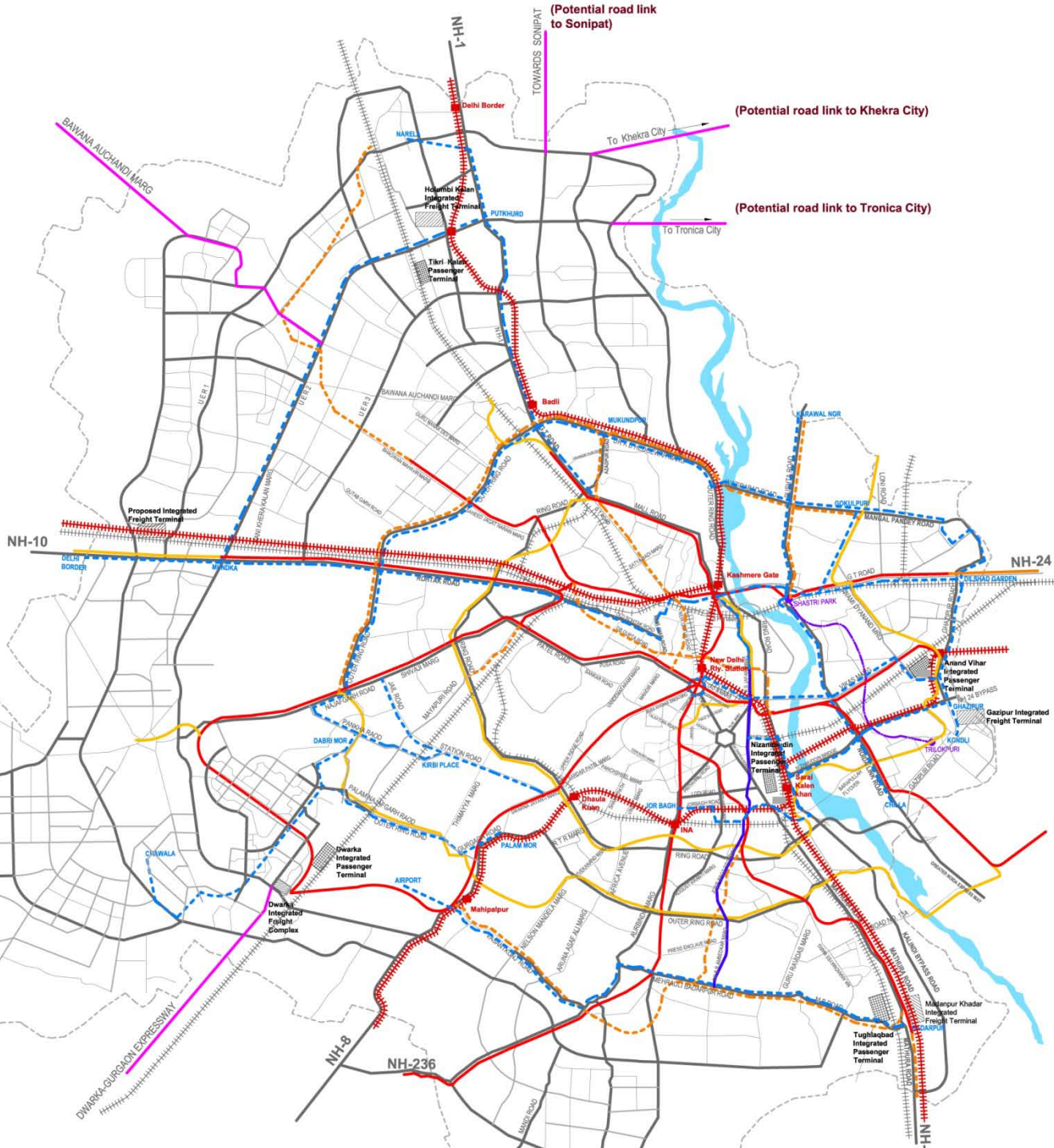


REPORT OF HIGH POWERED COMMITTEE ON





# HOW TO DECONGEST DELHI



# Sub-Regional Transport Network Plan for Delhi



## LEGEND

-  NCT Delhi Boundary
-  Major Roads (60M & above R/W)
-  Major Roads (45M & above R/W)
-  Major Roads (30M & above R/W)
-  Railway Line
-  RRTS & Stations (Approved in 36th GBM dated 10.412)
-  MRTS Ph- I & II
-  MRTS Ph- III
-  MRTS Ph- IV (Proposed)
-  MRTS (Proposed)
-  Monorail (Proposed)
-  Integrated Transport Corridor/BRTS
-  Integrated Transport Corridor/BRTS (Proposed)
-  Integrated Passenger Terminal
-  Interstate Bus Terminal
-  Integrated Freight Terminal
-  Proposed Inter-State Roads (60M & above R/W)

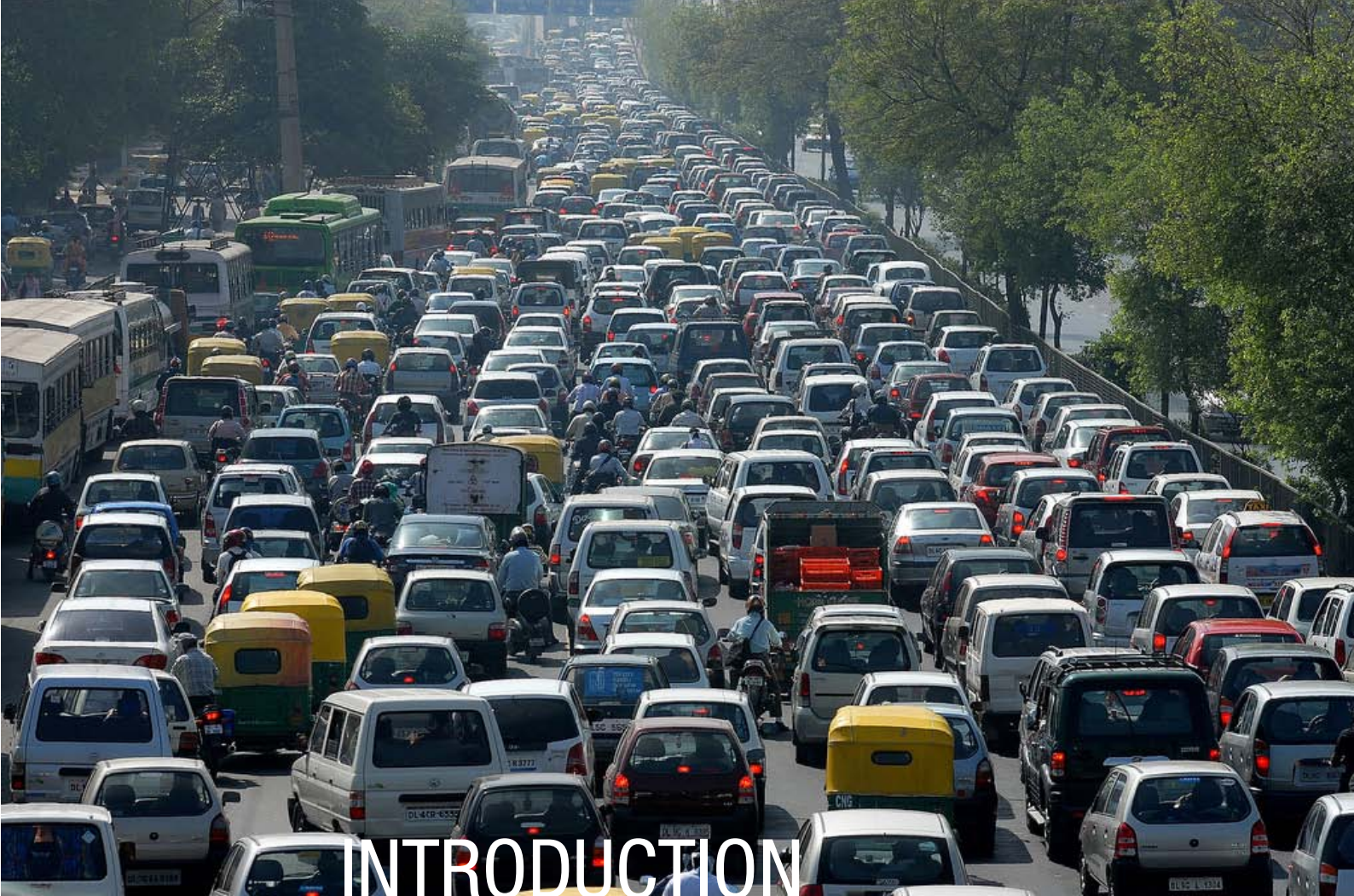




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# INTRODUCTION

## BACKGROUND

The National Urban Transport Policy notified by MOUD states the objective that the goal of mobility in cities is on moving more people more efficiently, rather than vehicles. However, the congestion is a major problem in Delhi. Recently, The Hindustan Times, a national daily, published a special series in its 2014 August-September Edition on the ground issues related to congestion that plague Delhi with the help of analysis of experts from respective fields. Taking note of the six week long 'Unclog Delhi' campaign, Honourable Urban Development Minister constituted a High Powered Committee to prepare a Detailed Action Plan on How to Decongest Delhi. Key stakeholders (see list on page 5) attended and deliberated on important issues and recommended strategies to decongest Delhi. The committee noted:

### 1. Fate of Road Based Infrastructure Approach

- When it comes to roads, 'congestion' may be defined as reduction of average travel speed to below 10km/hr or traffic Volume/ road Capacity (V/C) ratio greater than 1.
- The feedback received through daily newspapers and data collected by various agencies shows clearly that major road infrastructure such as flyovers, underpasses, etc. built over past several years have breached their capacity well before schedule and have in fact led to more delays and congestion on major corridors. Moreover, these projects have severed communities making it more difficult for people to cross streets on foot, etc making them subject to accidents and shift towards





- private transport. This is particularly a huge problem for children, women, elderly and disabled people.
- International case studies from China, Sao Paulo, Los Angeles, etc. dealing with similar challenges show that building 8-12 lane roads has not solved congestion issues, on contrary the problems have worsened, and has also led to reduction of average travel speeds on major corridors even in these developed cities/countries.
- This is because more lanes make room for more vehicles which keep filling up the space and thereby adding to greater congestion, air pollution, traffic hazards, inefficient use of public transport and retarded development.

## 2. Reverse Trend in Modal Shift

- The Modal share of Delhi presently is very encouraging compared to other western/ developed countries, as only 25% of population is using private vehicles (cars/2-wheelers) and the rest are using public transport or non-motorized transport as their only mode of travel. If focus is not given to public transport and NMT modes at this stage, then more people will shift to private vehicles, thereby further adding to congestion.
- The Metro Rail services shall provide some relief to Delhi in shifting people from private vehicles to public transport. However, it has been seen in the past that **due to poor quality of buses/ trams/ non-motorized transport**, people have shifted from buses to Metro even for short trips, or opted to continue with their cars/2-wheelers - **due to over-crowding on Metro. This trend needs to be reversed by improving bus services**, so that car-users may also use Metro comfortably instead of their private vehicles.
- The Regional Rapid Rail System also needs to be implemented on priority in order to shift regional trips from cars to this high quality public transport system. MoUD is taking steps to implement three RRTS corridors namely: Delhi-Meerut, Delhi-Panipat & Delhi-Alwar. DPRs are already ready and further action for the implementation needs to be expedited.

