Administrative Requirements for Highway Construction Programing

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Many details of the programing of highway construction projects have been covered including methods of scheduling project construction through the various highway operations. This paper will attempt to summarize from a chief administrator's point of view certain basic administrative requirements for highway construction programing and describe what might be considered desirable responsibilities of the various legislative, policy making and administrative groups in the over-all planning and construction scheduling process. As a point of reference, it should be noted that the thoughts expressed are flavored in terms of the operation of the North Carolina State Highway Department, which has a responsibility for over 70,000 miles of highways. This over-all responsibility includes all of the primary roads, all of the rural secondary roads and approximately 30 percent of the city streets in the State. Within the corporate limits of the municipality, the Highway Department is generally responsible for the construction and maintenance of the major thoroughfares that carry traffic into and through these areas. The city has, however, a financial responsibility in the acquisition of the right-of-way for such thoroughfares.

In attempting to discuss administrative requirements for highway construction planning and programing, it might be desirable to first define what might be considered to be possible areas of responsibility of the various policy making and administrative groups.

THE LEGISLATURE

The adequacy and general level of service provided by the highway commission has a profound effect upon the economy and the development of the State. It is therefore axiomatic that the State legislature should have the ultimate responsibility for the determination of the amount and type of taxation to be levied for the maintenance and construction of highways. It must also determine the scope and magnitude of the highway operation as it relates to the city and county governmental operations. It should exercise control over the annual or biennial budget of the highway department. This control should consist of determining the amount of funds necessary for overhead, for maintenance, and should include appropriation breakdowns for construction of the various highway systems (Interstate, primary, secondary, and urban). The legislature should not become involved in any particular road project and should not develop arbitrary distribution formulas for road construction that make it impossible to provide a uniform level of service for all of the citizens in all areas of the State.

STATE HIGHWAY COMMISSION

The Governor of the State is responsible for the over-all administration of all State departments. The magnitude of the highway operation is such, however, that it is believed fundamental that the Governor should have a policy-making body, commonly known as the State highway commission. For purpose of continuity the highway commission should be appointive with overlapping terms. It should represent the public in all highway matters and have over-all responsibility for all policy-making decisions. Generally it should operate as a part-time body in the same manner that a city council operates as a policy-making body for many municipalities. It is believed that all basic policy determinations should rest with the State highway commission and that there should be a chief administrative officer whose responsibility it is to recommend

policy to the commission and to execute and administer the affairs of the highway department in line with the policies adopted by the commission.

The highway commission should have final responsibility for the adoption and recommendation of budgetary matters to the legislature. Their respnsibility should include the adoption of long-range highway needs studies and they should have final responsibility for the adoption of the short-range highway program. The activities of the commission should include the actual selection of projects to be included in any one year highway program. Once the highway commission has determined in the public interest those highway projects which appear to be most urgent and will provide the greatest benefit to the traveling public, the actual philosophy of the planning, design, and location of the facility should rest with the administration. Finally, the highway commission must have authority for the award of all contracts, the expenditure of funds to the various field divisions for maintenance and other activities. All policy matters and actions by the highway commission should be taken at monthly public meetings and be a matter of public record.

MANAGEMENT

It is believed that the efficient administration of the operations of the highway department can best be carried out by the development of two distinct levels of management which might be considered as staff functions and operational functions. Within this framework of functional responsibility there are three key positions, namely, the chief administrative officer, often referred to as the director of highways; the controller, or business manager of the highway operation; and the chief engineer.

The top level of management is referred to as the staff operation and consists of the chief administrative officer who has over-all responsiblity for the execution of the policies of the highway commission. To aid him in this activity, he should have several staff departments, such as personnel, public relations, central purchasing, legal, a department of secondary roads, (in North Carolina) and a planning department.

In addition, the chief administrative officer should have as his chief aid at the staff level, the controller of the highway department. The controller should be responsible for all financial operations, for developing proper audits and systems for the development of the proper flow and use of money on a business-like basis. The controller should be responsible to the director for making certain that all departments and activities are operating within the appropriate budgets. He should be responsible for reporting all expenditures and for carrying out financial policy matters as adopted by the highway commission.

The chief engineer is the deputy of the chief administrative officer and is in charge of highway operations. It is his responsibility to design, construct, and maintain the highway system. The chief engineer should have direct responsibility and authority over all operating personnel.

ADVANCE PLANNING

The matter of advance planning for highway projects is the key to efficient construction programing. The remainder of this report will concern itself with the organization of the planning operation and how from the administrative point of view the advance planning operation can be used to translate a project from the preliminary approval stage by the highway commission into the actual construction stage.

