IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

OPPORTUNITIES FOR DEVELOPMENT OF AN INTEGRATED MULTIMODAL TRANSPORTATION MODEL

[1]Ar. Pooja Singh, [2]Dr. Arun Kapur, [3] Ar. Shubham Jajoriya

[1]Assistant Professor, [2]Associate Professor, [3]Principal Architect (Revani Ventures, Gwalior)
[1]Amity School of Architecture & Planning,
[1]Amity University, Lucknow, India.

***Abstract*: With the increasing demand for transportation and the rapid urbanization of India, innovative solutions and methods are being developed and imported from other nations. Numerous Maestro Rapid Transit systems have emerged in numerous cities over the past decade, including Metro Rail, Bus Rapid Transit systems, and Monorails. The interconnection of these public transportation modes and several other means is currently a crucial issue from the users' and planners' points of view, for simple travel between the numerous modes and sustainability of the city's overall public transportation network. This paper attempts to comprehend the integrated multi-modal urban transportation system for Indian cities. With the use few case studies and taking references of a few previous studies by researchers, efforts are made to identify the characteristics, benefits, and challenges of integrated multi-modal urban transportation for Indian cities. The Urban Transportation Planning Concepts regarding the development of Interchange Hubs are explored.**

***Index Terms*: Multimodal Transportation, Content analysis, City Planning, Integrated Public Transport**

I. INTRODUCTION

One of the fundamental components to a society's smooth operation is transportation. The transportation system advances social, economic, industrial, commercial developments and further transforms society into an organized one. It is one of the crucial forces for determining the direction of development.

To achieve the desired transportation balance and make the system effective, it is crucial to provide organized facilities. Since transportation involves the movement of people and goods, a system access point is required. These access points are referred to as "Terminals" or "Fixed Facilities" because of their fixed locations within the system.

The size of the city and the scale of the move determine the demand for the fixed facility. Due to their functional characteristics and employment potential, metropolitan cities are growing at a faster rate.

The role of the terminals and fixed facilities in the transportation system becomes more crucial since the existing facilities are incapable of meeting current demands. Significantly, the location of the transportation hub is crucial in integrating the transportation system with a capital city like Lock Haven; yet, problems are more frequently reported in central areas where the available transportation facilities cannot meet demand. The increased intercity traffic is in direct conflict with the intercity business traffic, posing movement-related issues.

In light of this background, it is crucial to plan and develop a major transportation system using a methodological approach. A transportation system must meet a variety of demands in order to be efficient and affordable. For instance, it would be ineffective if inadequate sidewalks and pathways forced parents to transport children to local destinations where they would prefer to walk or ride a bicycle, or if inadequate mobility options forced urban commuters to drive even though they would prefer to rideshare or take public transportation. Physically, economically, and socially disadvantaged people in particular need different mobility options: walking and cycling for local travel, public transportation for longer journeys, and automobiles when necessary. In order to be efficient and affordable, transportation must be multimodal.

The Indian government is taking numerous steps to encourage sustainable urban transportation. Seven cities have populations in excess of four million. In Delhi, about 180 kilometers of metro rail are currently in operation, while the first five cities are currently building another 450 kilometers of metro rail network including Lucknow where the first phase of metro rail is in operational stage. Additionally, 11 cities are debuting Bus Rapid While two other cities have them in the planning stage, the transportation system. However, the efficiency and effectiveness of mass transit depend on a number of factors, including the availability of various modes of transportation in the city, the design and layout of routes, the flow of commuters at a given station, the frequency of service, etc. Transportation infrastructure development, traffic management, intelligent transportation systems, use of green and renewable fuels, higher traffic speeds, lower operating costs, maximum utilization of public transportation, reduction of congestion and accidents on the road, simple and safe transportation of pediatric patients, etc. are the crucial criteria for the sustainability of public transportation facilities. In order to meet the constantly changing transportation needs of urban commuters, authorities work to combine two or more public transportation modes to ensure easy and uninterrupted

travel in cities. The process that has emerged as a result of this is known as the Multimodal Transport System (MMT). It involves the coordinated use of various modes and their integration to fight against traffic congestion, longer travel times, and air pollution.

