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Achieving Intermodal Balance for Efficiency and Livability of Cities

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Abstract

At the closing of the second millennium our civilization can boast a remarkable progress in technological developments which have been growing at an exponential pace. Telecommunications, jumbo-jets and personal computers have become ubiquitous in many countries in recent decades. In the "softer" area of managing complex systems, and even more so in economic, social and ethical aspects, our achievements have not been as uniquely progressive, however. This dichotomy between technological advances and systemic difficulties is quite obvious in the focal areas of our civilization - the complex technical-social-environmental system of cities.

The heavily urbanized civilization entering the third millennium strongly depends on the health of cities (or, more precisely, urbanized areas). Their "lifeblood", transportation systems, utilize sophisticated technology of vehicles, rail lines, highways and intermodal terminals; yet, if one would observe Los Angeles freeways or Bangkok arterial roads on any weekday morning, he/she would find commuters on highways resembling the behavior of a flock of sheep, rather than an intelligently organized and controlled system.

A broader view of cities shows that transportation is a major component, often the key contributor, to the economic and social conditions, as well as environmental quality of urbanized areas. Moreover, it is increasingly recognized that the qualitative aspects of life, referred to as livability, are strongly affected by the composition of transportation modes deployed in individual urbanized areas. Major problems caused by chronic road congestion, unsatisfactory public transportation and neglect of pedestrians are caused by inadequate understanding of the transportation systems and their interaction with the functioning of cities.

In most cities current problems, need for short-term solutions, pressures by individual groups or interests and other factors prevent a long-range view of the complex transportation problems. This presentation will focus on a systems view of transportation, its role and impact on cities and quality of life in them. The need to improve understanding of the interactions between cities and different transportation modes is particularly emphasized.

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ACHIEVING INTERMODAL BALANCE FOR EFFICIENCY AND LIVABILITY OF CITIES

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The Importance of Intermodal Systems

In most urbanized areas there is a continuous dynamics, often controversy and competition, in the planning and operations of different modes of transportation. The preferences and dilemmas of users in choosing their travel modes, pressures by industrial groups and lobbies promoting individual modes, even narrow orientation of some transportation professionals to a single mode only, create these controversies and often lead to compositions of modes which are not efficient as an overall system.

The most important is the perennial “cars vs. transit” controversy. Similar debates appear often, however, also between bus, light rail and metro transit modes, about the roles of bicycles, and about the importance of pedestrians for quality of life in urban areas – in city centers as well as in newly developing suburbs.

A recent comparative study of urban transportation in industrialized countries has reached the following interesting conclusions.

- The basic trends of increasing car ownership and use, with its direct and indirect impacts, are common for all industrialized countries;

- Understanding of the complex problems of urban transportation, particularly with respect to roles of different modes, varies considerably;

- Policies toward transportation modes – highways, transit, pedestrians and others – also
vary greatly among cities and countries;

- As a consequence of different policies and a myriad of implementation measures, some cities have made remarkable successes in increasing their efficiency and livability, while others suffer from further deterioration of their livability and lack of clear goals for the transportation system and the city.

- Cities which have made the greatest efforts to accommodate unlimited use of private cars suffer more from road and street congestion than the cities which have pursued development of intermodal systems.

All cities face serious problems referred to as the "Collision of Cities and Cars." Among these, chronic traffic congestion, air pollution and noise are often discussed; actually, long-term impacts of excessive car use, such as urban sprawl and dispersal of activities, deterioration of social life and creation of "private cities" with segregation of population and land uses are much more permanent problems.

There are major and very important differences among cities and countries in the understanding of these issues, and in their efforts to resolve the transportation problems and enhance livability of cities. Some cities have set clear goals and undertaken many measures to achieve intermodal systems; others tend to make only palliative measures and give little attention to the contribution of unlimited accommodation of cars to transformation of cities into vehicle-based, rather than human-oriented environments.

Most European cities tend to utilize a greater diversity of modes than their industrialized peer countries, particularly the United States, Canada and Australia. This is a result of many factors. Differences in geographic, historic and social conditions play an important role, but at least equally important have been the policies. In most European countries policies have always promoted certain balance among modes. Good examples are transportation policies in Belgium, Germany, Netherlands and Switzerland which have fostered parallel and vigorous improvement of transit systems even at the times of the most intensive construction of urban highways.

