The Development of a Land-Use Data Bank For Transportation Planning

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This paper discusses the different levels of data collection necessary for transportation planning. A complete description of the land-use and other data collection programs of the Pittsburgh Department of City Planning is used as the basis for identifying the relationship between the types of detailed data and resulting information needed for specific decisions on transportation facility development correlated with comprehensive planning and those broader regional studies leading to more generalized transportation networks.

The utilization of simulation in the Pittsburgh Community Renewal Program is briefly described as well as the type of outputs this simulation will produce. Its application and close correlation with transportation planning programs are suggested.

• THIS is an exciting era for the professional fields associated with urban development. City planning and transportation planning are undergoing a rapid metamorphosis in their research programs with the introduction of new analytical techniques and the application of mechanical data processing, systems analysis, etc. Each week seems to widen the horizon. This paper briefly explains the application of some of these new approaches in the Pittsburgh City Planning Department, with particular emphasis on our development of a centralized information system and how acquired knowledge might be applied to transportation planning.

One of the principal responsibilities of the planning department is to develop facts, information, and knowledge about Pittsburgh. A substantial portion of the author's job as director of the department is to interpret those facts to other groups in the community, such as the city council and other public agencies, in order to contribute to a better understanding of the city. The ultimate objective is to help the department prepare more intelligent plans leading to public policies and development programs by these other public bodies. This interaction produces many questions about the nature of the urban area which in turn are posed to the planning department staff to answer. The staff of the department, who are knowledgeable in data sources, data collection, and data interpretation, have developed increasing skills to provide the significant facts and information needed in performing these functions.

To avoid misunderstanding, it should be made clear that I am not an expert in data systems, data collection, or data retrieval. As a matter of fact, I had never seen an IBM machine or a punch card before 2½ years ago. My personal transformation as director of the department is indicative of the revolution that is occurring in the planning field and also in the transportation field.

After being exposed to data processing as a means for automating physical property and land-use information, then progressing to the concept of a centralized information system which integrates economic and social information with this property and land-use data, and still later being introduced to the utilization of simulation, linear programming and the evolving techniques of operations research, I now have the greatest respect for the kinds of skills and knowledge involved and the contribution these tech-

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niques can make to effective planning. A source of constant amazement is the ability of the department's staff to quickly respond with accurate information which is correlated in the most useful manner. These technological tools make it possible for the planner to perform his task much more effectively.

There are a few general problems in the area of information collection and use which should be explored.

You might say that I must bridge a gap which occurs between the development of sophisticated information and the interpretation of it in actual use. I try to grasp what experts are doing in these research fields in order to understand the trends which are occurring and the implications of those trends. My next task is to use that information in working with other agencies and in hammering out compromises, agreements, and public policy.

There seems to be a significant breakdown in communication, or at least in fundamental understanding, between what "highpowered" research organizations, such as the Penn Jersey Study, PATS, and CATS, are doing and the response and utilization of that research by the practicing engineer in making decisions. This is where the planner has his chief contact, that is, with the district engineer or structural engineer at the regional or state level. This is where information becomes action.

As an example, I had occasion to meet with responsible state highway engineers making decisions on where highways should be built and the standards of construction. These men had very little confidence in the recommendations of one of these transportation studies (PATS). As a matter of fact, they had practically no inclination to approve the recommendations of the final plan which has been accepted by the community. The planning commission of the city of Pittsburgh has actually adopted the recommendations of PATS as a part of the city's master plan, but the state highway department has not accepted the recommendations. Ironically, the PATS staff were actually state highway employees and the membership of the policy committee guiding the study was weighted in favor of state highway executives. There is great skepticism on the part of engineer and action oriented people at the local decision level with the sophisticated techniques being developed by such studies.

There are also other problems. For example, there is still a weakness in many of the transportation studies (as well as city planning programs) in the application of land-use and population information.

The Penn Jersey Study, and other similar groups, are making significant contributions to the sophistication of methods leading to the estimating of future population and land-use changes, but we still have a long way to go before understanding the urban area sufficiently to make firm decisions on future changes which will enable decision makers to earmark hundreds of millions of dollars for construction at some date in the future. In other cases, the studies do not sufficiently recognize the total transportation needs of a region, particularly mass and rapid transit.

Those who represent the sophisticated research approach must somehow get their contribution across to the practical, hard-bitten local engineer—so he, in turn, can do a better job.

RESEARCH APPROACH

The department's centralized information system in Pittsburgh started very simply, but now it has expanded into a substantial data collection and information system. At the present time, we not only have physical land-use data for every parcel of land in the city, but we also have (or are placing on tape) social and economic data which are proving to be of immense value.

This expansion of a data bank to an information system is indicative of other efforts to use a variety of new techniques of analysis that seem to have applicability to city planning. For example, the utilization of PERT in the programming of our community renewal program research effort has been invaluable. There are still other techniques arising out of other research programs that seem to have future applicability.

One of my responsibilities as the director of a city planning agency is to listen to new ideas and if they make sense, try them. I am attempting in our planning program to tap the techniques and resources of many different fields of knowledge. From the

very beginning, it has been realized that only by the contribution of many different professional fields is it possible to begin to understand the complicated urban scene and plan for its future.

Pittsburgh's research is oriented to the development of a community renewal program, but some of this work would appear to have great application to transportation planning and other areas of urban knowledge.