It is believed fundamental that there should be an advance planning department staffed to the chief administrative officer and that it should not be a part of the engineering or operational phase of the highway department. Those charged with the responsiblity for highway planning of individual projects or for the development of long-range highway plans should operate as a staff administrative unit and have no other responsibilities other than the planning function. In North Carolina, the entire planning operation is staffed to the chief administrative officer or director. The planning department is, however, broken down into two distinct units. One phase of the planning department headed by the State planning engineer is concerned with those studies normally made as required by the highway planning survey and is concerned

with the making of all types of traffic and origin-destination surveys. The other section of the planning department headed by the advance planning engineer has direct responsibility for the advance planning operations. This group reports to the director of highways and to a planning board which will be discussed in detail. The advance planning department is responsible to the director and the highway commission for the following activities:

1. The development of criteria as to the desirable levels of highway service that should be provided on the primary and urban highway systems. (In North Carolina all secondary road planning is handled by the department of secondary roads, staffed to the director, and operates under definite criteria set forth by the State legislature and the highway commission.)
2. Based on adopted levels of highway service as recommended by the advance planning department and as approved by the highway commission, it is responsible for the development of a long-range or 15-year highway plan which sets forth the needs on the various primary and urban systems and delineates the priorities of needed projects. This long-range plan estimates the amount of funds needed to provide the desirable level of service and is the basis by which the highway commission makes recommendations to the legislature as to the amount of funds that are required for highway purposes. The advance planning department is responsible for a continual review and up-dating of the long-range plan.
3. The department is responsible for making recommendations for a yearly construction program to be recommended to the planning board, the director, and finally to the highway commission.
4. When any construction project or group of construction projects have been approved by the highway commission, it is its responsibility to analyze the concept of the project, to call for such basic surveys and information as required and finally to make recommendation as to the specific details of the project as it pertains to a general corridor location and to the type and standards for the proposed facility, including locations and types of grade separation interchanges and other pertinent data that will later be used by the design department. They are responsible for obtaining estimates of costs of various alternate types of proposals that might be considered.
5. It is responsible for working cooperatively with all municipalities in the State in developing thoroughfare plans which are to be the basis for highway improvements in and around the urban area. (The 1959 Legislature of North Carolina, after a comprehensive study by many agencies, adopted legislation indicating that highway improvements in urban areas should not be contemplated until a comprehensive, over-all land development and thoroughfare plan had been adopted by both the city and the State as a basis for future highway improvements.)

ADVANCE PLANNING ORGANIZATION

The advance planning department is headed by the advance planning engineer. He has three staff assistants: (1) a rural transportation planning engineer who is generally responsible for the planning of projects on the rural portions of the primary highway system, (2) an urban transportation planning engineer who is responsible for working with cities and towns in the development of thoroughfare plans and is responsible for the general supervision of the planning of major primary and urban projects in and around the urban areas, and (3) a regional planner who is a qualified planner and is responsible for working with the urban transportation planning engineer in the cooperative development of thoroughfare and land development plans with cities and towns. He is also responsible for providing general planning guidance to both the urban and rural transportation planning engineers in terms of the over-all planning for the State.

These three key staff positions supervise a group of eight to twelve project engineers. The project engineers are assigned specific project proposals for analysis and recommendation. They work on the details of thoroughfare plans and the details of the long-range needs study. The project engineers are assigned specific projects approved by the highway commission and work up the basic concept of the project for submission to the advance planning engineer and finally in a complete report form for submission to the planning board.

The academic disciplines required for the advance planning department at the top level generally would be advanced or master degrees in the transportation engineering area. The regional planner should have an advanced degree in the general field of urban and regional planning. Project engineers for the most part are civil engineering graduates with some having advanced degrees in transportation planning. Other disciplines are also included within the framework of the project engineer operation, and they include planners, statisticians, specialists in land use and geography. In summary the organization of the advance planning department should provide the broadest possible scope in order that any proposed highway project will be analyzed in its broadest terms as to the economic impact that it may have upon the community rather than being analyzed only from the strictly engineering and traffic point of view.