Recent years have seen a strong revival of the use of bicycles, which enjoy supportive policies and investments in countries like The Netherlands, Denmark and Germany. Pedestrian treatment has been raised from providing protection from vehicles, to construction of entire plazas and pedestrian traffic networks in cities, i.e., creation of a human-oriented urban environment.

Recent Experiences in the United States

The developments in the United States in recent decades have produced results which many other countries can use to learn what should, and even more so, what should not be done to cope with increasing car ownership, urban sprawl and endless increase in the volume of vehicle travel. The experiences that the United States offer are briefly summarized here.

During the most extensive construction of highways, urban roads and parking facilities, throughout the 1950s and 1960s, transit and all other modes were badly neglected. The strong stimulus to car use and discouragement of transit led to the development of basically unimodal transport systems in many cities. Car was considered to be the only significant mode of travel; transit, consisting of buses on streets, became relegated mostly to captive riders and some services for the peak commuter loads. Bicycles were considered sporty vehicles for the youngsters and nature enthusiasts, while many newly developed areas have been designed with no pedestrian facilities whatsoever.

This obsession with the car only was so strong that a considerable number of transportation professionals failed to recognize the need for intermodal transportation systems. Growing environmental concerns during the 1970s led to a change in attitudes. That triggered a strong resurgence of transit and increasing interest in paratransit, bicycles, pedestrians and other modes. Yet, the conservative wave of the 1980s revived strong forces which consider the car as the only significant urban transportation mode. Serious problems which total car dependency causes are still not recognized by a large portion of transportation professionals, particularly theoretically oriented economists.

The Federal Transportation Act of 1991, so-called ISTEA, represented a major step toward treating transportation as a system, instead of a collection of independent modes and facilities. Based on extensive countrywide discussions, the ISTEA recognized the severe limitations and increasing problems of total car dependency and fully endorsed - actually mandated - promotion of different modes. This orientation is demonstrated even in the title of this law: "ISTEA" stands for Intermodal Surface Transportation Efficiency Act.

This transportation law, and its similar-in-spirit successor of 1998 - TEA-21, are only the beginnings toward a recovery from the powerful trend toward full car dependency of recent decades. Deeply entrenched interest groups, including highway builders, car manufacturers and oil industry, as well as suburban land developers, continue to use simplistic arguments to prevent any changes in the strong emphasis on cars and highways only. The role of systems planning is undermined by the deceptive statement that any planning that would "limit the freedom of individuals" to drive cars represents an "imposition by the government."

The Debates, Interests and Ideologies

The level of understanding, professional discussion and search for constructive urban transportation policies vary greatly among countries and contain many deep paradoxes. Conservative economists and politicians, particularly those from Great Britain and the United States, continuously argue that the main problem in urban transportation are government subsidies to transit, both in investments and operations, which are actually aimed at maintaining moderate fares and high transit use. Their strongest criticism focuses on investments in high quality transit systems - rail and buses on separated rights-of-way the modes most capable of maintaining the intermodal balance. Free market, according to them, is the only solution.

These widely publicized arguments are indefensible in both theory and practice. First, they are based on the illusion that urban passenger travel, involving extensive external effects, represents an area where free market conditions can apply. Second, these critics of transit evaluate modes on the basis of costs only, disregarding the strong advantages of high quality, independent transit systems over bus-on-street services. Finally, if this scrutiny of user accountability and governmental role are applied to all modes, it is easy to show that the highway system and car driving involve far greater government role and user subsidy than any other mode.
Thus, if applied to all modes, the conservative philosophy should be much more critical of car use than of transit and other modes. This biased treatment of different modes has been recently challenged by Paul Weyrich, himself being a leading conservative in the United States.

The highway bias in urban transportation has often been propagated and carried around the world by many investment studies of the World Bank. These studies apply economic evaluation for highway projects, which include user and other benefits, but ignore direct financial accounting because car users do not pay for any costs directly. For transit projects, however, financial analysis is applied which focuses on direct costs and revenues, but underestimates user benefits and positive impacts on city livability - major assets of transit systems.

Some liberal economists and political leaders, on the opposite extreme of the ideological spectrum, claim that they represent community and public interests. Yet, they sometimes go to the other extreme, supporting militant transit unions which use strikes to maintain obsolete operating practices. These conditions result in transit system inefficiency, while the strikes inflict hardship of urban population and permanent damage to the competitiveness of transit.

