Integrated Land use Transportation Plan

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# Outline of the Module

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<td>The concept of land use transport integration is based on the nature of interaction between spatial and transport development. While allocation of land uses impact demand for travel as people need to access different activities, transport infrastructure adds to the attractiveness of a location by improving accessibility and leads to change in land values. With improved accessibility, the locations become attractive for investments and it results in further development of these locations.</td>
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<td>INTENDED AUDIENCE(S)</td>
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<td>- To provide an understanding of the concept of integration with regards to land use and transport.</td>
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<td>- To provide a step by step tool for facilitating adoption of integrated land use transport decisions by the cities.</td>
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# MODULE OVERVIEW

**STRUCTURE/ CONTENTS**

**MODULE DELIVERY OUTLINE**

**MODULE ACTIVITIES** (METHODS OF TEACHING)

**SUPPORTING MATERIALS**

**MODULE FEEDBACK**

**MODULE DEVELOPER** SRPMC.
Contents of the Enclosed Compact Disc (CD)

1. Soft Copy of the Module in PDF Format
2. Power Point presentation of the Module
3. Reference Material for all Sub Modules
   i. Land use Planning
   ii. Traffic and Transportation Planning
   iii. Transit Oriented Development
4. Other Related Documents
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1 Introduction

What is land use transport integration? The concept of land use transport integration is based on the nature of interaction between spatial and transport development. While allocation of land uses impact demand for travel as people need to access different activities, transport infrastructure adds to the attractiveness of a location by improving accessibility and leads to change in land values. With improved accessibility, the locations become attractive for investments and it results in further development of these locations.

What are the benefits of land use transport integration? When land use transport integration is effectively implemented, the following benefits can be expected: □ Sustainable use of urban land (low intensity uses in ecologically and culturally important locations; high intensity of use in locations that can support it) □ Reduced vehicle emissions and higher quality of living environment □ Less time spent in travel and therefore higher productivity as well as quality of life □ Greater access to public transport and thus to jobs; additional health and quality of life benefits by enabling and encouraging more walking and cycling.

How integrated are the land use and transport decisions that the cities take? The Indian cities undertake preparation of both spatial as well as transport plans. While, the preparation of spatial plans which are more commonly known as ‘Development Plans/ Master Plans’ statutory in nature, transport plan preparation is undertaken by cities when they perceive their need. Therefore, while spatial plans are prepared every ten years, transport plan preparation is ad-hoc and not regular. The spatial plans are statutory plans prepared by the Urban Development Authority for the city area and developable area in the plan horizon (15-25 years). They consist of two parts: A. Land use plan, and B. Development control regulations to implement the land use plan

What are the key elements of integration? The integration of land use with transportation systems has to happen at all scale/levels of planning and through multiple intervention mechanisms. The most important elements of land use transport integration are listed below: 1. Enabling Urban Structure 2. Complete network and complete streets 3. Public Transit and its Strategic Alignment 4. Transit oriented development and value capture (i). Along routes (ii). Around Transit interchanges) 5. Accessibility improvements in terms of local area plans (last mile connectivity) 6. Re-development & Re-vitalization & Transit (i). Inner city (ii). Derelict areas (iii). Slums) 7. Integrated Multimodal Transit Interchanges Apart from the above mentioned elements Inter jurisdictional coordination is also important overarching aspect.
Public transit is a practical means to access employment, education and public services, therefore the land use can be enhanced such that its restructuring to an extent brings about changes in the sprawl of population and the mobility needs of the people are served. In the process there is also scope for rationalizing the land use and improving living environment. Community benefits could be optimized in terms of improvement of landscaping, infrastructure and environment.

1.1 Confluence of Land use & Transport

1.2 Settlement pattern and Size

It refers to the number of houses within a contagious built-up area. It is important to note that cities need to keep a small settlement size in order to reduce the trip lengths. Hence infill areas and regeneration areas need to be identified and used for future growth before identifying new growth areas.

1.3 Distribution of population density

Cities will need to adopt density as a tool to keep the settlement size small. Density is viewed in the form of gross densities and the current density should be used as a reference point to plan for future densities. In order to achieve a compact city form a high density scenario is desirable. However the cities should also understand that one cannot just increase the density considerable since most of the city will already be built up and the scope for increasing the density is hence limited to regeneration and vacant land development. The following density ranges can be used as a guideline to understand the concept of high and low

What are the infrastructure challenges in densification? The decision to densify existing urban area has the following challenges:

a. Adequacy of Infrastructure such as Water and Sewerage.

b. Condition of the existing infrastructure.