The centralized information system contains and will contain a great deal of information that might not appear to be directly applicable to transportation planning. However, as the approach to transportation planning expands in its effort to respond to the dynamics of change in an urban area, whether by growth or contraction, the difference between effective transportation planning and general city planning becomes more and more obscure.

The description and brief history of the formation of the Pittsburgh City Planning Department's information system contained in this paper are largely derived from the department's Community Renewal Program Progress Report No. 3, "Data Processing," by Richard K. Guenther, Neiland J. Douglas, Jr., and Joseph P. Ott (Jan. 1964).

DATA COLLECTION PROGRAM

Up to 1960, the Pittsburgh City Planning Department faced the same problems of data collection and analysis that are common to planning agencies throughout the nation. To accumulate real property and land-use data for a multiblock study area required many man months of detailed collection procedures in many different agencies; land use from field inspection, property information from the county assessor's office, building condition from the city inspection department and the county health department—months of hand transfer of figures, hand calculation, and laborious statistical analysis. When the study was completed, the work sheets were filed in some box and never touched again. When a new study arose in the same geographic area, similar ground would have to be ploughed for the data was not kept up-to-date, and the original work sheets were frequently lost in the interim period. Not only did this process involve clerical employees, but it also frequently involved technical and professional employees who could have more fruitfully spent their time in developing plans and recommendations for action.

The initial objective of the data processing program was therefore to consolidate internal office records and establish a means for updating and effectively utilizing these records.

Although there was recognition of the fact that information handling did not in every case require data processing equipment, it was generally conceded that, even from the initial stages of such an undertaking, some degree of mechanized support would be necessary to cope with problems of volume and speed.

One of the biggest obstacles faced, in those early stages, was the task of managing the wealth of data that was available in different forms, for different geographic areas. In assembling the data so that a degree of comparability could be maintained, a spatial classification system had to be devised which permitted aggregation and disaggregation of specific spatial units.

In confronting this problem of spatial units, three questions were posed. A satisfactory answer to each question was necessary before a spatial system could be established.

1. What are the different types of spatial divisions that can be utilized for statistical purposes?
2. What are the characteristics of these various units, particularly in regard to size, homogeneity, and boundaries?
3. What potentialities for research are offered by each type with regard to the availability of data on demographic, social, economic, and physical characteristics?

The ultimate spatial solution assumed the form of a data block. The data block approximates what is commonly thought of as a normal city block, and it always encompasses one or more Census blocks. Approximately 4,000 such blocks have been delineated and mapped within the city of Pittsburgh (there are 6,000 Census blocks). The

following list of administrative or functional districts are examples of areas that are composed of such blocks:

Census tracts	Capital improvement districts
Police and fire districts	Recreation areas
Health districts	Public housing projects
Transportation zones	Public welfare districts
School districts	Social welfare districts
Dioceses and parishes	Meter reading routes

Data relating to individual parcels of real property were the first to be collated and reconciled. Through the use of IBM punch cards, selected items of information were recorded for each of the approximately 155,000 parcels of property within the city.

Other initial decks of punch cards included detailed information on (a) publicly-owned and publicly-held tax-delinquent property, and (b) detailed data on all real property transactions since 1954. In addition, two complete decks of punch cards were established for the purpose of identifying property owners (including their mailing address should they not reside at the property in question), and the name and address of the mortgage holder, should one exist.

In the course of the two years required to collect, standardize, and centrally record the real property data, there was a growing awareness that simply mechanizing the internal record-keeping operations within the department would not, in itself, satisfy the requirements of a modern, and comprehensive, community planning and renewal effort. Therefore, serious attention was next directed to the area of policy decision making, encompassing municipal management in the broadest sense. Within this context, the concept of "planning information" was felt to consist of two components: (a) the particular problem being confronted, and (b) that data most applicable to the situation. The planning department then moved to assign priorities to various development problems and to identify data required to analyze and resolve these problems.

This approach, coupled with efforts directed at viewing the urban area as a system (and utilizing simulation techniques to attempt estimates of the economic and social consequences of alternative renewal policies) led to the idea of establishing a centralized information system.

CENTRALIZED INFORMATION SYSTEM

Purpose

Such terms as "municipal data banks," "urban facts libraries," and "regional data centers" have become more and more frequent in the past year or two. Although the specific goals and objectives of many of these proposals differ, they are all representative of a serious problem experienced by both public and private administrators who are concerned with business in today's urbanized areas. The problem may be described as a need for current, accurate, and adequate information that will support a sound decision making process.

An information system is simply an organized method of using data for a specific purpose. The extent of such a system depends upon a series of judgments on such matters as how much information to collect, what degree of accuracy is demanded, whether to include a particular class of information, how to identify that class of information if included, whether or not to use data processing equipment, which configuration of equipment to use, etc.

EXPANDING AND UPDATING

One of the first attempts at large-scale data collection, from an "outside" agency, resulted in the acquiring of the land-use survey forms from PATS. After the forms were coded, they were all keypunched.

In relatively close succession arrangements were formalized with the City Treasurer's office whereby all future changes in land and building assessments, tax delinquenquencies, and property ownership and mortgages, would be made available to the Department of City Planning. Similar arrangements were made with the city's Bureau of Building Inspection, facilitating the receipt of occupancy permits, building

permits, and permits for alteration and repairs (which include demolitions). The Department of Public Works, and in some instances the Department of Lands and Buildings, are the sources for detailed data on capital improvements, and public works projects. Such changes as street vacations and zoning reclassification are not recorded until copies of the appropriate ordinances, as passed by City Council, are received.

