Source: Urban Transportation Systems

Overview—Criteria for Selecting Modes

Life in cities—i.e., in organized human settlements, which are mostly referred to as *communities* in this book—is possible only if people have *mobility*[1] on a daily basis—the ability to move around so that they can do what they have to do or like to do. One characterization of a city is that it consists of specialized, frequently clustered, activities that perform discrete functions. Residences are separate from workplaces, major shopping is concentrated in identifiable centers, and larger entertainment and relaxation facilities are found at specific locations. They have to have *accessibility*.[2] Unlike in a village, very few of these destinations are reachable on foot; at least, they tend not to be within a *convenient* walking distance.

The large ancient and medieval cities were actually conglomerations of neighborhoods in which daily life could take place

[1] *Mobility* is here defined as the ability of any person to move between points in a community by private or public means of transportation. The usual obstacles to mobility are long distances, bad weather, steep hills (all constituting friction of space), but, above all, the unavailability of services, high fares, and possibly other forms of exclusion.

[2] *Accessibility* is here defined as the possibility of reaching any activity, establishment, or land use in a community by people (or by conveyances of goods or information) who have a reason to get there. It is a measure of the quality and operational effectiveness of a community.

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within a short radius; only occasionally was a longer trip to a major event necessary. Industrialization during the nineteenth century caused a true urban revolution by disaggregating the small-scale pattern into metropolitan structures with strong and intensive production and service zones. Assisted transportation became mandatory, and was, indeed, quickly invented—horse cars, steam railroads, electric streetcars, and eventually underground metro (electric heavy rail) systems.

The twentieth century brought further development of the rail modes, and introduced individual motor (gasoline- and diesel-powered) vehicles—buses and automobiles. The latter came to dominate the transportation field, at least in North America, and dispersed the urban pattern further into sprawl. We are all familiar with this situation, since this is our environment, and it has been examined endlessly by scholars, journalists, and concerned citizens. What is not quite so apparent is that urban life and spatial patterns are entering a new, postindustrial, period, which is characterized by the emergence of many dispersed special-purpose centers (not just the historic single all-purpose center), overall low densities, and movement in many different directions at any given time with diverse trip purposes. Electronic communications systems play an increasingly large role. All this makes it more difficult to operate effectively the traditional transportation modes that served us well under more structured conditions. Everything has not changed, but the task of providing responsive transportation services is now more challenging. Also, the expectations are higher.

There is a large inventory of available means of mobility today, most of them tested under various conditions in various places. In the United States, it is not just a question of how to cope with the automobile—admittedly a very seductive mode—but rather of how to equip our communities with a reasonable array of transportation choices, so that the best aggregate level of mobility is offered to all people. Never before has any other culture enjoyed the same freedom of movement, but there are deficiencies: not everybody can take full advantage of the current car-based transportation capabilities, and the systems that we do have are not necessarily (quite unlikely, in fact) the best, the most economical, the cleanest, and the most responsive options that could be provided. The vehicular pollution problem is perhaps on the verge of being solved, if some serious additional effort is applied, but plenty of other issues remain.

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The trends and problems are global, and while the scope of inquiry of this book is definitely directed to North America, these concerns do not exist in isolation, certainly not as far as transportation technology is concerned. It is common practice to refer to "industrialized countries" as having special needs and capabilities—which is an obsolete concept, because *industry* (i.e., manufacturing) is no longer the determining factor. The search for a proper label has some significance. "Advanced countries" is a pompous and patronizing characterization that does not contribute much to an operational discussion. "Peer countries" has some validity, but only if everything is compared to a U.S. situation. "Developing countries," on the other hand, is a very common term that helps to summarize broad descriptions, but obscures the fact that there is tremendous variety among these countries. Saudi Arabia, Brazil, Kenya, and Indonesia do not fit in the same box easily.

The fact of the matter is that cities and their populations are not homogeneous in different parts of the world, not even within the same country (not even in Sweden). Each city has components that range in their transportation expectations from the most comfortable to the most affordable. There are districts in African cities that expect and can pay for the most advanced services, and there are neighborhoods in American metropolitan areas that are not much different from those found in Third World countries. The relative size of the various user cohorts is, of course, different, but the demands within them are quite similar.

