APPENDIX-1: Transit Oriented Development (TOD) Methodology for Initial Projects

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I. Goals of the TOD Methodology for Planning in Delhi.

a. Help achieve the MPD-2021 targeted 80-20 modal shift in favour of public transportation.
b. Make public transport the preferable mode of transportation by making it easily accessible, efficient, reliable and safe for maximum number of people.
c. Promote social equity through equal and safe access to public transportation for all.
d. Help achieve Clean-Air Quality Targets for Delhi.
e. Provide a variety and high-density mix of housing, employment and recreation options within walking/cycling distance of each other and of MRTS stations - in order to induce a lifestyle change towards healthier living and better quality of life.
f. Help reduce the severe housing deficit by providing affordable housing stock within accessible distance of public transport and amenities, through redensification.
g. Provide savings in public money through reduction of investments in physical infrastructure like additional roads, piping/cabling costs, as well as large savings in the time-cost currently lost in traffic congestion.
h. Utilize the induced private-sector investment near MRTS nodes to provide funding for public transport improvements as well as provision of social amenities.
i. Help save environmentally sensitive lands and virgin lands through high-density compact development.

II. Each TOD Project would be undertaken in two parts:

Part 1: Connectivity; Multimodal Integration; Public Transport Accessibility Level (PTAL)

i) Provide direct and safe connectivity of pedestrians and non-motorized transport to Stations and local destinations.
ii) Provide seamless interchanges between all modes of public transport and feeder transport
iii) Increase accessibility of Public Transportation through increase in supply, frequency and reliability.
iv) Document current Public Transport Accessibility Levels (PTAL) and facilitate the desired PTALs in the project area based on a Targeted 80-20 Modal Split by the Masterplan of Delhi 2021 - through appropriate transportation and urban planning, design & retrofitting strategies.
v) Ensure Safety and convenience for Pedestrians and Public Transport Users; Provide Transit Supportive uses e.g. hawkers, ATMs, convenience retail, amenities, etc. at required locations.
vi) Improve local connectivity and para-transport facility provisions through urban-retrofitting measures so that Short Journeys (constituting nearly 60% of the total number of trips) can be made by foot or non-motorized modes.

vii) Integrate with EcoMobility (Nallah) corridors.
viii) Create livable ‘places’ through introduction of round-the-clock activities, provision of public amenities and spatial improvements of underused and unsafe streets/spaces.
ix) Propose/summarize MPD-2021 revisions required to achieve the above goals

Transportation Demand Management (TDM); Inducing Modal Shift towards public transport.

Transportation Demand Management, or TDM, is a general term for strategies that increase overall mobility and efficiency of travel in the city by encouraging a shift towards high-occupancy vehicles (HOVs) and reducing motorized trips, especially during peak periods. This supports the National Urban Transport Policy’s focus on moving people and goods rather than private vehicles.

TDM seeks to reduce motorized trips by increasing travel mode options, providing incentives to people to modify their travel behavior and mode choices, and reducing the physical need to travel through transportation-efficient land uses. Time taken to commute by various modes, the Cost of the entire journey and the reliability/efficiency of the System are major factors in decision making for mode-selection.

The following strategies may need to be implemented:

x) Dedicated Road Space Allocation for BRT and NMV to increase efficiency, reliability and safety of these modes.
xii) Use Parking Management, Pricing and Enforcement as a Demand Management tool to induce modal shift and better utilize available road space.
xii) Launch programs to promote use of non-motorized modes and carpooling.
xiii) Landuse management, mixed-use and urban design policies to reduce/eliminate motorized local trips (shift to NMV and foot).

xiv) Prioritize housing and other mixed-use typologies that have zero/minimal parking requirements e.g. affordable housing, local convenient stores, etc.

xv) Suggest Employer based TDM strategies.

xvi) Propose/summarize MPD-2021 revisions required to achieve the above goals

Part 2: Travel Demand Management (Part-II) through Mixed-Use and Landuse Management – Transit-supportive uses, Non-permissible uses in TOD zones, Densification

The Aim of Part 3 of the TOD Project is to identify potential for accommodating a large part of the burgeoning population of the city along the influence zones of the MRTS corridors under study (as intended by the MPD-2021) in order to reduce further car-centric sprawl in outskirts of the city. It also aims at effective landuse Management such that need local motorized trips is reduced/eliminated and city-level peak hour directional trips may be balanced.

Densification will mandate a corresponding increase in PTAL, as well as decentralized Infrastructure and resource management systems in order to minimize pressures on existing services of the city.

Under this goal, the TOD Project aims to:

i) Analyze the potential and opportunities for absorption of more population through infill, redevelopment or redensification within influence zones of MRTS Stations as per the Masterplan target of FAR 400.

ii) Propose the Density projections and corresponding PTALs for the Influence Zones under study along with connectivity, placemaking and parking demand management strategies and required physical and social infrastructure augmentation - required to facilitate an integrated and unique TOD.

iii) Propose Housing and other mixed-use typologies that have zero/minimal parking requirements.

iv) Enlist the non-permissible uses that are unsuitable for each particular TOD Typology.

v) Proposed Development Criteria such that decentralized and sustainable infrastructure systems become part of the development.

vi) Develop a TOD-based Urban Development Code that promotes walkability, better connectivity, safety and overall sustainability in urban design.

