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Promotion of Non-Motorized Vehicles, Pedestrian Facilities and Safety

Gongula Sahithi, Addula Sai Nath Reddy
Shaik Shreef
M-Tech 1st year
Jawaharlal Nehru Technological Institute Hyderabad
Department of Transportation Engineering

Abstract
This Paper Aims To Outline The Strategies Essential To Advance The Usage Of Non-Motorized Modes Of Transport, Pedestrian Facilities, Safety And Improve Sustainable Transportation Also Referred As Green Transportation Which Enhances Economic Growth And Improves Accessibility. Congestion, Traffic Jams, Environmental Pollution, High Cost Of Travel, Increasing Cost Of Fuel, Ill-Health, Etc Are All The Issues That Many Countries Are Dealing With. As A Result Of The Increased Usage Of Automobiles. Engineers In Developing Nations Are Trying A Variety Of Steps To Address These Issues, Including Expanding The Road, Increasing The Number Of Lanes, And Lowering The Speed Limit. However, Making Walking And Cycling More Appealing By Enlightening Sidewalks, Foot Pathways, Carriage Ways, And Other Public Spaces Is Crucial To Reversing The Trend Toward Increased Motor Vehicle Usage. Non-Motorized Transportation Is Indeed A Very Cost-Effective Means Of Transport That Has A Lot Of Health, Economic, And Social Advantages, Especially Among The Poor.

Key words: *Non-Motorized Vehicles, Sustainable Transportation, Pedestrian Facilities And Safety, Congestion, Environmental Pollution.*

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I. Introduction

Non-motorised walking, bicycling and variants such as small-wheeled transport (cycle rickshaws, skates, skateboards, push scooters and hand carts) and wheelchair travel are all examples of non-motorized transport better known by its acronym NMT, similarly recognized as active transportation and human powered transportation includes These modes offer both recreation and transportation and are also useful for short trips up to 7 kms, which take up the major share of trips in urban areas.

Congestion, traffic jams, environmental pollution, high cost of travel, longer travel distances owing to city sprawl, increasing cost of fuel imports: ill-health, etc. are all problems that cities in developing nations are facing as a result of rising population and automated automobiles. Designers are searching for alternative approach options, and one of them is to encourage and participate in non-motorized activities. Investments in facilities, awareness programmes, smart urban design, better public transportation, and disincentives for the use of motorised private cars can all help to promote NMT. The goal is to promote non-motorized modes of transportation as an ecologically friendly feeder option for public transportation as well as a preferred mode for short-distance rides.

The adoption of cycling and walking as feeder modes can help buses reach more obscure places. In addition, public transportation does not offer a door-to-door service. This is dependent on traffic demand; for example, if there are low-demand regions, public transportation may not be able to reach all sections of the city. When it comes to supporting clean urban transportation, NMT is usually a vital component.

II. Background

Earlier people's sole mode of transport was walking, where ever it may be either the work place, home and any social gathering until the discovery of wheel. Pedestrians and vehicles are the two most important elements in designing roads and highways. However, for a long time, the designer was concentrated on vehicle issues and neglected pedestrian safety. Moreover, most transportation codes include specific considerations and standards for pedestrians. It is, therefore, necessary to promote the non- motorized vehicles and pedestrian facilities which is used for the sustainable environment.

People have avoided walking and rely on vehicles for transportation. A significant proportion of cities have been built to accommodate motorised transportation, making them more fuel-dependent, increasing pollution and road risk, and discouraging people from utilising more environmentally friendly modes of transportation.

III. Methodology:

The information in this paper as been drawn from numerous sources, including existing data approximately 10-20 articles on NMT's and pedestrian facilities have been reviewed, both international and national. After deep study on various documents referenced areas have been chosen. The study procedure is listed below.

