AN INVESTIGATION OF THE ALLOCATION OF STATE HIGHWAY CONSTRUCTION EXPENDITURES IN TEN STATES AND RECOMMENDATIONS OF A SYSTEM OF FINANCIAL PLANNING AND CONTROL FOR SUCH EXPENDITURES

By

John L. McKeever

AN ABSTRACT OF A THESIS

Submitted to

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ABSTRACT

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Objectives of the Study

State highway department officials are striving to overcome serious road deficiencies that exist at present in the various state highway systems—interstate, primary, secondary, and urban extensions. It is a major thesis of this study that currently utilized management procedures will not enable many state highway departments to accomplish their construction objectives.

The dissertation has dual objectives:

1. To study, evaluate, and analyze current management practices and problems in the planning and control of construction expenditures in ten state highway departments in the western region of the United States.

2. To develop a system of recommended procedures for financial planning and control of construction expenditures that will provide for optimum utilization of taxpayers' funds.

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The objectives are primarily concerned with construction expenditures for several reasons. First, the bulk of highway funds are expended on construction projects. Second, the planning and control of construction expenditures represent a major and somewhat neglected area of highway finance.

The Major Features of the Proposed System of Financial Planning and Control of Construction Expenditures

The study revealed that officials in eight of the ten survey states were allocating a substantial portion of their construction funds on the basis of personal judgment and political expediency. If consistently followed, such practices will result in a failure to accomplish long-run and short-run organizational objectives.

To eliminate the subjective element in allocating scarce construction funds, the following features of a proposed system of financial planning and control are discussed in detail as a means to achieving state highway objectives:

1. The elimination of the current practice of distributing construction funds by commissioner, or other, districts.

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This distribution by areas has no relevance to actual construction needs as they exist throughout the state.

2. The installation and use of a priority listing system based on a sufficiency rating procedure whereby road sections are rated, or graded, on the basis of established standards and designs for the various highway systems (interstate, primary, secondary, etc.). Use of this system for construction fund placement will inject a high degree of objectiveness into the scheduling of construction projects.

3. The preparation and dissemination of an annual report to the public based on construction activities at the end of the current year in overcoming highway deficiencies and enumerating the construction projects to be undertaken in the coming year. The report is to be based on sufficiency ratings and budgeted and actual construction data to permit public evaluation of highway management in fulfilling their responsibilities.

4. The enactment of state legislation to enforce the use of the aforementioned procedures.

5. The use of various long-range techniques in planning and controlling construction expenditures.

6. The elimination of certain rigidities now existing in the organizational structures of many of the ten survey states.

Although not directly concerned with state highway construction fund allocation, the survey revealed a lack of coordination and cooperation between state and county officials in planning a rural state highway system. The means to acquire

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an integration of the two systems into a coordinated whole are discussed in detail.

Techniques Utilized in Achieving the Objective of the Study

In addition to available literature in the field, a survey was conducted in ten states in the western region of the United States. Officials were personally interviewed in the highway departments of Arizona, Colorado, Idaho, Kansas, Montana, Nebraska, New Mexico, South Dakota, Utah, and Wyoming.

The survey served several purposes necessary to the development of the study: (1) It determined the actual procedures being utilized by highway officials in allocating scarce construction funds. (2) It revealed the use, or lack thereof, of the sufficiency rating procedure as a basis for scheduling construction projects in the annual budget. (3) It developed other areas of inadequate financial planning and control that were not anticipated in the preliminary stages of the study.

Although the survey does not fulfill the requirements of statistical sampling procedure, it does represent an intensified study of the ten state highway departments mentioned previously.

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Findings of the Study

The survey revealed that little cooperation and coordination existed between county and state highway officials in planning and integrating the rural highways of the states. Large sums of highway user revenue were prorated to county officials with little or no control exercised over its use.

In allocating construction funds within the state highway systems, highway commissioners initially prorated the funds among their represented districts by unrealistic formulas or by concession and argument among themselves. Both methods gave very little consideration to construction needs as they existed throughout the states.

Highway commissioners, or other highway officials, often scheduled annual construction projects on the basis of personal judgment or submitted to the pressures of vested-interest groups to construct roads in specific localities. Such practices in allocating construction funds generally did not provide for the optimum use of construction monies and would not result in accomplishing highway construction objectives—the construction of the most efficient state highway system in the most economical manner.

Highway officials made little use of construction priority lists based on sufficiency rating procedures even though such lists were made available. The sufficiency rating procedure represents a system of determining construction priorities based on the needs of the highway sections competing for the funds. Sufficiency rating methodology as a basis for allocating scarce construction monies tends to reduce the subjective element in the decision-making process to a minimum where a choice of construction alternatives exists.

Highway officials planned on a short-run basis only. Very seldom were long-range objectives and plans established and followed. Inadequate reports for public dissemination were being prepared by highway officials. These reports did not provide the necessary information for public evaluation of highway management performance. Certain weaknesses and rigidities were found to exist in the organization of highway departments that exerted a detrimental effect on sound construction expenditure planning and control.

Recommendations

To achieve greater cooperation in integrating the planning and control of rural highways, it is recommended that state highway officials be delegated the authority to plan and control the

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use of funds designated for county highway use. This procedure would require legislative action by the state and the counties.

In allocating funds for construction of state highway systems, it is necessary that the initial distribution by districts, commissioner or otherwise, be discontinued. This proration of funds has absolutely no relationship to construction needs throughout the state.

As a basis for allocating scarce construction funds, it is recommended that priority lists based on the sufficiency rating procedure be used. Only by complete adherence to such a system will optimum use of the taxpayer's funds be assured and highway construction objectives achieved. The elimination of commissioner districts and the use of the sufficiency rating procedure must be enforced by state legislation to prevent circumvention by highway managers.

It is recommended that highway management extend its planning period to cover at least a twenty-year program. Several long-range planning techniques as they apply to construction expenditures are recommended.

It is also recommended that more complete and timely progress reports on state road construction and finances be made, and

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the type of information to be included in the report is suggested. Recommendations are made pertinent to changes in the highway department organization to provide for greater flexibility in the performance of the highway functions.

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PREFACE

Highway departments are big business today, with total annual expenditures in the billions of dollars for the fifty state organizations. Approximately 690,000 miles of the major highways in the United States are under the jurisdictional control of the state highway departments. At present, a substantial portion of this mileage is below standards conducive to safe and efficient travel.[1] State highway managers are endeavoring to overcome this construction lag which, incidentally, has been with us since the turn of the century.

