

IMPACT OF THE BART SYSTEM ON METROPOLITAN LAND USES

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Although there will be many other opportunities at this conference to discuss the general framework for transportation planning and evaluation, I shall, as a framework for my own remarks, make a brief attempt at the same thing.

Quite clearly, transportation is an intermediary service whose effectiveness depends on the larger context in which it is embedded and its influence on the social purposes that it aims to serve. In general, these purposes have to do with interaction of the type that is necessary for both production and consumption. The transportation of goods and the transportation of people form 2 different aspects of both production and consumption, but I will disregard the transportation of goods at this point, for 2 basic reasons. First, the evaluation of the BART system does not involve the transportation of goods except very indirectly and, second, in any case, the transportation of people is far more costly and more important for the welfare of the community.

The movement of people in production and consumption leads into a system of interaction in which the various aspects are inextricably interlinked. By way of example, consider the journey to work. Superficially, this journey is necessary to assemble the factors of production and consequently to produce. In basic concept, and in some land use models, however, we can regard this as a trip from work to home, and thus as a trip that is made for the purposes of consumption of housing. This view is not at all unrealistic in the sense that improved transportation systems may lead people to make longer work trips in order to enjoy better housing. The same illustration, therefore, also suggests that lowering total transportation cost is not a good direct measure of the efficacy of the system because such a measure underestimates the benefits of increased choice that accompany an improvement.

In this context and with some additional thought, we can therefore distinguish a number of levels of the impacts of transportation systems on the welfare of a region. In the first instance, we have the level of convenience, safety, and cost to the collective users of the transportation system. This is a conventional standard by which transportation performance is measured, and it is by no means an insignificant one. At a second level, we have the impact of the transportation system on the choices available to both residents and businesses regarding consumption and production in the metropolitan area. The exercise of these choices inevitably leads to changes in the land use pattern, and consequently we look to these changes for one type of measurement of this effect. A third type of impact has to do with the influence of the transportation system on the environment through noise, air pollution, vibration, and neighborhood disruption. A fourth type of influence arises because of the impact of transportation arrangements on the total efficiency and amenity of the metropolitan region, which in turn leads to acceleration or deceleration of the growth of the region in competition with other regions with different transport arrangements. Finally, a fifth consideration cuts across all of these and comprises the considerations of equity with respect to all of the impacts on impoverished and minority groups within the population. Quite clearly, given the present social goals for metropolitan planning, our view of each of these impacts must be substantially disaggregated by contrast with many past analytical approaches. This disaggregation will enable us to compare the status of many different groups of the population under transportation alternatives.

This paper is concerned principally with the second level of measurements. That is to say, we are concerned with the impact of a transportation system on the choices available to the population of the metropolitan region with respect to production and consumption. We expect to be able to track the use of these choices directly through changes in travel patterns, which I will not discuss, and slightly less directly through

the impact of these choices on the development of land uses. At the same time, a study of the development of land uses will lay a basis for a much richer and more complete evaluation of the impacts of a new transportation system.

The remainder of this discussion raises more problems than it answers. This is intentional because the paper is being presented to a conference that aims to develop methods and concepts. I do not wish to presume to anticipate the very great contribution that we expect to get from the participants in the conference. If, therefore, anything that follows seems too dogmatic or strongly opinionated, it may be taken as an effort to stimulate a reaction and a discussion.

In the framework of this introduction, the problem of dealing with the land use and related impacts of the BART system may be divided into 3 very broad categories. There is the simple problem of collecting and perhaps processing relevant information. There is a problem of interpreting or digesting that information. And there is the problem of evaluating the picture that emerges from this interpretation. It will perhaps be beyond the scope of any studies undertaken to make a final or even an interim evaluation of the BART system. Nevertheless, we must include evaluation in our scheme in order to structure our thinking. We might better, therefore, reverse the order of steps and say that we must decide how the performance of a system will be evaluated in order to decide what performance characteristics need to be measured for the total system (that is, total metropolitan living arrangements); and in order to construct these indicators of performance, we must determine what data will have to be collected. Quite obviously, these various considerations interact, and we cannot propose to make evaluations or construct indexes of performance where the costs of data collection or data processing are exorbitant or where the reliability of the only available measures is very low indeed.

