Integrated Urban Transportation - A Major Challenge for Transportation Engineers

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Abstract
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BY

Vukan R. Vuchic, Ph.D.

ABSTRACT

Pedestrians, private automobile, public transportation and other modes are components of a total urban transportation system. However, for historical reasons and because of major differences in their physical, operational and cost characteristics, different modes are being planned and operated by different organizations or public agencies.

Coordination among these organizations is seldom adequate. Highway and street departments tend to consider the automobile as their main "client"; transit agency and its passengers are still sometimes considered as a separate system, while pedestrian travel is often simply "allowed to adjust itself" to the conditions dictated by auto traffic and various other constraints.

Although some improvements have been made in recent years through founding of metropolitan planning agencies and transportation departments, most cities are still far from having integrated transportation systems which would provide high quality travel at moderate cost and with low negative side effects.

Inadequate coordination, and often direct competition among agencies in charge of different modes are a major reason of the serious problems in urban transportation. Complexities of modern cities require a much more careful planning and coordination of all transportation modes than is presently the case. The need for such improvements continues to increase with the energy crisis, requirements for improved urban environment and the economic and social problems of our cities. Urbanized civilizations cannot progress if their cities are deteriorating.

Transportation, including all modes, should be treated as a single activity which must be closely coordinated with urban form and land use. A careful balance must be achieved between functional requirements (performance and economics) of transportation systems, affecting directly its users, and urban environment, concerning all population (users and non-users).

Coordination of different modes should be based on the fact that the basic unit in transportation is not a vehicle, but a person. Recognition of this fact will lead to much greater applications of priorities for public transportation. While the automobile will continue to dominate many categories of urban travel, a substantial portion of present auto use should be shifted to public transportation to achieve benefits of decreased total cost of urban travel, lower negative impact of transportation, improved reliability of auto travel (less congestion) and reduced energy consumption.

Since no significant construction of urban freeways is expected in the foreseeable future, auto travel must be improved by making more efficient use of existing facilities. Modern traffic engineering design and regulatory measures, often neglected during the period of extensive freeway construction, hold a considerable potential. Full control of parking supply and rates can contribute to prevention of excessive congestion during peak hours. It can be effectively used as a disincentive to auto use for certain trip categories. Improved pedestrian facilities are also an important component of an efficient transportation system. These improvements depend, however, on a better balance between expenditures for private and public components of transportation systems than is the case now. The present situation, where many individuals pay thousands of dollars for luxurious vehicles while many states and cities have no funds for modernization or maintenance of streets is a paradox which must be corrected.

The changing trends represent a challenge and a major opportunity for us transportation engineers. Our role should become broader and more important for cities than it has been up to now. But we will assume that role and utilize its opportunities only if we broaden our views from the private automobile and highway only, to the entire transportation system. Change of our title is not sufficient: broadening of technical knowledge systems are needed. Our steps in that direction have often been reluctant so far. Unless we accelerate them, we will miss this challenge to respond to the urgent need for improvement of our cities.
INTEGRATED URBAN TRANSPORTATION - A MAJOR CHALLENGE FOR TRANSPORTATION ENGINEERS

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As public servants, traffic engineers have traditionally had to respond to changes in our society's economy, living habits and values. In recent years, however, we have witnessed particularly strong changes in urban transportation, the primary area of traffic engineer's involvement. Increased concern about both positive and negative impacts of transportation on cities, desire to preserve neighborhoods, reduced availability of public funds, energy constraints and changing governmental roles have all been factors requiring attention. There is the need for new approaches and solutions to transportation, encompassing all modes and a broader scope of issues than has traditionally been the case. The traffic engineer faces the challenge to respond to these changes and to assume the role of transportation engineer. Are we prepared to accept that challenge and regain the position of leadership in urban transportation?

Traditional Practices

Some of the present problems in urban transportation can be easily traced back to historical developments over the past several decades.

Transit services were originally introduced in cities as private profit-making undertakings. Their public role as an essential service, however, soon became recognized, and this led to early instances of public control of transit services and fares. Even financial assistance to transit was not introduced in some countries earlier than is sometimes believed: for example, in 1887 the British Parliament adopted the "Cheap Trains Act" allocating £2 million to suburban railroads in order to keep their fares and enable lower income people to commute. Yet, we still sometimes evaluate transit services not by their quality and the number of passengers they serve, but by their financial results (profit or deficit), a totally inappropriate criterion.

Streets and highways, traditionally recognized as public facilities, must serve a multitude of activities: travel of public and private vehicles, through and local trips, including walking, meetings, play and other community activities. However, the widespread introduction of the private auto to our streets and highways led to the suppression of most of these roles in favor of only one: facilitating auto travel. Persons in charge of these facilities - traffic and highway engineers - began to consider the auto driver as their only client. Little attention was given to faster and more reliable travel of transit vehicles, while pedestrians were often treated as an interference to auto traffic which should be minimized.

