

Service Level Benchmarking in Urban Transport for Indian Cities

Ahmedabad | Bhubaneswar | Hubli-Dharwad | Kohima | Mysore | Surat

An Initiative of the Ministry of Urban Development, Government of India

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Background



Urban Transport Service Level Benchmarking

- A comprehensive framework to **measure and monitor urban transport performance** in India - established in 2010 by the Ministry of Urban Development, GOI
 - Assess, Describe and Inform – What is going on?
 - Review and Explore – How are we doing? Where are we (Baseline)?
 - Account and Compare – Who accomplished what? What is the best practice? Where are others?
 - Plan and Decide – What should we do? Where (Target) do we want to be?
 - Improve and Learn – How can we do better ? What strategies will work?
- It is an ongoing process



Urban Transport Service Level Benchmarking - Summary

- There is a stagnancy in
- Assessing **investment outcomes**
- To **showcase** achievements / good practice

- **Periodicity ? Baseline:2011-12 Round 1: 2015-16**
 - Annual activity linked to annual budgeting exercise
 - Once in 5 years
 - As part of CMP



National Urban Transport Policy

National Mission for Sustainable Habitat objectives

NUTP	NMSH
<ul style="list-style-type: none">▪ To ensure safe, affordable, quick, comfortable, reliable and sustainable access for the growing number of city residents to jobs, education, recreation and other needs.	<ul style="list-style-type: none">▪ Adopting energy conservation approach▪ Mitigating GHG emission levels▪ Environmental sustainability▪ Improving public transport service quality



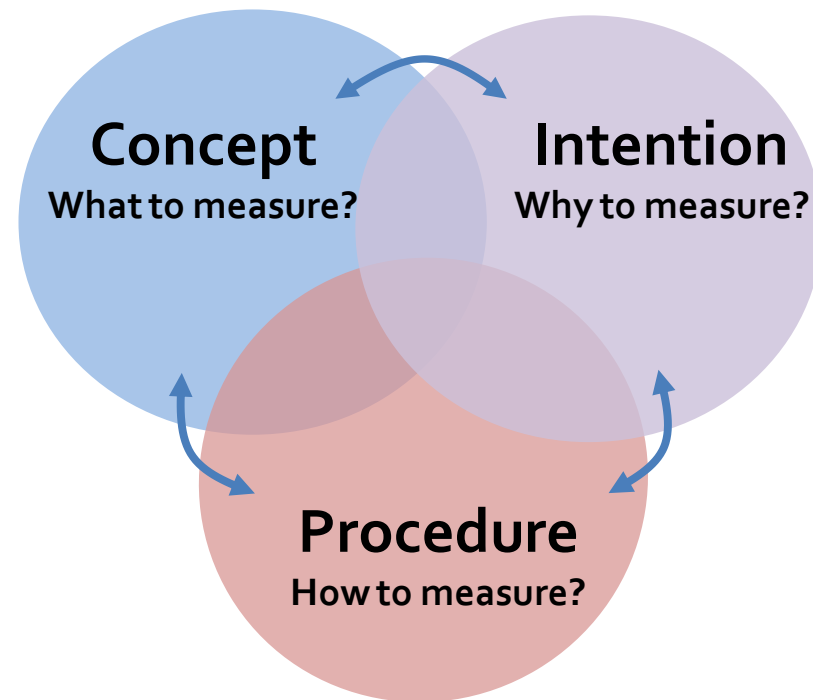
NUTP & NMSH Strategies

NUTP	NMSH
<ol style="list-style-type: none">1. Integrating Land use and transport planning2. Equitable allocation of road spaces3. Improving access to business and market4. Priority to the use of public transport<ol style="list-style-type: none">I. Quality and pricing of public transportII. Technologies for public transportIII. Integrated public transport5. Priority to NMT6. Parking management7. Freight traffic planning8. Establishing institutional mechanisms for enhanced coordination9. Use of cleaner technologies10. Use of ITS11. Innovative financing mechanism	<ol style="list-style-type: none">1. Promoting public transport.2. Developing CMP, integrating land use and transport.3. Setting up of UMTA.4. Designing one department as a nodal department for urban transport at the state level.5. Banning any development less than 500m. on the side of new bypasses so that they remain as bypasses.6. Setting up a dedicated urban transport fund exclusively for transport needs.7. Greater use of NMT8. Use of Hydrogen, alternative fuel or battery operated vehicles

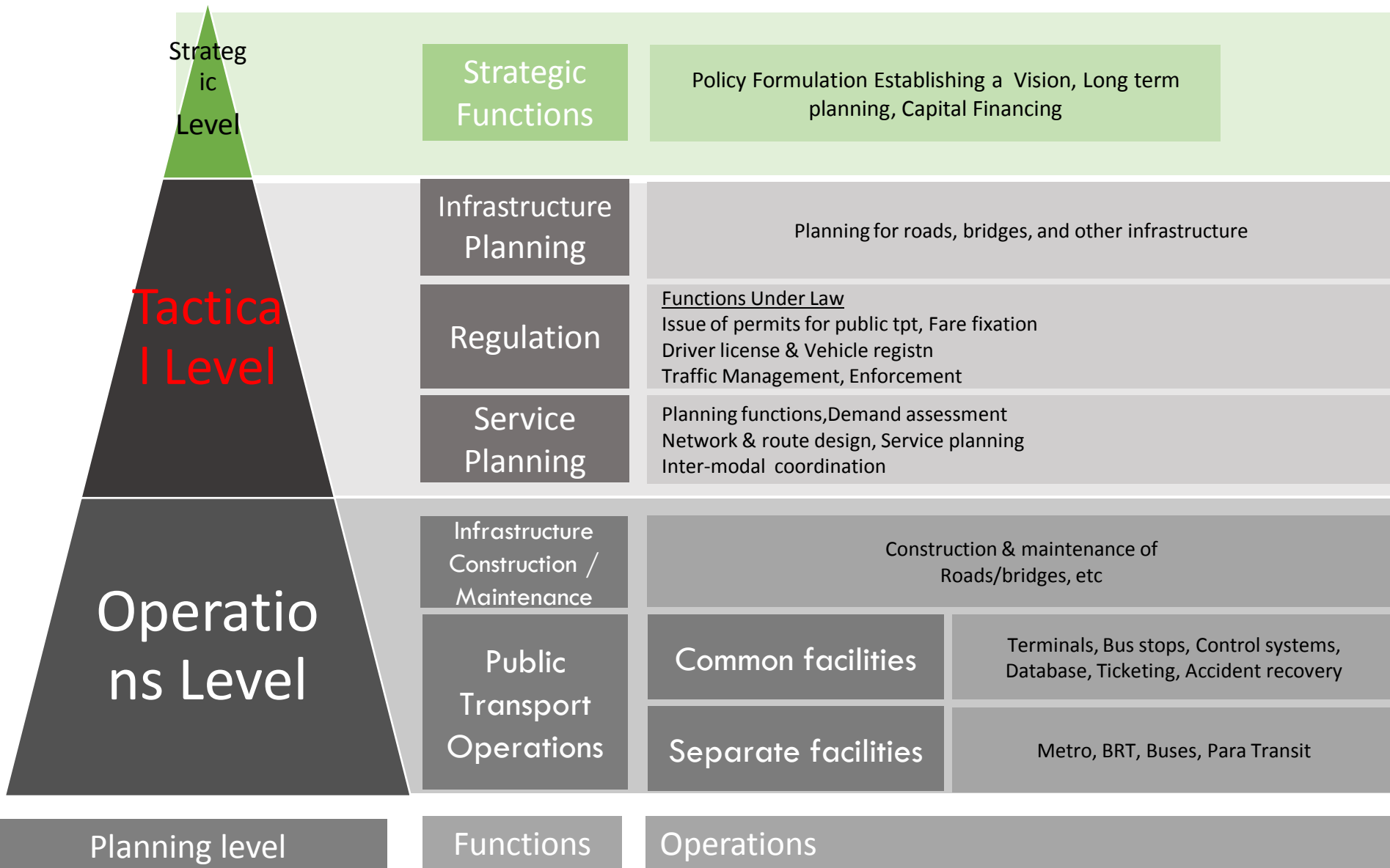


Frameworks are essential

- Focus Areas/Dimensions
- Indicators are embedded in **frameworks** that are conceptual and procedural constructs
- Frameworks **organize** how indicator systems are designed, managed, and applied
- Frameworks provide **focus** and **structure**



SLB Assessment Focus



Preparation



Preparing for SLB

- Study area
 - Municipal Vs **Contiguously Developed Area**
- Network
 - Land use Plans, Google
 - Hierarchy (To select major streets)
- Transit Network Selection
 - Headway 1 Hour
 - Bus Stops
- Special Areas – Hilly Areas (Access)
- Street Lights – Lux Levels
- Surveys