IV. Barriers towards Non-Motorized vehicles in urban areas

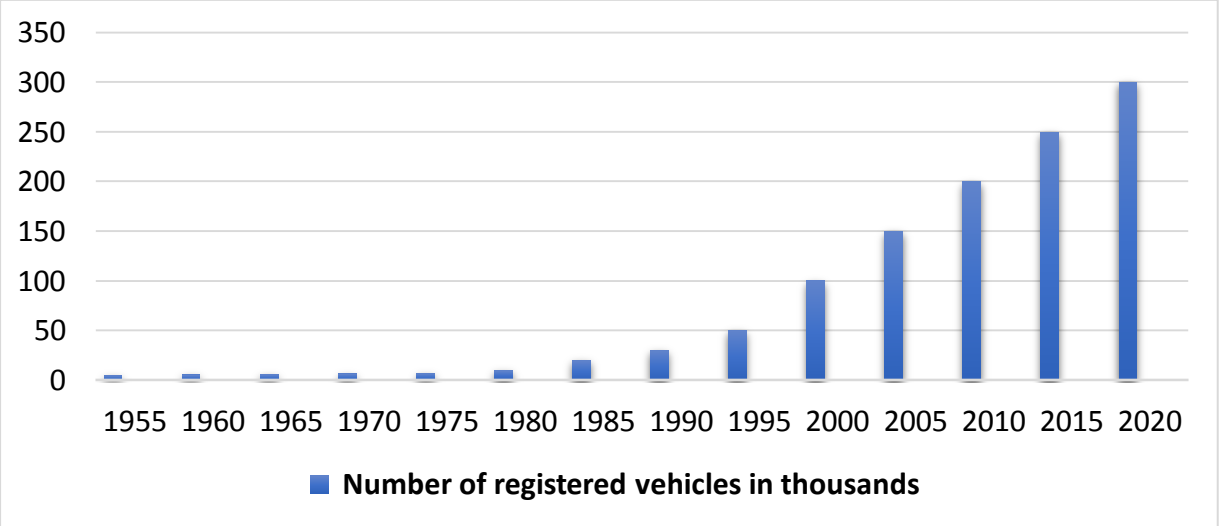
Bicycles, rickshaws, pedicabs, animal-drawn carts, and walking are examples of non-motorized transportation. However, animal-drawn vehicles are primarily utilised in rural regions. Bicycles, cycle rickshaws, and walking are among the human-only modes covered in this article. Walking is the primary mode of transportation in big cities.

Reasons for the decline of NMT:

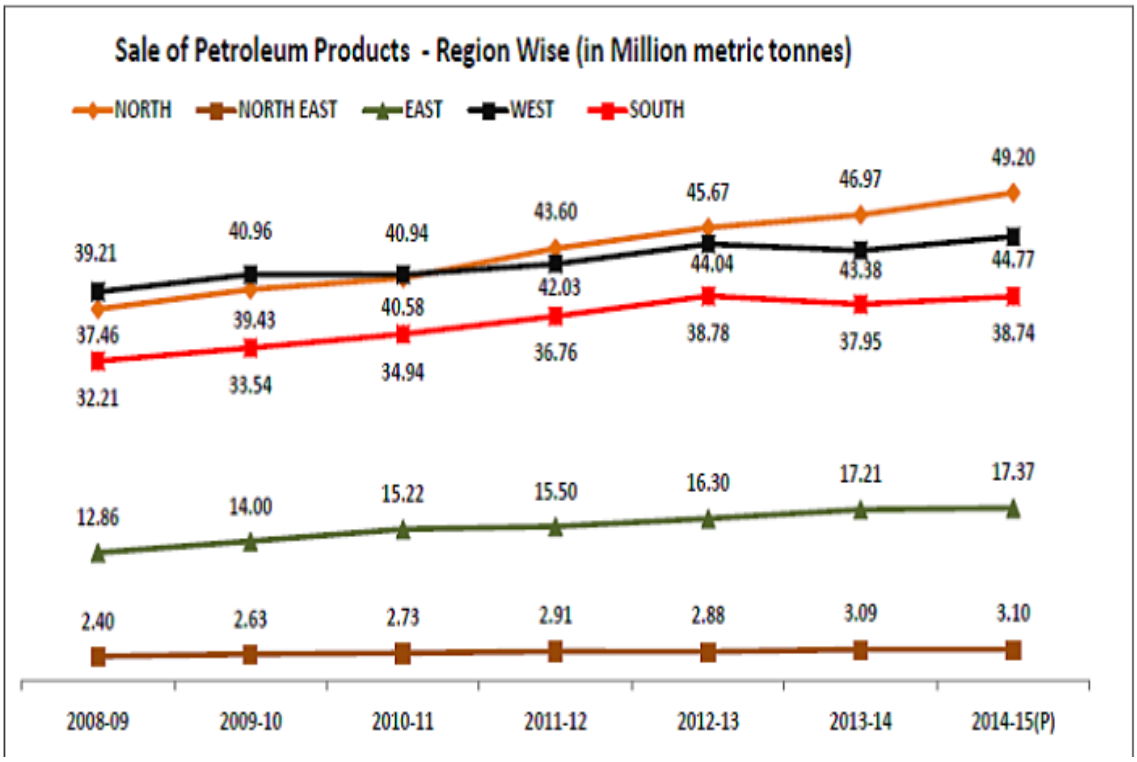
- ♣ Individual features are age, income, and physical abilities
- ♣ Bicycles are not convenient with slopes higher than 4 per cent.
- ♣ Weather conditions (temperature, wind, rain, snow).
- ♣ Infrastructure is also frequently mentioned as a factor. Bicycle paths may be quite instrumental to improve the convenience and safety of bicycle trips.
- ♣ Non-motorised transport modes tend to be associated with low status people.
- ♣ Private-vehicle-oriented transport and spatial planning, which is business-as-usual in most countries, particularly developing.
- ♣ **Public perception and status**: walking, cycling (and public transport) is perceived as the transportation mode for the poor. The richer part of the population often has a disproportionate decision power, which makes NMT-focused policy risky. Often in developing countries there is a gender bias towards male cyclists.
- ♣ **Safety**: pedestrians and particularly cyclist are vulnerable, and therefore need separate road space, or at least be respected and taken note of by vehicle users. Lack of social safety, especially for females can also be a barrier. NMT users have a higher risk of being involved in accidents than car users, particularly in developing countries.
- ♣ Lack of convenient public transport, which is required to make NMT a good option for multi-modal trip (i.e. the combination of cycling and rapid bus or rail systems).
- ♣ Chicken-and-egg problem: people don't start cycling if there are few cycle lanes, and planners don't build these when there is no interest in cycling.
- ♣ Lack of overall long-term, integrated vision and planning.
- ♣ High costs for bicycles, including taxes.

Growth of automobiles in India

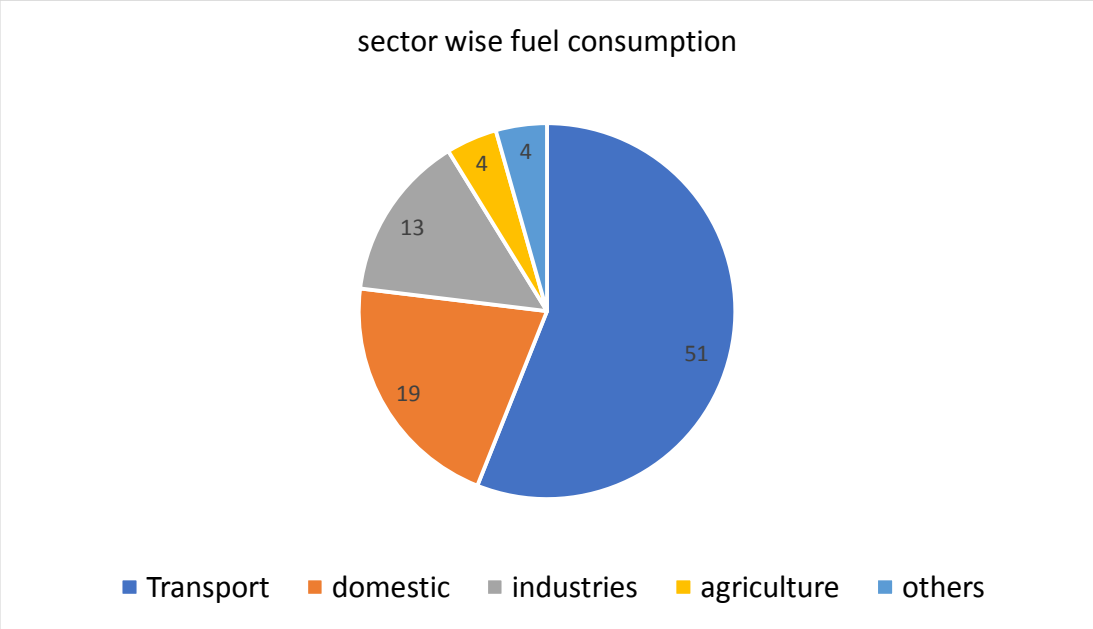
India's demand for transportation is continuously increasing. The demand for road transportation has grown as a result of sustained economic development, improved road infrastructure, and greater family disposable income. Since 1951, the number of registered motor vehicles in India has been steadily increasing. The total number of registered automobiles expanded from around 5 thousand in March 1955 to 300 thousand as of 2020.Between 2006 and 2016, the total number of registered cars in the nation increased at a compound annual growth rate (CAGR) of 9.9%.



