

# Planning in Highway Administration— Important Considerations and Summary

ROBERT W. PATERSON, *University of Missouri*

• THIS PAPER attempts to relate what has been said at this conference to some of the painfully difficult problems of planning and administration in the highway departments.

At the beginning of the conference, W. L. Haas described the reasons and events leading to the decision of the Highway Research Board and Bureau of Public Roads to call this meeting. Now, at the end of the conference, the author would like to reopen the question—Why was the conference organized?

- Was it because the purely technical knowledge necessary for building and maintaining roads is today but one aspect of an increasingly complex operation?
- Was it because there is difficulty in merging planning with operational activities? Construction or engineering development is outdistancing planning.
- Was it because the activities of the highway agencies are becoming so large and so complex that no individual can comprehend all the problems he must face and resolve them imaginatively?
- Was it because planning, in the technical sense, must somehow be merged with planning in the organizational or administrative sense?
- Was it because the sensitivity toward planning of top administrators in the highway agencies is becoming dulled by the need to direct more attention to other areas of activity?
- Or was it because there is increasing difficulty in designing the kind of planning activities which will yield maximum results throughout the organization?

The subject matter dealt with in the previous papers supports the view that all of these considerations were in-

involved in the decision to hold the conference. Some of the problems which were discussed may be more crucial than others but the divisive effects of all of them are apparent in the highway agencies, other government agencies, in educational institutions, and in private business and industrial establishments.

## PROFESSIONAL CHARACTER OF HIGHWAY ESTABLISHMENTS

The typical State highway organization in the United States is the showcase for effective public management of an enterprise. Its commission is a policy making board with representatives from both major political parties. The commission leans heavily on the chief executive officer of the department—the highway engineer. It requires that executive personnel possess professional qualifications. But, the final test of an organization is its ability to attract and hold competent personnel. It must provide career opportunities for competent people. The effectiveness of planning in the personnel division is vital to the health and development of the whole highway department for it is there that job qualifications, performance evaluation techniques, promotion and salary adjustment programs, employee personnel histories, and training programs are developed and expanded. One must be allowed to advance on the basis of ability—and the criteria that are being used to assess ability must be specified. Missouri is one of 10 to 15 States that are considered by highway administrators to be outstanding in the establishment of career systems. This is not to say the State has been able to resolve all questions concerning the administration and operation of highway activities, but the awareness of technical competency needed for planning various activities and the need for

proper interaction of planning between functional units has been recognized.

In thinking about the reasons why highway departments seem to be more effectively operated than most other public agencies, one confronts some assessment difficulties. There are however some salient reasons for such a belief. First, an end product—roads—is clearly visible to all employees and to the public as the reason for the agency's being. This fact immediately suggests a number of ways by which the activity of the agency may be satisfactorily measured. Miles of road constructed, area of right-of-way acquired, or the amount of maintenance and resurfacing completed during the year can be counted for a variety of road classifications. By merely keeping construction and maintenance crews on the roads, some impressive figures can be racked up each year that would seemingly indicate forward progress.

Second, highway departments are professionally staffed and in most instances there are few flagrant political patronage abuses. Thus, the public and personnel of the agencies have a sense of confidence in the operation which other kinds of government operations often lack.

Third, a level of assured support exists in those States where user taxes and license fees are allocated for road purposes.

Out of these characteristics can grow an acceptable road program built around a minimum of planning. What sets the outstanding department above the rest is its use of comprehensive planning procedures which flow throughout the functional divisions of the agencies. This kind of planning is far different from that involved in establishing and scheduling materials requirements for a section of roadway, from the establishment of cost and revenue requirements for the operation as a whole, or for the technical limits that are finally derived for the expenditure of capital on equipment. Important as these facets are, they are not enough if the kinds of problems that now exist and that threaten in the future are to

be solved. Not only must a road system be maintained, but changing use patterns, changing points of road congestion, changing locations of industrial development and land use have to be recognized. More resources must be developed when comprehensive planning is undertaken if the reservoir of public good will is to be held and strengthened.

S. T. Hitchcock provided an excellent view of the technical features of planning and interestingly enough he has concluded that, "social and economic considerations must be included as well as physical." The inclusion of social and economic factors appears to be recognized as the central fact of comprehensive planning. Highway departments learned to plan well for physical requirements during the slowly expanding period when the road system was being created. Now other appropriate disciplines must be incorporated into planning operations. Now problems of change prevail in almost every sphere of human activity. The problems are not only engineering in scope.

