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Prospects for competitivenes of urban public transport

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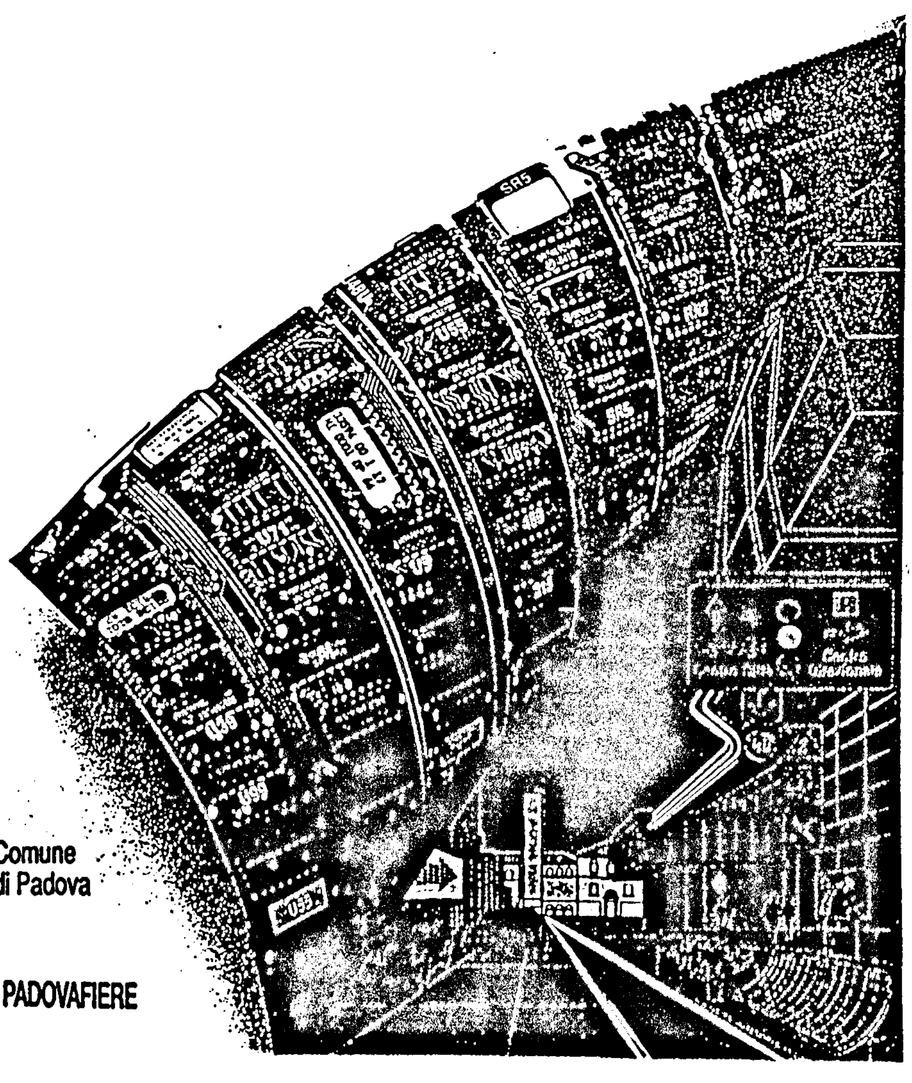

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PROSPECTS FOR COMPETITIVENESS OF URBAN PUBLIC TRANSPORT

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1. Urban Transportation: "The Sheep Phenomenon"

If we observe a herd of sheep who want to pass through a gate to a green pasture, we see them pushing so hard that they get stuck at the gate and pass through it only very torturously and with great delay. It is obvious that if they would not push, but pass one or two at a time, the sheep would get through the gate much faster and more easily. The problem is, we conclude, that the sheep are animals with a rather low level of intelligence.

If a creature from Outer Space observes one of our cities from a Spaceship ("flying saucer") on a weekday morning, he will certainly come to conclusions about the behavior of humans in traffic very similar to those we reached about the sheep.

The observer from Space would be surprised that the humans, who build beautiful buildings, excellent vehicles and have tools for sophisticated controls, do not manage their cities and their travel as an intelligent system. Traffic in streets mostly consists of individuals driving vehicles for their own immediate benefit. The control that could make the entire system work much more efficiently virtually does not exist. Operation of the transportation system is not much better than what the sheep would arrange.