Preparatory Study for Benchmarking

Study Area Delineation

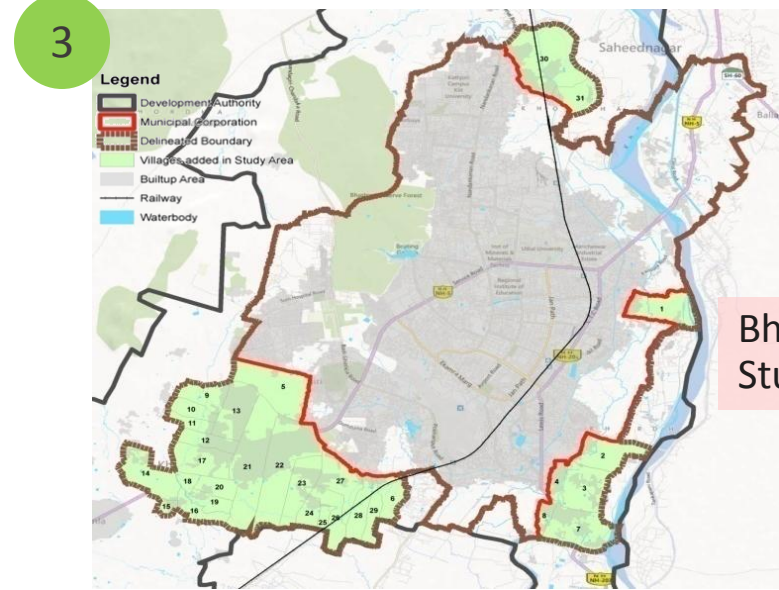
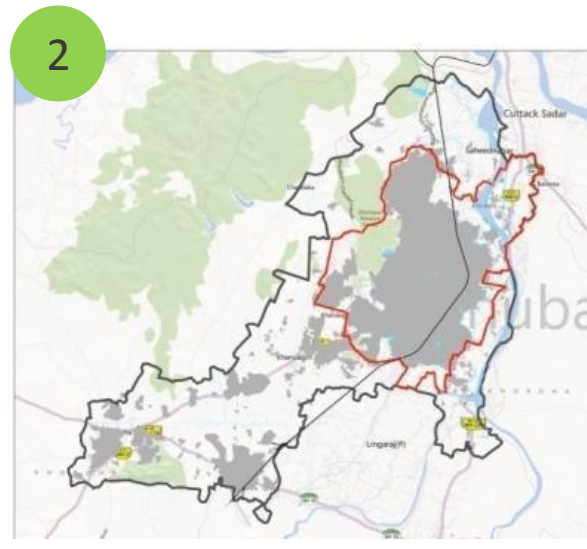
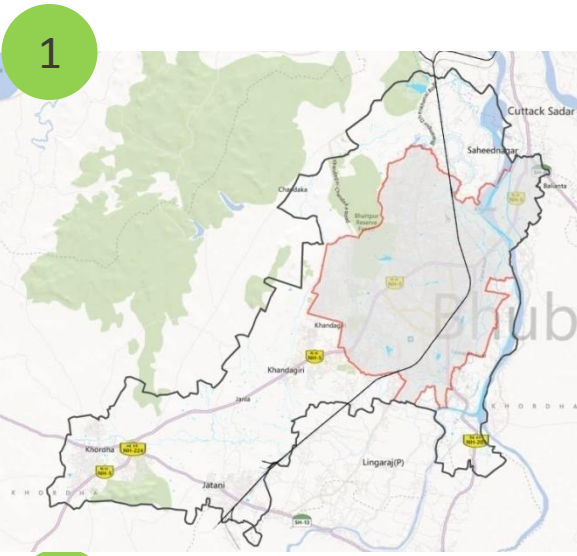
1 Mark the Municipal limits of the city- (a)

2 Mark the village / town boundaries in Urban Development Authority area (b)

3 Digitize the contiguous built-up area adjoining the municipal limits (c)

4 Select the villages/ towns that correspond to step 1. (b & c = d)

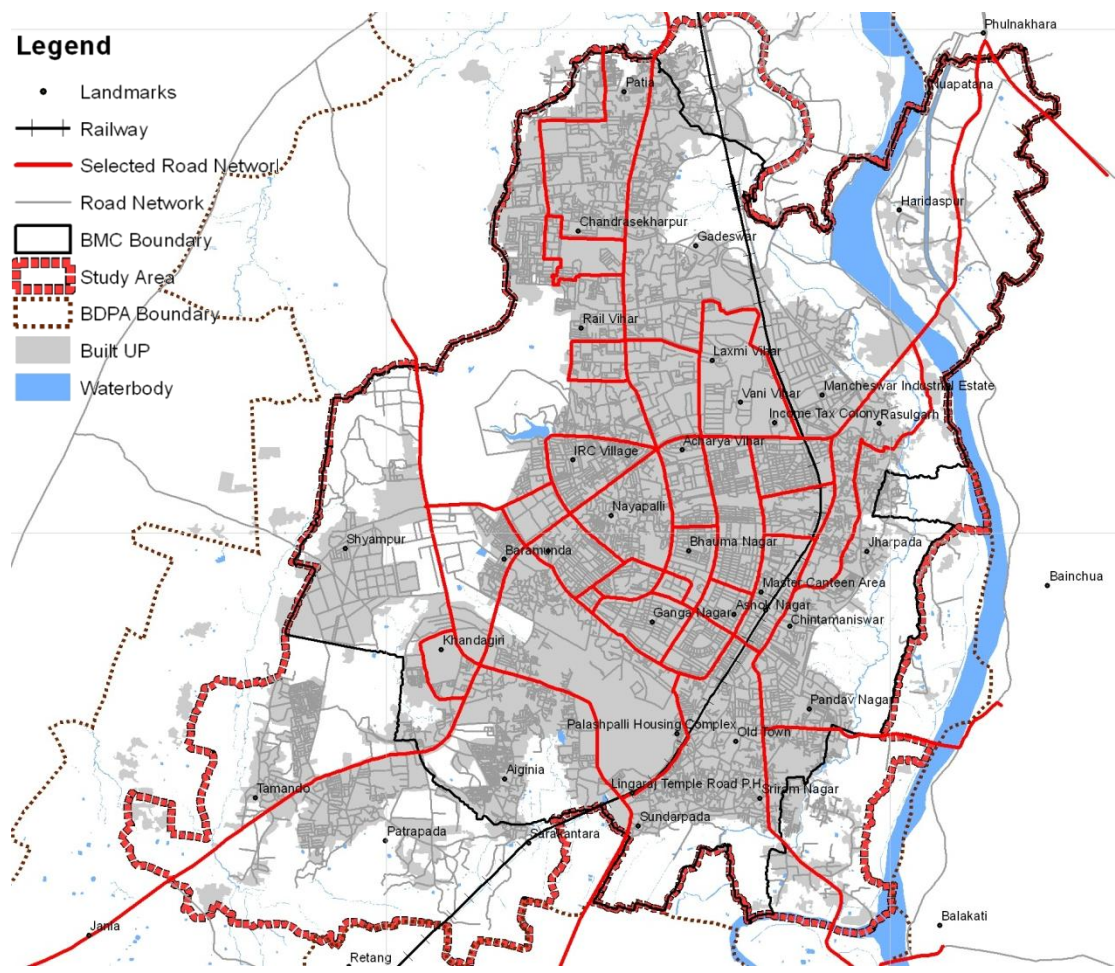
5 Define the Study area i.e. Municipal area + Area selected in step 4 (a + d)



