumbai are becoming pivotal points of urban life and activities with a range of functions and services springing around such places. Railway stations such as Vashi and Belapur demonstrate this with the utilisation of air rights of the station premises for revenue and real estate development. Station areas have become more than just places of transit, and are moving towards becoming vital components of the public space network for the city as a whole. The concentration of people and their diversity allow such places to develop into multi-dimensional destinations for a wide range of purposes like work, shopping, learning, recreation etc. Given such a scenario of potential and dynamic development possibilities in and around rail stations, it becomes important to imagine such areas holistically and generate a comprehensive development strategy encompassing all present and future needs while integrating them appropriately with the larger vision of the city.

Khandeshwar Railway Station Precinct is a site in Navi Mumbai that has the characteristics of potential development and change into a multi-activity hub. This location is proposed to be serviced by three different city level transportation systems – railways, metro and bus. This unique combination of transport options make this area one of the spots in the city with significant development anticipated around it. Undoubtedly, the precinct will witness a large flow of commuters accessing all modes of public transport. CIDCO Smart City Plan proposes to develop this station area to a vibrant hub. Connected possibilities of real estate development for revenue generation as well as provision of socio-cultural and recreational functions for residents and visitors of this part of the city is envisioned around Khandeshwar Railway Station. The scope of the project and the actions are as under-

- Developing a multi-modal transit hub as a new urban centre for this part of Navi Mumbai
  **Action:** Safe, barrier-free, clear and efficient movement pattern connecting across all movement choices viz, train, bus, metro, etc

- Generating a diverse program of uses that catalyze the nodal character of the precinct
  **Action:** Appropriate functional mix to achieve diverse, public engagements and attractions

- Formulating an integrated development framework incorporating transportation and other allied functions
  **Action:** Adequate revenue-generating development parcels for realising the proposal in PPP or similar partnership models

- Creating a modern contemporary image through three dimensional disposition of built form and open space in consonance with the natural setting
  **Action:** Balance development between built form and domains of nature as well as develop the precinct based on the principles of Transit Oriented Design

- Developing a destination for a wide range of user groups
  **Action:** Create a variety of public urban spaces (squares, plazas, streets, recreational spine, etc.) dedicated both for transit operations as well as multi-dimensional activities

With the implementation of this project, around 40 hectare area will get segregated in an organised manner with due consideration of metro and local railway station in close proximity. The plaza proposed will add on to the public space in the city with 20% of total area of the development exclusively assigned for recreational activities.

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Adelaide City Council Representatives @ CIDCO
12th August 2016
CIDCO Representatives met with the delegation from Adelaide City Council at CIDCO, Navi Mumbai for a knowledge exchange on e-government solutions. Mr. Suresh Babu, Ms. Geeta Pillai and Ms. Amritha Pai presented CIDCO’s work to the visiting delegation. Mr. Faiyaz Khan presented CIDCO’s IT Solutions, including e-Office, Legal Tracking System and CLAIMS (CIDCO Land Information Management System). Council-woman Natasha Malani and the Director of Economic Development, Matt Grant, Presented the Adelaide’s online platform for managing the city’s different services. The visit was facilitated by Austrade.

French Delegation @ CIDCO
31 August 2016
The CIDCO team of planners and transportation engineers met a French delegation comprising of two companies; IXXI, with expertise in ticketing systems and revenue management of multimodal transportation networks and Lumiplan, with experience in passenger information systems and transportation logistics. The meeting was facilitated by BusinessFrance, a trade body for French companies and businesses while the coordination on the Indian side was done by the NIUA-CIDCO Smart City Lab. The CIDCO team was interested in understanding the current ticketing systems in France and the complexities arising from multiple transport operators. Moreover, the latest innovations occurring around the theme of real time passenger information systems were discussed. The interaction ended with a discussion of the Navi Mumbai Airport and the Navi Mumbai Metro.

Exposure Visit by RICS Students@ CIDCO
27 September 2016
MBA Infrastructure Management Students from RICS visited CIDCO for an exposure visit. Mr. Mankar, from Planning, Mr. Shabade from Transportation & Communication and Mr. Mahadev from NMIA participated in the interaction. They discussed the CIDCO’s Smart City Projects, NMIA and Highway Connectivity for the Airport.

International
Smart City Expo, Puebla
16 - 18 February
Mr. Ravindra Mankar and Ms. Anupama Karanam participated in the Smart City Expo held at Centro Expositor in Pueblo, Mexico. The conference had more than 100 speakers in three days of plenary presentations and parallel sessions, with the participation of over 500 cities and 80 companies. The key themes for discussion were urban and technologies digital entrepreneurship, equitable cities, cities and alive participants, sustainable cities, urban planning and mobility.

Global Mobile Vision
6 - 8 October, 2016
Mr. Faiyaz Khan participated in the Global Mobile Vision Conference from 6th to 8th October in Seoul. The conference included an exhibition of various tech solutions developed by Korean companies. Mr. Khan also visited the Disaster Management Centre at the Seoul City Hall and the Songdo International Business District.

Domestic
Leadership Through Self Discovery
8 - 12 August, 2016
Mr Tulsidas Parab, Mr. Sudhakar Visale, Mr. Prabhakar Phulare and Ms. Amritha Pai participated in a training program “Leadership Through Self-Discovery” organised by Administrative Staff College of India. The training was held in Hyderabad from 8th to 12th August. The program included series of talks and interactive decision making exercises. It focused on developing public speaking skills, team management techniques and building a goal oriented approach through decision making role play exercises.

Sustainable Smart Cities India Conference
22 - 23rd September, 2016
Ms. Pranjali Mane, Mr. Avinash Shabade, Ms. Shyla B. Andrews and Mr. S.K. Verma participated in the 3rd Sustainable Smart Cities India Conference in Bangalore. The speakers at the conference included government representatives, consultants and vendors. It involved presentations from different industry sectors, all focusing on the theme of sustainability.

Effective Land Acquisition Rehabilitation and Resettlement
26 - 30 September, 2016
Mr. Kishan Jawale, Ms. Vaibhavi Vishal Mahalkar and Mr. Shwetal Kanwalu participated in a four day training program on the LARR Act at the Administrative Staff College, Hyderabad. The program focused on the interpretation and implementation of the LARR Act.
SURAT
Urban service delivery and financial sustainability

VISION
Smart Utilization of Surats’ Potential for enhancing Quality of life for the citizens by Providing Equal Access to Best Quality Physical Infrastructure, Social Infrastructure and Mobility; Thus making Surat a Futuristic Global city with focus on enhancing economy, protecting the ecology and preserving the culture of the city.

CITY SELF-ASSESSMENT

- Population: 44,67,797
- Area: 335.82 sq.km
- Density: 13304/sq.km
- Literacy rate: 87.89%
- Total SCP project Cost: 2597 Crore INR
- Gender Ratio: 754
- Slum Population: 10.46%
- Unemployment: 0.29%
STRATEGIC FOCUS

- Improved transport and mobility
- Futuristic development - to make Surat a Global City
- Environment and Climate Change
- Improved IT connectivity and smart features
- Smart development through retrofitting

AREA BASED PROPOSAL (ABP) RETROFITTING

8.69 sq.km (2.58%)
1802 Cr. INR (69.39%)

- 24x7 Quality Water Metered Supply
- Smart Sewage Management with Recycle-Reuse Capabilities
- Effective Storm Water Management and Recharge Mechanism
- Trade Facilitation by Setting up Logistic Park and

PAN CITY PROPOSAL (PCP)

795 Cr. INR (30.61%)

- Renewable Energy Generation
- Smart Open Spaces and Smart Parking Facilities
- Affordable Housing and Inclusiveness
- Smart City Systems

• SMAC Centre
• Integraed Transport Mobility Administration Centre
• S-Connect Card Management System
• ERP with GIS Platform
• Connected Surat
• Automatic Fare Collection System

Legend
1. APMC Market
2. Amusement Park
3. Millennium Market
4. Ragukul Market
5. Ji Ac Market
6. Bombay Market
7. Parsi Bhashu
8. SMIMFR Hospital
9. Anjana Sewage Farm
10. Solid Waste Transfer Station
11. MD Landmark

BRTS Phase – 2
In operation
BRTS Phase – 3
On verge of completion
BRTS Phase – 3
Final stage

Legend
- Slums
- ESR
- Water Distribution System

1. Road
2. Canal Road
3. Canal
4. New Road
5. Old Road
6. River
Surat’s financial mobilisation plan for its smart city proposal (SCP) exemplifies its approach and success in financial management reforms that other Indian cities struggle with. Surat has the most efficiency of resource allocation along with Ahmedabad and Chennai among the lighthouse cities. The per capita smart city expense of Rs 5820 is the third lowest amongst the lighthouse cities and is accompanied by a balance in the distribution of budget across pan city and area based proposal, 31 % vs 69% respectively. The city has tapped into five of the six sources of revenue identified by the pool of lighthouse cities.

Surat has assessed to a good extent, the proportion of capital financial needs for its smart city plans against its annual municipal revenues. This ratio (revenue capacity) for Surat is 0.9, signifying a lower dependence on external grants for scaling up the smart city process. The municipal revenues for the city are high enough for an increased adoption of smart technologies beyond the mission.

The city has already implemented Jawaharlal Nehru National Urban Renewal Mission (JnNURM) property tax reforms and has been rated AA by the credit agencies, thereby enabling it to borrow from the markets if needed. The city demonstrates its commitment to make projects operationally sustainable by planning to recover 120% of the O&M costs for the smart city projects.