Analyzing our policies and practices in urban transportation, one can easily discover a number of irrational situations which prevent urban transport from efficient functioning. A few examples illustrate this.

1. Public schools and parks are favored by public policies over private schools and golf courses. But in transportation, travel by private auto is favored by many policies and financial decisions over travel by public transport - bus and train.

2. In most transportation systems we favor large over small vehicles because of their higher productivity, benefits to users, social interest, etc. Large ships are favored over small ones, Jumbo jets over small propeller airplanes; yet, in urban transportation our policies, investments and traffic controls give the same rights to low-capacity automobiles as high-capacity transit vehicles.

3. Many technical studies, such as highway design and traffic regulation, use vehicles as basic units, rather than persons. This practice confuses the means of transportation with its basic purpose: the purpose of transportation is movement of persons and goods, rather than transporting vehicles.

4. Pricing of various services, privately or publicly supplied, is usually related in some way to the cost of providing them, to efficiency of the system's operation (regulation of demand), or to users' ability to pay. In highway and street transportation none of these principles is applied: travel is simply free, i.e., a service that has limited capacity is "offered" to anybody who comes. Moreover, the social costs caused by an individual's imposition on other drivers, on urban environment, and excessive consumption of (increasingly imported) oil, are not charged to the user in any form. This results in the "sheep phenomenon", i.e., wasteful congestion of streets and highways.

The lack of logic in this practice can be illustrated by imagining the same method of financing for another type of service. Suppose that telephone companies would be financed through government subsidies supplemented by flat annual charges for each telephone, while long distance telephone calls would be free. What would happen?

The number of telephone calls would increase greatly and exceed capacity of lines. Calling would only be limited by users' ability to "get through" with their calls; once a person gets through, he/she would "use the opportunity" to speak as long as his/her heart desires. Revenues would not be increased and the telephone company would not be able to supply the required capacity. The result: users would have much lower cost, but also much lower quality of telephone services than they now have.

5. Our observer from Outer Space, if given an opportunity to hear our discussions about urban transportation, would be amazed by widespread myopic views and policies. He would notice that some policies promote small vehicles against large ones (cars vs. buses and trains): large funds for financing transportation can be used for highways, but not for public transport; that people favoring steered vehicles with rubber tires "fight" with those who argue that more rail transit systems are needed; etc.

The result of these illogical relationships and policies is rather easy to see. Congestion in the streets of our cities, suburbs and entire regions has become a regular phenomenon - a way of our urban and suburban life. Polluted air, deterioration of the urban environment and, most importantly, loss of human character, are noticeable in many cities. Public transport, vital for our entire urban civilization, is chronically underfinanced and often neglected in transportation planning: it is "added" after large new urban complexes have already been built, instead of incorporated in their plans for permanent competitive service. Pedestrians, i.e. the people for whom the cities exist, are often "forgotten" in urban design and regulation.

2. Regulating Social and Individual Interests

The preceding discussion shows that the difficult problem of finding a reasonable balance between the interests of society and individuals has been resolved better in many other areas, such as schools, public parks and even in air quality control, than in urban transportation systems regulation. Transportation tends to be handled by short term decisions. There is a serious lack of understanding of the complex relationships between urban form and different modes of transportation, primarily public transport, private and pedestrian travel. These modes have inherently different characteristics and play different roles in urban transportation. A critical review and reexamination of our urban transportation attitudes and policies is needed.

The dilemma between individual and social interests exists in many areas of a civilized society. Immediate personal convenience often leads to major social problems, so that society must limit certain actions of individuals (often misnomered as "freedom") in order to avoid malfunctioning of entire systems - from which every individual would ultimately also suffer. Penalties are used to prevent throwing trash on streets. Legal regulation is used to force auto owners to keep their engine emissions below prescribed levels. Pricing is sometimes used to reduce peak hour demand for certain public events and reduce overcrowding, etc.

These regulatory measures must be used whenever a user of a certain service does not feel its total consequences, i.e., when there are significant externalities. This is distinctly the case with transportation, as the following example illustrates. Exhaust from an automobile does not affect its driver, but it affects all drivers behind him, as well as the entire environment. If the exhaust pipe was placed on the front of the vehicle, the driver would be very interested in keeping emissions clean; with rear exhaust, legal measures must be applied to force the driver to behave in the interest of society.