Although these mentioned departments were extremely valuable data sources in establishing the real property master file, it was obvious that a great many more non-city agency sources would have to be tapped. A service contract was executed with a local private firm, the Real Estate Statistical Service, which entailed the firm supplying to the Department, once a week, detailed information on every property transaction that occurred within the city. (Since real estate transactions are kept historically by the State Tax Equalization Board, arrangements were made to borrow these files, and transaction data going back to 1954 were keypunched.) These transaction prices, when multiplied by the assessments, brought into being the "transaction index." This index has proved a most useful tool for both social and economic analyses.

The Allegheny County Health Department has also been a valuable source for maintaining real property data. Through its housing code enforcement and building inspection activities, field survey sheets are made available, and arrangements have subsequently been made for the Department to microfilm and then keypunch these field sheets from previous years. (There are 12,000 to 15,000 inspections carried out each year in the City.) The Health Department (along with the State Board of License Control) is similarly in a position to assist with the problem of keeping the land-use files current through another of their activities, e.g., licensing control. Following a reconciliation of their complete license file, with the Department's coded land uses, all that is required is the annual receipt of a listing indicating new and revoked licenses, with supporting information.

Other significant sources for real property data include the Urban Redevelopment Authority, the city's Department of Parks and Recreation, and Department of Lands and Buildings. Procedures have also been established whereby all field work carried out by Planning Department personnel involves reporting selected standard items of data to the research section.

Liaison has also been established with a considerable number of other local and state agencies and departments to the end that their cooperation can be elicited in providing selected information in a format prescribed by the Planning Department. The following are examples of the types of socio-economic information that has been (and is currently being) sought on a time series basis—by data block—with the understanding that in the future it will continue to be forwarded to the Planning Department on a regular basis:

Migration (intercity and intracity)
Employment (occupation, by place of work and residence)
Vital statistics
Unemployment (duration, etc.)
Public assistance (by type)
Personal and earned income
Total earnings and salaries
Criminal convictions (adult and juvenile)
Federal food stamp program
Public medical care
Public and social welfare caseloads

As was fully anticipated, the problems encountered in attempting to gain continuing access to such information have proved quite difficult. Because of the highly sensitive nature of much of the data, compounded by the fact that in most instances it must be obtained by family and/or street address (to permit aggregation by data blocks), the policy is that no public disclosures will be made as to exact sources, or descriptive detailing, of these particular data files.

The Pittsburgh Board of Public Education has cooperated to a considerable extent with the Planning Department. Based upon a feasibility study of automated record

keeping and reporting, performed by the Planning Department, the School Board is retaining the services of a management consultant who will design and assist in developing a total information system to meet the School Board's needs. Among other things, the Planning Department will benefit from the citywide, triannual school census (which will henceforth be expanded to include a 100 percent enumeration) as well as the receipt of selected attendance and child accounting information on a regular basis.

FUTURE OBJECTIVES

The centralized information system is undergoing the kinds of "growing pains" that are to be expected of an undertaking of this magnitude. Qualified and experienced personnel have been extremely hard to obtain and retain, and the unforeseen demand by various agencies to participate actively in the program has forced some re-evaluation as to how financing and administration should be handled in the long run.

The immediate objective of the centralized information system is to provide an information processing facility which meets the needs of the Department of City Planning. Over time, there is the intent to reduce duplication in the collection, storage and processing of data required by those public, quasi-public and civic agencies who are involved in physical, social, economic, or governmental planning in the Pittsburgh area.

Data that are felt to be relevant for the system will be obtained in the course of any given agency's normal operations. The raw data are stored and remain available to all other contributing agencies, subject to mutually agreed constraints of confidentiality. The operation does not necessarily require the collection of any "new" data, and it is possible for individual research and/or retrieval requests to be honored independent of the specific purposes for which the data are intended.

In operating such a centralized system, participating agencies need only acquire relatively inexpensive unit-record equipment, since the complex processing of information is handled at the information center. However, should any agency have the demand for its own computing installation, and yet still desire to avail itself of the services of the CIS, data transmission between computers can readily be handled over leased telephone lines.

Other benefits currently being realized include substantial reduction of duplication of data collection, processing and storage, accompanied by increased accessibility and usefulness of data. These benefits are leading, in turn, to lower unit costs in information handling and, even more important, to improvements in the performance of various departmental functions by providing more comprehensive and up-to-date information to support administrative decision making.

A basic goal of Pittsburgh's community renewal program is to establish a coherent and realistic set of community development goals and objectives, which will be adhered to. A primary requirement is the basic information necessary for rational decision making and for measurement of the course of events. Intelligent direction requires information, not only about the immediate problems or areas of concern but also about the functioning of the economic, social, and political aspects of society generally. It must be based on knowledge and a comprehensive understanding of the way the society functions, the extent to which it meets the needs of its members, and the nature and effects of changes in its growth patterns and institutional arrangements. It must also take into account the probable course of economic and social events and the relationship between them and the decisions and actions being considered.