The pan city proposal for Surat city is envisaged to maximise the benefits out of the public services base. The proposal will aim to improve public services and citizen interface. It will be centered around the theme of “citizen friendly Surat” through intelligent transport and connectivity. The idea is to integrate various services and offer citizens a variety of options to avail these services in a convenient and cost-effective manner. This pan city solution should also provide real time data so that service delivery improvement process continues by undertaking data analytics. Providing optical fiber connectivity to home, open data access and multi-application smart card are the other components.
MEASURABLE IMPACT

AREA BASED PROPOSAL

SOCIAL
• Affordable housing
• Quality of life
• Access to schools, anganwadis and health centers
• Job opportunities
• Inclusive mobility & access
• Safety & surveillance

GOVERNANCE
• Water supply
• Drainage
• Solid waste management
• User charge recovery
• Property tax collection
• Quality of service delivery
• Emergency response time
• Citizen engagement
• Surveillance
• Infrastructure maintenance & management

SPATIAL
• Walkability
• Use of non-motorised modes of transportation
• Affordable housing
• Open space configuration
• Efficient land use

ENVIRONMENTAL
• Storm water management
• Sewage management & treatment
• Vehicle speeds
• Alternative energy sources
• Congestion
• Carbon footprint
• Pollution
• Water & energy consumption

ECONOMIC
• Business environment
• Textile trade
• Innovation & incubation of new businesses
• Affordable housing
• Employment opportunities

PAN CITY PROPOSAL

PUBLIC SERVICES
• Transport
• Parking
• Mode share
• Road safety
• Response to emergencies
• Air quality
• Use of public transport
• Women’s safety
• Incident management
• Tourist experience
• User- interface for service delivery

GOVERNANCE
• Transparency in governance
• Accountability
• Interoperability between agencies
• Productivity
• Operational controls
• Transit revenue loss capture
• Asset management through data driven decision making
KOCHI
Leveraging water transport for effective multi-modal connectivity

KOCHI leverages the strength of water transport in the city for an effective multi-modal transport connectivity to combat differential levels of development between eastern mainland and western islands.

VISION
Transform Kochi into an inclusive, vibrant city of opportunities with efficient urban services, sustainable growth and ease of living

CITY SELF-ASSESSMENT

Population
6,02,046

Area
107.13 sq.km

Density
5620/sq.km

Literacy rate
97.36%

Total SCP project Cost
2076 Crore INR

Gender Ratio
1031

Slum Population
0.86%

Unemployment
4.45%
STRATEGIC FOCUS

- Transportation
- Heritage and Tourism
- Society and Governance
- Economy

AREA BASED PROPOSAL (ABP) RETROFITTING
6.92 sq.km (6.46%)
1386 Cr. INR (66.76%)

- Seamless multi-modal road-rail-waterway-last mile linkage through
- Reconstituted Urban Form and Rejuvenated natural elements
- Universal provision of Best in class smart urban services
- Identity and culture elements
- Embedded Smart Solutions

PAN CITY PROPOSAL (PCP)
690 Cr. INR (33.24%)

- Extension of EMV enabled SMART Card solution to all service
- Integrated Mobile Platform which provides a single mobile based platform for city information, citizen engagement as well as citizen services across service providers
- GPS/GPRS-enabled meters for city-wide water connections to capture automated meter and citizen data on a centralized location
- Efficient metering billing and collection solutions
- Bulk meters and Pressure Relief Valves/isolation valves to used to isolate a unit for service.
- Centralized command and control centre backed by efficient ICT infrastructure
The city of Kochi is spread over the eastern mainland and the western islands. These two areas are very different and yet together they define Kochi's character. Kochi selected the Fort Kochi-Mattanchery-Central City area to be developed in a holistic and replicable manner. West Kochi (Fort Kochi-Mattanchery) is characterised by multi-cultural settlement patterns, heritage hotspots, settlements of urban poor, poor infrastructure and a narrow road network. The city centre is characterised by commercial areas, mixed land use development, use of multimodal transport and a higher quality of life.

Water transport between these two areas has existed in Kochi for over many decades. It allows transportation of people and goods within 20 minutes between the two areas which otherwise takes over an hour by road during off peak hours and up to 2 hours during peak hours. But the poor quality of the boat jetties and boats, poor last mile connectivity and lack of integration with other modes has left the system underutilised.

The smart city proposal proposes to improve the quality and efficiency of water transport connectivity between the western islands and eastern mainland. The proposal for seamless multi-modal transport covers 4km of waterway, 110 km of pedestrian friendly roads with links to metro, mobility hub and other waterways in the city. Leveraging the waterway for effective mass transit system and integrating the same with the rail, and bus transport will provide a unique set up for development.

Based on city profiling exercise, extensive citizen consultation and in-depth review of existing plans, the 1729 acres retrofit transformation of Fort Kochi-Mattanchery-Central City was selected for area based development (ABD). The ABD proposal is two pronged with a focus on heritage and tourism as well as improving the quality of life. The proposal aims to meet 5 goals- seamless multi-modal transport, renewal of open spaces, inclusive essential services delivery, restoration of heritage area, and embedded smart solution across all components in the two prongs. The site for ABD was selected based on a thoughtfully set strategy which considered alignment with citizen priorities and city vision, scope of economic and livelihood impact, inclusiveness, impact with respect to the number of beneficiaries, building on the unique strengths of the city and readiness of the projects.

Pan city solutions in Kochi focus on intelligent government services and intelligent water management. Integrated delivery of government-to-citizen (G2C) services using “smart card” and mobile platforms is planned to be implemented in two phases. Phase 1 will extend Europay MasterCard and Visa (EMV)-enabled SMART card payment solution from transportation to all city services in 6 months. In phase 2, city will develop an integrated mobile platform for citizen engagement and ubiquitous delivery of all G2C services in 12-15 months. Implementation of intelligent water management solutions including smart metering and command and control system for city-wide 24x7 water supply will use instrumentation and analytics for better management of demand and supply.

The total Smart City Budget for Kochi is Rs. 2076 Crore. Kochi has identified sources for 100% of its budget. It is utilization three out of the five proposed sources of funding. Its per capita smart city expense is Rs. 34509.5.
MEASURABLE IMPACT

AREA BASED PROPOSAL

SOCIAL
• Levels of urban services
• Social & economic status of slum dwellers
• Inclusion of marginalised communities
• Control over morbidity & water borne diseases
• Crime rate

ENVIRONMENTAL
• Green cover
• Resource efficient infrastructure
• Dependency on private vehicles
• Pollution
• Renewable energy

ECONOMIC
• Business opportunities
• Economic output

SPATIAL
• Conservation of vernacular architecture
• Open spaces
• Compact & mixed use development
• Safe & eco-friendly mobility
• Blue-green networks
• Fine urban grain

GOVERNANCE
• Transparency
• Response time
• Institutional integration
• Level of service
• Revenue realisation
• Return on assets

PAN CITY PROPOSAL

PUBLIC SERVICES
• Mobility access
• Average travel speed
• Accidents
• Air pollution
• Assured supply & value for user charges
• Easy payment & information access

GOVERNANCE
• Government revenue
• Response time
• Citizen participation
• Non-revenue water
• User charge realisation
• Monitoring of water delivery services
Cities: An urban play-lab for children

Cities are the new critical urban laboratories for interactive engagement of children with the urban environment. The Child Friendly Smart Cities initiative puts forward this opportunity to open a discourse and encourage cities themselves to become catalysts in mainstreaming the needs of children and contribute to a new form of playable urbanism.

Today, 27% of the world’s children live in cities and nearly half of them live in slums and dilapidated conditions. Considering the fact, that cities not only have a direct impact on children’s health but also act as critical facilitators of fundamental thinking on how children perceive and become an active part of their urban environment, reinforces the importance of balanced development of all groups of children within their urban context through skilful planning of cities.

Given that by 2020, India will be the youngest nation with 64% of its population under 29 years of age, re-establishes the importance of harmonious development of its children and youth within their urban context. The National policy of children, 2013, India emphasizes the importance of a sustainable, integrated and inclusive approach for development and protection of children, recognizing the rights of children to have an appropriate life. Proactive efforts have led to aligning children’s needs in urban areas as part of the national urban development missions such as the Smart Cities Mission.

Although policy frameworks and global urban agenda has addressed the rights of children in cities, their everyday needs are often not fully considered in the urban planning processes and mainstream discussions about urbanism. While children growing up in urban areas have access to various opportunities, they are also vulnerable to urban challenges such as pollution, cramped housing conditions, long commutes, inadequate access to recreational and play spaces and high crime rates etc. In addition, rapid and uncontrolled growth of cities in recent decades has further outstripped the capacities of urban administrations and infrastructure services to meet the physical and social needs of people living in them. It is well known that issues which make urban life difficult for children also impact other sections of society, such as women, elderly and disabled. Thus, including child-friendly aspects in city-making is an objective that cuts across many overlapping problems and does not just benefit children alone.

In this intensively urbanising world, cities need to play a stronger role, towards developing an inclusive urban form which can be enriched and further interwoven with physical cues that provide a sense of place from the vantage point of children. To realise this, innovative methods such as the popsicle test1, the toddler walk-shed2, urbancity953, need to be explored in detail to overlay a new form of playful urban dimension into the constrained existing urban fabric. Only through such pro-active urban experiments can a discourse be opened, that promotes children’s everyday freedoms and choices and links it directly to their local geography, mobility and safety; cultivating a unique identity for the city and fostering a sense of belonging for its children and youth.