Bhubaneswar
Study area :179 sq.km

Preparatory Study for Benchmarking

Selection of network inventory



Digitization of roads



Classification of road into four levels



Arterial and sub arterial and all roads where PT is plying

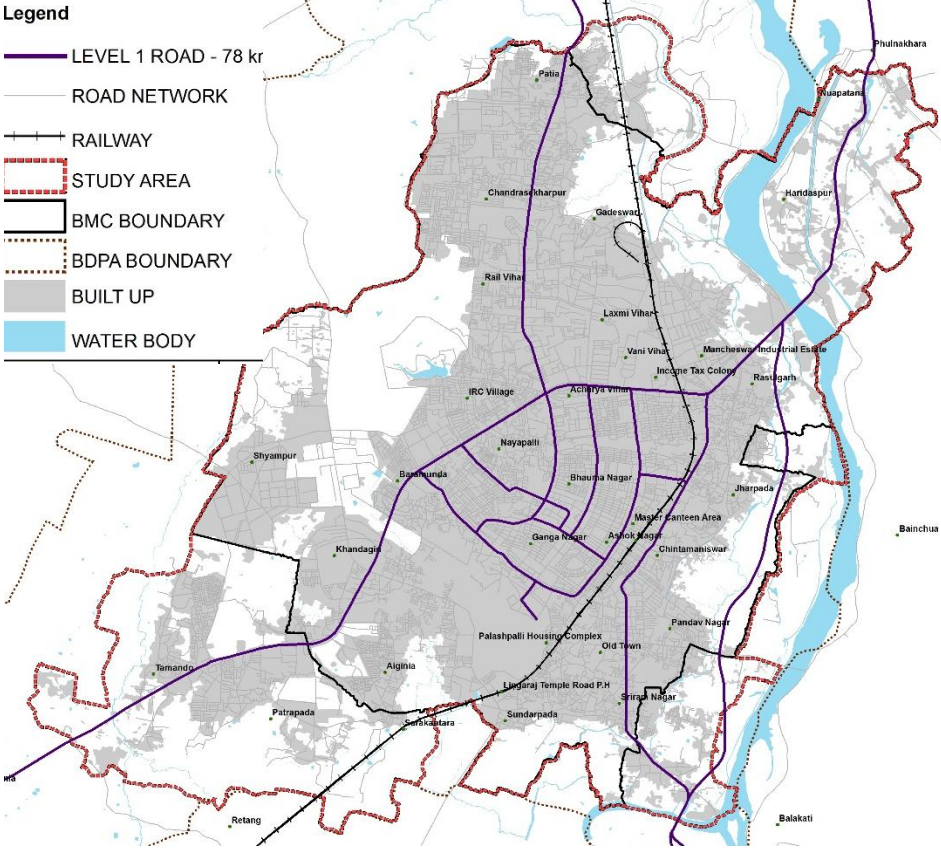
Length of selected road network – 141 km (approx 10% of total network)

Preparatory Study for Benchmarking

Hierarchy

Level 1

- In case of Bhubaneswar, Level 1 roads are the roads which takes care of primary traffic movement in and out of the city,
- All the NH, SH roads have been considered as Level 1 roads
- Orbital roads that are long and that cut across the city.
- Roads, which are helping in forming the shape of the city i.e. ring / radials / Grid form



Lengths of the road network within delineated area (km)

Level 1 roads	78 km
Total	78 km

Preparatory Study for Benchmarking

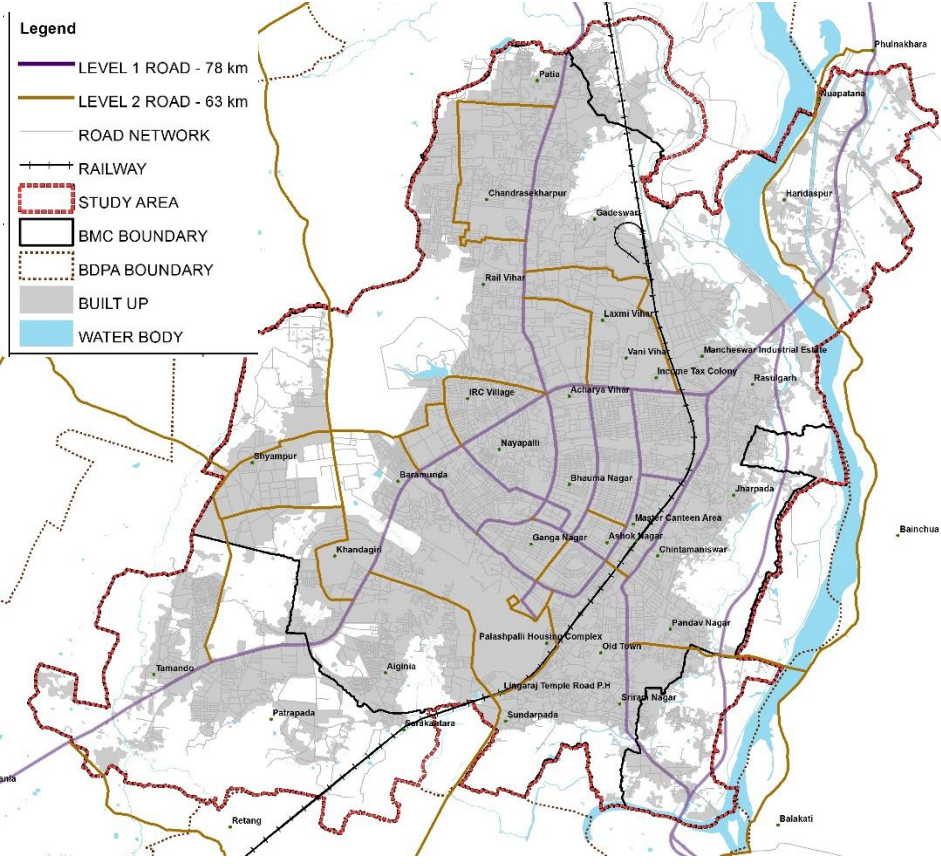
Hierarchy

Level 2

- Long roads (roads having lengths of approximately half or three quarter length to the city size)
- Major district roads & Other district roads
- Roads, which are further dissecting level 1 roads and form grids or pattern

Lengths of the road network within delineated area (km)

Level 1 roads	78 km
Level 2 roads	63 km
Total	141 km



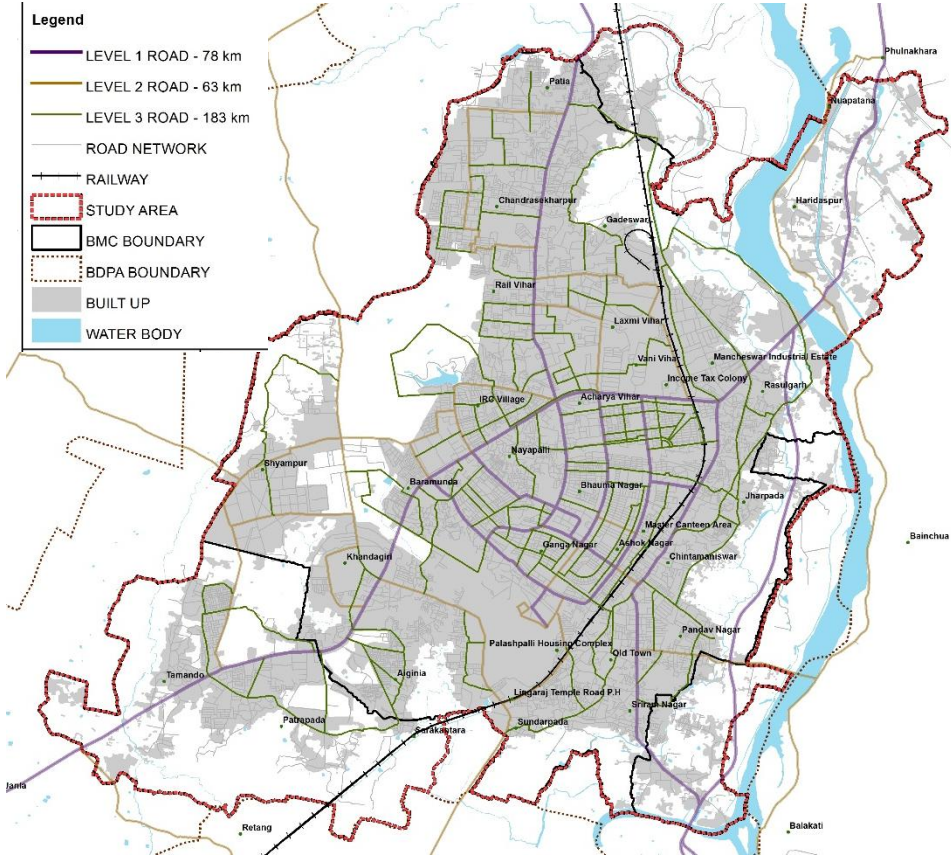
Preparatory Study for Benchmarking

Hierarchy

- Level 3**
- Roads that connect level 1 and level 2 roads
 - Roads, that further create smaller grids

Lengths of the road network within delineated area (km)

