FRAMEWORK FOR USING SOCIAL INDICATORS TO MONITOR, EVALUATE, AND IMPROVE A PUBLIC TRANSPORTATION SYSTEM

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This paper proposes a general framework for using social indicators to monitor, evaluate, and improve a public transportation system. Discussion of this framework is preceded by a definition of social indicators and an explanation of five of their functions. Some general factors and techniques concerning the selection, measurement, collection, and storage of social indicators are suggested. The specific approach presents eight areas of concern. These areas are suggested as performance criteria for evaluating any public transportation system. Furthermore, important questions are listed and are broken down by related factors. From this systematic approach, the authors specify four sample indicators. These indicators are then developed for the framework's stages of monitoring, evaluating, and improving public transportation systems. In the final section, one of the sample indicators is applied to the Atlanta Model Cities Shuttle Bus System.

A SOCIAL INDICATOR is defined as a variable that measures or reports on a single or several dimensions of the performance or condition of man and his systems. Four key distinctions are contained in this definition. First, a social indicator is a variable. It can vary with time to allow comparisons and identification of long-term trends or unusually sharp fluctuations. Second, a social indicator can either measure or report on or both the performance of man or his systems. The distinction here is measure or report. The former implies quantification by numbers or units. The latter suggests additional qualitative description.

The third distinction involves the dimensionality of the phenomenon. Social indicators can be disaggregated by relevant attributes of either the persons or the conditions measured (e.g., race and sex or peak and off-peak flows) and by the context surrounding the measure (e.g., neighborhood, city, or SMSA).

The fourth distinction underlies the words performance and condition. Normative judgment is usually required for some consensus of what the performance or condition should be (a norm) and on whether the movement of the performance or condition is toward or away from the norm.

FUNCTIONS OF SOCIAL INDICATORS

Springer (1) suggested five functions of social indicators that are based on managerial rationality. First, they can be used to assess the state of a system. This assessment implies a quantitative and descriptive statement about the character of the system. Second, they can help assess the performance of the system. This assessment suggests norms or performance standards that should be related to goals of the system.

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Third, social indicators can help to define the actions or decisions necessary to ameliorate or improve a condition. The fourth function is that of anticipating the future of the system. This function includes (a) defining of alternative futures for decision-making, (b) forewarning of an impending crisis, and (c) targeting of defined goals. Finally, social indicators could offer some guidance about areas in which existing information is inadequate and research is needed.

This overview of social indicators provides the foundation for the proposed framework. In this framework, we have addressed mainly the first three functions of social indicators.

Before discussing the approach to this framework, the authors suggest some general factors and techniques that should be considered when developing social indicators.

GENERAL FACTORS AND TECHNIQUES IN THE DEVELOPMENT OF SOCIAL INDICATORS

Certain general factors and techniques should be considered in developing social indicators to evaluate a public transportation system. Each of the factors discussed in this section applies to the selection, measurement, collection, and storage of social indicators. In addition, general techniques are described for each of these four processes.

Factors

At least six factors should be followed in the selection, measurement, collection, and storage of social indicators. First, we must consider the type—e.g., rail rapid transit, bus transit, or some combination of the two—and institutional control—i.e., control by a private corporation or public transportation authority—of the system. Different systems may require entirely different social indicators, or at least different systems may place different emphasis on similar indicators.

The second factor to be observed is the territory served by the system. Does the transportation system serve a nation, state, SMSA, town, or neighborhood? Is the system in the northern, southern, eastern, or western region of the country?

A third factor pertains to the users of the public transportation system. Users have different demographic and travel characteristics; this causes the selection, measurement, and collection of social indicators to vary. Demographic characteristics include race, sex, age, income, occupation, marital status, family size, and type and location of dwelling unit. Examples of travel characteristics are trip purpose, trip destination, trip frequency, trip mode, trip length, and trip time and frequency.

Time frame is also important. How often should one measure, collect, and store indicators—weekly, monthly, quarterly, yearly, or decennially? If one is measuring on a daily basis, should he consider peak or off-peak hours? Are indicators of short- or long-term changes needed? What is the time lag between collection of indicators and storage of results?

