A Method for Attaining Realistic Local Highway System Plans

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Because of the growing importance and influence of the work of the urban planner with its attendant impact on the development of highway transportation systems and consequently on the work of the highway engineer, the State Highway Commission of Wisconsin, in conjunction with the University of Wisconsin and the U.S. Bureau of Public Roads undertook a study and evaluation of local highway system planning in Wisconsin.

The study took somewhat over one year to complete and utilized research techniques developed by the social, as well as the physical, sciences. The purpose of the study was to determine the existing status of local highway planning in Wisconsin, to determine the effectiveness of local plans in actually achieving integrated urban highway systems, to isolate and analyze any strengths or weaknesses in the existing planning process, and to outline a method of effecting the attainment of current and realistic long-range highway system plans in urban areas.

The results of the study establish for the first time in Wisconsin a framework for the factual evaluation of local highway planning. Based on such findings the study recommends revised highway planning procedures that should result in the preparation of practical and workable local highway system plans that can be cooperatively adopted and jointly implemented by the various levels and agencies of government, and that should provide the key to integrating land use and transportation system planning in the state's rapidly expanding urban areas. The recommended procedure involves important changes not only in organization and staff requirements at the state level but also in administrative policies and practices, and in the scope, detail, and technical content of both state and local long-range highway system plans.

• THE NATION'S POPULATION is currently undergoing an unprecedented growth and urbanization. The widely dispersed characteristics of this urbanization with its accompanying dependence on motor vehicle transportation have created severe pressures to extend urban street systems and to widen, realign, and reconstruct existing trafficways. These urban street systems form important links in the national highway network and are essential to its proper functioning. Moreover, these urban street systems form the framework for the nation's urban development and, as such, determine to a large extent the character and pattern of that growth. The importance of the local highway systems to the sound development of urban areas as well as to the proper development of the national highway transportation system requires that these local systems receive the cooperative attention of both the city planner and highway engineer.

The recent exchange of criticism between city planners and highway planners in connection with the construction of the National System of Interstate and Defense Highways has rather dramatically highlighted the importance of highways in urban development and the need for cooperative planning of highways in urban areas. This exchange of criticism has been reflected, probably to the detriment of both professions, in the

popular press as well as in the professional planning and engineering journals. It has been the cause and subject of several important national conferences of city planners, highway engineers, public work officials, and leaders from government, commerce, and industry, such as the Hartford Conference (held at Hartford, Conn., September 1957, sponsored by the Connecticut General Life Insurance Company) and the Sagamore Conference (held at Syracuse University, October 1958, sponsored by the American Municipal Association, AASHO, the Automotive Safety Foundation, and HRB).

As a result of the findings and the recommendations of the Sagamore Conference on Highways and Urban Development, the U.S. Bureau of Public Roads directed its regional and division engineers to effect the attainment of current and realistic urban highway plans for each urban area within its jurisdiction, these plans to be cooperatively developed and endorsed by all agencies concerned.* This directive indicated that these plans must not only be adequate for future traffic needs but must be in harmony with, and an integral part of, the over-all plans for urban area growth and development. As a logical first step toward this objective the Bureau, in a subsequent directive,** requested that an inventory of the existing planning situation in the local communities be made by the individual state highway agencies, and provided standard questionnaires for such an inventory. Accordingly the State Highway Commission of Wisconsin from March to September 1960 conducted a local planning inventory in Wisconsin and in August 1960 activated an Urban Planning Section in its Planning and Research Division. The need to analyze and evaluate the results of this inventory as well as to devise a sound procedure for carrying out the directive of the Bureau of Public Roads to effect the attainment of current and realistic urban arterial highway plans for each urban area resulted in the undertaking of a special research study and evaluation of local highway system planning in Wisconsin.

PURPOSE AND OBJECTIVES

The purpose and general objectives of this special study were (a) to determine the extent to which municipalities in Wisconsin have actually prepared long-range plans for the development of integrated urban street and highway systems and have actually attempted to implement these plans through legislative action and administrative practices; (b) to determine the effectiveness of these plans and plan implementation devices in actually achieving integrated urban highway systems; (c) to isolate and analyze any strengths or weaknesses in the existing local highway planning processes, and (d) to outline a method of effecting the attainment of current and realistic local highway system plans in urban areas and suggest possible changes in the legislative framework or administrative practices that might improve the local highway planning processes, with particular emphasis on possible functions of the State Highway Commission.

