Sustainable Mobility in a Low-Carbon Future- Surat

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OPTIMISM Project (India)

Policy Brief 2

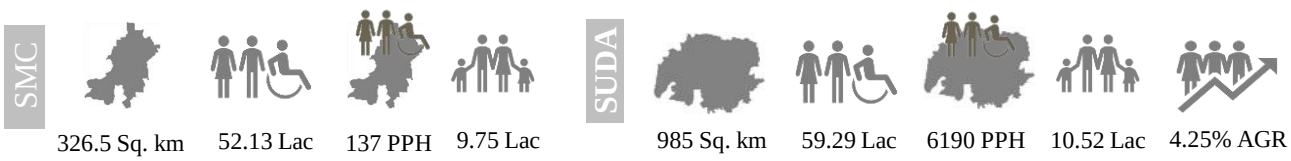
Introduction

Surat, an industrial city in Gujarat, has a population of 5.9 million spread over its Surat Urban Development Authority (SUDA) area of 326.5 sq. km. Deemed among the world's fastest growing cities, Surat is known as a textile and diamond hub of the nation, resulting in a massive influx of migrant workers, particularly male migrant workers. With one of the earliest ports in India, Surat also offers rich colonial heritage. Its robust economic base consists of small and medium scale industries that take up almost a quarter of the total land-area. The city has an incomplete ring-radial road network and is experiencing rapid urbanization along its radials, engulfing industries formerly located on peripheries within new residential development. Traffic volume in Surat tripled over the last decade as a result of rising average household incomes. Incompatible land-uses placed in proximity and reliance on personal motorized transport leads to several local sustainable challenges.

Current Transport Scenario

88% of the total population resides within the municipal area, resulting in a population density of 136 people per hectare (PPH). Owing to its compact and polycentric urban form, Surat's average trip length is much shorter (5 km) than the national average (7 km) for similar-sized cities. Intensification of road-based transport solutions over the past two decades results in a 22% decline of non-motorized transport mode-share. Details of the current transport scenario are as follows:

Motorization & Road Infrastructure: Along with rapid urbanization and rise in income levels, vehicle ownership in Surat drastically increased from 40/1000 people to 296/ 1000 people. Personal motorized vehicles (66% two-wheelers and 13% four-wheelers) dominate the vehicle composition and contribute to 85% of VKT and related GHG emissions. Inconsistent road widths, missing links, unclear road hierarchy and contested road spaces in Surat, especially in its historic core, leads to longer and more frequent traffic congestion. Vehicular parking encroachment along ~48% of the total road network further disrupts traffic flow by creating severe bottlenecks.



Non-motorized Transport Network & Infrastructure:

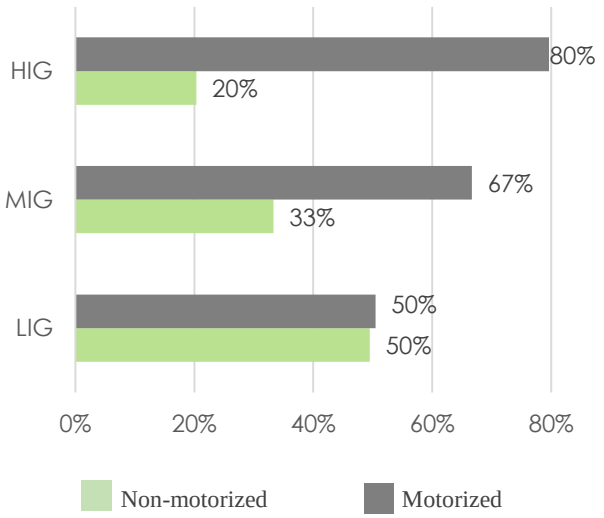
Like many Indian cities, Surat has poor quality of NMT infrastructure. Only 20% of total road network have footpaths, and only 7.6% have cycle tracks, and 25% of the NMT network is encroached by vehicular parking. Only 38% junctions in Surat are signalized. 74% of the NMT users find NMT infrastructure discontinuous & disruptive and 42% report being hit by vehicular traffic while using the carriageway (due to lack of adequate NMT lanes). The overall LoS for pedestrian infrastructure is 3, and that for cycling infrastructure is 4. Although Surat has shorter average trip length, average NMT trip lengths are unusually long (~3 km for walk trips, 4 km for cycling trips). Out of the 40% NMT trips, the majority of them are taken to access work opportunities by lower-income groups, indicating captive users.