Generally the decision to densify by allowing higher FAR is along wider roads with the facility of public transport. Most case studies also indicate that the larger trunk lines are laid along this route due to wider road widths available unless specific dedicated utility corridors are provided which are not generally provided
2 Integrated Land Use & Transport Strategy

Integrated Multimodal Transit Interchange Facilities A single mode of transport cannot cater to the transport needs of a city. For an efficient transportation system, various modes need to be introduced and developed in an integrated fashion. These modes need to be further integrated to enable easy transfer of passengers from one mode to another with minimum time loss. Integration of transit facilities is a must for the success of public transport systems in the city.

- Efficiency allow for efficient movement of people and the public transport services they use, through the interchange facility, as well as being simple to manage and maintain.

- Accessibility for all potential users and an environment which is safe, secure and comfortable. Not only are accidents and crime removed, but also the fear of these unpleasant experiences is also removed, thereby increasing the usability of the interchange zone.

- Understanding of an interchange zone covers more than information. Adopting principles of legible design and interchange zone management from the outset will result in places that are easy to use, require minimal signage and are well integrated with their surroundings.

- Providing a high quality interchange facility and interchange zone environment will improve all aspects of a users’ experience. A high quality interchange facility and zone design will influence how it is perceived by its users, operators and providers; whether it has characteristics which give it a significant identity; whether its quality of design, configuration and facilities make it feel safe, give it a sense of place or make it a destination in its own right creating social, economic and environmental value and instilling a sense of civic pride in those who use it.

Physical integration – This includes integration in terms of network (MRT/BRT/suburban rail/public transport) hence the networks are planned in such a way that it is convenient to change from one mode to another. The hierarchy of modes and the 35 location of these interchange points will determine the size of the interchange. One of the key objectives is the integration of public transport interchanges with activity centers in the city. Integration also allows decisions about local land use to lend support and gain benefit from increased accessibility provided by improvements to public transport. The location of interchanges / hubs / nodes on the network is an important consideration from a network efficiency and effectiveness perspective.

Fare integration- Fare integration will ensure that people get onto public transport as this will ensure that the cost of transportation reasonable. Fare integration can further be of the following types □ Transit Route Integration- Single mode □ Transit modes integration- multimodal □
Integrated Land use Transportation Plan

**Transit modes + Intermediate Public Transport System + Parking**

*Information Integration* - Integration can also be achieved if information is easily and freely available to all users. The emphasis needs to be on journey planning where a person is able to make an informed decision on the mode and route one takes.

Integrating land use and transport will encourage development that:

1. Increases access to public transport, walking and cycling
2. Encourages people to travel shorter distances and make fewer trips
3. Reduces car dependency.
4. Managing travel demand - minimise the need to travel and the length of trips, particularly by cars - direct travel to the most sustainable mode of transport
5. Mixed use centres- centres containing a variety of services and activities such as businesses, shops, community services and entertainment facilities
6. Multi-purpose trips- Trips taken for more than one purpose, for example, shopping is done on the way home from work
7. Trip-generating development- Businesses and services that are frequently accessed by many people and create a demand for travel.
8. Mix of land uses- Promoting the concept of Mix land use.
9. Transport network, both public and private

**TOD Principles – Five Ds**

1. **Density** Increased density tends to reduce per capita automobile travel and increase public transport ridership
2. **Diversity**
   
The more diverse the land uses, lesser the need to travel outside the area. Think of a well connected area with jobs, housing & shopping avenues within a small radius.
3. **Design Elements**
   
   These include elements such as footpaths & safe roadway crossings for pedestrians, safe & efficient bicycle paths, and a closely spaced grid-like roadway network
4. **Destinations**
This variable represents the attractiveness or vibrancy of an area. Availability of jobs or shopping areas for instance would influence this variable.

