IMPLEMENTING TRANSIT-ORIENTED DEVELOPMENT FOR ADVANCING CLIMATE ACTION IN CITIES

MOBILISE YOUR CITY WEBINAR

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DIRECTOR- URBAN DEVELOPMENT, WRI INDIA
Zoning and the neighborhood unit—as planning concepts—evolved as a response to the degenerated environmental and social conditions fostered as a consequence of industrial revolution in the early 1900s.
EVOLUTION OF THE NEIGHBORHOOD

Neighborhood Organization

1930
Perry's Neighborhood Unit

1980
New urbanist: Traditional neighborhood

2008
Doug Farr's Sustainable Neighborhood

Source: (STEUTEVILLE, 2017)
https://www.cnu.org/publicsquare/2017/10/31/great-ideas-new-urbanism
TRANSIT ORIENTED DEVELOPMENT (TOD)

Creation of compact, walkable, pedestrian-oriented, mixed-use communities centered around high quality mass transit systems
- TOD Institute
INDIA’S NATIONAL TOD POLICY (2017)

TOD integrates land use and transport planning and aims to develop planned sustainable urban growth centers, having walkable and livable communes with high-density, mixed land-use.

Citizens have access to open green and public spaces and at the same time transit facilities are efficiently utilized. TOD focuses on creation of high-density mixed land use development in the influence zone of transit stations…….TOD advocates pedestrian trips to access various facilities such as shopping, entertainment and work.

METRO RAIL POLICY (2017)
FULL-CIRCLE

From public health crisis to public health crisis.......and beyond...
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METRO RAIL POLICY (2017)
COUNTER-NARRATIVE IN TIMES OF COVID-19
2015-2030 – UNPRECEDENTED URBAN GROWTH – ESPECIALLY IN S. ASIA & AFRICA
RAPID GROWTH & URBAN TRANSFORMATION

Urban population expected to almost double from 420 million in 2015 to over 800 million by 2050

India’s population split – 1980, 2015, 2050

India’s urban population has increased by > 2.5 times since 1980; projected to double again by 2050.

<table>
<thead>
<tr>
<th>Year</th>
<th>Urban Population</th>
<th>Rural Population</th>
<th>Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>161</td>
<td>538</td>
<td>699</td>
</tr>
<tr>
<td>2015</td>
<td>420</td>
<td>862</td>
<td>1282</td>
</tr>
<tr>
<td>2050</td>
<td>814</td>
<td>806</td>
<td>1620</td>
</tr>
</tbody>
</table>

But recent research has shown that official figures underestimate India’s “hidden and messy” urbanization.

SOURCE: World Urbanization Prospects, 2014
MORE OF THE POOR WILL LIVE IN CITIES

Source: Ravallion et al., 2007c: 8. Note: Example trend based on data from India.

Share of the national population that is poor

Share of the poor that is urban
PERSISTING PROBLEMS IN CITIES RISKING LOCK-IN

Congestion  Sprawl  Inefficiency

30-70 Years  150 Years  30-70 Years

BUSINESS-AS-USUAL IS UNSUSTAINABLE

Photo credits: (left) WRI Ross Center for Sustainable Cities, (Mexico, center) Pablo Lopez Luz, (Mexico, right) Ruimc77/Flickr
21 Indian cities - including Delhi, Bangaluru, Chennai and Hyderabad – will run out or by 2020, affecting 100 million people.

Annual waste generation in India is 62 million tonnes, expected to increase to 165 million tonnes by 2030, and 436 million tonnes by 2050.

2°C pathway, needs 50% reduction in building energy demand and related greenhouse gas (GHG) emissions by 2050.

The economic cost of congestion in Delhi alone is $8.9 billion per annum and could rise to $15 billion by 2030.
I'll be happy when this is over...

CLIMATE CHANGE

MORE TROUBLE

coronavirus
GLOBAL CLIMATE CHANGE TARGETS ARE NOT POSSIBLE WITHOUT THE TRANSFORMATION OF CITIES

23% of global GHG emissions are from transport

70% of GHG emissions come from cities
PROGRESS ON NATIONAL COMMITMENTS?