These principles of inclusive city making are being supported by the city of Bhubaneswar, through establishment of Child Friendly Smart City Centre, to develop knowledge driven, effective planning and urban design frameworks that include children’s perspective and encourages their participation to create vibrant urban neighbourhoods. The initiative promotes layering of the city from the perspective of children through micro-landmarks that shape their understanding of a place, provide opportunities for independent mobility and greater interaction for a better designed public realm and open spaces. It is through such urban dialogues that children will discover and develop ingenious ways to shape unexpected places and make the city their own.

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Indian cities continue to need heavy amounts of capital for financing urban infrastructure. An estimate by McKinsey Global Institute pegs it at $1.2 trillion over the next 20 years. These needs assume a much greater significance given the scarcity of public finances despite the potential impact of these investments in improving the quality of life for the citizens, an objective of the National Smart Cities Mission. The potential of integrating ICT technologies in urban resource management will undoubtedly achieve positive externalities in pricing the valuable urban assets (roads, water, energy) thereby generating revenue sources for the ULBs for the operational expenses of these assets. Yet, the upfront capital investments needed to build smart cities requires the city administrators to focus on alternative revenue sources that are financially feasible.

CIDCO Smart City Lab captured some of the best practices that cities globally have attempted for Value Capture Finance (VCF)- a principle that communities benefiting from public investments on infrastructure should pay for it. The Smart Cities Council Financing Guide for Smart Cities lists between 25 to 30 tools available for urban infrastructure financing, the Lincoln Institute lists about 8 to 10 broad tools for the same. The World Bank 2009 report on Unlocking Land Values to Finance Urban Infrastructure also lists multiple ways of capturing land values gains for public investment. The message through each of these reports and in the study at CIDCO Smart City Lab is unambiguous, Indian Smart Cities need to proactively pursue and implement a basket of each of these tools based on their local context to capture the monetary benefits of their intended Smart City investments. The cities will do better not to focus on one specific VCF tool but use multiple options concurrently in the area based approach and then scale the successful options to pan city. The Smart City mission is an opportune moment for the Indian Smart Cities to attempt these financing mechanisms and achieve financial sustainability for their proposed developments.

Problem statement
Urban infrastructure is traditionally financed through higher government grants/ transfers, augmentation of local self revenues above operating expenses and long term borrowing. The public private partnership model contrary to popular belief has also been practiced for a long time, especially in New York city in building its City Hall, its ferry terminals and even as recently as Battery Park city. The 20 lighthouse cities under the National Smart City mission too have identified six broad categories for their financing needs: mission grants, convergence with other missions, own source revenues, public private partnerships, borrowing and others (including corporate social responsibility). While the plans have varying budgets and ambitions, there are couple of broad conclusions reached through preliminary analysis of their SCPs.

1. As a group, the 20 lighthouse cities will leverage the seed funding given by the mission (Rs 1000 Crore each approximately) to raise 2.2 times of additional funding through the five other sources. Yet 50% of the group (10 cities) have a leveraging factor of less than 0.5 i.e. they will raise less than 50% of the national mission grants through additional sources.

2. The average revenue demand for the 20 lighthouse cities calculated by dividing the funding requirement (SCP funding requirement minus the mission grants and convergence) by the municipal revenue income of the cities is 3.2. This means the cities will have to raise about three times their last municipal revenue income to adjust for additional capital required for their smart city proposals. Again within the group this factor varies from 0 to 19.

Thus it is evident that

- First, cities are limiting the financial possibility of fully monetizing the benefits of their smart city investments thereby relying entirely on the mission grants and convergence and;

- Second, the demand for raising additional capital through monetizing their land and other assets and infrastructure spending is high.

This urban infrastructure conundrum can be addressed to a great extent through Value Capture Finance (VCF) frameworks discussed herewith.

What is value capture?
Value capture refers to the recovery of a share of the increment in land valuation due to the positive externalities from actions other than the land owner’s investments. The appreciation in land valuation due to the positive externalities from actions other than the land owner’s investments. The appreciation in land valuation due to the positive externalities from actions other than the land owner’s investments. The appreciation in land valuation due to the positive externalities from actions other than the land owner’s investments.

All these changes are associated with increases, most often large spikes, in land values of the affected properties for no effort of the land owner. The land owners in the proximity of these changes become indirect yet rent seeking beneficiaries of an "unearned increment". The potential for windfall gains encourages speculative investments in lands in urban areas and its surroundings. For example investment in a transit corridor distorts land valuations in areas adjoining to the corridor and consequently make housing unaffordable to those who would benefit from the transit usage.
Such passive value accretion makes real estate one of the hottest investment assets. A large share of such land transactions are purely speculative in nature, done in anticipation of new investments in the neighbourhood. Naturally these transactions are of temporary nature to capture the increase in valuations and then exit the market. This creates large resource misallocation problems, crowding scarce investment resources out of productive sectors and into speculative activities. Its unfairness and inefficiency apart, this turn of events creates another sub-optimal outcome.

Since governments recover limited value from its investments, their capacity to make similar investments elsewhere is constrained. Private developers will be loath to make large investments when a major share of its returns is captured by others. Economists tell us that this is true of all positive externalities. When faced with such situations, there will be an under-supply of the activities that create the positive externalities. Governments and developers under-invest in such developments, leaving every one worse off. This problem assumes even greater significance given the vast potential for such investments in India and the even greater demand for them. Unfortunately financial constraints bind and severely limit such investments. Many governments across the world have sought to address this problem by attempting to capture some share of the value increment using various innovative policies. For fiscally strained local and state governments in India, VCF may be the best opportunity to finance their massive investment needs.

**Value capture strategies**

The most common strategy to capture value created by investment externalities is through different forms of taxation. They include development charges, impact fees, or higher building fees. Other forms include setting apart a share of the developable land for specific uses or transferred to the local government and sale of Floor Area Ratio (F.A.R) or air rights. A brief description of an illustrative list of such VCF methods is outlined below.

a. **Land development and land auction (leasehold to freehold):** The most direct value capture is for governments to build land banks through strategic acquisitions. Once a part is developed, the value of the remaining land rises and the government can capture the entire increment by selling it. However, given the political economy surrounding land transactions, this government-as realtor strategy is likely to encourage undesirable practices.

b. **Tax Increment Financing (TIF):** Tax Increment Financing or TIF is one of the most popular value capture mechanism in many developed countries, especially the United States. In TIF, the incremental revenues from future increases in property tax or a surcharge on the existing property tax rate is ring-fenced for a defined period of time to finance some new investment in the area. The increment would generally come from a higher taxation rates or, less often, from the natural increases in the absolute value of tax revenues.

TIFs are especially useful to finance new investments in existing habitations. One example is the Smart City project. Here since the seed funding comes from the government, apart from being a financing tool, the escrowed tax-increment can be used to finance its expansion to other areas in the city. In other words, the public investment
Retrofitting proposals for CBDs, economic hubs, tourist and innovation centres would qualify for BID (Business Improvement District), Urban Improvement District (UID) or SUD (Smart Urban District) where commercial property owners and businesses pay the levy for improved infrastructure. Pune, Jaipur, Jabalpur, Solapur, Davanagere, Indore, NDMC, Kakinada, Belagavi, Chennai could leverage TIF.

made under the Smart City program would be the seed capital to catalyze smart city interventions across the city. The geographical focus would also enhance accountability by linking expenditure with outcomes relevant to the local residents.

New York City uses a form of TIF, called Business Improvement District (BID), to deliver infrastructure and other services in designated areas through Public Private Partnerships (PPPs) by the levy of a special additional tax on commercial property owners. By 2012, there were 67 BIDs spread across the city’s five boroughs investing $100 million annually.

Provided that the necessary investments are made and predicted levels of services achieved, the additional tax is about 5% of the rate-able value in the UK and for a maximum period of 5 years. The biggest BID in the US, the Times Square Alliance reported $11 million in assessment revenue and $18 million in total revenues in 2014.

c. **F.A.R Sale:** The F.A.R across Indian cities is very low, close to one in the vast majority of areas. Given the acute scarcity of vacant land and the adverse impact of the sprawl, it is desirable to encourage vertical development and densification in certain areas. This can be done by incorporating higher F.A.R for these areas in the Master Plan. A two-tier F.A.R structure, with a certain basic F.A.R bundled with property right and the remaining to be purchased, can be designed to enable value capture. The efficient mechanism for F.A.R sale is to define variable neighbourhood F.A.R limits depending on the existing and new infrastructure and then auctioning the F.A.Rs in the market. This is in contrast to current Indian scenario where uniform F.A.R is applied throughout the city.

In this context, Indian cities can also consider emulating the French land-use policy which restricts the landowner’s property right to a low baseline F.A.R and considers building rights beyond that as a public resource. Accordingly, additional construction, up to the limit laid out in the Master Plan for that area, can be purchased for a building right fee or by meeting an affordable housing mandate.