Level 1 roads	78 km
Level 2 roads	63 km
Level 3 roads	183 km
Total	324 km

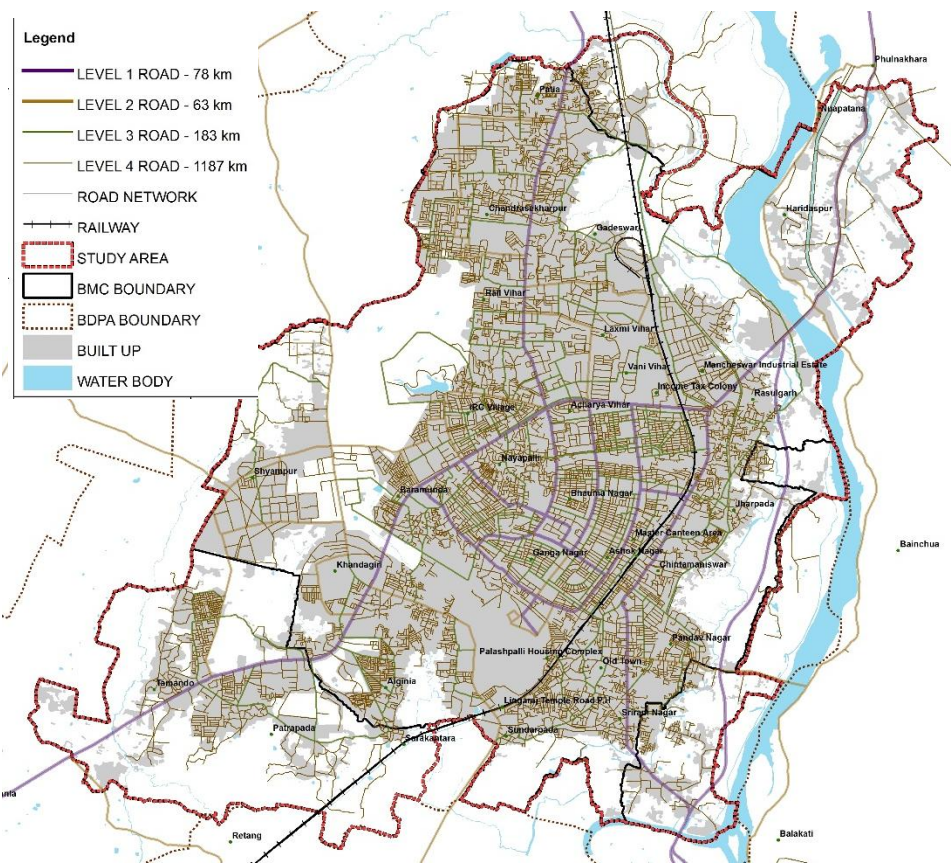


Preparatory Study for Benchmarking

Hierarchy

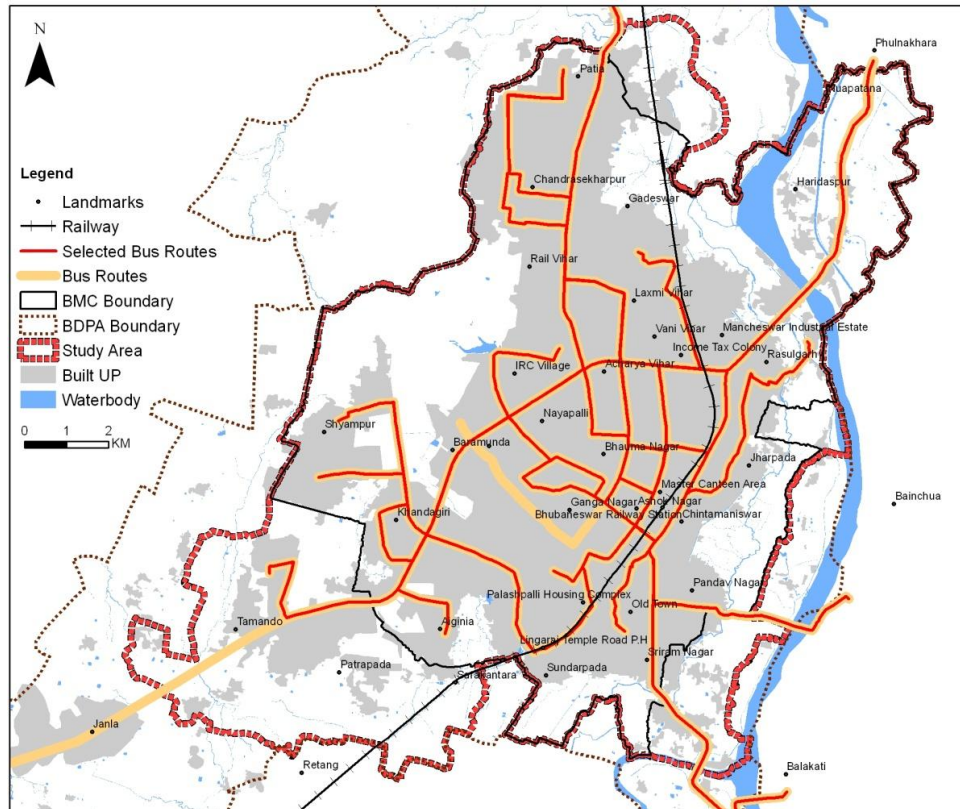
Level 4	<ul style="list-style-type: none"> ▪ Roads that are connects to residential units. ▪ Roads that have right of way < 9m
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Lengths of the road network within delineated area (km)	
Level 1 roads	78 km
Level 2 roads	63 km
Level 3 roads	183 km
Level 4 roads	1187 km
Total	1511 km



Preparatory Study for Benchmarking

Selection of Public Transport – Routes



1

Identification of corridors with Headways < 60 mins –

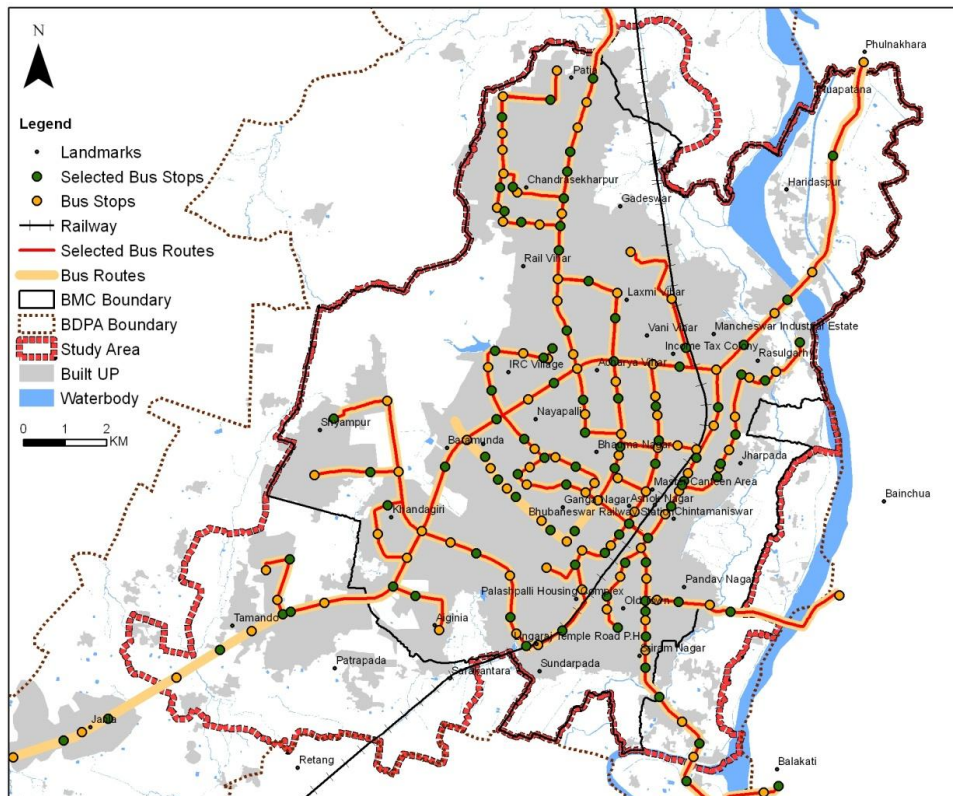
- Less than 10 min- Survey all the routes
- 10-20 minutes- 25% of the randomly selected routes
- 20-60 min- 25% of the randomly selected routes

2

All routes that ply on the selected road for inventory

Preparatory Study for Benchmarking

Selection of Public Transport stops



1

Selection of bus stops for calculating average waiting time

Out of the total number of bus stops (N), a sample of (n) bus stops (depending on city size) is selected to calculate the avg. waiting time :-

1. > 4 million - 10%
2. 1.4 million - 25%
3. <1 million - 50%

2

A reco survey was conducted in Ahmedabad. it was observed that waiting time is not always half of headway

3

Relation between headways and waiting time was established through this surveys for