In spite of the fact that I am generally unsympathetic to the idea of saying "Our first step will be to take an inventory of the situation," I will nevertheless start with a brief canvass of the data situation because of the priority that must be given to considerations of evaluation and interpretation.

Over the past 10 years, very substantial strides have been taken in the development of urban metropolitan data systems—at least in principle. We now know a great deal more about the nature of the data requirements for analyzing metropolitan systems, about the availability of data and the costs of acquiring it, and about the potential methods for managing data files. Unfortunately, this knowledge and the available computer technology that could be used to implement it have not yet given rise to any substantial data banks. We are thus all familiar with the fact that in most respects the initiation of a large-scale transportation study (such as was conducted in the Bay Area in the mid-sixties) is the principal occasion on which comprehensive and large-scale data bases become accumulated. For comparative impact studies of the type that we will be discussing here, data bases that have to do with the distribution of activities are important, and important at more than one date. Because I happen to believe that such data bases will be needed for a wide variety of planning purposes over a long period of time, I am not bashful about suggesting the basic content of such a data base, or about reviewing certain necessities in terms of the acquisition of information.

Basic population information is available by census tracts for any metropolitan area for years evenly divisible by ten. There is some anticipation that the coming decade will see the inauguration of a quinquennial census, with data being collected in 1975. The 1970 Census will be highly accessible and will contain a wealth of detailed cross-tabulations that were not available in previous decades. For this reason, it is, in my view, the pivotal data element for an evaluation of the BART system. If, however, a 1975 census is not taken, a number of serious problems about securing comparative data could permit conclusions to be drawn in the immediately foreseeable future. Because a large number of the effects of the BART system will in effect be long run, it is not entirely unreasonable to say that the first really complete evaluation will have to be made at the time of the next really complete federal census, be it 1975 or 1980.

At the same time that we need to know about the location of population on a basis that comprehends the social and economic characteristics of that population, we also need to know something about the distribution of employment. The fine-scale distribution of

employment in a metropolitan area is not the object of any ordinary ongoing federal census activity. The periodic publication of County Business Patterns gives employment at the finest possible SIC detail, but not at the necessary levels of area detail. The sporadic Census of Business and Manufacturing is not complete in its coverage and not very small-scale in detail. The best complete data file for the San Francisco region was compiled by the Bay Area Transportation Study Commission, and unfortunately this does not correspond in date with any comprehensive survey of the distribution of population except as is reflected in the BATSC origin-destination survey. There are 2 alternatives with respect to the long-term distribution of industry by category and by small areas. One is to rely on the feasibility of turning the Census of Population inside out. This depends in the first instance on proper coding of the location of place of work and in the second instance on resources for tabulation. These issues should receive detailed local attention. There are still other difficulties in relation to the coding both of the location and of the industry that may or may not prove to be insurmountable, given the way in which census data are collected. The second approach is to initiate periodic and repeated retabulations of the State Bureau of Employment Security records. In this case multiple establishments reporting from a single employer have to be disaggregated, and many other adjustments have to be made. In my view, however, this is the method of choice, because conceivably standardized procedures can be set up and undertaken at regular intervals, say annually or biennially, to the substantial advantage of local planning, including transportation planning.

A third basic element of a land use data base consists of some kind of classified tabulation, currently updated, of land and structures. Except for things such as bay fill, land is essentially a constant quantity, although the subdivision of parcels creates record-keeping difficulties. Structures in place are also constant quantities except that it would be nice to have a record of the condition of the buildings, which changes over time. A recording of these data is currently not feasible unless code enforcement is being very vigorously pursued in most municipalities, and records are accessible and translatable into a form for machine processing. The real issue, therefore, becomes the updating of structure files for new construction and demolitions, preferably given some base year data. For residential structures, the Census will provide a benchmark of a sort; for nonresidential structures, it is conceivable that the BATSC files could be employed. Because new construction and demolitions are ordinarily governed by permits, a permit file can with some qualifications be used to update a structure file. Because the news that we have about the impact of BART on the San Francisco economy is already stressing the amount of construction that has taken place, obviously any valuation scheme will be somewhat sensitive to the tabulation of these variables. A scheme for dealing with them either from local records or on the basis of sampling with periodic universe surveys will have to be devised.