5. Distance to Transit Service

The closer a transit stop, higher the probability of a transit trip in lieu of a trip by personal automobile

2.1 Data Collection and Analysis of the Existing Urban Transport and Environment

2.1.1 Review of the City Profile

To study the city’s present socio-economic profile and trends over a period of time, the consultant should collect data from secondary sources on land area, administrative boundaries, regional linkages, demography and socio-economic characteristics.

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<th>Description</th>
<th>Source for Primary Data</th>
<th>Data level</th>
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<td>Location</td>
<td>Geographical location</td>
<td>Master plans of the city and region if available/CDP</td>
<td>City wide</td>
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<tr>
<td>Land area</td>
<td>Total land area</td>
<td>Master plan of the city and region</td>
<td>City wide</td>
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<td>Growth pattern</td>
<td>Master plan of the city and region</td>
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<td>Identification of notified areas</td>
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<td>Demography</td>
<td>Population growth trends by census wards or enumeration blocks</td>
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<tr>
<td></td>
<td>Number and size of house hold</td>
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<tr>
<td></td>
<td>Age-sex pyramid</td>
<td>Census</td>
<td>City wide</td>
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<tr>
<td>Socio-economic data</td>
<td>Population by income / expenditure on transport at TAZ or ward level</td>
<td>If city level GIS data available or enumeration block data of the census and primary surveys</td>
<td>City wide</td>
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<tr>
<td></td>
<td>Vehicle ownership (including bicycles) by social group</td>
<td>RTO, other local agencies / primary surveys</td>
<td>City wide</td>
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</table>
2.1.2 Delineation of Traffic Analysis Zones

For the purpose of analysis and development of travel demand forecasting model, the study area is required to be subdivided into smaller areas known as Traffic Analysis Zones (TAZs) or Zones as they are commonly referred to. Zones are an aggregation of various units such as households work place, shopping area, and other activities, which cannot otherwise be represented individually. TAZs which are located inside the planning area, as defined in Task 1, are called internal zones. The areas, outside the study area are aggregated into larger zones along the major directions of travel and are termed as external zones. These zones help analyse trip interactions between internal-internal, internal-external, external-external and external-internal.

2.1.3 The Basis of Zoning

TAZs are delineated taking into account various factors such as administrative boundaries, physical barriers like water bodies, railway lines, highways and homogeneous land uses. There are no standards to delineate the TAZ boundaries but the following criteria can help in guiding the delineation of TAZ boundaries:

1. **Administrative boundaries**: TAZ boundaries should follow administrative boundaries, including those of municipal corporations, villages, investment areas, and so on. Within these boundaries, TAZs should follow census ward boundaries. This is to ensure availability of secondary information like population, land use and other socio-economic information which can be useful to start with. In case a master plan is available, the zones or sub-zones of the city as indicated in the plan may be used.

2. **Physical barriers** in the city like rivers, lakes, canals, railway lines may be considered for delineating TAZ.

3. **Road network and Public Transport (PT) network in the study area**: The zone size would also get affected by the road and PT network in the study area.

4. **Homogeneity in land use**: This is another important consideration. For example, major centres like industrial areas or major residential pockets should be considered as a single zone.

5. **Special traffic generators** at regional / city level like railway station, sports complexes / major freight centres etc. might be considered as separate zones.

**Zone sizes**

Within the developed area of the parent city, the zone sizes should be as uniform as possible. If some zones are much bigger than the others, a significant number of trips will be made within the zone (intra-zonal trips) that will not reflect on the network.

As a general guide, a population of 1,000 – 3,000 is optimum for a small area and a population of 5,000 – 10,000 may be optimum for a large area. If the study area includes outskirts and peripheral areas around the city which are not fully developed, these may be
merged with the existing administrative zones at which socio-economic, census, etc data is available.

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2.2 Review of Land Use Pattern and Population Density

Once the zones for the study area have been defined, the next step is to collect data in which, slums should also be considered as a part of residential land use and not a separate land use. And also residential land use zones should have income groups marked as well. This can be done by using data on household assets and the type of building (available from property tax data/ household survey) as a proxy. If data on household assets is not available then the disaggregation of residential land use into income groups can also be done by using per capita floor area as a proxy, which can be calculated using the formula given below:

\[
\text{Per Capita Floor area} = \frac{\text{Household area}}{\text{no of members in the household}}.
\]

Housing characteristics can be a useful indicator of income. The per capita floor space is also an indicator of a low-income household.