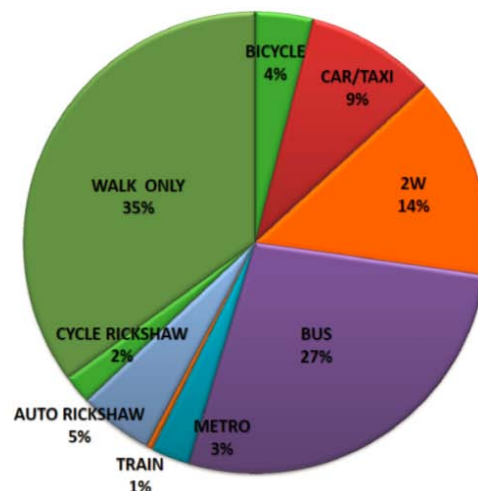
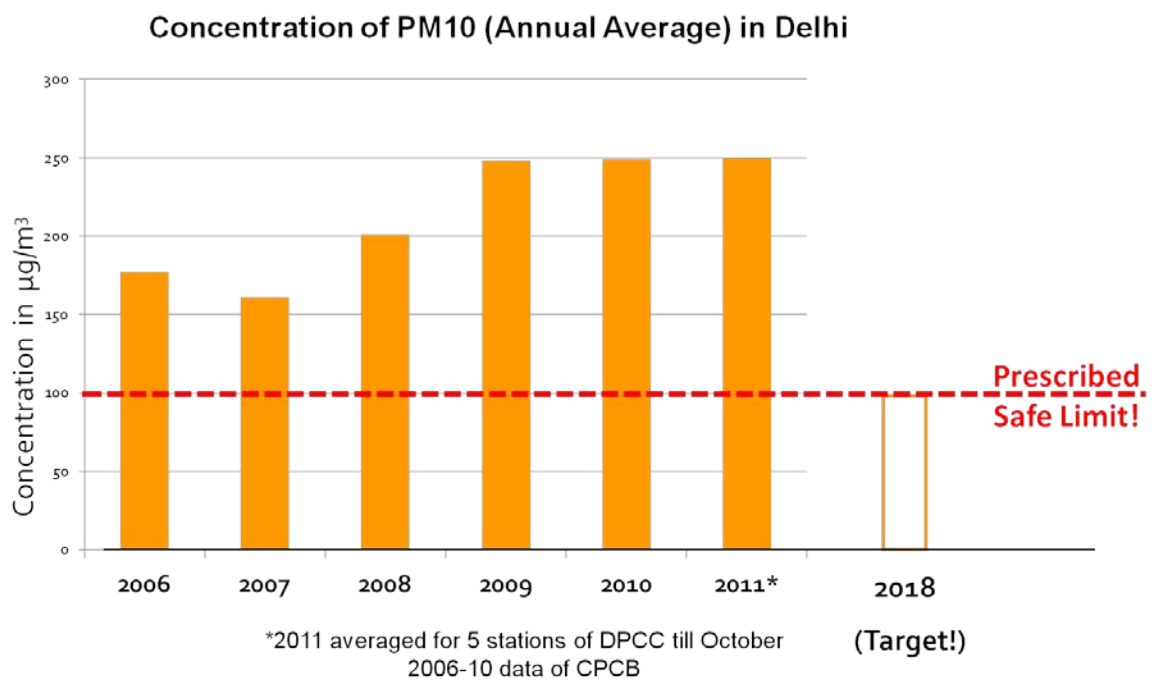


Figure 1: Current Modal Share of Delhi



### 3. Air Quality has reached Emergency/ dangerous levels

Delhi has lost the air quality gains of its first generation action that included large scale conversion of public transport buses and three wheelers to natural gas, relocation of polluting industries and improvement in emissions standards for vehicles among others. This is largely because of the explosive increase in vehicle numbers due to increased dependence on personal vehicles in the absence of **adequate, comfortable and efficient** public transport services and walking and cycling facilities. Air pollution levels have worsened, in recent times. Both particulate levels (PM10 and PM2.5) as well as nitrogen oxides are increasing steadily in Delhi's air. Even ozone which was not a problem earlier is rising again. During winter PM2.5 levels are normally 3 to 4 times the standards and during smog episodes it can go as high as 7 to 8 times the standards. This has serious public health consequences.



**Figure 2: Delhi losing Air Quality gains of CNG conversion, due to the exponential increase in private vehicles**

### 4. Action Plan to Decongest Delhi

The High Powered Inter-Ministerial Committee on **“How to Decongest Delhi”** constituted under the directions of Hon’ble Urban Development Minister, met five times after it was constituted on 07-10-14 (the complete list of attendees is given in Annexure). The meeting took place in Ministry of Urban Development on 10-10-2014, , 03-11-2014, 12-11-2014, 18-11-2014, and 27-11-2014. Deliberations took place among representatives of following departments/ministries from Delhi:

- (i) Ministry of Railways
- (ii) Ministry of Road Transport and Highways
- (iii) Ministry of Defence



- (iv) Ministry of Home Affairs
- (v) National Highway Authority of India
- (vi) PWD, Govt. of NCT of Delhi
- (vii) Ministry of Urban Development, GNCTD
- (viii) Director, UTTIPEC, Delhi Development Authority
- (ix) Principal Secretary Transport, GNCTD, New Delhi
- (x) Member, NCRPB, New Delhi.
- (xi) Chairman, New Delhi Municipal Corporation
- (xii) Vice Chairman, Delhi Development Authority, New Delhi
- (xiii) Delhi Metro Rail Corporation
- (xiv) Commissioner of Police, Delhi.
- (xv) Municipal Commissioner, South Delhi Municipal Corporation, New Delhi.
- (xvi) Municipal Commissioner, North Delhi Municipal Corporation, New Delhi.
- (xvii) Municipal Commissioner, East Delhi Municipal Corporation, New Delhi.
- (xviii) Managing Director, Delhi Transport Corporation, New Delhi.
- (xix) Director General, Institute of Urban Transport (India) New Delhi.

*It was agreed unanimously by the Committee that the primary solution to decongesting Delhi is prioritization and promotion of public transport and inducing people to shift towards it, from their private vehicles. While it is still essential to provide city level connectivity for all modes (roads/ rail/ bus/ cycle) in order to separate local travel from regional travel, the primary focus of the Govt. needs to be on inducing a modal shift towards public transport.*

**The 'Prioritized Action Plan to Decongest Delhi' as a 9-Point strategy is recommended by the High Powered Committee chaired by Secy UD, Govt of India.**

- 1. Parking Pricing & Management**
- 2. Multi-Modal Integration at Metro Stations & Railway/ ISBT**
- 3. Bicycle Sharing System with bicycle tracks/ bicycle highways throughout the city**
- 4. Road retrofitting as per Street Design Guidelines**
- 5. Bus Service Improvements**
- 6. BRTS Corridor Development**
- 7. Integrated Road Network – new bypass/ elevated roads**
- 8. Intelligent Transport System**
- 9. Capacity Building Programme**



# PARKING PRICING & MANAGEMENT



A screenshot of a parking pricing application interface. The top section contains search filters for arrival and departure dates (November 15, 2009), times (5:00 AM to 11:30 AM), and vehicle types (Regular, SUV, Lg. Van/Truck). A "Calculate Rates" button is prominent. Below the filters is a "WARNING" message: "Rates may include BestParking discounts. Click [icon] to print free Reservations/Rate Guarantees!". The main area is a map of Manhattan, New York, with various parking spots marked with colored icons and prices (e.g., \$31, \$37, \$39, \$40, \$43, \$44, \$50, \$52, \$53, \$54, \$55, \$57, \$59, \$61, \$63, \$64, \$65, \$66, \$67, \$68, \$69, \$70, \$71, \$72, \$73, \$74, \$75, \$76, \$77, \$78, \$79, \$80, \$81, \$82, \$83, \$84, \$85, \$86, \$87, \$88, \$89, \$90, \$91, \$92, \$93, \$94, \$95, \$96, \$97, \$98, \$99, \$100). The map also shows street names like W 20th St, W 21st St, W 22nd St, W 23rd St, W 24th St, W 25th St, W 26th St, W 27th St, W 28th St, W 29th St, W 30th St, W 31st St, W 32nd St, W 33rd St, W 34th St, W 35th St, W 36th St, W 37th St, W 38th St, W 39th St, W 40th St, W 41st St, W 42nd St, W 43rd St, W 44th St, W 45th St, W 46th St, W 47th St, W 48th St, W 49th St, W 50th St, W 51st St, W 52nd St, W 53rd St, W 54th St, W 55th St, W 56th St, W 57th St, W 58th St, W 59th St, W 60th St, W 61st St, W 62nd St, W 63rd St, W 64th St, W 65th St, W 66th St, W 67th St, W 68th St, W 69th St, W 70th St, W 71st St, W 72nd St, W 73rd St, W 74th St, W 75th St, W 76th St, W 77th St, W 78th St, W 79th St, W 80th St, W 81st St, W 82nd St, W 83rd St, W 84th St, W 85th St, W 86th St, W 87th St, W 88th St, W 89th St, W 90th St, W 91st St, W 92nd St, W 93rd St, W 94th St, W 95th St, W 96th St, W 97th St, W 98th St, W 99th St, W 100th St. The map also shows landmarks like Chelsea Park and New York Penn Station. The bottom right corner features logos for various parking services: Edison Park Fast, Enterprise Parking Systems, Alliance Parking, Hertz, Five Star Parking, and Townhouse Management. A "Reservation (w/ Rate Guarantee)" and "Rate Guarantee (Space Permitting)" button is also visible.





## Parking Pricing and Management (PPnM)

PPnM is the key measure for travel demand management. The supply of free/ inexpensive parking at the final destination is a key decision factor for people choosing to drive a personal vehicle, rather than taking a bus, Metro, IPT, NMT, walk or carpool. It is suggested that the following pricing strategies be employed to manage and bring down public parking space demand:

### ISSUE

One of the major problems being faced today is that of 'Parking' which is largely attributed to phenomenal increase in personalized vehicles and their use and the related aspect of unregulated and underpriced parking. In absence of organized parking space and facilities, valuable road space is being used for parking of vehicles. The problem of parking is usually faced 1. Along the streets; 2. In planned commercial centres; 3. In residential colonies; 4. In large institutional complexes. Experience has shown that the lack of enforcement and inadequate policy interventions has resulted in growth of parking demand along with the growth of vehicles in the city. Also, the provisions related to parking within the plot area are normally not adhered to, resulting in vehicles spilling on to the roads and adding to congestion. As recommended by the Environment Pollution Authority for the NCR, the approach should be focussed more on 'demand management' through enforcement and pricing policy rather than only increasing supply of parking.

### RECOMMENDATION OF THE COMMITTEE:

- a. **Pricing of parking shall be based on 'user pay' principle**, reflecting the cost of the public good – precious urban space. Without proper pricing of parking, it is impossible to manage/ curtail the ever increasing demand for parking space. No government subsidized parking for private motor vehicles is to be provided in public spaces or roads.
- b. **Parking on footpaths to be a cognizable offense with heavy penalties and compounding.**
- c. **On-street and off-street parking on roads and parking lots to be clearly demarcated on ground** so that each parking space can be paid for, monitored and enforced.
- d. All multi-level/ off-street designated parking lots should be developed as part of comprehensive area level plans for "**Parking Management Districts (PMD)**" that deals with on-street, off-street, multi-level and no-parking zones with proper circulation plan and demarcated "on-street parking" and "no parking" areas. The pricing of on-street and off-street should be adjusted, dynamically or by fixed pricing, such that people are induced to use off-street more than on-street. The entire PMD (composed of on-street, off-street, no-parking, multi-level parking and control centre) should be managed and enforced by a single government agency



Figure 5: Parking System and Markings. Courtesy: UTTIPEC

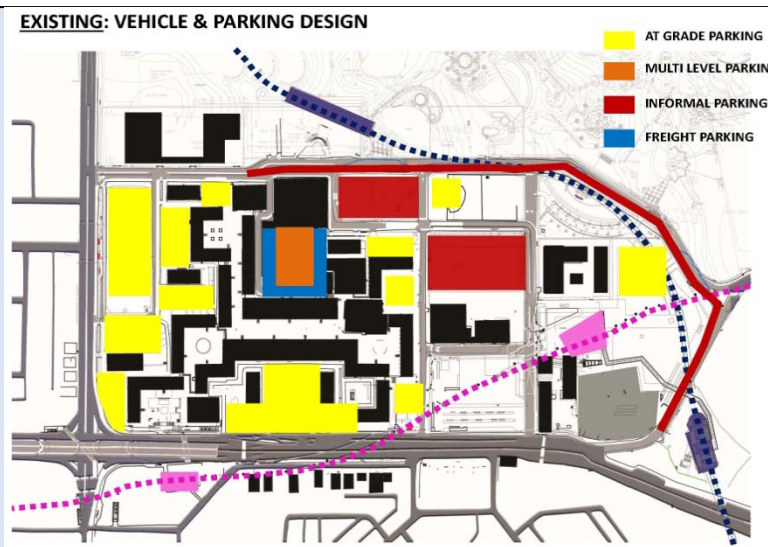


Figure 3: Nehru Place – Current Situation. All available ground space is used for rampant, unregulated, under-priced and haphazard parking. Courtesy: UTTIPEC