METHODOLOGY

The study was based on an analysis of a statewide local planning inventory covering 32 cities and villages in all, including all municipalities in the state with population of 25,000 and over. Using the results of this inventory, six cities were selected for more intensive study, and the following research procedure applied:

1. All existing plan documentation including land-use, arterial street, and highway system, and community facilities plans, all existing plan implementation devices including zoning, subdivision control and official map ordinances, and capital improvement and urban renewal programs along with copies of the official proceedings of the local plan commission and common council, were collected from each city studied. These data were reviewed and analyzed for possible impact on the highway planning

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*See Circular Memorandum to all Regional and Division Engineers, from Ellis L. Armstrong, Commissioner, U.S. Bureau of Public Roads, Subject: Urban Highway Planning; 25 Nov. 1959.

**See Circular Memorandum to all Regional and Division Engineers, from G.M. Williams, Assistant Commissioner, U.S. Bureau of Public Roads, Subject: Inventory of Urban Planning; 28 Jan. 1960.

process as well as a provision for measuring the over-all status of local planning in each city studied.

2. For each city having a highway plan the extent to which this plan had been actually implemented through major highway construction undertaken since the adoption of the plan was then determined by a series of overlay maps. The overlay map process clearly indicated any serious discrepancies between the adopted local highway system plans, actual major highway construction, and established Federal Aid System routes. Each major discrepancy indicated by the overlay map process was regarded as evidence of a possible breakdown in the local highway planning process.

3. Each such possible breakdown was then investigated through structured interviews directed toward an analysis of the local highway planning process. Interviews were held in each case with individuals active in the local planning process, including engineers, planners, elected officials, and recognized community leaders.

4. The results of the structured interview were then summarized and analyzed in light of the factual information provided by the collection and analyses of the plan documentation, the official proceedings, and the overlay maps. This analysis was made on an individual, city-by-city basis and a body of material was thus created from which general conclusions were drawn about the specific fact situations involved in each case. In addition, because of the full range of planning experience represented by the cities studied, generalizations were drawn from the same body of material and are believed applicable on a statewide basis.

RESULTS AND CONCLUSIONS

Certain generalized conclusions pertinent to the purpose and objectives of the study have been drawn based on the research findings and on the results of the statewide urban planning inventory.

Current Status of Local Planning in Wisconsin

Somewhat less than one-third of the cities inventoried, which included all cities of over 25,000 population in the State, had prepared even rudimentary comprehensive community development plans. In other words, over two-thirds of the cities lacked such plans in spite of the fact that these cities had well-established plan commissions, that the State planning enabling act clearly indicated that it is the duty and function of the local plan commissions to prepare and adopt such plans, and that this legislation has been in effect for about 40 years in Wisconsin.

Further, about one-half of the cities inventoried had prepared an arterial street and highway system plan of sorts, even though some of these had no comprehensive plan. Moreover, of the cities that had prepared such arterial street and highway system plans about 60 percent had done so without the collection of essential traffic data and about another 45 percent had done so without the collection of essential land-use data.

All of the cities inventoried had adopted zoning ordinances, all but two had adopted subdivision control ordinances, and about one-half had adopted capital improvement budgets, although only one-third of these cities had prepared comprehensive plans. About one-half had adopted official maps, although 40 percent of these had not developed arterial street and highway system plans. It is apparent that in some cases the plan implementation devices are being used to implement long-range plans, whereas in other cases the implementation devices are simulating or substituting for the necessary long-range plans.

Effectiveness of the Plans and Plan Implementation Devices

From the results of this study it is concluded that existing local arterial street and highway system plans have been quite ineffective in actually achieving integrated urban highway systems in Wisconsin. It was found rather conclusively that state and federally aided highway improvements undertaken since the adoption of the plans that did exist in the cities studied were not implementing those plans. For example, the overlay map studies showed that in the city having the most extensive highway construction activity

of those cities studied, and the second most extensive construction activity in the entire state, about one-half of the total capital investment in such construction resulted in highway improvements that departed significantly from the adopted plan, a plan that was only five years old. The structured interviews conclusively showed that where such construction did conform to local plans this conformance was not due to such construction being used in a positive manner to implement effectively the objectives expressed in the plans, but was instead almost completely coincidental.