135 Countries Set GHG Targets

Source: CAIT Paris Contributions Map/WRI

- GHG target
- Intensity target
- INDC but no GHG target
- No INDC submitted
INDIA’S CLIMATE ACTION SITUATION

Key areas of action-
1. Renewable energy
2. Sustainable Mobility
3. Water preservation
4. Disaster resilient infrastructure
5. Low-carbon pathways

Prime Minister Modi said: “the scale of global action required to combat climate change is still lacking…We need a comprehensive approach to include values, lifestyles, and development priorities to combat climate change.”

Climate action summit, New York

3rd largest GhG emitter
½ originate in urban areas
Per capita emissions is 1/3rd of global average

Source: https://unfccc.int/resource/docs/natc/indbur1.pdf
The extraordinary urbanization challenge

Source: UN Habitat; UN World Urbanization Prospects 2014 Revision; Image: Harvey Barrison

- Globally, 800 million per decade
- India's urban population will double to 800 million by 2050

INDIA AT THE CENTER OF THINGS

75% of India’s 2050 infrastructure has yet to be built

Source: Global Buildings Performance Network
Delhi NCR
54 sqkm/year

Mumbai
5 sqkm/year

Pune
42 sqkm/year

- Rapid growth in satellite towns of Delhi (Gurgaon, Noida, Grt Noida, Faridabad etc)
- Mumbai, little movement in peripheries, but witnessing inner city redevelopment
- Pune capitalising on Mumbai’s slow down, attracting new economies like IT/ITES

Source: Generated by WRI India using data from Bhuvan NRSC
HIGH COST OF SPRAWL

Suburban
City's Annual Cost, per Household

Urban
City's Annual Cost, per Household

For more data and more reports, visit thecostofsprawl.com
Data based on Meaford Regional Municipality
ADDITIONAL COSTS OF URBAN SPRAWL

- Lost time
- Increased infrastructure costs
- Poor health
- Loss of public space
LOCATION LOCATION LOCATION!

Bangalore: 60% jobs within 60 mins

Image Source: LSE Cities.
ALMOST ALL CITIES FAIL AIR QUALITY STANDARDS

PARTICULATE MATTER PER M3 FOR TOP 50 CITIES – HIGHER PARTICULATE MATTER MEANS WORSE AIR QUALITY

SOURCE: Mortality data from World Health Organisation: http://apps.who.int/gho/data/node.wrapper.ENVHEALTH3
TRAFFIC FATALITIES

Image source: WRI India

Data from MoRTH

Traffic Fatalities (2013)

140,000

Traffic Fatalities

9.1%  3.5%

28.6%  41.2%

Chart 1.1: Compound Annual Growth Rate 1994-2003 and 2004-2013

Number of Road Accidents 1994 - 2003

Number of Fatalities 2004-2013

Number of persons Injured

1  0.6  1.8

1.3  1.5

0.3
HIGH QUALITY PUBLIC TRANSPORT AFFECTS QUALITY OF LIFE

MASS TRANSIT PLAYS A MAJOR ROLE IN REDUCING URBAN EMISSIONS, AND LEADS TO BETTER GROWTH

Note: * Determined by composite rankings against a range of indicators. Based on ranking of 24 international cities with #24 being the top rank. For more information on these see PwC Cities of Opportunity available at http://www.pwc.com/us/en/cities-of-opportunity/
ACTION AREAS

• Sustainable Mobility
• Landuse-transport integration (TOD)
SOLUTION: PUBLIC TRANSPORT (EG. BUSES AND BRT SYSTEMS)
SOLUTION: MULTI-MODAL INTEGRATION

Integrate various modes of PT and IPT through schedule, fare, and physical integration.

Key Building Blocks of Multimodal Integration

- Infrastructure and Operations
  - Multimodal hubs
    - Transfer stations

- Institutional Framework
  - Metropolitan transport authority

- Integrated Payment
  - Smart cards
SOLUTION: NEW/CLEAN SUSTAINABLE MOBILITY

Electric vehicles

Shared Mobility

Shared Mobility is creating new markets.

- Share
- Car Share
- Park!

2P

P2P

P2P

B2C

Self Drive

JustPark

Getaround

zipcar

CARMAnet

PARK GIPGA

The global B2C space is growing with entry by Hertz, Enterprise Rent-A-Car, Avis, Daimler, BMW and U-Haul. This market is still nascent in India. However, the self drive car rental place is an upcoming one.