It is with the construction lag and the manner in which highway officials are planning and controlling the expenditure of construction funds that this paper is concerned. The study evaluates current practices of highway officials in allocating and spending scarce construction funds and makes recommendations relevant to the use of better planning and control procedures in the utilization of the taxpayers' funds.

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[1] For further discussion of the inadequacy of present state highway systems, see infra, page 10, footnote 2.

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Several persons have contributed to the development of the subject matter of this dissertation. To Dr. O. D. Turner, who made the author aware of the problem of financial planning and control in highway departments, a special debt of gratitude is owed. Appreciation is extended to Mr. Robert Livingston of the Colorado State Highway Department for providing the author with the necessary insight into the specific construction problems which gave direction to the study. To all of the state highway officials who so graciously gave their time during the survey, sincere appreciation is offered for their cooperation.

The author is deeply indebted to Professors Lemke, Mead, and Simonds for their valuable guidance and suggestions. Prior to his departure for Brazil, Professor Grunewald made many valuable contributions for which the author is grateful. To Mr. Timon Walther, appreciation is extended for the advice so generously offered.

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CHAPTER I

INTRODUCTION

In the present-day United States there exists the greatest network of highways ever to be constructed on the face of the earth. No other country possesses, or has possessed, a highway system comparable to that now available to the road user—pleasure or commercial—in the continental United States; yet a great portion of the highway system at present is obsolete in terms of current and future traffic needs. A vast construction program is now underway to alleviate this condition. New roads are being constructed and old roads are being improved to bring the highway system up to the standards and design adequate for current demands and projected traffic needs of the years 1970–1975.

When President Eisenhower affixed his signature to the Federal-Aid Highway Act of 1956, a construction program was undertaken which called for an expenditure of approximately 101 billion dollars over a thirteen-year period. It is this construction program with its unprecedented expenditures which

brings about the need for an evaluation of current practices of financial planning and control now being utilized by state highway departments.[1] This increase in highway activity came about over a span of a few years and gave the highway departments little or no time to set up the planning and control procedures necessary to handle the sudden expansion of revenues and expenditures. However, at present there should be no reason for the lack of proper procedures, since sufficient time has elapsed for state highway administrators to become cognizant of the problem.

The Objective of the Study

Much has been written, from both biased and unbiased viewpoints, relevant to the methods of financing the highway construction and improvement program called for in the Federal-Aid Highway Act of 1956. Most of the discussions of this nature have revolved around various principles and theories of taxation—the revenue side of the picture. These arguments have succeeded in relegating an equally important problem—that of planning and

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[1] For further evaluation of current financial practices in ten state highway departments, see infra, Chapters V, VI, and VII on short-run financial procedures, and Chapter VIII pertinent to long-range financial practices.

controlling expenditures—to a position of secondary consideration. The revenue problem represents only one aspect of the total financial picture. The expenditure phases of the program determine largely the effectiveness of the nation's highway departments in constructing and maintaining an adequate system of roadways. There seems to be, therefore, cogent reason for inquiring into the practices of state highway departments relative to the allocation and expenditure of revenues.

It is a well-recognized principle in the industrial segment of our economic society that wisely, carefully planned spending can result in savings. The process by which spending results in savings is known as financial planning and control, and it comes about by careful consideration of dollar placement where there is a choice among alternatives for the expenditure. It is this choice among alternatives that creates the problems of financial planning and control. The problem is accentuated in state highway departments because of the extensive road system to be constructed, improved, and maintained; the political environment within which the highway organization must operate; and the highly specialized nature of the highway organization itself.

It is a major objective of this dissertation to study, evaluate, and analyze current practices and problems pertinent to the

planning and control of construction expenditures in ten state highway departments in the western region of the United States.[1] From the knowledge gained of the systems, procedures, and philosophies practiced by managers of these highway organizations, it was possible to accomplish the second major objective of the dissertation—the development of a recommended system of planning and controlling construction expenditures in state highway departments. The latter objective is not based solely upon the information gained from highway officials in the aforementioned ten states, but also relies upon information contained in current readings and analysis of planning and control procedures existing in state highway departments in general.[2]

The two objectives are primarily concerned with construction expenditures for several reasons: (1) The greatest problems of planning and control exist in this area of highway finance.

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[1]The ten states surveyed by the author during August and September, 1960, were Arizona, Colorado, Idaho, Kansas, Montana, Nebraska, New Mexico, South Dakota, Utah, and Wyoming. For further discussion of the survey states, see infra, Chapter X, pages 358–59.

[2]Due to the paucity of current literature in several areas of financial planning and control in highway departments, the second objective was accomplished primarily from data accumulated in the survey.

(2) The bulk of highway funds are expended on the construction or reconstruction of state highways. (3) This phase of highway activity offers the highway official the greatest opportunity to accomplish one of the major organizational objectives—constructing highways designed for maximum utility at a minimum cost.

The objectives are directed toward financial planning and control of construction expenditures in the state highway departments. However, a situation developed out of the survey pertinent to the division of authority and responsibility between the state highway departments and their counterparts in the counties. From interviews with state highway officials it seemed that problems of cooperation and coordination existed between the two administrative units. Since there is a need for an integration of the planning function between the two road authorities, the problem and the proposed recommendations are made a part of the objectives of the dissertation.

The aforementioned objectives are considered in the light of the aims and goals of the state highway organization. From the study, evaluation, and analysis of current practices of highway management in planning and controlling construction expenditures, it can be determined whether highway officials are achieving organizational objectives. From the tools, techniques, and methods

available, an over-all system of financial planning and control of construction expenditures which will result in a more efficient accomplishment of construction objectives can be devised. The proposed method can provide for long- and short-range planning giving consideration to all the limiting factors of funds, personnel, equipment, and facilities.

It is recognized that changes in statutory provisions may be necessary before the recommended methods and procedures for the planning and control of expenditures can be fully implemented in such a manner as to assure the attainment of the desired objectives. Such legislation should be so designed as to provide a definite, clear-cut, positive guide to actions of state highway officials in the planning, allocation, and control of expenditures for highway construction.

In order to gain the permission of the highway authorities to personally interview highway personnel during the survey of the ten states, the author promised anonymity to both individuals and to state highway departments. Under this condition, the writer was able to acquire information that would never have been put in writing had a mail questionnaire been used to accumulate data of such a personal nature. Therefore, throughout the dissertation the anonymity of the respondents has been respected. Referrals

will not be made to a particular state highway department except in those instances where the author received permission to quote the highway personnel involved.