#### CHANGE AND GROWTH

Professor Joseph Schumpeter, during his career as one of the great economists of all time, constantly emphasized the close relationship between change and growth in the American economic system. Perhaps no one would deny that change is the central fact of American society. Quite early in the country's history some entrepreneurs perceived the direction of national developments and became able plotters in order to take advantage of the opportunities they foresaw. Planning, which is both the response to and director of change, has slowly, over the years, become institutionalized. No longer can it be performed on an *ad hoc*, personal, or tentative basis. Now it must be built into organizations—but it is not always well developed and carried effectively into their life blood.

#### ORGANIC STRUCTURE OF ACTIVITY

Certain basic administrative functions must be performed by all organi-

zations, but often the proper interaction between them is not provided. These administrative components are finance, personnel, program, and planning. Others have specified more detailed lists but these have universality and clarity which provide adequate room for the development of subclasses. Table 1 gives the functions of administration, but is not intended to indicate the precise content included within each function. It is intended to suggest the flow of activities that must be harnessed.

All this appears neat enough on paper. Unfortunately moving into operational programs, difficulties, problems, and human irrationality multiply whenever alternative possibilities or choices are present. Interestingly enough, beyond superficial insights, very little is known about why there is a high "we feeling" in one organization and a grudging "they feeling" in another.

To some extent beliefs about what is and what is not important in administration are colored by the complexity of administrative development of an organization at a given time and its present stage of evolutionary development.

In looking back upon the dramatic cases of success in business, it is relatively safe to generalize as follows: those firms that have become household names around the world have, at some time in their history, been able to institutionalize the process of change as a vital force in management. They are alert to change, flexible in adapting to it, and precise in evaluating its meaning for the company.

Carefully devised organizational charts can emphasize concern about certain functions. But the institutionalizing of this concern can occur only outside the charts. To give an organization meaning requires a clear concept of objectives by those who are responsible for formulating its policies and for its administration. Hopefully, executives will attempt to provide meaningful statements to high- and low-level operatives and create a two-way chain of communications throughout the organization. Coordination of activities and policy development are not appropriate functions for bottom echelons in the organization (those who have had responsibility for planning have probably questioned whether some high-level executives should be engaged in it at all).

Concerning the process of institutionalizing change it may be of interest to see how Mason Haire views shifts over time in organizational control and authority over the firm. He sees the historical development as shown in Figure 1.

The shifts from the State to the staff expert as the ultimate source of authority encompass all the problems and literature in the fields of organizational theory and management science in general. They reflect that:

1. Increasingly American concerns are becoming divorced from money markets.

TABLE 1  
ADMINISTRATIVE FUNCTIONS

PLANNING	PROGRAM	PERSONNEL	FINANCE
GOALS <sup>1,2</sup>	goals	goals	goals
organizing	ORGANIZING	organizing	organizing
staffing	staffing	STAFFING	staffing
budgeting	budgeting	budgeting	BUDGETING

<sup>1</sup> If the specified goals and objectives as developed in planning the operation of the activity are incompatible at the other functional levels there will be a need for review in Planning

<sup>2</sup> The use of capital letters indicates the administrative unit which has organizational responsibility for a given activity. For example, employment of people is the responsibility of Personnel but Planning, Program, and Finance will set requirements for their needs, and may take part in interviewing candidates for positions, particularly when professional staffing is involved.

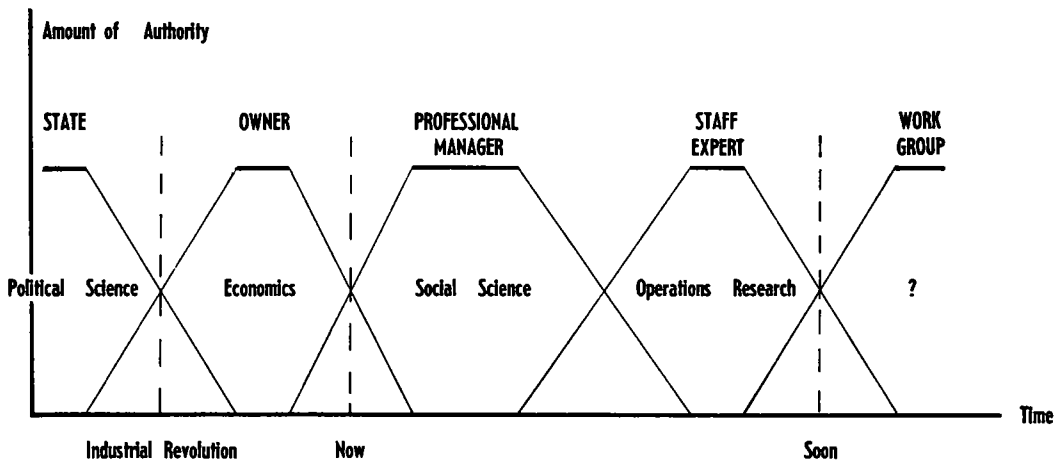


Figure 1. Shifts in organizational control.