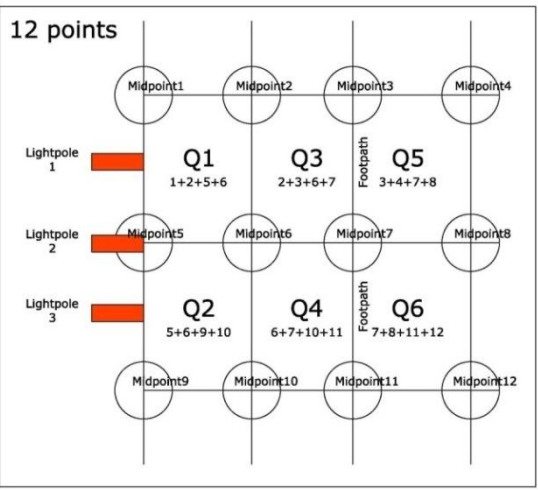
1. <10 mins
2. 10-20mins
3. 20-60 mins

Headways	Constant
<10	0.40
10-20	0.40
>20 - 60	0.29

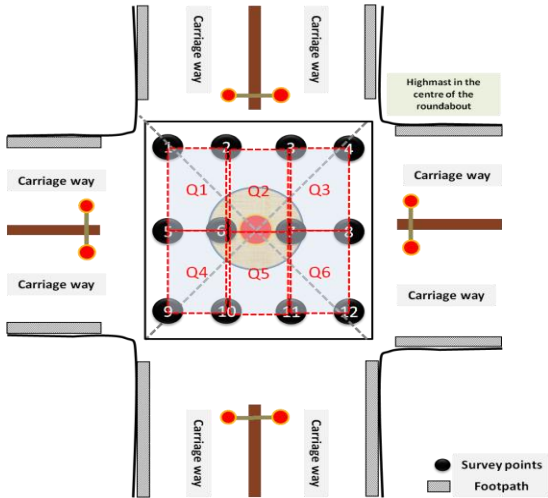


Street Lighting (LUX Level)

Link



Junction



Methodology

LUX reading consists of 12 point readings
 Average LUX levels on each of the selected links= $(Q1+Q2+Q3+Q4)/4$

Average LUX levels on each of the junctions = $(Q1+Q2+Q3+Q4+Q5+Q6)/6$

Level of service on which cumulative frequency crosses 50% mark

Target is LoS 2

Range	LoS
≥ 30	1
$>25-30$	2
$>20-25$	3
<20	4

Data collection

Secondary Data Collection

- Data sources like annual reports, websites, etc for secondary data collection
- Focus of data collection was on updated information for the indicators using data that is dynamic in nature.
- Necessity to cross check data – to avoid misinterpretation and to identify valid reason for change in number

Primary Data Collection

- **Road inventory Survey**
- **Level of Comfort Surveys**
- **Speed and Delay Surveys**
- **NMT Facilities at Transit Stations**
- **Lux Survey**
- **Land use along Transit corridor**



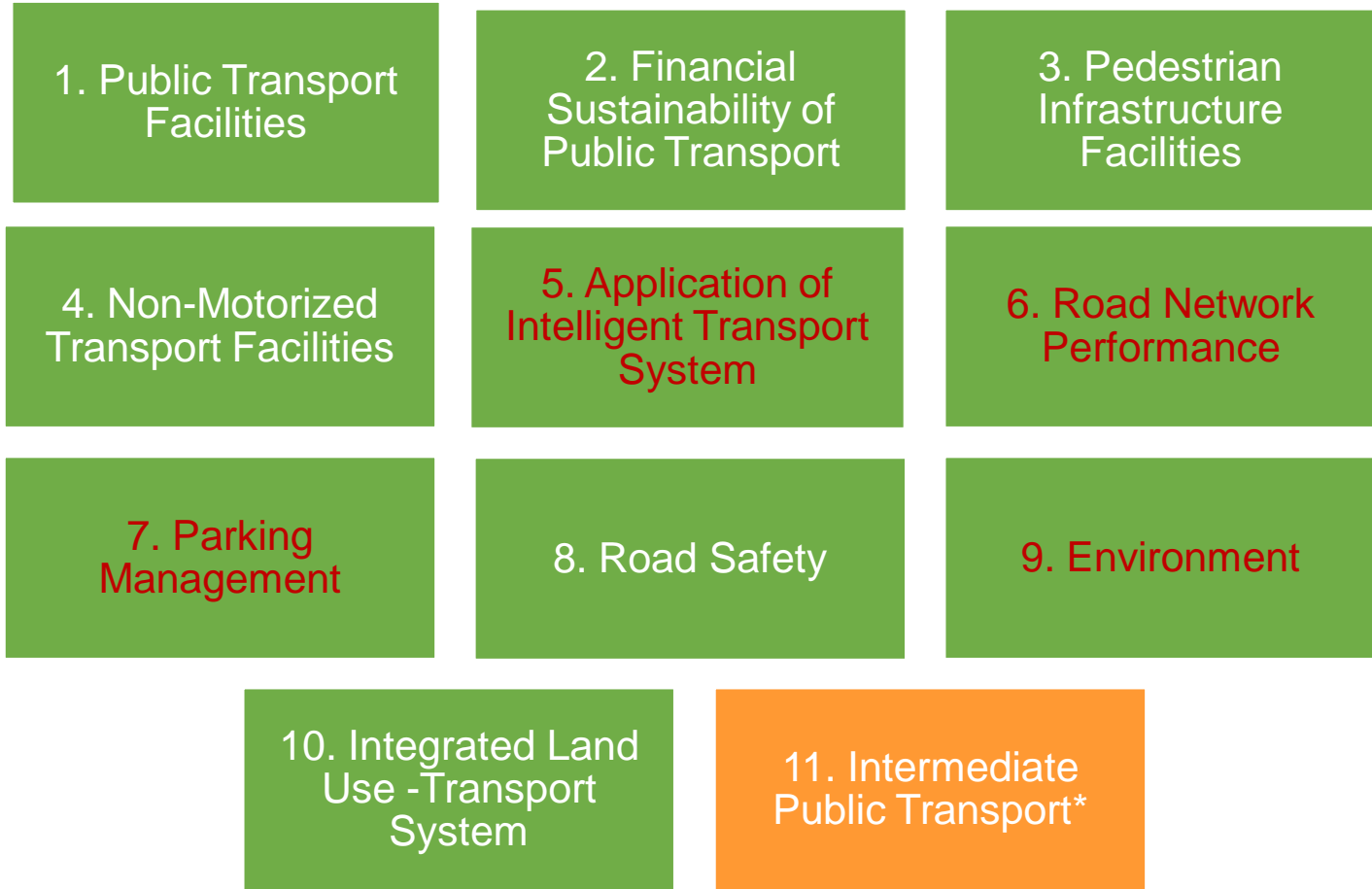
MoUD's Service Level Benchmarks (SLBs)

Focus Areas:



MoUD's Service Level Benchmarks (SLBs)

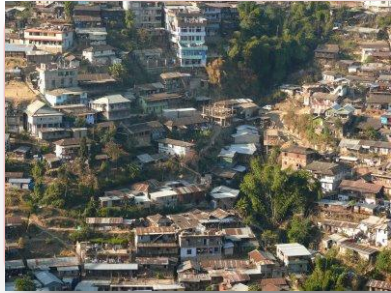
Focus Areas:



* Additional Focus Area suggested by CoE

Adapting Indicators for Hill Cities

Why do we need to look at Hill Cities differently?



Geographical constraints

- Steep slopes, landslides, heterogeneity of climate, land use pattern and scarcity of buildable land



Scale and Size

- Size of these cities maybe smaller but the scale is much larger as it is driven by both residents and visitors



Functionality

- specific features of these areas tend to reflect on the different time frame for the local mobility, economy and also the social characteristics

Adapting Indicators for Hill Cities

Research background methodology to compute basis for Hill Cities

Developing a base

Base information required to collect for all hill cities

1. Contours
2. Generate Elevation from Contours
3. Generate Slopes from Elevation.
4. Using Path distance tool and applying Tobler's hiking function (vertical factors) to calculate the cost in terms of time.

Survey required for computation

1. Public transport user survey
2. Average walking speed

Interpretation of 500m buffer



Adapting Indicators for Hill Cities

Computation

Result from survey

Sample size 1% of ridership-220nos

- 75% of bus users use walk as an access and egress mode
- 45 % of the bus users are walking 10 minutes
- 23% of the bus users are willing to walk upto 20 minutes to a bus stops
- Average walking speed is 2.3 km/hr

Calculation for computation

1. 500m = 230 m

i.e. It takes 6 minutes to walk 230m in hill areas

2. Willingness to walk = 20 mins
= 750m

i.e. Coverage of public transport is 750m instead of 500m because people walk more on hilly areas.