Throughout the survey, the writer found that career executives of state highway departments were willing to discuss their opinions of the deficiencies that existed in their respective organizations. In most instances, their dissatisfactions were primarily directed toward established policies—or lack thereof—of planning construction expenditures. Their complaints and criticisms were generally directed toward the failure to achieve highway objectives rather than failure to attain personal objectives and goals.

Interdisciplinary Aspects of the Dissertation

Although this study is intended to be a discourse on the principles of accounting theory and practice as applied to the very narrow area of financial administration in state highway departments, its accounting implications must be interpreted in the broadest meaning of the term. One student of accounting set forth the broad aspects of the discipline as follows:

> The content, objectives, and procedures of accounting may be considered from at least two standpoints. The first of these is the view that accounting serves to record,

classify, and present the financial effects of business transactions for an enterprise, to measure income and other financial results for the information of those persons interested in the fortunes and progress of the firm as an institution—especially creditors, investors, and the general public. . . .

The other view—with which we are here concerned—is that accounting data and procedures are intimately connected with the processes of operation and management of the business enterprise; that accounting is a part of management. The accounting system—that integrated set of activities related to the books and records of the institution—deals with a large mass of detail which has considerable relevance to the actual handling and carrying on of operations from day to day, and the way in which things are done (in terms of standard operating procedures) is an inseparable part of both the process of management and the process of accounting. . . .

From this angle, the major function of accounting is to serve managerial needs and to facilitate the attainment of managerial objectives. Managerial accounting is concerned with systematic collection of facts about the detailed operations within the enterprise; it involves the procedures related to internal control; the minimization of errors, fraud, and waste in carrying on the operations; the preparation and administration of budgets; the interpretation of cost and revenue data in terms of organizational units of responsibility and with respect to different problems of managerial decision; and the orderly handling of details in operation from the standpoint of systematic standard procedures.[1]

More specifically, the study is concerned with the application of a system of budgeting to construction expenditures in a state highway department.[2] The value of budgeting, which is

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[1]William J. Vatter, Managerial Accounting (New York: Prentice-Hall, Inc., 1950), pp. 97–98.

[2]See infra, Chapter VII, page 239.

referred to as "accounting in the future,"[1] is predicated on two extremely important factors. The first is procedural, or the manner in which the budget is prepared. Basically, the theory and procedure which enter into the construction of the budget provide the foundational utility for its subsequent use—the second factor. Well-designed and carefully prepared budgets would seem to be of little value if proper use is not made of them.

The two concepts—procedure and use—cannot be separated according to the disciplines which are concerned with their use. The reason for this is obvious. While many reports are based on historical accounting data, the budget is a forward-looking process that is concerned with the future. However, it also has value as a tool for evaluation of past performance which is historical in nature. In the use of the budget as an instrument in planning for the future, the forecasting of highway revenues and expenditures in budget preparation is based, at least, upon the principles of accounting and engineering,[2] and, since it is

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[1] Adolph Matz, Othel J. Curry, and George W. Frank, Cost Accounting (Chicago: South-Western Publishing Company, 1952), p. 432.

[2] The sufficiency rating procedure which serves as the basis for determining priority allocation of construction funds as recommended in this dissertation is based on established engineering standards and designs for highways. These engineering standards are described in Chapter VI, page 180.

concerned with the future, it would also seem to involve the planning and control functions of management encompassing the decision-making process where a choice of alternatives is necessary, and a control procedure in evaluating managerial performance. Therefore, it must by necessity combine at least three so-called disciplines—engineering, management, and accounting—in analyzing the financial planning and control practices in highway departments. One student states that accounting is a part and parcel of management:

> . . . nor is accounting, although a service function, at the elbow of management in the role of servitor. The role is rather that of alter ego. Through the processes and techniques of accounting properly applied, management is not merely informed. Its thinking is provided with standards of reference, vehicles of judgment, and forms in which to express these judgments and to effect changes. The accountant is an integral part of the personality of management.[1]

Importance of the Study

The road systems in many states are below standard and are inadequate for present and future traffic requirements.[2] Many

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[1]Chester F. Lay, "The Functional Cycles of Accounting and Management," Readings in Cost Accounting, Budgeting, and Control, ed. William E. Thomas, Jr. (Chicago: South-Western Publishing Company, 1955), p. 37.

[2]The inadequate condition of the highway systems became apparent from interviews with highway officials in the ten survey

highways are carrying traffic volumes far beyond their capacity and structural standards; yet states are faced with a shortage of funds necessary to bring their systems up to required standards over a reasonable span of time. Construction needs are great while construction funds are limited. Therefore, it is imperative that a system be utilized that will provide the greatest possible efficiency in allocating construction funds among highways having the greatest need. Inadequate methods of planning and controlling the use of construction funds will result in an expensive and unnecessary prolongation of the achievement of organization objectives as they relate to the construction function. It is only through good planning and control of construction expenditures that the state highway departments will achieve their desired objectives.

The fact that many state road systems are in an inadequate condition has led to the idea—seemingly prevalent in many state highway departments—that it does not matter where dollars are spent on improvements; the resulting improvement is beneficial. As a result of such thinking, proper attention may not be accorded

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states. For a more complete discussion of the topic of the inadequacy of state highway systems, see A Ten-Year National Highway Program, A Report Prepared by the President's Advisory Committee on a National Highway Program (Washington: U.S. Government Printing Office, 1955), p. 1.

to the matter of priority in the expenditure of funds. It is a fundamental thesis of this dissertation that each dollar expended for highway construction should provide optimal benefit and service to the highway user. Thus, any method of planning and control should incorporate a system for determining—in the light of all existing conditions, variables, and circumstances—a priority of construction based on needs. A major facet of the method of planning and control of highway department construction expenditures developed in this dissertation is the determination of priorities.[1]

Another factor in support of a system of priority determination in allocating construction funds is the problem of highway safety. Many of the present roads were constructed to traffic standards existing one to three decades ago and no longer suffice for current or future needs. Motor vehicles are designed for high-speed travel; therefore, the allocation of construction funds should give consideration to the problem of removing safety hazards from highways.

Huge sums of money are being funneled through highway departments for road construction and other highway functions.

[1]The basis for priority determination is sufficiency ratings; see infra, Chapter VI.

From the viewpoint of revenue and expenditure, the state highway department is often one of the largest organizations in the state, including private industrial firms and other state, federal, and municipal governmental agencies or units. State highway officials have an important responsibility to the citizenry of their states to provide the best highways possible and to do so with a maximum of efficiency and a minimum of cost. To do otherwise would be an emasculation of the authority and responsibility delegated to them by the people of the state.