Utilization of Simulation

The development of this centralized information system enabled the City Planning Department to utilize still another tool for the planning program—simulation. Some of the first applications of the simulation technique to urban areas has been in transportation planning. The principal purpose of the simulation activity in our department is to test the impact on the city of alternative land use and urban renewal project plans. I was attracted to simulation through the problems inherent in trying to develop a method to anticipate effectively the impact through urban renewal of alternative land-use plans, and the resulting dislocation of population, etc., on adjacent areas or on other portions of the city.

As an example of the type of problem that led to the use of this technique, the following is a typical problem. On the north side of the city of Pittsburgh is a sizable area, predominantly residential, and densely populated with low-income white and Negro families. It has the rare quality in this city of being flat and fully developed with utilities. It is adjacent to a new freeway on one side and railroad development on the other. What alternative land-use decisions are applicable to this area in the long-range future, and depending on that decision, what would be the market at different periods in the future for the new type of land use? Further questions evolved: what would be the most advantageous type of renewal for this area, and depending on the type of renewal, at what period of time in the future should it occur? Also, what would be the impact of relocating 15,000 to 20,000 low-income people in the other areas of the city, and in turn, the impact of these people on the housing market within the city as a whole, and the shifts and changes they might create in receiving neighborhoods. We intend to use the simulation model to measure the impact of these alternative consequences. The understanding gained from these measurements will allow the directors of action agencies and city council to choose the best alternative renewal program.

The simulation program is being prepared through a prime contract with the Center for Regional Economic Studies of the University of Pittsburgh, while the technical preparation of the model is under the direction of Wilbur A. Steger of the CONSAD Corporation of Pennsylvania. The full explanation of the simulation model is contained in the department's Community Renewal Program Progress Report No. 5, "Simulation Model," by Dr. Steger (Jan. 1964). This report by the department's consultants explains their attempt to convey into computer language at both feasible and useful levels of abstraction the dynamic system of the city of Pittsburgh which is deeply embedded within a metropolitan region. The consultants have come to the following conclusions in terms of the substance of the model and the type of simulation which they expect to be able to achieve.

Substance of the Model

1. A decision model, that is, one intended to produce information against which municipal decision makers must apply their own choice set of (subjective) values, is being constructed.
2. For the purposes of urban renewal decision, for the most part, Pittsburgh is to be treated as a closed system. (The only qualification of this is the adjustment made for certain exogenous inputs.)
3. There is a whole set of urban renewal decisions that can only be disposed of by treating Pittsburgh as a closed system.
4. This is a "decision model" intended to introduce the principle of a "system-wide rationality" into urban renewal decisions.
5. Although it is a decision model, it is not geared to any form of an "investment" model (such as the San Francisco model).
6. It is a model to be tied into a specific social system for making urban renewal decisions. It will fit into a political-administrative decision sequence. For best use, adjustments in that system, as well as in the simulation model, must be made for effective utilization of the type of information to be supplied by the model.

Type of Simulation

As presently conceived, it should contain the following characteristics of "simulation" models:

1. It will be as behavioral as the North Carolina, or the RAND urban transportation studies, in the sense that the behavioral interrelationships to be carried in the model will consist mainly of correlations between observed consequences of behavior. These will be in terms of such activities as, "the redistribution of population with the city, the economics of residential rehabilitation and/or code enforcement," or "the relative attractiveness of various commercial areas" in terms of such variables as size and type of commercial activity, distance from residential location and the costs and benefits of rehabilitation. It is therefore not a "micro-analytic" simulation model in the

same sense as G. Orcutt's program at the University of Wisconsin for simulating the United States economy. (It does not contain the individual, problem-solving heuristics of single decision makers in the city.) However, we shall simulate, in certain sections of the model, particularly the industrial and governmental, decision processes reasonably similar to those of humans.

2. Outputs are specified dynamically through time, in that certain exogenous shocks (such as population and/or employment and/or industrial-commercial changes) occur only through specified intervals over time, or through changes in urban renewal plans, which also begin, proceed through time, and end.

3. There is no attempt at optimization, as in most other management science computer-oriented applications.

4. Parameter changes, such as trends or relationships which are different in a growth cycle, as opposed to a declining cycle, can be introduced as needed.

5. Output formats can be specified in the level of detail contained in the innards of the model for any point in time, or for any interval desired by "simply" writing in "simulation English" a report generator which reaches back into the running of the model and elicits the appropriate information.

6. It is fully "computerized," although man can readily change parameters, some relationships and all planning alternatives examined.

It would appear that the research which has been and is being carried on by the Department in order to make simulation applicable to the planning program will enable other planning agencies throughout the country to use at least portions of it for their own purposes. If we are successful, this technique can be applied to total urban regions and will provide planners an infinitely higher degree of understanding of a total regional system which, in turn, can be correlated with regional transportation planning programs.

It appears that the detailed simulation effort within a dense central city at a very microlevel could be correlated with regional traffic planning simulation efforts so that knowledge gained from these efforts can be pooled for the benefit of all planning and transportation efforts throughout the nation.

The anticipated outputs from the community renewal program are listed in Appendix A. This list of outputs would have been impossible without the land-use data and property file, the continuing efforts to develop a centralized information system, and the utilization of simulation in the planning effort and its contribution to determining the impact of the dynamics of urban change.