While there are aggregating parks demand valet, the models.
SOLUTION: LANDUSE AND TRANSPORT INTEGRATION
Elements

- Pedestrian & Non-Motorized Transport (NMT) Friendly Environment (Walking & bicycling)
- Multi-Modal Interchange and Inducing Modal Shift (Public Transport, cycling & pedestrian priority)
- Place making and Ensuring Safety (Active edges & Public spaces)
- Connectivity and Network Density (Travel Demand Management)
- High Density, Mixed-use, Mixed-Income Development near stations (Mixed-use & density)
BARRIERS TO IMPLEMENTING TOD

• Land (Amalgamation incentives, pooling)
• Consumer demand/ jobs
• Infrastructure provisioning (for resource efficiency)
• Regulatory (Scales of Plan)
• Governance (Institutional Coherence)
• Finance (LVC, PPP)
BEGIN WITH: NEIGHBORHOODS THAT MEET PEOPLE’S NEEDS

LIVABLE NEIGHBORHOODS FOR SUSTAINABLE CITIES

In order to live in cities that enable communities to experience full and purpose-driven lives, livable people-oriented neighborhoods should meet seven basic needs through urban planning, design strategies and physical interventions.

Livable neighborhoods

1. Basic services
2. Move
3. Feel safe
4. Be healthy
5. Socialize
6. Flourish
7. Work
REGIONAL ACCESSIBILITY (60 MINS)

<table>
<thead>
<tr>
<th>JOBS</th>
<th>POPULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 20 %</td>
<td>2,44,661</td>
</tr>
<tr>
<td>20 – 40 %</td>
<td>4,68,235</td>
</tr>
<tr>
<td>40 – 60 %</td>
<td>9,63,473</td>
</tr>
<tr>
<td>60 – 80 %</td>
<td>22,57,396</td>
</tr>
<tr>
<td>80 – 97 %</td>
<td>45,09,957</td>
</tr>
</tbody>
</table>

- Majority have good access to jobs within 60 minutes in normal case scenario
REGIONAL ACCESSIBILITY (60 MINS) WORST CASE

<table>
<thead>
<tr>
<th>JOBS</th>
<th>POPULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 20 %</td>
<td>10,93,490</td>
</tr>
<tr>
<td>20 – 40 %</td>
<td>15,56,066</td>
</tr>
<tr>
<td>40 – 60 %</td>
<td>23,61,129</td>
</tr>
<tr>
<td>60 – 80 %</td>
<td>26,88,847</td>
</tr>
<tr>
<td>80 – 97 %</td>
<td>7,44,141</td>
</tr>
</tbody>
</table>

- People living along major corridors have good access to jobs within 60 minutes of travel in worst case scenario.
Major office nodes located away from city core are not well connected by metro as of today

only 7% jobs within 500m distance of station; 38% within 2kms
**SOLUTION: STRATEGIES FOR ROAD INFRASTRUCTURE IMPROVEMENT**

<table>
<thead>
<tr>
<th>Character of road network</th>
<th>Strategic Focus</th>
</tr>
</thead>
</table>
| Dense network with a hierarchy  
*This is an ideal condition which most likely not present in any of the TOD zones* | **Focus on accessibility**- enhancement of road infrastructure conditions to create complete streets |
| Dense network of mostly local roads                           | **Focus on upgradation, along with accessibility**- Select roads can be upgraded to higher categories (higher width) based on contextual realities such as land availability, connectivity to larger networks outside the TOD zone etc |
| Thin road density                                              | **Focus on augmentation (adding new roads), along with accessibility**- Alignment of new roads to be suggested based on availability of land, connectivity to existing roads of required hierarchy. Also, smaller local roads can be suggested to join missing links and thus to create a complete pedestrian network. |
Effective vehicle movement

People wait on the road

Bus stop occupies entire footpath

Insufficient footpaths and seating

Source: EMBARQ India | Marol, MIDC Project
SOLUTION: COMPLETE STREETS

- Demarcate lanes
- Demarcate bus stopping area
- New bus shelters
- Provide seating, shade
- Provide sufficient space to walk
SOLUTION: NMT PRIORITY

Redesign roads to make them safer for all users esp. pedestrians and cyclists.