Plan of the Dissertation

An underlying hypothesis of this study is that state highway departments should strive to make the best possible use of available resources through the institution and utilization of the most effective system of financial planning and control possible. It is the objective of the dissertation to examine the tools, techniques, and methods of planning and control of construction expenditures and, from them, develop a system which will provide an adequate highway plant for the road user.

A feature of the plan of the dissertation should be brought to the attention of the reader. It was stated previously that the dissertation had two major objectives: (1) to study, evaluate, and

analyze current practices and problems of planning and control of construction expenditures in ten state highway departments, and (2) to make recommendations that would provide a better system of planning and control of construction expenditures. Accomplishment of the aforementioned objectives necessitates: (1) a description of current financial planning and control procedures existing in the ten survey states, (2) an analysis of the practices, and (3) a series of recommendations to correct inefficiencies in planning and control procedures. In presenting these three latter factors, description and recommendation have been blended together throughout the dissertation, while the critical analysis of the survey findings has been segregated and treated separately in Chapter IX. Descriptions and recommendations are based on cause and effect as substantiated by observation and inspection. This is not to intimate that the critical analysis is postulated on emotion and/or bias.

In order that the reader may more fully comprehend the broad and specific aspects of modern highway administration, Chapters II and III are devoted to (1) a brief history of the development of the highway systems, (2) the systems of road classification existing in the United States today, and (3) a brief discussion of the organizational structures of those political units

concerned with highways. In Chapter IV, information relevant to past and present sources of funds and highway expenditures for the federal, state, and local governmental units is discussed. Also, a brief inquiry into the theory and problems of highway taxation is made in Chapter IV.

In Chapters V, VI, and VII, the short-run aspects of budgetary planning and control of construction expenditures are discussed. Chapter V is concerned with distribution of the highway funds among the counties, cities, and state, and the need for greater planning and control in this allocation. Also in Chapter V, the problems of allocating the state's portion of the highway fund over the budgeted activities of maintenance, administration, other services, and construction are discussed.

Chapter VI is devoted to a discussion of the sufficiency rating procedure as the basis for allocating scarce construction funds over the highway systems by priority listings. In Chapter VII, an application of the priority listing process as determined by sufficiency ratings is made to a realistic budgetary situation for construction funds, the purpose being to bring together the parts into a whole system of planning and control.

In Chapter VIII, the long-run aspects of planning and control of construction expenditures are enumerated and discussed.

The tools and techniques which are necessary to expenditure planning and control are set forth in some detail. Chapter IX is devoted to a discussion of three important aspects of highway financial administration: First, the need for state legislation to enforce the use of the recommended procedures of financial planning and control is considered. Second, certain features of the highway organization as they relate to financial administration are discussed. Third, a discussion of the need for proper and adequate reporting to the public is undertaken. A necessary part of any financial system is accurate and timely reporting to those who use and finance the system, or organization.

In Chapter X, the objectives, plan, and findings of the survey are discussed. In addition, the statistical limitations of the survey are set forth. Chapter XI is devoted to a critical analysis of highway practices of financial planning and control as determined by the findings of the survey. In Chapter XII, a brief review of the study and recommendations is presented and conclusions are made.

CHAPTER II

THE HISTORY OF AMERICAN HIGHWAYS

Throughout history, man has been motivated by complex urges or drives to fulfill certain needs and desires. Frequently, the satisfaction of these needs has taken him over the highways of the world.[1] Often he has been in quest of the riches to be acquired by opening channels of trade between cities, countries, or continents. He has sometimes sought to expand his circle of power and influence by marching armies over the highway to subjugate his neighbor or the world. The highway provided him the means of escape from religious, racial, political, and economic intolerance. He found in the highway an excellent instrument for the fulfillment of his gregariousness, curiosity, knowledge, and a host of other human needs and desires.

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[1]The terms "highway" and "road" are used synonymously. They represent a means by which the general public can traverse the distance between two geographical points. In our present system of highways, trails of a very primitive nature are still in use and are open to public travel by motor vehicle or other forms of locomotion.

Governments also found use for the highway. It was an important device to provide the cohesiveness necessary to bind the separate political units into a united whole to give it strength, protection, vigor, and flexibility. Whether for good or bad, the highway served the means for the state to expand its borders and to meet various national emergencies. It was instrumental in the development of a nation's economic, social, and cultural levels.

John Brew sums up the effect of the highway on our culture as follows:

> The diffusion of ideas as well as food and raw or fabricated articles was a function of the Road. Social and political systems, philosophies and religions, sorcery, alchemy and scientific knowledge all were passed from man to man, from place to place, along the Road. Impulses for change were ever coursing up and down its length.
>
> Culture knows no status quo; those conservatives who desire it pursue an illusion which is, in fact, a cultural paradox. The concept exists in almost all cultures, yet the realization is impossible in any. The very nature of human culture precludes its establishment. The Road itself is perhaps its greatest enemy. Hence one of the first acts of its exponents during the intermittent periods when they rise to full power is to close the Road, and we have forbidden cities, iron curtains, and other choices to block the flow of new ideas and revolution. Historical evidence clearly demonstrates that the closing of the Road can do no more than retard the rate of changes. Yet so obvious is the threat of the Road to the status quo that the high priests of the cult are forever trying to choke it off. . . .[1]

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[1]John O. Brew, "The Highway and the Anthropologist," Highways in Our National Life, ed. Jean Labatut and Wheaton J. Lane (Princeton, N.J.: Princeton University Press, 1950), pp. 4–5.

Early History of Roads in the United States

When the early settlers of the New World set foot on the shores of the North American continent, they found only animal trails and Indian footpaths cutting through the vast forest covering the coastal regions of the Atlantic Seaboard. The early settlements were made along the coastal areas or on navigable rivers or bays. Travel from home to home or from settlement to settlement was conducted on foot, horseback, or by boat.