The relationship between total travel costs by private and public transportation in urban areas as a function of the number of trips in an area, such as the central city, is shown in Figure 1. Since every traveler seeks the lower cost mode, the division between private and public transport stabilizes at point I: P_a persons travel by auto, P_t travel by transit.

If a portion of auto users ΔP would switch to transit, lower traffic volume on streets would reduce average costs to all auto users, while increased transit ridership would make a better transit service economically viable. Thus, as the diagram shows, a shift of the intermodal division line from I to some point S' would benefit both groups of travelers. The problem is, however, that at point S' the situation is not stable: some transit users would notice that auto travel is less costly and they would switch back to automobiles, until the division would return to point I.

To achieve a socially desirable balance, public policies and actions should create conditions which bring the intermodal division by users' choice to the left of I: S should become a stable division point. This can be achieved by two different policies:

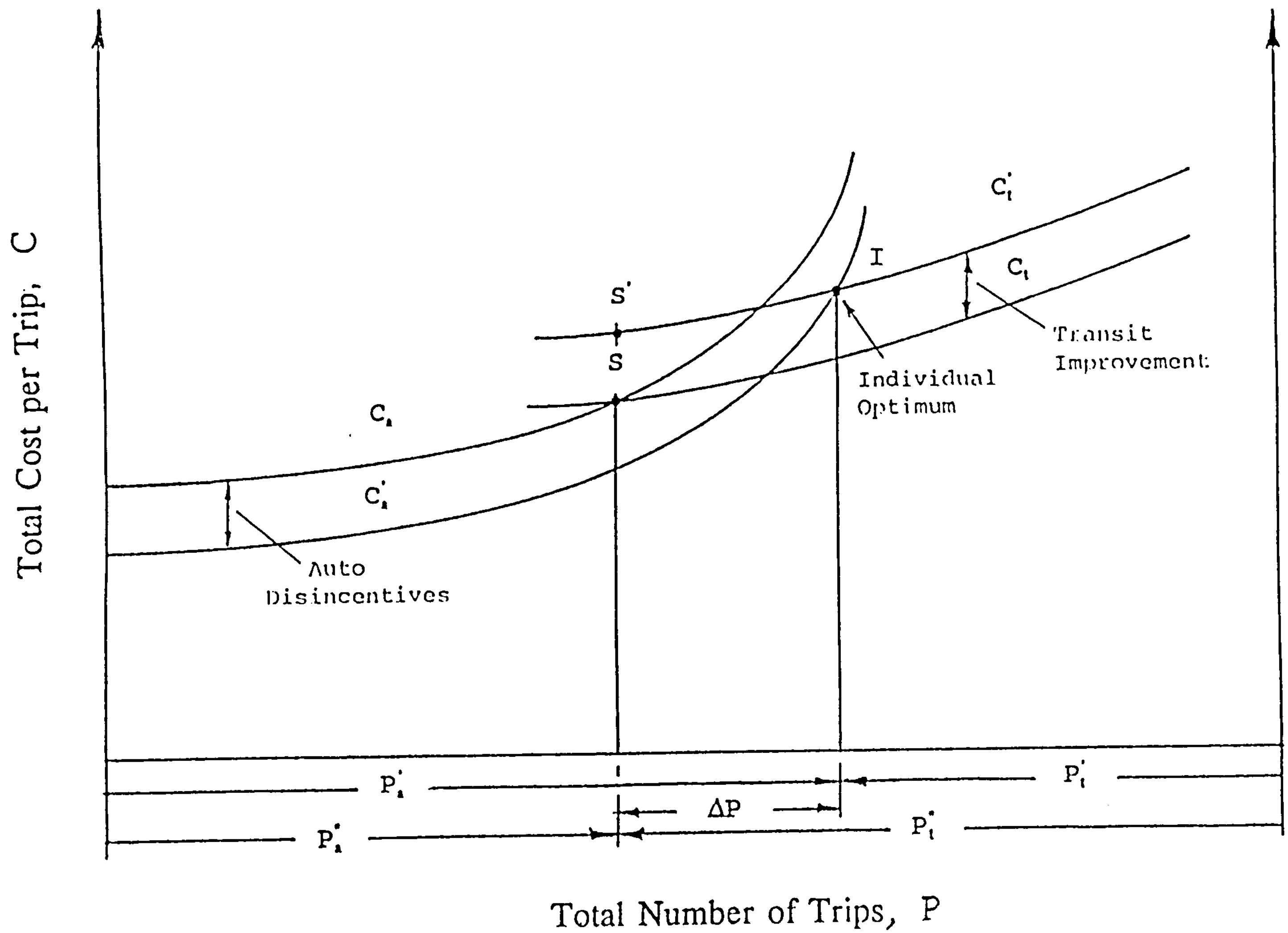

Figure 1. TRAVEL DISTRIBUTION BETWEEN AUTO AND TRANSIT

Policy I: Make transit more attractive (lower the C'_t curve to C_t); or,

Policy II: Make auto use less attractive (raise the C'_a curve to C_a).

Actually, it can be shown that a combination of these two policies is the most efficient way of shifting the intermodal division of travel from individual to social optimum (I to S).

This introduces the basic problem in urban transportation: structure of costs and charges for auto travel. First, auto users impose numerous and often very high externalities - costs on other drivers, on urban environment, etc. - for which they do not pay directly. In some cases they pay through taxes, but these do not reflect large fluctuations of externalities among different areas and times of day. Second, most of the costs of owning