Public Transport Network & Infrastructure:

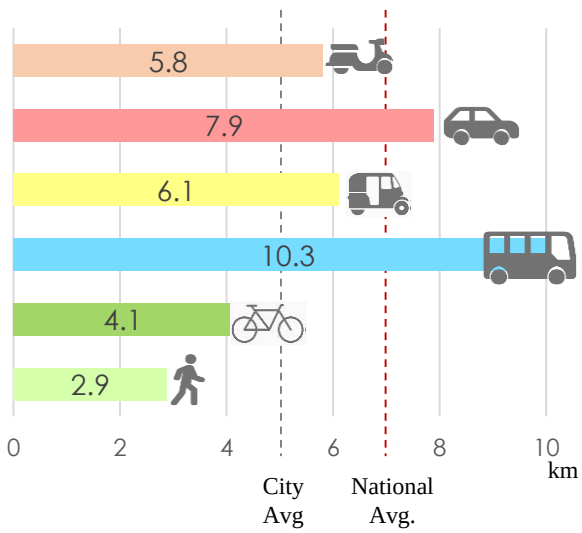
Public transport network in Surat, consisting of the city buses and Bus Rapid Transit System (BRTS) is spread across 376 km and carries ~80,000 passengers in a fleet of ~925 buses. 52% of the built-up area lacks access to PT stop/ station. Hence, despite having nation's largest BRT, poor last-mile connectivity in Surat restricts the mode share of PT at 1.4%, drastically lower than the national average (for similar-sized cities) of 21%. Like NMT, all trips by PT are taken to access economic opportunities, that too by the city's poorest. While the IPT network is much wider, IPT trips are more expensive than PT.

"Although buses are more affordable than autos, their unreliability, leaves us with no other option. Women find auto (shared) are unsafe, as over-crowding inside makes them prone to harassment, while they find buses are inconvenient due to its limited coverage and low frequency."
-FGD Participant

NMT Dependence by Income Groups



Travel characteristics as defined by trip length



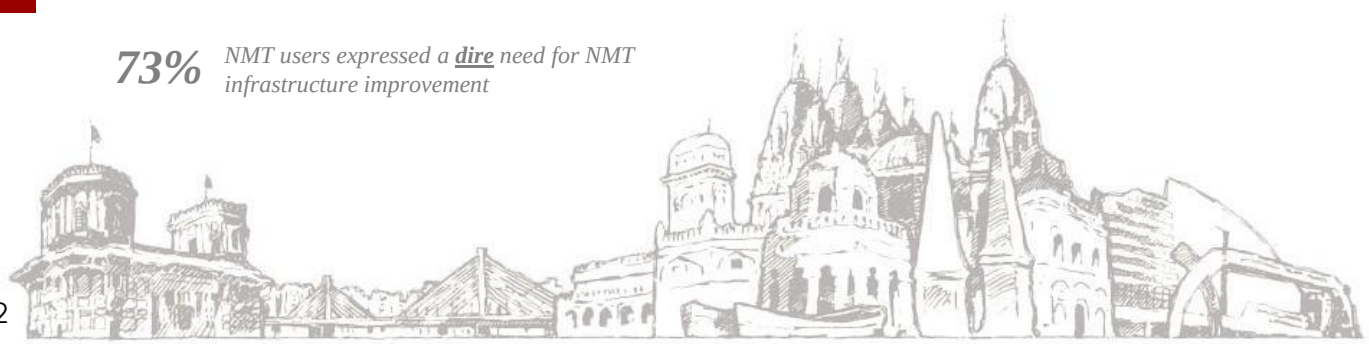
42% *NMT users reported being hit by vehicles while using the carriageway due to lack of footpath*