Even the sale of petroleum products has been increased during the period from 2008 to 2015. when considered from north to south and east to west the sale of petroleum products are high in north, north east and south regions than east and west regions



When it comes to fuel consumption, the agriculture sector uses 4%, the industrial sector uses 13%, and the domestic sector uses 19%, but the transportation sector uses 51%, which is quite high as shown in the below pie chart.



NMT Policies

Chennai NMT policy:

The Greater Chennai Corporation, the municipal administration of Chennai, India, enacted a Non-Motorised Transport (NMT) Policy in 2014 to promote walking and cycling while reducing the use of personal automobiles. The policy seeks to reverse the ongoing drop in walking and cycling by establishing a secure and enjoyable network of footpaths, cycle paths, green spaces, and other NMT facilities.

Despite the absence of secure non-motorized transportation facilities, one-third of all trips in the city are already conducted by foot or by bicycle. Through a restructured urban transportation network, the Corporation's Chennai Street Design Project will guarantee that these trips become safer, healthier, and more pleasurable. The Corporation will examine the policy's performance using indicators such as walking and biking modal shares, pedestrian and cyclist fatal crash incidence, footpath and cycle track usage, public transportation modal share, and private motor vehicle kilometres travelled.

To meet these objectives, the policy mandates that at least 60% of the city's transportation budget be spent on building and maintaining NMT infrastructure. Wider sidewalks, safe cycling infrastructure, better-designed crossings, and street furniture comes under this.

The city has set great objectives for itself, including constructing safe and continuous pathways on at least 80% of all streets by 2018, increasing the percentage of walking and cycling trips to over 40%, and, most importantly, eliminating pedestrian and cyclist deaths by 2018. The Greater Chennai Corporation has created approximately 50 kilometres of high-quality sidewalks so far. The innovative NMT Policy has encouraged numerous national and international cities to implement similar programmes from Chandigarh to Nairobi

The National Urban Transport Policy for India:

Priority is given to non-motorized transportation under India's National Urban Transport Policy (issued by the Ministry of Urban Development, Government of India, in April 2006). The NUTP identifies the importance of para-transit's function, especially for short journeys, as well as its growing, although unwise, usage as a substitute for declining public transportation systems. General improvements in public transportation should, in theory, restore para-transit (including rickshaws) to its former position in the transportation hierarchy, and this should be kept in mind while discussing NMV facility upgrades to ensure that they do not clash with other plans. some of the crucial points from the NUTP policy.

- Cyclists and pedestrians' safety concerns must be addressed by supporting the creation of separated bicycle and pedestrian lanes. Traffic flow would be improved if vehicles travelling at various speeds were separated.
- Not just on arterials, but also on approach roads to public transportation stations, segregated NMV pathways are necessary. When paired with the development of NMV parking, this will boost the usage of public transportation.
- It is critical that NMT facilities be developed and built with the assistance of the government and the community (i.e., potential users).
- To ensure pedestrian safety, activities on pathways such as street sellers must be carefully supervised.

V. Environmental impacts

Air pollution is one of the most significant environmental issues in metropolitan areas, where the bulk of the population is subjected to unhealthy air. India's increasing urbanisation has resulted in a massive increase in the number of automobiles. Cars are currently the primary cause of air pollution in cities, as the number of vehicles continues to rise and congestion rises as a result.