The study further indicates that the relationships existing between the State Highway Commission and the State's urban areas regarding highway plan preparation and implementation are generally unsatisfactory to both the State and the local agencies, and existing plans were more apt to serve as a center of dispute than as a basis for close liaison and cooperation. It may be of particular concern to the Highway Commission that the study indicated that 59 percent of the lay leaders and 79 percent of the technicians interviewed believe that the local plans did not have the understanding, acceptance, or support of the Highway Commission. In fact only 35 percent of the lay leaders and 33 percent of the technicians, and the latter group included the district highway engineers, believed that the cooperation of the highway commission in plan preparation has been satisfactory in the past. Similarly, only 53 percent of the lay leaders and 40 percent of the technicians believed that the cooperation of the State Highway Commission has been satisfactory in plan implementation. In short, the study clearly demonstrated that the existing local arterial street and highway system plans are not serving as statements of mutually agreed on, long-range objectives to guide and coordinate the highway plan implementation activities of all levels of government toward the ultimate attainment of practical and workable urban highway systems. The highly unsatisfactory situation in this respect apparently represents an almost total breakdown of the local highway planning process in Wisconsin.

Factors Contributing to the Breakdown of the Planning Process

The results of this study indicate that several factors contribute to this apparent breakdown of the local highway planning process.

The first and probably most serious contributing factor, found to exist in all of the cities studied that had prepared and adopted highway plans, concerns the technical adequacy of the plans themselves from an engineering standpoint. This factor probably more than any other is basic to the widespread breakdown of the local highway planning process. The study found that existing local highway system plans are little more than intuitively created street patterns rather than engineered systems designs based on quantitative analyses, and as such, are not a sound basis for capital investment. Further, these plans do not provide the necessary and desired long-range solutions to the urban traffic and transportation problem.

It is significant that the State Highway Commission completed a comprehensive origin and destination survey in each of the four cities studied that had adopted plans before the highway plan preparation and that the resulting traffic data were made available to the local governments in time for the planning work.

In some cases the traffic data was used in the local arterial street and highway system plan preparation in a "qualitative" manner only through intuitive application of the planning data and visual examination of the existing traffic flow diagrams and trip desire lines as revealed by the origin and destination survey. In other cases it was apparent that the origin and destination data, and the existing traffic patterns and desire lines which this data established had been used directly as a "qualitative guide" to judgment in evolving the plans. In addition, certain portions of these plans had been quantitatively tested by the time-honored system of projecting existing traffic patterns by applying a single expansion factor to existing traffic volumes.

It is significant, indeed of central importance to this study, that in no case was any attempt made to relate trip generation to land use, to apply such trip generation factors to the future land-use plan or projection to simulate future traffic patterns, or to assign this simulated future traffic demand to the proposed system in order to analyze the system capacity. The technical adequacy or feasibility of these existing system plans

is, therefore, at least subject to question and it necessarily follows that these plans cannot serve as expressions of agreed on objectives among the various agencies involved in highway planning and plan implementation. The traffic and highway engineers interviewed were particularly critical of this lack of applied systems analysis and design in local highway plan preparation and indicated that such lack made the existing plans largely unworkable.

Urban highway system plans prepared without such traffic systems analysis provide no basis for agreement on the feasibility and soundness of the plan, either between the city and the state or between local line and planning departments, and therefore fail to fulfill the basic purpose and function of such a plan. Moreover, a plan that is not an engineered systems design may actually create more problems than it solves. Proper quantitative analyses assure full use of basic planning and traffic data often collected at great expense, but as indicated by the study, used to a very limited degree if at all.

The study revealed, and this should be significant to all highway agencies, that this lack of technical adequacy is known and fully understood by only a few technicians closely involved in planning and plan implementation. Consequently when the highway agency is called on to implement portions of an adopted plan and refuses to do so on the basis of traffic assignments and cost benefit ratio studies, it is apt to be regarded as obstructionist, and public relations accordingly suffer severely.

