

# **AN INVESTIGATION OF THE FACTORS OF THE DESIGN OF ROADS THAT AFFECT PLANNING FOR TRAFFIC (PEDESTRIAN) SAFETY IN THE THIRD WORLD**

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## **INTRODUCTION**

Since the rapid development of urbanisation and industrialisation, the increasing use of motor vehicles, bicycles, on urban road systems, as well as other relevant problems, have made the road systems most of the developed and underdeveloped countries more crowded.

In the Third World and less developed countries there are sections of the road, subjected to heavy traffic flow, aligned by poor building stock, containing mixed land-use, void of landscaping, with discordant power poles and street structures. Oluwoye (1997) reported that the broad nature of the road and the road environment in the Third World countries are seen as:

- \* Points of traffic congestion where the road has insufficient capacity to cope with existing traffic volumes.
- \* Pedestrian movements -- there is no provision for zebra crossings, no island or refuge, no sidewalk along the road.
- \* Unpleasant living, shopping and working environments due to noise and air pollution.
- \* Inadequate provision for off-street parking and loading facilities, largely brought about by historical circumstances and lack of foresight and investment in the facilities.
- \* Use of public streets for informal activities associated with adjoining properties.
- \* Placement of informal activities on the carriageway.
- \* Parking of cars along the street obstructing pedestrians and leading to a visually unpleasant environment, danger and lack of visibility.
- \* Reduced amenity of adjoining residential development in side streets due to on street parking and traffic movements.
- \* Traffic conflicts/accidents and hazards created by having retail/commercial/industrial development on land fronting commercial roads and requiring vehicle access to it.

Seven issues surrounding the environmental factors that affect the planning for pedestrian safety in the Third World have been identified:

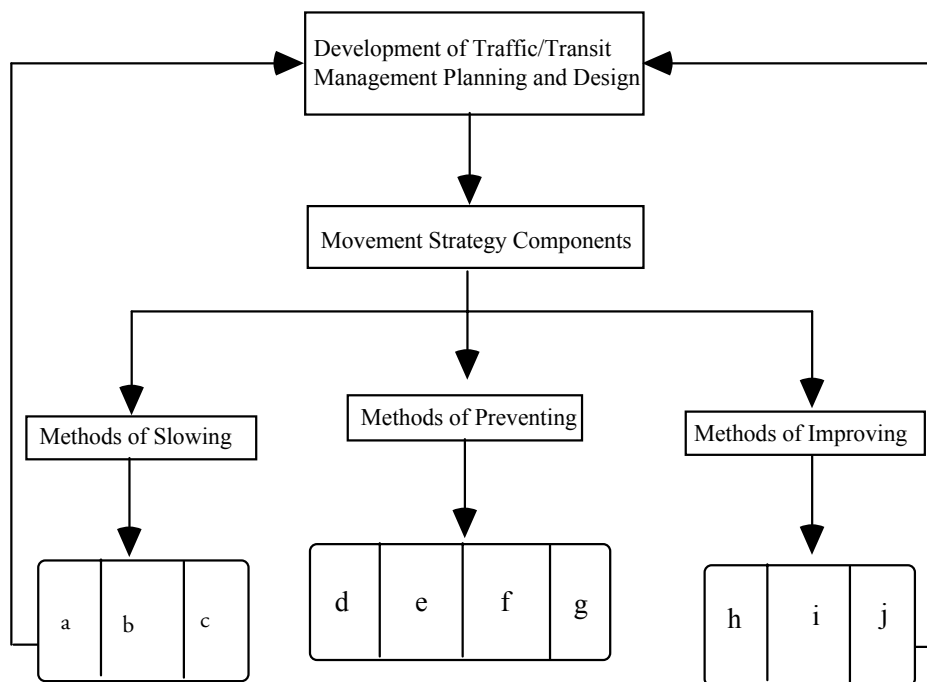
- (1) town planning
- (2) road alignment
- (3) road width
- (4) surface conditions
- (5) parking
- (6) public transport
- (7) footpath

The purpose of this paper is to discuss and assess the environmental factors that affect planning for pedestrian safety.