III. Surveys and Base Data requirements:

(i) Detailed Spatial data in Shape-file format will be provided by DDA Courtesy DSSDI, Survey of India. *Data will be usable within DDA Vikas Minar premises only.*

(ii) Digital Copies of Approved Zonal Plans by DDA.

(iii) The following Sets of Transportation Data shall be provided by DDA to consultant team:

A: For Assessment of Public Transport Accessibility Level (PTAL)

- Primary data for DTC bus route network for Delhi plotted on road network centre lines (courtesy DSSDI/ DTC)
- Secondary data related to passengers travelling on the study corridor in other public transport modes including DMRC/ DTC/ STA (for private buses)
- Data on operational characteristics of bus routes operating in the Project Area such as no of buses, no of trips, frequency, bus stops/ terminals, start and end time of bus services etc. from DTC & for private buses from Transport Dept. GNCTD.
- Operational characteristics of existing MRTS services operating in the Project Area such as no of trains, no of trips, frequency, stations, start and end time of metro services, interchange points, usability, crowding at peak hours, reliability, variety of para-transport options, etc.
- Future public transport system planned for the Project Area by DMRC and Transport Dept. GNCTD.

B: Traffic & Transportation Surveys and Base Data

- Inventory of Road network in the Project Area to be provided Courtesy DSSDI, Survey of India. *Data will be usable within DDA Vikas Minar premises only.*
- Existing Street Typologies and Hierarchy (as per MPD-2021)
- Inventory and locations of transport infrastructure including bus stops/terminals/ para-transport terminals/stops/ MRTS stations with exits & elevator locations, etc. in the Project Area
- Speed and delay data at junctions and mid-blocks
- Pedestrian count survey for ‘along’ and ‘across’ movements
- 16-hr Traffic Volume Count at identified major intersections along with turning movements for all modes including segregated counts for pedestrians, cycles/cycle-rickshaws and autorickshaws.
- Origin destination Survey at the major bus stops/ terminals / metro stations in the project area.
- Boarding alighting passenger count at major bus stops/ terminals / metro stations in the project area.

**C: For Assessment of Parking Caps/Provisions**
- Assessment of current parking provisions for private vehicles (both authorized and unauthorized) including locations, number of spaces, accumulation, parking index, parking duration, parking turnover and usage pattern. This will help access the type of parking demand and patterns based on time and location/context.
- Assessment of on- or off-street parking locations currently used by all para-transport modes including cycle-rickshaws, auto-rickshaws, vans, metro-feeders, etc.
- Summary of Parking Guidelines and ECS requirements as per MPD-2021.

**D: Activity Studies for Streets and Public Spaces within Influence Zone**
- Graphic (on plan) and visual (photographic) inventory and location of all existing activities, informal and formal uses, hawkers, public amenities, obstructions & encroachments within R/W, utility structures, informal parking locations by mode, parking stands for cycles/cycle-rickshaws/auto-rickshaws/scooters/ cars within Road R/W or in public spaces.
- Site Photograph and Video documentation of the area at typical locations and problem areas (where barriers to movement, or impediments to public safety and comfort exist.)

**E: Socio-Economic Data from Mission Convergence, GNCTD**
- DDA will obtain and provide socio-economic data obtained for entire Delhi by the Mission Convergence Project of GNCTD.

**F: CUBE Transport Model developed for NCT by Transport Department, GNCTD.**
- DDA will obtain and provide the CUBE Transport Model for NCT developed by Transport Department, GNCTD.

**IV. Project Area Definition:**

The Project Area for a TOD Project is defined as the 1500 m catchment from the MRTS Stations under study. Within this catchment, the inner 500 m influence zone will be the intensive analysis zone.

*Figure 1: Study Area – 1500 m catchments from six MRTS Stations along selected corridor*
V. Project Methodology/ Scope Of Work:

**Step 1:** Primary Tasks.

City-Level & Site-level Integration/ Geo-referencing of all available Data:

A: All City level Traffic/Transportation as well as available socio-economic raw data to be integrated/geo-referenced into Spatial Database, including the following:
   i. Integration of all Zonal Plans of DDA into Spatial database.
   ii. Integration of NCT Transport model (CUBE) with Spatial Plan (in GIS).

B: Map the location, boundaries and ownership of lands earmarked for Redevelopment in MPD-2021.

C: For Project Site – Integrate All Survey and Traffic/Transportation raw data into Spatial Database.

**For Site Level TOD Influence Zone Proposal:**

**Step 2:** Define the Existing “Influence Zones” of each MRTS Station.

a) “Station Area” is the plot on which the Station stands. This is generally fully owned by the Transit Agency.

b) “MRT Walking Zone” in the zone which lies within actual 500m (6-minute) walking distance from MRTS Station.

c) “MRT NMT Zone” in the zone which lies within actual 1500m (6-minute) Cycling/Cycle-rickshaw distance from MRTS Station.