As the coastal areas continued to increase in population, old trails were expanded to provide for better travel between trade centers. One of these was the Boston Post Road connecting the settlements in New England with New York. "The region traversed by this road was a dense wilderness penetrated by wild animal and Indian trails for more than half a century following the first permanent settlement at New Amsterdam by the Dutch, in 1613, and the landing of the Pilgrim fathers at Plymouth, Massachusetts, in 1620. . . ."[1] One hundred and ten years after the first permanent settlement, post riders were carrying mail over

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[1]American Association of State Highway Officials, "1673–First Colonial Post Rider," Public Roads of the Past (Washington: American Association of State Highway Officials, 1953), p. 24.

the improved Boston Post Road covering a 600-mile route between Boston and Williamsburg, Virginia.[1]

Many of the colonial roads were long and winding as a result of following Indian or animal trails, or from being laid out in such manner as to permit farms to remain intact. Their condition and maintenance is described by Lane as follows:

> Little grading was done and the traveler often found his horse or vehicle mired fast. Washouts occurred after every heavy rain. Surveyors attempted to make some swamps passable by hauling a few loads of stone or by laying a number of logs crosswise to form a corduroy pavement. Implements for repairing roads were mainly those used by hand.[2]

Eventually all the land in proximity to the coastal areas was settled and new migrants were forced to move inland. To maintain contact with the more heavily populated areas along the coast, new trails were cut through the wilderness. Two of these roads were to become important trade and migratory routes.

The first to be developed was the Pennsylvania Road, which connected Philadelphia and the forks of the Ohio where

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[1]U.S., Public Roads Administration, Federal Works Agency, Highway Practice in the United States of America (Washington: U.S. Government Printing Office, 1949), p. 1.

[2]Wheaton J. Lane, Highways in Our National Life, ed. Jean Labatut and Wheaton J. Lane (Princeton, N.J.: Princeton University Press, 1950), p. 69.

Pittsburgh now stands. Over this route passed thousands of migrants pouring into the rich Ohio Valley. Later, in 1775, Daniel Boone laid out the famous Wilderness Trail traversing the Cumberland Gap to the farmlands of Kentucky and Tennessee.

> Pioneers thronged the trail across the Appalachians. Between 1775 and 1800, probably 300,000 people passed through the Cumberland Gap on their way to the west—15 or 20 wagons every day during the open months.[1]

The Turnpike Era

After the War of Independence, the road system in the states and territories was in a chaotic condition. Financially, the states were unable to construct new roads or improve their old road systems and yet the young and now free country had a great need for better highways. New settlers were constantly moving west, and in the east there was a need for the products of the vast farmlands of the rapidly developing northwestern states of Ohio, Kentucky, and western Pennsylvania.

The situation was alleviated by the construction of turnpikes under the ownership of state-chartered corporations.

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[1] U.S., Department of Commerce, Bureau of Public Roads, Highways in the United States (Washington: U.S. Government Printing Office, 1954), p. 1.

Pennsylvania was the first state to charter a corporation, the Lancaster Turnpike Road Company, which led to the construction of the Lancaster Turnpike connecting Philadelphia with the west.

> The Lancaster Turnpike from Philadelphia to Lancaster was "stoned" in 1792 by throwing on it stones of all sizes. These were afterward removed and stones "passing a 2-inch ring" substituted. This is said to have been the first scientifically built surfaced road in America. . . . By 1828 there had been 3,110 miles of chartered turnpike in Pennsylvania costing over $8,000,000. . . . But other states were similarly employed. New York and New England by 1811 had chartered 317 turnpikes.[1]

So great was the competition among the great trade centers along the Eastern Seaboard for the western trade that each of them encouraged the construction of an extensive series of turnpikes to bring the products of western farms and industry to their merchants. States, counties, and cities often subscribed to large blocks of stock in the turnpike companies, most of which were of dubious value as most of the chartered companies failed to achieve anticipated profits. "The turnpike era was one of speculation excesses, and it also introduced into American politics the great problem of controlling corporations."[2]

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[1]George R. Chatburn, Highways and Highway Transportation (New York: Thomas Y. Crowell Company, 1923), pp. 60–61.

[2]Lane, p. 73.

With the turnpike came many new businesses. Stagecoach and freight-hauling companies were organized to provide public transportation needs and to move the products of a growing country to those places where they were needed. Inns, taverns, and comfort stations mushroomed along the turnpikes to accommodate travelers. Many of the taverns and inns were to remain as landmarks long after the highway ceased to exist.

Although the turnpikes were an important factor in the development of trade and commerce in our country, they were destined to pass out of existence by the middle of the nineteenth century. The instruments of their doom were the railroads and canals.

> . . . in 1829, the first steam locomotive in the United States was given a trial run. Within two years regular service was started on the Baltimore and Ohio Railroad. The railroad proved the best means of transportation over long distances. Canals, too, bid for passenger and freight business, and were successful for some years. The slow horse-drawn vehicles, with their small capacity, could not compete. The Conestoga wagon freight lines and the stage coaches went out of business. As tolls dropped off, the turnpike companies failed. Highway transportation in rural areas entered into a long period of neglect.[1]

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[1]U.S., Department of Commerce, Bureau of Public Roads, Highways in the United States, p. 2.

The Period of Neglect

The railroad had captured the imagination of the public. The resources of the nation were directed toward its development and growth. The road system entered into a period of neglect that was to last until the beginning of the twentieth century.

During this seventy-year period there was a general expansion of road mileage as the population increased and spread farther westward. Surfaced roads conducive to all-weather traffic increased from about 27,000 miles in 1830 to 100,000 miles in 1890 and were found primarily in the vicinity of heavily populated areas. The remaining 1,900,000 miles of rural highways existing in 1890 were nothing more than dirt roads with little or no drainage, grading, or maintenance. Wet weather turned them into impassable bogs preventing any type of vehicular travel. Road construction and maintenance were the responsibility of cities, towns, or counties. Finances for the road system came entirely from local sources and were quite inadequate to provide anything beyond the primitive level. Those concerned with road construction and upkeep frequently did not possess the necessary qualifications or experience to construct roads having any degree of permanency.

The "Good Roads" Movement to the Present

By 1890, the population of the country had increased tremendously. Industrial expansion brought about a substantial growth in the size of cities, and the demand for food products necessitated the settlement and development of farms located considerable distances away from railroad centers. The need for better farm-to-market roads became obvious. A "good roads" movement was initiated by farmers. It was during this same period that the bicycle became popular. So wide was the use of the bicycle that a National League of American Wheelmen was organized to defend the rights of bicyclists and to urge rural road improvement.

The farmer and the bicyclist succeeded in stirring up so much controversy about the condition of the country's road system that a "good roads" movement was soon introduced into Congress and led to the passage of the first highway legislation.

> On January 26, 1893, Representative Deborow introduced a resolution in the House of Representatives, "intrusting the committee on agriculture to incorporate in the agricultural appropriation the sum of $15,000 to be expended for the purpose of making investigations for a better system of roads. On the same day Representative Lewis presented a similar resolution, "intrusting the committee on Agriculture to incorporate in the bill making the appropriations for the Agricultural Department a clause authorizing the Secretary to make an inquiry regarding public roads. . . . As a

> final result a statute carrying an appropriation of $10,000 was approved March 3, 1893. Under this statute the Office of Public Roads Inquiries was instituted, October 3, 1893.[1]

The above statute called for an investigation into the road system existing at that time and, in addition, required that data be collected concerning the best methods of highway construction. Up to this time, little consideration had been given to the best methods of building highways, even though European countries had been constructing roads to tested and approved engineering design for years.