56% *NMT users feel that NMT infrastructure is inadequate, inconvenient and unsafe*

73% *NMT users expressed a **dire** need for NMT infrastructure improvement*

4% *Households actively choose PT*

35% *PT users feel vehicle ownership would improve their access to economic opportunities*



Scenario I (2030):

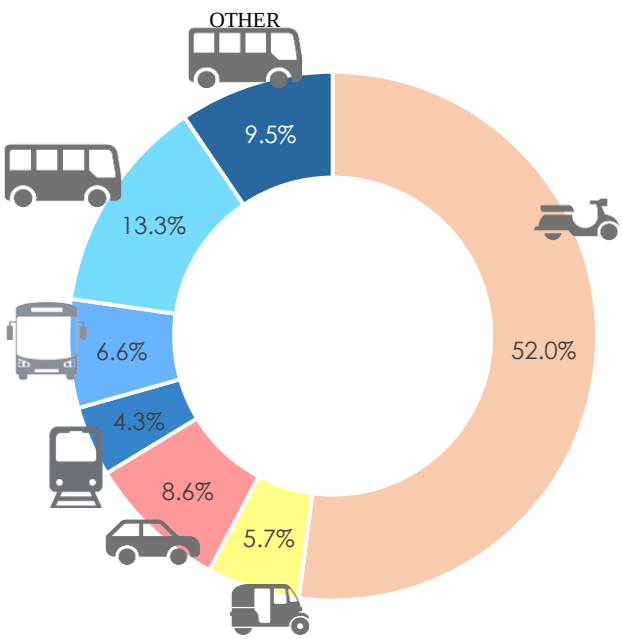
Surat CMP's proposals for 2046 are recalibrated for target year 2030. All other short- & medium-term interventions are directly borrowed from the CMP without alterations.

Strategies:

To ensure planned and well-managed urbanization in Surat, the LCMP focuses on two main strategies:
(i) create an efficient road network with clear hierarchy and supportive NMT
(ii) increasing the density along PT corridors through infill development or green-field developments

Principles:

(i) segregation of incompatible land-uses like residential and industrial
(ii) strengthening development in growth nodes (hubs of economic opportunity) around the core urban area through strategic rapid transit links
(iii) invest in a robust, reliable, safe, and convenient PT system that promotes multi-modal accessibility for all
(iv) promote active transport with emphasis on NMT infrastructure to ensure equitable road space distribution



Motorized Mode Share

Proposals related to Motorization & Road Infrastructure:

(i) reduction (22%) in the personal vehicle mode share from 75% to 53% in 2030 to mitigate air pollution and emission related impacts
(ii) capping annual vehicle kilometre travelled (VKT) at 45 million, significantly lower growth rate than 2016.
(iii) detailed interventions to achieve an efficient road system that minimizes conflicts are:

a) redesigning ring-roads with uniform width (ex. 90m for inner ring-road) to reduce bottlenecks around the inner city,

b) construction of 536 km of new road network to relieve congestion,

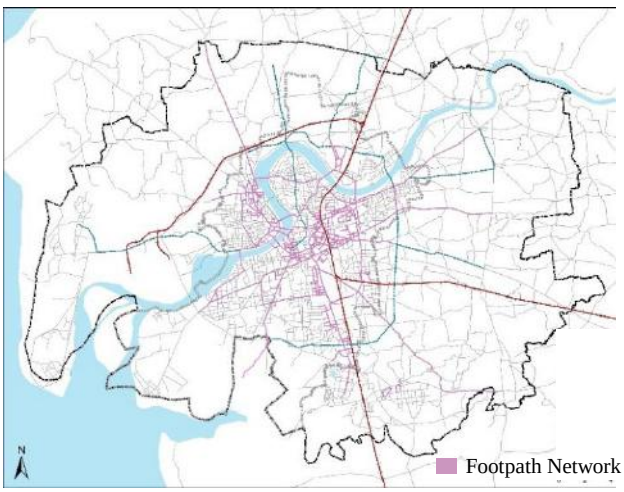
c) 39 new rail over-bridges, 16 new underpasses and 6 new flyovers/ bridges,