2. An internal value system is developing within the corporation in response to public attitudes or presumed attitudes.

3. An internalization of the ultimate source of authority has been taking place.

4. Human factors have been the cause of great difficulty and concern.

Whether these things are of importance in public agencies is a source of great discussion among public officials and political scientists. Actually a strong case can be made that the latter three points apply equally well to the modern corporation and the public agency. But, although general tendencies can be sensed, lack of knowledge about the specific features of organizational behavior must be admitted.

#### ORGANIZATION THEORY

How to say something meaningful about the planning process in an organization, without knowing whether there are universal principles which apply to organizations and what they are, is the dilemma.

One view of organizational theory is built around the belief that there is a conflict between the needs of individual personalities and of the organization so that what actually happens in organizations can be understood in terms of dissatisfactions and frustrations of employees who react and adapt in diverse

ways, reactions of management to employee resistances and adaptations, and the continual interaction and feedback of tensions between management and employees. This is represented by the degree of "we"—"they" feelings expressed or held by both groups. Out of it comes a sense of "the organization" as a whole. But, as Professor Dwight Waldo has pointed out, if the employee is driven toward a realization of self and is thwarted by the formal organization, "to what extent is his thwarted nature innate, to what extent culturally determined? . . . To what extent do alternative and better organizational strategies exist? If they do not exist, can they be created?"

Another way of looking at the organization is through its historical development. By watching the physiological changes in the organization over time one perceives that it creates its own needs and requirements. The square-cube law of geometry specifies that as volume increases by a cubic function, the surface inclosing it increases by a square. Perhaps this does nothing more than help set a framework for speculating about what happens to an organization's efficiency when its size increases.

Efforts to explain decision making in organizations (not its technical aspects as specified by Shaneman) through a series of games have not been too productive. For as mentioned by Russell Ackoff, "In a real problem-solving situa-

tion the decision maker is not given a game to play, he must extract it out of the situation itself."

All of this poses an interesting prospect. Will a new elite rise? Computer technology is bringing a new kind of technical man into the organization to handle the apparatus. In many cases this new technical elite is responsible directly to the executive or his immediate staff. Other organization specialists are blooming under much the same condition. This sort of thing, though, is not new really, as was shown in Figure 1.

Comparative studies in administration reflect the great diversity and complexity of organizational environments. Some with vertical systems of authority work well; some with horizontal systems work well. And far from being a subject of just recent origin, one can cite historical works dealing with modern organizational problems.

Perhaps a definition of organization should be set out somewhere to satisfy those who like for things to be tidy. Some may remember POSDCORB—planning, organizing, staffing, directing, coordinating, reporting, and budgeting. It was used in the late 1930's to indicate the work concerns of the executive. Administration was conceived as a technical matter concerned with round-about production which governed efficiency. Administration was thus organization and the fellow who did this administering or organizing was an executive.

Today, however, there are more sophisticated definitions (if not any significant increase in the discovery of universal laws appropriate to organizations). Professor Bakke has produced the following: "A social organization is a continuing system of differentiated and coordinated human activities utilizing, transforming, and welding together a specific set of human, material, capital, ideational, and natural resources into a unique problem-solving whole engaged in satisfying particular human needs in interaction with other systems of human activities and resources in its environment."

If, at an earlier time, the complexity and interrelationships between POSD-

CORB items were understated, some progress is being made toward understanding the role of organizational structure, purpose, environment, and competition; and in recognizing the fact that these factors affect the society of the organization in ways and combinations of ways not fully comprehended.

Those interested in highway planning and its service to particular highway departments must be interested in things that affect the ebb and flow of information through organizations, for they are the things that determine whether work is meaningful or not. One dares say that planners in highway departments are often very frustrated that the maximum benefit from planning is not being realized in their highway departments. Developments occur within and without the organization that demand consideration in planning operations and often earnest pleas for support fall upon the ears of the deaf or near deaf.