The selection, measurement, and collection of social indicators for public transportation might vary with the weather, seasons, or economic conditions. Thus, the fifth factor to consider is the condition or context involved.

The last and most important consideration is the usefulness of the indicator. Will the indicator provide useful and reliable information as well as information compatible with data of other agencies? The information being measured, collected, and stored must be useful in evaluating a system. For example, using many indicators to measure the same dimension of a phenomenon is wasteful. However, specifying different indicators to measure different dimensions of a phenomenon is useful.

The decision-maker must also have reliable and accurate information with which to monitor, evaluate, and ultimately improve the public transportation system. Biases in the selection, measurement, collection, and storage of social indicators should be minimized. Typical examples would be (a) selecting indicators based on existing normative interests, (b) measuring indicators improperly because of poor operational definitions or wording of survey questions, (c) collecting indicators with sample distortions or undercounting, and (d) storing erroneous data because of keypunch mistakes.

Finally, social indicator information should be compatible with that of other agencies. Will other agencies (especially public) be able to compare these indicators with any they have obtained? Should the indicators be compatible on a geographic, temporal, or definitional basis? For example, in measuring personal income of the bus rider, one should use standard income categories. Similarly, trip purpose information should be measured according to standard categories. "Unless there is a direct link between a local department and a federal bureau little effort is made to coordinate and standardize data collection" (6).

Techniques

Some general techniques are suggested for the selection, measurement, collection, and storage of social indicators. These methods are by no means the only ones but are simply useful general approaches.

Selection—Several logical approaches have been suggested for the selection of social indicators: selection by their similarity in measurement, selection according to the level of decision-making, or selection from broadly defined areas.

Measurement—Next to the selection of indicators, the measurement of indicators is the hardest of the four stages to perform. In fact, many social indicators and phenomena are selected based on their ease of measurement rather than on their usefulness. One must first decide whether an indicator can be measured with or without a respondent. The latter case is easily handled. For example, one could ride a bus during a peak hour and easily count, by himself, the number of vacant seats.

When a respondent is needed, additional considerations are required. The indicators desired must be clearly defined. Assuming that the indicator selection procedure has been properly followed, much of the definition would already have been completed. Next, one would decide if structured or unstructured questions are to be given to the respondent (2). The former provides the respondent with fixed-response alternatives. Examples of this technique are two-choice and multiple-choice questions. Variations of these two types use specific ranking and scaling techniques to measure the response exactly. On the other hand, unstructured questions permit the respondent to talk freely and at length about the subject.

Collection—A first step in collecting social indicator information is to check existing data. Agencies that might have information useful to managers of a public transportation system would be (a) federal agencies and departments (e.g., Bureau of the Census, Bureau of Labor Statistics, Department of Transportation, and Department of Commerce), (b) local and regional authorities (e.g., transportation, housing, and welfare), and (c) other public and private institutions (e.g., universities and research centers).

Once these sources have been checked, the collection of new information would be considered. In so doing, the following three questions must be answered: Who will collect the needed information? How will it be collected? Where will it be collected? It may be decided to contract out the data collection, in which case results are presented as a package. On the other hand, if the data are collected in-house, the other two questions must be considered.

A useful method for collecting information is the sample survey. In the evaluation of a public transportation system, four survey techniques are possible: observation (on-board or bus stop) survey, mail-out survey, home interview survey, and destination survey.

The on-board survey would require only one or two persons to observe how the actual users of the public transportation system react to the service. A respondent may or may not be required.

In the mail-out survey, questionnaires would have to be prepared and given to the users of the system or sent to all residents within a specific area. Obviously, this preparation requires adequate knowledge of questionnaire development and sampling techniques and a listing of home addresses.

The home interview also requires proper questionnaire development, sampling, and, more importantly, interviewing. Home interviews are expensive, tedious, and

time-consuming, but they do permit the collection of more information—attitudinal as well as factual.

All three techniques mentioned would require verification by telephone or return visit. In addition, editing of the collected data would be necessary to check for human errors.