Therefore, for the purposes of examining transportation needs, it can be suggested that we recognize the presence of various economic and social classes (user groups) that react differently to transportation systems and have to be serviced differently. In a perfect world, such distinctions would not have to be made, since everybody is entitled to mobility. Equity is an important concept, and social reforms are undoubtedly needed in many instances, but the duty of urban transportation is to provide service for communities the way we find them today. Purposeful and relevant change comes next, but upgraded mobility systems can only do so much in implementing community reforms.

Thus, to define a base for the discussion of transportation modes, the following distinctions that are present in any society can be made:

- *The affluent elite*. This group is basically separate and only barely visible from the outside. The members live and play

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in their own enclaves and have their own means of mobility (limousines and private jets). They do not affect the rest of us, except to cause some envy; they do not participate in daily urban operations, and they do not use the subway. They do have much influence in decision making.

- *The prosperous cohort*. This group has the same expectations from transportation services as everybody else—rapid, comfortable, and secure accommodations—but members of this group can exercise a choice and be selective. They insist on control over their private space, and they might use public transportation, but only if it meets very high standards. The expense of transportation is not a significant barrier; the demand is for individually responsive means of unconstrained mobility. The private automobile does this (most of the time), and there is an open question as to what proportion of Americans falls in this group of dedicated motorists who have no other choices in mind.
- *The middle class*. This group has largely the same attitudes as the previous group, except that they operate with more frugal means. They include among their members proportionally more individuals who will favor public transportation as a matter of principle and the proper thing to do. It has always been the case that the professional and educated classes lead the public debate, start revolutions, and demand reforms. They have to be counted on as the formulators of public opinion, and they will determine policy directions in places where they constitute a vocal presence. It is a fact that members of this group, whether they are Argentines, Egyptians, Belgians, or Americans, will act and behave in the same way and demand the same type of services and facilities. They all read the same books and drive the same cars. The only differences among them are their relative proportion of the populace in any given society and some cultural variations. Europeans, for example, cherish their old city districts; Americans regard them as quaint "theme" areas; and members of emerging societies are still frequently embarrassed by them.
- *The surviving cohort*. This group consists of working people of modest means whose principal preoccupation is basic existence. They have little influence on decisions and politi-

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cal processes—except in instances where they constitute the overwhelming majority and are politically organized. They need and deserve transportation services, but they cannot afford high charges, and their choices tend to be limited. Some degree of subsidy will almost always be necessary to attain acceptable service levels.

- *The disadvantaged class.* This group includes the poor and those who have some personal handicap and insufficient resources to purchase proper services. Poverty always comes at different levels, but the problems are universal and unforgiving. This group represents the largest challenge to public agencies and institutions in achieving basic mobility for all. No social assistance program really works unless physical accessibility is ensured. Communities in the United States are certainly not immune from these requirements, and the current "welfare-to-work" effort is only one example of the initiatives needed.

The preceding is not by any means intended to be a sociological analysis of contemporary societies, but only a hypothesis of how different populations react to mobility needs and services provided. More specifically, the adequacy of operations can be looked at from three perspectives, which eventually leads to the selection of a proper response or transportation mode:

- The point of view of the *individual,* which will stress personal attitudes and emphasize usually humanly selfish considerations
- The policy of the *community,* which has to stress the common good and long-range capabilities
- The concerns related to *national* efficiency and well-being

The personal concerns will encompass the following:

- *Time spent in travel.* This includes time spent to reach the vehicle or access point, to possibly wait, to actually travel, to possibly transfer, and to reach the final destination (probably on foot).
- *Costs incurred.* These include primarily the out-of-pocket expenses on any given trip (including possible tolls and purchase of fuel), but there are also considerations of previous investment (buying a car) and the sunk costs (investment in equipment and insurance).

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- *Operational quality*. This concerns reliability, safety (from accidents), and smoothness of motion.
- *Human amenities*. These include security (from criminal activity), privacy, sanitation, climate control, seats, visual quality, and social standing.