THE PLANNING BOARD

As previously stated, the advance planning department reports to the director of highways and also to the planning board. The advance planning department is a staff department and makes recommendations but does not have final administrative authority on highway projects. The planning board is organized to analyze the recommendations of the advanced planning department and to provide a liaison between planning and design and engineering operations. It is also organized to provide liaison between planning, engineering, and the Bureau of Public Roads. The planning board consists of the director, the State planning engineer, the controller and the public relations officer from the staff departments. From the operation department, it includes the chief engineer and his four assistant chief engineers who are in charge of administrative activities, location, roadway design, and right-of-way activities, bridge location and design activities, and construction and maintenance activities. The Bureau of Public Roads is represented on the planning board by the division engineer, the district engineers and the planning engineer of the Bureau. The planning board meets each Monday morning to analyze the recommendations of the advance planning engineer who serves as secretary to the planning board. Final approval of a project planning report by the planning board normally moves the project from the planning stage to the engineering or design stage. As a means of summarizing the construction programing procedure and illustrating how it works in North Carolina, the following general procedure is followed.

CONSTRUCTION PROGRAMING PROCEDURE

In North Carolina the programing of projects is generally carried out on what might be considered an encumbrance procedure. The first step in the development of projects is the recommendation each year of a selected group of projects to the highway commission by the advance planning department, the planning board, and the director for their consideration. After thorough analysis of all of the high priority projects as shown by the long-range plan, the highway commission will then adopt in a preliminary stage a group of projects which will approximately equal one year's anticipated revenue of major Federal-aid and State matching funds and other State construction funds. These projects are generally approved for construction that will take place perhaps three or four years later.

This approved group of projects is then sent to the advance planning department for their recommendations. At this point the projects will be assigned to various project engineers who may call for certain types of origin-destination studies, aerial mapping or other types of basic traffic and planning data. For a rural type of highway project, such as a new four-lane, divided facility between two urban areas, the advance planning department will generally present to the planning board what is known as a "Stage A" report. This will recommend the type of facility and may set forth several possible corridor locations.

The planning board will then approve or send back for further study the preliminary concept of the project. If approved, perhaps two basic corridor locations may be flown for more detailed topography and sent forth to preliminary design to make an actual location study and to make estimates of costs.

When these studies have been completed, the matter will be referred back to the

advance planning department. The advance planning engineer will then make specific recommendations to the planning board as to the most desirable location and type of a project in a "Stage B" report.

After analysis of the project, the planning board will then generally adopt the project and if it appears that the project is going to cost a great deal more than was anticipated or if the concept of the project differs from the initial approval by the highway commission, or if there are questionable points about the project, the planning board may then refer the project to the State highway commission for their analysis with a request that they determine whether this project should be modified or approved for public hearing.

After approval or modification by the highway commission as to the general concept of the project, preliminary plans are prepared to the point that a public hearing may be held on the matter.

After the public hearing has been held and the results of the public hearing transcribed for the planning board and for the highway commission, the planning board and the advance planning department analyze the results of the public hearing. At this point the planning board will normally make final recommendations to the highway commission as to whether the project should go ahead as originally proposed or whether there are possible modifications as to the type or general concept of the project. Final decision will be made at this point by the highway commission to go ahead with the actual design and construction of the project. For routine, non-controversial projects, the highway commission may not be involved in the actual approval at the preliminary planning stage or public hearing stage. However, all major projects are referred back for final approval to the highway commission after planning board approval and after the public hearing.

After the public hearing and final approval by the planning board and/or highway commission, the project moves from the planning phase to the chief engineer's operation, who schedules the details of the design and right-of-way acquisition in the light of work loads existing in various areas of the State and in terms of the over-all master schedule for project design and lettings.

SUMMARY

In summary, it may appear that a construction project goes through many advanced planning stages in the North Carolina operations. It is believed, however, that the rather complete and detailed analysis made of the project by the advance planning department and the top level staff on the planning board will, in the long run, provide a highway facility that has been considered from all angles and will provide the best traffic and land use service to the public at the lowest cost.

The planning board, made up of all disciplines, has the opportunity to work with a given project through all of the planning stages. With the Bureau of Public Roads as a part of the planning board, practically all of the major problems are worked out initially before the project gets into the design stage. In this manner good liaison is maintained between the State and the Federal Government and each agency has had a hand in the development of the project. Thus, with this type of operation, major conflicts which often occur in the last stages of design are eliminated by a thorough initial analysis of the project in the planning stage.

It has been North Carolina's experience that the best approach to construction planning and programing is through the operation of a well-qualified advance planning department which has a thorough understanding of the needs of the State and has no other function other than the continuous analysis of long-range and short-range needs. And finally, through the medium of a planning board, the desirable liaison and coordination can be maintained between the planning function, the engineering function, and the responsibility of the Bureau of Public Roads in both areas.