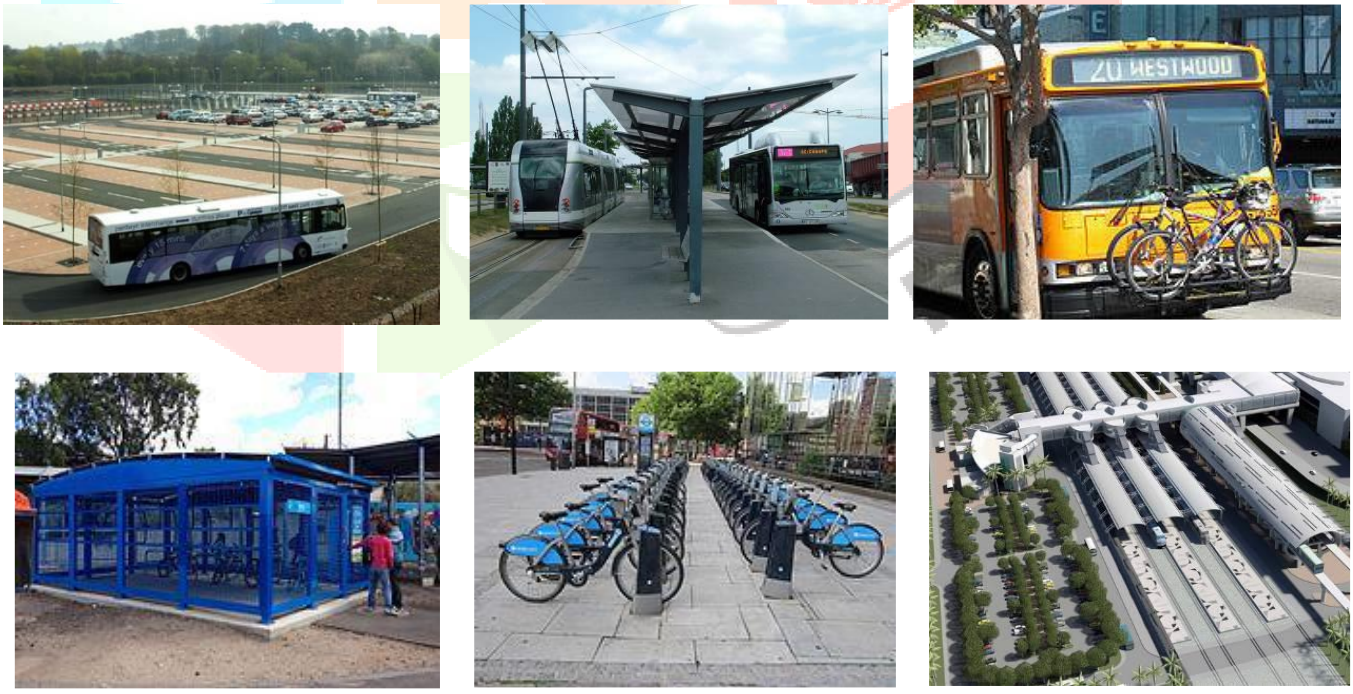
II. INTEGRATED MULTI MODAL TRANSPORT SYSTEM

Integrated Multimodal Transportation System (MMT) consists of a route that includes two or more different modes of transportation, such as buses, trains, cars, and taxis; it may be operated by the government or privately, and it requires passengers to change to a different mode of transportation in between. Some modes of transportation have always depended on other modes. Urban business systems typically provide train and subway services and frequently extends to local airports. In developed nations, the primary goal of integrated multi-mode transportation systems is to reduce reliance on the automobile as a more prevalent mode of ground transportation and increased use of public transportation. In the developing nations, a variety of transportation methods are used.

When several modes are operated on the same track, efficiency is lost over time and by an increase in the number of vehicles. If managed properly, the system can also help increase efficiency in areas where local authorities have established tracking systems. This multi-mode system can be beneficial for cities with a rapid urbanization rate and higher population densities. The primary goal of MMT is to promote public transportation in urban areas. A coordinated integration of various modes results in less congestion on the road, better convenience for commuters, efficiency, and cost effectiveness. Key components of MMT can be identified as: Transportation infrastructure, on top of which transportation modes operate; Transportation modes: a network representing various modes, routes, and paths; Multiple trips: This is the use of individuals for these modes in various combinations; Transmit points: enabling people to switch from one mode to another. In other words Multi-mode transportation planning refers to decision-making that takes a variety of modes into account such as walking, cycling, automobiles, public transportation, etc., and connections between modes so that each can play their optimal role in the overall transportation system. In this context, a multi-mode transportation system is an integrated strategy that incorporates all components of urban transportation into a single system for more effective use of available transportation resources and infrastructure for better mobility within a wide range of mode options for commuters.