One of the most difficult aspects of metropolitan data for purposes like those presently in hand is the issue of valuation of land and structures. Residential structures, with the land on which they stand, are usually valued more or less reliably by their owners in the census or implicitly by the report of the rental value of their occupiers. Data of this type do not exist for commercial activities because in most cases the rental or owner valuation of nonresidential buildings is not available. A major data processing activity might have access to assessment records, but it is well known that many problems arise regarding the interpretation of these records. The levels of the assessment in general, the unevenness of the assessment, and the tendency for assessments to lag behind current market prices are but a few of the issues involved. Nevertheless, I cannot see any easy way to evaluate the impacts of a large-scale transportation change without understanding the impact on values as well as on volumes of construction and occupancy.

We may now set the question of data temporarily to one side and take a look at questions that have to do with the interpretation of the data. Insofar as possible, I hope to hold the question of interpretation slightly separate from the question of evaluation. There are a number of issues of interpretation, and I will try to take them up one at a time.

In the first instance, I do not think that it would be wise in general to undertake any partial interpretation, whether based on partial data or not. For example, if we had data about the volume of construction of commercial space around the BART subway stops, we would, I think, find it necessary to attempt to evaluate the vacancy, abandonment, and decline in economic value (or at least the observed changes) among similar properties located elsewhere within the metropolitan region. The question that is relevant here is whether the change in the transportation system is in fact changing property values or only redistributing them. It also seems likely that the changes in commercial values and in residential values might be expected to move in opposite directions. That is, if a new transportation system such as BART facilitates the concentration of commercial activity and the dispersion of residential activity, then the prices of centralized commercial land would be higher than those ordinarily expected and the prices of peripheral land might be on the average higher. Nothing could necessarily be said about the totality of land values.

The discussion in the preceding paragraph has of necessity referred to some set of comparative values having to do with what would "otherwise" have happened. The necessity for this comparison raises 2 additional issues of interpretation of major importance. The difficulty of providing a standard of comparison for measured events is undoubtedly the most vexing problem in the whole evaluation procedure.

One approach to the problem of comparisons would be to select one or more control cities in which major transportation innovations are not immediately anticipated. Such a metropolis should be approximately the same size and industrial composition as San Francisco and should have a prospect of enjoying approximately the same growth rate. The types of candidates that might be considered probably include Seattle, Denver, the Twin Cities, Houston, and Phoenix. It would be desirable in the control city to collect much of the same information as would be used in evaluating the impacts of the BART system, on both a before-and-after basis. This suggests among other considerations, therefore, that we would have to take into account the local capabilities for data collection and data management in making this selection. Such a control city should in any case either be conducting a large-scale transportation study or have a very lively multi-purpose regional planning agency.

The problem of using a control city is of course expensive and chancy. It is chancy in the sense that there may indeed be peculiar features of San Francisco that cannot be captured in any other city, and also in the sense that if only one control is selected its basic developmental motivations may diverge from those of San Francisco in the next decade. As a hedge against the unreliability of control methods as a basis for interpretation, it is therefore important to develop projection methods that provide a more or less self-contained basis for comparison. Two fundamentally diverse approaches to this problem may be considered.

At the simplest level, and in any event, the impact study should attempt to make trend projections, probably based on BATSC data and on the 1970 Census and extended into the 1980 decade, perhaps in 5-year increments. Similar trend projections may have been undertaken by BATSC and by other planning agencies in the region, but in order to provide a basis for evaluating impacts, they now have to be redone on the assumption that the BART system is nonexistent.

A general difficulty having to do with projection systems of any kind is whether a divergence from the projection signalizes a failure of the system or a basic and unanticipated change in the total environment. This problem is endemic to transportation studies and cannot be evaded with respect to the evaluation of the BART system. It poses a major problem of research strategy that I believe should be discussed at this conference but on which I am not prepared to make any detailed advance statements.