Parking facility operators represent another nearly independent group which strongly affects the entire urban transportation: they are generally interested in maximum profits and operate their facilities accordingly, although that type of operation is often directly contrary to the public interest. Parking can be used, though its rate structure to influence travel patterns and intermodal distribution. Public parking authorities in most cities are no more responsive to the public interest than the private operators.

This traditional division of urban transportation activities by modes and facilities has led to serious problems, compounded by the practice of short-range planning without full consideration of the total urban transportation system and its role in cities. The process followed in most of our cities for several decades, shown in Fig. 1, created the "vicious circle in urban transportation" which led to excessive construction of highways and parking facilities, and deterioration of transit services. It should be noted that the basic policies adopted toward these two major modes intensified, rather than corrected the development of the vicious circle, leading to the crisis we are facing now. Transit was treated too long as a private business without any assistance, while the Highway Trust...
Fund created a separation of auto driving from other types of travel in physical mode, rather than by function. Denomination of transit service to "second class" distinction was a result of these policies.

The extreme favoring of private expenditures while suppressing financing of public facilities has not been reflected only between auto and transit, but also within the auto/highway system itself. While prices of automobiles, their repairs, gasoline, etc. have been continually increasing, most of the taxes have increased much less, if at all. Thus the 4c/gallon federal tax on gasoline has not changed for some 20 years. The consequence is our rapid progress toward extreme private affluence and public poverty. Many auto drivers pay $5000-8000 for their automobiles with power steering, stereo music, etc., and then drive them over highways with potholes, intersections without channelization and with poorly maintained signals. Allocating a tax of 2-3c/gallon to badly needed modernization of both streets and transit services in our cities is bought by all available means, while much larger increases in gasoline price by its suppliers will be accepted as "normal." It should be understood that proper financing of public components of urban transportation would benefit not only transit riders, but also auto drivers, and thus the cities in which both of them live.

In addition to these traditional, but also obsolete attitudes, we often suffer from a strong "modal fanaticism." The emotional antagonism between "auto people" and "transit people" is a major obstacle to finding the best solutions. "Bus vs. rail" is another common debate issue. A proper understanding of characteristics of each mode could greatly facilitate a consensus on their optimal roles in cities. For example, car-pooling is never competitive with local bus service on streets, which, in turn, is not competitive with rail transit. Advocacy for each one of them against the others is therefore counterproductive. Each one of these modes serves a different category of trips; in many cities all three should operate as complementary modes in an integrated system.

Recent Developments

A number of changes which have taken place in recent years have been aimed at correcting the deficiencies of policies that are restricted to or favor a single mode. The improvements have been, however, far from adequate.

Metropolitan area transportation planning agencies, founded to perform comprehensive planning of integrated multimodal transportation systems, failed in most metropolitan areas to take a leadership and guidance in developing and implementing plans. Sometimes they merely collected individual plans of the agencies within their jurisdictions and put them together into an "integrated plan," without checking their mutual compatibility. They generally paid little attention to transit; they sanctioned the plans developed by highway departments, later approved deletions of highways from the same plans, responding in each case to political pressures instead of guiding governments in establishing transportation policies. They were never given the powers required for effective planning and implementation of plans. Apprehension toward planning, based on various prejudices, is still quite deep in our society. If a corporation plans poorly and goes bankrupt, its management is considered shortsighted. If a governmental agency plans, some voices always criticize it for "big government" accusations. Massive pressures are often exercised to change individual parts of plans, often defeating their overall goals.

Citizens groups have become very active in transportation planning in our cities. Many engineers complain that such citizen activities only serve selfish interests of individual groups, or as public forums for unsatisfied ego-centric axes. While this has sometimes been the case, it would be a dangerous deception if all citizen activities were considered in this light. In many cases citizens have shown better common sense and a deeper understanding of the wider impacts and complexities of urban transportation planning than the engineers who focused on planning only the single facility in question. Many highway departments made a grave mistake by following actions which placed them in the role of defendants in numerous court suits. Instead of popular leaders in public projects, many highway engineers are today often perceived as representatives of agencies which support special groups against the interests of the public.

Most of the state highway departments have now been changed into departments of transportation, reflecting the need to handle all modes of transportation in a coordinated manner. This significant step has been made, but the scepticism, interest and financing for different modes are still very uneven: the traditional heavy focus on highways is still clearly visible.