A second major factor contributing to the breakdown in the highway planning process concerns the lack of a documented state-wide, long-range highway system plan. As a consequence, local plans are being developed without any real knowledge of the long-range plans of the State Highway Commission itself as to the ultimate future treatment of the major intra- and inter-regional traffic corridors. Because the highway network forms the basic framework for urban growth and development today and because any changes in this network have far-reaching effects on the urban pattern, it becomes very difficult if not impossible to formulate sound local plans except within the context of a broader plan which expresses regional and state highway transportation needs. In this respect, the term plan implies documentation, for only through adequate documentation can a plan serve as a statement of mutually agreed on long-range objectives.

A third major factor concerns the existing federal aid systems, which simulate long-range highway system plans per se but do not reflect the local plans. Major highway construction implements the plans expressed in the aid systems and, therefore, if local highway plans are to be meaningful (that is, are to be successfully implemented), provision must be made to adjust the federal aid systems to the plan at the time of plan adoption.

A fourth major factor concerns the lack of active participation at all levels of government by key line agencies who are ultimately responsible for plan implementation in the technical aspects of the plan preparation beyond data collection. This factor is certainly related to the first and most basic contributing factor, inasmuch as the lack of technical adequacy is at least partially the result of a lack of direct participation in the plan preparation by technicians of the key city line departments and the State Highway Commission. The lack of such direct participation in plan preparation is also an important factor in the decided lack of interest by line agencies in active plan implementation.

Other factors apparently contributing to the breakdown of the local highway planning process but perhaps somewhat less critical than the major factors just enumerated include the following:

1. A definite lack of any common understanding of many of the terms and concepts involved in local arterial street and highway system planning. Inasmuch as agreement on terminology and the basic concepts that such terminology might represent is necessary to ready communication and understanding among the various individuals and groups involved in local planning, a need appears to exist to establish common definitions of terminology and concepts relating to urban planning on a statewide basis. The study indicates that agreement is lacking on such important matters as the definition of the purpose and function of an arterial street and highway system plan, the definition of the term "urban area" itself, the desirable delineation of both planning areas and

planning responsibilities by governmental levels, and the definition, function, and application of plan implementation devices.

2. The apparent weakness of certain widely used plan implementation devices, and the decided lack of application of other more effective plan implementation devices to arterial street and highway system plan implementation.

3. A lack of stability in the local highway system plans due to a general lack of understanding, acceptance, and support of the plans by the public and, sometimes under pressure from segments of the public, by elected officials. The ease and rapidity with which the local plans are often revised when a specific improvement project implementing the plan meets stiff local resistance has made the highway engineer question the integrity of the plans and be unwilling to invest any money in stage construction based on ultimate plan proposals.

This study was undertaken with the expectation that some of the breakdown in the local planning process would be attributable to the ineffectiveness of the local plan commissions in getting common council support for their recommendations. The study, however, revealed the contrary to be true and it can only be concluded that any changes in the local planning procedures at this time should be built around the plan commissions and should seek to strengthen the commissions and their role in plan implementation.

RECOMMENDATIONS

Any procedures to effect the attainment of current and realistic urban arterial street and highway plans for the urban areas of Wisconsin should include the following:

1. Assuring the technical adequacy of these plans; i.e., their ability to meet the future traffic demands that will be placed on the proposed facilities from both an engineering and a financial standpoint, as well as the proper integration of the highway and land-use development.

2. Assuring the incorporation of intra- and inter-regional transportation needs in the local plan proposals, thereby integrating state and local highway system planning.

3. Assuring effective plan implementation so that the planning is for action and not merely "for the sake of planning," as appears to have been the case too often in the past.

4. Functioning substantially within the framework of the existing state planning enabling legislation as it affects local planning.