In this connection, however, I would recommend that a part of the BART evaluation study go back to the original preliminary surveys justifying the project as they were made in the middle and late 1950's. These studies should be examined in minute detail from the point of view of their reliability as predictive and projective systems, and the final output should be a 3- or 4-way comparison. One element would be an independently projected Bay Area status without BART. Another would be an actual measurement of the regional situation with BART. A third would be the projection made by the consultants of the region with BART, and a possible fourth would be any projections made at

the same time without BART. This comparison, it seems to me, is essential for the ultimate improvement of the transportation planning process, because there is some reason to believe that the actual performance of the BART system will diverge somewhat from the projections made by the consulting engineers. Such divergence, if it exists, may be a weakness in the transportation planning process and should in any case be subject to careful scrutiny and possible future correction.

This discussion then introduces the second and related issue with respect to the attitude of this impact study toward projections. It is perfectly clear that a trend projection of past developments that does not assume the existence of the BART system is probably simpler than a reliable projection of what will indeed happen under the BART system. I think it should be a matter of discussion for this conference whether the impact study should involve itself in projecting a future for the region with the BART system. This would be an exceedingly valuable exercise in view of the 15 years or so of experience in land use modeling since the original projections were made, and it is an opportunity that will not occur frequently in terms of the mass of data and the extent of technical capability that ought to be assembled for the evaluation of the system. It is not, however, strictly necessary for an evaluation of the impact of BART. It is necessary only for some type of evaluation of the capability of transportation and land use modeling methods.

In spite of the relative low priority that I give this type of projection, I think that one rather telling point can be made about a comparison between transportation forward planning methods and transportation impact evaluation methods. It is probably fairly obvious that no very good evaluation of the BART impacts can be made without, as I have discussed earlier, measuring changes in property valuations. The question therefore arises, if land values are important in an ex post evaluation of transportation impacts, are they not equally important in an ex ante evaluation? If the answer is yes, we must acknowledge that very few land use projection models enable us to predict land values under alternative assumptions as to transportation systems. It might be wise in the course of this study briefly to explore issues of this type.

I turn now very briefly to the question of the evaluation of impacts. This question, as I have suggested, will probably arise at a much later date in the study, and the actual evaluation will be undertaken largely outside the impact study on the basis of its interpreted results. The study staff, however, will want to be able to make selected evaluations on its own account and, at the same time, will wish to be sure that the proper information has been provided to the evaluators and decision-makers of the region and elsewhere. It is quite certain that large numbers of people all over the United States, and indeed all over the world, are watching the outcome of the BART experiment with considerable interest. They will not be entirely satisfied with figures regarding ridership, schedules, and financial performance. Indeed, it is assumed in advance that, on the basis of overall financial accounting, BART will not be self-liquidating and that the benefits that will accrue to the residents, businesses, and land owners of the Bay Area fully justify their assuming most of the capital costs of the system. The evaluation of land use impacts is therefore a nontrivial aspect of the total impact study.

I think there are 2 or 3 different ways of looking at valuation that may be of use in the discussion of methods for interpretation and data collection as they will certainly be undertaken in the impact study and with respect to the valuation itself. These questions essentially have to do with the worth of a land use plan to the users of the plan and the relation of these impacts to broader social goals. There will also be a residual problem of separating the impacts of transportation per se from possible coordinated land use planning efforts.

Even though the property valuation changes that take place partly as a result of transportation changes are important, they are not the final measure of the impact of transportation on land uses. In this respect they are analogous to transportation costs that are not the final measure of the efficacy of a transportation system. The direct impact of land use changes fall differentially on 3 general classes of entities—households, businesses, and land owners. The social goals that we will discuss have to do with other impacts that are valued by the community but that are not measured by their effects on these 3 groups of people.