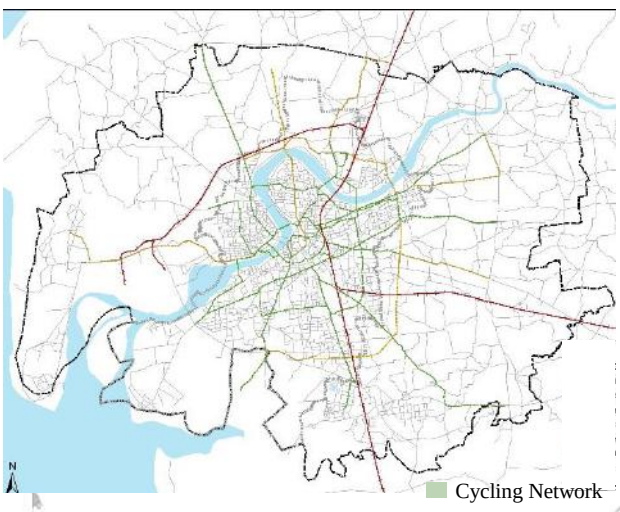
d) new network of radials from inner-city to growth nodes with rapid transit links. As a result a 43% decrease in traffic congestion is projected.

BAU Scenario	LCMP Scenario
57% Traffic Congestion	14% Traffic Congestion
62% Mode Share	35% Mode Share
25.7 VKT (in million km)	19.7 VKT (in million km)
55% HH with PT Access	89% HH with PT Access

Proposals related to Non-motorized Transport Network & Infrastructure:

(i) promote NMT modes by upgrading existing NMT infrastructure to ensure uniform widths of at least 1.8 m, and expand the network by adding 418 km of new footpaths and 288 km of new bike lanes, especially in accident-prone zones (30% of total network)
(ii) creating a culture for bike-sharing through 2 bike-sharing schemes with over 16,000 cycles, 64 bike-share docking points, and Intelligent Transport System (ITS).
(iii) redesign all trunk routes and transit routes as per *Complete Streets* guidelines and *Universal Street Design* guidelines to promote access for all
(iv) minimize road fatalities by identifying safe movement routes from residential areas to work, schools, and PT stations, formulating Accident Management Plan, Junction Design and Signalization Plan and creating an Accident Monitoring Cell
(v) increasing the share of households residing within the 10 minutes' walk of a PT stop by 34%.





Proposals for Public Transport Network & Infrastructure:

The proposal is to improve bus mode share from 2% to 24%, reduce VKT by 49%, reduce congestion by 43%, and reduce emissions by 16%. The specific proposals are:

(i) expanding the current PT network by adding 213 km of BRTS and 73 km of Metro

(ii) increase public-transit ridership through three levels of transit-friendly streets:

(a) 240 km Integrated Multimodal Transit network

(b) 264 km long Bus-Priority Lane network for streets 18m or wider, and

(c) large-scale network of Transit-Ready Streets along streets 30m or wider.

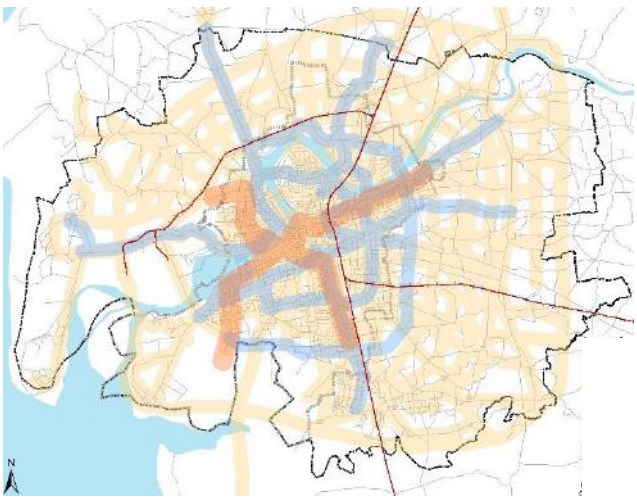
(iii) increase sustainable bus fleet through 5,000 Electric bus fleet (city bus and BRT)

(iv) installing bus stops every 500m and 36 new Bus Depots to increase access to PT; as a result 83% households will be within 250m of PT stops

(v) introduce 12 km of BRT/ LRT along the Inner Ring-Road to relieve congestion and improve mobility.