During this period the states were not idle. Many of them passed laws requiring that the state and county share in the cost of financing new construction and maintenance of their highway systems.

> The good-roads movement swelled tremendously with the coming of the horseless carriage. It has continued without let-up since. The Duryea Brothers built the first gasoline automobile in 1893. There were 8,000 automobiles in the United States in 1900, only seven years later. By 1925 there were 20 million motor vehicles on our roads and streets.[2]

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[1] Chatburn, pp. 136–37.

[2] U.S., Department of Commerce, Bureau of Public Roads, Highways in the United States, p. 2.

From the period 1900 to 1925 there were many changes in the types and kinds of roads being built, in machinery for building them, and in governmental organization for the work.[1]

It was during the above period that most of the state highway departments were created for the purpose of construction and maintenance of highways. This was an important step forward, for it provided for central planning, giving consideration to such factors as road classification and continuity, broader powers for highway taxation, and the means to build an organization of personnel possessing the necessary qualifications to construct highways according to the standards and design required by the motor vehicle.

With the coming of the automobile, new types of highway design became necessary. Experiments were conducted to test new kinds of road-building materials. "The first Portland cement concrete pavement in the United States was built in 1891, on the streets surrounding the Court House in Bellefontaine, Ohio."[2]

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[1]U.S., Public Roads Administration, Federal Works Agency, Highway Practice in the United States of America, p. 5.

[2]Albert C. Rose, "The Highway from the Railroad to the Automobile," Highways in Our National Life, ed. Jean Labatut and Wheaton J. Lane (Princeton, N.J.: Princeton University Press, 1950), p. 85.

By 1924 the mileage of concrete pavement had increased to slightly over 31,000 and its use in construction was increasing at the rate of 6,000 miles per year.[1]

Bituminous and brick pavements were also popular during this period. Both were used in paving city streets, and where traffic would justify the cost they were used in paving rural roads.

> The more extensive use of brick and of bituminous pavements of the mixed type on concrete base began also at about the same time, and was due to the same cause, the increased use of motor trucks. In 1914 there were approximately 1,500 miles of brick pavement; in 1924 there were 4,319. In 1914 the mileage of rural highways paved with bituminous concrete or sheet asphalt was still negligible; in 1924 there were more than 9,700 miles of these.[2]

During this period, new road-building machinery made its appearance.

> Power shovels and horse-drawn dump wagons appeared on grading jobs. The dump wagon was an adaption of the farm wagon, so constructed that the load could be dumped by pulling a lever. Mechanical mixers displaced hand-mixing labor for making cement concrete. The concrete pavement finisher was being developed as the period ended. Portable plants for preparing bituminous mixtures were placed on the market. These were important contributions but utilization of the

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[1] U.S., Public Roads Administration, Federal Works Agency, Highway Practice in the United States of America, p. 6.

[2] Ibid.

> internal-combustion engine as power in road-building equipment was to produce more revolutionary changes in construction methods.[1]

Shortly after World War I, the total road and street mileage increased to about three million, of which only 387,000 miles were surfaced. By 1958, total road and street mileage had increased to 3,479,000, of which 2,448,000 miles were surfaced.[2] With increasing car and truck registrations, the major objective of highway departments was to hard-surface the farm-to-market roads. Within a decade they were within realization of their objective only to find that the accomplishment of their original plans was no longer adequate.

> The important roads were surfaced. But in the meanwhile the number of motor vehicles had increased tremendously. Speeds were much higher. Trucks were bigger and carried heavier loads. The road builders began again, for the older surfaces were wearing out and costing too much to maintain. In rebuilding, they were made wider, stronger, smoother. Steep hills were cut down; sharp curves were rounded; "blind" spots were improved to give better sight distance.[2]

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[1] Ibid., p. 7.

[2] U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958 (Washington: U.S. Government Printing Office, 1960), pp. 106–7.

[3] U.S., Department of Commerce, Bureau of Public Roads, Highways in the United States, p. 3.

With the opening of the Pennsylvania Turnpike in 1940, an old concept in road construction and finance was underway—the turnpike. This time, however, the movement was being directed by state governments rather than by privately owned, state-chartered firms. The return of the turnpike created considerable controversy over the manner in which they were being financed and constructed. The construction of the costly limited-access highways was financed from receipts of bond issues authorized by state officials, while the interest service on the bonds, road maintenance costs, and provisions for amortization of the debt were derived from toll charges placed on vehicle owners using the road. The cost of financing toll roads was, and is, considered excessive by many interested persons. One of the reasons given for this thought is as follows:

> In most instances the state has not guaranteed that it will redeem the bonds if toll revenue is insufficient. This method of financing has proved to be expensive, in that interest rates on toll revenue bonds range much higher (almost double) than for State guaranteed bonds.[1]

Another controversy over the use of state-operated turnpikes centers around the inability of state highway officials to

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[1] Ibid., p. 12.

provide similar highways in the form of freeways from road user revenue other than toll charges. One antagonist states:

> The answer, often overlooked by the public and by the victimized motorists themselves, is that the motorists have already paid in advance for toll roads through gasoline taxes. And the appalling fact is that motorists who ride on toll roads usually pay for them not just twice, but three and four times.[1]

The reasons given for the inability of highway officials to construct freeways from highway revenues instead of having to revert to turnpikes and toll charges are many and varied. Several of the reasons are stated in the following quotations:

> Why did the toll road return? Economic necessity brought it back. "The toll road movement," says economist Wilfred Owen of the Brookings Institution, "has developed out of the failure of public-highway management because of the political interference to apply the tools available to it in a manner productive to effective highway development." This is a polite way of saying: "Public enterprise has failed, so state governments have returned to the principles of private enterprise—the price system."[2]

Mr. Springer attributes the condition to a diversion of highway funds for nonhighway purposes:

> Thus began the sinister practice of diversion—the use of gas-tax money for purposes never originally intended. Since 1924, says the Federal Bureau of Public Roads, states

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[1]John L. Springer, "Tired of Paying Highway Tolls?" Coronet, XXXIV, No. 2 (June, 1953), 43.

[2]George Koether, "Tax Road or Toll Road," Look, XVII, No. 12, 79.