Our country has implemented a variety of initiatives to enhance city air quality. Improvements in fuel quality, the adoption of appropriate policies and laws of vehicle emission standards, better traffic planning and management, and so on are among them.

Vehicles have a major impact on the environment through their manufacture, use and eventual disposal. It is estimated that the CO_2 emissions produced over a car's lifespan 10% come from its manufacture and 5% from its disposal, with the remaining 85% coming from fuel use and servicing operations. Pollutants that are considered include not only emissions from motor vehicle exhaust, fuel evaporation and the resultant secondary pollutants, but also pollution produced by the wearing down of tires and metals.

Carbon monoxide (CO), nitrogen oxides (NOx), photochemical oxidants, air toxics, benzene (C6H6), aldehydes, 1,3 butadiene (C4H6), lead (Pb), particulate matter (PM), hydrocarbon (HC), sulphur oxides (SO2), and polycyclic aromatic hydrocarbons are the most common pollutants released as a result of vehicle/fuel emissions (PAHs). While hydrocarbons and carbon monoxide are the most common contaminant in petrol/gasoline-powered cars, the predominant pollutants from the diesel-based vehicles are Oxides of nitrogen and particulates.

Table 1 comparison of emission of different modes of transport

Transport mode	Passenger average	Co2 emission (g/km passenger)
Plane	88	285
Train	156	14
Bus	12.7	68
Motor bike	1.2	72
New car	4	42
Old car	4	55
Bicycle	1	0.3

Some of the impacts of secondary pollutants are

Photochemical smog which is also known as **"Los Angeles smog,"** is a mixture of pollutants that are formed when nitrogen oxides and volatile organic compounds (VOCs) react to sunlight, creating a brown haze above cities. It tends to occur more often in summer, because that is when we have the most sunlight.

Pollutant	Concentration (ppb) (1 hour average)	
	Highly polluted	Moderately polluted
PAN	5-35	0.5-5
Hydrocarbons (excluding methane)	500-1200	50-300
Sulphate aerosol (µg m-3)	10-50	5-15
Nitrate aerosol (µg m-3)	10-50	5-15

Table 2. Concentrations of PAN and aerosols in typical polluted atmospheres

Acid Rain is an important regional environmental problem. Although motor vehicle emissions are not the major cause of acid deposition, their contribution cannot be overlooked. In addition to those aerosols produced in photochemical smog, sulphate and nitrate compounds are formed under other atmospheric conditions and mechanisms and contribute to the production of "acid rain". Acid rain refers to rainwater and dry deposition with high acidity (low pH value). The most important strong acids in a polluted atmosphere are Sulfuric acid (H2SO4), Nitric acid (HNO3), Hydrochloric acid (HCl).

Health effects due to pollutants

Pollutants are harmful to both human health and the environment. Pollutants produced by cars have a wide variety of negative health and environmental consequences. In some situations of acute exposure to pollutants, particularly carbon monoxide, the consequences can be both direct and indirect, ranging from impaired visibility to cancer and death. The respiratory and cardiovascular systems are supposed to be directly affected by these pollutants. High levels of Sulphur Dioxide and Suspended Particulate Matters, in particular, have been associated with higher mortality, morbidity, and pulmonary function impairment.

Pollutants	Effect on human health
Carbon monoxide	Affects the cardio vascular system, exacerbating cardiovascular disease symptoms, particularly angina; may also particularly affect foetuses, sick, anaemic and young, children, affects nervous system impairing physical coordination, vision and judgements, creating nausea and headaches, reducing productivity and increasing personal discomfort.
Nitrogen Oxide	Increased susceptibility to infections, pulmonary diseases, impairment of lung function and eye, nose and throat irritations.
Sulphur Dioxide	After lung function adversely.
Particulate Matter and Respirable Particulate Matter (SPM and RPM)	Fine particulate matter may be toxic in itself or may carry toxic (including carcinogenic) trace substances, and can alter the immune system. Fine particulates penetrate deep into the respiratory system irritating lung tissue and causing long term disorders.
Lead	Impairs liver and kidney, causes brain damage in children resulting in lower I.Q., hyperactivity and reduced ability to concentrate.
Benzene	Both toxic and carcinogenic. Excessive incidence of leukaemia (blood cancer) in high exposure areas.
Hydrocarbons	Potential to cause cancer.