Discussion

Wiley.—North Carolina is really courageous to put out a program like this for so many years ahead. I can see why the general public would receive something like this with a great deal of enthusiasm. And if the program can actually be followed, I think that enthusiasm will continue.

I would be a little fearful that the farther away in time you get from it, the more changes you will find may have to be made. But did I understand you to say that you have a program of actual priorities for the first few years?

Babcock.—Yes.

Wiley.—This program extends over a 15-year period?

Babcock.—That is right.

Wiley.—Is this an attempt to pick up projects which you estimate will become deficient during the period?

Babcock.—No, not really. I do not know how many of the rest of you have had the same experience, but we have had a situation for 15 years where you had a certain gas tax and a certain motor-vehicle tax, and a certain—automatic—diversion to the prison department. The whole process of budgeting consisted of making a general estimate of what the taxes would yield, then setting aside enough to support motor vehicles, prisons, and everything else, and giving whatever was left over to the highway department to use about as they saw fit. We think the levels of service that we have defined are reasonable and rational for North Carolina. And our whole point in doing this was to find out whether we had sufficient funds to do what we felt should be done.

If the legislature does not see fit to revise or revamp present tax laws to permit this level of service, it is our feeling that we should drop this level of service. In other words, if there is not going to be enough construction money, we would recommend to the commission that they do not consider paving any secondary roads with a traffic volume of less than a hundred vehicles a day, as contrasted with maybe 50.

In effect, we are saying, "If it doesn't look like it is possible to meet these needs that we have outlined, we are going to have to give up the widening of 18-ft rural collectors and put all emphasis on trunk system." This really is the purpose of this report.

Winfrey.—Babcock mentioned the fact that if the commission decides to improve the road from A to B, then that assignment goes to advance planning to work out the general level and the type of facilities and all that. How did it get to the commission in the first place?

Babcock.—It got to the commission in accordance with our priority list.

Winfrey.—Who presents it to the commission?

Babcock.—I do. With the city manager-city council form of operation, my job is to be the liaison.

Titus.—When the project then goes to the chief engineer, what leeway does he have to make changes in standards, design, etc.?

Babcock.—If he runs into a problem or his design engineers run into a problem that indicates that the planning board has not given the right answer, it comes back to the planning board. For example, last week the question of improving a mile or so of two-lane road that has to be four lanes coming into Raleigh originally went from the planning board as a four-lane facility for which we were attempting to get full control of access. That came to $3.5 million. Without full control of access, the project came to about $1.2 million. We held out for full control of access, but lost. We wanted a permanent median and got most of it, but it will come back if engineering determines that a major revision should be made in the concept because it is uneconomical.

Livingston.—Since the planning chief lost the argument for the $3.5 million job in favor of the $1.2 million project, will the redesigned project be adequate to supply the demand?

Babcock.—That is a matter of opinion. No, the problem in this case is that the highway leads into Raleigh, and it can be taken to six lanes, but you will never get control of access, because the area is all industry. We thought we would try to hold it to as tight a line as we possibly could and then by 1980 maybe we would realize that we ought to come in with a new facility that could be tied in with a revamped thoroughfare plan for Raleigh.

Granum.—Mr. Babcock, suppose that your studies should indicate the desirability of bringing your primary system up to date in ten years, rather than 15. Do you have some alternative figures that can be supplied as to what it would cost on an annual basis?

Babcock.—Our plan was based on roughly a 15-year projection of population growth and our 15-year projection of traffic volumes, and the level of service we thought should be provided in this period. If we try to do the job in ten years, we would be providing a higher level of service than was indicated.

Granum.—What is your design standard year? Is it 20 years after the date of construction that you are planning for as a design standard? Or is it current traffic or 15-year-hence traffic?

Babcock.—What we are designing for is a projection which is roughly 15 years ahead. For example, what we show as top priority projects today are those sections of highway that in the period 1960-1965 will have inadequate capacity. The next group will probably be satisfactory for the first five years but will start to break down between 1965 and 1970. The next group will break down between 1970 and 1975.

North Carolina is a rather large state, but rural, with not too high traffic volumes except in a few areas like Charlotte and Winston-Salem. When we shift from two lanes to four lanes, we are going to have built-in capacity that will last for a long time. That is why we are trying to wake people up to the fact that we now need four lanes on a third of the primary system.

Granum.—Then your design standard is based on the projected 20-year-hence traffic from date of construction, at least on the primary system. Is that right?