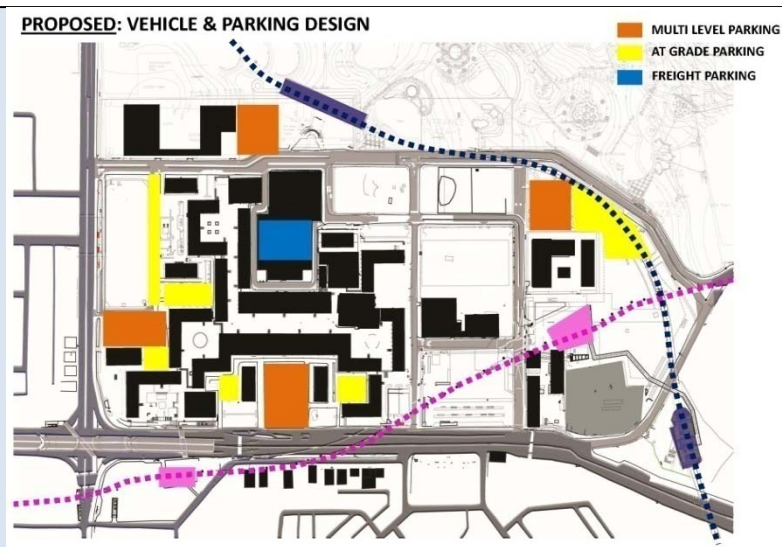


Figure 4: Nehru Place – Parking Management District. Long term parking accommodated in multi-level parking facilities. Limited on-ground parking available for short term visitors at steep price. Public space freed up for use by pedestrians. Courtesy: UTTIPEC

- e. and operated on PPP basis. If on-street parking is strictly enforced (by the private agency with the help of police), no incentives for the use of multi-level parking facilities would be required as it will become a viable business opportunity.
- f. **Standalone parking-only sites are not required.** Parking lots are permissible in all land use zones (except green open space) and is free of FAR. Therefore, multi-level parking facilities could be provided by developers in any projects such as commercial, social or industrial buildings and be made available to the public at a price. However this would be viable only if street level parking is clearly demarcated, priced and strictly enforced.
- g. Parking fee/pricing should be market driven and vary around the city based on time, location and local demand/ congestion levels through the day. As a thumb rule – higher the congestion, higher the fee to be levied in the area to reduce parking demand.
- h. All multi-level or exclusive parking facilities for private parking must also provide at least 10% of total space provision for IPT (Intermediate Public Transport) modes, NMV (Non-Motorized Vehicles) and feeder buses, as per local requirement.
- h. The following area level Parking Management and circulation plans shall be implemented on mission mode by the concerned local bodies (MCDs)

### Implementation of Parking Management Districts

	Area	Cost	Timeframe
1.	Connaught Place	<ul style="list-style-type: none"> <li><b>Parking structures already exist in these areas and only management plans need to be prepared by ULB.</b></li> <li>Management of street parking and multi-level parking to be done by same agency, in order to achieve success.</li> </ul>	One year each
2.	Sarojini Nagar		
3.	Nehru Place	<ul style="list-style-type: none"> <li><b>Conceptual plans have been prepared/ approved by UTTIPEC.</b></li> <li>MCDs need to engage the consultant for preparation of the PMD plan.</li> <li>Area level Parking Management Districts (PMDs) need to be financially self-sustaining and models shall be provided by the developer/ manager.</li> </ul>	Two years each
4.	Karol Bagh		
5.	Kamla Nagar		
6.	Vikas Marg		
7.	Lajpat Nagar		
8.	Bhikaji Kama Place		

*UTTIPEC informed the committee that the necessary plans have been prepared scientifically after studying the traffic movement and available spaces in the localities. These are available on their websites. Local Bodies (MCDs/NDMC) are therefore requested to implement these plans to decongest the concerned areas.*



STRATEGY TWO

# MULTI MODAL INTEGRATION (MMI) AT METRO STATIONS & RAILWAY/ ISBT





## Multi-Modal Integration (MMI) at Metro stations

### ISSUE

While the Delhi Metro has provided a world class service to the people of Delhi, the lack of planning and integration beyond the immediate station buildings in the earlier phases has resulted in the creation of an environment that is neither comfortable nor convenient and safe for the users of the Metro. The majority of its riders, almost 80%, (people who access the Metro by foot, bus, cycle, cycle-rickshaw or auto-rickshaws) are amongst the worst affected. Last-mile connectivity and provision of safe and comfortable modal options for people is and must remain one of the primary objectives for the city. With nearly two million people using the Delhi Metro every day, and with the future expansion – the Delhi Metro shall soon be the city's life-line. Therefore, it is critical that a comprehensive strategy for affecting the modal share of the commuters goes hand-in-hand. Improved accessibility at the Metro stations for pedestrians and Non-motorized transport must form a mandatory part of all Metro Station designs. The project looks specifically at the provision of essential facilities and amenities including Intermediate Para Transit parking, vending zones, bus-stop locations, cycle-rental facilities etc. within the immediate Station Area, a subsequent Project (Phase II) will be looking at improving the last mile connectivity within a 2Km zone of all Metro Stations to help people optimize travel trips in terms of time and money and providing efficient, comfortable and safe connectivity for all users.

The goal of this very significant recommendation of Multi-modal Integration at Metro stations is to provide comfortable last-mile-connectivity options to people. This may be done by:

### RECOMMENDATION OF THE COMMITTEE:

- Providing well planned and properly designated spaces for all modes such as buses, autos, rickshaws, cycles, etc. within the 5 minute walking catchment of the stations.
- Providing basic amenities like toilets, proper signage, cafes, vendor-stands, lighting, trees, shading devices, etc. for commuters.
- Providing High quality walking environment including safe crossings/ skywalks/ well-shaded walkways/footpaths, etc.
- Providing safety and a sense of safety for all users esp. women and children.
- Direct pedestrian crossovers/skywalks to all neighborhoods/ destinations within the catchment so that people can walk to the metro station directly rather than coming on ground level and looking for motorized transport to cover short distances.





The following timeline and tentative cost structure is estimated for various phases of MMI:

#### Cost and Timeline for implementation of MMI and IPTs

MMI phases:		Cost	Timeframe
<b>First Phase :</b> under planning/ implementation	68 Phase-III Metro Stations	<b>Approx. 680 crores</b> @apprx. 10 cr. per station	One year
<b>Second Phase :</b> to be started.	129 Ph-I&II Metro Stations	<b>Approx. 1290 crores</b> @apprx. 10 cr. per station	Within 2 years.
To be started simultaneously	4 (nos.) Integrated Passenger Terminals: i) Kashmere Gate ii) Sarai Kale Khan iii) Bijwasan/Dwarka Sec-21 iv) Anand Vihar	<b>Approx. 700 crores EACH.</b>  • Budget contribution to be made by all participating departments, primarily including Railways, Transport Dept. GNCTD	Within 5 years.

### Multi-Modal Integration at Railway Stations/ ISBT

A seamless integrated regional and local network of public transport network is planned/ proposed in order to provide a viable alternative to motor vehicle users and decongest road space. These include the following:

- The Regional Rapid transit System (RRTS) Corridors planned by NCRPB is the most critical transit system that will help decentralize growth/ urbanization in the NCR and reduce permanent immigration into Delhi while facilitating growth of satellite towns. The following RRTS corridors are recommended for implementation in a time frame of 5-10years:
  - i) Delhi – Sonipat – Panipat (111 Km) in Phase-I
  - ii) Delhi – Ghaziabad – Meerut (90 Km) in Phase-I
  - iii) Delhi – Rewari – Alwar (180 Km) in Phase-I
  - iv) Delhi- Bahadurgarh-Rohtak
  - v) Delhi- Palwal-Mathura
  - vi) Delhi-Bulandshaher- Khurja
  - vii) Delhi – Baghpat – Baraut
  - viii) Delhi-Ghaziabad-Hapur-Gadmukteshwar
- The Ring railway system is currently one of the most under-utilized public transport systems of Delhi. It is still a very affordable mode of transport for long distance commuters due to its speed and low cost. However due to bad connectivity to the



- Station areas, lack of integration with Metro and Bus Stops, etc. it is not considered a desirable option for long distance commutes. Incentives such as TOD may be provided to Ring Railway at particular stations which may overlap with Metro Stations or Railway Terminals, in order to generate cross-subsidy for improvement of the system.
- For seamless integration of regional and city level modes, world class interchange facilities on the lines of Waterloo station, London or Hauptbahnhof Station, Berlin, need to be created to provide all requisites for comfort and ease of commuters.
- 6 (nos.) Integrated Passenger Terminals at the following locations, which integrate between national level traffic (airports/railways) with regional (RRTS/ISBT) and local (bus/metro) traffic:
  - i) *Sarai Kale Khan (Central Delhi)*
  - ii) *Anand Vihar (East Delhi)*
  - iii) *Kashmere Gate (Central Delhi)*
  - iv) *Bijwasan/ Dwarka Sector-21*
  - v) *Holambi Kalan (North Delhi)*
  - vi) *Tikri Kalan (West Delhi)*

#### Cost and Timeline for implementation of IPTs

<p>4 (nos.) Integrated Passenger Terminals:</p> <ul style="list-style-type: none"> <li>i) Kashmere Gate</li> <li>ii) Sarai Kale Khan</li> <li>iii) Bijwasan/Dwarka Sec-21</li> <li>iv) Anand Vihar</li> </ul>	<p><b>Approx. 700 crores EACH.</b></p> <ul style="list-style-type: none"> <li>• Budget contribution to be made by all participating departments, primarily including Railways, Transport Dept. GNCTD</li> </ul>	<p>Within 5 years.</p>
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Figure 6: Trilokpuri MMI Project. Courtesy: UTTIPEC

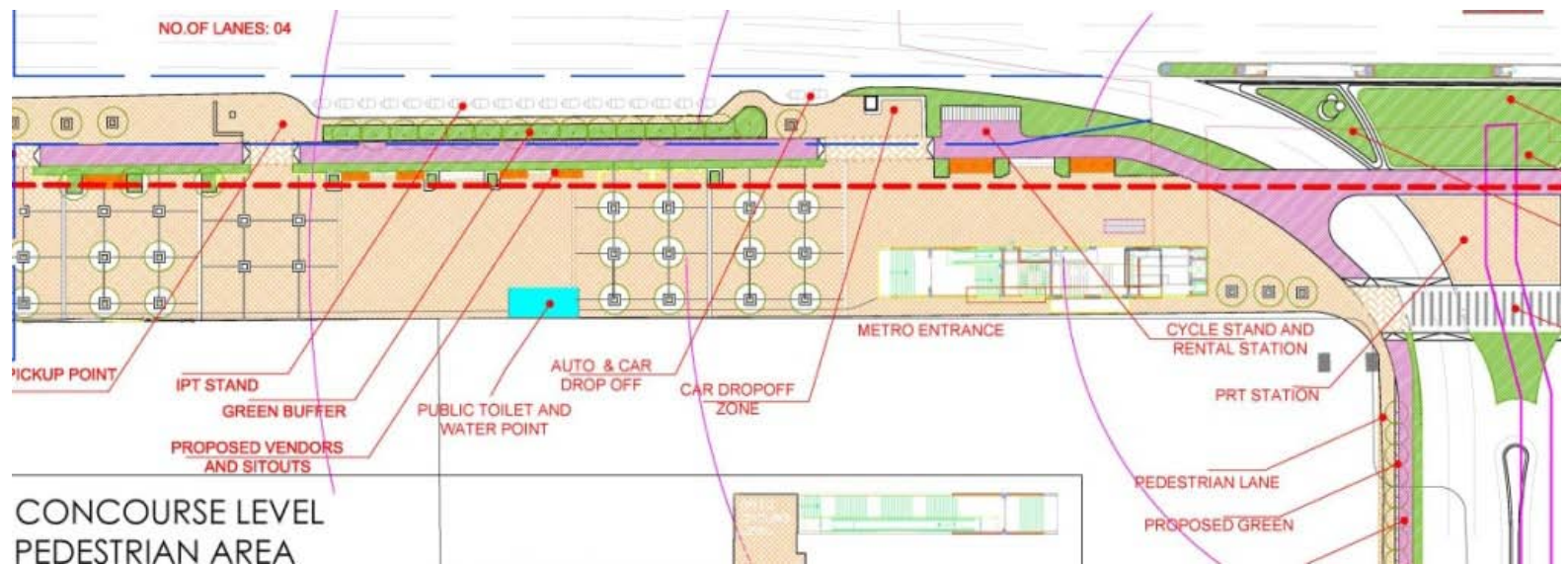


Figure 7: Sample Multi-modal Integration (MMI) Plan at Dhaula Kuan Metro Station showing designated space for all modes near the station exits. Courtesy: UTTIPEC

STRATEGY THREE

# BICYCLE SHARING SYSTEM WITH BICYCLE TRACKS/ CYCLING-HIGHWAY NETWORK THROUGHOUT THE CITY





## **Bicycle Sharing System with bicycle tracks/ cycling-highway network throughout the city**

### **ISSUE**

With a mix of slow and fast moving traffic on the roads, travel by bicycle and rickshaws is very unsafe. Data has shown that although approximately 35% of population of Delhi owns cycles, only a fraction of them use cycles for commuting due to lack of safe cycling facilities or cycle-parking facilities. Even with a small number the share of cyclists on the road is far greater than those who use the car. Inadequate cycling facilities is slowly pushing the population to the use of vehicles, thereby causing loss of environment, health and life in far greater numbers than it was two decades earlier. With fewer cycling means, people tend to spend a higher amount on reaching the bus station than on the bus fare. The road fatalities on cyclists are on the rise every year and for lack of dedicated cycling infrastructure, there is enough discouraging environment but choose to switch to motorcycle.