Many Brazilian cities have used the sale of building rights to not only raise resources but also guide densified urban growth along transit corridors. In 1995, the Brazilian city of Sao Paulo introduced an innovative instrument, Certificates of Additional Potential Construction Bonds (CEPACs), to facilitate price discovery for the additional building rights. It sold a limited quantity of building rights for a large enough area – one CEPAC for each square meter of additional building right – through an electronic auction. The national securities market regulator regulates the issuance of CEPACs. Those proposing to build over the basic F.A.R would have to purchase CEPACs from the secondary market. The city holds periodic auctions for each area, gradually releasing additional F.A.R so as to maximize the value capture. This can be a potentially useful strategy for transparent value capture, especially in new developments.

d. **Impact Fee:** Impact fees are levied, apart from the development charges, on new constructions in an area where a large new public investment has been announced. Such investments could include major roads and highways, metro rail, industrial corridors, ports, airports, and any other public infrastructure facility. They are levied to recover at least a share of the investment made. The impact fee generally vary depending on the location, the land usage, and height. It is collected when the landowner applies for new construction permission. Impact fees are calculated based on the total cost of the project investment proposed and the development potential within the influence area. To this extent, they are unique for each project area and would require a project-wise notification. They differ from development fee in so far as they are generally used to

**Environmental and heritage based proposals** such as Kochi, Jaipur, Surat, Vishakhapatnam, Guwahati, Coimbatore and Udaipur can utilize impact fees, primarily to internalize the impact of development on existing environmental and cultural fabric and to continue maintaining the quality of these assets to match the increased development. Generally impact fees are capped at the maximum cost to provide the infrastructure. Hence for the cities mentioned above, the total estimate of impact fees would in the range of Rs 10,000 Crores or $1.6 billion (2016 prices) which is the sum of the area based investment budgets.
finance specific large new infrastructure projects, and not basic civic utility services.

An example of impact fee is the levy on new developments within the 1 km wide Growth Corridor (GC) on both sides of the 162 km Outer Ring Road (ORR) around Hyderabad. The impact fees were higher for the part of the corridor within the ORR and for commercial uses, and increases with building height. Impact fees have become an important component of municipal infrastructure finance in growth areas of the United States.

e. **Land Pooling Schemes**: Land Pooling Scheme (LPS) is a form of land procurement where all land parcels in an area are pooled, converted into a layout, infrastructure developed, and a share of the land, in proportion to original ownership, returned as reconstituted parcels. There are different variants of such schemes depending on how the infrastructure development is financed. In most cases, a share of the developed land is sold to finance its cost, whereas in others, the land owners give a betterment charge to cover the infrastructure cost. Such LPS are a common feature in countries like Japan and Germany. In India, a few states like Haryana and Gujarat have successfully used land assembly program where the owners agree to exchange their barren lands for infrastructure-serviced smaller plots. Gujarat has used it unique version of Town Planning Scheme (TPS), in existence for more than half a century, to guide the development of Ahmedabad city and its surrounding infrastructure. The Government of Andhra Pradesh is currently undertaking the largest ever LPS in India as it procures over 30,000 Acres for the construction of its new capital city, Amaravati.

In addition to the above schemes, there are other tools for value capture that cities could look at. These are

- **Air Rights** - In densely built up cities, where land is scarce, there has been a trend in recent years to develop on top of areas like railway yards and stations. In such cases, air rights can be sold through auctions. This would enable efficient utilization of scarce urban space, besides generating revenues for the local government. The most famous examples of such air rights allocation are the Atlantic and Hudson Yards Projects in New York City, parts of both of which are developed on old railway yards. Similar developments can be auctioned off on bus and railway terminals in several Indian cities. CIDCO has demonstrated success in developing commercial and office space above suburban railways stations in Navi Mumbai.

- **Transferable Development Rights (TDRs)** - Since most Indian cities have developed their urban form largely independent of modern urban planning norms, implementation of Master Plan poses a great challenge. Arguably the biggest problem is the acquisition of private land which have been reserved for roads and utilities, open spaces, and community assets in the City’s Development or Master Plan. One strategy that has assumed wide acceptance in recent years is the allotment to the land owner of transferable development rights equivalent to the extent of land foregone. This involves separating the permissible development potential of the land from the land itself and allowing its transfer. Accordingly, the land loser is compensated with additional F.A.R of an equivalent extent which can be used by himself or transferred to a third party for use elsewhere in another zone (receiving zone) provided the infrastructure in the receiving zone supports the transferred F.A.R. A TDR certificate is issued to the land owner and this certificate can be redeemed elsewhere. This opens up the possibility of a market where such development rights can be bought and sold. The Mumbai Development Control Rules 1991 granted the suburbs a total F.A.R of 2, with the base F.A.R of one allowed free of cost and the remaining to be purchased by developers in the form of TDRs. Following this, many other Indian cities like Hyderabad have allowed additional F.A.R to acquire land for widening roads.

- **Land Value Tax** - Considered as the most ideal value capture tool - used by countries like Denmark, Australia, and New Zealand - is an annual land-value tax on the increment of (built-up) land value. Apart from capturing any value increment, it helps stabilize property prices, discourage speculative investments and is considered as least distortionary among all value capture methods. But the absence of transparent price discovery in Indian property markets and poor state of land titles make its administration difficult. Despite this, a vacant land tax can be a useful instrument to discourage speculative hoarding of land, with attendant upward pressures on land prices, and incentivize land owners to develop the land. Though many Indian states have such tax, hardly any enforce their collection with any degree of rigor.

- **Capital Gains Tax** - Capital gains tax is the commonest form of value capture. The tax is imposed when the property sold and accrues on the incremental value addition. The long-term capital gains tax rate in India is 20%. Unfortunately, being a direct tax, it does not endow on the local government in India and therefore does not directly contribute to infrastructure and other local investments. Further, the lack of adequate information about market prices mean that capital gains are grossly under-estimated in India’s context. Even assuming credible price information availability, such capital gains taxation suffer from the problem of cascading of taxes. Apart from the physical investments made in the property, which is deductible, the land owner typically would have paid...
Various forms of taxes like development fee, impact fee etc., which are generally not deducted from the capital gains calculation.

- **Betterment levy** - Betterment levy is a one-time upfront charge on the land value gain caused by public infrastructure investment. Great Britain for a period imposed a betterment levy equal to 40 percent of the land-value gain attributable to public investment. This is also exercised in the United States using special assessment district, whereby annual levies are imposed on the district. An example of this is the WAVE streetcar system in 2009. Unlocking Land Values to Finance Urban Infrastructure, Land and Policy Options, World Bank downtown Fort Lauderdale whereby the adjoining property owners would raise the funding gap required after the central, state and transportation grants. This is different from the TIF mechanism described in its frequency of incidence. This tax poses a similar problem to capital gains tax because of the disparity in market prices not being realistically reflected in government attributed rates (ready reckoner or circle rates). Secondly it is difficult to attribute specific gains in the land value to investments in infrastructure.

Thus there are a range of options available to city managers for value capture of infrastructure investments under the Smart City Mission. The options vary in their method of taxation (tax, charges or land dedication), frequency of incidence (one time v/s recurring) and the subject of the incidence (residents, landowners, businesses). A sustainable financial plan taps into multiple options based on clear rules and predefined charges and annual increases for recurring taxes. There should also be scope for renegotiation of the tax rates periodically and varying rates based on proximity to the infrastructure investments.

This paper demonstrates the range of options available to the cities for their resource mobilization.

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**NEWS @ Smart City Lab**

- **CIDCO Smart City Lab participates in National Consultation Workshop for Development of TOD in Indian Smart Cities**
- **CIDCO Smart City Lab writes for European Cyclists’ Federation**
- **Central Government announces 13 more smart cities**
- **CIDCO Smart City Lab develops a knowledge product on Value Capture from Infrastructure Investments for Smart Cities**
- **CIDCO Smart City Lab publishes Volume 2 Number 1 of its newsletter - A National Smart Cities Mission Special Issue**
- **CIDCO Smart City Lab gives comments on UNCSTD theme paper on Smart Cities**
- **CIDCO Smart City Lab attends the BRICS Friendship Cities Conclave 2016**
- **CIDCO Smart City Lab presents at WRI India Sustainable Cities CONNECTKaro 2016 Conference**

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**Upcoming trainings for CIDCO staff**

**October**
- Data Visualisation
- Smart Cities Asia 2016
- LTA-UITP Singapore International Transport Congress and Exhibition (SITCE)
- 7th International Conference on Transforming Health Care with IT 2016

**November**
- Smart City Expo World Congress
- Sustainable City Development 2016
- Urban Mobility India Conference and Expo 2016

**December**
- Achieving Service Excellence
- Strategic Leadership and Change Management
- Leadership Skills Development
TRANSIT ORIENTED DEVELOPMENT

Curitiba - Transforming City with Bus Transit

Curitiba’s urban planners recognized early on that, even if growth in population cannot be controlled, the development of infrastructure in the city can guide the city’s development. Using bus transit supported by Master Plan, the city changed its radial configuration of growth to a linear model of urban expansion along mixed land use transport corridors. Curitiba approached public transportation not as a solution to advancing problems of congestion and pollution, but as a tool to develop a compact, sustainable and inclusive environment.

Context
Curitiba is the capital city of the State of Parana in Southern Brazil. Currently, the city has a population of more than 1.8 million (2015) distributed within city limits of about 430 square kilometres and a total metropolitan area population of over 3.2 million (IBGE estimate, 2010).