The destination survey would be conducted at major destination points such as places of employment, shopping centers, and recreational centers.

Finally, when the collection is to be performed and how often it should be repeated must be determined exactly. These two determinations will be based on the previously mentioned factors concerning the condition at the time of collection (e.g., peak hour) and usefulness of the collected information (e.g., time series projection or monitoring a change).

Storage—Two plausible storage alternatives are available to the decision-maker. Data can be processed and stored in computer-compatible format, or data can be processed by hand. Except for small-scale surveys, computer storage would usually be the best selection. If computer storage is used, a few points should be considered. First, the data should be stored on files by each individual case. This technique permits aggregation at a later time. The data should not be grouped by user attributes or by level of aggregation before permanent storage inasmuch as this method restricts the decision-maker in his analysis.

AN APPROACH FOR SELECTING SOCIAL INDICATORS TO EVALUATE A PUBLIC TRANSPORTATION SYSTEM

The Approach

The approach comprises three steps. Eight general areas of concern are suggested and are given below. These represent specific performance criteria for a public transportation system. The second step further defines these areas by formulating detailed questions that represent the major question that the decision-maker would like to answer. The third step is to break down each question into the important components and the major factors related to these components.

1. Accessibility—This refers to the ability of the rider to travel from a selected initial location to a desired location. Where should the routes be located? The breakdown of this question is as follows:

Components	Factors
User origin	Number of people, percentage of elderly, percentage of one-car or no-car families, percentage of low-income residents, percentage of singles (25 to 35 years old), type and value of residential units
User destination	Office building, industry, retail center, supermarket, school, hospital, park

2. Comfort and Convenience—These refer to the quality of satisfaction and enjoyment or the physical ease in using the system. How can comfort and convenience be optimized? Some of the factors involved are as follows:

Components	Factors
Adequate seating	Number of riders per route, headways on route, number of packages (briefcases)
Comfortable air	Weather, time of day, operation of bus
Adequate design features	Handles, steps, doors, credit card, coins, paper tickets
Better bus driver	Training, skill, determination, physical limitations
Volume of buses	Origins, destinations, crowding policy, hours of operation

3. Economy—Economy refers to the efficient use of resources to provide an optimum and practical system. But how can the system's cost equal the cost of operation? Some of the items that should be considered follow:

Components	Factors
Fares	Costs, subsidies, ability to pay, charter revenues, off-peak fares, special fares (for children, the elderly, the disabled)
Variable costs	Labor, bus depreciation, maintenance, vandalism

4. Dependability—Dependability refers to the reliability of the system to perform properly. How can the system be made more dependable? Some items of interest here are as follows:

Components	Factors
Major delays	Bus stop location, speed, capacity, headways, railroad crossing, number and types of riders
Better bus driver	Training, skill, determination, physical limitations

5. Safety—This implies security and freedom from danger for both the passenger and the vehicle. It also refers to protecting the system and the passenger from undergoing injury or loss. How can the system be made safer? Items that might be germane to the answer follow:

Components	Factors
Cause of accidents	Poor driving, vehicle failure, signal failure, weather, personal accident on bus
Safety design features	Small steps, elevator, self-opening door, extra handles, reserved seats
Safety enforcement	Bus driver awareness, time of bus operation, presence of enforcement officer

6. Speed—Speed refers to the rate of performance of a system and implies swift or quick movement. How can the system's buses be made to operate at higher speeds? Items pertinent to the answer follow:

Components	Factors
Reduced delays	Number of riders, number of buses, route characteristics
Express route	Origin, destination, street linkage

7. Clarity—This addresses the ease in visibility, use, or understanding of a system and how it operates. How should the system be promoted? Items that may aid in the solution to the question follow:

Components	Factors
Communication media	Pamphlet, newspaper, radio, television, friend or relative, neighborhood organization
Understanding media	Percentage of population that is literate, blind, and knowledgeable of the system
Route identification	Overhead sign, bus number and color, street name, shelter