The above “MRTS influence zones” are to be plotted by calculating the actual movement distances along centre-lines of public roads, using the above criteria. The Centre of the Station Platform is to be used to calculate travel distance.

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**Note:** At the end of the complete TOD Planning/Design exercise, the final Plan may imply a revision to the extents of the 3 TOD Influence Zones (based on any changes made to the street network, building entries, etc.)
**Project Part 1:**

**Connectivity and Mode-based Travel Demand Management Strategies** – Multimodal Integration; Retrofitting; High Public Transport Accessibility Level (PTAL)

**Step 3: Context Plan**

Using the GIS data and Imagery available courtesy DSSDI, locate the corridor or project area in the larger city context – overlaying the following:

a) **Landuse Plans** of MPD-2021 and relevant Zonal Dev. Plans and Layout Plans

b) **Existing Street Hierarchy** and Typologies as per MPD-2021, ZDP and any approved Layout Plans.

c) **Local Street Network Plan** of the area locating and incorporating the approved or planned proposals in the project area.

d) **Transportation Systems and Infrastructure Map** (incl. Railway, Metro & BRT corridors and Stations, Other bus networks and stops)

e) **Environmental Features** e.g. Nallahs including hidden hydrology i.e underground systems, where available), forests, natural wetlands, waterways, natural greenways, etc.

f) **Identify the Agencies and key Stakeholders** that need to cooperate, provide information or work together for success of the project.

g) Any other information as required.

**Step 4: Opportunity & Problem Analysis**

– based on “UTTIPEC Format for Submission”

a) **Detailed “Station Area” and “Influence Zones” Base Map:**

- MRTS station exits and relative location of bus stops, cycle-rickshaw stands, auto-rickshaw stands, other para-transport – as existing or designated, with interchange points.
- Location of informal activities, hawkers and public amenities relative to Station Exits.
- Continuity of footpaths and documentation of all impediments for pedestrian and cycle/cycle-rickshaw movement in the influence zones and access to stations.
- Extent and type of Encroachments within R/W.
- Location of crosswalks and Signalized/ non-signalized Junctions.
- Local Street Network showing any impediments to pedestrian/ NMV movement and identification of movement “desire lines” and blockages.
- Nallahs and other environmental features which could be transformed into ecomobility corridors or nodal public spaces.

b) **Existing Use pattern and Edge Conditions along main Public Transport Corridors/ Network:**

- Existing landuses. (e.g. residential/ inactive commercial/ active commercial/ informal/ slums/ unauthorized colonies/ unauthorized parking, etc)
- Street Interfaces – boundary walls, active frontages (commercial/ mixed use), “entry points” of buildings and compounds, etc.
- Activity pattern within R/W including hawkers, idle parking, informal drop-offs, etc.

c) **Site Photo and Video documentation of the area at typical locations and problem areas** (where barriers to movement or impediments to public safety and comfort exist.)

d) **Land Ownership Patterns** esp. for Public lands

e) **Existing Vehicular Circulation Plan**

f) **Existing Pedestrian, Cycle/Cycle Rickshaw Network and Public Transport Stops/Nodes**

g) **Existing Services Layout Plan** showing both underground and over ground service locations. (Data to be provided courtesy DSSDI and validated by all concerned agencies)

h) **Existing Street Sections**

i) **Summary of Opportunities and Constraints** (1:1000 scale Drawings)
Step 5: Evaluation Criteria

– The criteria and design principles to be followed for the design and execution of the project are to be outlined during the course of this analysis and agreed upon by UTTIPEC, under various categories including:

I. Functional Requirements to meet the requirements of all user-groups.
II. Ease of Implementation and Phasing.
III. Economical (cost comparison)
IV. Environmental (safety, universal accessibility, impact on air-quality and natural environment, etc)
V. Aesthetics

Step 6: Proposals for Connectivity; Multimodal Integration; Retrofitting

– based on UTTIPEC Guidelines & Checklists

Analyze Base Information to Propose:

a) Proposed Pedestrian, Cycle/Cycle Rickshaw Network and Public Transport Stops/Nodes
b) Proposed Vehicular Circulation Plan
c) Proposed Street Sections for Road Hierarchy Matrix – as per Identified Needs and Equitable Distribution of Road Space (UTTIPEC Street Design Guidelines)
d) Dedicated Road Space Allocation for BRT, HOV and non-motorized modes on major corridors in order to increase efficiency, reliability and safety of these modes. Deliverables:
   i. Provide detailed alignment plan (not construction drawing)
   ii. Street Sections at each typical condition
   iii. Detailed design of each Junction
   iv. Signalization plan
   v. Services layout plan
   vi. Feasibility report of properties/structures/encroachments affected, etc.
   vii. Identify implementing road & land owning agencies
e) Detailed “Station Area” and “Influence Zones” Proposal including Alignment Plans for main Public Transport Corridors/Network (– as per UTTIPEC MRTS Connectivity Standards & Street Design Guidelines):
   • Distribution of road space as per needs of all road users, responding to adjacent landuses, transportation needs, and other supportive activities.
   • Physical design of disabled-friendly station access area for bus including shaded areas for hawkers, ATMs, Convenience retail, Amenities, etc. and comfortable egress from Metro or BRT to other interchange modes.
   • Moved or relocated bus stops for easy and fast interchange with Station Exits;
   • New designated parking locations for cycle and cycle-rickshaw stands, auto-rickshaw stands, other para-transport and amenities – within required distance from stations.
   • New Pedestrian and NMV Circulation plan integrating with locations of para-transport stands, important destinations, etc.
   • New proposed Crossings and fully signalized crossings enabling at-grade safe movement for pedestrians & NMVs.
   • New safe short cuts for pedestrians and cyclists - in case of large blocks, parking lots, encroachments or other urban impediments.
   • Plan showing R/W to be reclaimed (from encroachments), or, widened/retrofitted to provide better footpaths and cycle paths, or, any new R/Ws to be added.
   • Potential of connecting to Nallah as an NMV corridor and development of Natural features as civic destinations. (i.e. Integrate with UTTIPEC Eco-Mobility Plan)
f) Proposed New Edge Conditions to Ensure Safety and “Eyes on the Street”:
   • Street Interfaces – Show locations where boundary walls and setbacks may need to be removed to provide better walkability or accessibility, and most importantly – Safety for pedestrians.
   • Identify any areas where private land may need to be annexed or illegal settlements pruned to provide better public accessibility to Stations.
g) Photomontages showing Transformation of Areas where barriers to movement or impediments to public safety and comfort existed earlier.

h) Land Ownership pattern Impacts – Areas where various land owners (other than road owning agencies) need to be consulted.

i) Proposed Services Layout Plan with Sections showing both underground and over ground service locations. (Data to be provided courtesy DSSDI and validated by all concerned agencies)

j) Other drawings as required.

Step 7: Calculating Public Transport Accessibility Levels (PTALs)

Public Transport Accessibility Levels (PTALs) are a detailed and accurate measure of the accessibility of a point to the public transport network, taking into account walk access time and service availability/frequency/reliability and accessibility. The method is essentially a way of measuring the density of the public transport network at any location within the city.

The current methodology is primarily developed in 1992 and used in London. The model has been thoroughly reviewed and tested, and has been agreed by the London Borough-led PTAL development group as the most appropriate for use across London.

For London’s PTAL, walk times are calculated from specified point(s) of interest to all public transport access points: bus stops, rail stations, light rail stations, underground stations and Tramlink halts, within pre-defined catchments. The PTAL then incorporates a measure of service frequency by calculating an average waiting time based on the frequency of services at each public transport access point. A reliability factor is added and the total access time is calculated. A measure known as an Equivalent Doorstep Frequency (EDF) is then produced for each point. These are summed for all routes within the catchment and the PTALs for the different modes (bus, rail, etc) are then added to give a single value. The PTAL is categorized in 6 levels, 1 to 6 where 6 represents a high level of accessibility and 1 a low level of accessibility. Levels 1 and 6 have been further sub-divided into 2 sub-levels to provide greater clarity.

The PTAL measure therefore reflects:

- Walking time from the point-of interest to the public transport access points;
- The reliability of the service modes available;
- The number of services available within the catchment; and
- The level of service at the public transport access points - i.e. average waiting time.

It does not currently consider:

- The speed or utility of accessible services;
- Crowding, including the ability to board services; or,
- Ease of interchange.

PTAL is used as a development planning tool to determine both permitted parking standards and development densities in London. Large site developments must follow planning guidelines that allow more parking in areas with low PTALs and lesser parking in areas with high PTALs. They also relate the allowed density of development to PTAL (i.e., areas with better public transport may have higher density housing or offices).

Transport for London (TfL) also have software to calculate PTALs across wide areas using GIS and timetable data, the typical result being a map with coloured bands relating to PTAL grades. See Fig. 3 & 4.

The Detailed PTAL Methodology being currently used by Transport for London (TfL) is placed at Appendix-2. The same may be followed for the initial PTAL mapping for the Study Area in Delhi.

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Figure 3: PTAL Map for Greater London (http://www.london.gov.uk/thelondonplan/maps-diagrams/map-2a-03.jsp)

Figure 4: PTAL Map for Borough of Newham, London – Note that not all areas with Train/Tube Stations have high Public Transport Accessibility Levels i.e. >6. (Source: http://www.londonprofiler.org)
The reasons for selection of PTAL Methodology for Delhi are:

- An accurate measurement of the accessibility level is required for formulating other related TOD-strategies for Delhi such as Parking Policy and Densification.

- The current London PTAL Methodology focuses on walking accessibility as a criterion. This is appropriate for Delhi as well, since data has shown that 78% Walk to access MRTS in Delhi (RITES Household Survey 2008). In addition, several News articles have recently pointed out that inspite of this fact, the quality and ease of walking access to MRTS in Delhi is very poor.