Between the two ideological and political extremes, the loser is the public and quality of life in urban areas. To enhance efficiency and livability of cities, it is necessary to suppress the extremism and advance better understanding by the public of the role and forms of transportation. This is achieved through a systems approach: a comprehensive view of the relationships of different modes and their impacts on urban areas.

Clarification of Fundamental Problems in Intermodal Relations

It can be easily shown that an intermodal system which utilizes several modes in their most effective roles is superior to a unimodal system, i.e., complete car dependency. This can also be seen by comparing efficiency and livability of the cities which have developed in recent decades following these two concepts. The problem is, however, how to define the desirable intermodal system (i.e., roles of different modes) and how to implement it. The policies and implementation methods require resolution of several major obstacles.

The Conflict Between Individual Equilibrium and System Optimum Conditions. In the relationship between the private car and transit, there is the problem of the discrepancy between the individual equilibrium and social optimum. This situation is shown on the diagram in Figure 1.

The diagram of costs or total disutility of travel as a function of the number of trips shows that in auto use this disutility increases as the volume of cars increases due to congestion, higher cost of parking, etc., as shown by curve "A" plotted from the left. The disutility of travel by transit, plotted from the right to left as curve "T", decreases with travel volume, because for high passenger volumes the service can be more frequent, rail modes can be used instead of buses on streets, etc.

The intersection of the A and T curves is where the disutilities of travel on the two modes are equal. When each individual chooses the mode of least disutility, that point represents the distribution of trips between autos and transit; that is the Individual Equilibrium.

It should be pointed out that if some persons switch from autos to transit, the disutilities on both modes decrease. Translated to real world, such a shift results in decreased street congestion, benefiting auto users, and better transit service, benefiting transit travelers. However, because the disutility of auto travel is lower than disutility on transit, people would return to the initial Individual Equilibrium distribution, increasing the disutilities on both modes.

The desired shift from the Individual Equilibrium toward Social Optimum, which represents higher efficiency of the entire system, can be achieved by implementation of two types of measures:

- Transit use incentives, such as faster service, more extensive network, separate rights-of-way, etc., would reduce disutility of transit travel, so that curve T' would be obtained.

- Auto use disincentives, such as reduced parking capacity, increased parking rates, traffic taming, etc. would result in increased disutility, shown by the curve A'.

The diagram shows that with these policy measures the distribution of travel is moved from the initial Individual Equilibrium to the point designated Social Optimum, with **lower disutilities on both modes.**

Low Operating Costs of Auto Travel. The first diagram in Figure 2 shows direct or out-of-pocket costs of urban travel by different modes. It is obvious that these costs are substantial only when travelers pay for parking and tolls (for bridges, tunnels) or road charges. If parking is "free", i.e., paid by employers or stores, direct costs of travel are extremely low, usually lower than transit fares.

The problem is that this low-cost travel carries a large "load" of other costs, as the lower diagram in Figure 2 shows. The fixed part of traveler's costs, amounting often to 80-85 per cent of total costs, are usually not considered by travelers in their selection of travel modes. In addition to these fixed user costs, auto travel causes subsidies, environmental and social (congestion) costs, which can be very high, particularly during peak hours.

Consequently, a basic problem in urban transportation is the cost structure and large costs user does not pay: the "cheap" auto travel by out-of-pocket costs (upper diagram) carries a "large bag" of hidden costs, shown by the bars under the horizontal line in the lower diagram. That "hidden bag" represents an important element which must be considered in planning a balance between modes. Its reduction is needed to increase livability of cities.

This structure of costs leads to a far greater use of the auto than would be the case if auto users paid full costs - or at least a significant portion of them - directly for each trip. Having to compete with auto travel for individual trips, transit must usually be subsidized so that its fares are reasonably comparable with cars' low operating cost.

Resolving these fundamental problems in the relationships among urban transportation modes is very complex, and it requires a revision of the procedures used in planning and management of transportation. This procedure is briefly reviewed here.

What Causes the Neglect of City Livability?

The neglect of the quality of life, or livability, in transportation planning and regulation in many cities has been caused by an emphasis on individual projects, and insufficient attention to the complex city-transportation relationships. A systems approach of urban transportation leads to the definition of four levels of planning and management of transportation systems and facilities, as shown in Figure 3.

Level IV represents planning and operation of individual facilities, such as a boulevard, metro line or a pedestrian area. Quality of work at this level is usually good, because technical expertise exists, while management and financing are carried out under jurisdiction of a single agency.