8. Flexibility—This final approach is that of flexibility, which refers to the capability of the system to respond to change or a new situation. How can the system be made more flexible? Items to be considered follow:

Components	Factors
Overloads and drop-offs	Weather, headways, rider habits, work hours
Prediction of overloads and drop-offs	Weather forecast, increased ridership, announced sales and sports events, staggered work hours, holidays
Route or schedule change	Origin, destination, volume

The Selection

Many indicators could have been selected, but the authors chose four samples. Those indicators selected are:

1. Origins, destinations, and number of female users of the system who are 16 and older;
2. Ability to pay (which equals weekly transportation cost divided by weekly income), presented as a frequency distribution for various income categories;
3. Number and time of daily work trips; and
4. Monthly vandalism cost.

The first indicator would contribute to two of the five main functions. It would help assess the performance of the public transportation system in terms of accessibility. The origins and destinations for these females would be compared to each existing route to determine the degree of accessibility.

The second function of this indicator is to anticipate future travel patterns. Comparing present travel patterns with past travel patterns would indicate changing trends and predict future travel patterns. Such trends as the growing female labor force and the increasing number of female heads-of-households would be typical examples.

The reason for selecting this particular group of users is twofold. First, females seem to be highly dependent on public transportation, constitute a large portion of the users, and have the most diverse travel patterns. Second, the age group was selected to include those females of employable age or who had a source of income.

The second sample indicator would have four functions. First, ability to pay would assess the present fare policy on an equal basis for all users. The indicator would determine if users were paying more than a certain percentage of their income on transportation costs. It would also aid in planning future fare policies by showing how many users would be helped or hurt by a fare increase or decrease. This indicator would also provide valuable information for supporting or refuting a pending sales tax or subsidy program.

The third function performed by ability to pay would be to improve an existing fare problem. The determination of which and how many users are paying a high percentage of their incomes for transportation would help in making a decision on subsidies or fare reductions.

Finally, ability to pay might point out further areas to be investigated. Some examples might be the following:

1. How many users ride the bus only for their work trips and drive automobiles for other trips?
2. What percentage of users with a high ability-to-pay ratio ride in the off-peak hours?

The third sample indicator would serve four functions. First, one could assess how a public transportation system competes with personal transportation (automobiles). This assessment would be done by comparing the total number of work trips to either (a) the potential number of work trips for a particular route or area or (b) the total number of automobile trips for a particular area (e.g., metropolitan area or CBD).

One could also use the comparison to assess how close the system is to a specific goal (e.g., to serve a minimum of 20 percent of a metropolitan population with public transportation).

Second, this comparison would indicate a possible source of new bus riders, e.g., workers who commute in automobiles. Third, if the decision-maker knew the time of these trips, he could estimate when to increase worker ridership. For example, attracting new riders in off-peak hours might be easier than in the peak hour because of present peak-hour crowding and the lack of capital to purchase more buses.

Finally, this indicator could suggest further areas to be investigated. For example, if the indicator showed a very low number of bus work trips compared to automobile work trips, the decision-maker could determine the origins and destinations of these automobile trips. He might then compare existing bus routes to these travel patterns to see how the routes might provide better access for the automobile driver.

The reasons for selecting this indicator are threefold. First, the work trip is the most important trip to the traveler. Second, the work trip is usually the most frequent and predictable trip for any traveler. Third, to increase ridership, the decision-maker would do better to attract new riders than to increase the frequency of trips for permanent riders.

Monthly vandalism cost would include damage occurring to the bus (e.g., torn seats) as well as physical injury to the driver or the passengers or both. This indicator would function in four ways. First, indicating a higher or lower estimated cost per month would effectively measure the system's performance. Second, when the present vandalism cost is compared to past costs, the decision-maker can determine whether the system is improving in terms of optimum economy, i.e., maximizing net revenue.

The third function relates to ameliorating the problem of vandalism. Vandalism costs would be listed by cause and location. This method of listing could remove much of the analysis normally performed on social indicators and place the decision-maker much closer to the solution. Bus drivers would report when and where actual vandalism occurred. In some cases the actual cost would be less important than the type or degree of vandalism. An increasing monthly vandalism cost would also suggest topics that should be further studied, e.g., unemployment of youths.