(vi) introducing an ambitious Ferry System along Tapi river with a 46 km network and 12 stations

(vii) fare integration for all PT modes and creating MATA for better PT system management1



Scenario II (2030):

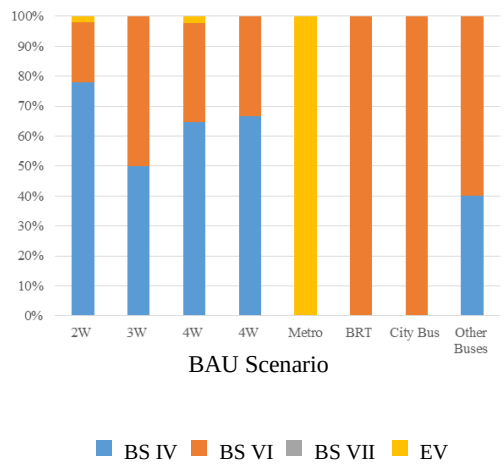
Building upon Scenario I, this scenario aims at ambitious mitigation to deliver the 1.5^{0}C scenario and adopts proposals outlined in Pathways to Deep Decarbonization in India' report (2015).

Strategies:

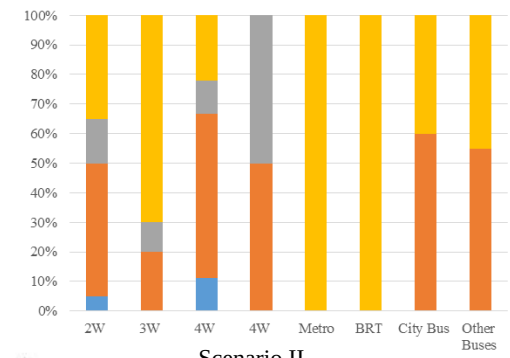
Adding to the interventions of Scenario-I, the following strategies make-up this scenario:
(i) technological improvements like vehicle & fuel-efficiency, energy intensity, increased adoption of Evs
(ii) sustainable behavioral changes like greater shift to public transport, shared mobility, higher vehicle occupancy
(iii) increased dependence on NMT and PT

Principles:

(i) aggressive adoption of Electric Vehicles
(ii) migrating existing fleet to more more-efficient and sustainable fleet (migrating from BS-3 to BS-6/ 7)
(iii) promote shared mobility and carpooling to achieve a higher vehicle occupancy
(iv) reverse travel demand for shorter trips, and enable a switch to NMT for shorter trips



BAU Scenario



Scenario II

Proposals related to Motorization & Road Infrastructure:

(i) reduction (37%) in the personal vehicle mode share from 75% to 38% to mitigate air pollution and emission related impacts
(ii) capping annual VKT at 12 million, enabling a 73% reduction in annual VKT.
(iii) incentivize more fuel-efficient fleet across all modes of transport to:
(a) migrate 2W fleet (BS2,3&4) to have 45% BS6, 15% BS7 and only 5% BS4
(b) migrate 4W fleet (BS2,3&4) to have 55% BS6, 15% BS7 and 10% BS4; alter Petrol to Diesel share from 70:30 to 90:10
(iv) for aggressive adoption of EV, subsidize and incentivize personal EV fleet (35% for 2W and 20% for 4W)
(v) redesign streets, transit stations and public spaces to accommodate shared mobility with pick-up/ drop-off points, signages, etc.