The "categorical imperatives" to the development of planning as a sophisticated tool of the highway administrator which were specified by David Carley form, not a plea, but a warning to top management. The imperatives he stated are as follows:

- The recognition that highway planning and development is inextricably bound up with all of the other development factors of a given governmental unit and cannot be a distinctly separate operation.
- The planning of highway networks can no longer be limited in scope to a single route or community but must be based on a regional or a statewide systems concept. Also planning efforts by the many governmental units with responsibilities for highway construction must in some manner be coordinated.
- Highway planning is more than fact-gathering, origin-destination studies, and projections of traffic. It ought to be a socially-conscious and esthetic operation, tied strongly to careful consideration of other resources and their uses.

The author believes that one of the reasons why highway organizations in the United States have been able to create a united public support is that research in the past has been conducted on the basis of establishing need. Studies have pointed to current road deficiencies, and legislatures and the public can come to grips with exposed weaknesses and plans to correct them. This was fine so long as it was merely a matter of filling in lines on a road map across the nation. However, times do change and today there are economic and social forces of almost, if not actually, revolutionary force. More and more reliance must be placed on research and planning based upon future expectations or anticipations of conditions.

Then too, there is a significant issue to consider that involves a set of deeply-imbued ethical precepts. It seems reasonable to say that road programs have been predicated upon the belief that in the foreseeable future every American shall continue to have the right to drive a car. But the nation is growing, motor cars are more powerful each year, and highways are likely to become increasingly congested each year. At some future time will Congress, in the public interest, have to restrict the rights of individuals to drive at certain places at certain times, or encourage mass transit facilities? Almost all Conference participants listed traffic congestion in metropolitan centers as one of the critical problems. Are not those who are engaged in the management and planning of roads and highways going to have to set up some new hypotheses and move from research based upon established need to research based upon anticipated needs under new sets of criteria? The highway administrator and planner has been dilatory in entering the urban highway planning field and other forces have rushed to fill it.

The people of Missouri are much like people elsewhere. The level of awareness of Missourians as to what action should be taken to provide policy makers with the best knowledge possible is perhaps no keener than that of residents

in other States. The State has 8 major government departments and 60-odd agencies and no programs of information coordination. There is no program control center to assure maximum usefulness of statistical and research activities of one department with the needs of other agencies. There is no statewide economic base study to provide knowledge and guidance for either public or private concerns, although the Research Center at the University of Missouri is now engaged in such a study. It might be said that Missouri is ill-prepared for the job of comprehensive planning. And so it is, as are almost all the States.

#### THE PLANNING PROCESS

Rigidities in present conditions call for planning. But before planning, objectives must be established. An idea for a new road system, a new product, a new economic goal, a new approach to foreign trade must germinate and develop. From the new idea plans to build policies and programs to secure its acceptance may be made.

W. L. Haas' description of the planning function fits the requirements admirably: "Planning is one of the least understood and least effective aspects of highway management, yet it is an indispensable part of administration. It is the key operation from which all other activities flow. It serves to actuate the enterprise and gives direction and guidance in accordance with the principles and philosophy of the administrator."

The theme of planning rests on the degree to which dependence is placed on art. Planning to be sure involves art, and much more. More and more dependence is on science in the highly formal process used today in assessing the validity of proposed objectives. For example, a good deal has been learned about uncovering the operational variables between alternative courses of action. The numerology of depreciation schedules is easily obtainable. What were once largely subjective problems have slowly been reduced to problems of an objective nature. But, excluding engineering content that bears on road

systems, the planner is still very much in the realm of art.

Given an objective—the establishment of a 41,000-mile Interstate Highway System by 1975—the administrator turns to planning. A host of planning problems arise: (a) there is the problem of obtaining a staff of well-qualified personnel to work at multiple tasks and to coordinate diverse activities; (b) the objective must be scrutinized to reduce it to well-defined components; (c) it is necessary to accent the fact that the planning staff is bound by the need to predict what the future will be like; (d) action or plans statements must be prepared; and (e) careful attention must be given to the effect of change upon the highway organization brought about by the plan (the feedback problem).

C. A. Steele gave a penetrating overview of the source materials for measuring change. Of particular importance was his emphasis on the fact that because of the kinds of shifts that have been occurring—in population, location of industry (including farming), and place of residence—planners must become fairly conversant with the qualities of social and economic research. The urban transport problem and the question of mass transit prospects were again raised.