Application Transportation Planning

Data alone are meaningless. Some agencies have collected enormous amounts of data about their urban areas and yet this data collection of itself has not yielded more effective decisions. Decisions must be based on highly refined information determined from the data. Far too many individuals have the erroneous impression that an elaborate statistical technique will compensate for poor quality data. It is true that some of the newer statistical techniques can squeeze the last drop of information out of data, but unfortunately these techniques can neither supply information which is lacking, nor eliminate misinformation. It is generally true, in my opinion, that a more elaborate analysis and statistical technique in fact requires higher quality data. I would also observe that the task of collecting useful land-use data (or for that matter data on any subject) demands just as much intelligence, foresight and imagination as the job of the highway designer and decision-maker. It never pays for the researcher to become so engrossed in the desperate accumulation of huge stacks of data that he never stops to think what he will do with it after it has been collected.

I would further suggest that the essential characteristics of useful information are (a) relevancy and completeness—not too much, not too little, just enough to yield the essential information required; (b) freedom from bias—by itself, or in accumulation it must not warp eventual results; and (c) repeatability—the ability to maintain data over time.

There appears to be several alternative approaches to land-use data collection for a transportation planning program. One approach would be that each of the separate communities within a metropolitan area or region (or alternatively, each county) collect the precise data needed for the transportation planning program. When aggregated at appropriate statistical levels the data would also serve the purposes of broad transportation planning. The experience of the city of Pittsburgh through its information system would suggest that this possibility could be utilized (see Appendix B).

The obvious problem to this is that few communities have the staff or the funds to accomplish this type of data collection program.

Another alternative is more characteristic of the approach in most urban regions and that is for the regional transportation agency to collect the data and make them available to local planning jurisdictions for their purposes. This approach necessitates close cooperation between all agencies concerned so that the manner in which the data are collected by the regional transportation program is at either sufficient detail or can be systematically allocated to the minute geographical level needed for more detailed comprehensive planning purposes.

These alternative methods imply differential approaches to transportation planning itself. For example, the Pittsburgh Area Transportation Study developed proposals for the expressway and freeway plan within the study area by indicating corridors of traffic and the general standards that should apply to the physical development of highways within these corridors. The corridors which should be served by rapid transit were also indicated. The regional thoroughfare and highway system that should supplement and feed into these high-capacity freeways and expressways were indicated to a more limited extent. It has been the task of our City Planning Department to study in detail the location of these highways, including their design and precise location within these corridors of traffic. These studies have been made to locate this freeway network in relation to the broad comprehensive planning goals and policies adopted by the Department. Where adequate local planning agencies exist, this approach is the most satisfactory relationship between regional transportation planning and local more specific community planning. This approach to levels of responsibility, however, implies close coordination in land-use data collection.

On the north side of the city of Pittsburgh, PATS confirmed a previous recommendation that a freeway be built to thread its way through a narrow, deep valley, completely occupied with intensive urban development in the valley floor and with the hillsides partially developed by marginal mixed land uses. Highway location studies developed by the state highway department prior to the PATS recommendations suggested that the location of the freeway (Interstate 79), should be on a hillside along one side of the valley. This location of the freeway would have necessitated tremendous earth moving and would have left great scars on the hillsides. It also would have left isolated, inappropriate slum areas along the floor of the valley as well as the present extremely inadequate service road in the bottom of the valley. It would have left practically no land for subsequent development when urban renewal occurred at a later date.

Within our department, a detailed study of this valley and road was made. It was concluded that if the freeway were placed in the valley floor and its construction coordinated with local urban renewal activities clearing both the hillside scattered development and isolated leftover parcels in the valley floor, an infinitely more satisfactory solution would result. The freeway on the valley floor would be considerably cheaper to build, would be aesthetically much more satisfactory, and in the long run, would be infinitely less expensive to maintain. This location would also permit the city to clean up a blighted area, construct a major trunk sewer line, and coordinate a rapid-transit line with the freeway. Furthermore, the city would ultimately save substantial tax funds that would have had to be spent in maintaining an inadequate service road and in providing public services to the isolated pockets of urban development that would have been left if the recommendations of the state had been accepted.

The information needed for locating the corridor of traffic in this general location could logically be developed at a much more general level than the type of land use and other information needed by the city planning department in pinpointing the location of this freeway. Our department needed detailed parcel-by-parcel information which would

include assessed values, sales prices, ratio of assessed to sales values, building condition, neighborhood environmental indices, detailed population information including family characteristics, family income, employment, and information on social problems. From this detailed information, the department then developed a series of plans and recommendations including the relocation of the population, coordination with other types of public actions, such as urban renewal project planning, school planning, subsidiary thoroughfare construction, utility construction, and rapid transit construction. The original proposal by the state highway department would have been limited in its approach to these other problems. Its plan avoided the necessity to integrate this freeway construction program with the other public and private actions necessary to serve total community planning. The Department's total plan also included information and policies needed to minimize possible adverse impacts on the city and surrounding neighborhoods.

Another recent study conducted by the City Planning Department on the specific location of a highway within a traffic corridor designated by PATS further illustrates the need for the integration of land use and other information utilized in the development of a transportation plan coordinated with a community master plan.

The PATS recommendation included a proposed freeway and the development of a rapid transit line on an existing streetcar right-of-way within the Saw Mill Run Valley in Pittsburgh. In this case, we are faced with short-run improvements to the existing highway, the integration of these short-run improvements with a major storm drainage and sewer construction program. The countywide transit authority faces the intermediate range decision to develop a rapid transit line through the valley. Our department must prepare specific location recommendations for the freeway and other transportation facilities, as well as the other urban transportation improvements and land-use changes. These interim public policy decisions related to this transportation program necessitate considerably more information and in far greater detail than did the original study by PATS. In addition to the specific land use, population, economic and social information needed by our department, the problems of strategy, timing, local resource allocation, and financing of subsidiary public actions became almost more important and more difficult to solve than did the original PATS determination that a freeway was needed through this corridor at some future date.