Level III comprises networks or systems of individual modes: a street network, regional rail system, or a network of bicycle ways. This level is also usually performed well because of single jurisdiction.

Level II refers to integrated multimodal systems: auto/road, bus and rail transit, pedestrian systems and other modes. Coordinated planning and operation of these different modes is much more complex than the work at Levels IV and III because it requires higher technical expertise, cooperation of many agencies and integration of different interests. Some cities lack experts who are familiar with multimodal systems, conflicts of interests among extreme proponents of individual modes represent a serious obstacle to progress in this direction. It is observed, however, **that all cities which have efficient transportation and are considered livable, such as Toronto, San Francisco, Vienna and Oslo, have well integrated intermodal transportation systems**.

Level I is the highest and most important level of urban transportation planning: it relates transportation with other activities with the physical form, functioning and quality of life in the city.
This planning and operation is most complex but it is often performed much less effectively than the preceding three levels.

The four planning levels, shown in Figure 3, can be analyzed in individual cities when their efficiency and livability are evaluated. In the cities with unsatisfactory livability, major problems are usually found in unsatisfactory performance at Levels II and I. The problems may be caused by insufficient attention given to these levels, by inadequate quality of technical work on intermodal planning, or by inability to implement such complex plans.

Systems Approach to Urban Transportation

As mentioned, evaluation of transportation conditions, their positive or negative impacts on city's livability, requires a systems approach, and a long-range view of the city. The basic guideline for logical sequence of steps in such a process can be defined by the above four levels of transportation planning.

Planning and implementation of projects at Level IV can be efficient, but if the higher levels of planning are neglected, the results may lead to uncoordinated developments; they may even be counterproductive. In many cities technically excellent projects were built, but they led to development of inefficient economies and unattractive urban environments. Creation of cities that had extensive structures but were designed for machines rather than for people led to critical evaluation and definition of the concept of "quality of life" and, specifically for cities, "livability".

With the experiences, successes and failures in urban transportation developments of recent decades, it has been increasingly realized that transportation more than most other elements not only physically shapes the city, but it influences the type of life, social and environmental conditions. Consequently, the logical sequence in urban transportation planning should be from Level I toward Level IV, as shown in Figure 4.

The decisions at Level I include such elements as the degree of privacy, intensity and type of social interactions, activities, diversity of land uses, convenience of travel because the choice of several travel modes is available, etc. If privacy, social separation and dispersed activities are adopted as social goals, consumption of land, energy and other resources are not problems, auto-dominated cities may be logical solutions. On the other hand, if "open cities" with diverse activities and densities, intensive street life, preservation of historic objects and areas are important, an intermodal transportation system will be required. Analysis and planning at Levels I and II must clarify these goals and lead to logical policies toward different goals.

Whether a city will be auto-oriented or mostly transit-pedestrian based is a matter of decision which the citizens and leaders of each city/metropolitan area should make. That choice will vary among cities and countries. The point is, however, that such a decision should be rationally made, so that for each city type (land use distribution, open or private city, etc.), the corresponding transportation system is provided. It is important that this decision making sequence prevents the creation of cities which require, for example, an intermodal system, but the city is physically built with total reliance on highways only. Such an uncoordinated development, which occurred frequently in the past, results in an intensive "collision of cars and cities" and in the types of cities which cannot be described as livable.

Following the decisions at Levels I and II, coordinated networks of different modes, based on the roles defined for them, should be developed at Level III. The networks are streets and highways, different modes of transit - particularly street transit and rapid transit, as well as bicycle and other facilities. The mode that is often neglected, expected to "happen" by itself, are the pedestrians, which actually represent the basic element of livability of cities. The work at Level IV, individual facilities, follows as the last element in this logical sequence.

<u>Public Transit Is the Basic Element of Livable Cities</u>

In closing, it can be said that unsystematic planning and focusing on Level IV while neglecting Levels II and I, have often led to a lack of vision of the future city and policies to achieve it. In many cases this trend resulted in deteriorated quality of urban life: dominance by vehicles and neglect of the humans. The problems of reduced livability have led to extensive analyses of the nature of different modes, their optimal roles and impacts on cities and society.

Following a period of the "Honeymoon with the automobile", it became obvious that public transit is a basic element of all livable cities. However, the desirable relationship among modes, particularly autos and transit, is difficult to achieve because of the differences between the behavior of individuals and efficiency of the entire transportation system.