These, then, are the four indicators selected as typical samples for evaluating a public transportation system. The next sections set up a framework that explains how these indicators could be used to evaluate the system.

MONITORING THE PUBLIC TRANSPORTATION SYSTEM WITH SAMPLE INDICATORS

Monitoring usually implies periodic observation or regulation of a process or system. To monitor a public transportation system with selected social indicators requires first that indicators be measured and collected and preferably that they be stored. Consequently, this section discusses these three phases of the monitoring process as it applies to the four sample indicators.

Measurement of Sample Indicators

Measurement of the first social indicator, female bus users who are 16 and older, would require a structured questionnaire and a respondent. The origins and destinations could be recorded by full addresses or by nearest street intersections and could be coded later into census tract and block numbers or intersection numbers for computer storage. If additional information such as number of transfers, time of trip, frequency of trip, and purpose of trip is needed, the use of structured questions is suggested to facilitate coding and analysis. Furthermore, trip purpose categories should be standard.

The ability-to-pay indicator would require a respondent and questions structured for computer analysis. Secondary sources, such as the U.S. Bureau of the Census or a local welfare or planning department, would also provide income information. The indicator itself would be measured as a cost ratio. The exact number of weekly trips (including transfers) could be recorded, or a structured question could provide

categories listing the number of trips in groups. The weekly transportation cost would then be calculated. For this measurement to be accurate, the respondent would also list whether she pays cash or a token or has a free pass for most of her trips. The type of fare payment could vary for different systems.

A structured question would be used to provide the respondent with a choice of recording either weekly, monthly, or yearly income. This would eliminate the problem of incorrectly converting a monthly or yearly salary to a weekly salary.

Once this ratio was calculated, it would be compared to a locally established standard on the percentage of income a user should have to pay for the cost of public transportation.

The third indicator, number and time of work trips per bus route, would require a respondent, structured questions, and some outside information source. The respondent would be used to ascertain the number and time of her daily work trips. An outside source would be needed to determine either of the following: the potential number of work trips for a particular route or area or the total number of automobile trips for a particular area (e.g., neighborhood, CBD, SMSA). The best source for this information would be an area-wide transportation study. This type of study would have origin trips recorded by purpose, mode, and zones. An example of such a study would be the Atlanta Area Tranpsortation Study (AATS) conducted in 1961.

Actual measurement of the indicator would result then from either of the following ratios:

1. Number of daily bus trips per route divided by number of potential bus trips per route or
2. Number of daily bus trips per system area divided by number of daily automobile trips per system area.

If the first ratio is used, each route could be evaluated. However, if the second is used, the measurement of daily trips should be expanded to include all routes.

The fourth indicator, monthly vandalism cost, would be measured in dollars and would have to be estimated because of the time lag between actual repair and billing. A normative standard would be established as a percentage of operating cost (e.g., not more than 1 percent). This standard would provide some value to the indicator and would also be a goal for the decision-maker.

A respondent would not be necessary to measure monthly vandalism cost. This information would normally be included in a regular budget analysis of most public transportation systems.

Collection of Sample Indicators

Collection of sample indicators would be directly dependent on how each is measured. As already mentioned, most of the required information would be collected from the sample questionnaire by means of an on-board survey.

The on-board survey would be conducted by three agents, one near each bus door and the third between the doors. The agents would distribute the questionnaire, answer questions, and scan the completed form for mistakes. The questionnaire would be short and simple to fill out inasmuch as the rider would have to complete it before leaving the bus.

The number, origins, and destinations of female riders (16 and over) would best be collected with an on-board survey, a simple and inexpensive technique. The data would be collected on a normal weekday for all bus hours and for each route.

The use of home interviews would be impractical for such a small amount of data. However, a metropolitan agency conducting an annual home interview survey could ask several additional questions on public transportation.