1. Urban Multi-Modal Commuting:

Public transportation systems, such trains or metro systems, have the most effective methods and the most capacity for moving people throughout cities. Multi-mode transportation is therefore heavily focused on getting people into the transportation network and then, once off the network, to their final destinations and the associated modes of transportation, which include the integration of several modes. The following are the types of mixed-mode approaches that have been accepted in various countries:



Multimodal urban commuting Examples: Park and ride, feeder service, bike and ride, bicycle on the bus, bicycle parking, bicycle rental service, and integrated multiple transit station

i. Automobile to Public Transport Nodes:

Automobiles are a common and convenient mode of transportation, but they are also accepted in a variety of multi-mode settings. They can offer a quick commute to train stations, airports, and bus terminals where all-day "park and ride" spaces are available. Cars give commuters the relatable comfort of single-mode travel while significantly lowering the financial and environmental costs**.**

ii. Bus to Public Transport Nodes:

Several large cities connect their legacy networks to their business networks. This enables commuters to reach locations that are often thought to be far from comfortable walking distance since they are not directly served by rail. Feeder businesses are a specific illustration of this. Feeder businesses operate most efficiently when they are scheduled according to the regular hours.

Feeder businesses are quite successful at meeting customer needs, which helps to increase patronage and therefore improves operating income.

iii. Cycling to Public Transport Nodes as 'Bike-And- Ride':

Bicycles are used all around the world to travel to and from train stations and other public transportation hubs, a practice known as 'Bike-and-Ride'. Due to the threat of theft or vandalism of bicycles left at these locations, "bike and ride" transportation greatly benefits from secure bicycle parking facilities. Some train, bus, and ferry system's permit commuters to bring their bicycles on board, allowing cyclists to ride at both ends of the commute. A public bicycle rental programme has been implemented in several cities, allowing travelers to get to and from a train station.

iv. Transfer Facilities:

In recent years, there has been an increasing emphasis on designing facilities that make such transportation easier and more efficient. They are intended to make it easier for passengers to go from one mode of transportation to another. For instance, an internal station may include services for air, rail, and high-speed transportation.

2. Multimodal Transport Requirements:

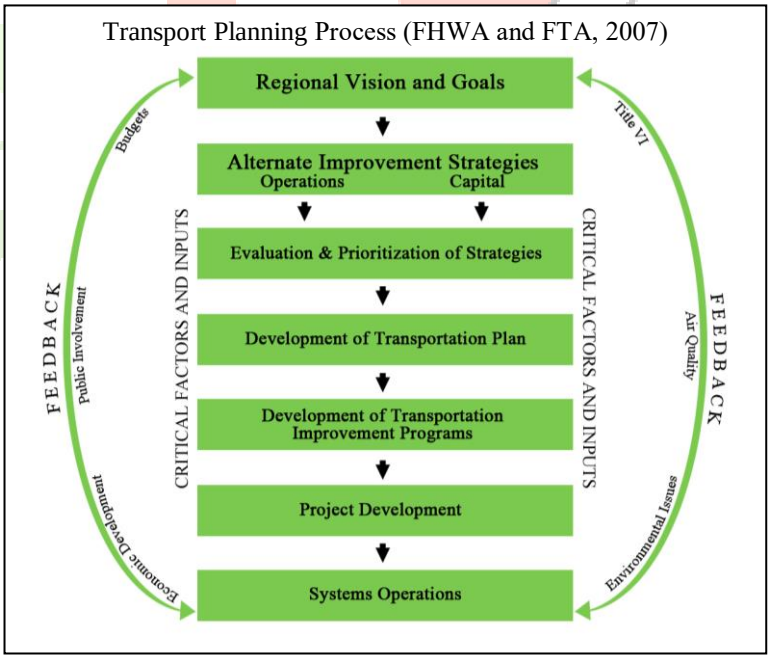
The use of several modes of transportation entails extensive structural changes that cover new trade and transportation procedures. To implement many modes of transportation, numerous measures are required, ranging from the streamlining of commercial regulations to the development of transportation infrastructure. The three main elements must be upgraded for a successful multi-mode transportation system. These components include commercial practices, administrative requirements, and transportation infrastructure.

III. MULTIMODAL PLANNING CONCEPTS:

Multi-mode planning refers to planning that takes into account a variety of modes (such as walking, cycling, being autonomous, taking public transportation, etc.) and connections across modes.