Modified Indicator within Focus Areas

Pedestrian Infrastructure facilities – Hill Cities

Methodology

Classification of footsteps

Step 1:

- Identify steps that connect to PT stops @ 250 metre length either side of the stops – Survey 75%

Step 2:

- Identify steps that connect level 1 & level 2 roads(connecting commercial and Institution and residential) - Survey 50%

Step 3:

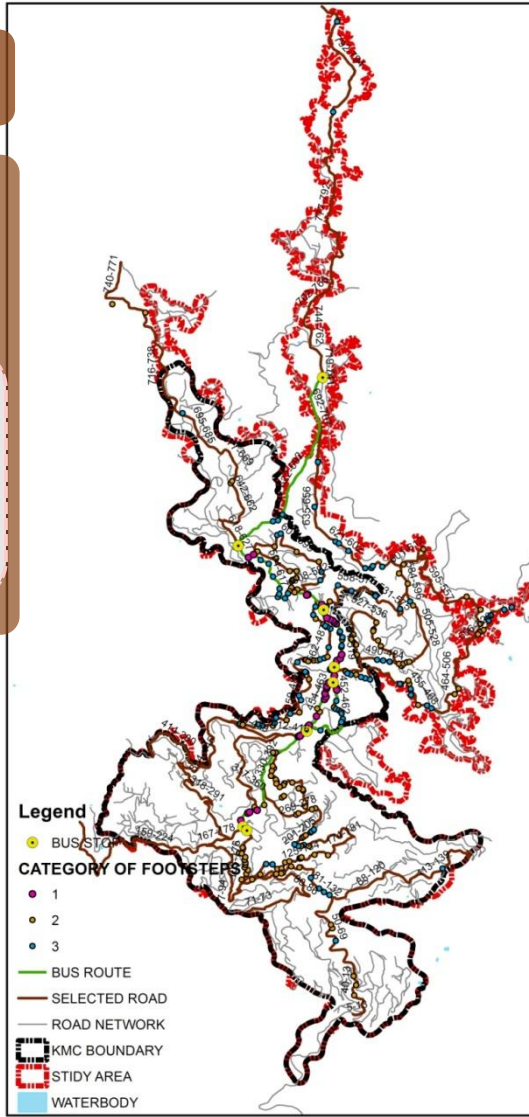
- Identify steps that provide connectivity to more than 10 households- survey 25%

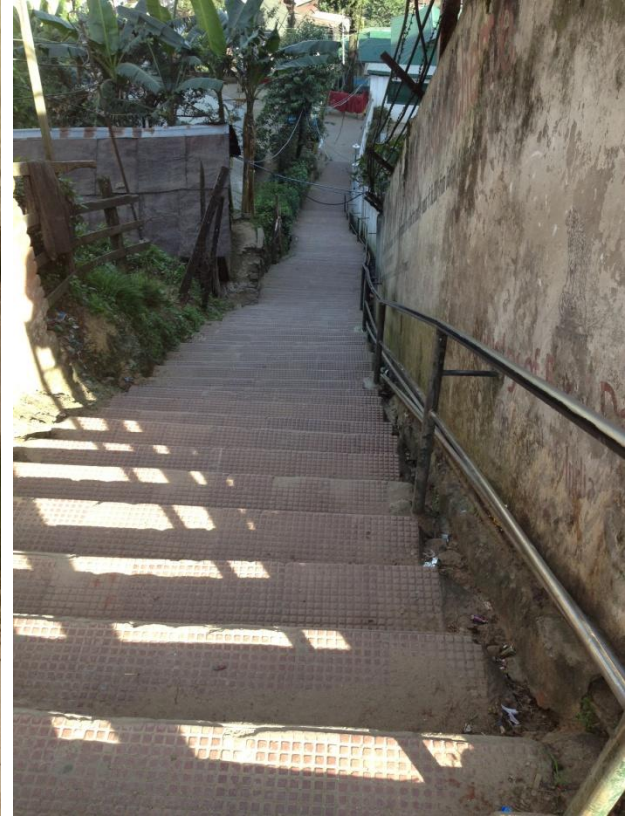
Survey required for computation

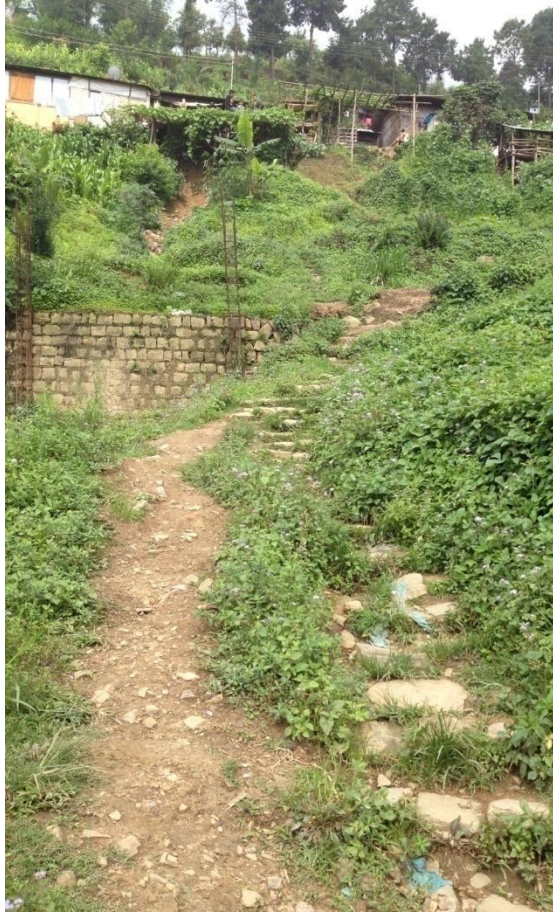
1. Footstep survey

1. Quality of footsteps
2. Pedestrian interview

Sample 70 nos







Focus Areas, Indicators, Measurement, LOS



SLB Focus Areas and Indicators

1- PT FACILITIES

2 - FINANCIAL SUSTAINABILITY

User Focused		Operator Focused	
Service Availability/ Accessibility	Service Delivery	Service Effectiveness	Cost Efficiency
1. Presence of Organized Public Transport System in Urban Area (%)	4. Average waiting time for Public Transport users (mins)		1. Extent of non fare revenue
2. Extent of Supply Availability of Public Transport	5. Level of Comfort in Public Transport		2. Staff per bus ratio
3. Transit Accessible Area (% Built up area within 500m of PT Plying)	6. % of Fleet as per Urban Bus Specification		3. Operating Ratio



SLB Focus Areas and Indicators

1- PT FACILITIES

2 - FINANCIAL SUSTAINABILITY

User Focused

Operator Focused

Service Availability/ Accessibility

Service Delivery

Service Effectiveness

Cost Efficiency

1. Presence of Organized Public Transport System in Urban Area (%)

5. Average waiting time for Public Transport users (mins)

8. Total Boarding per 1000 population

1. Extent of non fare revenue

2. Extent of Supply Availability of Public Transport

6. Level of Comfort in Public Transport

9. Breakdown of Public Transport

2. Staff per bus ratio

3. Transit Accessible Area (% Built up area within 500m of PT Plying)

7. % of Fleet as per Urban Bus Specification

10. Vehicle Utilization of Public Transport

3. Operating Ratio

4. Affordability of Public Transport

11. Average ravel Speed of PT on Major Corridor



Extent of Supply/Availability of PT

Calculation

Buses on road/Current population of the study area*1000

Mega Cities (4 Million+ People)		Metro Cities (1-4 Million)		1.) Other cities 1 (<1 Million People)	
Buses/1000 population	LoS	Buses/1000 population	LoS	Buses/1000 population	LoS
>0.6	1	>0.4	1	>0.3	1
0.4 – 0.6	2	0.25 – 0.4	2	0.2-0.3	2
0.2 – 0.4	3	0.1 – 0.25	3	0.1-0.2	3
< 0.2	4	<0.1	4	<0.1	4



1. Public Transport Facilities

Overall Level of Service for the focus area:

Sr. No	Public Transport Facilities	Target LoS	Bhubaneswar Indicator Value - PT Facilities	Bhubaneswar LoS -PT Facilities
			2015	2015
1	Presence of Organized Public Transport System in Urban Area (%)	1	100%	1
2	Extent of Supply-Availability of Public Transport (PT per 1000 population)	2	0.09	4
3	Transit Access Area (% built-up area within 500 m of PT plying)	2	75%	2
4	Affordability of Public Transport (% expenditure on transportation)	2	9%	1
5	Average Waiting Time for Public Transport Users (minutes)	2	6	2
6	Level of Comfort in Public Transport (passenger/seat)	3	1.5	1
7	Percentage Fleet Size as per Urban Bus Specification (UBS) (%)	3	100%	1
8	Total Boarding per 1000 population	2	38	4
9	Average Travel Speed of Public Transport (kmph)	2	19	2
10	Breakdown of Public Transport (per 10,000 km)		28	4
11	Vehicle Utilization (km per day)		176	4
Total Score				24

Overall LoS	Calculated LoS
1	11
2	12 – 22
3	23 – 33
4	34 - 44

Overall LOS	3
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Overall LoS	Calculated LoS	Comments
1	11	The City has a good public transport system which is wide spread and easily available to the citizens. The system provided is comfortable.
2	12 – 22	The City has public transport system which may need considerable improvements in terms of supply of buses/ coaches and coverage as many parts of the city are not served by it. The frequency of the services available may need improvements. The system provided is comfortable.
3	23 – 33	The City has a public transport system which may need considerable improvements in terms of supply of buses / coaches and coverage as most parts of the city are not served by it. The frequency of the services available needs improvements. The system provided is not comfortable as there is considerable over loading.
4	34 - 44	The city has poor or nil organized public transport system