### CONCEPTUAL MODEL

The use of traffic management techniques provides only one approach to the improvement of the community or pedestrian environment. Notwithstanding, most features of the planning techniques or simple design criteria are to enhance the streetscape or street system for the convenience and safety of the pedestrian. This paper calls for planning of pedestrian safety in order to establish efficient, economical and safe movement of people, goods and services. As traffic is a function of land-use, and in order to design efficient traffic systems, there is need for planned population densities and rational arrangement of land use that generates traffic (Oluwoye, 1999). The land uses must be planned so as to avoid excessive concentration to preserve open spaces and recreation areas, to relate employment centres with residential sectors and to minimise journey to work trips.

Figure 1 and Table 1 shows the traffic calming concept for traffic safety measures automatically includes planning to improve the roads and road environment.



where,

- a = slowing of vehicles at points along a street
- b = slowing average vehicle speed
- c = slowing vehicles through intersections
- d = preventing access to or exit from certain streets
- e = forcing vehicles to turn
- f = preventing or discouraging vehicles from turning
- g = limiting capacity
- h = improving safety
- i = improving street environment
- j = regulatory

**Figure 1: Conceptual Framework of Typology and Traffic Management and Control Devices**

The expressions a to j in conceptual model above are amplified in Table 1 below. However, the application of traffic management principles and techniques is one of the basic approaches for improving the pedestrian environment and promoting pedestrian safety. Most pedestrian environment conditions such as sidewalk and street systems can be improved by the use of simple planning techniques designed to ensure both the convenience and safety of the pedestrian. In fact, some pedestrian environment features, for instance malls or traffic free streets, are actually traffic management techniques. Briefly the author will outline some essential design and planning criteria which need to be considered when planning for pedestrians.

**Table 1: Typology and Examples of Traffic Management and Control Devices**

<p><b>A. Methods of slowing vehicles at points along a street</b></p> <ul style="list-style-type: none"> <li>- Stop signs</li> <li>- Speed bumps and humps</li> <li>- Pavement undulations</li> <li>- Rumble strips</li> <li>- Traffic chokers</li> <li>- Off-set street alignments</li> <li>- Signalization</li> </ul>
<p><b>B. Methods of slowing average vehicle speeds</b></p> <ul style="list-style-type: none"> <li>- Speed limit signs and markings</li> <li>- Narrow streets</li> <li>- Bending street alignments</li> <li>- Channelization</li> </ul>
<p><b>C. Methods of preventing access to or exit from certain streets at intersection</b></p> <ul style="list-style-type: none"> <li>- Full and partial barriers</li> <li>- Turn prohibitions</li> <li>- Do Not Enter signs</li> <li>- One-way streets</li> <li>- Street closings</li> </ul>
<p><b>D. Methods of forcing vehicles to turn</b></p> <ul style="list-style-type: none"> <li>- Diverters and semi-diverters</li> <li>- Turn signs and pavement markings/traffic stars</li> <li>- Do Not Enter signs</li> <li>- Oneway street terminals</li> </ul>
<p><b>E. Methods of preventing or discouraging vehicles from turning</b></p> <ul style="list-style-type: none"> <li>- Turn prohibition signs</li> <li>- Narrow entrances</li> <li>- Barriers</li> <li>- Median barriers</li> </ul>
<p><b>F. Methods of slowing vehicles through intersections</b></p> <ul style="list-style-type: none"> <li>- Stop signs</li> <li>- Traffic signals</li> <li>- Traffic circles</li> </ul>
<p><b>G. Methods of limiting capacity</b></p> <ul style="list-style-type: none"> <li>- Narrow streets</li> <li>- Reducing number of lanes</li> <li>- Increasing parking</li> <li>- Traffic chokers</li> </ul>

**H. Related methods of improving street environment**

- Increasing sight distances
- Limiting parking near intersections
- Marking cross walks
- Installing pedestrian signals
- Installing pedestrian safety islands

**I. Methods of improving street environment**

- Planting of trees and shrubs
- Street maintenance
- Litter removal
- Better street lighting
- Installation of parks

**J. Regulatory Methods**

- Banning Ordinances (e.g. trucks)
- Parking Ordinances
- Enforcement Policies

**ANALYSIS OF FRAMEWORK*****Town Planning***

In planning, land use activity zoning is essential. Sound knowledge of town planning techniques is also necessary for locating pedestrian-generating activity centres/places in such a way as to reduce conflicts between pedestrians and vehicles within the town.