There are several dedicated types of transportation planning that reflect various scales and objectives:

- ***Traffic impact studies***: evaluate traffic impacts and mitigation strategies for a specific development or project.
- ***Local transportation planning***: creates municipal and neighborhood transportation plans.
- ***Regional transportation planning***: creates plans for a metropolitan region.
- ***State, provincial, and national transportation planning*** develops plans for a large area to be implemented by a transportation agency.
- ***Strategic transportation plans***: Create long-range plans that are typically 20 to 40 years in the future.
- ***Transportation improvement plans***: (T) or action plans identify specific projects and programmes that will be implemented within a short period of time.
- ***Corridor transportation plans***: Identify projects and plans to be implemented on a specific corridor, such as along a certain highway, bridge or route.
- ***Mode- or area-specific transportation plans***: Identify ways to enhance a certain mode (walking, cycling, public transportation, etc.) or area (a campground, downtown, industrial park, etc.).



The transport planning process typically includes the following steps:

a) **Data collection and analysis:** This step involves gathering information on the current transportation system, including the number of vehicles, their routes, and the number of passengers or goods transported.

b) **Setting goals and objectives:** Based on the data analysis, planners set goals and objectives for the transportation system, such as reducing congestion, improving safety, or increasing efficiency.

c) **Developing strategies and alternatives:** Based on the goals and objectives, planners develop strategies and alternatives to address transportation issues. This may include adding new transportation modes, modifying existing infrastructure, or developing policies to encourage the use of public transportation.

d) **Evaluating alternatives:** Once the strategies and alternatives have been developed, they are evaluated based on various criteria such as cost, feasibility, and environmental impact.

e) **Selecting a preferred alternative:** Based on the evaluation, a preferred alternative is selected, and a detailed plan is developed.

f) **Implementation:** This step involves implementing the selected alternative, which may involve construction of new infrastructure, modification of existing infrastructure, or changes to policies or regulations.

g) **Monitoring and evaluation:** Once the transportation system changes are implemented, planners monitor and evaluate their effectiveness in achieving the goals and objectives set in step 2. This helps to identify areas for improvement and refine the transportation plan for the future.

In recent years, transportation planning has expanded to take into account non-automobile modes of transportation as well as factors like environmental impact and accessibility for non-drivers. Many highway agencies have changed their names to transportation agencies recently and have added capacity related to environmental analyses, community involvement, and non-motorized planning. Some are employing more comprehensive and multimodal evaluation (Ltman 2012). Transportation engineering techniques are improving to account for a wider range of options (such as alternative designs and pricing incentives) and impacts (such as polluting effects and land use effects). Additionally, a growing portion of transportation funds are flexible, allowing them to be used for a variety of programmes and projects rather than just road projects.

Most regions employ four-step models to forecast future transport conditions (see Figure above). The region is divided into several transport analysis zones (TZs), each with a few hundred to a few thousand residents. The number and kind of trips coming from each TZ are predicted based on generic values calculated from local travel surveys that count trips made during peak seasons from one zone to the next. These trips are planned with specific destinations, modes, and routes based on their generalized costs (combined time and financial costs), with more trips planned with specific routes and modes that take into account factors like travel speeds, connection delays, and parking costs. Transportation models are being improved in a variety of ways to better predict future travel activity, including the effects of several transportation and land use management strategies.

This predicts future peak-period traffic volumes on each route and identifies areas where traffic volumes will exceed available space (based on the volume/capacity ratio, or V/) at certain road intersections. Utilizing level-of-service (L) ratings, which range from A (the best) to F (the worst), the amount of congestion on major roads is assessed.

IV. UNDERSTANDING THE TERMS AND CONCEPTS IN TRANSPORTATION PLANNING:

Traffic congestion can either be **recurring** (occurs daily, weekly, or annually, making management easier) or **non-recurring** (often caused by accidents, special events, or road closures).

The term **"design vehicle"** refers to the largest vehicle that a road is intended to accommodate. Passenger Car Equivalents (PCE) indicate a larger vehicle's traffic imapcts compared with a typical car.

A **queue** is a queue of vehicles that are waiting (for instance, at an intersection). A platoon is a collection of moving vehicles (such as when traffic signs turn green).

The term "**availability**" refers to the number of people or vehicles that can be accommodated.

The term "**load factor/capacity**" refers to the portion of capacity that is actually utilized. For instance, a load factor of 0.85 indicates that 85% of the maximum capacity is actually utilized.