Proposals related to Non-motorized Transport Network & Infrastructure:

(i) increase NMT trip rate to allow 85% recreation and other purpose trips (shorter) by NMT modes
(ii) redesign streets with adequate and safe NMT infrastructure to enable majority last-mile trips by NMT modes

Proposals for Public Transport Network & Infrastructure:

(i) increase PT frequency along all routes for improved efficiency
(ii) increase PT coverage and enable IPT to function as feeder services to increase PT mode share by 35%
(iii) incentivize more fuel-efficient fleet across all modes of transport to:

(a) migrate 3W fleet (BS2,3&4) to have 20% BS6, 10% BS7 and 70% EV

(b) migrate City Bus fleet (BS3&4) to have 60% BS6 and 40% EV

(c) migrate BRTS fleet (BS3&4) to a 100% EV fleet

Scenario III (2030):

Building upon Scenario II, this scenario includes social and political transformation on account of ongoing processes of empowerment and democratization. It is rooted in social aspects of sustainability- like gender equality, equal opportunity, and sustainable mobility, mainly reflected by incorporating a higher WFPR (especially for women and poor), in turn increasing the trip rate and overall transport demand.

Strategies:

To mitigate trade-offs of LCMP proposals, and foster synergies with SDG 1, 3, 5, 8, 11 & 13, this scenario relies on:

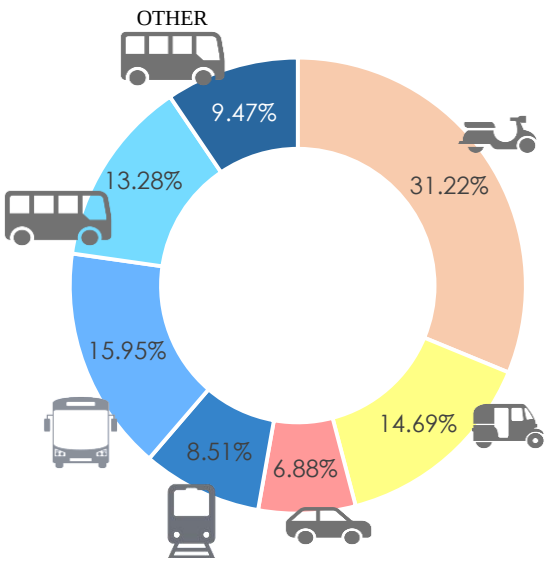
(i) accounting for a higher for a travel demand caused by higher workforce participation rates for women and poor
(ii) ensure 100% NMT coverage, with special emphasis to re-design NMT infrastructure in accident prone zones
(iii) ensure equitable distribution of road space
(iv) adopt a smoother (less aggressive) transition to Electric Vehicles, owing to much higher travel demand

Principles:

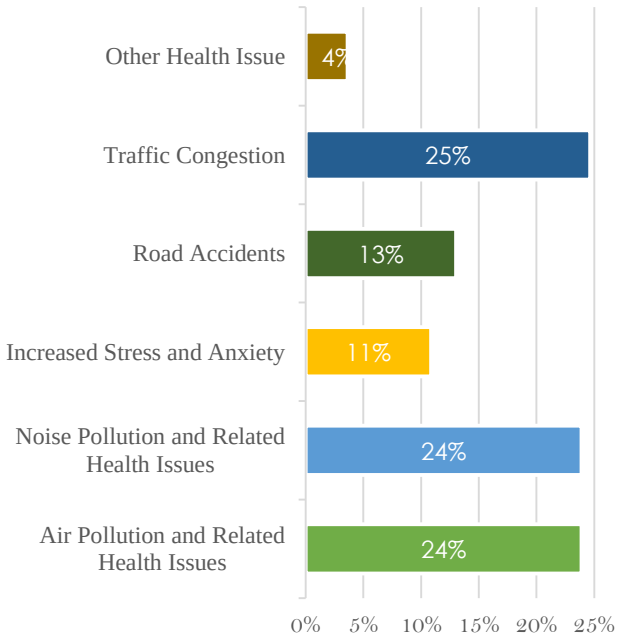
(i) mitigating the trade-offs caused by intensive road infrastructure expansion
(ii) discourage the use of private motorized vehicles and promote PT and Mobility-as-a-Service (MaaS)
(iii) inclusive street design to promote safe, multi-functional streets for all, with designated spaces for street vendors and curb-side pick-up/ drop-off points for MaaS
(iv) move NMT captive users to PT, while increasing the usage of NMT as last-mile connectivity mode.