While it is quite important to locate or zone pedestrians and traffic-generating places such as shopping centres, commercial and industrial estates, schools, recreational areas and so on, on accessible sites, at the same time, they should be carefully zoned to enhance the streetscape and allow for safety.

Careful design and planning with provision of open space for pedestrians, playing or recreational areas for children away from vehicular flow and for minimal through traffic on local streets in residential areas, where pedestrians accidents particularly those involving young children are likely to occur, will reduce pedestrians and vehicular conflict. Planning designs should lay emphasis on potential pathways for pedestrians.

Also, a good distinctive road hierarchy and the control of the associated land-uses should be considered for pedestrian safety. The main aim of establishing a road hierarchy is to rationalise the primary functions of the road system. At the higher levels in the hierarchy such as freeways and arterials - the primary function of roads is the movement of road traffic. But down the hierarchy, roads become increasingly multi-functional, combining traffic movement with land use access (Westerman, 1985, Oluwoye and Zehner, 1987, Oluwoye, 1988). In developing countries most arterials and distribution roads do accommodate heavy traffic volumes and they also serve as public transport routes. Incidence of both pedestrians and vehicle conflicts is usually high on local distribution roads because they carry the major proportion of local access, which is unavoidable. Traffic management measures such as reduced speed limits, junction priority treatment and roundabouts could be designed or provided to reduce pedestrian and vehicular traffic conflicts. These measures would also help to alleviate conflicts with local traffic.

### ***Road Alignment***

The alignment of the road is significant. It should provide adequate interaction between motorist and pedestrian in developing countries. An early view of pedestrians by motorists is very important. Visibility can be enhanced by the removal of parked vehicles and other roadside obstructions, such as illegal pole or shed erections (typical in Africa) or by modifications to the layout of pedestrian facilities. However, the layout of the road is a very significant factor. There needs to be a balance between long straight sections of the road, for this sometimes reduces the perception of distance while sharp road curves reduce sight distances.

It is also necessary to bear in mind when planning in developing countries, that the vertical alignment of any road is dictated by the topography hence whenever such details presents minimal sight distances, appropriate road design features need to be incorporated into the road layout to modify, separate or restrict pedestrian movement in order to prevent conflicts. (Office of Road Safety, Canberra 1978).

### ***Road Width***

Usually at intersections, there are conflicting needs between pedestrians and motorists with regard to road width. While pedestrians require a narrow road with minimal time to cross the road thereby reducing their vulnerability, the motorist requires sufficient width to provide a road capacity that is compatible with the total vehicular flow.

Thus at intersections, road widening may have an adverse effect on capacity especially at signalized intersections. At such intersections, use of channelisation to divide a crossing into more than one movement as well as pedestrian refuges or medians may be appropriate in assisting pedestrians across such wider streets. However, such features increase the total road width, and at signalized intersections may require a pedestrian to take two signal cycles to complete the crossing. However, channelisation could serve the following purposes in enhancing pedestrian safety:

Segregation of pedestrian waiting points from vehicle flow by providing refuge islands across the vehicular flow and prevention of prohibited movements (of both pedestrians and vehicles) by siting barrier islands at entry to or exit from a street (Fisher, 1985).

### ***Surface Conditions***

This can considerably increase the vulnerability of pedestrians to vehicular traffic. In areas where pedestrians generating activity is relatively high, the road surface should be designed to provide good skid resistance particularly in wet conditions when possible reduced visibility could greatly increase danger to pedestrians. This is very essential at the approaches to intersections and pedestrian crossings where vehicles may have to brake suddenly.

Similarly, surface colour is another important principle. Surface texture and colour can be used to delineate an area of pedestrian activity, particularly to emphasis pedestrian crossing location in order to enhance visibility of pedestrians. Also, roads in areas of pedestrian activity should be well maintained: to eliminate the possibility of pedestrians falling and stumbling as well as reduced mobility which is likely to distract the motorists attention.

## ***Parking***

Parking control is one of the significant traffic management techniques. Control should be implemented to increase and provide pedestrian safety through increased visual perception of pedestrians and motorists.