Standard transport planning procedures define the lowest level of service that is acceptable. Roads that exceed this are deemed to fail and require evacuation or other interventions. This approach is justified on the following grounds:

- It focuses mostly on motor vehicle travel conditions. It is assumed that transportation mostly consists of motorized travel, frequently giving little thought to the travel conditions experienced by other modes. As a result, it tends to lead to automatic dependence, decreasing modality.
- It defines transportation issues as primarily traffic congestion while ignoring other types of issues such inadequate mobility for non-drivers, the cost burden of vehicle ownership to consumers and parking costs to businesses, accident risk, and unavoidable social and environmental impacts.
- It recognizes the propensity for traffic congestion to prevent growth (as congestion increases, demand for travel on a corridor slows down), as well as the effects of generated traffic (additional peak-period vehicle travel caused by expanded congested roads) and inducted travel (total increases in vehicle travel caused by expanded congested roads).
- By allocating resources primarily towards road expansion at the expense of other modes (widening roads and increasing traffic speeds and volumes tend to worsen walking and cycling conditions and frequently leave little money or road space for improving other modes), it can create a self-fulfilling prophecy.
- Short trips (within TAZs), travel by children, off-peak travel, and recreational travel are frequently overlooked or undercounted in travel surveys and other statistics, resulting in walking and cycling being undervalued in planning.

Recently, transport planning has evolved to be more multi-modal and comprehensive, taking a wider range of options and effects into account. Transport planners have begun to apply level-of-service ratings to walking, cycling, and public transit, and to consider demand management strategies as an alternative to roadway capacity expansion.

V. GREEN TRANSPORTATION HIERARCHY

1. Pedestrians
2. Bicycles
3. Public transportation
4. Service and freight vehicles
5. Taxis
6. Multiple occupant vehicles (carpools)
7. Single occupant vehicles

The Green Transportation Historians favour more affordable and cost-effective (in terms of space, energy, and other costs) modes of operation.

Some urban areas have established a transportation hierarchy that states that more resource-efficient modes will be given priority over lone employee autonomous transportation, particularly on requested urban corridors. This gives a foundation for shifting emphasis in transportation planning, road space allocation, funding, and pricing in favour of more efficient methods.

VI. MULTIMODAL TRANSPORTATION PLANNING:

Multimodal planning refers to transportation and land use planning that takes into account a variety of transportation options, typically including walking, cycling, public transportation, and driving an automobile, as well as accounts for land use factors that affect accessibility. A growing body of resources are being developed for multimodal planning (Williams, Larridge, and Carroll 2016).

Multiple modes of transportation accounts for the various capabilities of various modes, including their availability, speed, density, cost, limitations, and consequently their most appropriate uses.
The table below summarizes the performance of various transportation modes.

Table-1: Mode Profiles

Mode	Availability	Speed	Density	Loads	Costs	Potential Users			Limitations
	Times and Locations Served	Typical Speed	Space needed	Carrying capacity	Users costs	Non-Drivers	Poor	Handi - Capped	
Walking	Wide (nearly universal)	2-5 mph	High	Small	Low	Yes	Yes	Varies	Requires physical ability. Limited distance and carrying capacity. May be difficult or unsafe to use
Wheelchair	Limited (requires suitable facilities)	2-5 mph	Medium	Small	Medium	Yes	Yes	Yes	Requires suitable sidewalk or path. Limited distance and carrying capacity.
Bicycle	Wide (feasible on most roads and paths)	5-15 mph	Medium	Small to medium	Medium	Yes	Yes	Varies	Requires bicycle and ability. Limited distance and carrying capacity.
Taxi	Moderate (in most urban areas)	20-60 mph	Low	Medium	High	Yes	Limited	Yes	High cost and limited availability .
Fixed Route Transit	Limited (major urban areas)	20-40 mph	High	Small	Medium	Yes	Yes	Yes	Limited availability. Sometimes difficult to use.
Paratransit	Limited	10-30 mph	Medium	Small	High	Yes	Yes	Yes	High cost and limited service .
Auto Driver	Wide (nearly universal)	20-60 mph	Low	Medium to Large	HIgh	No	Limited	Varies	Requires driving ability and automobile. Costly
Ridesharing (auto passenger	Limited (only suited for some trips)	20-60 mph	High	Medium	Low	Yes	Yes	Yes	Requires cooperative motorist. Chauffeuring (special trips) require driver's time.
Carsharing (Vehical rentals)	Limited (needs nearby services)	20-60 mph	Low	Medium to Large	Medium	No	Limited	Varies	Requires convenient and affordable vehicle rentals services.
Motorcycle	Wide (nearly universal)	20-60 mph	Medium	Medium	HIgh	No	Limited	No	Requires motorcycle and ability. Moderate costs.
Telecommute	Wide (nearly universal)	NA	NA	NA	Medium	Yes	Varies	Varies	Requires equipment and skill.