I could readily document other descriptions of this fundamental relationship which is so vital between the broad regional study and the data and information needed for it in comparison with, and yet in harmony with, the needs of a local planning agency which must translate broad plans into specific reality.

This relationship is further heightened when the broad regional study does not adequately take into consideration the planning of all forms of transport. Urban transportation to the city planner implies the total range of transportation facilities. Unfortunately far too many engineers oriented to highway construction are only concerned with urban highways. They give a very slight and not very polite nod to the existence, but relative unimportance, of such means of movement as mass and rapid transit (a declining industry) to railroads (a declining industry), and no thought to the pedestrian. The city planner must be intimately concerned with all these forms of urban transportation, including their terminals, since he is constantly called upon to make decisions on their specific location. Take, for example, the central business district and the transportation facilities needed to serve such a concentrated area. Or the example within Pittsburgh of a major research park which was stymied in its planning due to the initial reluctance of the highway engineers to coordinate effectively the location, design and their timing of highway development with local land use and development needs. This situation could have seriously jeopardized a major development program within the city. Fortunately, these problems have been erased but do serve to indicate the difference in orientation between a local approach to transportation planning and a state or regional approach.

CONCLUSION

Close cooperation and integration is a necessity at all governmental levels. The true test of the adequacy of land-use data, and in turn the knowledge gained from these

data on the characteristics and changes in land uses over time, is our ability to use it effectively for current programming purposes and the foundation it gives to estimate future changes to the urban area. The transportation planner and the local community planner must plan for a total system of transportation to serve the needs of an urban area for each cumulative year in the future. The intimate ties between the objectives and goals of the two points of view strengthen the necessity to integrate decisions on an urban transportation system with the total range of public policy development and decision processes. As our data base changes, we must have the ability to make appropriate shifts in transportation policies. The development of an information base serving both purposes should give a portion of the needed tools to accomplish this objective.

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Neiland J. Douglas, Principal Planner, Department of City Planning; Joseph P. Ott, Senior Processing Supervisor, Department of City Planning; and Clark D. Rogers, Instructor, Graduate School of Public and International Affairs, University of Pittsburgh, gave inspiration for the preparation of this paper.

Appendix A

COMMUNITY RENEWAL PROGRAM OUTPUTS

The following list represents a summary of the likely results of the Community Renewal Program. These factors will be calculated in the described manner for each alternative renewal program. Each alternative program will cover a period of eighteen years (1962-1980) and will include various combinations of clearance and redevelopment, rehabilitation and conservation, and vacant land development projects. The consequences of each alternative program may then be compared and the preferred alternative selected.

Outputs

(1) Population Factors

- Biannual population projections by census tract (189) by age, sex, race and household heads (1962, 1964, 1966.... 1980).

(2) Employment Factors

- Biannual projections for fifty (50) employment and categories (SIC) for the City, Allegheny County, and the remainder of the six county region.
- Biannual employee income projections for fifty (50) employment categories (SIC) for the City, Allegheny County and the remainder of the six county region (1962, 1964, 1966.... 1980).

(3) Industrial Location Factors

- Biannual employment projections for fifty (50) employment categories by census tract (1962, 1964, 1966.... 1980).
- Biannual projections of the number and type of industrial firms and their employment and land requirements by census tract (1962, 1964, 1966.... 1980).
- Biannual projections of place of residence of all employees by firm by census tract and distance from place of work.

- Biannual projections of number of new firms to be created with estimated employment of that firm by census tract.
- Biannual projections of blight index by census tract in terms of:
  (a) mixed land use
  (b) adequacy of street layout, maintenance, and access
  (c) assessed value of site area
  (d) condition of industrial buildings
  (e) vacancy rate
  (f) plans of firms in census tract
- Biannual projections of number of firms and employment of firms which are likely to move or be displaced from each census tract and place of relocation.
- Projections of costs of urban renewal by project and for city as a whole in terms of:
  (a) planning, acquisition, relocation, demolition, site improvements
  (b) resale value
  (c) non-cash grant-in-aid

(4) Commercial Location Factors

- Biannual projections of commercial employment by various commercial categories (SIC groupings) by census tract (1962, 1964, 1966.... 1980).
- Biannual projections of total sales by various commercial categories (SIC groupings) by census tract (1962, 1964, 1966.... 1980).
- Biannual projections of blight index by census tract in terms of:
  (a) adequacy of street by layout, maintenance and access
  (b) adequacy of parking
  (c) assessed value of site area
  (d) condition of commercial buildings
  (e) condition of structures in immediate neighborhood
- Projections of cost of urban renewal by project and for city as a whole in terms of:
  (a) planning, acquisition, relocation, demolition, site improvement
  (b) resale value
  (c) assessed value of site
  (d) mixed land use
  (e) adequacy of streets and facilities
- Biannual projections of number of occupied structures by value or rental by census tract.
- Biannual projections of number by type of occupied structures by census tract.
- Biannual projections of size of housing units by census tract.
- Biannual projections of tenure of occupied housing by census tract.
- Biannual projections of number of vacant housing units by value or rental by type of by census tract.
- Projections of cost of urban renewal by project and for city as a whole in terms of:
  (a) planning acquisition, relocation, demolition, site improvements
  (b) resale value
  (c) non-cash grant-in-aid
- Biannual projections of the number and characteristics of families by age, sex, race, and head of households who are likely to move or be displaced from each census tract and place of relocation.