2.2.1 Review of the Existing Transport Systems

A review of existing transport infrastructure and facilities needs to be done for all transport modes including public transport (private and public), private vehicles, walking, cycling, cycle rickshaw, auto rickshaw, shared auto rickshaw, etc. For this purpose, a number of surveys need to be conducted. The data collected must be visually represented, such as on maps, to avoid any ambiguity. The information that needs to be collected is given in Table

2.2.2 Study of Existing Travel Behaviour

Two important considerations should be taken into account while collecting data on travel patterns. The collected data should cover the travel behaviour of all individuals within a household, and the data should be segregated by mode and trip purpose. The household survey is designed to capture access time of the trip, trip purpose, the address of the trip starting and ending points, mode of travel
for each stage of the journey and to represent people’s perceptions towards different modes of transport in terms of time, cost, comfort, safety and security. The questionnaire is divided into two parts:

1. General or household questionnaire

2. Individual questionnaire

3 How do we develop integrated land use & transport strategies?

**Integrating Land use and Transport: A Cyclic Process** It is vital to understand, that there exists no 'single step by step’ process to achieve land use-transport integration. Also, not all the above mentioned elements may be applicable concurrently in a city. The manner in which each of the elements is to be applied is determined by the nature of existing settlement pattern, strategies, socio-economic and political background, etc of a city. Some cities may have explored some of these concepts and hence would require only strengthening and addition of supplementary elements. Others may need strategic introduction of some of these elements. Hence the planning process of integrating land use and transport is never a predetermined process. It can be defined as a cyclic process where one element influences the other in a manner that the socio-economic and environment impacts of urban development be minimized, as rendered in figure below Indian cities vary in size, density, settlement pattern, soci-economic systems and hence, varying mobility patterns. Hence it is important to consider this phenomenon while planning for city development. Some mega cities may require interventions at a regional level to influence land use and transport integration,while smaller cities may require only interventions at city level. A region may not be dominated by a single city, but shared by regional clusters. Growth potential of the various growth centers are to be explored and growth distributed across the region. Growing cities are to be regarded as ‘Cities within a City’ by identifying and redistributing activity and land use to develope multiple centers within it. In order to achieve land use transport integration it is important to work on all these elements simultaneously.

### 3.1 Public Transport Strategy— Inter Modal Integration

- Integrated Public Transit Network Planning
- Integrated Fare policy and ticketing
- Intermodal Stations to minimize delay/transfers
- Intelligent Transportation Systems (ITS)
- Access to the public transit network that includes integration with auto-rickshaws, taxis, and NMT modes like cycle rickshaws, and inland water transport
- Park and ride Facilities along mobility corridors
• Corridor Integration

• Institutional Integration

**Non-Motorized Transport Strategy**

• Establish connected walking networks

• Adequate walkway and path surfaces

• Create bike lanes and bicycle boulevards

• Correct roadway hazards to NMT

• Use street furniture and pedestrian friendly design features

• Integrate cycling with transit.

• Provide bicycle parking/rickshaw stands and encourage sharing

• Address security concerns of pedestrians and cyclists.

• Develop /encourage bike rentals/sharing

### 3.2 Accessibility Improvements

• Neighbourhoods with a complete street network and easy access to transit services

• Promote sustainable mode for travel (walking, cycling & public transport)

• Street design should be pedestrian friendly and cyclist-friendly

• In India, National Urban Transport Policy (NUTP) recommends

• To integrate land use and transport planning in cities, and to bring about comprehensive improvements in urban infrastructure

### 3.3 Complete networking and street

Complete network pattern with hierarchy of streets.

• Availability of alternate routes for users (Stockholm - Grid streets with traffic calming measures, increase connectivity of various neighbourhoods to the city centre)

• Higher accessibility to public transport

• Safety and comfort of pedestrians and NMV users

• Missing links in intermediate roads
3.4 Transit Oriented Development

A Transit Oriented Development (TOD) is a mixed-use residential or commercial area designed to maximize access to public transport and incorporates features to encourage transit ridership

- High densities around transit stations
- Provides multiple transportation choices by multimodal integration
- Mixed land use
- Pedestrian friendly and walkable neighbourhoods

3.5 Integrated Transit facilities

An integrated multimodal system needs to be developed

- To provide a viable and low cost solution of transport
- To minimize the need to change modes in a trip
- To provide convenient, comfortable and time saving journey

3.6 Inner city and transit

- Re-densification of low density areas with mixed land use
- Redevelopment of brown field areas and areas with other types of dereliction
- Provide high quality infrastructure facilities
- Build Strategies for efficient and optimum utilization of existing urban land and services

3.7 Freight Management Strategy

Unregulated loading and unloading of freight traffic add congestion on the roadways.