The desirable balance among auto and transit modes must be achieved by two sets of policies: Transit incentives and Auto-use disincentives. Applications of these measures in different cities around the world have shown very good results in increasing efficiency and livability. To be introduced, however, the following major elements are needed:

- Adoption of a planning sequence which is based on the vision of the future city and then translated into individual modal systems and projects (i.e., from Level I toward IV).
- Technical expertise which includes different modes and ability to develop intermodal coordinated transportation systems.
- Development and implementation of policies that lead to integration, rather than uncoordinated operation of different modes.
- Effective implementation of transit incentives and auto disincentives.
- Extensive education of the public and political leaders about the relationship between policies, types of transportation and character of cities, without which transportation policies cannot be easily implemented.

As a result of these developments and experiences, the role of public transportation has outgrown from the one of basically providing transport for people, to a critical element in forming and influencing not only physical form, but also the character and lifestyle in urbanized areas: transit has clearly become a *sine qua non* of livable cities.

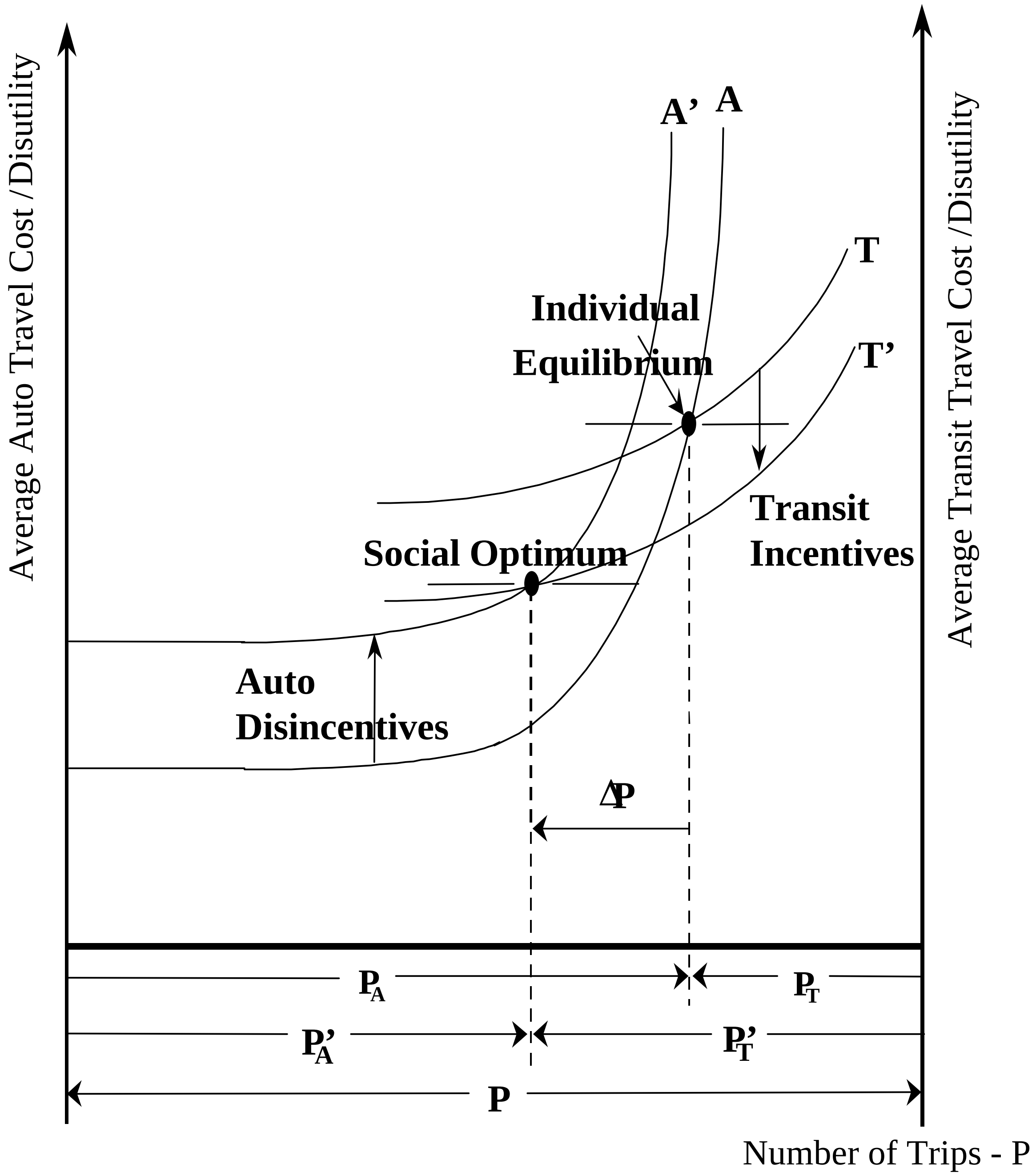
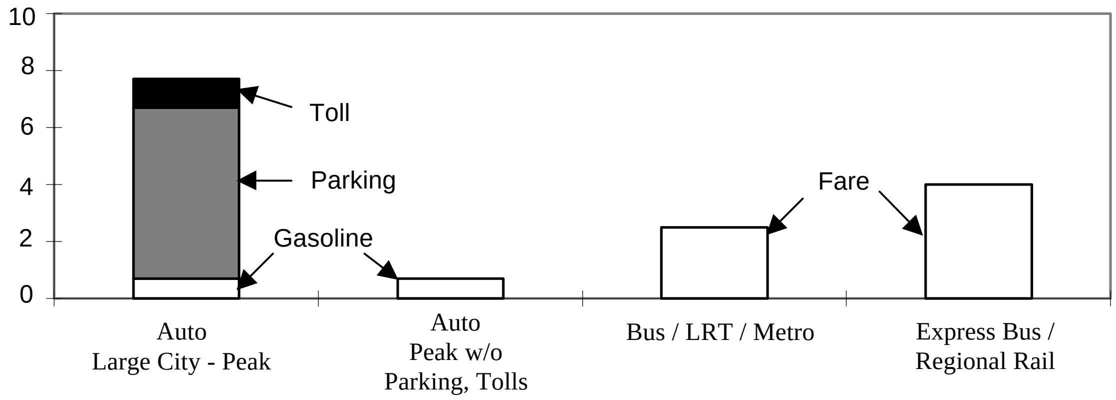
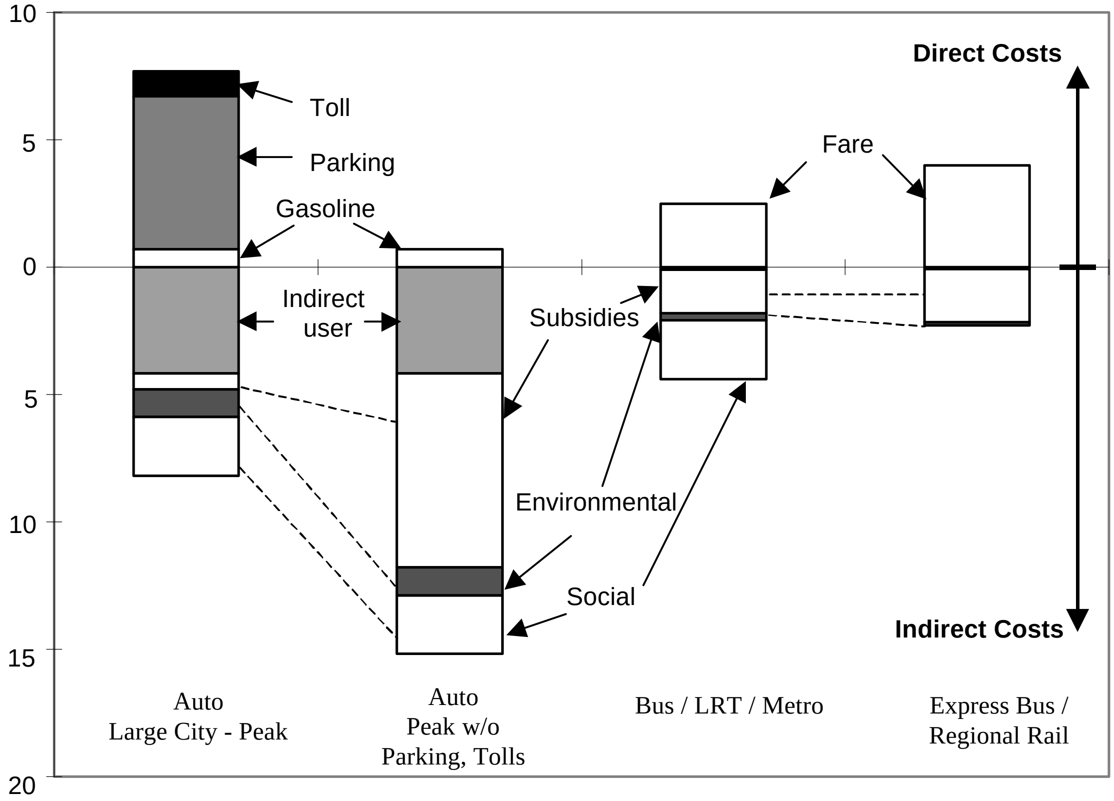