The following method of effecting the attainment of practical and workable local highway system plans in Wisconsin was proposed as a result of this study. It is thought that this procedure, if adopted, will overcome all the major weaknesses found by the study in the existing local highway planning process and permit local arterial street and highway system plans to be cooperatively developed, endorsed, and implemented by all agencies concerned. An outline of the recommended procedure follows:

1. The State Highway Commission should actively encourage the preparation of documented comprehensive community development plans, including arterial street and highway system plans, for each urban area in Wisconsin. It is recommended that, for planning purposes, the definition of urban area be not that definition specified by established policy interpretation of Title 23, U.S. Code, Section 101, but be "An area including and adjacent to a municipality or other urban place of five thousand or more as shown by the latest available federal census and in the case of incorporated municipalities, including the extra territorial plat approval jurisdiction of the municipality as defined by Section 236.02(2) of the Wisconsin Statutes."

Such plan preparation could be most effectively encouraged through the establishment of a firm policy that after an established cut-off date no more federal and state aids will be made available for new construction in urban areas that do not have such plans prepared and adopted.

This recommendation would effectively overcome any weaknesses in the local highway planning process now stemming from a lack of documented local plans.

2. To assure the technical adequacy of future plans the State Highway Commission should offer to extend limited technical assistance and advice to the local units of gov-

ernment during plan preparation through a staff familiar with both land-use and highway system planning techniques. It is most significant that in the interview process this was the most frequent need voiced by interviewees. It was mentioned by 89 percent of the interviewees, or specifically by 100 percent of the technicians and 74 percent of the lay leaders. This assistance and advice should be initiated during the basic data collection phases of the planning work, continue during the sketch plan phases of both the land-use and highway system plan, and extend to a review and analysis of the final local highway system plan.

The Commission's assistance and advice should be directed toward two primary objectives: (a) the incorporation of intra- and inter-regional transportation needs in the local plans, and (b) the assurance that the finished plan is technically sound and workable.

The attainment of the first objective implies the preparation of a documented statewide long-range highway system plan by the State Highway Commission. In interview process the second most frequent need voiced by interviewees was for a documented long-range State Trunk Highway system plan. This was mentioned 24 times, or by 55 percent of the interviewees, or specifically 59 percent of the technicians and 50 percent of the lay leaders. Such a statewide plan should include a "master plan" setting forth the general location of the major traffic corridors, and in general terms the type of facility required to meet the ultimate traffic demands of these broad corridors. Such a general plan should be prepared within the context of a comprehensive statewide development plan based on the careful collection and analysis of population, economic, and land-use data. Consequently the proper preparation of such a statewide highway system plan should be a joint effort between the Planning Division of the State Department of Resource Development and the State Highway Commission.

A general plan of this sort, though necessary as a statement of agreed on, statewide long-range objectives, is, however, quite ineffective as a basis for extending technical planning assistance and advice to local governments. The proper extension of such assistance requires the preparation of precise and definitive plans, beyond the general plan stage, setting forth the ultimate development of each of the traffic corridors specified on the general plan. Such plans should set forth proposals as to centerline location, ultimate rights-of-way width required, type of access control to be exercised, and type and location of interchanges and grade separations. Although such definitive plans are most easily prepared along existing locations, seeking to preserve the capacity and life of such locations; surveying, mapping, and electronic computing techniques now available make the preparation of such definitive plans along new locations equally feasible without the need of resorting to expensive and time-consuming field surveys. In Wisconsin such plans can be developed entirely on photogrammetrically compiled topographic maps, the control for which consists of monumented U.S. Public Land Survey corners tied to the State Plane Coordinate system. Such maps and monumented permanent control permit precise and accurate field identification of the proposed facility location as well as land acquisition therefor without the need for traditional and expensive centerline location surveys. Such precise plans are not to be regarded final and inflexible solutions to the intra- and inter-regional transportation problems, but rather as sound points of departure against which any proposed development alternatives can be evaluated. The preparation of such definitive plans would do much to allow local planners to bring the full weight of plan implementation devices at the disposal of the local governments to bear on the reservation and advance acquisition of right-of-way as well as to assist these planners in making intelligent recommendations on desirable land-use and development alternatives. The benefits possible to both the state and local units of government from the preparation and application of such definitive plans are great indeed. Such possible benefits include the following:

(a) Reservation and advance acquisition of necessary right-of-way at undeveloped land prices. In this respect, the full benefit of local plan implementation powers can be realized through the application of the official map and of subdivision control in urbanizing areas to reserve and acquire right-of-way at no cost to the governmental units involved.