and operating an automobile are fixed. Consequently, vast majority of costs of driving an automobile in the city are independent of individual trips. Travelers' decisions to drive are thus based only on a small portion of their costs for operating an automobile and they are unrelated to the costs they impose on others.

Figure 2 illustrates this problem. The direct, marginal cost of operating an automobile, shown above the horizontal line, is usually very small compared to the total cost of operating an automobile; the remaining costs of purchasing and insuring the vehicle, as well as social and environmental costs, are under the horizontal line because they are independent of a specific trip. Generally, only marginal or "visible" cost influences the decision of people in selecting the travel mode.

Consequently, transit must compete with respect to costs with the very low marginal cost of driving an automobile. If parking is subsidized ("free" for the user), transit fares must be quite low to be competitive, and this makes high operating subsidies for transit necessary.

Increasing the direct costs of driving an automobile is therefore a very efficient method to influence division of travel between auto and transit: it not only discourages auto use and thus eventually reduces the need for transit subsidies. Taxes on gasoline have such an effect, but parking charges or entrance fees to an area represent by far the most effective forms of direct costs.

3. Achieving a Competitive Transit System

These differences in charges for travel by public and private modes, as well as differences in the types of service (the habit-creating convenience of personal vehicle) necessitate the use of various measures to shift urban travel from the individuals' optimum to the social optimum.

As shown above, introduction of direct charges for auto use which varies with area and time of day represents the most fundamental measure toward achieving a desirable balance between private and public transportation. This measure has been proven extremely effective