- Many softwares are available which make similar calculations as PTAL to estimate accessibility of an area, e.g. Accession (http://basemap.co.uk/products/accession.aspx), EMME/2 (http://www.inro.ca/en/products/emme/index.php), etc. However these are expensive, require a lot of training to use and are very data hungry. In comparison, PTAL is a simple calculation (easily performed by a spreadsheet) and can be easily mapped on a GIS database.

- The Goal of using the PTAL Methodology is to create simple easy-to-use plug-ins for all departments of Delhi by which even a non-technical person can understand and evaluate public transport accessibility within the study area. A similar process is already being followed in London where all Boroughs just use the PTAL tool off the TFL website as a simple GIS application. Such an application needs to be created for Delhi and is part of the current scope of work.

Major Tasks for calculating PTALs within Study Area:

1) Calculate PTALs within the Study Area as per the currently accepted London PTAL Methodology (Appendix-2).
2) Plot the PTAL values from 1-to-6 on the GIS database of the Study Area.
3) As per desirable 80-20 Modal split, propose the augmentation required in public transport supply and frequency as well as connectivity enhancements required to reach the desirable levels of 4-6 PTAL score for the entire study area, based on distance from major nodes.
4) For PTAL scores below 5, the reasons for low-score (other than distance from Station nodes) must be highlighted and recommended to the UTTIPEC team.
5) Create the customized GIS plug-in for Delhi that may be used by any external agency or layman, to check/measure public transport accessibility in their area.
6) Propose additions or modifications that may be required to the PTAL Methodology for further customizing the tool to the unique needs of Delhi.
7) Develop a web-interfaced GIS-based application by which point-to-point multi-modal public transport route-mapping, and travel time and cost calculations can be made.

![Plan a Trip](http://tripplanner.transit.511.org/)

**Figure 5: Screenshot of Website: http://tripplanner.transit.511.org/**

**Note:** After initial application of PTAL Methodology, customization of PTAL would be required to include the following variables into the PTAL calculations:

- The speed or efficiency of accessible services;
- Crowding, including the ability to board services;
- Ease of interchange;
- Increase in accessibility due to availability of cycle rickshaws in certain areas (already 12% of Metro users use cycle-rickshaws to access the Station).

However, this is not included in the current Scope of Work for initial TOD projects.
Step 8: Parking Management Policies for Travel Demand Management

Parking Management strategies are aimed at encouraging more efficient use of existing parking facilities, reduce parking demand and shift travel to HOV modes. Smart management of parking helps to ensure access to local businesses, and provides access for visitors to regional and neighbourhood attractions without encroachment on valuable public spaces.

**Enforcement is the key to the success of any Parking Strategy.**

**TIER-I: Design-based Parking Management Strategies:**

1. **Enforcement Aids** – As per proposals for HOV, para-transport and non-motorized parking made in Step 6 & 7, Traffic Police and MCD are to be consulted on the design features required to ensure good enforcement. Parking space markings and signages to be accordingly shown as part of the “Parking Management Plan.

2. **Reclaim street space from car parking** for other needed public uses such as cycling lanes, cycle-rickshaw stands, para-transport/TSR stands, widened sidewalks, hawker zones or multi-utility zones (as done in Step 6). Provide designated idle-parking locations for shoppers in commercial areas, wherever essential, but priced so as to ensure 85% occupancy during peak hours and exponential increase in price with time. Shopkeeper parking may be consolidated in park-and-walk locations within walking or cycle-rickshaw distance from destinations, as per point iv.

3. **“Park Once-and-Walk” / “Park Once” / Shared Parking locations** – As per market demands, common shared parking facilities may be constructed in dense, mixed landuse areas. Feeder modes like vans, circulators or NMV services can be provided from these facilities to all nearby destinations. Street improvements must be implemented to make it convenient for commuters/shoppers to Park-and-Walk to their destinations.

   **Tasks:**
   
   - Estimation of common parking requirements and proposed centralized locations to be proposed. There should be a shared parking lot within 10 minute walk of homes/shops/other uses.
   - On-street parking regulations to be strictly enforced in these areas as per 8i.
   - A Shared Park-and-Walk Parking Plan for the entire TOD Project Area is to be submitted including the following drawings:
     
     A: Data and Drawings showing basis for Shared Parking calculations.
     B: Site plan of parking spaces intended for shared parking and their proximity to land uses that they will serve.
     C: A signage plan that directs drivers to the most convenient parking areas for each particular use or group of uses.
     D: A pedestrian circulation plan that shows connections and walkways between parking areas and land uses. These paths should be as direct and short as possible.
     E: A safety and security plan that addresses lighting and maintenance of the parking areas.

4. **Curb Spillover Parking Impact in Residential areas** – Spillover parking must be prevented (through pricing and enforcement) as it may cause excessive congestion within neighbourhood streets making access difficult for emergency vehicles.

   **Tasks:**
   
   - To avoid spillover parking into residential streets (from market-priced spaces), potentially affected zones must be identified and demarcated on spatial plan, and market-rate parking pricing is to be applied to this entire zone, not just a few streets.