Integrated transportation and land-use planning was adopted in Curitiba to address rapid population growth and to keep it from becoming an uncontrollable, sprawling metropolis (Parsons Brinckerhoff Quade & Douglas, Inc., 1996). In 1964, Curitiba prepared the “Preliminary Urban Curitiba”, a plan which evolved over the next 2 years to become the “Curitiba Master Plan”. Parallel with the evolution of the plan, in 1966, Curitiba created a planning institute, the “Instituto de Pesquisa e Planejamento Urbano de Curitiba (IPPUC)”, to develop, supervise, monitor, and continually update the Master Plan. (Karas, 1985). The Master Plan directed Curitiba’s growth along proposed bus lanes called “Structural Axes”, by creating articulated densities along the corridors.

Curitiba’s integrated transportation system plays an important role in the realization of this Master Plan. It is a system of median bus ways along the five “structural axes” complemented by “direct” express service on parallel arterial roads, and by an extensive feeder bus network.

Transforming City with Bus Transit
The BRT in Curitiba was key in the transition of the city from radial to a linear model of urban growth. The transport system is based on the major radial corridors of the city or the “structural axes”. Each of the structural axes was developed as a “trinary system” comprising three roads. The central road of the three contains a two-way bus-way that feeds into transfer points called “terminals,” and also provides a limited number of traffic lanes. Approximately at the distance of one block from each side of the central bus-way/service road, a one-way traffic road of three or four lanes is developed for use by private vehicles. Intensive high density land use development has been permitted and encouraged on the block between the bus-way and the main traffic roads on either side. This land use form creates a concentrated, high demand for transport services along a narrow corridor that can be met efficiently by a track-based public transport service – the bus-way. The bus-way system along the five structural axes is only part of the Curitiba city-wide bus mass transit system. The system, termed the Rede Integrada de Transporte (RIT – Integrated Transport Network), provides a hierarchy of types of bus service, which include city bus-ways, inter-district express service and feeder network, all operated under an integrated tariff system. Curitiba achieved its intended compact development, independent of private vehicles, using policies and practices in majorly four areas: land use planning, public transportation, parking policies and
Land use planning

The Master Plan prepared in 1964 directed urban development in Curitiba to the “structural axes”. Several land use policies emerged in the city which helped to bring out the best of the “trinary road system”. These included:

- The master plan allows only high-rise (10 to 20 story buildings) and mixed development along the BRT corridors. Also, large-scale shopping centres are only allowed in transit corridors.
- Land within two blocks of the bus-way has been zoned for mixed commercial-residential uses. Beyond these two blocks, zoned residential densities taper with distance from the bus-ways. It brings together various land uses in walkable areas within short distances from the transit station.
- The zoning prescribed by the structural axes has a combination of control and incentives. This includes various bonuses to develop as planned; incentives to transfer development rights; firm control over location of large scale development (such as large shopping centers); provision of incentives to developers to increase residential density close to the transit corridors; and development of transit terminals with a wide range of facilities.

As one move further away from the corridor, buildings become shorter, less dense and lastly it turns into predominantly residential areas. This land use planning has led to greater number of people staying within the first zone and the density gradually decreasing towards the feeder corridors.

Public Transportation

The public transportation system (RIT – Integrated Transport Network), provides a hierarchy of types of bus service, which include city bus-ways, inter-district express service and feeder network, all operated under an integrated tariff system.

- The bus-way system has been instrumental in driving land use development and has been used to stimulate development along the structural axes. The buses run frequently and reliably, and the stations are convenient, well designed, comfortable, and attractive.
- Travel demand for the bus-way system is generated as the bus-ways enter and cross the central business district (CBD) while traffic access is limited by traffic management methods (bus-only access, pedestrianisation, parking controls, etc.).
- The BRTS offers many of the features of a subway system at the low cost of a bus system. This includes vehicle movements unimpeded by traffic signals and congestion, fare collection prior to boarding, quick passenger loading and unloading.
- The inter-district express
- The bus feeder services integrated into the bus-way attract commuters through interchange terminals and stops.

Parking Policies

Parking policies have assisted in shaping travel demand, particularly to/from the central area in Curitiba. Some policies are:

- On-street parking is limited in location and duration
- City’s central area is partially closed to vehicular traffic
- Off-street parking is expensive
- Within structural corridors, development must provide off-street parking

Institutional mechanism

The organisations involved in implementation of the BRTS are the city government (Curitiba Municipality); research and urban planning institute (IPPUC); public transportation corporation (URBS) and private bus operation firms. The inherent structure of the organisations and institutional policies help the system function efficiently.

- An auxiliary to the city’s executive branch of government, the Curitiba Institute of Urban Planning and Research – IPPUC (Instituto de Pesquisa e Planejamento Urbano de Curitiba) was responsible to plan and test solutions. Due to the dual responsibility, new plans were generated, tested,
The population began to trust the ideas of the Institute, and this trust has largely been responsible for changes in the mentality of the city’s inhabitants.

• Work based on the Master Plan in 1965 was financed by the Development Company of Parana and by the Curitiba municipal government’s Department of Urban Development. Operation of the bus system is financed completely by bus fares, without any public subsidies. The Inter American Development Bank, the private sector, and the Municipality of Curitiba financed the north-south Bi-articulated Bus Line project (approved in 1995).

• The municipal government collects detailed operational information, audits the implementation and collects income received from the whole system, and pays the operators for services rendered in real costs. Detailed regulations establish the rights and obligations of the operating companies, define the faults and penalties, and seek to eliminate waste while constantly improving the quality of service. This arrangement ensures the fair distribution of income among operators and prevents unhealthy competition among drivers over specific routes.

In addition to the land use-transport sector, Curitiba has also followed enlightened policies on housing, environment, waste recycling, social matters (particularly for the young), and other initiatives.

• Areas outside the transit corridors are zoned for residential neighbourhoods. Also, Public housing for low income families are built along the transit ways.

• Single fare system of ticketing subsidises the cost of commute for long distances (mostly used by low-income population residing in periphery of the city) over shorter trips. Besides being socially just, the system facilitated the implementation of fare integration between different companies.

• In spite of having potential to raise funds for a heavy rail or subway, Curitiba built on its previous bus systems network and developed a BRT system to guide development, and in the process developing a low cost public transportation system.

Reflections
Long-term vision, strong leadership and flexibility in plan has lead to the success of TOD in Curitiba. By utilising the existing corridors for BRT and adopting measures to intensify development along these corridors, Curitiba established a public transit system at relatively low cost. Through the use of public transportation and land-use instruments, the local governments effectively directed population growth to establish compact dense settlements independent of private vehicles.
Defining Density
The term urban density is multifaceted and covers a broad range of urban characteristics. The relationship between Transit Oriented Development (TOD) and urban density is critical. TOD concentrates most growth and development within a short walk of frequent transit stops and stations giving rise to concept of an active node with mixed economic and commercial activities. The form of development varies from community to community based on local goals, character, and needs and there is no ‘one-size-fits-all’ approach to achieving an appropriate level of density to support transit. Different studies have highlighted different types and appropriate levels of densities and their relation with various factors including the transit system and travel pattern.

Density, precisely mean the mass or number per unit area, focusing on utilising the available land resource efficiently. Traditionally density has been measured/mapped using built density, residential density and population density.

Measuring Density
To understand the impact Transit Oriented Development has on an urban area, it is critical to measure its impact on urban density over a period of time. To achieve the same there are multiple methods actively followed to calculate it efficiently and effectively, based on the urban context, activities generated as a result, and other concerned factors.

- **Measuring Built-up Area**: Floor Space Index (FSI) or Floor Area Ratio (FAR) is the ratio of built-up area of all floors on a plot to the total area of the plot. Built density defines the urban fabric or the form of development; higher this value taller is the built form of the city, other things remaining constant. Builtup area is measured as FSI in Indian cities. FSI values are traditionally capped within Indian cities by using the development control regulations, resulting in a low rise urban form within the cities. To capitalise on the development opportunities in TOD, it is recommended to concentrate the built-up area density (through use of higher FSI) within a walking distance (500 to 800 metres or roughly a 10 minute walk) or a bikable distance (1 km to 1.5 km, roughly about 10 minute bike ride) from the transit stations.

- **Measuring Households (Residential Density)**: The number of households (HHs) or dwelling units (DUs) per unit area defines the residential density. It helps to estimate the land area required to accommodate a given population. This measure generally forms a part of the housing strategy with the city planning process. Increasing residential density gives an opportunity to improve affordability of land by distributing the cost of development among a greater number of households and lead to an efficient use of the associated resource and services. London uses the concept of measuring and increasing the residential densities in areas well served by transportation infrastructure. The housing strategy for London recommends densities varying from 30 DUs per hectare in suburban areas to 435 DUs per hectare in central London (Greater London Authority, 2003).

This estimate guides the provision of infrastructure and services for present and future population and indicates where densities may need to be regulated to achieve an optimum level.

- **Measuring Population**: By measuring the number of persons per unit area, population densities estimate the space available or consumed per person. Population density is often further classified into day-time and night-time densities to distinguish between the number of
visitors, workers and residents within the area. Higher the difference between day-time and night-time densities, higher is the imbalance in mix of land-uses. Moreover a high number of households and a high value of night time density indicates higher number of people per household. This helps define the capacity of the existing infrastructure and guides the provision of infrastructure and services for future population.