SLB Focus Areas and Indicators

1- PT FACILITIES

2 - FINANCIAL SUSTAINABILITY

User Focused

Operator Focused

Service Availability/ Accessibility

Service Delivery

Service Effectiveness

Cost Efficiency

1. Presence of Organized Public Transport System in Urban Area (%)

5. Average waiting time for Public Transport users (mins)

8. Total Boarding per 1000 population

1. Extent of non fare revenue

2. Extent of Supply Availability of Public Transport

6. Level of Comfort in Public Transport

9. Breakdown of Public Transport

2. Staff per bus ratio

3. Transit Accessible Area (% Built up area within 500m of PT Plying)

7. % of Fleet as per Urban Bus Specification

10. Vehicle Utilization of Public Transport

3. Operating Ratio

4. Affordability of Public Transport

11. Average ravel Speed of PT on Major Corridor



2. Financial Sustainability of PT

Overall Level of Service for the focus area:

Sr. No	Public Transport Facilities	Target LoS	Bhubaneswar Indicator Value – Financial Sustainability	Bhubaneswar LoS – Financial Sustainability
			2015	2015
1	Presence of Organized Public Transport System in Urban Area (%)	1	100%	4
2	Extent of Supply-Availability of Public Transport (PT per 1000 population)	2	0.09	1
3	Transit Access Area (% built-up area within 500 m of PT plying)	1	75%	2
Total Score				7

Overall LoS	Calculated LoS
1	3
2	4 – 6
3	7 – 9
4	10 - 12

Overall LOS	3
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Overall LoS	Calculated LoS	Comments
1	3	The public transport of a city is financial sustainable.
2	4 – 6	The public transport of a city is financial sustainable but needs some improvements
3	7 – 9	The public transport of a city is financial sustainable but needs considerable improvements
4	10 - 12	The public transport of a city is not financial sustainable.



SLB Focus Areas and Indicators

3. Pedestrian Infrastructure Facilities

Availability		Service Delivery	
1. Availability of Signalized Intersection (%)	2. Percentage of City Covered with Footpath	3. Signalized intersection delay (%)	4. Street Lighting (Lux)



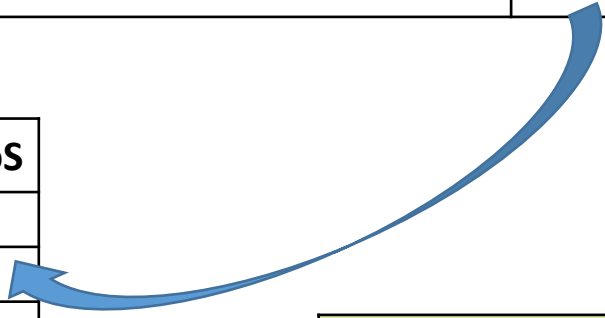
3. Pedestrian Infrastructure Facilities

Overall Level of Service for the focus area:

Sr. No	Pedestrian Infrastructure Facilities	Target LoS*	Bhubaneswar Indicator Value - Pedestrian Infrastructure Facilities	Bhubaneswar LoS - Pedestrian Infrastructure Facilities
			2015	2015
1	Availability of Signalised Intersection (%)	2	59%	2
2	Signalised Intersection Delay (%)	2	14%	1
3	Percentage City covered with Footpath (%)	2	33%	3
4	Street Lighting (LUX level) for Footpath	2	59	1
Total Score				7

Overall LoS	Calculated LoS
1	4
2	5 - 8
3	9 - 12
4	13 - 16

Overall LOS	2
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Overall LoS	Calculated LoS	Comments
1	4	The City has adequate barrier free pedestrian facilities at overall road network.
2	5 – 8	The City has pedestrian facilities which may need some improvements in terms of improvements in intersections, footpaths, and street lighting as some parts of the city are not served by it. The footpath available need improvements. The system provided is comfortable and sustainable.
3	9 – 12	The City has pedestrian facilities which may need considerable improvements. The pedestrian facilities at intersection, availability of footpath etc needs improvements as many parts of the city are not served by it.
4	13 - 16	The city lacks adequate pedestrian facilities.



4. Non-Motorized Transport Facilities

Availability

1. % of network covered

2. NMT Parking facilities at Interchanges (%)

Service Delivery

3. Encroachment on NMV roads by Vehicle Parking (%)



4. Non-motorized Transport Facilities

Overall Level of Service for the focus area:

Sr. No	Non-motorized Transport Facilities	Target LoS*	Bhubaneswar Indicator Value – NMT Facilities	Bhubaneswar LoS – NMT Facilities
			2015	2015
1	NMT Coverage (%)	3	7%	4
2	NMT Encroachment (%)	3	2.18%	4
3	NMT Parking Facilities at Interchange (%)		75%	2
Total Score				10

Overall LoS	Calculated LoS
1	3
2	4 – 6
3	7 – 9
4	10 - 12

Overall LOS	4
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Overall LoS	Calculated LoS	Comments
1	3	The city has adequate NMT facilities at overall road network.
2	4 – 6	The city has NMT facilities which may need some improvements in terms of encroachments, parking facilities at interchanges etc as some parts of the city are not served by it. The system provided is comfortable and sustainable
3	7 – 9	The city has NMT facilities which may need considerable improvements as many parts of the city are not served by it.
4	10 - 12	The city lacks adequate NMT facilities



5. Application of ITS Facilities

Availability			Service Delivery	
1. Availability of Traffic Surveillance (%)	2. Passenger Information System (PIS) (%)	3. Global Positioning System / GPRS (%)	4. Signal Synchronization (%)	5. Integrated Ticketing System

5. Application of ITS Facilities

Overall Level of Service for the focus area:

Sr. No	Application of ITS Facilities	Target LoS	Bhubaneswar Indicator Value- Application of ITS Facilities	Bhubaneswar LoS- Application of ITS Facilities
			2015	2015
1	Availability of Surveillance System (%)	1	38%	3
2	Passenger Information System (%)	1	50%	2
3	Global Positioning System (%)	1	0%	4
4	Signal Synchronization (%)	1	0%	4
5	Integrated Ticketing System (%)	1	0%	3
Total Score				16

Overall LoS	Calculated LoS
1	5
2	6 – 10
3	11 – 15
4	16 - 20

Overall LOS	4
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Overall LoS	Calculated LoS	Comments
1	5	The city has adequate ITS facilities
2	6 – 10	The City has ITS facilities which may need some improvements in terms of integrated ticketing system, signal Synchronization, GPS/GPRS, PIS etc as some parts of the city are nor served by it.
3	11 – 15	The City has ITS facilities which may need considerable improvements terms of integrated ticketing system, signal Synchronization, GPS/GPRS, PIS etc as many parts of the city are nor served by it.
4	16 - 20	The city lacks adequate ITS facilities



6. Road Network Performance

Availability		Service Delivery		
1. % Area under Roads	2. Road Density	3. Travel speed of Personal vehicles along key corridors	4. Travel speed of Public Transport along key corridors	5. Street Lighting (LUX Level) for Road

6. Road Network Performance

Overall Level of Service for the focus area:

Sr. No	Road Network Performance	Target LoS	Bhubaneswar Indicator Value- Road Network Performance	Bhubaneswar LoS- Road Network Performance
			2015	2015
1	Average Speed of Personal Vehicles (kmph)	1	28	1
2	Road Density of Built-Up Area (km/km ²)		12.26	1
3	Street Lightening (LUX Levels) for Roads	2		3
4	Percentage Area under Roads (%)		15.57%	1
Total Score				6

Overall LoS	Calculated LoS
1	4
2	5 - 8
3	9 - 12
4	13 - 16

Overall LOS	2
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Overall LoS	Calculated LoS	Comments
1	4	Primarily free flow- operations at average travel speeds usually about 70% of the free flow speed for the key corridors
2	5 – 8	Small increase in flow may cause substantial increases in approach delay and hence, decrease in arterial speed.
3	9 – 12	Significant approach delays and average travel speed of 1/3 of free flow speed or lower. Such operations are caused by some combination or adverse progression, high signal density, extensive queuing at critical intersections and inappropriate signal timing.
4	13 - 16	Key corridors at extremely low speeds below 1/3 to 1/4 of the free flow speed. Intersection congestion is likely at critical signalized locations, with high approach delays resulting. Adverse progression is frequently a contributor to this condition.



