ANNEX 2

City level indicators

Promoting Low Carbon Transport in Indian Cities

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Indicator Name	Description	Measurement/ data source	Relevance
Mobility and Accessibility			
Modal shares*	Modal shares by trip purpose i.e. work, education, health and others[1]	Household surveys and some relevant data may also be available in City Traffic and Transport Study (CTTS) and Comprehensive Mobility Plan (CMP)	Average modal share helps decision makers understand the movement towards or away from the goal of low carbon transport. The indicator helps to identify the preferable modes for various trip purposes and thus the intervention areas. For example, improving infrastructure for students so that they can use Non-Motorized Transport (NMT).
	Modal shares by social groups i.e. by income, women headed household1	National Sample Survey Organization (NSSO) data and household surveys	The indicator states the equity in service levels. It helps to understand whether the low carbon transport is by choice for vulnerable groups of society.
Travel time*	Average travel time by trip purpose i.e. work, education, health and others using different modes1	Household surveys or use validated four step model for different cities	The indicator is useful to understand the dynamics of land use and the properties of mode to reach specific destinations and accordingly plan strategies to achieve the low carbon goal. For example, less travel time to school using cycle will motivate students to use cycle to go to school and this can be done by taking up policies related to land use and infrastructure improvement.
	Trip purpose wise average travel time disaggregated by social groups	Four step model to capture travel time by specific social groups for different trip purpose	More travel time for vulnerable groups is an indicator of social exclusion and with the help of disaggregation by trip purpose, specific measures can be taken to increase social sustainability
Trip length*	Average trip length	CMP or CTTS for specific cities or	The indicator states the potential of using NMT and Public

[1] Needs to measured for all modes including pedestrians, bicycles, public transport (bus formal), public transport (tempos), para-transit (cycle rickshaw), para-transit (auto), motorized two wheeler and cars

*For these indicators the data should be collected separately for vulnerable groups such as: i) Slum dwellers ii) Within the slums, of households living in katcha housing as that is indicating BPL households iii) Recent migrants to the city and temporary migrants to the city iv) Households living in relocated sites v) SC households vi) Minority groups vii) street vendors etc. The data should also be disaggregated by sex

	frequency distribution	four step model	transport (PT).
	Mode wise average trip length disaggregated by social groups1	Household survey	The indicator defines the social cohesiveness in city. Longer trip length using NMT by lower income group as compared to middle or high income group not only indicates social exclusiveness but also unaffordable public transport system for the group.
	Trip purpose wise average trip length disaggregated by social	Household survey or relevant data from NSSO	The indicator helps to identify the required change in land use structure specifically for the different groups of society to attain social sustainability.
Affordability*	Affordability of PT and para-transit fare by social group	Measured as percentage of Household income likely to be spent if PT/ para-transit is used	Determines the affordability to different modes by different social groups.
	Cost of commuting	% of Household income spent on travelling disaggregated by social groups	Depends on the destinations, mode choice and the fare and pricing policies. Determines social equity.
Infrastructure and Land Use			
Infrastructure quality	Average speed on roads of different modes1	Available in CTTS, CMP and City Development Plan (CDP) for specific roads in cities	More the speed of vehicle, less travel time and hence more preferred the mode is. Infrastructure projects resulting in increase speed of Personal Motorized Vehicle (PMV) vs. PT will result in more users of PMV.
	Percentage of Household within 10 min walking distance of PT and para-transit stop	Needs to be calculated based on the PT stop inventory and number of households in census records	It's a determinant of accessibility as well as pressure for low carbon transport. Short distance determines the ease of access to PT and hence higher probability of using PT.
	Average number of interchanges per PT trip	Household surveys	Determines the efforts required to use public transport that effects competitiveness of PT with PMV
	Accessibility of disadvantaged groups by different modes1	More specific indicators to be able to measure accessibility for disadvantaged people needs to be developed and data collected	Ensures barrier free accessibility to the society by Non-Motorized transport and Public transport system.
Land use	Land use mix intensity	Job-housing balance determined	Indicates land use pattern that has impact on the trip rate