5. **Unbundling Parking Costs** from New properties and provision of consolidated parking locations – Requires that parking spaces be leased or sold separately (“unbundled”) from the rent or sale price gives a financial incentive to individuals to drive less or own fewer cars, or encourages companies to increase transit commute rates among their employees.
Including the price of parking in an overall lease may normally increase costs of housing/commercial properties by as much as 25% – whether or not the tenant has a car – therefore it is often an “invisible” cost to the customer.

Common paid parking facilities may be provided for visitors, overflow parking, irregular users, etc. in neighbourhoods as per point (iii).

vi. Park-and-Ride Facilities ONLY at terminal MRTS Stations or major Multimodal Interchanges – Park and Ride areas can be provided only at terminal MRTS/RRTS/BRTS Stations, so as to reduce the number of commuters driving into central congested areas along high-demand corridors.

Tasks:
- For the TOD site under study, calculations and design options to be made to demonstrate the density, type and mix of uses required to offset use of the same land for a park-and-ride facility.
- Comparisons to be made between mixed-use housing development vs. parking lot or garage in terms of cost, investment recovery and ridership generated throughout the day and week.

TIER-II: Pricing-based Parking Management Strategies:

vii. True Pricing of Parking - The supply of free or inexpensive parking at the final destination is a key decision factor for people choosing to drive a personal vehicle, rather than taking a bus, cycle-rickshaw, walk or carpool.

All public parking locations must be priced by directly linking parking rates to temporal demands, and providing financial incentives and prime parking spaces only to preferred markets such as carpools, vanpools and short-term parkers.

Surface parking rates must reflect the opportunity cost of the land.

The full cost of providing structured parking in public places including the land-opportunity cost, capital cost, and O&M costs – should be recovered from the user of the parking. Government should not subsidize this cost.

Free or very low cost on-street parking benefits only a few commuters and is extremely inefficient. Employees and shopkeepers who arrive first in the morning occupy the most convenient spaces, forcing customers arriving later to waste time and money looking for an available space farther away. Flexible parking meters, which set fees at levels that ensure an 85 percent occupancy rate throughout the day, optimize the use of scarce parking resources. Pricing should be done in a way so as to make it more financially feasible to parkers to use off-street facilities but making on-street parking exponentially expensive with time. This will encourage short-term parkers to use the on-street locations, thus enabling faster turnover of the limited number of available parking spaces.

Minimum prices should be fixed by Govt. but maximum left to the Market to decide. Under no circumstances should the price of parking me subsidized by the Government.

viii. Variable Market-rate Pricing – Differentiation in parking fees can be done according to zone, peak hour demand, weekdays and weekends, etc. by charging higher rates during peak hour, progressive increase in rates per hour. Market based instruments can be used to reduce the impact of high parking rates like mall and shop owners paying for parking and transferring the benefit to their customers etc.

ix. Coordinated Off-Street and On-Street Pricing (customized to commercial and residential areas) – As seen in almost all locations in Delhi where Parking garages exist, the low pricing of on-street parking facilities leads to overcrowding at the curbside and underutilization of off-street parking.

Therefore, in locations where off-street parking facilities exist, on-street parking should either be priced exponentially high with time, or prohibited altogether for ease of enforcement.

Tasks:
- Calculate “true cost” of Surface Parking and Off-street parking for the Study Area based on available market data and standard costs of structured parking construction and O&M (both permanent and hydraulic parking structures to be considered).

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2 Recommendations of the Environment Pollution Control Authority (EPCA) to the Hon’ble Supreme Court, July 2006
• Adopting market rate parking could entail charging for on-street parking on days and times that it are currently free. Minimum parking rates during such off-peak hours are to be proposed for the Study area.
• Price for on-street parking must ensure performance standards, including the desirable occupancy rate of 85%.
• Local market rates may need to be estimated in order to set a “minimum parking fee” during off-peak hours. **Maximum may be left to local parking operators/managers. On-street parking-price cap will not be applicable to the TOD Study Area.**
• On-street and off-street parking areas are to be designated through design and signage.
• Implementation of this strategy is most critical and it must be enforceable. Strategies for implementation are to be proposed in close consultation with MCD and Traffic Police.
• All current policy or implementation hurdles for this Strategy must be identified and taken up immediately for modification.
• In areas where an off-street parking lot or garage is available within 500 m (6 min walking distance), on-street parking would be prohibited or exponentially priced, as per discussion with Traffic Police.

**TIER-III: PTAL-based Parking Management Strategies:**

x. Provide parking caps in TOD Zones based on PTAL/ distance from MRTS Stations.
xi. Substantially replace ECS with cycle, para-transport and HOV parking in high PTAL zones
xii. Cycle and HOV Parking to be mandated as part of ECS requirements.
xxiii. Enlist non-permissible uses within the three TOD zones (to be finalized as part of Step 11 (3) as part of the TOD Urban Development Code)
xxiv. All TIER-I and TIER-II Strategies continue to apply in TOD Zones
xxv. Incentivize Employer Based TDM Strategies

The TIER-III Strategies are to be developed further in coming months, based on PTAL values developed for the Study Area in Step 7.