The author wondered what would be the relative financial outlays to provide an urban mass transit system for the metropolitan St. Louis area vs the urban highway - freeway - throughway system which, in the short-run at least, enables nearly everyone who wants to drive to do so. A host of procedural problems would be involved in establishing preliminary hypotheses—but what a research project it would be! The question is significant if highway users are not bearing the full costs of highways.

The technical side of planning involves not only physical but social and economic (and political) qualities. There is apparently a lack of satisfaction on the part of Conference members with planning operations in the social and economic fields. Highway programs until very recently put major stress upon the physical or engineering side of plan-

ning. Even today, how many highway departments engage the services of an economist, sociologist, or city planning professional?

Given this condition can the planning effort really be maximized—even if there is a situation where the chief engineer and top management are devoted in word and deed to planning? No matter how effective communications are, no matter how fluid are the lines between divisions, no matter how perfect the organizational arrangements, no real headway will be made until the appropriate content or subject matter disciplines are brought into planning operations. As Hope Wiley indicated, "(planning units) must welcome new procedures and new techniques . . ." Top management must have a broad appreciation of what these people are doing if their work is to be accepted as important to the organization as a whole. Otherwise these planning people will be shunted off into a cubicle or cell and are reduced to mere 9-to-5 routinized employees. "If it is to be effective, the planning organization cannot operate as an isolated cell within the highway department."

This matter really may be refined to a question of status. William Froehlich said, "Much of the effectiveness of the planning function is determined by its importance in the organization. If planning is to be a principal function of the administrator, it must be given a status to reflect this importance."

In short, if highway administrators are really serious about planning, the content and quality of their efforts will reflect that concern. The quality of management will also be reflected.

Planning concerns the future. The highway problems of the future involve such things as the following:

- Estimates of total transportation needs.
- Estimates of needs to be met by highways.
- Effects of technological developments influencing the choice between highway transportation and other modes.
- What shall be the division between public and private transportation and types of facilities.

- What design standards will be appropriate for each road system next year, in five years, ten years.
- Establishment of future needs in comparison with present facilities and cost estimates.
- Establishment of total resources and needs.
- Allocation of resources among different systems; including estimates of road usage and demand.
- Establishment of revenue estimates; including analyses of user and non-user support.
- Problems associated with the philosophy of fund dedication.
- Need for constant review of the benefits-received and services-rendered principles.
- Distribution of tax receipts among various road systems in proportion to use.
- Effects of economies of scale, the multiplier, and government economic policy.
- Effects of highways upon the quality of life of people.
- Establishment of trends of State support for all road systems.
- To what extent should future needs be built into today's construction.
- To what extent do better roads affect the economies of small towns and cities (distressed area problem).
- How can rural-urban needs be rationalized.
- To what extent and how rapidly should the comprehensive planning field be developed.
- How hard should the highway administrator push to obtain greater coordination between planning and research groups in State government, education, business, and foundation fields.
- How much obsolescence is there in plant and equipment which offsets the extent of commitment to the future.
- What will the economic, cultural, and social environment be in 1965, 1970, 1980, 2000, and what are the implications for national transportation system and for State systems.

In conclusion, this conference has obviously been a success. Far more questions have been raised than answers. But the stimulation will result in some approaches being made by highway departments to the study of future problems that would not otherwise have occurred. There could be no more appropriate result.

## DISCUSSION

*Steele.*—I would like to present two points that have not been completely settled up to this point. The first one is training.

It seems to me that the young man who enters college very often chooses a field that looks attractive to him then; but as he goes along, he finds his interests change as he gets more experience, and the first thing he knows, regardless of whether he started out in highway engineering or city planning or business administration, is that he is actively engaged in highway planning.

I also want to reiterate that first we should select the man who shows the greatest potential and the greatest combination of ability and interest, and then we should proceed to train him.

The second point is this: We have referred, in a number of instances, to a change in government responsibility for

the highway function that is likely to come, not only insofar as the rural roads are concerned, but also the city streets. I feel that if we in planning fail to recognize that, we are making a big mistake.

In a cost allocation study a part of the cost of highway services should be assigned to other than highway users.

They are beneficiaries too, but if we shift responsibility for all rural roads to the State the chances are that these are going to have to be financed from the incomes of the State. So perhaps some rethinking is needed there, and we should be prepared to offer advice and help when these things materialize through the thinking of the local officials, the legislatures, and other individuals and bodies that have the right to say what shall be done.