- The MoUD report of 2006 and GNCTD data shows that Delhi has a high mode share of walking and cycling trips - totalling nearly 46%. Adding to it is the fact that more than 60% trips are still below 4kms. Data shows that although more than 35% people of Delhi own bicycles, only approx. 6% use them on roads due to lack of safety. Due to this, currently, short trips are being made on private cars/ two-wheelers instead of walk or cycle, while actually it may be just a 12min bicycling distance.
- The bicycle sharing system can be effective in making the city centres and residential cores more liveable and accessible to nearby markets, mass transit stations, schools, institutions, and such areas.
- Bicycle sharing system will help in improving ridership to mass transit by providing cheap connectivity. Currently, the price of access trip is equal or more to the main trip.
- The system can also help in bringing down the costs on transportation spent per capita, while relieving congestion and improving air quality at the same time.

### **RECOMMENDATION OF THE COMMITTEE**

- Good bicycle infrastructure needs to be provided for and a convenient bicycle sharing system should be developed which will help take the shorter trips off the Arterial roads (thereby reducing congestion).
- The bicycle infrastructure needs to be continuous, obstruction free and with clearly demarcated bicycle tracks or lanes with good signage, road marking, lighting, at least one line of tree shade and frequent bicycle parking areas. The bicycle infrastructure needs to be provided at a higher level with protected edges to prevent monsoon flooding or encroachments by parked vehicles. Intersections to have bicycle queuing arrangement and dedicated bicycle signals for easy cross over. For large junctions, rotaries and for obstruction by arterials or waterways or



**Figure 8: Visualization of integration of Bicycle Sharing Station in Dwarka. Courtesy: Centre for Green Mobility**



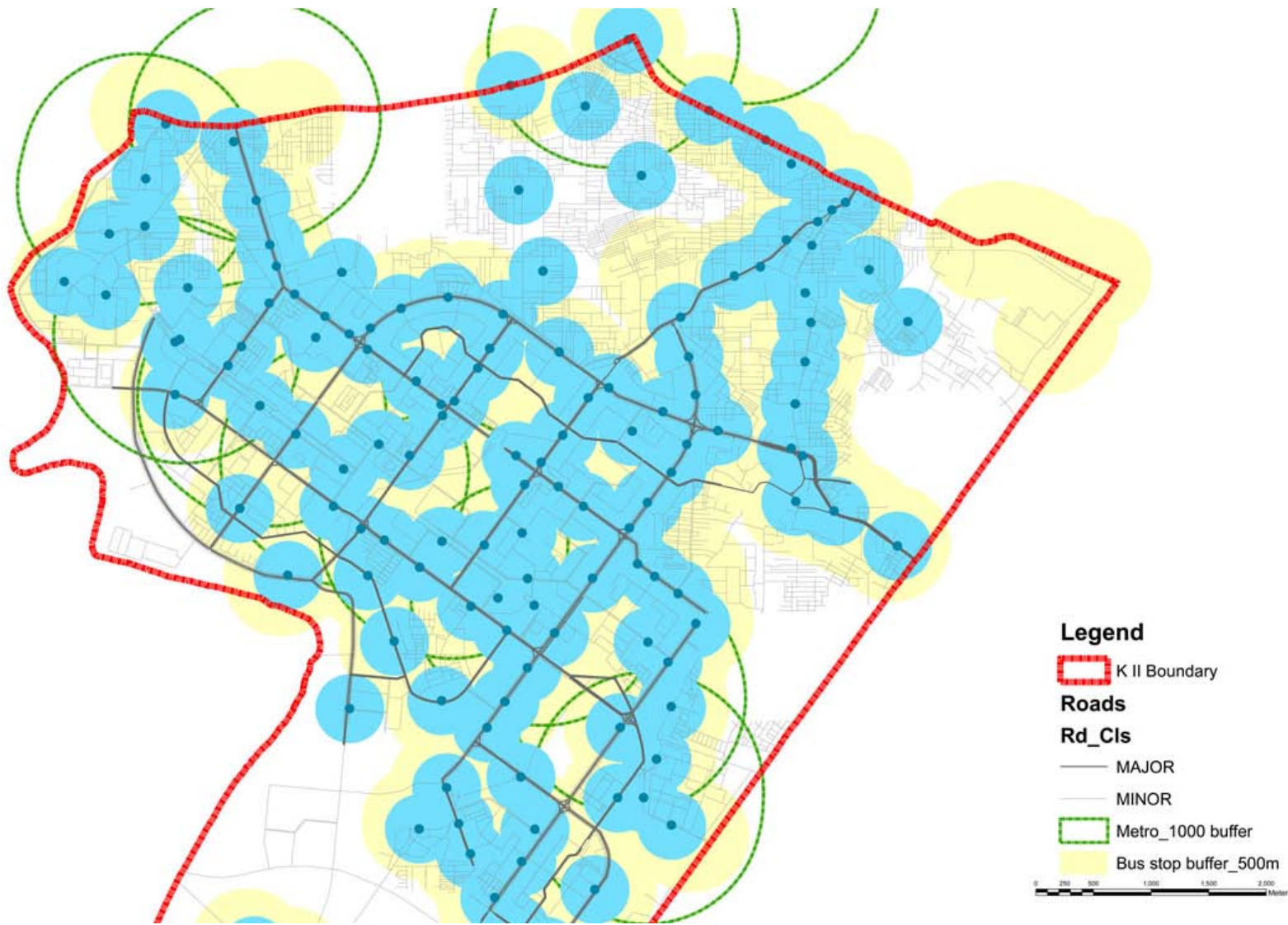
**Figure 9: Recently inaugurated cycle track at UT of Diu. Courtesy: Centre for Green Mobility**



- railways, special bicycle underpasses, bridges or ramps may be designed/ provided for.
- Bicycle tracks should be a minimum of 2m wide for single direction and a minimum of 3m wide for both directions. For tracks having pedal rickshaw movement, a minimum of 2.5m wide single direction and 4m wide for both directions should be provided.
- All streets above 18m Right of Way need to have dedicated bicycle tracks.
- The bicycle sharing system will be based on a dense network of stations placed approximately 250-300m apart and having fewer bicycles per station (10-50) with docks 1.2times the number of bicycles in each station
- The system with smart cycles, should be able to communicate with the stations and the control centre to help track them and make the checking out and checking in of cycles seamless.
- The cycle sharing system should be accessed by a smart mobility card or a smart card that will help make the system easy to use.
- The system should be procured by the government and will be run on long term basis by private operators who will be able to market and expand the system incrementally.
- **Encroachment of bicycle tracks and theft or vandalism of bicycle sharing infrastructure should be a cognizable offence under the Municipal Act/ MV Act or any other applicable Acts**

#### Cost and Timeline for implementation of Cycle Sharing System in Delhi

Cycle Sharing and provision of tracks		Approx. Area/ population	No. of cycle stations.	No. of cycles	Cost	Timeframe
Phase-1	Dwarka	12,00,000	300	4000	Approx 45cr.	End of 2015
Phase-2	All Arterial Roads of Delhi (above 40m ROW)	18,00,000	400	5000	Approx 70cr.	End of 2016
Phase-3	Entire West Delhi area	20,00,000	400	5500	Approx 80cr.	End of 2017
Future Phases.	Entire South Delhi area	27,00,000	500	6000	Approx 120cr.	2017 - 18



**Figure 10: Preliminary Sketch of Bicycle Stations in Dwarka. Courtesy: Centre for Green Mobility**

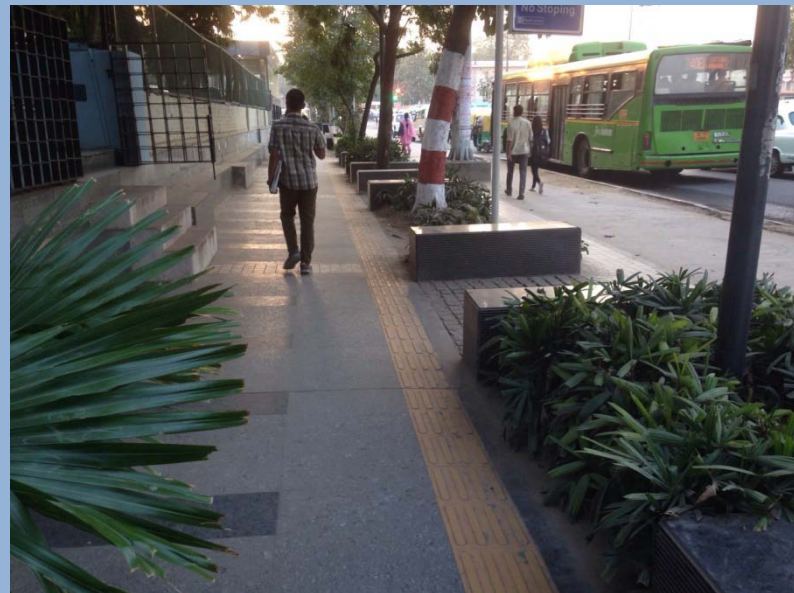
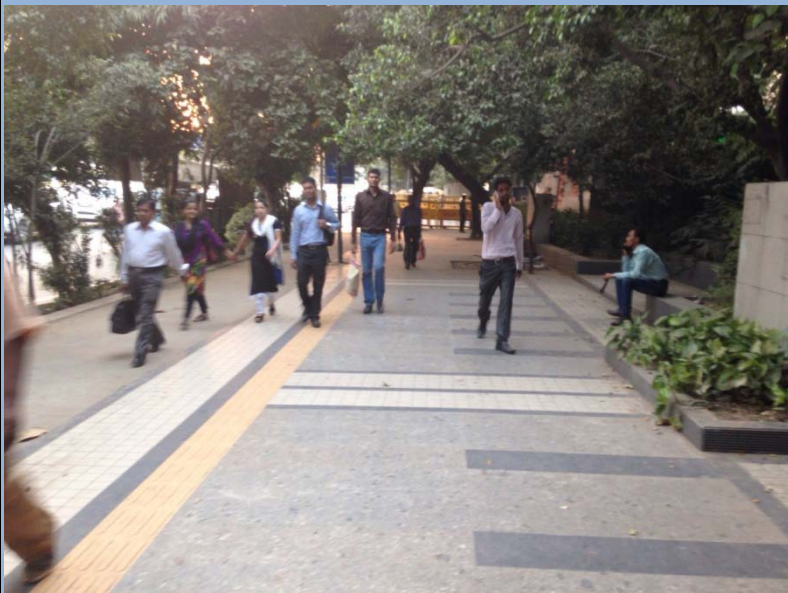
**Cost and Timeline for provision of Cycle tracks and Junctions**

<b>Cycle tracks (including design)</b>		<b>Cost</b>	<b>Timeframe</b>	<b>Agency</b>
<b>First Phase</b>	150 KMs of street length having cycle tracks	<b>Approx. 450 crores</b> @apprx. 3 cr. per KM	One year	PWD
	50 junctions	<b>Approx. 50 crores</b> @apprx. 1cr. per junction		
<b>Second Phase</b>	200 KMs of street length having cycle tracks	<b>Approx. 600 crores</b> @apprx. 3 cr. per KM	Within 2 years.	PWD
	100 junctions	<b>Approx. 100 crores</b> @apprx. 1cr. per junction		
<b>Third Phase</b>	300kms of street length having cycle tracks	<b>Approx. 900 crores</b> @apprx. 3 cr. per KM	Next 2 years	PWD
	100 junctions	<b>Approx. 100 crores</b> @apprx. 1cr. Per junction		



STRATEGY FOUR

# ROAD RETROFITTING AS PER STREET DESIGN GUIDELINES





## Road Retrofitting As Per Street Design Guidelines

### ISSUE

Walking is the most important and sustainable mode of transport. In Delhi, about 35% of the commuters of the city 'walk, only' as means of transport. These commuters are different from the ones who walk to catch the public transport. Therefore, in spite of the enormous motorization, the highest share of people still 'walk'. This is, in spite of the poor walking environment and danger to life by walking on roads. Data shows that more than 60% fatalities on roads are of the pedestrians. Safe walking environment is desirable and necessary for any society that's developing or in the developed world, as it provides for the basic right to commute. With increasing road widths that crossings at junctions are riskier and the space for walking is narrower than before, with the result that most activities happen on road even if the roads were not designed for them. The following aspects are important to consider:

**(i) Junction and Crossing improvements around Delhi as per identification by Delhi traffic Police:**

From transportation planning standpoint – ***More junctions mean better traffic dispersal.***

- The reason for congestion in Delhi is due to less number and poor design/management of junctions which greatly reduces the capacity of the road network to throughput and disperse traffic. Adequate number of junctions and proper geometric design with crossing and directional movement facilities – *help disperse traffic efficiently in multiple directions, while ensuring safety of all road users.*
- ***Poor design of junctions is primary reason for traffic jams and also pedestrian and cyclist fatalities on roads.***

**(ii) Footpath and Crossing provision as a non-negotiable requirement on all roads.**

According to Traffic Police data (2010), maximum fatal accidents occur on signal free corridors and foot of flyovers. Ring Road has recorded the highest fatal accidents followed by Outer Ring Road, Rohtak Road, G.T.Karnal Road. **The maximum casualty is of pedestrians & two-wheelers.** The maximum accidents have occurred during the lean hours both in the morning & night.