Why Not Drive?

Driving is frequently the fastest mode of transportation, and even though automobiles are expensive to purchase (taking into account fixed costs like depreciation, insurance, registration fees, scheduled maintenance, and residential parking expenses), they are typically relatively inexpensive to operate. Additionally, mobile travel tends to be more comfortable and dignified than other modes. This explains why 70 to 90% of trips are made by automated vehicles (depending on definitions and conditions).
But for a variety of reasons, travellers frequently require or prefer travelling by alternate modes:

- Many people are unable to drive. In a typical community, 20–40% of the whole population, as well as 10–20% of adolescents and adults, are unable to drive because of disabilities, economic hardships, ageing factors, or vehicle malfunctions. Inadequate transport options limit non-drivers' access to activities and force drivers to honk at non-drivers (according to the 2009 National Household Survey). According to a travel survey, 5% of all trips were specifically made to transport passengers.
- Many people shouldn't drive for some trips because of intoxication, disability, or economic constraints. For instance, efforts to reduce driving by high-risk groups (such as young men, those with dementia, or those impaired by alcohol or drugs) can only be successful if there are effective alternatives to driving. The high cost of automated transportation places a greater financial burden on many people with lower incomes.
- Travellers occasionally prefer using other modes of transportation because, for instance, walking and cycling are more enjoyable and provide healthy exercise, or public transportation for commuting puts less strain on the body and allows riders to read, work, or relax.
- A society might benefit from more efficient road, parking, fuel, and insurance pricing, or more efficient road space management, which favour higher-value trips and more efficient decisions in order to lower traffic congestion, parking costs, accidents, and election-related emotions.
- It is therefore intriguing to consider the benefits of shared mobility for individuals and society as a whole, as well as the prevalence of autonomous travel that results from travellers' lack of viable alternatives. For instance, if walking and cycling conditions, as well as the quality of public transport services, were better, how much more would people rely on these modes, and how much more would people rely on this mode, and how much less would there be of autonomous travel?

In actuality, travel by walking, bicycling, and public transportation tends to be much higher, whereas travel by automobile is much lower, in communities with better transportation options. For instance, Guo and Gandavarapu (2010) estimate that finishing the underground network in a typical U.S. On average, town increases non-motorized travel by 16% (from 0.6 to 0.7 miles per day) and decreases automobile travel by 5% (from 22.0 to 20.9 vehicle miles). Similar to this, residents of transit-orchestrated communities tend to use alternative modes of transportation 2-10 times more frequently and drive 10-30% less. Fewer than residents of communities that are home to the disabled (Servero and Rrington 2008; Letman 2009). Even significant reductions in travel time can be achieved if improvements to alternative transport modes are implemented in tandem with incentives such more cost-effective parking and insurance premiums.

This indicates an increasing demand for alternative vehicles, i.e., people would want to rely more on alternative vehicles but are constrained by poor walking and cycling conditions and inadequate public transport services. This is not to imply that people would stop driving together in an optimal transportation system, but it does indicate that people would, given better transportation options and more effective incentives, choose to drive less, rely more on alternative modes of transportation, and be better off overall.

The table given below compares various nonmotorized facility users.

Table-2: Nonmotorized Facility Uses Compared

Mode or Activity	Facility Requirments	Risk to Others	Basic Mobility
	Quality and quantity of pedestrian facilities	Danger these users impose on others	Whether the mode provides basic mobility benefits
People standing	Minimal	None	NA
People sitting at benches or tables	Seats or benches	None	NA
Individual walkers	Minimal	Low	High
Walkers in groups	Medium	Low	High
Walkers with children	Medium	Low	High
Children playing	Medium to large	Medium	Medium
Human powered wheelchairs	Medium	Low	Very High
Motor powered wheelchairs	Medium to large	Medium to High	Very High
Joggers and runners	Medium to large	Medium	Medium
Skates and push-scooters	Large	Medium	Low
Powered scooters and segways	Large	Medium	Low to High
Human powered bicycle	Medium to large	Medium to High	Medium
Motorized bicycle	Large	High	Low
People with handcarts or wagons	Medium to large	Low to Medium	Medium
Vendors with carts and wagons	Medium to large	Low	Sometime (If the goods sold are considered 'basic')

Public transportation, often known as mass transit or public transportation, generally refers to a wide range of goods and vehicles. The performance of various types of public transport is summarized in the given table. Actual performance depends on unique circumstances; for instance, the cost of a trip can vary depending on the costs that are included (for instance, whether major new roads or rail improvements are needed, whether park-and-ride facilities are included in transportation budgets, construction and operating costs, load factors, and trip types). The table given below summarizes different types of public transit and their performance attributes.