It may be that what we are going to



end up with is not what we would prefer to have. In other words, we may end up with a much more centralized highway administration than we believe desirable. However, if that is the trend of the times, we had better know it ahead of time and be prepared to meet it.

*Oliver.*—I can definitely confirm that it is a trend in Arkansas. In fact, it is already in legislative study.

*Campbell.*—There is a facet that perhaps I have missed. We want to know where the source of our money is, where our resources are for highway use. Have we gone so far in our thinking about allocation as to how we should divide it between construction, and maintenance and operation? There is a breaking point between each one of those, a point of diminished returns, or an optimum point. Have we really explored those areas: the allocations of our resources to those three? Is this something for the planning division to explore?

*Wiley.*—I think it is. Somebody came into the office a few weeks ago and wondered why in the world we were spending so much money for maintenance, instead of getting out and building more highways with that money.

And I asked him the question: If he had a five or six room house and the roof was leaking all over and ruining his furniture and everything else inside, would he build that extra room he needed, or would he patch up the roof?

Now, how much it is going to take to patch up the roof or to add the other room is something that has to be determined. I think we have a primary obligation to maintain those roads that we already have.

I don't think that there is anybody in this room or in the country that can look out to the year 2000 now and tell us what is going to happen at that time. But unlike the man that refused to start out on a trip at night because his headlights would only reach a couple of thousand feet down the road when he had to drive 200 miles, we cannot just stand and wait. We have to start out and, as we go, we will find that other people are on the road as well, and that each one is casting the light in the right

direction. I think that this is a thing that we have to keep working on, but the answers will develop as we go along.

*Granum.*—I think that this problem of economic balance between construction, maintenance, and operations as to use of funds is certainly important. If we knew the extent to which we can afford to invest in permanent facilities, for example, to reduce the cost of maintenance,—the extent to which we can afford to withhold capital investment with the certain knowledge that maintenance in its broadest sense is going to increase, it would be extremely helpful.

And in this light and in terms of specific decisions that have to be made, one example came to my attention recently. In an important urban area, the principal decision maker in that area put at the top of his list: "First, maintenance betterments; and second, operational improvements of a relatively minor nature."

And this decision making aspect had continued over a period of enough years so that the top administration at the State level actually and literally put a ceiling on the amounts they would permit that district to spend for these purposes in the interest of developing a broader program that would have more long-range lasting value.

*Levin.*—We have been talking for several days now about the economic and sociological elements. I think nobody would dispute the desirability of including them. But I wonder, however, about the difficulties of quantifying these two special elements. How do you add up items which at least at this stage may be very difficult or impossible to quantify?

How does the highway engineer who traditionally by training and experience has been used to quantification in very definite terms deal with the items that continue to be definite and certain and quantifiable, and the items in the realm of sociology and economics, many of which cannot be quantified? How do you balance in the urban areas deciding on location and things of this kind against design? How do you balance esthetics against cost and open space? How do you balance comfort

and convenience? How do you balance the relationship of church and school to a community?

*Paterson.*—If you have a metropolitan area highway department, whether it be the city metropolitan planning commission, highway commission, or the State highway commission that has an alternate choice for a road system, the relative costs can be plotted fairly easily, as to which system would be less costly to build the road to the same standard requirements. But it may have different implications insofar as what kinds of housing are likely to go up abutting the road system. There might be an older area as opposed to open space. It may be that in view of the economic and sociological trends in the older area, it would be much better to build the throughway through the older section, depending on what the trends are within that particular metropolitan area. I think you would have to analyze these before you could specify whether it would be better or not.

*Levin.*—And then it becomes a judgment decision, and the quantification decision as such need not be dealt with in this case?

*Paterson.*—I would say we should make every effort to do so, but there are limitations to it. I would be the last to argue there are no limitations to this.

*Levin.*—How do you get away from arbitrary decisions, then? How do you get away from tyranny in a broad sense, the tyranny of trees, for example; that some of the courts in the esthetic cases have talked about?

*Paterson.*—I guess it comes back to training. You want to be certain that the person who is doing this has had a wealth of training in his particular discipline. And of course it is going to get into the judgment category. Are not some engineering decisions in the judgment area?

*Levin.*—Yes, but they have an underlying flavor of fact and physical characteristics. It is the same as science. The decision to send an astronaut into orbit is obviously a judgment decision, but it is based on a vast body of fact which you could put in machines and get some

kind of an answer. Can you do the same with sociology and economics?