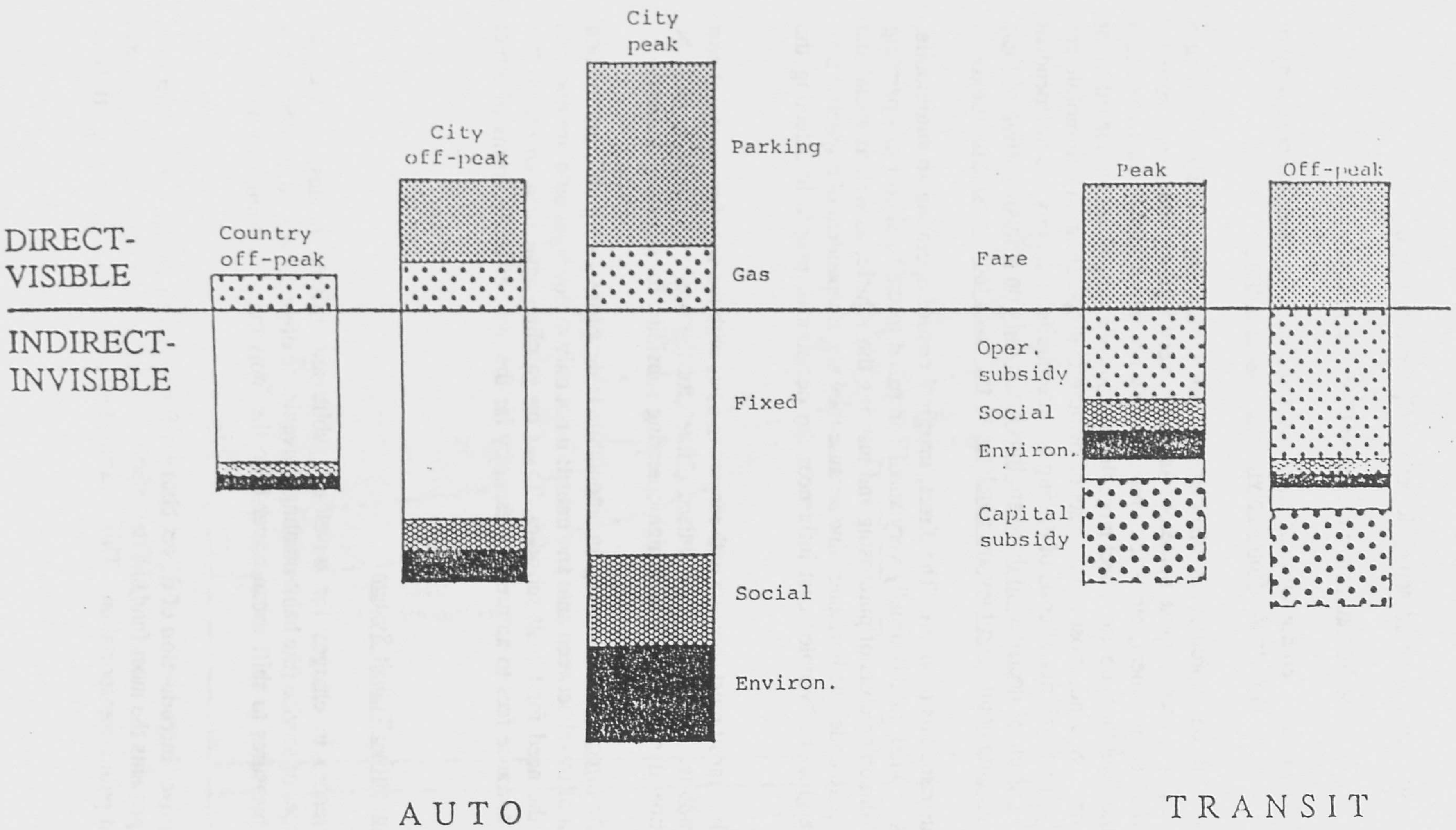

Figure 2. COST OF TRAVEL [¢/person-km]

in Singapore, but other cities are still reluctant to introduce similar measures. Several Scandinavian cities have recently made significant steps in that direction.

There have been two major obstacles to the introduction of pricing for auto travel. The first is the physical difficulty of collecting tolls at various points in the city. This problem can now be resolved by use of electronic devices which can identify vehicles in passing and automatically assign user charges to them. This technology is generally available. The second problem is political resistance - the human instinct against paying for services, exacerbated by politicians who try to capitalize on these feelings by opposing such "imposition" on drivers. This opposition is particularly strong because general understanding of the entire urban transportation problem is weak.

Provision of physically separated rights-of-way for transit systems is by far the most effective physical measure for making transit services competitive with the automobile. While large cities have been building metro systems intensively in the last three decades, medium-size cities have increasingly found light rail transit as the optimal mode to use separated rights-of-way and provide high-quality transit service. Busways can also provide greatly improved services on separate roadways or lanes, but only if the enforcement of the exclusive use of such facilities by buses is strict. This is in many cities very difficult to achieve.

Transit First Policy, a comprehensive set of physical and regulatory measures aimed at giving preference to transit vehicles over other traffic, has been successfully used in many cities. These measures require relatively low costs, but their effects can be very significant in increasing speed, reliability and image of transit services.

Comprehensive parking policy is another very effective measure for regulation of urban travel. Parking rates can be set at a level and structure which discourage use of automobiles for travel served well by transit, such as commuting. The supply of parking in central cities should be limited and highly priced, while park-and-ride at stations of high-quality transit services in suburban areas should be developed and stimulated.