Multi-mode transportation planning requires tools for evaluating the quality of each mode, such as Level-of-service standards that may be used to identify issues and suggest improvements for each mode. The tables below list factors that can be taken into account while evaluating various modes.

Table-3: Different types of public transit and their performance attributes

Name	Description	Availability	Speed	Density	Costs
		Destination Served	Passenger travel speeds	Passenger Volumes	Cost per trip
Heavy rail	Relatively large, higher-speed train, operating entirely on separate rights-of-way, with infrequent stops, providing service between communities.	Limited to major corridors in large cities	High	Very High	Very High
Light Rail Transit (LRT)	Moderate size, medium-speed trains, operating mainly on separate rights-of-way, with variable service between urban neighborhoods and commercial centers.	Limited to major corridors	Medium	High	High
Streetcars (also called trams or trolleys	Relatively small, lower-speed-trains, operating primarily o urban streets, with frequent stops which provide service along major urban corridors.	Limited to major corridors	Medium	High	High
Fixed route bus transit	Buses on schedules routes.	Widely available in urban areas	Low to Medium	High	Low to Medium
Bus Rapid Transit (BRT)	A bus system with features that provide a high quality of service.	Limited to major corridors	Medium to High	High	Low to Medium
Express Bus	Limited stop bus service designed for commuters and special events.	Limited to major corridors	High	High	Low to Medium
Ferry service	Boats used to tranport people and vehicles.	Limited to major corridors	Low to Medium	Low to Medium	Medium to High
Paratransit	small buses or vans that provide door-to-door, demand-response service.	Widely available	Low	Low	High
Personal Rapid Transit (PRT)	Small, automated vehicles that provide transit service, genrally on tracks.	Limited to major corridors	Low to Medium	Low to Medium	Medium to High
Vanpool	Vans uses for ridesharing.	Widely available	Medium to High	High	Low
Shared Taxi.	Private taxis that carry multiple customers.	Limited to major corridors	Medium to High	Low to Medium	Medium to High
Taxi	Conventional taxi service.	Widely available	Medium to High	Low	High

VII. AUTOMOBILE DEPENDENCY AND MULTI-MODALISM:

Mobility dependency refers to transportation and land use patterns that support automated transportation and offer reasonably superior alternatives. The opposite, multi-mode, refers to a transport system that gives users a variety of transport options in order to provide a high degree of accessibility, even for non-drivers. The table below compares automated dependency and multiple-mode transportation systems. Effectively integrated, in order to provide a high degree of accessibility, even for those who do not drive. The table below compares automated dependency and multiple-mode transportation systems.

Table 4: Auto Dependence and Multi-Modal Transportation Compared

Factor	Automobile Dependency	Multi-Modal Transportation
Motor vehicle ownership	High per capita motor vehicle ownership.	Medium per capita motor vehicle ownership
Vehicle travel	High per capita motor vehicle mileage.	Medium to low vehicle mileage.
Land use density	low.Common destinations are dispersed.	Medium. Destinations are clustered
Land use mix	Single-use development patterns.	More mixed-use development.
Land for transport	Large amounts of lands devoted to roads and parking.	Medium amounts devoted to roads and parking.
Road design	Emphasizes automobile traffic.	Supports multiple modes and users.
Street scale	Large scale streets and blocks.	Small to medium streets and blocks.
Traffic speeds	Maximum traffic speeds.	Lower traffic speeds.
Walking	Mainly in private malls.	Mainly on public streets.
Signage	Large scale, for high speed traffic.	Medium scale, for lower-speed traffic.
Parking	Generous supply, free.	Moderate supply, some pricing.
Site design	Parking paramount, in front of buildings.	Parking sometimes behind buildings.
Planning Practices	Non-drivers are a small minority with little political influnce.	Planning places are high value on modal diversity.
Social expectations	Non-drivers are stigmatized and their needs given little consideration.	Non-drivers are not stigmatized and their needs are considered.

Mobile dependency is a matter of degree. Few locations are completely autonomous (i.e., driving is the only mode of transportation). Numerous remotely mobile areas frequently have significant amounts of walking, bicycling, and travel between particular groups or situations. Even "car-free" areas typically include some automated travel by emergency, delivery, and service vehicles.