Proposals related to Motorization & Road Infrastructure:

(i) avoid all proposed road widening project to prevent displacement and eviction of residents and businesses (SDG 1 & 8),
(ii) review the need for 536 km of new road infrastructure from urban equity approach
(iii) aid existing traffic management plans with a freight management to mitigate collisions and road safety concerns
(iv) introduce congestion pricing for private vehicles within inner city as decongestant measure
(v) subsidize a shift to electric vehicles, specially for IPT fleet and 2-wheelers for emission & pollution reduction.



Motorized Mode Share



Issues encountered due to heavy motorization and road development

Proposals related to Non-motorized Transport Network & Infrastructure:

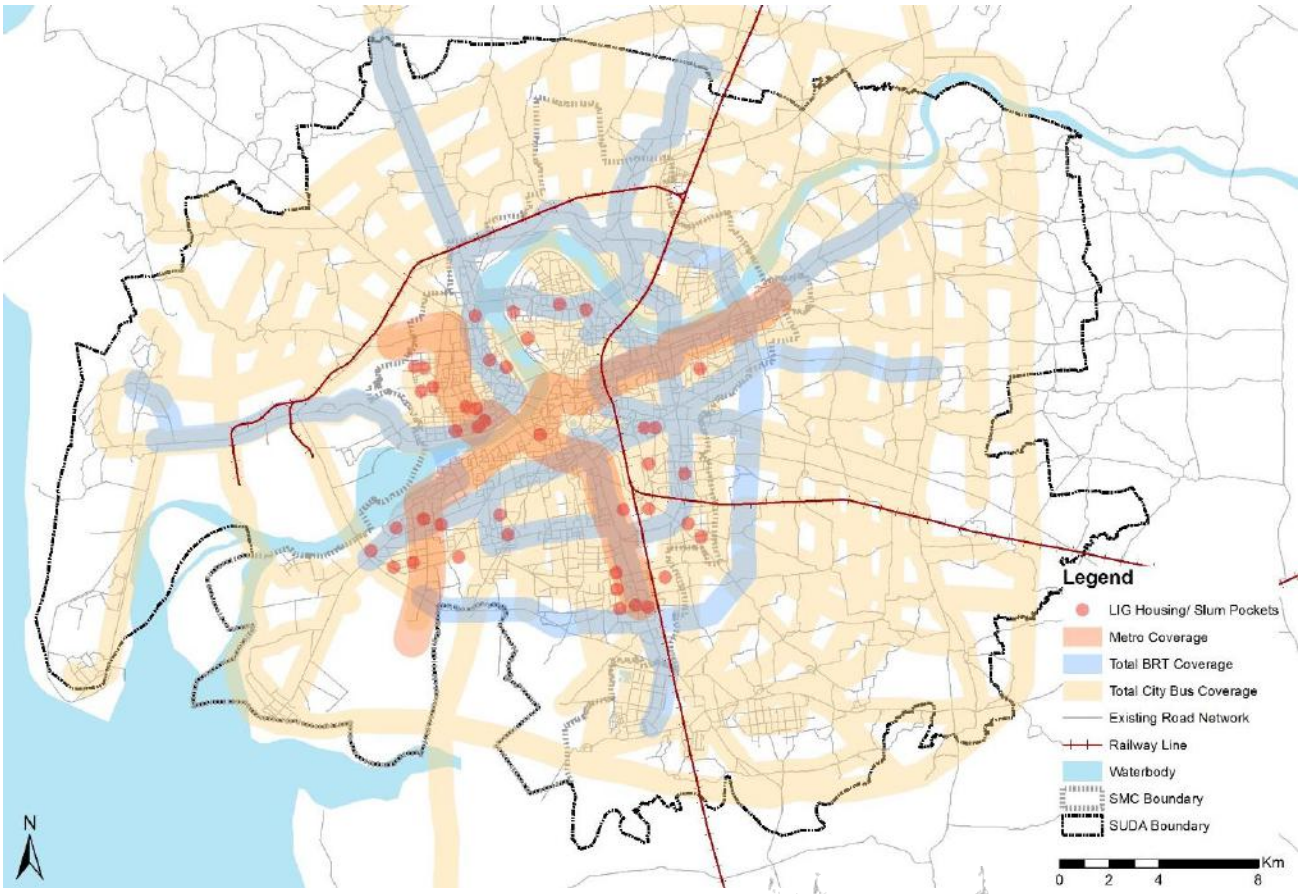
(i) increase footpath width to 4m along commercial fronts and tourist spots for safe & easy pedestrian access.
(ii) redesign high-conflict intersections with refuge islands, smoother/ flattened turning curves, pedestrian/ cycling signals and reduced carriageway widths.
(iii) prioritize cycle lanes to build a robust cycling network; supplement with wide-spread bike-sharing network.
(iv) ensure all PT/ IPT stops are accessible by NMT and have supportive NMT infrastructure
(v) strengthen NMT infrastructure along identified safe routes for daily needs