As far as households are concerned, it is probably feasible to make global estimates of the utilities that they derive as the result of land use and transportation patterns combined. These utilities have a limited set of components. First, households may receive more or less housing benefits in the form of space, amenity, and quality of shelter. Second, they may obtain more or less advantages of accessibility to opportunity within the region, considered quite separately from the costs that they incur in interaction. Third, under any given set of arrangements, their transportation and living costs will be determined in relation to their income, leaving a certain level of purchasing power for all other expenses. In general, and with an exception to be noted later, the costs of these other expenses are not very much influenced by housing and transportation arrangements.

The expenses of businesses are influenced by transportation and land use arrangements in ways that are somewhat difficult to estimate and that may not be easy to evaluate in an impact study. These expenses, however, can be translated into impacts on the resident population in the following ways without raising many difficult issues of evaluating business interests. First, if transportation and land use arrangements make it cheaper or more expensive to provide goods, services, and amenities to the resident population, their purchasing power will increase or decrease for the subset of nonlocal goods that they purchased locally. Much of the costs of most purchased commodities are determined, however, outside the metropolitan region. Second, if local land and transportation arrangements affect the costs of export industries or of service industries supplying export industries, their competitive positions in the United States and world economy will be influenced. Two types of adjustment are possible. Low costs may stimulate growth and high costs may discourage it; equally likely, it seems to me, is the probability of a wage adjustment in the export industries. In this case, households are directly affected. It seems unlikely, however, that the bulk of these economic effects can be very well estimated in an impact study of the type we are discussing, and approximate methods will have to be sought.

The impact of particular plans on land owners will be reflected directly in the values of their properties. How this is to be translated into social welfare functions is a problem on which I am not presently prepared to take a stand. In general, there seems to be a view that, for purposes of getting things done, an anticipation of profits will make some groups of real estate owners vigorously vocal but that, for long-run evaluations, their interests are speculative and do not reflect real income and should therefore be disregarded. Some further discussion of this topic might be useful.

There are obviously a certain number of major social objectives that cannot be measured by the present impact on individual entities such as households, businesses, and land owners. One of these is the preservation of the environment, both at present in terms of the protection from pollution and in the future in terms of a much broader scale of conservation. Many conservation goals must be pursued through the use of the police power rather than through the impact of transportation systems like BART and are hence excluded from present consideration. Public open space and recreational facilities that are related to conservation are only one of the many public services whose supply and enjoyment is strongly influenced by the transportation and land use system. Some review should probably be reserved for the adequacy of these public supply systems in view of the increasing relative importance of public goods in American consumption. A most important social goal in terms of opportunities for choice has in part been taken care of by our previous discussion of accessibility, but it may very well be that the community as a whole may wish to place a higher importance on accessibility to employment, recreation, and other goods than the individual does, so that these possess a value higher than that reflected in individual utility functions. There are many parallels in the community insistence on adequate levels of health and education for the general population, even without regard for the preferences and utility functions of the consumers of these services.

The final and quite possibly overriding social goal in present American planning is equity. I do not here presume to make any definition of this difficult concept nor to suggest how it can be reconciled with many other social goals with which it may to some extent conflict. It is quite possible, however, to assert that transportation and land

use arrangements will have differential impacts on many different ethnic, social, and economic groups, and that currently, insofar as possible, there is a strong tendency to attempt to respect the interests of those groups. A sound evaluative scheme will therefore demand evidence as to these impacts, and this means that transportation and land use measurements and predictions must be as disaggregated as possible on these various dimensions.

Looking back over what I have written, I think that there is ample room for much detailed and specific discussion of topics that I have purposely slighted or inadvertently omitted altogether. I share what I think is the feeling that the BART experiment is of major importance in urban transportation planning and that its effects must be carefully weighed in relation to a potential of many billions of dollars of expenditure that may be either properly directed or misdirected. The program of study that I have laid out is intrinsically ambitious and would ultimately, in conjunction with other topics discussed elsewhere at this conference, entail very large expenditures. But if my assumptions about the importance of a proper evaluation of BART are correct, even expenditures of tens of millions of dollars, properly directed, would not be amiss. I hope that we will be able on the basis of our discussions to make some contribution, first, toward keeping these expenditures within bounds but, second, toward giving them proper direction and ensuring the adequacy of the results.