- Measuring employment/jobs: For any TOD, jobs available per household near the transit station is an important parameter to guide the level of density and manage the travel demand. Jobs/HH is a measure of non-residential area needed to support the economic productivity of a space. Mixed-use developments with significant jobs per households ratio will improve diversity. State of Florida, Department of transportation density guideline matrix suggests a range of 15 jobs/HH in urban core (predominantly non-residential) areas having commuter rail or LRT and 4 jobs per household in areas having equal mix of residential and non-residential uses, served by bus. In this standard jobs/ sq. km varies from 40,000 to 2,00,000 jobs based on mode of public transport. Similarly, Ottawa’s comprehensive plan suggests 20,000 to 25,000 jobs/ sq. km for any mixed use development.

Employment density/job density also refers to average floor space available per employee. It is often used as a measure of intensity of use and an indicator of space available per person within a workplace. Employment densities are significant as they have a direct influence on the utilisation of the commercial spaces, thus defining the economic productivity of the space. The City of London, has around 97,000 employees/ sq. km, and Canary Wharf, has around 2,32,000 employees/ sq. km (Buchanan, 2008). The employment density depends on the nature of activity. For example, in an industrial space it will be different from that in a space with service sector. Employment density measures can be used to estimate the level of gross employment that can be accommodated within an area.

Cities are complex systems and thereby require multiple views of urban densities at different scales of urban fabric. Indian cities have relied entirely on FSI to regulate densities thereby ignoring the other important parameters. This has therefore deteriorated both the housing and the infrastructure (including public spaces) within the cities. Density regulations for TOD has to be based on high builtup density, high household density

<table>
<thead>
<tr>
<th>Built Density and Population Density</th>
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<tbody>
<tr>
<td>Dharavi has low FAR: 2, high du/ha: 630 and high population density – 3148 ppH.</td>
</tr>
<tr>
<td>Kwong Ming Court, Hong Kong has high FAR – 12.5, high du/ha – 1507, high population density – 4910 ppH.</td>
</tr>
<tr>
<td>The Esplanade has high FAR – 9.6, low du/ha – 361, low population density – 591 ppH.</td>
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Dharavi, Kwong Ming Court, housing estate Hong Kong, Cambridge, MA, The Esplanade
Densities, FSI and Crowding

In Mumbai a family averages about 5 people, living typically in an apartment of 25 sq m. That is 5 sq m per person. In Manhattan the apartment size is typically 1,000 sq ft (about 90 sq.m) and occupancy averages 1.7 persons. The average floor space per person works out to 55 sq.m per person. Each Manhattan resident occupies 11 times as much floor space as a Mumbai resident. So for the same plot area, FSI 11 will have 11 times the built-up floor area as FSI 1. But because of the space each family takes up, FSI 11 in Manhattan will have the same number of people at FSI 1 in Mumbai. Similarly, in terms of head count, FSI 15 in Manhattan corresponds to FSI 1.35 in Mumbai. These apparently very different FSI values of 15 in one place and 1.33 in another will give us identical levels of street crowding in both cities. So when you compare FSI in different cities you need to also remember how much floor space each resident occupies in each of those cities (Praja, 2014).

Sirish B. Patel, proposes using crowding as an alternative measure. Indoor crowding, park crowding and amenity crowding. He advocated that FSI alone cannot be a tool for density mapping. He defines Indoor Crowding (IC) as occupants per hectare of built-up area and Street Crowding (SC) as occupants per hectare of street area.

So, instead of saying that in Mumbai people live in 5 sq.m per capita, and in Manhattan occupy 55 sq.m per capita, we can say that in Mumbai Residential Crowding is 2,000 persons per hectare (a hectare is 10,000 sq.m), and in Manhattan Residential Crowding is 182 persons per hectare of built-up residential area. It is an inversion of the residential space taken up per capita (Praja, 2014).

Density in Indian Cities

Over 377 million people live in about 8,000 urban centres in India. As per Census of India 2011, there are 3 cities with population greater than 10 million and 53 cities with population greater than 1 million. Top 10 cities having 8% of the total urban population live in just 0.1% of the total land and 53 million plus cities have 13.3% of urban population in 0.2% of the land area in India. Pushkarev and Zupan in 1977 prescribed minimum residential densities ranging between 5,400 persons/sq.km to 9,000 persons/sq.km (Victoria Transport Policy Institute, 2016) depending on the mode of transit for a TOD. Similarly, State of Florida transport prescribes gross population densities ranging from 10,000 persons/sq.km to 20,000 persons/sq.km in TOD zones based on mode of transit. In the 33 smart cities announced in the first year of Indian Smart Cities Mission, average city densities varies from values as low as 980 person/sq km (Dharamshala) to values as high as 26,555 person/sq km (Chennai). Analysis of densities in these 33 cities reveal that even the 75th percentile is only 8719 persons/sq km (Bhagalpur) and the average density in is 5916 persons/sq.km. Therefore, in case of tier 3 cities like Dharamshala, Panaji, and most of the tier 2 cities such as Raipur, Ranchi etc., there is a definite need to increase densities to support transit investments, provided that other parameters such as housing, public transportation, pedestrian and NMT infrastructure, and urban design are improved. In tier 1 cities of India such as Mumbai and Chennai, densities are high and sufficient for transit, therefore requiring interventions in other aspects of TOD so as to improve the quality of the urban space. The second highest density in the smart cities of first year amounts to only 13,304 persons/sq km (Surat), which is considerable lower than the highest density (Chennai).

Even though average densities are low in most of the Indian cities, their core areas have sufficient densities which can generate a demand for public transit system, which may vary from bus based systems to heavy rail depending on the density. In areas in the cities where the densities are low, re-densification together with improvements in urban space (NMT and pedestrian infrastructure, housing and urban design) becomes an important tool. TOD therefore is a tool to optimise densities to improve quality of life.

and high population density provided that other mitigating elements such as open space provision, pedestrian circulation networks and public transportation corridors are available.

Successful TODs such as Canary Wharf and King’s Cross consider all views of urban densities discussed above. Even Indian cities, such as Delhi have recently recognised these relationships for housing, transportation and infrastructure provision. This can be seen in the Draft TOD policy of Delhi Development Authority from 2012, which mandates that 50% units of size ranging between 32 to 40 sq.m and the balance 50% comprising of homes ≤ 65 sq.m.

These discussed measures alone are not the only ways to measure and control density but depends on multiple other factors such as social construct of the urban area, proposed or existing urban policies and projects for the city, existing economic growth magnets and possible target areas for development.

Thus, apart from these there are other measures that can be used to map density. These includes street crowding, an indicator of footfall on street and in public places; and availability of open spaces per person, addressing quality of life.
Urban Density

Measuring Built up area
Floor Space Index (FSI) or Floor Area Ratio (FAR)

Measuring Household Density (Residential Density)
Dwelling Units/Unit Area

Measuring Population Density
Persons/Unit Area

Land Utilisation and Density

Difficult to justify bus
Bus service begins to be viable
Bus service fully viable. May justify other forms of public transport

(Source: Greater London Authority, 2003)
Relationship Between the Different ways of Measuring Densities

Urban Design in TOD

(Source: Density Atlas)
Enablers for TOD

Success of any Transit Oriented Development depends on the effective use of implementation mechanisms for land-use planning, land value capture and travel demand management. By shaping the components of a TOD, these enablers link it with the larger city planning processes and goals. As seen in the global practices, enabling mechanisms are of three types - Land-Use Planning Mechanisms, Process Mechanisms and Financial mechanisms.

Land-Use Planning & Design Mechanisms
It includes land-use master plan, overlay plans, influence zone plans, comprehensive mobility plan and other planning and visioning documents which outline a city or region’s plan for growth in the future. The significance of these documents is three fold. First, they present a city’s vision for long term growth and development, second, they outline the land-use and mobility structure of the city and third, they are legally binding in nature and they regulate development. Through a land-use document, a city can establish a statutory framework for the implementation of a development project. This also means that the projects are developed, allowing room for necessary adjustments across the city.

A Master Plan is critical in implementation of a Zonal plan or other mechanisms including Land Assembly under Town Planning Scheme. An example would be the Master Plan of Delhi 2021. Its language enables the preparation of a comprehensive redevelopment scheme for the influence area of an MRTS stations. Initially, the draft MPD-2021 proposed that the influence zones of MRTS stations be further classified into three zone categories with certain location thresholds (Hiroaki Suzuki, 2015). But this structure of the influence zone has been changed to into a continuous area within 500 m depth on either side from the center line of MRTS in MPD 2021 TOD Gazetted Notification in July 2015.

Delhi’s use of influence zone is similar to San Diego’s 1992 ordinance which created Urban Village Overlay Zones to promote compact infill development around the transit nodes (trolley stops) (Bhisnha Bajracharya, 2005).

Form Based Codes are documents which define the physical shape and design of a built form. These are useful tools in preserving the heritage and culture of a historic neighbourhood. It can also be used to preserve commercial facades, define building envelopes and to in general preserve the activity in a given public space.

Land-Use Planning and Design Mechanisms are important tools in the process of developing a TOD as they provide the statutory framework necessary for various changes in land-use, densities and design of the TOD. Appropriate land-use and design mechanisms may even act as a prerequisite for the process mechanisms. Delhi and Ahmedabad demonstrate this by creating policies for moving the process forward. In reality though policies which can be restrictive for a long period of time (through master planning exercises) and infact discourage higher density living. Hence having a framework that gives the flexibility to city managers to guide the development is undoubtedly a practical approach. Singapore and Hong Kong exemplify this approach by varying their densities, floor space index in response to market demand on an ongoing basis (Bertaud, 2014).