> have used $3 billion of motorists' taxes to grow oysters, support public cemetaries, operate ski schools, and for other purposes as far from road building as the mind can imagine.
>
> In 1951, out of every dollar that poured into state treasuries in highway-use taxes, only 53 cents was used directly on highway work. Another 37 cents went for administration and tax collection costs, to state highway police and payments to holders of highway bonds. Yet in that year, states diverted $266,771,000 to other purposes. This sum could have built a modern two-lane highway from New York to California—a free road.[1]

As of 1954, toll roads of all types consisted of approximately 5,268 miles, or 1.5 percent of the 371,000 miles of the major rural roads existing in the United States at that time. By the middle of the 1950's, turnpike construction was being subjected to a careful evaluation. Some of the turnpikes were not producing anticipated revenues, and the value of the bonds had declined substantially. In addition, the Federal-Aid Highway Act of 1956 created some doubt as to the placement of the toll roads in the interstate system. The federal government gave no indication that it would pay for the turnpikes, nor does the law provide for toll roads in the interstate system. There would seem to be some doubt as to the use of toll roads in the future.

World War II prevented further construction, as the materials and labor for highway improvement were severely limited

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[1] Springer, Coronet, XXXIV, No. 2, 43.

due to the war effort. Roads scheduled for construction and reconstruction were postponed. Existing roads were given only the necessary maintenance to keep them in operation.

This three- to four-year period of neglect during the war years left the road system in a condition that was even worse than normal.

> Following the end of World War II, a peacetime traffic quickly resumed its stride. Within a year it had broken prewar records, and has continued to grow ever since. The States were ready for a big road-building program. Plans were prepared and large amounts of State and Federal money available. But because of high prices and shortages of materials, men and machinery, the expected program did not get into high gear until about 1948. Meanwhile the mileage of roads no longer adequate for the traffic carried, or dangerous for present day speeds, or difficult to keep in good condition, grew steadily larger.[1]

In 1956, Congress passed, and President Eisenhower signed, the Federal-Aid Highway Act of 1956. This program provided for the construction of the greatest network of modern roads ever built. The keystone of the act is the so-called interstate system calling for 41,000 miles of superhighways that will crisscross the nation, permitting high-speed, nonstop travel from one point to another. The act provided for a thirteen- to fifteen-year period of construction.

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[1]U.S., Department of Commerce, Bureau of Public Roads, Highways in the United States, p. 4.

There are many interested persons, however, who already think that the proposed system will be obsolete by the time it is completed. Our rapid increase in population coupled with the increase in motor vehicle registrations seems to be the crux of the dilemma.

CHAPTER III

HIGHWAY CLASSIFICATION AND ADMINISTRATION

In certain areas of highway practice today there is a conglomeration of complex and controversial procedures and issues. In other phases of highway activity, a uniform body of principles has been developed and put into practice by highway personnel in the performance of their tasks. A knowledge of highway system classification, the jurisdictional responsibility for each classification, and the organization structure of highway authorities is imperative to the comprehension of subsequent discussions of financial planning and control in state highway departments. For these reasons, these aspects are treated in some detail in this chapter.

Traditionally, each state or political subdivision thereof has been charged with responsibility for actual construction and maintenance of highways within state boundaries. Nevertheless, the federal government plays an increasingly important role in financing and controlling the development of the nation's highways.

Over the years, the classification of the highways in the United States has developed into a rather intricate and confusing picture. As might be expected, there are widespread variations in the practice of the various states as to administrative control over highways. Some of the systems of the most-used highways have been superimposed on other larger systems and have become an integral part of the latter. As a result, some highways may be a part of three or four systems. A classification of highways according to character of the road and traffic using it may result in a different classification according to administrative control for maintenance and improvement. Both of these aspects are treated in the following paragraphs.

Highway Classification

Prior to 1890 the road system was, with few exceptions, under the direction and control of local authorities. Cities were responsible for roads and streets that fell within their jurisdictions, and counties built and maintained roads designed to serve the rural areas. The invention and development of the automobile brought about the need for better highways and highway planning. No longer were local authorities able to supply the know-how and the funds necessary to build and construct the road systems

required by faster and heavier motor vehicles. As a result, states were forced to bring road-building under centralized control. The passage of the Federal-Aid Road Acts of 1912 and 1916 made state participation in highway construction and maintenance a necessity. The federal government offered financial aid upon the stipulations that the state governments control the use of the funds and that each such state set up a state highway organization to cooperate with the federal agency.[1]

Between 1891 and 1920, every state enacted legislation that eventually brought responsibility for the more important road systems under the control of state highway departments.

> At first a small office was created to control the use of State-aid by local governments. State and local funds were used in building the State-aid roads, but maintenance was often left to the counties. The final step was full State control of construction and maintenance of a State highway system by a State highway department.[2]

The state system

The federal government has control of all national forest, national park, and national Indian reservation roads. The mileage

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[1]U.S., Public Roads Administration, Federal Works Agency, Highway Practice in the United States of America, pp. 8–9.

[2]U.S., Department of Commerce, Bureau of Public Roads, Highways in the United States, p. 3.

in this system represents the only roads that are solely the administrative responsibility of the federal government. All other roads and streets are the direct responsibility of the states and their political subdivisions. Most road systems are organized along jurisdictional lines, such as state, county, township, and urban. The data in Table 1 indicate the classifications of the total rural and municipal mileage of roads and streets in the United States by administrative control and system.

The statistical data presented in Table 1 and following tables include roads located in the continental United States and do not take into account the road systems of Alaska, Hawaii, and Puerto Rico. The reason for this omission is that data for the latter are not complete as yet or are of doubtful validity.

Of the 3,074,000 miles of rural roads existing in the United States in 1958, 482,000 miles, or approximately 15 percent, were primitive[1] and unimproved, while 509,000 miles, or 16 percent, were nothing more than graded or drained dirt roads. Approximately 1,233,000 miles, or 40 percent of total rural highways, had surfaces of stabilized soil or of gravel and stone. Only 850,000

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[1]The primitive road is nothing more than a trail. It has not been surfaced or graded and is generally inaccessible during many months of the year.

TABLE 1.—Rural and municipal mileage in the United States, 1958, classified by administrative control and system.