The communal concerns should include the following:

- *Efficient networks and services*. They should have the ability to support economic and social life, and cause minimal disruptions and delays in normal urban operations.
- *Efficient urban patterns*. To the extent that transportation systems can help to achieve more compact settlement forms, the configurations and activity locations should be deliberately shaped.
- *High degree of livability*. Transportation modes should provide access to all places and establishments and have minimal local environmental and visual impacts.
- *Economic strength*. Economic development, tax revenues, and local jobs should be boosted due to good transportation.
- *Fiscal affordability*. Services should result in limited drain on local resources, maximum use of external assistance, minimal indebtedness, and low annual contributions.
- *Institutional peace*. There should be minimal need to change ordinances or regulations, modify labor rules, displace families and establishments, disturb existing institutions, etc.
- *Civic image and political approval*. Services should include features that are admired by outsiders and endorsed by local residents (voters) and businesses.

The national concerns exist at a higher and overarching level, and they might not always be achieved if left to local initiatives:

- *Use of national wealth*. This involves the implementation and operation of the most cost-effective systems, particularly as seen from the perspective of the national budget.
- *Conservation of fuel resources*. This particularly concerns those derived from petroleum.
- *Environmental quality*. Air quality over large areas and regions demands specific attention.

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- *Equity.* This is a concern to ensure that the needs of the less-privileged members of society are specifically addressed.
- *National technological capability.* Those systems that enhance technological advancement and production capacity within the country should be emphasized.
- *Well-functioning, well-equipped, and balanced communities.* Such built environments should be created in all parts of the country and within all metropolitan areas.

Recognizing the fact that no proposed or existing transportation system can satisfy equally well three separate sets of criteria, there is a need to amalgamate the preceding lists, perhaps even to make some compromises. There is also the practical consideration that the discussion here has to move toward workable guidelines for the *selection of appropriate modes* in any given urban setting. This means that some of the considerations are so overarching and basic that they simply have to be accepted as given; others make no distinction among modes and, therefore, are not operative in the evaluation process. Attention has to turn to functional aspects. All services and systems eventually exist and perform at the *local* level in communities.

Trip Purpose and Clientele

Most transportation modes can make a reasonable claim to be able to satisfy all trip purposes within a community. They have to, because no city can provide too many overlapping services. There are, however, modes that respond best to selected situations with identifiable needs. These usually encompass paratransit and various high-technology modes (shuttles and district services). With respect to user groups, the options are more complicated, because people tend to have differing expectations. These range from placing comfort features first to a single-minded emphasis on affordability. Concerns with equity very much enter into these evaluations.

Geographic Coverage and Grain of Access

The more capital-intensive modes best serve concentrated corridors, and door-to-door accessibility has to be added by feeder services. The grain of the former has to be rather coarse, i.e., not able to reach many dispersed points directly. Any mode that attempts

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to do the latter as communal transit for the sake of user convenience will not be in a position to provide rapid service, because of the many stops that will have to be made. To a large extent, this consideration explains the popularity of the private automobile.

Carrying Capacity

Transportation modes available today cover a wide spectrum in their ability to do work, i.e., carry people. A fundamental and not-too-difficult selection task is choosing a proper mode to respond to estimated demand volumes. If the users from a district number a dozen or so during a day, only individual street-based vehicles (perhaps in joint use) can be considered; if they number several tens of thousands, a subway will have to be built. The suitable responses at the extreme ends of the scale will be expensive in one way or another.

Speed

Time distances, not *physical* distances, are of concern here. For any given traveler in an urban situation, the maximum speed that a vehicle or train can attain on an open channel is of little interest; what matters is the total time consumed from the origin point to the destination and the inconveniences of transfers along the way. The private automobile is a formidable competitor again, except on truly congested street networks. The aggregate rapidity of movement is also a communal concern to the extent that time spent in travel is unproductive and tiresome to the participants.