The information needed for the ability-to-pay indicator, i.e., frequency of trips, type of fare payment, and personal income, would be collected with a questionnaire in an on-board survey. The survey would be run all day on a representative sample of the routes. Collection could be repeated quarterly on different routes to ensure that the indicator presents a clear picture of the total system.

Not all of the required information for the third sample indicator would be gathered by an on-board survey. Only number and times of work trips for each route could be collected. Data on the number of automobile trips per area would have to be obtained from local public agencies or private consultants.

Monthly vandalism cost would not require surveys. The maintenance or finance department of the public transportation authority could keep a record of monthly or weekly expenditures due to vandalism. This record would be listed by route for comparative purposes.

A monthly record of vandalism cost is only a suggestion. The frequency would depend on the size of the cost and the system as well as the variation of cost by week, month, or year.

Storage of Sample Indicators

Except for very small public transportation systems, the first three indicators should be processed for computer storage. Information for the ability-to-pay and the daily work trip indicators could be coded by an optical scanner if the questionnaire is prepared properly. However, the number, origins, and destinations of female adult riders would probably be coded by hand before computer storage. Vandalism costs would not require computer storage but could be processed easily by hand.

EVALUATING THE PUBLIC TRANSPORTATION SYSTEM WITH SAMPLE INDICATORS

Analyzing the Sample Social Indicators

In general, analysis of social indicators would be performed on a continual basis with periodic input of new data. In addition, the decision-maker would have to keep in mind the basic functions and the qualitative or quantitative nature of the social indicators.

The female rider indicator might be best analyzed by cross tabulation and computer graphics. Cross tabulation would be easy and would produce simple tables on the similarities or differences in travel characteristics among females of various ages, races, and incomes.

The origins and destinations could be plotted on a map by the computer. This mapping would require an established grid system that used centroids of census tracts or street intersections. From these desire-line patterns, the network of existing routes could be analyzed. Finally, certain land use or simulation models might be used to analyze the residential mobility of these users. This analysis would be helpful in predicting future bus route locations. Examples of these models would be the San Francisco CRP Model, the Pittsburgh Urban Renewal Simulation Model, the Penn-Jersey Regional Growth Model, and the Chicago Area Transportation Model (3).

Analysis of the ability-to-pay indicator would also be conducive to computer summaries and cross tabulation. Values of the ratio could be grouped and summarized for each route and for the total system. Transportation cost could be cross tabulated with each income category or type of user. Computer graphics could be used to plot histograms by income category, transportation cost, or type of user. However, such graphics could also be easily done by hand.

Correlation and factor analysis could be used to determine those variables that are more indicative of users with a low ability to pay (i.e., a high transportation cost-income ratio). Based on this analysis, a regression equation that uses these variables to predict the number of users with a low ability to pay might be developed. A subsidy policy could then be established.

The number and time of work trips could be analyzed by running simple computer summaries. Typical summaries would be the number of work trips for various time intervals during the day. These summaries could be totaled for each route or the whole system or both. Each total could then be compared (by hand) to the number of potential work trips for the route or the number of automobile trips for the entire service area.

Analysis of monthly vandalism cost would involve periodic comparison with previous figures to determine possible fluctuations in total cost. Furthermore, the decision-maker would be interested in the causes of a high or increasing monthly vandalism cost. Neither computer nor statistical analysis would be necessary because of the small amount of data; however, these techniques could be used. A regression equation could be developed to predict future vandalism costs. Additional information such as the number of teen-agers per neighborhood, available recreational facilities, and the season of the year would be needed.

A more interesting approach would be to plot the locations in the service area where vandalism occurs. Computer mapping might be necessary depending on the number and frequency of acts of vandalism. Such a map would also be helpful to other agencies such as the urban renewal authority, the planning department, and the police department.

Formulating Alternative Recommendations

Alternative recommendations would be based on analysis of the social indicator. The analysis results would show how well the public transportation system is performing, how the system might be affected in the future, what should be done to improve the system, and what areas of the system need further study.

From analyzing the origins and destinations of female riders one might arrive at the following alternative recommendations:

1. Provide express routes for domestic workers,
2. Provide route modifications for more convenient medical-dental trips or shopping trips,
3. Extend routes to go past day-care centers in the morning and afternoon peaks,
4. Discontinue service in certain areas because of low ridership, and
5. Provide new routes to remove excessive transfers.