(b) Permitting private capital to be intelligently invested in urban development with full knowledge of highway improvements contemplated, thus protecting both the stability of the private investment and the capacity of the proposed highway improvements.

(c) Permitting the development of integrated highway systems through careful stage construction directed toward ultimate objectives.

(d) Assuring the best possible investment of public funds in highway improvements, as well as the protection of this investment from premature obsolescence.

The attainment of the second objective (namely, that of the technical adequacy of the finished plans) requires that local arterial street and highway system plans be the product of a quantitative systems design wherein the major street pattern itself and the capacities of sections and intersections of this pattern are carefully fitted to projected traffic loads. Methods are now available by which this can be done quite readily and, considering the benefits to be derived, quite economically. These methods have been developed through the application of operations research techniques to highway planning studies and are equally applicable to large and small communities. Though a detailed account of the techniques required is beyond the scope of this study, a brief outline of the highway systems design approach required to prepare an adequate plan might be in order. It consists of the following:

(a) Relating trip generation directly to land use. Presently this requires the classical type of origin and destination survey but eventually it may be possible to simplify these surveys greatly or even eliminate the need for such surveys entirely.

(b) Establishing the future land-use patterns. This may be done on the basis of a prepared land-use plan, a land-use projection based on an urban area growth model, or a "planned projection" that would use a growth model to establish ranges within which policy decisions can be made and that indicates not only feasible but also optional choices.

(c) Having established future trip generation factors and future land use, establishing total trip generation for the design year or design area. It is the future land-use pattern that determines the future origins, destinations, and travel linkages and not the existing origin and destination survey data.

(d) Converting trip generation to travel pattern (future desire lines) by a model expressing zonal inter-change. Some models do this by expanding interchange volumes between pairs of zones as found in an origin and destination study and then adjusting for the mutual effects of interchanges among all zones by an iterative process; others synthesize the interchange patterns on the basis of rationally developed but empirically adjusted models.

(e) Developing a planned network of facilities to serve the volumes and location of these projected travel demands, making quantitative assignment of this demand to the proposed network, and adjusting the network if necessary to relate planned capacities to future loads, thereby attaining a workable system.

Because these systems design techniques require experienced staff and access to high-speed computers and computer programs, it is recommended that the State Highway Commission offer, as the major part of its participation in the local plan preparation, to review and analyze the local highway system plan to assure its sound foundation in an engineered systems design.

The attainment of this second objective may also require some review by the State Highway Commission of the engineering feasibility of the plan in respects other than traffic capacity, as well as some assistance in cost analysis.

3. On completion of the local arterial street and highway system plan it should be formally adopted by both the local plan commission and the State Highway Commission as well as by the local common council. It should be formally agreed among the parties involved that on mutual adoption no major changes in the highway system plan or in the land-use plan that supports it are to be made unilaterally by the agencies involved without first resubmitting the proposed changes to the State for a systems analysis. Any major changes in either the land-use or the highway plan could then be intelligently reviewed in light of how the proposed changes might affect both the ultimate highway system and the urban pattern.

4. On mutual formal adoption of local arterial street and highway system plan the existing federal aid systems should be adjusted to the plan in an optimum manner thereby assuring sound plan implementation through state and federally aided highway improvement projects and to limit the state's responsibility in plan implementation.

5. Finally, the planning staff of the State Highway Commission, through the district offices, should then continue to maintain a close liaison with the local government with respect to highway planning matters, offering to extend such assistance and advice on plan implementation as may be requested by the local governments.

CONCLUSIONS

The adoption of the local highway planning procedures recommended herein by the State Highway Commission should result for the first time in the preparation of practical and workable local highway system plans that can be cooperatively adopted and jointly implemented by the various levels and agencies of government. The recommended procedures should, moreover, serve to create a greater awareness of the importance of planning among city engineers, traffic engineers, directors of public works, and highway engineers than has been true in the past, as well as a greater willingness on the part of planners to allow the planning effort to become what it should be—an interdisciplinary team effort. It should, thereby, provide the key to integrating land-use and transportation system planning in the state's rapidly expanding urban areas.