(6) Governmental Factors

- Biannual projections of total capital and operating expenditures for school district and for city government by various functions for the city as a whole.
- Biannual projections of total revenues from City, State, Federal and other sources for school district and city government for city as a whole.
- Capital costs for the provision of new educational, recreational, sewerage, water, police and fire facilities.

- Operating costs generated by the provision of such capital investments.
- Biannual expenditures—revenue comparison for city as a whole based upon historical experience of the city.
- Biannual expenditure—revenue comparison for city as a whole based upon prescribed community facility and service standards.
- Biannual expenditures—revenue comparison as a result of the following change:
  - (a) borrowing
  - (b) increase taxes
  - (c) reschedule projects
  - (d) eliminate projects
  - (e) reduce standards
  - (f) adjust potential non-cash grant-in-aid

(7) Social Factors

- Biannual projections of median family income by census tract.
- Biannual projections of medium years of school completed by persons 25-years old and over by census tract.
- Biannual projections of percent of male civilian labor force that was employed by census tract.
- Biannual projections of percent of occupied housing units that are owner occupied by census tract.

Appendix B

INFORMATION SYSTEM

The description of an information system included in this appendix is an indication of the scope of information which I feel is needed to make meaningful decisions on the specific location of transportation facilities in relation to broad comprehensive planning. This level of detail is obviously not needed for regional transportation planning studies. This level of preciseness is desirable, however, where specific decisions must be made relative to alternative land uses served by a transportation system and for the specific location of transportation facilities. The data lists are oriented to the individual parcel thereby enabling the aggregation of the data at any level for analysis and decision.

A very valuable resource document is the first interim report published by the Metropolitan Data Center Demonstration Project in Tulsa, Okla., in October 1963.

I. PROPERTY IDENTIFICATION

Objective: The first requisite for data analysis in any urban area is the establishment of spatial statistical divisions within appropriate geographical boundaries in order to cross reference any single piece of property or specific land use with any other, as well as to permit aggregation or disaggregation at any geographic or statistical level. Accurate property identification is the base for all subsequent data reference. It is also necessary to have an accurate description of the ownership of property including multiple owners, part owners, etc., so that subsequent lists of ownerships for acquisition analysis can reflect all the subtleties of ownership relationships. Methods for continuous or periodic recording of changes in ownership, splitting of properties through transfer or subdivision must be "built in" to the organization, approach, and collection system.

Desirable Data:

A. Locational Data including the parcel number, street address, grid coordinate, local geographic location identification such as a lot and block number, street section reference, lot position, ward, census tract number, census enumera-

tion district number, census block number, cross reference number to any other data accumulation reference.

II. LAND USE AND PHYSICAL PROPERTY INFORMATION

Objective: To understand fully what the characteristics and use is for every parcel in the urban area. For land use planning and transportation planning the pattern, characteristics and use of physical property sets the framework for all subsequent decisions. The data should be collected in time series for historical trend purposes where at all possible. Building permits, utility permits, telephone company data, zoning permits, occupancy permits, demolition permits, board of adjustment records, assessor records, county agricultural extension records, real estate statistical records, all should be consulted where necessary for data changes in physical property and land use. Methods must be devised to create a constant flow of all changes into the data bank in order to keep the original data current.

Desirable Data:

A. Physical property data including parcel size, topographic characteristics, drainage characteristics, soil types, underground mineral characteristics, utilities connected, waste disposal facilities.
B. Building data, including number of buildings, floor area of building(s), portion of parcel covered by building(s), setback of building(s) (side, front, and rear), frontage and depth of building(s), height of building(s), number of stories in building(s), number of rooms in building(s), existence of basement(s), number of dwelling units in building(s), type and class of building construction, cost of building construction, year building(s) built, condition of building(s).
C. Land Use data, including reference to Standard Industrial Classification Code, mixed uses, use(s) by floor, use(s) by building(s), measurement of use(s), vacancies.
D. Legal and other restrictions over property use data, including the zoning category(s), variance restrictions, site plan restrictions, deed restrictions, easement(s), other legal prohibition(s), master plan category, specialized plan category such as street widening ordinance, airport special district, secondary use district.
E. Environmental conditions and influences on buildings and physical property data, including condition of property, condition of abutting public property, neighborhood environmental index, block or neighborhood blight index, public property condition index.

III. ECONOMIC INFORMATION

Objective: First to have information on the market value of property, the taxable value of property and the relationship between the two for purposes of estimating property cost and market trends for housing development or redevelopment in order to permit alternative route analysis costs, feasibility and transportation service analysis. Second, to determine income distribution for purposes of estimating future commercial activity and traffic generation. Third, to have employment data by place of work and home location for purposes of trip analysis for both people and goods. Fourth, to have information on products, raw materials, industrial linkages, markets, industrial and commercial competitive positions, industrial strengths and weaknesses, industrial plans for change, and the market for new or changing industrial and commercial development in order to anticipate employment location and traffic generation. Each item of information should be in time series and constantly up-dated. In addition to previous source locations noted, economic information can be obtained from specific surveys, chambers of commerce, labor organizations research sections, universities, independent market research companies, real estate groups, housing associations, state bureau of labor statistics, city or county tax billing department.