VI. Pedestrian Facilities

Sidewalks and walkways are "pedestrian lanes" that provide people with space to travel within the public right-of-way that is separated from roadway vehicles. Such facilities also improve mobility for pedestrians and provide access for all types of pedestrian travel: to and from home, work, parks, schools, shopping areas, transit stops, etc. Walkways should be part of every new and renovated facility and every effort should be made to retrofit streets that currently do not have sidewalks. The Institute of Transportation Engineers (ITE) guidelines recommend a minimum width of 1.5 m (5 ft) for a sidewalk or walkway, which allows two people to pass comfortably or to walk side-by-side. Wider sidewalks should be installed near schools, at transit stops, in downtown areas, or anywhere high concentrations of pedestrians exist. Sidewalks should be continuous along both sides of a street and sidewalks should be fully accessible to all pedestrians, including those in wheelchairs. Due to increase in traffic, it is difficult to walk along the road and accessibility of short journeys.
Various pedestrian facilities and their purposes are:

1. Side walk /walk ways: Creates the appropriate facility for the walking area of the public right-of-way. and improves pedestrian safety dramatically.
2. Curb Ramps: Provides access to street crossings.
3. Marked Crosswalks and Enhancements: Warns motorists to expect pedestrian crossings. Indicates preferred crossing locations.
4. Bus stops: Provides safe, convenient, and inviting access for transit users.
5. Roadway Lighting Improvements: Enhances safety of all roadway users, particularly pedestrians and commercial districts. Improves night time security.
6. Pedestrian Overpasses/Underpasses: Provides complete separation of pedestrians from motor vehicle traffic. Provides crossings where no other pedestrian facility is available. Connects off-road trails and paths across major barriers.
7. Street Furniture/Walking Environment: Enhances the pedestrian environment and enliven commercial districts by fostering community life.

Problems identified

- ✓ Usage of motorized vehicles for shorter distance because of unsafety sidewalks
- ✓ Sidewalks too close to high-speed traffic, discouraging pedestrian travel because of traffic noise and perception of hazard.
- ✓ Security problems on some pathways, primarily in secluded areas.
- ✓ Lack of curb ramps or improper design of curb ramps.
- ✓ Overpasses and underpasses are infrequently justified and, without proper planning, are underutilized.
- ✓ Information provided to the pedestrian is often lacking, confusing or misleading.

Methods to improve pedestrian safety

Inadequate roadway designs have been related to certain pedestrian accidents. Pedestrians and motorists equally contribute to pedestrian accidents by violating or failing to follow the regulations governing safe driving and walking. Because the majority of accidents are caused by human mistake, they will not be entirely avoided as long as people and motors occupy the same area.

However, because speeding, failure to yield, and neglecting to check both ways for traffic increase the effects of these accidents, new education, enforcement, and engineering solutions are required to manage the conflicts between pedestrians and motors.

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A complete program of pedestrian safety improvements includes:

- Provision of pedestrian facilities, such as sidewalks and crosswalks.
- Roadway and engineering measures, such as traffic control devices, lighting, and roadway design strategies implemented on streets and highways for both pedestrian and vehicular movements.
- Programs to enforce existing traffic laws and ordinances for motorists (e.g., obeying speed limits, yielding to pedestrians when turning, traffic signal compliance, obeying drunk-driving laws) and pedestrians (e.g., crossing the street at legal crossings, obeying traffic and pedestrian signals).
- Forgiving vehicle designs that minimize pedestrian injury from vehicle impact.
- Wearing of reflective clothing and materials by pedestrians, and/or using a flashlight when walking at night.
- Education programs provided to motorists and pedestrians.

VII. Conclusions:

- Reducing the pollution and traffic in fast growing cities is necessary by promoting non-motorized vehicles.
- Pedestrian facilities makes short distance travelling easy, further improving the safety of pedestrians.
- Walking and cycling increase the immunity power.
- This technology could contribute to socio economic development and environmental protection

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