**Project Part 2:**

**Landuse Based Travel Demand Management Strategies** – Mixed-Use, Transit-supportive uses, Non-permissible uses in TOD zones, Densification

**Step 9: Land and Demographic Opportunity Analysis**

(A) – Supplementary Mapping:

a) **Landuse Map** – On base map in GIS, superimpose up-to-date MP/ZDP landuse proposals as well as approved Layout Plans for vacant/ redevelopment sites. (already done in Step 1)

b) **Map any other approved land use commitments.**

c) **Heritage Features** – Map heritage buildings, sites and landscapes to be protected (as per regulation lines) and those to be conserved as per list of INTACH and/or MCD.

d) **Map Special Area boundaries as per MP/ZDP.**

e) **Map Lal Dora boundaries of urbanized villages.**

f) **Map approved BPL sites/ notified Slums** earmarked for in-situ upgrading/ reconstruction.

g) **Map showing areas under Unauthorized Colonies** – differentially code colonies already regularized.

h) **Map showing various types of under-utilized or illegally occupied lands within study area fit for tentative infill, in-situ upgradation or redevelopment projects:**
   - Empty lands with ownership pattern.
   - Under-utilized lands (with low density developments, especially if under government or civic ownership.)
   - Others
(B) – Socio-Economic Profile:

(a) Geo-reference Demographic Data – both, the existing population as per available socio-economic survey data, and projected population as per MPD must be documented:

i) Planned population of the Ward, as per MPD/ZDP.

ii) Actual population of the local area: As well known, actual population on ground in all wards is much higher and demographically variant from what is represented in official MPD/ Zonal Plans. Therefore actual types of resident population must be mapped by utilizing data already available from the following sources:
   - Mission Convergence project data from DSSDI
   - Household data collected by RITES/ Transport Department, GNCTD in 2008.

iii) What is the number of people living in slums (data available from DSSDI)

iv) What is the projected population increase (%) for the Ward (data available with DDA/ UTTIPEC as per MPD-2021)

v) Age group profiling of the area, if/as available from Census.

vi) Approximate Income profiling to be deduced from Mission Convergence Data from DSSDI.

(b) Economic Data: Combine/ geo-reference the following:

vii) Superimposed Revenue Maps available with DSSDI

viii) Sales Tax, Property tax, other tax revenues generated within LAP Area. (if available)

ix) Major tax paying uses/precincts in the area (if data available from MCD)

x) Changing real estate value/ trend within the LAP area (e.g. impact of Metro, etc. – if data available from MCD)

The data collected in Step 8(B) is to be discussed and agreed by the UTTIPEC Core Team and used for the analysis in subsequent stages.

Step 10: Deficiency & Need Identification for Urban Design Inputs.

1) Social and Physical Infrastructure Needs

(a) Assessment of availability and deficiencies in Social and Physical Infrastructure based on actual Local Area Population accessed in previous Step.

(b) Age and Economic Profiling – based on data documented in previous Step, enlist and locate potential sites for new social infrastructure that must be provided based on local age-group and socio-economic needs. This would ensure accessibility to all essential services to the local population.

(c) Missing landuses – required to provide a desirable mixed use mixed income neighbourhood. This would be critical in decreasing overall motorized Travel Demand in the Area.

2) SWOT Analysis – including Social, cultural, heritage and Economic Potential of area.

3) Clearly map the following on digital database and provide summaries for:

(a) Current Densities on study site as well as neighbouring areas within 1500 m catchment of MRTS Stations.

(b) Locations, areas and densities of slums, un-authorized colonies as well as vacant/ underutilized lands available within the Study.

(c) Lands within 1500M buffer of MRTS – that are either under-utilized or earmarked for redensification or redevelopment as per MPD-2021 or approved Zonal plans (e.g. low-density Govt. housing and office developments, etc.)

(d) Land/ Property ownership.

(e) Existing infrastructure and utilities (underground/ over ground) and their capacity deficits, if any.

(f) Current access to employment opportunities, convenience retail within walking distance from homes.

(g) Current access to education, health care and social infrastructure, and corresponding deficiencies as per MPD-2021 norms and deficits, if any.

(h) Existing environmental constraints and Topography – and corresponding ‘Suitability Analysis’ of available sites.
Step 11: **Design Proposals for Placemaking, Mixed Landuse and Urban Design based TDM strategies:** (by Multi-disciplinary team of UTTIPEC enlisted Experts)

(1) **Document Area Typologies and Propose Site Typologies:**
- Local Urban Typology analysis based on Table shown in Fig.5.
- Propose desired mix of uses for infill sites, based on Need/Deficiency Analysis in Step 9.
- List locally non-permissible uses (in addition to the defined Universally Non-permissible Uses).