Babcock.—That is right. You mean projects in advance planning that we are designing now would be designed and go through advance planning based upon a 20-year future projection of volume.

Granum.—What is the design basis on which these costs are based? Is it for 20 years after the date of construction, or estimated date of construction?

Babcock.—It would be for 15 or 20 years.

R. Johnson.—Your standard of service really governs an adjusted design standard for the particular system that you have chosen?

Babcock.—Yes. That is the basic philosophy that we are trying to promulgate here. You do not design a rural collector road serving two communities of 500 people with a volume today of a thousand vehicles a day, to the same standard as that for the truck system. Most of the people on the collector road are traveling about five miles and going 35 miles an hour, with an occasional person who wants to go in a hurry. We are setting three distinct design standards for our systems to determine our needs.

Kimley.—It might be stated that the standards were approved by the commission.

Babcock.—That is right. First, the systems were approved, then the level of service, and then we find out how much these levels of service will cost. And this is what we came up with.

West.—You have made an estimate of the cost of this. How did you arrive at your construction and right-of-way figures for 1970, for instance?

Babcock.—We could not, very easily. The best we could do is make our best estimates of cost and right-of-way figures, and then just continue with a rough percentage increase based upon present trends.

In other words, we say in here that this estimate anticipates a moderate increase, but any major inflationary tendency would change it. If traffic, for instance does not increase, or population does not increase, the amount of money coming in would drop off proportionately. Also, we are going back to the legislature in March and try to do what nobody has done yet—to pull out of thin air the small-car effect on revenue and how much more we will need because of it. I do not know how we are going to handle that.

Titus.—Within any one system, do you apply the desired operating speed uniformly, without regard to terrain or traffic volume?

Babcock.—Generally, we will accept a slightly lower operational condition in the mountains. But in the Piedmont and the flat country, no. We will design it all pretty much the same. We drop it on our secondaries very definitely, and on our rural collectors. But on our trunk system we design for just about the same operating speed as the Interstate standard.

Titus.—Are your primary and secondary systems defined by law?

Babcock.—Is there a stipulated mileage for the primary system and a secondary system? No. The highway commission could decide to number a thousand miles of road tomorrow morning, and they would be on the primary system. Or take the numbers off and they would be on the secondary system.

Titus.—West Virginia has a primary and secondary system without setting mileage, but reserving monies for those systems.

Babcock.—We recommend to the legislature amounts for State construction. We have three appropriation accounts: State maintenance and construction primary, State maintenance and construction secondary, and State maintenance and construction urban. And these are definitely earmarked by the legislature for use on the designated system.

Titus.—The standards are set up by administrative decree for each system?

Babcock.—No, they are not set up by administrative decree. Nothing is. They are set by Commission policy.

Titus.—But not by law?

Babcock.—That is right. Let us say we get $50 million to put on the secondary roads. The secondary road needs are $624 million. Mitchell County has a need of $5,329,000. That is the percentage it gets.

In other words, it is a straight needs percentage for each county. One county down east gets $10,000 a year to improve its secondary roads. Another gets $2.5 million.

Hall.—As I understand it, you are making a distinction between levels of service and geometric design standards. You relate them, but there is a distinction in your mind.

Babcock.—Let me answer that this way. If a road is on the rural collector or a less important system, we consider it satisfactory if a man can maintain an operating speed of 30 to 35 or 40 miles per hour, so that road might not ever get a high priority, because it would never even approach the necessary capacity-volume relationship.

Paterson.—You have a deficiency of $505 million over the 15-year period. And I was just wondering how you are going to handle that? By cutting out projects? Or bond financing?

Babcock.—I will tell you what we have recommended: Get about half the prisoners off our back and take care of them out of the general fund, instead of the highway fund. Raise the automobile fees from an average of something like $11 to an average of about $15. Take one-quarter cent of the gas tax, which goes to the general fund, supposedly to defray gas station inspection fees, and put that money in the highway fund. Raise the gas tax one-quarter of a cent. That will pay for the road program.

Granum.—Does the program contemplate replacement of pavements over the future period as part of the maintenance picture, or the construction picture?

Babcock.—Yes and no. Actually, where there are temporary pavements which we think are going to need up to 3 inches of asphaltic concrete or something of that order, they are included in the construction. But we have a tremendous maintenance organization. We have a thousand or eleven or fifteen hundred people in road oil alone, so if the improvement required is just a matter of surface treatment or minor bituminous concrete construction, just an inch or 200 pounds, it is under maintenance.