The Traffic Police had cited the following reasons for these fatalities:

1. Signal free high speed corridors.
2. Insufficient/ no pedestrian Crossing facilities.
3. Central verge without grills.
4. No speed breakers/ rumble strips on long stretches.
5. Absence of dedicated lanes for slow moving vehicles.
6. Heavy volume of traffic.
7. Glaring during night etc.





## RECOMMENDATION OF THE COMMITTEE

To combat the above, it is recommended that to begin with, the following steps be taken up immediately:

- Approximately 200 junctions will be identified **in consultation with Traffic Police** and the same will be taken up for retrofitting as per the Standard Crossing/ Junction designs approved by UTTIPEC in 2011.
- Minimum standard of footpath as per IRC codes needs to be 1.8m and the same has to be followed on all roads. Crossings to be provided as per as per guidelines given under IRC Code 103:2012 for Pedestrian facilities and UTTIPEC Street Design Regulations.
- **Encroachment of footpaths shall be a cognizable offense under the Municipal Act.**

### Cost and Timeline for provision/retrofitting of Footpaths and Junctions

Junction Retrofitting (including design)		Cost	Timeframe	Agency
<b>First Phase</b>	100 KMs of footpaths	<b>Approx. 200 crores</b> @apprx. 2 cr. per KM	One year	PWD
	200 junctions	<b>Approx. 200 crores</b> @apprx. 1cr. per junction		
<b>Second Phase</b>	100 KMs of footpaths	<b>Approx. 200 crores</b>	Within 2 years.	PWD
	200 junctions	<b>Approx. 200 crores</b>		

### IRC 40 M SUB ARTERIAL STREET WITH EXTRA PARKING LANE (4 Lane Divided)

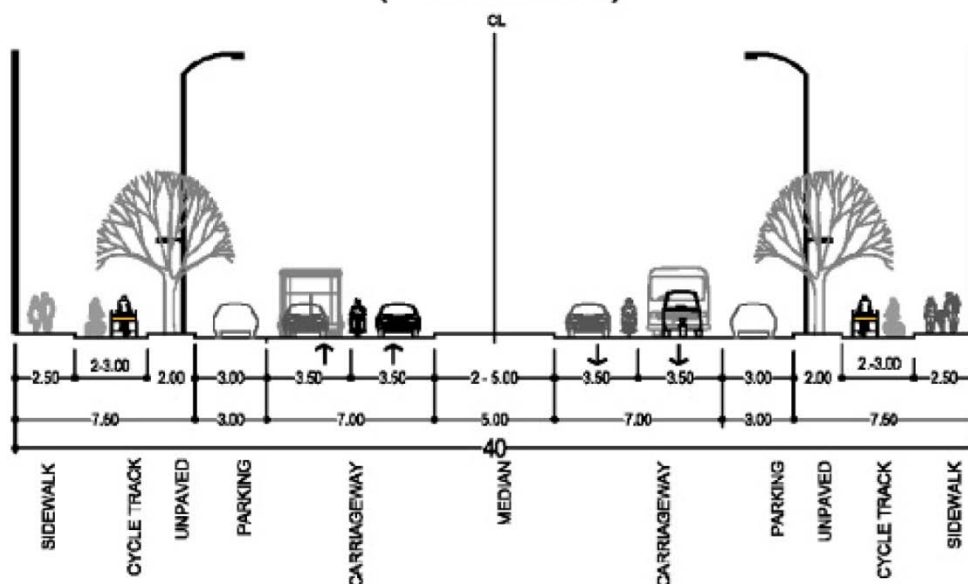


Figure 11: Sample, Street Design Guidelines. Courtesy: UTTIPEC



STRATEGY FIVE

# BUS SERVICE IMPROVEMENTS



## Bus Service Improvements

### ISSUE

The total passenger trips per day catered by buses are more 60% of the total public transport trips in Delhi, which is a significantly higher share than the Metro, at fraction of its cost. In spite of the popularity and use of the bus, it is still seen as a poor man's vehicle and therefore is in ever greater need of modernization. Bus transport, throughout the world caters to more commuters per day than any other mode – even in cities of Singapore, Tokyo and Hong Kong which are known for their efficient Metro systems. By providing a technological boost and making them more accessible to most residential and commercial places, buses can cater to heavy passenger loads and still maintain good reliable service that's comfortable and dependable. The bus stations, real time passenger information system, bus operations, bus priority signalling at junctions, comfortable bus docking arrangement on the street, and easy accessibility are assured ways of attracting more passengers to buses.

Four major issues were identified with respect to the bus service system of Delhi:

- i. **Access to bus service** within walking distance of homes.
- ii. **Low floor buses are must** (in compliance with universal access act)
- iii. **Air-conditioned buses to make it attractive to middle class** (comfort is key to encourage public transport use)
- iv. **Cheap & easy to use** – bus fares should be less than per/KM cost of two-wheeler use (therefore various cross-subsidy models are required)
- v. **footpaths & common mobility cards** (are primary requirement for efficient and safe last-mile connectivity)
- vi. **Reliability** (ITS based public information system)

### RECOMMENDATION OF THE COMMITTEE:

It was recommended that the "**Urban Transport Fund**" needs to be set up and the fund may be strengthened based on the following:

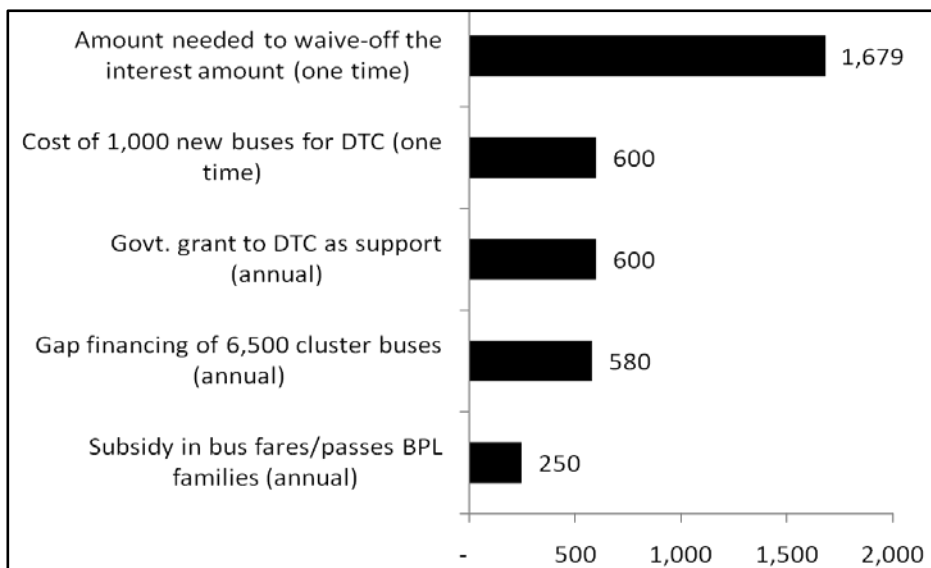
- i) Rationalization of the budgetary allocation to augment available funding for public transport
- ii) Tap different revenue streams related to transport, vehicles as well as transport demand management methods including parking, vehicle taxation, fuel taxes, advertisement revenue
- iii) Recurring cess from transit oriented development (TOD) along MRTS corridors from private sector and direct funding from TOD developments by Transport Dept.



**Cost and Timeline for implementation of Bus System Upgradation in Delhi**

For Improvement of Bus System:		Agency	Timeframe
1	<b>ITS</b> (OCC, PIS, Signalling, Management)	Transport Dept. GNCTD/ Tr. Police	1
2	<b>High Quality, air-conditioned low-floor A/C buses</b>	Transport Dept. GNCTD	1
3	<b>Single Mobility Card</b>	Transport Dept. GNCTD	2
4	<b>Car-pool/ High Occupancy Vehicle use incentivization</b>	Transport Dept. GNCTD	2
5	<b>Route Rationalization of all bus routes (DTC/ cluster/ BRT)</b>	Transport Dept. GNCTD	2
6	<b>Bus Parking and Depot space provision</b> – until provision of parking space for all required buses is not made available, it was agreed by the Committee that PWD would make available all major roads which lie vacant at night, for night time bus parking.		

**Graph: Estimated investment needed in bus transport in Delhi**







**Possible tap off from existing and potential revenue sources in one year in Delhi**

<b>Source of Revenue</b>	<b>Revenue (in crores)</b>	<b>Percentage share of revenue</b>	<b>Enhanced potential (in crore)</b>
Sales of Bus Tickets	858.89	100	<b>858.89</b>
Advertising on Bus Stops (Existing space)	101.11	100	<b>101.11</b>
Parking*	280	25	70
Additional advertising revenue potential (on Buses on rear windscreen, Plasma/LCD Advertising on Buses, JC Decaux Street Furniture advertising)	201.83	100	<b>201.83</b>
Green Tax	36	25	9
Commercial development in Bus Terminals on PPP Basis	104.27	100	<b>104.27</b>
Air Ambience Fund	29	25	7.25
Recurring TOD cess	10	100	10
<b>Total</b>	<b>1621.1</b>		<b>1362.35</b>
<p>Note: *Estimate of parking revenue potential -- Based on the available parking slots, parking demand, an average parking duration of 3.5 hours, and current effective parking rates of Rs. 8.57/ hour for 4-wheelers and Rs. 4.2/ hour for 2-wheelers – potential parking revenue collection is Rs. 280 crores</p> <p>If parking charges are hiked to at least Rs. 30 per hour the parking revenue potential can rise to Rs. 1000 crores. Higher rates can fetch more.</p>			



STRATEGY SIX

# BUS RAPID TRANSIT SYSTEM (BRTS) CORRIDOR DEVELOPMENT





## BRTS Corridor Development

### ISSUE

The Bus Rapid Transit System (BRTS) of Delhi has faced flak from many sections of the society including experts and technical personnel, with the result that BRTS could never gain the ground it lost. The prominent opposition was from the private vehicle lobby who perceived as the system taking away the road space that was otherwise to be assigned to them. However, BRTS still carries significantly more people per hour than all the vehicles put together in the pilot corridor of BRTS, a fact that's important to note. BRTS is a high capacity bus system and therefore should have this integration with the regular bus system in terms of fare collection, interchange and also should be provided with depot and parking spaces. Delhi requires a large number of buses that should be prioritized over other expenditure.

Bus Rapid Transit System, when designed & run as an efficient and integrated system, has shown across the world that it carries more passengers than any other mass transit system, even when more than one mass transit systems are present in the same city. In Delhi, on the pilot corridor, studies have shown that the speed of the bus increased thereby carrying more passengers per minute. Delhi still carries more than 60% of the passengers on buses from the overall mass transit ridership – much higher than Metro. With efficient and comfortable BRTS development, bus services will be able to provide greater comfort, reduce travel times and integrate with all systems to provide seamless travel experience. However, corridor development issues have to be addressed to make BRTS a success.