Source: thehindu.com, henrikvaluer.wordpress.com
In the safe access approach the needs of “PEOPLE” lie at the centre of the strategies developed for station accessibility plans and station area improvements.
SOLUTION: TACTICAL URBANISM
## SOLUTION: OPEN AND CIVIC AMENITIES SPACES AUGMENTATION

<table>
<thead>
<tr>
<th>Source-1: Public</th>
<th>Strategy</th>
</tr>
</thead>
</table>
| • Existing Parks, playgrounds, civic amenities spaces owned by BBMP/ any other public authority  
• Buffers of natural features which could be made accessible |

<table>
<thead>
<tr>
<th>Source-2: Private</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>A portion of open/ civic amenities space in large private developments will be publicly accessible</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source-3: Semi-public</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing open space/ civic amenities spaces in institutional/ semi-public developments to be made accessible to public as a shared facility</td>
<td></td>
</tr>
</tbody>
</table>
SOLUTION: NATURAL RESOURCE PRESERVATION (NAYA RAIPUR)

1 – Existing Terrain

2 – Riparian Corridors

3 – Road network

4 – NMT Network

5 – Amenities and Commercial Areas aligned to the NMT and open spaces

6 – Final layout
SOLUTION: PUBLIC SPACES (NAVANAGAR TOD: HUBLI-DHARWAD)
Solution: Resource efficiency
SOLUTION: RESOURCE OPTIMIZATION (BANGALORE METRO)
ENERGY DEMAND ASSESSMENT: NON-TOD VS TOD

- 2000 kwh annual per capita demand (city wide average)
ENERGY EFFICIENCY POTENTIAL: CONSERVATION MEASURES

- Energy efficient appliances and behavioral change applicable in total building stock
- Conservation by passive building design applicable in new building stock only

<table>
<thead>
<tr>
<th>Scenario</th>
<th>% Savings by energy efficient appliances</th>
<th>% Savings by passive building design</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAU</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Conservative</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td>Progressive</td>
<td>20%</td>
<td>40%</td>
</tr>
</tbody>
</table>

Demand reduction potential: Non-TOD vs TOD

- BAU Demand reduction
- Conservative Demand reduction
- Progressive Demand reduction
- BAU Demand reduction
- Conservative Demand reduction
- Progressive Demand reduction

![Demand reduction potential: Non-TOD vs TOD](chart.png)
ENERGY EFFICIENCY POTENTIAL: SOLAR RTPV

- Total roof area is calculated from the building footprint
- Electricity generation potential through solar RTPV per sq.m. per day: 4 kWh
- Usable roof area: 50%
- Sunny days a year: 250

<table>
<thead>
<tr>
<th>Scenario</th>
<th>% of adoption of solar RTPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAU</td>
<td>1%</td>
</tr>
<tr>
<td>Conservative</td>
<td>20%</td>
</tr>
<tr>
<td>Progressive</td>
<td>30%</td>
</tr>
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</table>

Solar RTPV potential: Non-TOD vs TOD

![Bar chart showing solar RTPV potential for different scenarios and locations.](chart.png)
WATER DEMAND ASSESSMENT: NON-TOD VS TOD

- Residential demand: 150 lpcd
- Commercial demand: 1.5 lit per sqm of commercial floor space
WATER EFFICIENCY POTENTIAL: CONSERVATION MEASURES

- Includes a range of water conservation measures

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Water saving potential (as a % of demand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAU</td>
<td>10%</td>
</tr>
<tr>
<td>Conservative</td>
<td>15%</td>
</tr>
<tr>
<td>Progressive</td>
<td>30%</td>
</tr>
</tbody>
</table>

![Graph showing demand reduction potential](image)
WATER EFFICIENCY POTENTIAL: SUPPLY enhancement

- Average rainfall * roof area / days in a year
- Annual average rainfall in Bangalore: 931 mm

<table>
<thead>
<tr>
<th>Scenario</th>
<th>% of rainwater harvested that can be used</th>
<th>% of demand met by wastewater</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAU</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Conservative</td>
<td>5%</td>
<td>20% (domestic); 25% (non-domestic)</td>
</tr>
<tr>
<td>Progressive</td>
<td>10%</td>
<td>30% (domestic); 50% (non-domestic)</td>
</tr>
</tbody>
</table>

Supply Augmentation Potential: Non-TOD vs TOD

![Graph showing supply augmentation potential for different scenarios and locations]
The opportunity

Game-changing solutions are out there

Managing Urban Expansion
Compact development

Improve Energy Efficiency
Smart, efficient buildings

Addressing congestion
Mass Transit, Bike sharing systems and other low impact modes

But solutions need *improvising*, *scaling* and *adapting* for maximum impact

• Source: UTTIPEC, DDA, WRI India
• Photo credit: Anne Maassen