7. Parking Management

Availability	Service Delivery
1. Availability of paid public parking spaces (%)	2. Ratio of Maximum and Minimum Parking Fee in the City

7. Parking Management

Overall Level of Service for the focus area:

Sr. No	Parking Management	Target LoS	Bhubaneswar Indicator Value- Parking Management	Bhubaneswar LoS- Parking Management
			2015	2015
1	Availability of Paid on-street Parking Spaces (%)	2	90%	1
2	Ratio of Maximum to Minimum Parking in the City	2	1.83	3
Total Score				4
Overall LoS				2

Overall LoS	Calculated LoS
1	2
2	3 - 4
3	5 - 6
4	7 - 8

Overall LOS	2
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Overall LoS	Calculated LoS	Comments
1	2	Paid parking spaces are available in the city and the demand is well managed by incorporating differential parking rates for the CBD.
2	3 – 4	Paid parking spaces are available in the city and the demand is well managed by incorporating differential parking rates for the CBD. However some improvements may be required
3	5 – 6	Paid parking spaces provided in the city need to be improved upon and to cater to the demand some differential parking rates for the CBD have been adopted. The city authorities need to initiative considerable improvements measures.
4	7 - 8	The city authorities need to initiate immediate actions with respect to providing paid parking spaces and demand management for parking.



8. Road Safety

Availability	Service Delivery		
-	1. Fatality rate per lakh population	2. Fatality rate for pedestrian and NMT (%)	3. Serious Injuries per Lakh Population

Road Traffic Accident: 'An event that occurs on a way or street open to public traffic; resulting in one or more persons being injured or killed, where at least one moving vehicle is involved

Fatal Accident: An accident in which one or more person were killed on the accident immediately at location or in next 90 days.

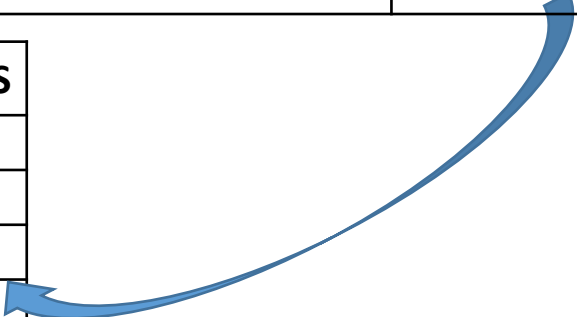
Serious Accident: Accidents in which person has received grievously injuries such like fractures, concussions, internal lesions, crushing, severe cuts and lacerations etc.

8. Road Safety

Overall Level of Service for the focus area:

Sr. No	Road Safety	Target LoS*	Bhubaneswar Indicator Value- Road Safety	Bhubaneswar LoS- Road Safety
			2015	2015
1	Fatalities per Lakh Population	1	25	4
2	Fatality Rate for Pedestrian & NMT (%)	2	0%	4
3	Serious Injuries per Lakh Population		47	4
Total Score				12

Overall LoS	Calculated LoS
1	3
2	4 - 6
3	7 - 9
4	10 - 12



Overall LOS	4
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Overall LoS	Calculated LoS	Comments
1	3	Level of Fatality rate in a city is very low.
2	4 – 6	Need some improvements in Road design and available road infrastructure, traffic management and in other such reasons which significantly contribute to road safety.
3	7 – 9	Need considerable improvements in Road design and available road infrastructure, traffic management and in other such reasons which significantly contribute to road safety.
4	10 – 12	Level of Fatality rate in a city is very high.



SLB Focus Areas and Indicators

9. Environment

Availability	Service Delivery			
-	1. Annual Mean Concentration of SO ₂ (µg/m ³)	2. Annual Mean Concentration of NO ₂ (µg/m ³)	3. Annual Mean Concentration of SPM (µg/m ³)	4. Annual Mean Concentration of RSPM (µg/m ³)

Reading of SPM (PM 10)	As per 2007 report , CPCB had defined SPM at very high range, which was modified in 2009 So the ranges have been modified based on 2009 standards.	SLB Ranges	LoS	Suggested range (CPCB)
		0-180 (Low)	1	0-60
		180-350 (Moderate)	2	60-120
		360-540 (High)	3	120-180
		>540 (Critical)	4	>180



9. Environment

Overall Level of Service for the focus area:

Sr. No	Environment	Target LoS	Bhubaneswar Indicator Value-Environment	Bhubaneswar LoS-Environment
			2015	2015
1	Annual Mean Concentration of SO ₂ (µg/m ³)	1	4	1
2	Annual Mean Concentration of NO ₂ (µg/m ³)	1	17	1
3	Annual Mean Concentration of SPM (µg/m ³)	1	83	2
4	Annual Mean Concentration of RSPM (µg/m ³)	1	32	1
Total Score				5

Overall LoS	Calculated LoS
1	4
2	5 - 8
3	9 - 12
4	13 - 16

Overall LOS	2
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Overall LoS	Calculated LoS	Comments
1	4	Level of pollution in a city is very low.
2	5 – 8	Need some improvements in emission standards, checking pollution etc.
3	9 – 12	Need considerable improvements in emission standards, checking pollution etc.
4	13 – 16	Level of pollution in a city is very high.



10. Integrated Land Use – Transport System

Availability	Service Delivery						
-	1. Population Density - Gross (Persons/Developed area in hact.)	2. Mixed Land-use on Major Transit Corridors / Network (% area under non residential use)	3. Potential of Development - City wide (FSI)	4. Potential of development along transit corridor (FSI transit corridor/ FSI)	5. Clear Pattern and Completeness of the network	6. Percentage network having exclusive ROW for Transit network	7. Terminals and Interchanges having multimodal facilities

10. Integrated Land Use – Transport System

Overall Level of Service for the focus area:

Sr. No	Integrated Land Use Transport System	Target LoS	Bhubaneswar Indicator Value-Integrated Land use-Transport System	Bhubaneswar LoS-Integrated Land use-Transport System
			2015	2015
1	Population Density (pph)		97	2
2	Mixed Land Use Zoning (%)		60%	1
3	Potential of Development (Citywide)		1	1
4	Potential of Development along Transit Corridor		2.75	3
5	Road Network Pattern and Completeness			2
6	Percentage Network with exclusive ROW for Transit		0%	4
7	Terminals and Interchanges having multimodal facilities (%)		0	4
Total Score				17

Overall LoS	Calculated LoS (for million+ cities)	Calculated LoS (for other cities)
1	7	<8
2	8 – 14	8 – 15
3	15 – 21	16 – 22
4	22 - 28	22 – 28

Overall LOS
3

Overall LoS	Calculated LoS	Comments
1	7	City Structure is appropriately planned in a manner which patronizes public transport.
2	8 – 14	City structure is some what coherence with the public transport system
3	15 – 21	Faint coherence between city structure and public transport system
4	22 - 28	Inconsistency in the city structure and public transport system leading to lesser ridership and high dependence on personalized motor vehicles



SLB Focus Areas and Indicators

11. Intermediate Public Transport

Availability		Service Delivery
1. Availability of ITS/GPS Facilities (%)	2. Presence of IPT per 1000 population	3. Average Travel Speed of IPT (kmph)

Indicator	Issues		Suggested Range	
2. Presence of IPT per 1000 population	Range can't be uniform as too less and too much IPT is not good			
	Range	LoS	Range	LoS
	<=4	1	3.5 to 4.5	1
	5-6	2	2.5 to 3.5 and 4.5 to 5.5	2
	7-8	3	1 to 2.5 and 5.5 to 6.5	3
	>8	4	<1 and >6	4



11. Intermediate Public Transport

Overall Level of Service for the focus area:

Sr. No	Intermediate Public Transport	Target LoS	Bhubaneswar Indicator Value- Intermediate Public Transport	Bhubaneswar LoS- Intermediate Public Transport
			2015	2015
1	Average Speed of IPT (kmph)		32	1
2	IPT Vehicles with ITS Facilities/GPS (%)		0%	4
3	Presence of IPT Vehicles per 1000 Population		26	4
Total Score				9

Overall LoS	Calculated LoS
1	3
2	4 - 6
3	7 - 9
4	10 - 12

Overall LOS	3
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Report Card



Report Card

Sr. No	Benchmarks	Level of Service for Urban Transport	
		LoS for 2015	LoS for 2012
1	Public Transport Facilities	3	3
2	Financial Sustainability of Public Transport	3	3
3	Pedestrian Infrastructure Facilities	2	3
4	Non-Motorized Transport Facilities	4	4
5	Application of ITS Facilities	4	4
6	Road Network Performance	2	2
7	Parking Management	2	4
8	Road Safety	4	3
9	Environment	2	2
10	Integrated Land Use Transport System	3	3
11	Intermediate Public Transport	3	3

Legend - Change Colour Code

	No Change
	Positive Change
	Negative Change

Legend - LOS Colour Code

	LoS 1
	LoS 2
	LoS 3
	LoS 4





Thank you

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