### RECOMMENDATION OF THE COMMITTEE:

- i. **Providing median station to reduce cost on operations and provide dedicated bus corridor** (on lines of success story of Ahmedabad)
- ii. **Providing high quality air-conditioned buses to make it attractive to middle class that can board at median stations and can be used out-of-corridor also** (comfort is key to encourage public transport use)
- iii. **Ensuring 'at-level' boarding of all buses and 'off-board' ticketing at the BRT stations.**
- iv. **Retrofitting the corridor for greater passenger access through footpath and cycle tracks on the BRTS corridor, such that BRTS is 'prioritized' over other motorized modes.**
- v. **Retrofitting the intersections for 'BRTS-priority' movement and greater passenger transfer.**
- vi. **Integrating BRTS operations with DTC bus operations under single authority and with fare integration.**
- vii. **Rationalizing all bus routes such that BRTS and Buses function as a single unified network with few high capacity routes (called BRTS) and rest medium or low capacity routes.**



- viii. **Operating BRTS and Buses on Gross Cost Model (GCM) as opposed to Net Cost Model (NCM), as:**
- GCM ensures greater bus availability and wider service reliability of the system since profit is not linked to ridership.
  - GCM ensures building in incentives and penalties to the bus operator in the contract, thereby improving operations
  - Driver discipline and Passenger safety is much higher through GCM
  - Possible to attract more private investment through GCM model for procurement and operations of buses
- ix. **Provide Depot spaces and Bus Parking** for BRTS and other buses such that dead-kilometres of the buses can be reduced and for efficient functioning of the Gross Cost Model.
- x. **Provide IT-based Real-time Operations for BRTS and Bus services**
- xi. **Cheap & easy to use** – bus fares should be less than per/KM cost of two-wheeler use (therefore various cross-subsidy models are required)
- xii. **Common Mobility Card is a must for seamless travel experience** (are primary requirement for efficient and safe last-mile connectivity)

#### Cost and Timeline for implementation of BRTS Corridor Development in Delhi

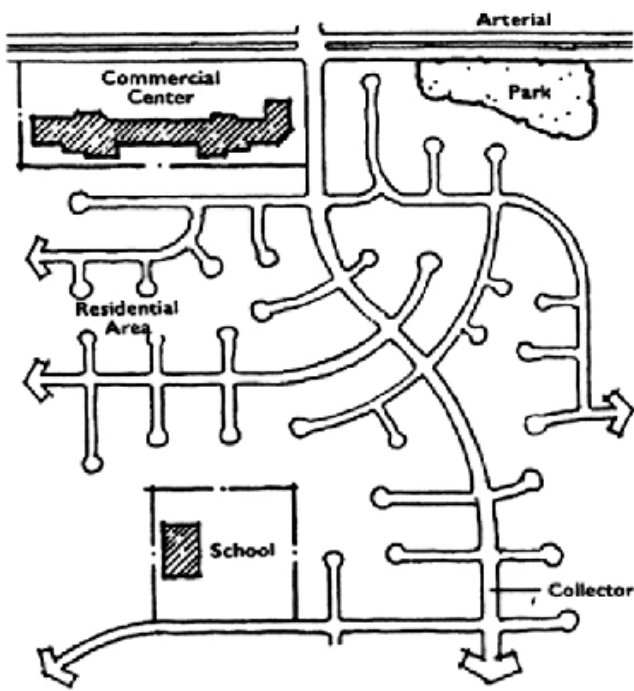
For Improvement of BRTS System:		Agency	Cost (cr)	Timeframe
1	<b>BRTS Corridor Development</b> including junction improvements	PWD		
	Karawal Nagar to Mori Gate (12.9km)		193.5	
	Gazipur NH-24 to National Stadium (12km)		180	
	Dilshad Garden Metro Station to Tikri Border (40km)		600	1 yr.
	Badarpur Boarder to IGI Airport via Mahipal Pur (26.1km)		391.5	1 yr.
	Harsh Vihar to Janakpuri Distric Centre – Janakpuri D-Block. (33km)		495	2 yrs.
2	<b>BRTS Depot Development</b>	DTC/ Transport Dept./GNCTD		
4	<b>ITS</b> (OCC, PIS, Signalling, Management)	Transport Dept. GNCTD/ Tr. Police	?	1 yr.
2	<b>High Quality, air-conditioned high-floor buses (normal, articulated and bi-articulated) with left side low floor boarding provision.</b>	Transport Dept. GNCTD	?	1 yr.
3	<b>Single Mobility Card</b>	Transport Dept. GNCTD	?	2 yrs.
5	<b>Route Rationalization of all bus routes (DTC/ cluster/ BRT)</b>	Transport Dept. GNCTD	?	2 yrs.



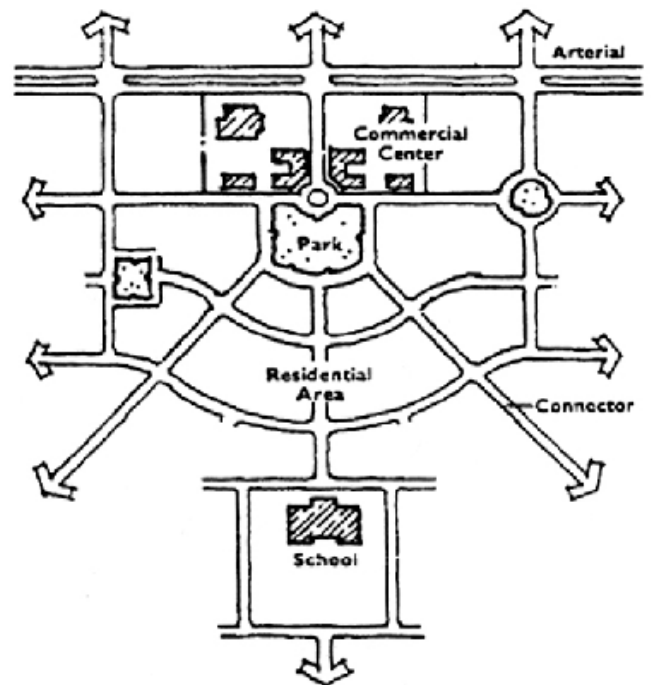


# INTEGRATED ROAD NETWORK

## Street Network



*Discouraged*



*Preferred*



## Integrated Road Network – new bypass/ elevated roads

### ISSUE

In the current scenario, only arterial roads are forming the network system of the city. There is complete absence of a secondary road network system resulting in restricted distributed of the traffic over a network and concentration of even local traffic on arterial roads, resulting in congestion on these roads. Further, closure of medians all along arterial/ sub-arterial roads to have signal-free corridors, have restricted movement of traffic/ people between neighbourhoods on either side. Moreover, connections between colonies are also not planned to enable direct connectivity to local destinations, forcing people to come to to arterial roads to make even the short local trips.

There are **three** types of road network improvements that need to be implemented:

#### i) **Local level Network Improvements impacting city traffic**

In the current scenario, only arterial roads are forming the network system of the city. There is complete absence of a secondary road network system, which restricts the distribution of traffic over a network, resulting in concentration of even local traffic on arterial roads, which leads to congestion. This is due to the following reasons:

- Previous planning paradigm of creating less junctions and culdesac-based neighbourhoods is such that people are forced to come on the major arterial roads even to access local destinations. Connections between colonies were also not planned to enable direct connectivity to markets, shops, schools, etc. forcing people to drive even for daily needs.
- Road-level signal free corridors created for movement for cars with closure of medians all along arterial/ sub-arterial roads – have restricted movement of traffic/ people between neighbourhoods on either side, leading to accidents and disruption between communities.
- Large tracts of land in the form of railway and drain corridors divide the city in segments. Railway corridors are especially big barriers as they do not provide enough underpasses/ overpasses to enable traffic in the city to move in a proper network. Such archaic policies need to be modified.
- In order to reduce congestion on the existing roads, it is proposed to identify additional/ alternative links and access corridors to augment the current network, with the following measures:
- Augmentation of road network is required to distribute high traffic volume over multiple roads, instead of stand-alone corridor/ junction capacity improvement strategies.

#### ii) **Segregation of through traffic from local traffic/ local movement of people – Bypassing of non-destined regional traffic without entering Delhi**

Delhi being at the heart of NCR – experiences a lot of through traffic of trucks and workforce movement between NCR towns, even when very often the traffic is not



destined to Delhi centres. Therefore multiple bypass routes are required in order to reduce traffic passing through the city.

In case signal-free corridors are required through the city to handle NCR level traffic, they should be in the form of elevated corridors instead of flyovers, etc. Such fully grade-separated corridors allow movement of people at the ground level without hampering city level traffic movement.

### RECOMMENDATION OF THE COMMITTEE

As per above, in order to reduce congestion on the existing roads, it is proposed to identify additional/ alternative links and access corridors *to augment the current network, with the following measures:*

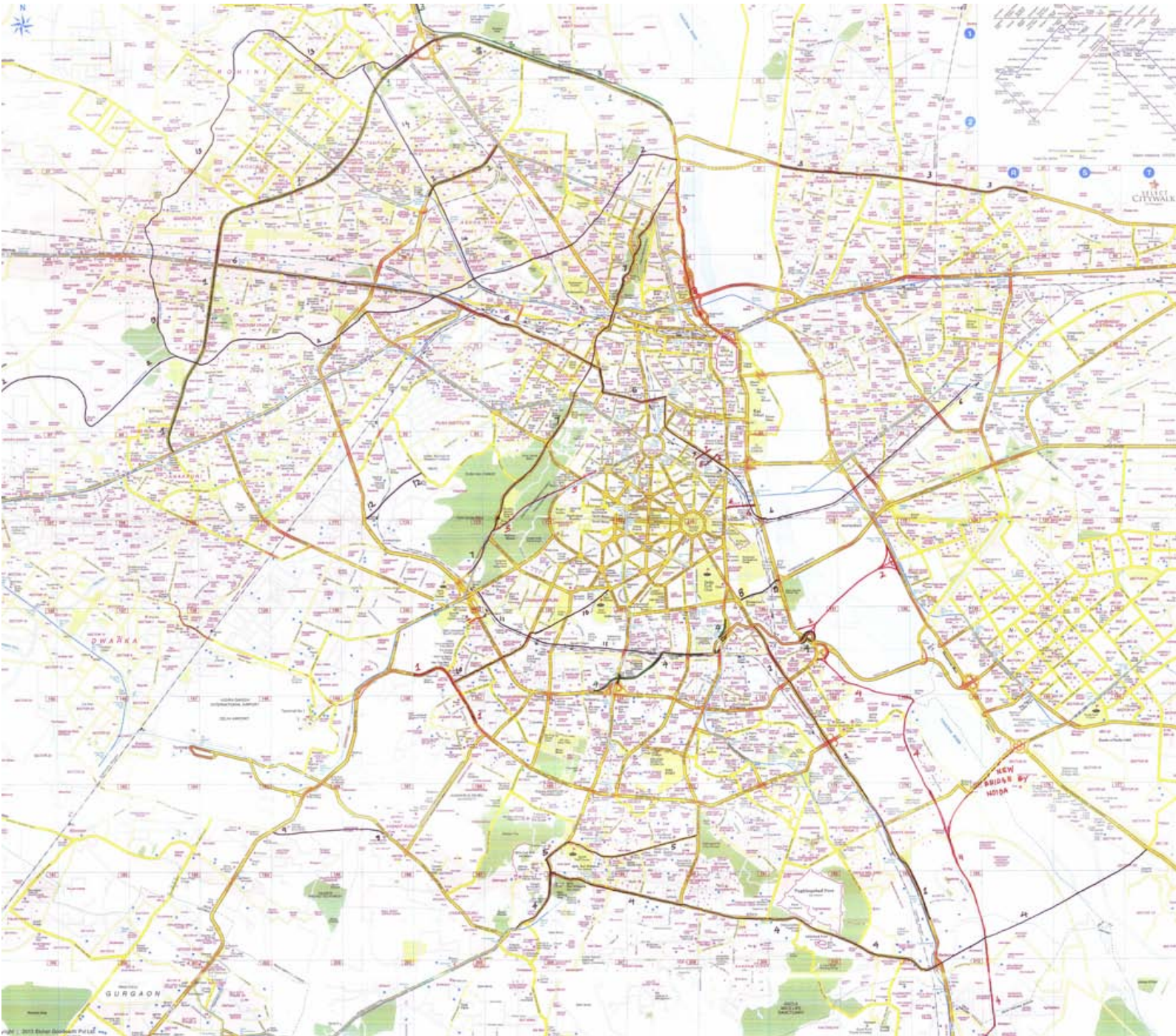
#### Short, Medium & Long Term Projects *(please see map attached at the last)*