Passenger Environment

In a prosperous society, personal comfort and convenience features are increasingly significant. If certain levels in quality of life have been attained in residences and workplaces, greatly inferior conditions will not be tolerated during travel. These features encompass the smoothness of the ride, privacy (or at least some distance from strangers), sanitation, climate control, availability of seats, visual quality, and anything else that registers through human senses. The challenging task in communal transit is to measure up to what private cars provide.

Reliability

Life in contemporary cities is stressful enough, and our society (as well as our employer) expects punctuality. Delays in traffic and

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travel are acceptable only as rare occurrences. There are modes that are more immune to traffic overloads and bad weather (rail-based, mostly), and there are others that are quite vulnerable to urban disruptions (street-based, mostly).

Safety and Security

Residents in cities are well sensitized, through continuous media attention, toward issues of personal safety and security—for good reasons. This is mostly a matter of the overall level of civilized behavior in a community and police protection, but there are modes that are perceived to be more susceptible to antisocial action and physical breakdown than others.

Conservation of the Natural Environment and Fuel

The attention paid lately to the quality of air and water around us and the concerns with resource depletion enter in the planning and design of many urban systems, particularly so with transportation. While these are national issues with national mandates, solutions can be achieved only through work at the local level, even if the consequences of any individual small action may be seen as marginal. Generally speaking, transit is benign, and low-occupancy automobile use is damaging.

Achievement of a Superior Built Environment

We can continue to expect that major transportation systems that significantly enhance the accessibility of specific nodes or corridors will generate a positive effect on land use and distribution of activities. This feature has potential for organizing the urban pattern, but evidence shows that this does not happen in all instances and it does not happen automatically—unless other constructive organizing programs are also implemented.

Costs

The expenses associated with transportation improvements and management can be broken down in considerable detail, but the commonly listed elements are right-of-way acquisition, construction of the channel (roadway or guideway) and facilities, purchase of rolling stock, and annual operation and maintenance expenses, which include compensation for the work force, purchase of fuel or power and supplies, maintenance of equipment and facilities, and managerial expenditures. Nothing is cheap, but some modes

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involve massive capital investments, while others consume large amounts of resources to run services and maintain hardware. It should not matter in the long run whether the funds come from municipal, state, or federal budgets since they are all drawn from the wealth of the entire society and country, but it does matter when decisions have to be made with respect to any specific system. The costs, either in their entirety or by separate components, are frequently, as might be expected, the life-or-death factors for any transportation project.

Implementability

This concern refers to elements that are complex, not always well defined, and frequently obscure to the general public in the political and institutional realms, sometimes reflecting established practices and habits. They can be critical items if progress with any project is expected, and they may sometimes represent insurmountable barriers. The engineers have an equivalent term—*buildability*—in public works construction. But that is a comparatively easy task since it refers to the physical ability to get something done. Implementability encompasses social, administrative, and political arrangements and habits, often unique to a specific community. Transportation systems affect much more than tangible artifacts and their operation. These factors operate at the local and state levels primarily, and no generalizations will be made here, except to call for serious attention and understanding well before any irreparable damage is done due to neglect or ignorance.

Image

Transportation systems and services are the public face of a community. Everybody comes in contact with them, and they are usually the first thing that a visitor from the outside experiences. They are elements of civic pride in many instances, and they show the seriousness that is applied to the creation of a livable and efficient community. But pride can also be a sin, and there are instances on record in which transportation solutions have been implemented for reasons other than functional necessity. This should not happen with full knowledge of the capabilities and potential of transportation modes in the contemporary city. There are legitimate reasons to applaud service systems that

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respond to the needs and capabilities of a community, to take pride in something that works well.

We should be ready now to apply the preceding criteria as a screen in reviewing the many transportation modes available for service. We shape our service systems, they do not shape us, but they do have a fundamental role in defining the structure of communities and how we live and operate in cities and metropolitan areas. Transportation systems and land use are two sides of the same coin. To achieve the exact built environment that we wish to have, work with both of them in a mutually supporting fashion is indicated. The record from the past has not always been inspired; we have the means, the methods, the choices, and, let us hope, the knowledge today to do better.

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