- Restricted delivery times
- Use of small and medium size vehicles with modern emission controls
- Develop Freight Terminals/warehouses
- Relocation of wholesale markets to the periphery
- Construction of bypasses

3.8 Parking Management Strategy

- Development of a parking strategy is necessary in order to shape the framework for the future provision, management and maintenance of parking facilities
• Development of Parking Strategy is based on an understanding of the parking supply and demand position in City

Parking strategies to be considered for any city include

• Restriction of on-street parking
• Parking Pricing
• Off Street parking facilities

3.9 Travel Demand Management Strategies

• To increase public transport modal shares, additional demand management interventions need to be implemented
• Congestion Pricing - mobility management strategy to reduce traffic congestion.
• Demand Management through restricted parking supply or imposing restriction of vehicles

3.10 Prioritization of Strategies

A clear implementation strategy for the Plan needs to be in place along with clear phasing of schemes and initiatives. Proposals may be classified as

• Long Term Proposals
• Medium Term Proposals
• Short Term Proposals

Long Term Proposals

• Mass Transit Systems
  • Metro / LRT / Mono Rail
  • Suburban Rail
  • BRT
• Intermodal Stations
• Truck Terminals & Intercity Bus Terminals
• Elevated Roads
• Freight Corridors
• Missing Roadway Links

Medium term Proposals
The medium term proposals are those whose effectiveness last up to 10 years

- Off-street Parking Facilities
- Flyovers
- Pedestrian Subways
- ROBs / RUBs
- Intelligent Transport Systems

**Short term Proposals**

The short-term proposals include those schemes whose usefulness might last up to a maximum of 5 years

- Pedestrian Infrastructure
- Bicycle Network and Infrastructure
- Pedestrian Zones
- Demand Management Strategies
- Parking Management
- Junction Improvements

### 3.11 Comprehensive Mobility Plan (CMP)

CMP is a vision statement of the direction in which Urban Transport in the city should grow. It should cover all elements of Urban Transport under an integrated planning process

#### 3.11.1 Need for Revision of CMP, 2008

The toolkit for preparation of CMP was first prepared by MoUD in association with ADB in August 2008. The focus of the toolkit was on the following:

1. To optimize the “mobility pattern of people and goods” rather than of vehicles
2. To focus on the improvement and promotion of public transport, NMVs and pedestrians, as important transport modes in Indian cities
3. To provide a recognized and effective platform for integrating land use and transport planning
4. To focus on the optimization of goods movement

However, to address the various mobility aspects of Smart Cities and the growing concerns of social and environmental sustainability of cities, a need was felt to review the existing guidelines and provide new guidelines for cities to plan and meet the growing challenges of overall sustainability
3.11.2 Scope of CMP

The preparation of CMP includes the following steps:

a) Understand the present travel characteristics and forecast travel demand for the planning horizon.

b) Estimate emissions from urban transport based on the travel demand and technological choices.

c) Integrate transport options with land use structure and develop alternative scenarios for sustainable transport.

d) Work out the mobility plan which is economically, socially, environmentally and technologically sustainable and be an integral part of development plans / master plans.

e) Suggest an implementation programme for a successful execution of the selected interventions.

3.11.3 Main Features of CMP

The main features of CMP are the following:

a) Prioritise mobility for all socio economic groups and genders.

b) Give adequate attention to sustainable modes of transport (i.e., public transport, pedestrians and non-motorised).

c) Provide a recognised and effective platform for integrating land use and transport planning.

d) Integrate impacts of transport on local air quality, emissions, safety and social aspects.

e) Focus on the optimisation of goods transport.