<table>
<thead>
<tr>
<th>MPD LU Mix</th>
<th>Max. Height</th>
<th>Street Character</th>
<th>Max. FAR</th>
<th>Gross Density</th>
<th>Function</th>
<th>TOD Typology</th>
<th>Local Need/ Opp.</th>
<th>NON-PERMISSIBLE USES</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPD Actual</td>
<td>MPD Actual</td>
<td>MPD Actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

*Figure 8: Urban Typologies Analysis*

(2) **Conceptual Proposals:**
- i) **Conceptual Spatial Layout/ Proposal** with proposed street network, vertical mix of uses, mixing of income groups, approx. FAR, variation of building heights and densities, etc.
  - On Govt Lands – minimum of 55% affordable housing units may need to be provided to meet overall MPD Housing goals
  - On Private land – various cross-subsidy models may be explored to provide requisite amount of affordable housing and/or need-based landuses on sites, as per the analysis in Phase 1.
  - ii) **Test for Financial Feasibility Analysis along with land/ stakeholders** (e.g. DDA, DMRC, Railways, DTC or Private Developers)
  - iii) **Conceptual cross-subsidy models** for ensuring provision of local/ contextual needs for civic and affordable housing uses.

(3) **Urban Development Code:** Development Norms will be different for MPD landuses provided within MRTS influence zones. The Codes and Building Bylaws may need to be restructured into three distinct sections under "Procedure Byelaws", "Performance Byelaws" and "Planning Byelaws", which need to include the following aspects:

  - (i) **Maximum Block-size regulations** to be defined within TOD zones to ensure walkability, safety and connectivity.
  - (ii) **Block-level Mixed use Typologies** to be suggested
  - (iii) **Boundary walls prohibited.**
  - (iv) **Minimum Setback requirements** to be abolished and replaced by:
    - a. Daylight access regulations
    - b. Parking access regulations
    - c. Fire-access regulations.
  - (v) **Minimum Ground Coverage and minimum Frontage** requirements to be set
  - (vi) **Open Space Design Criteria and suggested Typologies:**
    - a. Usable Open space design through sizing and enclosure
    - b. Ecological design for natural stromwater management.
    - c. Working landscapes as per (vii)
  - (vii) **Site Level Environmental Design Criteria:**
    - a. Decentralized infrastructure to be made mandatory and incorporated in the design proposal from conceptual stage - to ensure long term sustainability and resource efficiency.
b. **Energy Conservation** techniques like Orientation, Natural Ventilation, shading, daylighting and other low-cost techniques to be mandatory. Appropriate Codes to be selected for adoption.

(viii) **Redevelopment Criteria and minimum project size** criteria to be redefined. (for example, 4 Ha may not need to be the minimum redevelopment proposal size, in order to encourage more cooperative based small scale redevelopment and redensification)

(ix) **Enlist Non-Permissible Landuses within the three MRTS Influence Zones**

(x) **Summary of MPD-2021 revisions or additions required to achieve Transit Oriented Development in Delhi as per above principles and analysis.**

(4) **Detail Design Proposal** (as per Urban Design Code above) to include the following in graphic form:

i) **People Movement and Connectivity strategy** with proposed road space allocation and parking facilities for different modes including cyclists, rickshaws, NMVs/ pedestrians, etc. proposed including proposed improvements for better/shorter/safer connections to MRTS hubs and local shopping areas, highlighting deficiencies in public transport provisions.

ii) **Social Infrastructure Provisions and Mixed-Use Strategy** - provision of schools, parks, sports facilities, dispensaries, community centres, cultural centres, public amenities, night shelters, etc. as per local requirement; including proposals for upgradation of existing facilities and provision of new deficient facilities. Accessibility, safety and usability of all facilities must be highlighted. Appropriate uses must be proposed for dysfunctional buildings/ premises. Multi-use open spaces and buildings to be considered as part of proposed design strategy. Proposal must include identification of desirable/undesirable landuses, desirable mix of housing types and rental/tenure strategy for proposed uses.

iii) **Socio-Economic Strategy** including provision of livelihood generating areas for informal sector - vending zones, weekly markets, etc. Areas for night shelters and cottage industries must be provided as needed. Ward level deficit of affordable housing supply to be highlighted and required lands earmarked. Financial feasibility of projects to be enabled through flexibility in Design Codes, while mandating the inclusion of affordable housing in all public and private projects in the TOD Zones.

iv) **Physical Infrastructure Plan/Strategy**, particularly for solid and waste management, including consideration of decentralized systems and their spatial requirements.

v) **Landscape and Open Space Plan/Strategy** including active open spaces, sports facilities, multiuse spaces, working landscapes, etc. as well as their safety/ usability.

vi) **Urban Drainage Plan/Strategy** including proposed sustainable urban drainage systems, preservation and creation of wetlands and utilization/revitalization/ preservation of Nallah corridors, forests, greenbelts, etc.

vii) **Heritage Preservation** and protection lines and adaptive reuse strategies, as applicable.

viii) **Density and Built Form Strategy** - Three-dimensional studies and urban design typologies to convey desired character and mix of uses within areas to be redeveloped or densified. Non-permissible uses within each redevelopment/ redensification area is to be highlighted. Issues such as setbacks, boundary walls, building heights and vertical mixing of uses are to be incorporated as per the TOD-based Development Controls and Codes.

Final plans are to be publicized and provided to inform the ZDP and LAP process.

**Step 12: Phased Plan for Implementation and handover to implementing agencies.**

Phasing Plan is to be proposed. UTTIPEC to monitor and guide as necessary for initial TOD projects.