Process Mechanisms
They are mostly command and control tools and economic instruments which mobilise the projects of all sizes and shapes. These mechanisms include land assembly, transfer of development, establishment of partnerships between local jurisdiction, transit and other regional agencies along with the private sector. Land assembly is among the most complex of processes and a critical step in the densification of a neighbourhood. For the most part, land assembly in India has been conducted through two methods - land acquisition (based on the principle of Eminent Domain) and land pooling and readjustment. Eminent Domain refers to the power of the state or public planning authorities and development agencies to acquire land (with appropriate compensation) for the purpose of public use.

Land Acquisition can enable rapid availability of adequate amount of land for development, provided most of the owners agree for sale. It provides almost a clean slate for the new master plan for the assembled land as the value of the land appreciates, it provides opportunity for the development authority to accrue the benefits (Ballaney). One of the acts governing the process of land acquisition is the Land Acquisition Rehabilitation and Resettlement Act of 2013.
Urban Growth Boundary

Urban Growth Boundary, as in case of Portland, is a mechanism for managing growth. The Metro Council in 1995 suggested “concentrating development in urban growth boundaries, with some extent of satellite development”. On its basis, Portland prepared its growth management strategy called “2040 Growth Plan” which features a tight Urban Growth Boundary focusing growth in transit centres and corridors, and asks local governments to limit parking, and adopt zoning and comprehensive plan changes to be consistent with the plan.

Land Acquisition faces multiple barriers as listed below:

• Land title disputes
• Proving legitimacy of public use
• Displacement of land owners and loss of livelihood
• Compensation delays and disputes
• Development and redistribution of land
• Hold outs for speculation
• Poor capture of the appraisal of land value by the land owners after development
• Low participation of land owners in the decision making process, particularly when public use has been legitimately established.

As a result, land readjustment and pooling techniques are being used in many parts of the country as an efficient alternative. One of these is a Town Planning Scheme or TPS. A Town Planning Scheme adopts a different approach by engaging the land owners with the development authority for the planning process. In this land pooling/readjustment method, the development authority prepares a master plan for the given area, lays out the infrastructure and distributes the remaining land back to the land owners. There is no land acquisition in the process. Instead, the land owners are charged a betterment fee to pay for the infrastructure development. This allows the land owners to benefit from the appreciation of the land value and enables them to retain their livelihoods. It also means the method can be long and complicated. The method been successfully used in development of Magarpatta, Pune and in Gujarat for development of Sardar Patel Ring Road in Ahmedabad, Outer Ring Road in Surat, BRTS in Ahmedabad, Rajkot, Vadodara and Surat. Land Pooling is used in different countries, including Australia and Finland (I.P.Gautam, 2012).

Transfer of Development Rights is another land readjustment technique. It enables the planners to direct additional development as required, along with improvements to infrastructure, using finances generated through the process. Transferable Development Rights (TDRs) are essentially the rights to develop built space on land that can be transferred (Nallathiga, 2014):

I. horizontally from one location to another location (ex situ), or
II. vertically from surface to above or below (in situ)

Each piece of land has a potential for development defined by the property zoning, land-use and development control regulation (Nallathiga, 2014). The differential development potential of land can be utilised in a positive manner to preserve certain land-uses which are required to be kept with little or no development on site; while at the same time, this unutilised development potential needs to be tapped for beneficial use in other sector – such as residential housing (Nallathiga, 2014). TDRs essentially serve as a mechanism to achieve this objective. In case of Mumbai, the TDR program was initially started with the intention of acquiring land for public amenities i.e., reservations such as green spaces, gardens and playgrounds, and for road construction. In addition, the award of TDR was also made applicable to plot/land owners if they construct/develop the public amenities (or, planned reservations) as per the rules under DCR. The TDR scheme was later extended to achieve other purposes of city development like slum housing, conservation of built heritage, and even for the development/provision of public amenities that were otherwise to be provided by the MCGM (Nallathiga, 2014).

The challenge in the land assembly processes is the capture of the land value which increases with the improvements made to the land. There are different mechanisms that can capture this value, which fall into the category of financial mechanisms.

Financial Mechanisms

They are of two kinds: the first involves mobilisation of financial resources (which includes capture of land value) and the second involves use of financial tools to enhance quality of life within a TOD through behaviour change. Traditionally, financial resources come from either the central or state government sponsored schemes, such as JnNURM, through land monetisation driven EPC or PPP or through land value capture. EPC and PPP are driven through debt servicing or partnership equity. Land is also a major financial resource which can fund development. Its value can be captured in two ways- monetisation through sale or land and/or air rights or by capture of financial value accrued by the improvement of transit, quality of life and comfort. Any improvement to a transit system leads to a direct increase in the value of the land due to improved accessibility, infrastructure, service delivery and quality of life.

Monetisation of land in also seen in some TPS schemes in Gujarat where a small portion of land is acquired from the owner in exchange of providing infrastructure services instead of charging a betterment fee. This land is then assembled and either used for the infrastructure provision or sold to generate funds for financing the infrastructure improvements and other development.

Value capture is distinct from the user charges or fees that agencies collect once services start being delivered on the infrastructure. Value capture relies more on the intrinsic accretion of value increase in the location of the private land once public infrastructure is implemented in its vicinity. Different ways of capturing land value in India include - Land value tax, Fees for changing land-use, Land Value Increment Tax. Area based Development Charges, Value based Development Charges, Transfer of Development Rights and Incentive FSI, Premium on relaxation of rules or additional FSI. Charges for regularisation of unauthorised development, Land
Acquisition and Development and Town Planning Schemes.

The second part of financial mechanisms is the use of financial tools for bringing about a change in the user behaviour. Using congestion fees in a CBD area, or enforcing high on-street parking prices would be an example of de-incentivising use of cars in a dense walkable neighbourhood. Implementing subsidies for public transit fare, or implementing single fare system are examples of financial incentives for using public transit. An example of this is Pune’s draft for public parking policy, where it is proposed use of parking cost as a tool to discourage car use and promote transit ridership and walking.

All these mechanisms work at different stages of building a transit oriented development. From assembling land to implementing parking policies, each of them depend on the institutional capacities of various city agencies and departments. The purpose of the enablers is to mobilise the development process. Many of these mechanisms take time and coordination of various other processes. Thus, they need a comprehensive and proactive approach to ensure success.

Giving teeth to the guidelines

Cities often have guidelines or advisory documents instead of regulations and policies in many cases. Guidelines are simply recommendations which should be implemented, but they are not mandatory. One of the simplest examples here is the case of street guidelines, which have been developed in many cities across the country (including Delhi and Chennai), yet they carry little weight due to their advisory nature. Area Based Development within a Smart City Proposal or a city’s Transit Oriented Development Policy present an opportunity to turn such advisory documents into regulations and policies. Bhubaneswar has proposed this in its Area Based Development, where it is implementing a complete streets policy to diversify its mode share.
At the time of writing this article, the Indian junior cycling team has reached No. 1 ranking in the world, in the team sprint category. For us as a country deprived of both laurels in global competitive sports and bicycling in our urban spaces, this comes as a double shot of chai (or filter coffee). Be mindful, this team has achieved this ranking against all odds, lack of bicycle tracks in Indian cities as compared to other countries in that list - Korea, Japan, Germany and Sweden. Therefore the ponderance of this achievement will be appreciated by urban residents and children in Indian cities; cities of all scales where cycling is more than a commuting mode and more than a conversation piece (along with home crafted beer, vintage clothes and vinyl records) amongst liberal, climate change conscious yuppies.

The majority of lower income families in today’s Indian cities work in service sector jobs (drivers, maids, security guards, sanitation workers, vegetable vendors) etc. The standards of public transportation and the congestion on the roads have a bigger impact on their commute to work. And far from the climate change conversation, this labor sector makes a rational choice of using the bicycle to commute to work. In fact the primary commuting mode in the top 53 cities in India is bicycling or walking, the highest being 57% and the lowest being 17%, still comparable to any bicycling/walking oriented cities in the world. Bicycling is a livelihood means for vegetable vendors to sell their vegetables, it is a freight mode for decentralized waste management systems, it is an economic generator for all support jobs related to bicycling maintenance and repair shops seen strewn in any of these Indian cities. About 48% of the households in Indian cities own a bicycle, also considered as an household asset. The average trip length (excluding walk) in small, medium and large cities is between 2.5 - 6.9 km, distances that can easily be made by bicycling, walking and buses. Unlike in the bicycling capitals of the world, the bicycle has sustained in India despite the formal planning systems, not because of them. Despite the significance of this mode, the bicyclists have remained an invisible group for Indian city planners, until now. There were toolkits and plans made sporadically, and one successful implementation of a city wide network of bicycle lanes in the city of Diu. But largely bicycling has remained a low priority.
The National Smart City mission, when launched, gave cities the freedom to shape their vision of a smart city - a vision backed by citizens’ validation. The central government laid out the general guiding principles of quality of life, economic development and inclusion. The cities had to assess themselves on 24 parameters of urban living, of which five were directly related to sustainable mobility. It was no surprise when the first 20 winners (lighthouse cities) were announced that all of them had addressed the need for bicycling in their smart city plans. While all 20 have proposed expansion of the physical bicycle network (roadspace), 17 have proposed a bike sharing component thereby taking out the economic burden to own a bicycle (interestingly it costs 8 times more to own a bicycle in India than in China which has 4 times more bicycles than India) . At an initial glance, about $25-$30 million or 0.8-1% of the national government’s grant will be used by the 20 lighthouse cities for bicycling. While bicycling plans and investments have been done internationally at city levels, this leveraging of a national urban competitive grant to jumpstart sustainable mobility concurrently in 20 cities is probably a first. By the time all 107 cities have applied, we will see about $100-$150 million being used as seed funding by cities only for bicycle planning and infrastructure. If other planning interventions (TOD, urban design, greenways, pedestrian streets) that enhance bicycling experience in a city are considered, close to $1 billion in the Indian National Smart City mission will be utilized towards non-motorised transport. Urbanists and urban advocates from other countries will attest to the time it took to raise such funds for their bicycling campaigns.