Public transportation systems in nearly all large and medium size cities have been transferred from private to public ownership. Their management attitudes have changed accordingly, giving more attention to public needs than to short run financial results. But the agencies are still severely handicapped by at least three major factors. First, lack of a stable source of financing (this has been resolved in only a few cities, e.g. Salt Lake City, Atlanta). Second, inadequate cooperation from other agencies such as city police, streets and highway departments, and others. And third, the shortage of experts, particularly young persons, well versed in transit planning, design, and operation.

Current and Future Trends

Several recent and current changes in our economy and society have a direct influence on urban transportation. The major ones which should be considered in our attitudes and policies are described below.

Increasing emphasis is given to the quality of life and, consequently, quality of urban environment. Under this term we should understand not merely the absence of pollution and noise, but the shape and character of the man-made environment. This requires therefore not only "negative intervention," i.e. prohibition of air and water pollution, etc., but also positive planning of urban areas, sections and facilities. Our society is becoming more willing to sacrifice some functional efficiencies and pay additional costs to achieve a better environment than it was the case in the past.

Another change is that expansion of facilities,
particularly freeway systems, has been drastically curtailed. The emphasis is clearly shifting away from construction of new facilities to better utilization of the existing ones. The transportation engineer's role is changing in character, but not necessarily in importance. Serous neglect of existing streets and highways in the past, during the highway construction era, has created conditions for major potential improvements in flow of pedestrians, automobiles and transit vehicles on urban streets. The task is technically a most interesting one.

The third major change is, of course, the energy situation which will probably become an increasingly important factor in the near future. It will influence types of vehicles we are using and intermodal distribution of travel, but, most significantly, it is likely to change the life styles to an extent which may have more impact on transportation than the direct impact higher energy prices will have on our transportation systems.

Do these trends indicate that the automobile will eventually become economically unfeasible and that our cities will return to the forms typical of pre-automobile era? The answer is clearly negative: no such drastic changes can take place. Nothing can fully replace a personal vehicle, regardless of whether it is gasoline or electrically powered, large or small, etc. The changes that should take place include, however, certain shifts of travel among modes: decrease of auto use in central cities, where it can be substituted to a great extent by improved transit and walking; reduced volume of suburban travel through better coordination of land uses with transportation facilities, etc. It is important to start actions for such changes as soon as possible: the later the changes occur, the more drastic and costly they will be. Fundamental changes in policies, design and operation of transportation systems must therefore be given immediate and careful attention.

Towards Improved Urban Transportation

Definition of methods and strategies for achieving better urban transportation is, naturally, an extremely complex task. However, it is useful to briefly list and discuss the basic elements of the general approach, policies and tools, particularly those which are presently direct obstacles to improvements.

The Approach. The first precondition for making improvements is to achieve a better understanding of the entire system of urban transportation. If total urban passenger travel is considered as a basic function (instead of operation of an individual mode), it becomes clear that efficient transportation in all but very small cities can be achieved only by a combination of several different modes. The "family of modes" includes the auto at one extreme of service (dispersed trips), regional rail on the other (high intensity of trips), with paratransit, local bus and trolleybus, express bus, light rail and rapid transit between them. Allocation of different roles to individual modes should be a result of imaginative planning and careful analyses of a number of criteria such as levels of service, passenger attraction, costs and impacts. The modes should complement each other by serving both different types of trips and different portions of individual trips (e.g. park-and-ride sys-tems).

Each transportation system consists of vehicles, ways, terminals and various auxiliary components. For an efficient operation of different modes it is necessary to exert control over one or more of these components through regulatory measures or pricing. Thus one of the most effective controls of types of auto usage is control of parking supply or prices. It is, therefore, necessary to have full public control of parking rates by transportation authorities. The present parking practices, developed without any regard for their effects on travel patterns and thus, on the entire city, are irrational and must be changed. In some cities this will involve fundamental changes in the way parking facilities are financed and managed.

In the cases of conflict between efficient flow of vehicles and their impact on the surroundings, it is important to define who the "interested parties" are, so that the decision can be made as to who should be favored or what kind of compromise can be found. For example, on some residential streets traffic should be discouraged or even eliminated if it causes serious disturbance: on major arterials, however, traffic flow may be so important that neighborhood requests for additional signals or stop signs which would slow traffic down should not be accepted.

Related to this is the definition of a unit for determining priorities in traffic flow. Since the purpose of transportation is travel of individual persons, the basic unit should always be the number of persons carried at a time or in a traffic lane. Vehicles, often used for traffic analyses, are merely the tools for performing the transportation function.

Goals and Policies. The basic goal in improving urban transportation is to achieve a system which offers travellers a desired level of service at the lowest possible cost and negative impact. This is achieved if each type of travel is served by the mode which has performance/cost characteristics best fitting it, providing, of course, the modes are coordinated among themselves.