S. No	Name of Work	Target date	Funding
<b>I</b>	<b>SHORT TERM PROJECTS(already in progress)</b> (Marked in GREEN in the Map)		
1.	Construction of 6-lane road parallel on the side of supplementary drain from Swaroop Nagar to Jagatpur measuring about 9 KM. (Cost Rs. 200Cr)	June 2015	PWD, GNCTD
2.	Construction of Barapulla Elevated Road in Phase-II from JLN Stadium to Aurobindo Marg near INA Market and connecting loops of road construction in Phase-I at Ring Road and Lala Lajpat Rai Marg(3.5 KM) (Cost Rs. 550Cr)	December 2015	PWD, GNCTD And JNNURM
<b>I-A</b>	<b>SHORT TERM PROJECTS (About to be Taken up):</b> (Marked in RED in the Map)		
1.	<b>C/o Barapullah elevated road in Phase-III:</b> The work on this stretch of Barapullah will start very soon to connect Sarai Kale Khan to Mayur Vihar with a bridge across River Yamuna(4.0km) (Cost Rs. 1260Cr)	December 2017	PWD, GNCTD
2.	<b>Kalindi Bypass and New bridges/roads to Noida:</b> The proposal for construction of Kalindi Bypass from DND-Ring Road Junction to Faridabad Bypass (14 KM) along with proposed construction of elevated road along the drain from Chilla Regulator to Kalindi and a bridge parallel to the existing Kalindi Kunj bridge by NOIDA and development of road parallel to Hindon Canal from NH-24 to Chilla Regulator by PWD, Delhi would provide great relief to traffic in East Delhi, NOIDA and decongest Ashram Chowk and NH-2 in a big way. However, for approval of these proposals, the matter has to be resolved between the Govt. of Delhi, NOIDA and Govt. of U.P. (U.P. Irrigation Department) for which intervention of Ministry of Urban Development, Govt. of India would be required. (Cost Rs. 2000Cr)	Interstate Issue	PWD, GNCTD and NOIDA
<b>I-B</b>	<b>SHORT TERM PROJECTS (identified by Traffic Police):</b> (Marked in RED in the Map)		



**Figure 12: Cycle-only Elevated Roundabout at Intersection in Netherlands**

1.	Tunnel road from R/A of RML Hospital to the Upper Ridge Road with approximate cost of Rs.900 cores (4 Laned tunnel through Tunnel Boring Machine in Rock) and total length around 2.5 KM.	December, 2017	PWD, GNCTD
2.	Tunnel between Ring Road and Bhagwan Das road/ Purana Quila road- with approx. cost of Rs.450 crores (4 Laned tunnel through Tunnel Boring Machine) and total length around 1.5 KM.	December, 2017	PWD, GNCTD
3.	Underpass from Mandi House/ Tansen Marg to Kotla Road and Mata Sundari Road Across the Railway Tracks with approximate cost of Rs. 360 crores and total length around 1.2 KM.	December, 2017	PWD, GNCTD
4.	Underpass from Safdar Hashmi Marg to Vishnu Digambar Marg across the Railway Tracks with approximate cost of Rs. 360 crores and total length around 1.2 KM.	December, 2017	PWD, GNCTD
<b>II</b>	<b>MEDIUM TERM PROJECTS (identified by PWD):</b> (Marked in BLACK in the Map)		
1.	<b>Elevated Road along Najafgarh Nallah:</b> This elevated corridor along Najafgarh drain will connect West Delhi, Dwarka to Central Delhi, Connaught Place and North-East Delhi (Signature Bridge) and help decongest the Ring Roads. The project will also include an Ecomobility corridor at the drain level, with dedicated cycle-highways to provide safe connectivity to the working population(30km). (Cost Rs. 4000Cr)	December, 2018	PWD, GNCTD
2.	<b>Corridor Improvement Mehrauli Badarpur Roads and its extension to NOIDA:</b> Will provide connectivity from Noida to South Delhi towards Gurgaon and includes a bridge over River Yamuna which will be taken up by Noida Authorities(18km). (Cost Rs. 2750Cr)	December, 2018	PWD, GNCTD And NOIDA
3.	<b>East-West Corridor:</b> Construction of East-West Corridor from Anand Vihar Passenger Terminal to NH-10 via New Delhi Railway Station and Punjabi Bagh (20 KM). (Cost Rs. 2500Cr)	December, 2018	PWD, GNCTD
4.	<b>Tunnel at Nizamuddin to Lodhi Road-Mathura Road junction:</b> This tunnel is long proposed which is destined to take traffic from NH24 directly to Mathura road- Lodhi Road junction bypassing Bhairon Marg which is highly congested at present(1.5km) (Cost Rs. 600Cr)	June, 2017	PWD, GNCTD
9	<b>Mahipalpur Bypass to NH-8 to connect with Dwarka Link Roads:</b> This includes construction of Mahipalpur Bypass Road to Dwarka Link road Across NH-8. (Cost Rs. 630Cr)	June, 2017	PWD, GNCTD
10	<b>Direct Link from Airport to Lutyens Delhi:</b> Critical link for connectivity between Lutyens and Airport will include elevated/underground corridor (Safderjung Crossing Aurangzeb Road to Shanti Path) and construction of underpass at Moti Bagh(8km) (Cost Rs. 1500Cr)	December, 2018	PWD, GNCTD
11	<b>C/o Barapullah elevated road in Phase-IV:</b> This phase will extend the Barapullah road till Dhaula Kuan and to Aruna Asaf Ali Marg to connect to Airport.(6km) (Cost Rs. 1000Cr)	December, 2018	PWD, GNCTD
12	<b>Direct Link from Bar Square to Dev Prakash Shastri Marg:</b> Construction of this direct link will join ring road to defence area via Ridge. (Cost Rs. 450Cr)	December, 2017	PWD, GNCTD



**Figure 13: Map of Delhi showing all the projects**



13	<b>Elevated Road along Nangloi Drain:</b> This road from Meera Bagh to Mukarba Chowk is essential for outer areas of North Delhi(10km). (Cost Rs. 1500Cr)	December, 2017	PWD, GNCTD
14	<b>Elevated Road along Western Yamuna Canal:</b> This elevated stretch will connect Haiderpur to inderlok(6km) (Cost Rs. 1000Cr)	December, 2018	PWD, GNCTD
15	<b>New bridge North of Wazirabad bridge:</b> This bridge will connect Outer Ring Road to Tronika City in Ghaziabad. (Cost Rs. 1000Cr)	December, 2018	PWD, GNCTD
III	<b>LONG TERM PROJECTS</b> (Not marked in Map)		
1	<b>Eastern and Western Peripheral Highway:</b>	Interstate Issue	
2	<b>Elevated Road From Palam Vihar to Anand Parbat:</b> This elevated stretch along Railway Line will connect Palam Vihar, Gurgaon-Chuma Road to Anand Prabat and finally merge with proposed East-West Corridor (Proposed by Traffic Police)	December, 2018	
3	<b>Elevated road from Tikri Border to Zakhira:</b> Along Railway Line (Proposed by Traffic Police)	December, 2018	
4	<b>Urban Extension Road:</b> This critical road is needed to connect Noprth Delhi to the Airport, South Delhi, Gurgaon and Noida, providing an outermost ring bypassing the existing ring road and provide regional connectivity without making traffic pass through the heart of the city.	As planned by DDA	

**Note:** The High Powered Inter-Ministerial Committee observed strongly that **active co-operation from Railways and Ministry of Defence** would be required for preparation of the Detailed Project Report for these proposals and subsequently during their execution.



STRATEGY EIGHT

# INTELLIGENT TRANSPORT SYSTEM





## Intelligent Transport System (ITS)

### ISSUE

Currently, public transport system greatly lacks the integration and use of ITS for its day-to-day and short and long term operations. Intelligent Systems have long been the backbone of all successful public transport systems across the world and is responsible for efficient operations, inventory management, incidence control & management, fare collection system, passenger control and access, and numerous other applications that help streamline tasks. Performance and efficiencies of the systems can be dealt in an efficient and equitable manner with the integration of ITS. Intelligent systems are also very helpful in traffic management, control and for real time location mapping and providing information to the customers through means of different devices all powered by a central control monitoring system.

Intelligent Transport System (ITS) helps mainly for following areas:

1. Reducing congestion through smart signal management and synchronization
2. Improving Road Safety through better monitoring and management
3. Providing reliable of public services through smart public information system (PIS)
4. Improving operations management of both traffic and public transportation

### RECOMMENDATION OF THE COMMITTEE

The Committee recommends that ITS is the key to transform Delhi into a smart city and hence should be fully implemented. The following aspects of ITS need to be implemented:

#### i) **CCTV Surveillance and Information through Variable Message Sign (VMS)**

CCTV surveillance need to be installed at critical intersections and critical roads. The traffic conditions can be monitored by CCTV and information of any unusual events can be reported to users. This will also help for incident management for enforcement authorities and guide for users to take alternative paths to avoid problem area.

The CCTV surveillance will also be helpful in detecting crimes in the area. Some of the advantages of VMS are given below:

- VMS is a very effective tool for transmitting timely, reliable and comprehensive advisory messages to motorist/road users on traffic conditions.
  - VMS helps in Traffic and congestion management in case of accidents, road work, lane closure, diversion, bad weather, special events, VIP movement etc.
  - VMS can also be used within Parking Guidance and information system to guide drivers about available car parking slots.
- #### ii) **Automatic Vehicle Location System**
- Proposed ITS could have Automatic vehicle tracking system providing information on real time vehicle location on the network. This could be integrated with the control Centre.
  - The information can be utilized to generate number of reports on efficiency of route operations including



- Route-wise deviations
- Time table deviations
- Operational time deviations etc

**iii) Public Transport Information**

The Public transport/paratransit information system can be developed by tracking vehicles and informing users through PIS boards/voice communications etc. The information could be of various types such as

- Operation schedule and status information provision
- Operation management

**iv) Increasing efficiency in Road Management**

Efficiency of traffic management can be increased by sending information of maintenance/ incident, etc. to control centres and displaying to users:

- Road maintenance
- Management of special vehicle
- Construction work related information management

**v) Red Light Camera and Stop Line Violation Detection System (RLSVD)**

Red Light Violation is one of the major causes for accidents at signalized intersections. This can be controlled by installation of Red Light Cameras:

- RLSVD system comprises of Traffic Controller, Detection sensors, Video Camera, ANPR Camera & illuminator could be installed for reducing red light violations
- It is recommended that the proposed system should be capable of taking Snapshot with Number plate details and three seconds video should also be provided as evidence from RLSVD Server which could be used to issue challans.

**vi) Speed Camera through Automatic Number Plate Recognition (ANPR)**

- Speed cameras are used to reduce over speeding and enhancing safety on roads. Speed is calculated and challans issued for over-speed vehicles.
- This can be done by Using Radar or IR technology in forward facing or rear facing mode to capture images of passing vehicles, based on trigger from detection sensors.
- Video system is supported with Automatic Number Plate Recognition (ANPR) digital technology.
- Number plates are digitally recorded at Entry & Exit camera point and Central computer then arrives at average speed
- In case average speed crosses preset threshold, this speed violation data is digitally stored on central computer.

**vii) Automated Parking Management System(APMS)**

The automated Parking Management and Guidance system helps in efficient utilization of parking system and also reduces vehicle search km in the network. The component in this includes parking occupancy monitoring system, user guidance and information display system.

**viii) Intelligent Signalling System with Control Centre connectivity**

The purpose of system is to improve intersection efficiency/capacity and reduction of delays. The system installed to manage, control and monitor junctions as well as traffic movement, in an integrated and coordinated manner; both at a junction- and at an area-wide level.