*Paterson.*—Why is it that you can take a given cost figure? Why not another cost figure? Somebody has to make a decision that we are building for traffic 5 years hence, rather than 3 or 7 years. Some place a decision is made.

We can get some traffic counts and some traffic projections made, but somebody is making a decision that we are building for a given volume of traffic. Therefore, you determine your requirements, your road width, depth, and all the rest of it, on the basis of a number of cars per hour, day, or whatever it is. I do not think this is made on the basis of any quantifiable data. Someone makes a decision in regard to this. You can get some data, but you are making a decision based upon somebody's subjective view of what they are building for.

*Oliver.*—I think one example of what you are speaking of is the Interstate System.

We have made an estimate for the Interstate System hurriedly, and we did not include complete control of access in it. When we got through with the complete controlled-access estimate, it was very much higher than the original estimate made before the passage of the Act.

*Wiley.*—Somebody has to decide for what projected traffic a highway is to be provided. This could be mutually agreed upon by a number of qualified people that at least think they know what we can afford to do. At that point, then, it is possible to put a fairly accurate monetary value on the thing. You could make comparisons of alternate routes and say this one is better than the other because it shows a greater benefit-cost ratio.

But how do you put any kind of a valuation on the thing you are talking about? How many dollars can you say this is equal to, or worth?

*Paterson.*—How would you know, until you had built a number of roads, what your costs were going to be? We have known this for a long time. You have just had experience, that is all. We have not had any experience, but I

will wager that given some limitations with regard to city size, once we know what the impact of a road system is for a city of a given size, with a certain basic population and industry component, it will be possible at some time in the near future, with a little experience on the effects of the Interstate system going through a certain area, to predict fairly closely what the impact will be upon land valuation and on the drawing power that a given stretch of road will have for industry. We know a little about this in certain areas.

We will also be able to predict to some extent what residential patterns would satisfy the esthetic qualities that people are striving for.

We don't have any experience or any research, really. We have spent a lot of money for various things, but not for really important things.

*Levin.*—I have been at the receiving end of the thing I have been trying to ask for here, and I ask it not in any malicious sense.

Yes, we know a great deal about the sectors you indicate, but if you are talking about city X, that is one thing, but there might be a pull of these same elements. In other words, it erupts at city X and goes down to city Y. We are not favoring one over the other. We want to know what the net is.

You are talking about a national, State, and regional valuation, rather than a local valuation. You are talking about cities or routes, rather than a sector of highway, and so on.

*Paterson.*—No, I would take it on an even broader framework than this. I would maintain that the highway projections being made by a number of States are nothing more than projections because they ignore certain basic national tendencies.

As Mr. Steele indicated yesterday, we know something about the regional characteristics of growth. If this is the Eastern Shore of the United States, and this is the Western, since the census of 1930, you will see on the Eastern Seaboard there is a rolling up, and on the Western Seaboard there is a rolling up. In other words, there is a piling up of population across here on the East and on the West.

I do not believe you can design a highway system over here without taking into consideration the relative factors in this rolling up that are going on, nor can you do this in California on the basis of a State projection of population for California.

If this is true, then we have to know something about the regional characteristics, and the national characteristics of growth patterns.

That population is rolling out. It is also carrying with it industry. One of the interesting things about all this is, what happens to a city like St. Louis or Kansas City, assuming this rate of increase continues? I do not think you can really analyze these things unless you go toward the national studies.

*Holmes.*—I will try to answer it in a different way. I think it is not so much in all cases the inability to quantify as to the different approach taken by the social scientists and engineers and political scientists, but that we tend to quantify everything right off the bat.

And I think we would quantify things in our work that cannot be quantified. But we go ahead and convince ourselves, and apparently a great many others, that we are doing a great thing for them on the benefit-cost ratios we produce, including some time values that I do not think we can quantify. Yet we do not hesitate.

The social scientists have never approached it on that basis: they consider it on the basis of esthetics. Of course, they are good. But how much more should you pay to landscape a cut or such things as that? I think there are ways by which some of those things could be quantified, if we were to spend a little research money and if we got the people who are used to wanting to quantify things to look for the reason for doing it.

The States spend some money for certain of these things that have no benefit, perhaps, except for esthetics. The fact that they do spend that money, and their public accepts it, indicates that to that public and that State that amount of work was worth that much. At least, you can find a point.

Maybe some greater amount of work would have brought criticism. Maybe

some lesser amount of work also would bring criticism. Of course, in time, you will arrive at something which the public seems to have accepted, and to which you could assign some cost values.