32% *NMT users missing out on economic opportunities due to lack of transport options*

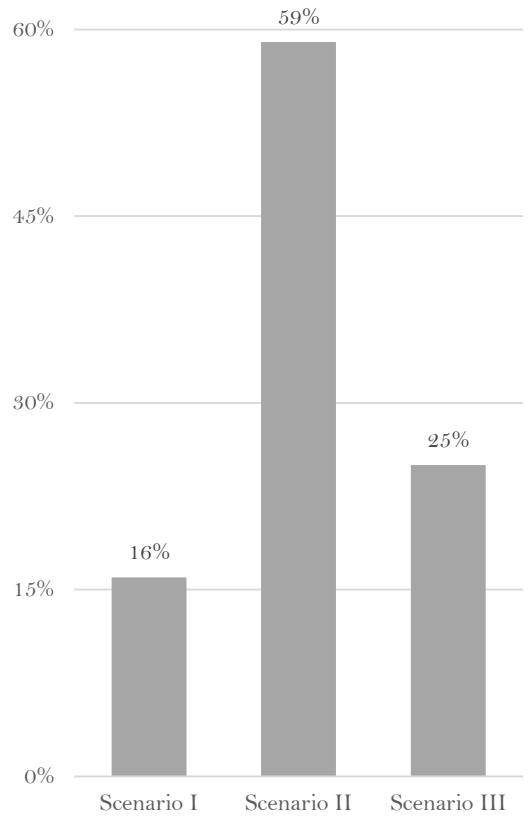
84% *NMT users wish to switch to BRTS or Metro, if their coverage improves*

Proposals for Public Transport Network & Infrastructure:

(i) shaded bus stops/ stands every 500m with adequate seating space, route information, signages and raised platforms for easy boarding and alighting;
(ii) provide cycle parking, docking stations and designated drop-off/pick-up points at all major bus-stops & stations
(iii) intensify development along Bus-Priority Streets, Transit-Ready Streets to enable modal switch to PT
(iv) enable multi-modal mobility through convenient interchange designs
(v) bus stations should have drinking water, public toilets, and resting facilities for bus drivers for decent working conditions.
(vi) promote a sustainable fleet for water transport like solar ferries
(vii) regularize IPT with fixed routes and fare structure that allows IPT to serve as a feeder network for PT



Vehicle Kilometer Travelled by Modes and Scenarios



Emission Reduction (compared to BAU) by Scenarios

Scenarios	SDG 1	SDG 3	SDG 5	SDG 8	SDG 11	SDG 13
Base Scenario	(-1)	(-1)	(-1)	(-1)	(-1)	(-1)
Scenario I	(+/-1)	(+/-1)	(+/-1)	(+/-1)	(+1)	(+1)
Scenario II	(+/-1)	(+1)	(+/-1)	(+/-1)	(+/-1)	(+1)
Scenario III	(+1)	(+1)	(+1)	(+1)	(+1)	(+1)

SDG Interactions by Scenarios

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