Although parked vehicles place a barrier between the pedestrian and moving vehicles, they do provide a degree of protection from uncontrollable intrusion of moving vehicles into the pedestrian area. Also, parked vehicles tend to reduce the width of unprotected roadway to be crossed by pedestrians, thus reducing over-all exposure to some degree. However, the increased risk resulting from the reduction of visual perception both by pedestrians and motorists outweighs the advantage of reduction in width of road to be crossed.

Vehicles, which stop abruptly also, create problems and those, which are temporarily, stopped; especially the commercial and public transport vehicle without fixed or authorized stopping locations. Problems (congestion) also result where there are no specified loading zones for commercial vehicles. (This constitutes a major problem in most town/cities). Particularly in third world countries, there is indiscriminate stopping of public transport to drop off and pick up passengers. Also, indiscriminate stopping and parking of commercial vehicles to load and unload goods similarly most private vehicles stop abruptly to transact business with the hawkers or street traders. Consideration should be given to convenience in loading and unloading zones. The size of most vehicles reduces the visibility interaction and thus increases risk to pedestrians, hence location of loading zones closer to pedestrian facilities such as bus stops, and pedestrian crossings should be avoided.

The possibility of conflict between vehicles leaving a parking space and pedestrians crossing or waiting at the rear of a vehicle to cross the road seems higher in the case of angle parked vehicles than for parallel parked vehicles. Apart from reducing such traffic problems particularly congestion; off-street parking design could help to improve pedestrians safety.

Also, minor road junctions with a major road require specific sight lines incorporated in the design of the junction; such design of necessary sight lines would help reduce the possibility of conflicts between pedestrians and vehicles.

## ***Public Transport***

There is a need for pedestrian facilities in most areas of pedestrian activity. Obviously, in developing countries most areas of pedestrian accidents are coincident with public transport routes; simply because there is no provision of Zebra crossings. Pedestrians cross the road anywhere and anytime at their risk. There should be provision of facilities for pedestrians to cross the road; this is very important in traffic management.

## ***Footpaths***

Footpaths should be mandatory in towns and cities because they are an important element in the reduction of pedestrian and vehicular conflicts.

The provision of a kerb provides visual and some physical separation and assists in channelling both the motorist and the pedestrians (Fruin, 1971; Pushkarev, 1975).

Appropriate footpath design requirements are related to the following factors of comfort and convenience of pedestrians. Although these have been discussed (earlier) the author will briefly elaborate on them:

\*Alignment - should provide the most direct link possible between origin and destination and should provide continuity of movement.

\*Surface - a sealed, uniformly surface and well-drained surface should be provided. Where footpaths, cross roads, midblocks/intersections, ramps should be provided at kerbs.

\*Grades - grades should not exceed 5%. Greater grades should be treated as ramps with special non-slip surface and handrails. Long grades should be provided with flat areas at intervals.

\*Width - footpath width is a function of the capacity required and published figures are available relating width to volume.

The width required is that which is free of permanent obstructions such as telephone shields, posts, signs public transport shelters and so on. The temporary obstruction of footpaths during demolition and constructions works, replacement of services and so on in well trafficked areas can cause increased risk because of displacement of pedestrians and the provisions of temporary facilities needs to be monitored.

Lighting -Adequate lighting of footpath surfaces and areas is necessary for nighttime traffic. Where the pedestrian system is separated from the road, lighting both for public security and comfort is required.

## CONCLUSIONS

The application of traffic management principles and techniques is one of the basic approaches for improving the pedestrian environment and promoting pedestrian safety in developing countries. Most pedestrian environment conditions such as sidewalk and street systems can be improved by the use of simple planning techniques designed to ensure both the convenience and safety of the pedestrian and driver along the arterial roads.

In overall planning in developing countries, the road hierarchy and the control of the associated land-use along the different types of roads are essential. Sound knowledge of town-planning techniques is also necessary for locating pedestrian-generating activity centres/places in generating such a way to reduce conflicts between pedestrians and vehicles within the town.

In the greater bulk of urban areas in developing countries (eg) road/road environment all the factors mentioned above should be considered in new development or redevelopment areas with scope for the introduction of footpath systems on pedestrians areas separate from the road alignment. It is important that these systems provide both continuity and direct access if they are to serve these functions effectively.

The more obvious areas of need for consideration of pedestrian's requirements are in the regional and central retail/commercial areas.

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