Desirable Data:

A. Assessed value of land and buildings.
B. Price at last sale of parcel or structure(s) if sale separate from land, and date of last sale of parcel or structure(s). Ratio of assessed value to sales price for each transaction.
C. Identification of taxable or exempt property with type of exemption, for example, Federal government, state government, municipal government, county government, school authority, or other separate taxing agencies' property, and private property.
D. Residential market indices by logical statistical groupings as indicators of shifts in housing demand and supply.
E. Earned income by place of residence and disposal income aggregated by appropriate statistical units to maintain confidentiality.
F. Employment by individual commercial establishment, business or indistry, also aggregated by commercial or industrial cluster related to Standard Industrial Classification Code.
G. Labor force data by salary, class, sex, occupational type related to Standard Industrial Classification Code.
H. Employee place of residence.
I. Gross sales of commercial and wholesaling establishments.
J. Business failures by location.
K. Data by commercial and industrial clusters relating to the questions previously indicated. For industrial clusters, the types of industries, linkages, markets, competitive position, general condition, problems, plans for change, etc. For commercial clusters, the trade area, commercial mix, competitive position, problems, plans for change, etc.

IV. DEMOGRAPHIC AND SOCIAL INFORMATION

Objective: To understand people; how many, where they live, how densely they occupy the land, the number of families and the characteristics of those families, how many children, proportion of elderly, individuals of working age, sex distribution, race, etc. We have to know how people are moving about within the urban area, where they are moving, what type of families, their income and the race of the individuals and families that are moving. We have to have this information on a constant basis, not just every ten years, as might be derived from the census, since entire neighborhoods can completely change in character within one or two years, or entire vacant areas be completely built up within a year.

We need to know the social problems of people by small geographic statistical areas such as the "data block" or census tract. Unemployment, public assistance, crime and delinquency, social pathologies, health problems, school dropout rates, are all indices of social problems within an urban area. These indices affect the feasibility of public decisions that can be made on physical project planning particularly related to the implications of population relocation, public resource allocation, political feasibility of property demolition, etc.

The highway planner and engineer can no longer ignore the lessons being learned in the renewal field. Social concerns and pressures will play an increasing role in the feasibility of physical project development, particularly in our larger, dense cities.

Data sources include boards of education, health and welfare agency information exchanges, departments of public welfare, health departments, census tapes, social work agencies, commissions on human relations, councils of churches, state agencies, police departments, employment agencies, city and county taxing agencies.

Desirable Data:

A. Identification by parcel and structure, the number of persons, number of household(s), number of occupants per room, race of occupants, sex of occupants,

age of occupants, education of occupants, family income class, occupation(s) of occupants, employment status, a major industrial grouping in which occupants are employed, place of work, tenure of household head, place and date of previous residence, means of transportation to work, occupants rent or own, occupants receiving public welfare services or assistance, occupants receiving health and welfare services other than public, children in school, type and location of school, birth-death data, crime and delinquency data.

B. Data relating to health information including health hazard conditions at this parcel, diseases reported at this pardel.

V. TRANSPORTATION INFORMATION

Objective: To understand and project the flow of people, goods and vehicles. The data and resulting information itemized to this point describes the characteristics and the activity for each parcel of land and within each structure in the urban area. The next task is to understand the home base location of all vehicles used for transportation, how many, their total movement out of their home base so the aggregate of those total movements can be understood. Our data base must be accurate, comprehensive, flexible for analysis, continuously up-dated, and consistently refined so that each year in the future we can examine the trends we discern, analyze their implications, re-examine our future proposals, and hopefully over time be even better prepared to accurately estimate what will happen in the future.

Data described below is again parcel oriented. It is tied to the land use and population data and does not reflect the vast amounts of other data required for transportation planning over and above that which should be geographically oriented and identified. Where possible, origin and destination data, vehicle trends, psychological analysis of driver habits and desires, etc., should be tied back to geographic location so that future analysis can be identified with other indices that might at first blush have little relevancy, but on experimentation may lead to new insights over traffic and travel.

Desirable Data:

A. Vehicle registration by residence, or other location.
B. Means of transportation by all employees by place of residence, and location of employment.
C. Off street parking facilities for all parcels and uses with identification as to amount of area per type of vehicle, self or employee parked, at grade or in structure, individual spaces or "jammed" spaces.
D. Characteristics of access to parcels and parking facilities, peak period demand.
E. On street parking facilities aggregated by meaningful areas such as commercial blocks, street frontages, areas, or commercial, public, institutional, sports, industrial districts, etc.
F. On street and off street aggregates including shortages or excesses by appropriate statistical areas.
G. Ratios of parking to sales, parking to employees, parking to dwelling unit(s), parking of occupant(s), parking to floor space, depending on the use.
H. Truck loading space(s), including area, maneuvering room and ratios to appropriate measurements depending on type of land use.
I. Traffic and parking demand indicators for major parking or vehicle activity terminals such as sports arenas, auditoria, airports, transportation terminals by type of vehicles, hourly rates.
J. Specialized terminal data relating to water, air or railroad transportation terminals or land uses utilizing these forms of transportation, including switching facilities, docking facilities, area occupied and capacity, etc.