The ability-to-pay indicator would show the type and number of users who spend more than a locally set standard percentage of their income. From these results the following recommendations might be suggested:

1. Decrease or increase the fare for all riders,
2. Decrease the fare for all those paying more than the standard percentage of their income on travel costs (e.g., elderly, low-income Blacks, or disabled),
3. Decrease fare in off-peak hours and increase it in peak hours, and
4. Provide a subsidy to special groups of users.

Such subsidies might be provided with welfare checks.

Analysis of the number and time of work trips might produce the following recommendations:

1. Provide more air-conditioned buses in the peak hours to attract potential (automobile) work trips,
2. Provide express routes in peak hours on weekdays only for workers traveling to the same destination or area, and
3. Provide separate buses for workers and nonworkers in peak hours.

From the costs, types, and locations of monthly vandalism, one might arrive at several recommendations. Examples are presented later.

Evaluating and Selecting Alternatives

The decision-maker would have to evaluate each alternative by performing economic and social analyses. For the first sample indicator one might be faced with evaluating the social and economic benefits of providing an express bus route for domestics. The economic costs would be the use of the bus and driver for only a fixed number of riders. However, the return trip of the bus might be an express route for CBD-oriented workers and thus would provide an economic benefit. This reverse routing would depend on the origins and destinations of the user groups.

The social benefits would be numerous. The express transportation would make traveling easier for domestics. In addition, more domestics might be able to find jobs. Finally, the express route for the CBD worker could reduce the number of automobiles on freeways leading into the city.

The second sample indicator also provides challenging alternatives. Consider, for example, subsidization of trips made in off-peak hours by the elderly and disabled. The economic cost would be valued at the amount of subsidies given. The economic benefit would be increased ridership during the off peak and possible reduction in delays in peak hours. Social benefits would be obvious. Many of these users would have small fixed incomes (e.g., social security, pensions, and welfare) and would not be able to pay a large transportation cost.

Finally, evaluation of the vandalism recommendations would involve some important implications. For example, assume that the decision-maker is evaluating the idea of requesting more police protection in a specific neighborhood. He might see very small economic costs to his system for this alternative. However, if a civil disorder were to start because of this recently added police protection, the economic and social costs would encompass far more than those incurred by the public transportation system.

IMPROVING THE PUBLIC TRANSPORTATION SYSTEM WITH SAMPLE INDICATORS

Once he has selected the best recommendation, the decision-maker would attempt to improve the system. Consequently, this section presents one possible approach for the decision-maker to implement his selected improvement.

Establish a Public Information Campaign

A public information campaign would consist of pamphlets distributed on the bus, at ticket booths, or at bus terminals. Communications media would be used to reach non-users and would also remind permanent users of an upcoming change. Finally, store owners could help distribute pamphlets to customers or possibly arrange special sales with reduced bus fares for shopping at their stores.

The value of a public information system would be threefold. First, the permanent users would be notified of a change beforehand, which would prevent inconvenience. Second, nonusers would be reached and possibly attracted as permanent riders. Finally, the campaign would provide continuing public relations with the general public.

Activate and Monitor Improvement

Once the public is informed, the decision-maker would activate the improvement. The improvement would then be monitored throughout a predetermined trial period. The monitoring process would attempt to answer the following questions: How many riders have been attracted and why? How many permanent riders have discontinued use of the system? How have other parts (other routes) of the system been affected? What is the reaction of the permanent riders to the improvement?

Continue Monitoring

Monitoring the public transportation system would be a continuing process. With it lies the key to observing sharp changes in the measured indicators, i.e., the use or performance of the system. It also provides a solid informational basis for predicting long-term trends for planning purposes, a prerequisite to calibration of the forecasting and simulation models. Finally, monitoring would provide the decision-maker with a clear picture of how the system is performing and thus would enable him to determine and provide the needed improvements.