Figure 1 Transportation Policies for Shifting the Individual Equilibrium Toward the Social Optimum



a) Direct (Out-of-Pocket) Costs



b) Direct and Indirect Costs

Figure 2 Costs of Urban Travel by Different Modes

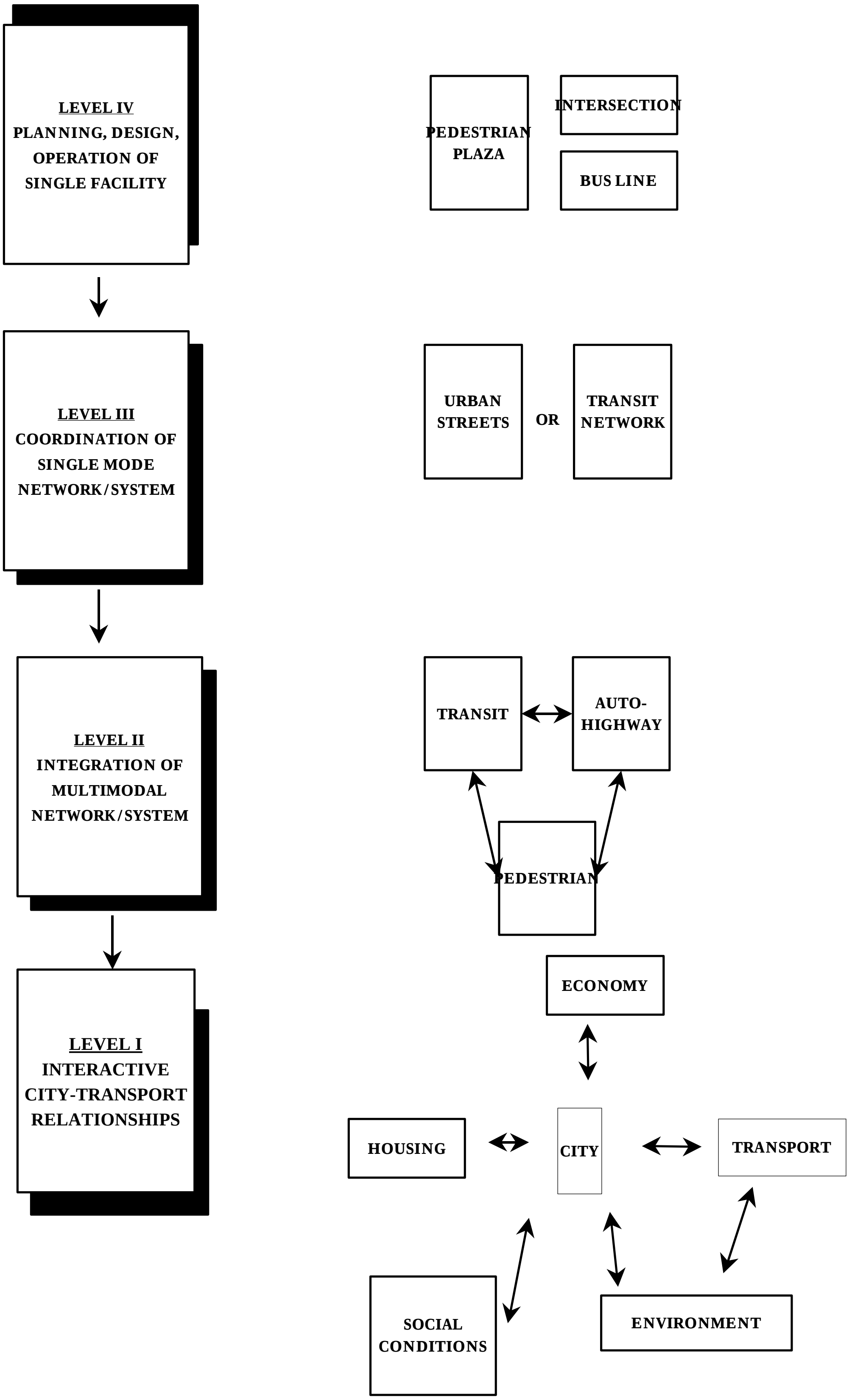


Figure 3 Four Levels in Urban Transportation Planning

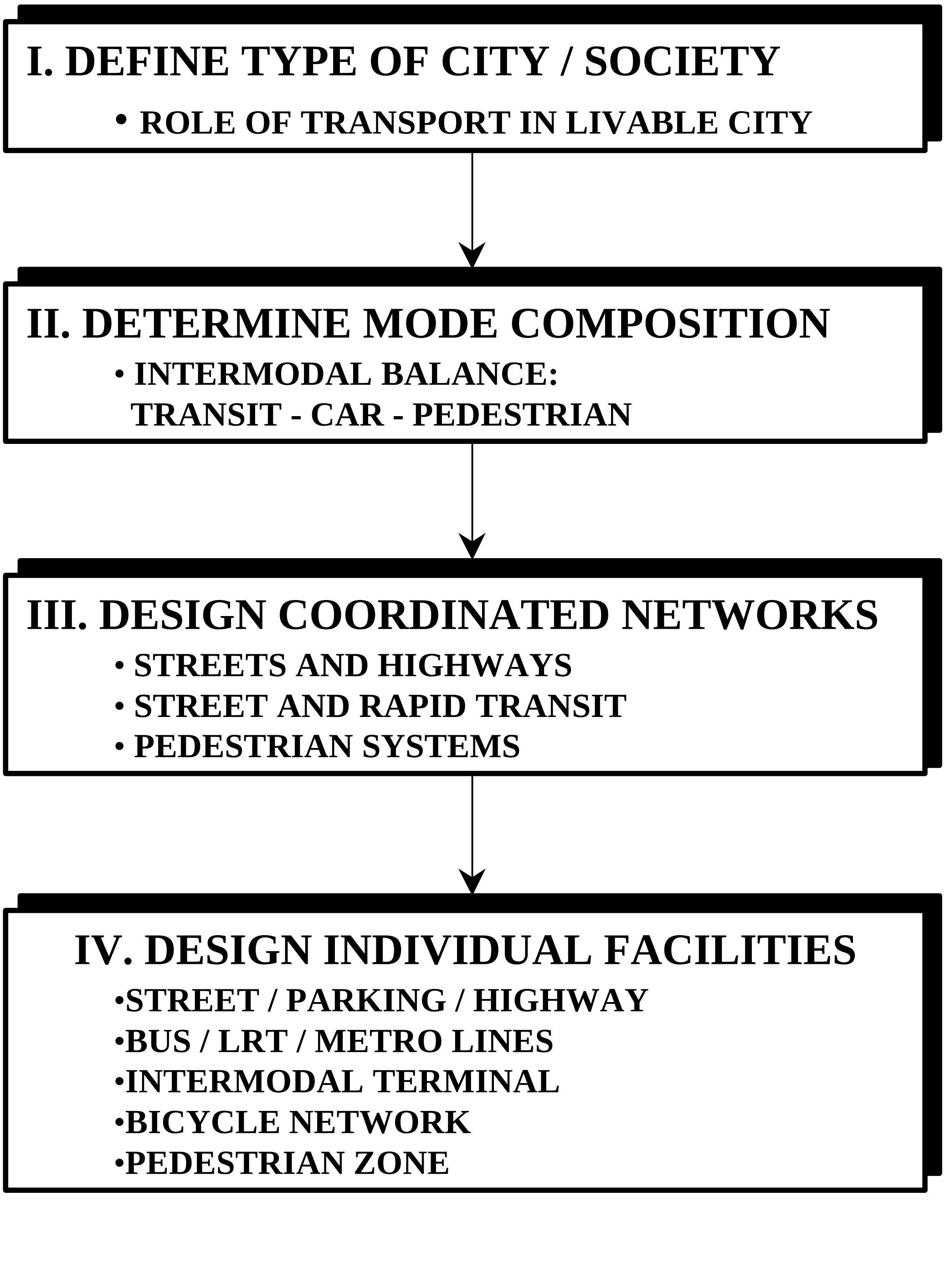


Figure 4 Logical Planning Sequence in Urban Transportation