Finally...

There is the city of Ludhiana, in the state of Punjab. This city is home to 1500 factories making bicycle parts and employing 250,000 people. More than 10 million units of bicycles are manufactured in Ludhiana every year and more than 50% of India’s bicycles are made here. Yet, the city ranks high in per capita automobile ownership, accident rates and air pollution. One of the first 20 lighthouse cities, Ludhiana now aims to utilize its manufacturing strength to achieve sustainable urban mobility, allotting $1 million of its smart city budget to bicycling.

These are the transformational changes the Indian Smart City Mission hopes to bring about. Stories of change that are not driven solely by bottom up demands or top down mandates but also through convergence of sustainability, inclusion, economic productivity and technology. India has always had a thing with bicycles, whether in Bollywood, political representation, youth culture - it’s now time that Indian cities too have a dalliance with this two wheeled beauty.


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Housing delivery to the bottom of the pyramid is a key challenge faced by India as the country is witnessing rapid urbanisation. According to a report by Government of India, the housing shortage was estimated to be 18 to 30 million homes in 2012. This housing crisis will get acute as India's urban population is projected to increase from 330 million in 2011 to over half a billion by 2030. Indian cities will need to plan for 48 million houses in next 14 years to manage this urbanisation. The majority of this housing will need to be developed for the economically weaker sections of the society.

The process of rapid urbanisation, with millions migrating to the cities from villages, in search of better livelihood opportunities has often been chaotic and unplanned. Conventional urban planning mechanisms are slow to accommodate this influx of people who with their limited funds cannot afford to rent or buy in the formal housing market. Because of the lack of any other viable alternatives, the majority of them end up in informal housing with unregulated construction that is highly vulnerable to natural disasters. The self-built housing, however, provides a significant benefit over any other form of housing delivery for this section of the society. The self-built incremental housing is inherently flexible process that accommodates changing family needs and makes it easier to appropriate and adapt parts of the home as a small shop, workspaces to make supplementary income. Use of home as a productive asset is a critical imperative for the low-income families.

The rigidity of current formal mass-housing delivery mechanism points towards the need for empowering the urban local bodies with the tools for developing demand-optimised, diverse housing stock by facilitating community participation & engagement in the design process. To bridge the gap between socioeconomic data and design decisions, Urban Risk Lab at Massachusetts Institute of Technology is developing digital toolkit to assist policy makers with a comprehensive, end-to-end housing delivery model. This effort, supported by TATA Center for Technology and Design at MIT focuses on providing access to safe, affordable, incremental housing in tier II and tier III cities of India. The research project aims to create a policy support tools for city authorities to support the low income residents to invest, build and adapt part of their homes as per their needs within a regulated framework.

The toolkit - based on the Housing for All Plan of Action guidelines - not only aims to provide a platform for government and private consultants to collaborate on individual projects but will drastically reduce the time and effort spent in the current manual process. By developing a digital platform to analyse of household and livelihood profiles gathered during “Housing for All” surveys – valuable data that in the current process is rarely used to improve design decisions, this tool will help urban local bodies in understanding the citywide housing deficiencies, to prepare annual action plans, and to provide diverse set of housing typologies.

Urban Risk Lab at MIT
The Urban Risk Lab at MIT develops methods and technologies to embed risk reduction and preparedness into the design of cities and regions to increase the resilience of local communities. Operating at the intersection of ecology and infrastructure, rural and urban, research and action; the Urban Risk Lab is an interdisciplinary organisation of researchers and designers. With a global network of partners, the Lab is a place to innovate on techniques, processes, and systems to address the complexities of seismic, climatic, and hydrologic risks. The lab is currently developing digital tools to assist policy makers with a comprehensive, end-to-end housing delivery model. This effort, supported by TATA Center for Technology and Design at MIT focuses on providing access to safe, affordable, incremental housing in tier II and tier III cities of India – where users can invest, build and adapt part of their homes as per their needs.

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The views expressed in this paper are solely those of the authors and not necessarily those of the National Institute of Urban Affairs or the NIUA-CIDCO Smart City Lab.
Valet EZ is a mobile-based application that helps find secure parking spots in your city and provide valets on-demand who will assist in parking and attending to your vehicle.

**So, why is parking seen as a fundamental challenge in the urban landscape?**

**Scourge of free parking** – The perception that parking should be mandatorily provided and for free is regarded by most experts as the biggest challenge to reforming the parking sector. Ironically, free or highly subsidised parking is free only for the immediate user of the service. There are significant social costs to the neighbourhood, to commercial establishments in the vicinity – both direct (having to pay for their own private parking) and indirect (lost business from customers who never visited due to lack of parking), the city (congestion, lost productivity and loss of economic activity) and of the general chaos that impacts all commuters on their way to an office meeting, to the store, or to a restaurant.

**Alternatives that could address this issue**
The most obvious solution is public transport. However, public transport is unlikely to fully curb the aspirations of an emerging middle class to own their own vehicle. Auto sales projections for the coming decade bear this out. Owning a vehicle is not just about aspiration; it has utility in providing greater control over one’s mobility and privacy. Another rapidly emerging alternative in recent years has been organised cab aggregators. The emergence of alternative forms of mobility will change the usage of a personal vehicle but is unlikely to stop the growth of private vehicle ownership for the foreseeable future. With a private owned car remaining stationary for 90% of the time and space a major constraint, parking remains a growing challenge across the urban landscape.

**What will it take to organise the parking sector?**

In a scenario of increased vehicle ownership and inability of cities to cope with increased supply of vehicles, addressing the parking challenge will move up the priority list. At the same time, the rise of ‘not in my backyard’ (NIMBY) from local communities (both residential and commercial) shows the growing barriers to the indiscriminate use of on-street parking. While the potential opportunity appears straightforward, there are high barriers to overcome in building an effective infrastructure solution. Any presumption that a centralised solution by government fiat – especially in terms of providing infrastructure - will address the problem fails to fully comprehend the diffused nature of the problem. Valet EZ sees the path to addressing the parking challenge through tackling three key factors that influence the sector:

**Parking inventory supply:**

**Lack of quality and timely inventory**
The most significant challenge faced by parking users is the non-availability of adequate appropriately priced inventory. Bridging information asymmetry on parking availability would bring about market-driven pricing and allow the introduction of features such as advance booking. The opportunity to make money from parking on underutilised real estate for short periods provides incentives to bring on additional supply, creating a dynamic market and brings in greater efficiency in the management of urban spaces.

**Making the economic case with users: Competing with free**
The clearest way to competing against ‘free’ parking is through superior customer experience, high quality products, and a compelling range of product/service offerings. The greater opportunity in the long term is to transform parking from a capital asset to a pay-per-use model. This lowers lease rental costs for businesses while for home owners this could mean that they no longer need to incur the huge upfront cost of purchasing car parks and instead rent for as long as they need.
it. This model also helps in better revenue realisation for the inventory holder.

**Addressing the dual challenge:**

**Localised density and scalable network**

In densely packed and parking space constrained cities, there is a need to innovate on creating additional parking inventory. Valet EZ envisions a decentralised network model of parking lots, bringing new (and dynamic) inventory onto the market and management through the effective use of technology. This model will address the core concerns of security and reliability to develop a scalable network. With the right economics, property owners with spare spaces and inventory can participate on a platform similar to a managed marketplace.

Use of technology to manage parking spaces has largely focused on smart parking solutions in private parking spaces or aggregating existing parking inventory. However, countries with major space constraints and growing automobile markets pose a different parking challenge and require a solution more suited to their unique needs.

A parking solution that is scalable and replicable can be built on the base of a **Parking Technology Stack** – a series of technology driven tools and processes that help in the creating an ecosystem for both inventory holders and customers. Such a tech stack would comprise of several layers of solutions and toolkits for inventory development, space management, security, pricing and billing systems, add-on services all integrated on a open platform. This parking technology stack would help provide an ecosystem with common standards and tools to manage a dynamic decentralised network and provide a high degree of standardisation for parking users.

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Source: SIAM, IBEF 2016
Smart Cities Challenge Round II

Round I of the Smart Cities Challenge was completed with the announcement of 13 winning cities in the Fast track competition in April 2016. With a total of 20 winning cities in the first round of competition and 13 winning cities in the fast track competition, the mission announced 33 smart cities in the first year of the challenge.

In the first year itself the competition was extended from 100 cities to 109 cities by including state capitals wherever they were left out from the competition. In September 2016, the mission marked the second year of the smart cities challenge with the announcement of 27 winning cities in the round II of the competition. These 27 cities are from 12 states. With this, 60 cities are now in the process of implementation of their smart city proposals. The remaining 49 cities out of the total 109 smart cities of India will now compete in the third year of the challenge.

Legend
- Round -II Cities
- Fast Track Cities
- Light House Cities

For any comments/suggestions please contact
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