APPLICATION OF VANDALISM INDICATORS TO MODEL CITIES SHUTTLE BUS SYSTEM, ATLANTA, GEORGIA

The Model Neighborhood Area (MNA) in Atlanta consists of six neighborhoods and approximately 45,000 residents. Of the households in the MNA, 56 percent have annual

incomes of less than $4,000. Only about one-third of the MNA families own an automobile (4).

The Model Cities Shuttle Bus System was developed in June 1969 to provide intra-neighborhood transportation and to complement the regular Atlanta bus system. Model Cities buses are provided by the Atlanta Transit System, Inc. Fares are 10 cents per ride, and transfers worth 15 cents credit toward regular bus fares are available. Supplemental funds are provided by the Model Cities program to make up the difference between revenues and operating expenses.

Between the months of January and February 1971, a substantial variation in bus ridership occurred (5). An on-board survey was conducted, with a questionnaire, to determine the cause of this variation. The Model Cities staff discovered that one of the main reasons for this drop-off was a reduction in the evening ridership.

Through discussions with Atlanta Transit System officials and bus drivers, the staff discovered that 50 percent of the vandalism occurred after dark (8:00 p.m. to 12 midnight). The bus drivers reported that the vandals were youthful joyriders engaged in rock-throwing battles with youths of various neighborhoods as the bus proceeded along the route. In addition, numerous complaints were received by the Model Cities staff from the Atlanta Transit System concerning assaults on drivers and night riders. Thus, vandals were scaring off potential night riders as well as causing damage to the bus.

Several alternatives were possible for improving the system: increase the fare enough to make joyriding too expensive; place an armed guard on the bus from 8 p.m. to midnight; request more police protection at the locations of the rock fights; or discontinue bus service from 8 p.m. to 12 midnight. Each of these improvements would have obvious disadvantages. Increasing the fare would place a burden on the regular night riders. Placing an armed guard on the bus or extra policemen in the neighborhoods could have led to a riot and possible harm to innocent people. Finally, discontinuing service in the evening would reduce ridership and would inconvenience night riders.

Weighing all these points, the Model Cities staff selected to end bus service from 8:00 p.m. to 12 midnight and consequently lose 15 percent of their riders. In so doing, cost of the annual vandalism contract with the Atlanta Transit System was reduced from $8,000 to $4,000.

The staff then looked for an improvement to increase lost ridership by using the funds saved from vandalism cost. The solution was to provide a new north-south route connecting the Southside Comprehensive Medical Center in the MNA to Grady Hospital outside the MNA. The Center provides health services to many of the residents because there are no doctors in private practice in the MNA. The Center also refers many of its patients to Grady Hospital.

The new route complemented the existing loop system. Residents can transfer from the loop system to the north-south route and reduce their travel time by about half an hour. Furthermore, the additional Grady ridership more than made up for the 15 percent loss of night riders.

The Model Cities staff used an extensive public information campaign to inform riders of the discontinued night service and to promote the new Grady express route. Handouts were distributed in neighborhood stores, community group meetings, schools, and all Model Cities project offices. A total of 20,000 handouts were circulated.

Thirteen resident interviewers were placed on the buses for 2 weeks. During the first week the interviewers explained the changes that were to be made. In the second week, interviewers were positioned on the Grady and loop routes and acted as guides, pointing out various activities along the route and helping riders transfer.

Currently these improvements are being monitored. Vandalism costs are reported monthly and were only $30.45 and $37.34 for May and June. The Grady ridership increased from approximately 200 per day to 340 per day in May. During the month of June, the Grady ridership remained the same and an increase of about 2,200 riders was recorded for the loop system.

SUMMARY

In the past, social indicators were applied on a nationwide basis. Such approaches attempted to evaluate broad goals and policies or to predict long-term trends. Generally, these approaches have not investigated the use of social indicators for transportation planning or evaluation.

The framework developed in this paper lends itself more to an urban area and concentrates on public transportation systems. Specifically, the authors have shown how social indicators were used to reduce operating costs and increase ridership for the Atlanta Model Cities Shuttle Bus System.

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