Figure 14: Operations Control Centre for Bus Operations. Courtesy: DIMTS

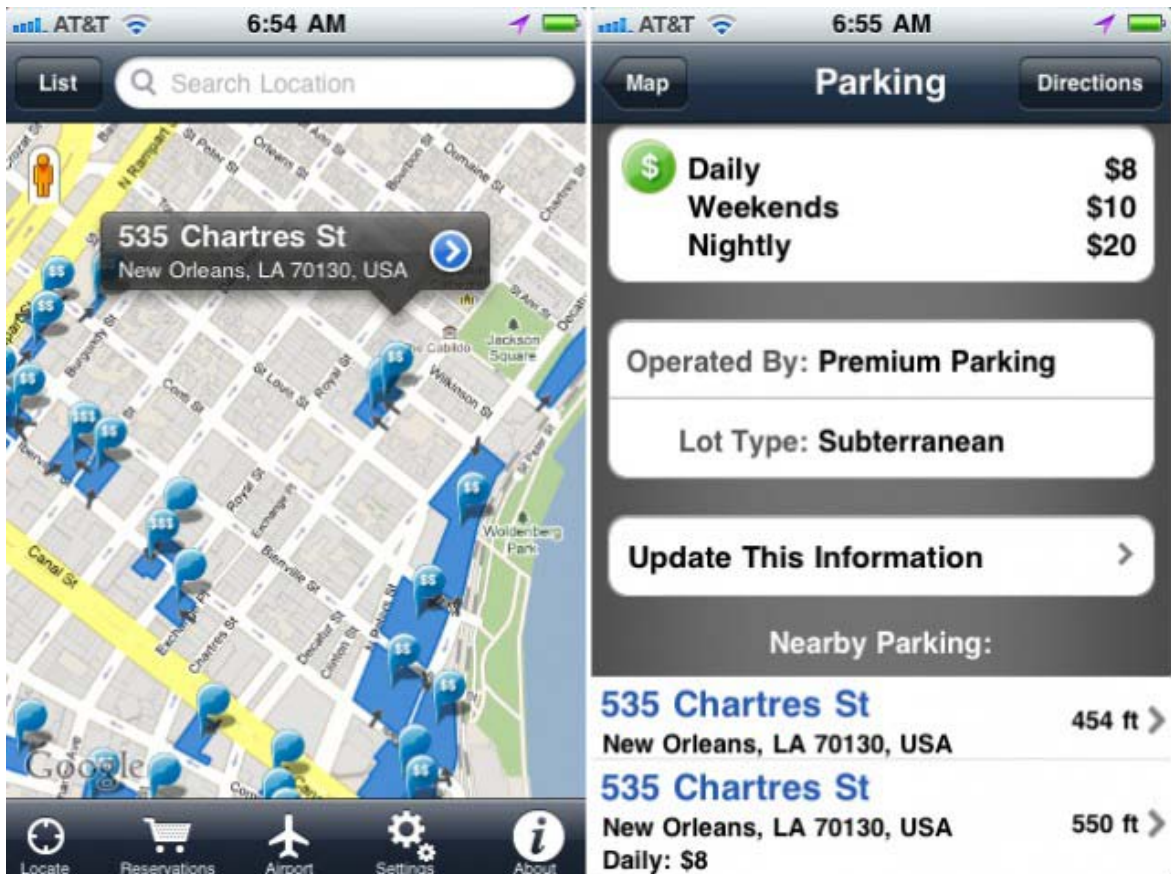


Figure 15: Phone app for parking location and operations. Courtesy: DIMTS



As part of system, Vehicle detection is done to enable queue length measuring and signal vehicle actuation. Various sensors are installed at upstream/downstream of junction approaches to determine classified flow volumes and making changes in signal timings as per traffic requirements.

It is recommended that the system should be such that all the signals are managed from control centre ensuring dynamic signal timing and queue management for efficient flow of traffic.

**ix) Automatic Fare Collection System**

As part of system, fare collection can be done using Electronic Ticketing Machines connected to central server. All the transaction could be recorded and available online for authorize officials. The system will help in reducing revenue leakages and improve passenger convenience/commercial recovery significantly by providing facilities of card payments/integrated ticketing etc. The data collected will also be useful for analysis of various routes, with reference to loading patterns etc for suggesting measures for improving route efficiency.

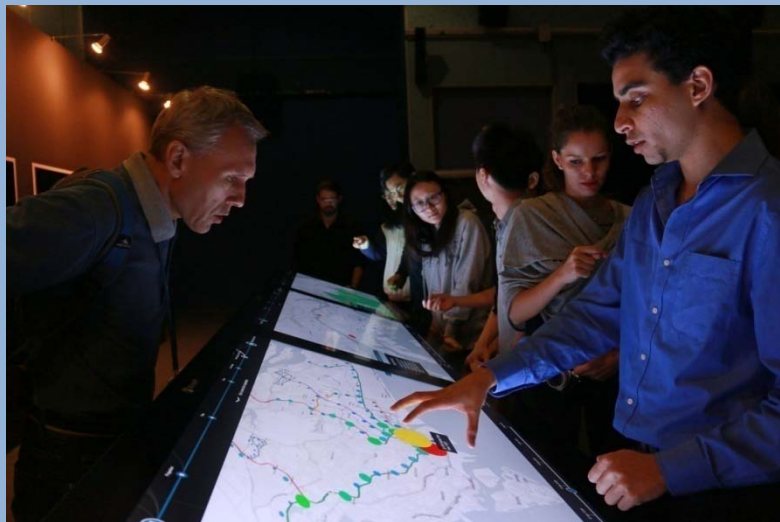
**x) Control Centre & Data Storage**

- Control centre would integrate, control and manage the information system through a combination of hardware and software. This will be a monitoring centre for all ITS activities.
- Data storage facility is provided through the data centre which is part of the control centre.
- A digital transmission system capable of connecting and transmitting the data to control centre through uninterrupted communication system could be developed



STRATEGY NINE

# CAPACITY BUILDING





## Capacity Building of Transport Department/ DUMTA

### ISSUE

The Technical capacity issues have been and still are the biggest impediment to planning and successful implementation of sustainable transportation projects in Delhi. Urban transport has never been a recognized area of work until recently and therefore much of the planning work is still being taken up by road engineers who are essentially trained in structural and traffic engineering. This has led to short term and incorrect solutions being proposed for simple street up-gradation projects. For efficient use of resources and for having the benefits of initiatives reach the masses, it's important that the all agencies dealing with transport has a high level of technical capacity to envision, propose, coordinate, implement and monitor transport projects for Delhi.

The committee observed that the Delhi Urban Mass Transit Authority (DUMTA) needs to be formed in order to effectively plan, manage and monitor the operations and integration of all aspects of transportation and traffic management – Metro, BRTS, Bus, Cycles, Rickshaws, Motorized vehicles, Pedestrians, Street Design – each having a different need and demand combined with varied technical and planning expertise that is required to plan, realize and oversee them. The various agencies dealing with transportation, in the current form, are focused more on administrative issues rather than technical handling of issues. In fact, for most technical matters, the administrators tend to rely only on 'consultants' with very limited in house capacity to even provide proper terms of reference, evaluate the consultants work and take forward the execution of the consultants proposal through the life of the project.

### RECOMMENDATION OF THE COMMITTEE

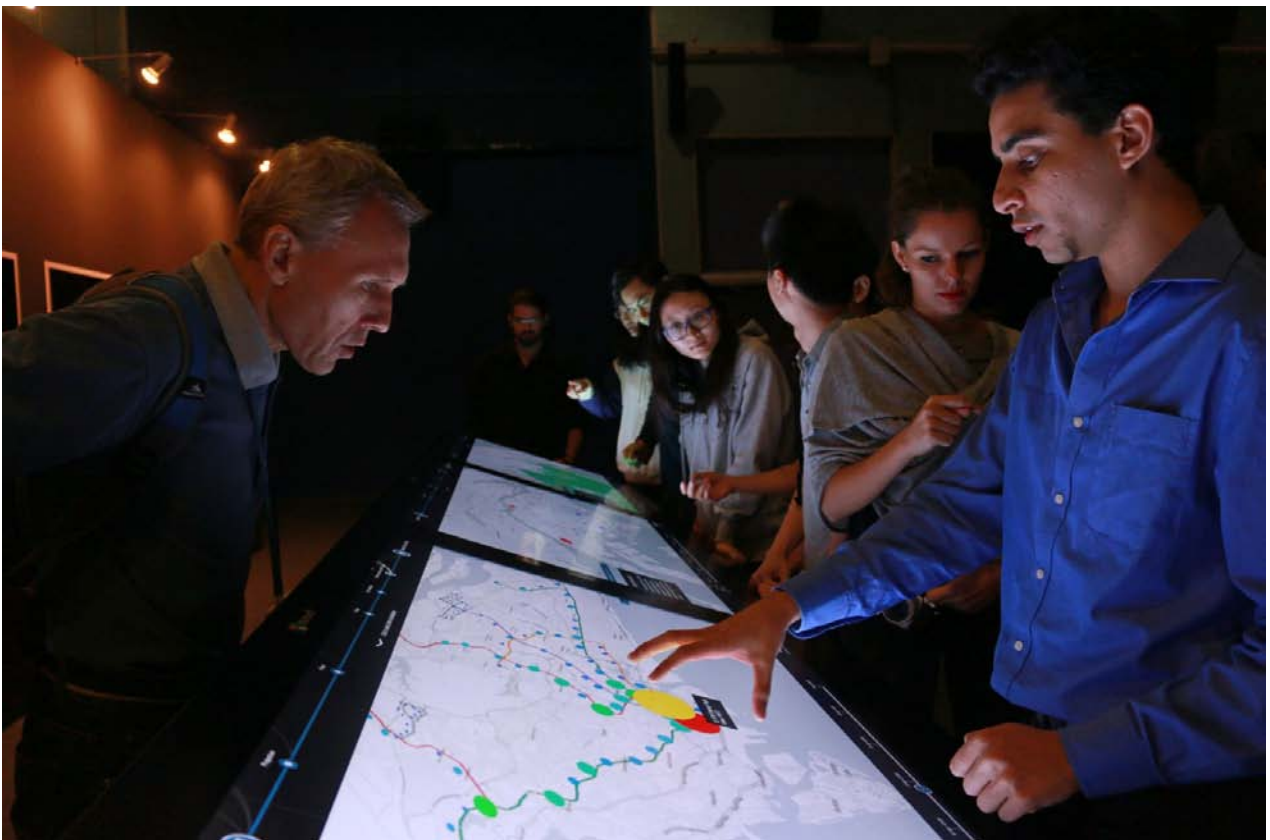
The Committee recommended that serious, long term Technical Capacity Enhancement is required within the government in two key areas:

- A. Planning:
  - a) Envisioning & Conceptualizing projects
  - b) Planning, Design & Operations
  - c) Contracting, Specifications & PPP
- B. Monitoring:
  - a) Procurement & Testing
  - b) Monitoring framework
  - c) Management Information System
  - d) Contract & Facility Management
  - e) Project Management
  - f) Operations Management

The Committee also recommends that high quality professionals need to be attracted into the government, and the trend of exporting our best qualified



**Figure 16: The Singapore Housing Development Board office – a smart facility for its govt. employees and the public alike. Courtesy: UTTIPEC**



**Figure 17: Exhibition at the Singapore Land Transport Authority. Courtesy: UTTIPEC**

professionals abroad on to private sector needs to be reversed. In order to re-attract the high quality technical manpower into the government, the 'typical government Office' first has to become a smart office with smart people, in order to make a beginning towards building smart cities. For this, we need to provide government employees with world class facilities, dignity of work with a sense of pride, a transparent working system, high salaries and a competitive work environment. Engagement of a few professionals from the market at market-driven rates/ salaries on contract of 3years/ 5 years could also be considered.





REPORT OF HIGH POWERED COMMITTEE ON: HOW TO DECONGEST DELHI

# SUMMARY OF STRATEGIES



## Summary

Given below is the summary of costs of various strategies. These costs are preliminary and based on experience. However, detailed technical studies shall be required to bring out actual figures.

Sr. No.	Strategy	Preliminary Cost (in crores)	Timeline
1	Parking Pricing and Management: Implementation of 5 pilot Parking Management Districts on PPP basis	10	1 year
2	Multi-Modal Integration at Metro Stations, part of DMRC retrofit	2,670	2 years
3	Bicycle sharing system	315	2 years
	NMV lanes	2,200	2 years
4	Road Retrofitting & Junction Improvements	800	2 years
5	Bus Service Improvements – purchase of new buses	2,000	2 years
6	BRTS – corridor development	1,860	2 years
7	Elevated Roads, Tunnels and Bypass	30,000	4 years
8	Intelligent Transport System	1,200	2 years
9	Capacity Building	40	2 years
<b>Total</b>		<b>41,095</b>	

### Costs represented graphically