Local design in all major developments in cities and suburbs must be such that use of transit is encouraged and made more convenient than use of automobile. Good examples of pedestrian- and transit-friendly designs are found in cities like Toronto, Munich and Gotteborg. However, many shopping centers in North America have designs that virtually prevent walking, so that the entire travel is placed on often congested auto/highway system.

Long range planning of coordinated land use and transportation in an integrated manner remains the fundamental measure for preventing the "collision between the automobile and the city" which we experience today. However, that planning must not only include physical design. It must also incorporate various regulatory, pricing and policy measures discussed above.

Education of civic leaders and public at large represents a sine qua non for implementation of all these measures. Without public understanding, the major changes in urban transportation policies that are needed will continue to face insurmountable resistance.

4. The Goal: Cities with Good Mobility and Livable Environment

Various pressures and crises in metropolitan areas create situations in which temporary measures and partial solutions are introduced, while overall, long-range goals are often overlooked. This is undesirable, because some of the partial solutions may actually lead away from long-range goals.

While every urbanized area may define its specific long-range goals somewhat differently due to local conditions, the overall goal in urban transportation planning should be to create cities which provide for good mobility and have a livable environment.

It has been shown that the present problems stem primarily from the fact that transportation in cities is not treated as a system which must be based on an optimal trade-off between individual and social interests. To correct this problem, it is necessary to coordinate and optimize operations of transportation systems at four different levels. These levels are defined as Four Degrees of Transportation System Optimization.

Degree I Optimization: Maximize efficiency of an **individual facility**, such as a freeway, street or a subway line.

This optimization is frequently done. Most metro lines are operated optimally under a central control system, since there is no interference from other vehicles. Some streets and arterials are optimally designed and traffic on them operates under full signal control. Most freeways, however, are not fully controlled and high vehicular volumes lead to breakdowns of traffic flow. "Intelligent highways" should have controls that will greatly reduce frequency at traffic flow breakdowns.

Degree II Optimization: Achieve optimum integration of a **single-mode network**; for example, street network in the city center; a freeway network; or, a metro network.

Examples of this optimization can again be found in networks of metro systems, such as Paris, Tokyo or, with a more complex network, BART in San Francisco. Street networks often have coordinated signal controls, but a network with positive control of vehicle inflow to ensure smooth traffic flow is found only in Singapore. Some cities have a moderate success in preventing congestion by controlling parking supply in an area (Boston, London).

Degree III Optimization: Integrate for maximum efficiency a **total, multimodal urban transportation system**, consisting of different modes. Streets, freeways, parking, rail and bus transit and pedestrian traffic should form a total coordinated system.

This is a complex task which requires an integrated approach to transportation at the level of policy, financing and cooperation of different agencies. Most advanced in this type of effort have been some West European cities, such as Rotterdam, Hamburg, Munich and Zürich.

Degree IV Optimization: Plan and implement a coordinated system of **urban development (land use) and transportation.**

This is the most important - and most complex goal to achieve. Again, some good examples of coordinated land use/transportation planning are found in Western Europe: in Stockholm, Amsterdam and Frankfurt, for example.

Unfortunately, examples of failures to optimize urban transportation systems are much more numerous than examples of successes, and most urban transportation problems can be traced to these failures. To illustrate this, two extremes can be described. Many U.S. cities developed in recent decades, such as Houston, have been designed without coordination of land use and transportation plans; without intermodal or street network optimizations. At best, individual freeways are controlled for maximum throughput of vehicles. Thus, only Degree I Optimization is sometimes used. Present problems of chronic congestion in the central areas and suburbs of these cities illustrate the consequences of these practices.

At the other extreme are some older European cities, such as Rome and Naples, which have very low capability to accommodate automobile traffic, and yet, they have not provided adequate public transportation. As a consequence, mobility in them is not good, and their character, which should be heavily pedestrian-oriented, presents an environment which is often hostile to pedestrians.

The time is overdue for our urban civilization to upgrade its treatment of urban transportation through introduction of coordinated approaches to urban transportation systems. Transportation professionals have a major role to provide better understanding of the complex urban problems for government officials, civic leaders and for the public at large.