3.11.4 Key Outcomes of a CMP

The CMP should lead to the following outcomes in the long term:

a) Improvement in mobility for all socio-economic groups and genders

b) Improvement in air quality of Sustainable Urban Transport Scenario with reference to the BAU scenario

c) Improvement in safety and security for pedestrians, NMT and liveability in the city

d) Increase in sustainable transport mode share and a decrease in private motor vehicle use

e) Achievement of desirable indicators and benchmarks

f) Integral part of Master Plan

3.11.5 Data Collection for CMP

Primary Surveys

- Road network Inventory Survey
- Screen line/Outer Cordon Volume Count Survey
- Turning Volume Count Survey
- Speed & Delay Survey
- House Hold Interview Survey
- Road Side Interview Survey
- Pedestrian Count Survey
- Bus Passenger Count Survey
- Bus Occupancy Survey
- Terminal In and Out Survey
- On Street/Off Street Parking Survey
- Vehicle Operator Survey
- IPT Survey
- NMT Opinion Survey

Secondary Data Collection
- Population & Employment Details
- Land Use Information
- Vehicle Registration Details
- Pollution Details
- Private /Public Transport Bus Operation and Maintenance Details
- Bus Route and Bus Stop Details
- City ITS Facility Details
- Traffic Regulation Details
- Accident Data etc.
- Urban Bus Specifications

3.12 Financial/ Legal Instruments

- Increase in FAR
- Transferable development rights
- Mixed use zoning
- Spot zoning
- Land pooling
3.13 Way Forward

Indian cities are growing at a very fast pace and hence the need for integrated land use and transport planning is becoming imperative. The cities need to recognise that development plans and transport plans have a complementary role to play in promoting greater integration of transportation and land use planning and they should reinforce each other. This will help to ensure that the land use allocations, key site requirements and policies of a development plan are closely linked with the policies, proposals and investment priorities for transportation identified in the transport plan. The above problems are coupled with the fact that urban transportation is handled by multiple agencies at different levels of Government. The lack of clear definition of responsibilities among different tiers of government leads to institutional conflicts, including enforcement, infrastructure provision and use, policy formulation and coordination. The problems on the whole have led to an ad-hoc decision making process for the cities. The International and national case study cities provided in part C of this toolkit have clearly indicated that for an efficient city movement one measure alone will not solve the problem. The cities will have to pick and choose the measures depending on the local context. Invariably, trade-offs would be required in deciding on the measures to be used. Even in the case study cities it is evident that not all the measures were applicable in any city. These cities are also managing growth however they do provide insights and directions that could be explored by Indian cities.
Summary of the Module

The concept of land use transport integration is based on the nature of interaction between spatial and transport development. While allocation of land uses impact demand for travel as people need to access different activities, transport infrastructure adds to the attractiveness of a location by improving accessibility and leads to change in land values. With improved accessibility, the locations become attractive for investments and it results in further development of these locations.

A single mode of transport cannot cater to the transport needs of a city. For an efficient transportation system, various modes need to be introduced and developed in an integrated fashion. These modes need to be further integrated to enable easy transfer of passengers from one mode to another with minimum time loss. Integration of transit facilities is a must for the success of public transport systems in the city.

Integration in terms of network (MRT/BRT/suburban rail/ public transport) hence the networks are planned in such a way that it is convenient to change from one mode to another. The hierarchy of modes and the 35 location of these interchange points will determine the size of the interchange. One of the key objectives is the integration of public transport interchanges with activity centers in the city.

TOD Principles – Five Ds

1. **Density**: Increased density tends to reduce per capita automobile travel and increase public transport ridership.

2. **Diversity**: The more diverse the land uses, lesser the need to travel outside the area.

3. **Design Elements**: These include elements such as footpaths & safe roadway crossings for pedestrians, safe & efficient bicycle paths, and a closely spaced grid-like roadway network.

4. **Destinations**: This variable represents the attractiveness or vibrancy of an area. Availability of jobs or shopping areas for instance would influence this variable.

5. **Distance to Transit Service**: The closer a transit stop, higher the probability of a transit trip in lieu of a trip by personal automobile.

Other studies includes review of city profile, includes city’s present socio-economic profile and trends over a period of time, the consultant should collect data from secondary sources on land area, administrative boundaries, regional linkages, demography and socio-economic characteristics. Delineation of traffic zone analysis, review of land use pattern and population density, review of existing transport system, study of existing travel behaviour, public transport strategies are other models that should be practised to integrate land use and transport.