I do not know how you assign a value to reduction of air pollution. That goes into an area that city planners refer to as the hidden cost of motor vehicle operation. Of course there are many of these other hidden costs. So I think maybe in some of these social fields, if we were to look deliberately for means of quantification, we could not gain a great deal.

I think, on the other hand, we will always have to recognize that there are some judgment values that are going to be there just because people want them. We cannot prove why they want them any more than you can prove why you are willing to pay \$10 more for a particular suit just because you happen to like it better. That is all. You can afford it. And what will be liked in one State may not be liked as well in another. However, I think it can be approached, and that I do not think we have tried to do.

*Levin.*—This is all heavily involved in the process of planning, is it not?

*Holmes.*—It is heavily involved in the process I have described. I am sure of that. I would hate to say that we need to quantify in all this great number of conflicting and confusing areas and then come up and say, "But we can't do it."

*Telford.*—I was interested in this attempt to quantify everything, and I am inclined to think we sometimes go too far.

*Campbell.*—Do you think it would be necessary to quantify in terms of money values? There are other means of quantifying.

*Wiley.*—The thing that we run up against constantly is that there are certain things you can quantify, and you come out with a certain number of dollars in favor of a particular location, for example. But somebody, for esthetic reasons or otherwise, thinks that it would be better to do this other thing, and there may be some logical argument.

But how strong is this argument? In other words, this argument has to be balanced against this many dollars. You

may not be able to quantify this, but you have got to be able to arrive at a certain number of dollars before you can say, "Well, we are entitled to or should properly do this other thing."

Suppose on the Interstate System with future benefits in the billions of dollars we did find out or draw the conclusion, before we bypassed a small community, that it was going to hurt this community to a certain number of dollars. What would you do? Are you going to throw away your portion of the system, forget control of access, etc., just so you can go right through that community. Even if you do find that it is going to hurt that community, which I think is unlikely in most cases, what would you do?

I do not think we are going to change the over-all objectives of a system that has already been shown to be so great a benefit just because in a few cases it is going to be detrimental to a few individuals.

*Holmes.*—It is not a question of trying it inextricably to some kind of an equation and blindly taking the answer, but the more we can know about various factors, the better our judgment will be as to what the effect will be, and where the administrator can be helped by this. It is a judgment decision on almost every project, when you come right down to it.

*St. Clair.*—In the water resources field, where there is a multiple purpose project of power, flood control, recreation, wildlife protection, etc., in one way or another they have worked toward a quantification (see Lilley and the developments that have led to what is called the "Green Book") of some of these so-called secondary benefits that might serve as a model if we get to the point of extending the benefit-cost or rate of return type of calculation to the point of bringing in these broader benefits.

I do not think this is impossible, but it would always contain some arbitrary elements and would be never fully satisfactory.

*Campbell.*—What are the effects of a highway on the quality of living?

*Paterson.*—I have no solutions. Again,

you need some research projects related to this, but where these roads go, you build up certain suburban residential communities, and this does have some impact on the way people live, where they work, and how they play.

There is access to services, for instance. You may have to forego a given level of school systems for one not quite so good. The tax base itself is likely to change for individuals who are going into new communities. This is likely to mean a large difference in services rendered by the community itself.

*Campbell.*—Is that shifting to an economic slant? How about the social slant, and quality of living? Does it have any effects on that? To what extent can something like that, some exterior force, have an effect on the quality of a man's life?

*Paterson.*—I can think of several examples. For one, in the metropolitan community of 1920, there were residential communities with certain sociological characteristics. These are gradually breaking down, perhaps not all the way through society, but in the newer suburban areas—is it true that the individuals of \$6,000 income reside

quite closely to individuals with \$35,000 and \$50,000 income? This means there may be a change in the breaking up of barriers. This is one possibility.

The whole effect of the road system in making the United States as a whole accessible to communities a State or two States away is nationalizing the country, and in much activity in research, planning, and building we underestimate the effects of this nationalization.

*St. Clair.*—I think Professor Paterson is quite right about that. I think the controversy revolved around whether this is good or bad. I am inclined to think it is good, myself; but some of the sociologists seem to think if you break up little social structures that have existed since the 1850's or something like that, you are doing something bad.

I think that is just what we need to do; that a community in which there is an exchange between people, people of all nations, for example, is a living and growing and functioning community; but the one that is stabilized is dead.