parameters		using census data available at ward or electoral block level	and trip length
	Income level heterogeneity	Concentration index of different income groups in a zone determined by the asset ownership or housing type data in census-households	Indicates social cohesion
	Kernel density of roads, junctions and PT stop	Requires road inventory and public transport network data in vector form	Determines all over accessibility of city areas to transport infrastructure irrespective of the scale of study
Safety and Security			
Safety	Risk exposure mode wise1	Number of fatal accident per 100,000 users of the mode. Detailed accident data can be collected from traffic police	The indicator is the state of social sustainability and also a pressure for environmental sustainability. More the risk to a mode user less is the preference.
	Risk imposed by modes1	Number of accidents involving different vehicles and victims per 100,000 of all the road users. Detailed accident data can be collected from traffic police	Determines the cost imposed by a mode on the society.
	Overall safety	Number of fatal accidents per 100,000 populations. Detailed accident data can be collected from traffic police.	Determine health impact of transportation on society
	Speed limit restrictions	Percentage of roads having speed limit $\geq$ 50 kmph	More speed means more risk to the society
	Quality of footpath infrastructure	Percentage of roads with $\geq$ 2 m	Adds up to the safety and comfort of walking
Security	Percentage of road lighted	Data needs to be collected	Determines the security aspect on the road
	Percentage of footpaths lighted	Data needs to be collected	Determines the security aspect on the footpath thereby encouraging people to walk

	Percentage of people feeling safe to walk/cycle and use PT in city by gender*	Specially designed stated household surveys	Perception of people regarding safety aspect of using low carbon modes of transport that may avoid them to use these modes given the access to the carbon intensive modes of transport
Environmental Impacts			
Emissions	GHG emissions	Equivalent CO_2 emissions per passenger km by mode	Identify modes that require more attention either by causing either change in travel behavior or technology
	Lifecycle cost of different modes1	Total of- CO_2 emissions from construction of facility per km CO_2 emissions from production of vehicle or mode per unit Co2 emission unit transit	Identify the carbon intensive modes throughout their lifecycle The indicator is useful for technological improvements
Depletion of land resource	Per capita consumption of land for transport activity	Land use data from CDP or master plans of cities	Determines whether there is over or under consumption of land for transport infrastructure
	Land consumed for different transport activities1	Percentage of total land used in transport for different type of transport infrastructure- road, parking bus lanes, railways, etc.	Determines the impact of different type of transport infrastructure on land depletion
Health hazards	Percentage of population exposed to air pollution	Need to map air quality in city and mark households in the buffer area Or Get the relevant morbidity data from hospitals or medical authorities	Determine the health impact of transportation and identify the obnoxious gases or other such factors that need to be reduced from transport sector to improve health. Also the indicator is helpful in raising concern regarding sustainable transport.
	Percentage of population exposed to noise levels > 50 dB*	Need to map exceedance of noise levels in city and mark households in the buffer area	
Economic (Response Indicators)			
Investment	Trend in investments for development of infrastructure for various	Data from city budgets across years	Determines investment pattern on different types of infrastructure and trace the trend in development of infrastructure for low carbon modes of transport

	modes 1		
Cost borne by operators	Tax burden mode wise 1	Data to be collected from Regional Transport Office	Determines whether the tax policy takes into account the variation in external cost imposed by different modes
	Fuel prices at pumps by fuel type		Determines the trend in fuel consumption as with the change in fuel prices
	Other charges levied as applicable at city level disaggregated by modes1	Transport Department	Other charges have impact on the operational cost of the mode. For example, the high toll and parking charges on cars will discourage people from using it.
Fare policy	Percentage of subsidies granted	Transport department	Determines vertical equity among different social group and preference of mode by the authority
	Percentage of population owning passes	Transport department	Determines the utility of discounts offered on passes for the use of public transport