Automobile dependency has several effects. It increases total mobility (per capita travel), vehicle traffic, and associated costs. It makes non-drivers economically and socially disadvantageous since they have higher financial and time costs or less access to activities. This tends to decrease opportunities, for instance, for education, employment, and recreation. In an automobile-dependent community, virtually every adult is expected to own an automobile (as opposed to a household automobile shared by multiple drivers), non-drivers require frequent grooming, and it is challenging to grant driving privileges to disabled people because alternatives are infeasible. The variety of solutions that may be used to address issues like traffic congestion, road and parking facility costs, accidents, and polluting factors are reduced by ubiquitous dependency.

10. REFERENCES FROM ABROAD:

The report, which integrates Utopia's Transportation System: A Strategy for an Effective Transportation Future (Booz, 2012) describes cities with integrated transportation planning:

London:

London's overall public transport network is made up of a well-established rail network, an extensive business network, and a goods network. These networks are connected by multiple-mode structures created to make it simple for high volumes of traders to transact. Major stations, purpose-built bus interchanges and underground stations have all been developed to be within walking distance of railway stations and are often managed by bus station staff and furnished with real-time information systems (such as the countdown clock that indicates how many minutes remain until the arrival of the next bus).

Hong Kong:

Public transport services offered in Hong Kong include roads, trains, buses, minibuses, taxes and fares. This leads to very high public transport mode share (90%) and very low vehicle ownership rates (50 vehicles per 1,000 people). Services for Hong Kong transport are offered by a number of operators.

Singapore:

Singapore is regarded as an international leader in integrated multi-mode transportation planning. It established the world's first area licensing and electronic road pricing systems and uses a quota system to limit vehicle ownership. A government makes ongoing investments in transportation infrastructure.

11. CONCLUSION:

With an increase in the number of middle classes in India, personal vehicles have increased in several fields over the past decade, which has further led to a deterioration in traffic and environmental conditions. This has led to a need to switch from driving to walking or cycling for short journeys and to use public transport for lengthy journeys. Integrated multi-modal urban transport is a necessary step to achieving this objective. MMT is a promising area for research and development for the near future as well as for scientific and practical implementation of appropriate infrastructure; most Indian cities are lining up for improving the transport infrastructure by carrying out a variety of transport projects.

The integrated multi-mode transport system in Delhi is the precursor to future developments for appropriate integration of various transport modes in dense urban areas of India. The biggest challenge for Indian cities would be to achieve the highest level of integration of multiple modes in order to shift the dominant role of personal transportation to at least partial use of public transportation for mixed-mode travel.

RFERENCES:

[1] Buchari, Erika et al. (2008). Enhancing Public Transport System in Developing Countries towards Multimodal Public Transport System. Proceedings of the Conference on The Intelligent Public Transport System, April, Netherland.

[2] Hine, J. and Scott, J. (2000). Seamless, Accessible Travel: User's Views of Public Transport Journey and Interchange. Transport Policy 7, pp. 217-226.

[3] Kumar, P. (2009). Design Approach for Multi Modal Transport System. Architecture - Time Space & People

[4] Litman, T. (2012). Introduction to Multi-Modal Transportation Planning, Victoria Transport Policy Institute

[5] Singhal, B. I. 2010. Towards Sustainable Urban Transport in India. 2010.

[6] Verma, A. (VOL. 100, NO. 9, 2010). Achieving sustainable transportation system for Indian cities. CURRENT SCIENCE.

[7] Ministry of Urban Development G of I (1982). The Road Transport Corporations Act, 1950.

[8] Dawda NH, Gajera H, Joshi GJ, Arkatkar SS, Dave (2020). "Efficiency Based Evaluation of Public Transport and Paratransit Systems with a View to Integrating Transportation". Transp Res Rec J Transp Res board [Internet]. ; 1–16.

[9] Ministry of Urban Development G of I (1982). The Road Transport Corporations Act, 1950.

[10] Ministry of Urban Development G of I (1988). The Motor Vehicles Act, 1988. p. 1–233.

[11] Buchari, Erika et al. (2008). Enhancing Public Transport System in Developing Countries towards Multimodal Public Transport System. Proceedings of the Conference on The Intelligent Public Transport System, April 2-4, Netherland.

[12] Devadas, V., Nand Kumar 2007. Integrated Development Plan: A Scientific Approach, Journal of Indian Building Congress, New Delhi, Vol. 14, No. 1, pp. 35-42