Coordination of modes implies a proper balance between various components, modes, or between transportation and other activities. More specifically, the relationship which must be carefully analyzed and resolved on the basis of local relevant factors include:

- Convenience and safety of pedestrians vs. easy flow of automobiles.

- Relationship between through and local traffic on individual streets or networks. This and the preceding problem occur very often in planning improvements for CBD.

- The capacities of freeway interchanges, street network, and parking must be balanced. This is a very complex problem, but its neglect may cause congestion and underutilization of different facilities.

- Distribution of roles between auto and transit, which can be influenced by their levels of service, costs or charges, or by regulatory measures (favoring or prohibiting individual movements, parking, etc.).

- At the largest scale, and in a long run the most important task, is coordination of land uses and transportation networks, modes and facilities.

The Required Tools. To achieve these goals
and implement policies, several types of problems must be solved. Again speaking at a very general level, innovative solutions are needed in the following areas:

- Administrative: presently dozens of municipalities in each metropolitan area have jurisdictions over small sections of metropolitan systems or networks. Efforts to form agencies with a stronger control over entire metropolitan networks, as well as over different modes, must be intensified.

- Financing of both highways and transit should be secured on a permanent basis, through a steady source, rather than allow fluctuate with the politics in some governmental bodies and lead to financing of competing services.

- Technical and operational problems, particularly in coordination of different modes, also call for additional work.

- Public support must be secured through professionally sound work and thorough understanding of the needs of both residents and travellers in an area. Only by reestablishing the mutual trust can transportation engineers again become the leaders in urban transportation, rather than the unpopular specialists subjected to continuous criticism.

Task and Role of the Transportation Engineers

It has been more than 10 years since it became clear that traditional traffic engineering is far too specialized to cope with extremely complex requirements of transportation in modern cities. It has become obvious that we need transportation engineers who, in addition to thorough expertise in technical aspects of traffic engineering, have a good understanding of the total transportation system, including all modes, and its interrelationships with other activities in the city.

How have the traffic engineers responded to this change? Some have rapidly adjusted themselves to the broader task they have had to face. However, many have taken a defensive attitude which is difficult to justify. They feel that the extensive changes which occurred are an unjustified attack on the only "client" they recognize: the automobile, or his driver. They often support such attitudes by overgeneralizations such as "Everybody loves to drive," "Environmentalists are a major obstacle to the efficiency of our industry," etc., which have no more value than any other simplistic slogans. Improvements of pedestrian movements and of bus travel on streets are often only grudgingly accepted, and rail transit is still considered as the major foe of the automobile, "the symbol of American way of life." The fact is ignored that creating healthy cities should be a more important goal as "American way of life" than inducing people to drive automobiles through deteriorating cities.

The extremely long time it took to change the name of our organization into the "Institute of Transportation Engineers" shows how long this opposition to the broadening role of the traditional traffic engineers has been. Another example of such resistance is found in the attitudes of the Federal Highway Administration. Its publications and statements are still rather openly against rail transit and against a strong commitment to improvement of any transit through its separation from other traffic. Most of the support FHWA has given to bus transit has been reluctant, and often with the intention of preventing the introduction of rail transit. Special bus facilities in many cities do represent improvements compared with the prior operating conditions for buses, but they are seldom of a permanent nature: busways are usually degraded by allowing entry of liberally classified "emergency vehicles," then also of taxis, car pools and other vehicle categories. In most projects bus services represent merely commuter transit rather than regular transit. Car pools and van pools, which are thus also given preferential treatment, are in such cases direct competitors of commuter bus service.

One program which shows an encouraging new spirit is the Transportation System Management (TSM). Prepared and announced jointly by UMTA and FHWA, this program directly responds to the need for a coordinated approach toward integration of all modes of urban transportation and for better utilization of existing facilities. TSM program has a great potential, but it needs a more vigorous support by the FHWA and transportation authorities in individual cities, since most of the actions are in their domain.

Some of this criticism is sharp, but it is badly needed. The United States, as well as most other countries which have suffered from similar "unimodal" orientation of urban transportation policies, badly needs a new type of transportation engineer described previously. If traffic engineers continue to oppose the changes and thus refuse to accept their new role, other professionals from fields much more remote from transportation will fill the new positions. Should traffic engineers because of their conservatism allow the aerospace experts to become better transportation engineers than they are? Or should the traffic engineers respond to the challenge?

Thus, the time is now to ask the question: QUO VADIS, TRAFFIC ENGINEER?

Between the alternatives of opposing the changes and opting for a decreasing role in our cities, and undertaking the effort to redirect and broaden our field of activities and responsibilities, it is clear that the rational choice is to accept the challenge. Our change of name has been a good and important beginning in that direction, but now let us truly become transportation engineers in our thinking and in our actions.