Administrative Control and System	Mileage
Roads under state control:	
Rural road mileage:	
State primary system	395,000
State secondary system	98,000
County roads under state control[a]	136,000
State park, state forest, and Indian reservation roads	14,000
Total rural road mileage	643,000
Municipal road mileage:	
Extension of state primary system	39,000
Extension of state secondary system	8,000
Total municipal road mileage	47,000
Total road mileage under state control	690,000
Roads under local control:	
Rural roads:	
County, town, and township roads	2,330,000
Municipal roads:	
City streets	358,000
Total road mileage under local control	2,688,000
Roads under federal control:	
National park, national forest, and Indian reservation roads	101,000
Total roads and streets in the United States	3,479,000

Source: U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958, p. 107.

[a]County roads under state control in Alabama (8 counties), Delaware, Nevada (455 miles), North Carolina, Virginia (all but 2 counties), and West Virginia.

miles, or 29 percent, possessed surfaces that the motorist normally thinks of as "paved." Of the 850,000 miles of paved surfaces, 498,000 miles had a low-type bituminous surface consisting of tar or asphalt, while the retaining 352,000 miles had a high-type surface of bituminous penetration, bituminous asphalt, Portland cement concrete, or brick or block surfaces.[1]

State primary system.—The state highway departments of the nation have jurisdictional responsibility for 395,000 miles of state primary roads. These roads connect all the principal cities in the United States and provide the main channels of arterial highway traffic. Over these highways pass the bulk of passenger and commercial vehicular traffic. This system represents the ultimate in highway engineering and design, as the roads must meet the standards of heavy, fast-moving traffic.[2] In Table 2, data are presented to show the surface type of this important system. It should be pointed out, however, that surface type is only one factor among many that provides an indication of the

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[1]U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958, p. 107.

[2]The state primary includes the interstate system composed of 41,000 miles of high-standard roads.

TABLE 2.—The state primary rural road system, 1958 (mileage classified by type of surface.

Type of Surface	Mileage
Surfaced mileage:	
Low-type surface[a]	28,000
Intermediate-type surface[b]	135,000
High-type surface[c]	228,000
Total surfaced mileage	391,000
Nonsurfaced mileage:	
Primitive and unimproved	1,000
Graded and drained	3,000
Total nonsurfaced mileage	4,000
Total mileage	395,000

Source: U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958, p. 107.

[a]Consists of slag, stabilized soil, and gravel or stone surfaces.

[b]Consists of bituminous-treated and mixed bituminous surfaces.

[c]Consists of bituminous penetration, bituminous concrete, sheet asphalt, Portland cement concrete, brick, and block surfaces.

condition of a highway. Other factors of importance are surface condition, road foundation, road and shoulder width, and various safety factors.

It is apparent from the data in Table 2 that a substantial portion of the primary system has surfaced roads and that 228,000, or 58 percent, have a high-type surface. An extremely small percentage, less than 1 percent, or 4,000 miles, are nonsurfaced roads.

In addition to the rural roads, the state primary system also includes 39,000 miles of city streets. These are the municipal extensions of the state primary roads as they enter and pass through cities and towns along their routes. Responsibility for construction and maintenance—at least financially—rests with the state highway departments.

State secondary system.—Of the 2,564,000 miles of secondary highways existing in the United States in 1958, 234,000 miles were under the administrative control of the states and the remaining 2,330,000 miles were the responsibility of counties, towns, and townships. Of the total under state control, 136,000 miles represent county secondary roads that had been placed under the administrative jurisdiction of five states: Delaware, North

Carolina, Virginia, West Virginia, and, with relatively low mileage (455), Nevada. In these states, the counties have individually relinquished their responsibility for local-road administration to the state highway departments.

The remaining 98,000 miles of state secondary roads represent the more important highways in the secondary system that state highway officials or state legislators have determined should be under state control. The data presented in Table 3 indicate the surface type of this road system.

Sixty-nine thousand miles of the rural state secondary, or 73 percent, have an intermediate- or high-type surface, which serves to indicate their importance in the state system. Many of the state secondary highways service traffic volumes far in excess of many of the state primary roads. In contrast, 83,000 miles, or 61 percent, of the county roads under the centralized control of the aforementioned five states have a low-type surface, are graded and drained only, or are in a primitive and unimproved condition.

The various states have added to their secondary road responsibilities by bringing under their jurisdictions 8,000 miles of municipal extensions. These are the major county secondary

TABLE 3.—Rural state secondary road and county road mileage under state control, 1958 (classified by type of surface).

Type of Surface	Mileage
State secondary roads:	
Surfaced roads:	
Low-type surface	23,000
Intermediate-type surface	43,000
High-type surface	26,000
Total surfaced roads	92,000
Nonsurfaced roads:	
Primitive and unimproved	4,000
Graded and drained	2,000
Total nonsurfaced roads	6,000
Total state secondary roads	98,000
County roads under state control:	
Surfaced roads:	
Low-type surface	56,000
Intermediate-type surface	42,000
High-type surface	11,000
Total surfaced roads	109,000
Nonsurfaced roads:	
Primitive and unimproved	16,000
Graded and drained	11,000
Total nonsurfaced roads	27,000
Total county roads under state control	136,000
Total	234,000

Source: U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958, p. 107.

roads that enter and/or pass through small municipalities along their routes.

State park, state forest, and Indian reservation roads.— The states administer 14,000 miles of park, forest, or reservation roads in addition to the aforementioned systems. These are generally low-grade roads permitting access to state-controlled public recreation areas. Seven thousand miles of the system have primitive and unimproved surfaces, while 4,000 miles have high-grade surfaces.[1]

County, town, and township secondary road systems

Over 68 percent, or 2,330,000 miles, of the total road and street mileage in the United States is under the control of counties, towns, and townships. These political local units of states are responsible for the construction and maintenance of rural roads that are located within their jurisdiction.

The roads in this system are commonly referred to as the "farm-to-market" roads. Over these highways pass the products of farms and ranches on their way to local, regional, and national

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[1]U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958, p. 107.

markets. They also serve as feeder roads and connecting links to the major state highways. Secondary roads are the economic, educational, social, and cultural lifeline of the rural population in the United States. They may service one or two families living in isolated areas or many families residing in rural towns or communities. Traffic volume, passenger and commercial, on this system is light compared to that on the state primary roads. Therefore, construction standards and design can be lower than those of major highways.

The data in Table 4 indicate the type of surface existing on these roads in 1958. Of the total road mileage shown in this table, only 10 percent, or 355,000 miles, have improved intermediate- or high-grade surfaces, while 870,000 miles, or 26 percent, are nothing more than unimproved trails or graded and drained dirt roads with no surfacing whatsoever. Over 47 percent, or 1,105,000 miles, have a low-grade bituminous surface.

Municipal roads and streets

Three hundred and fifty-eight thousand miles of city roads and streets are the responsibility of the local city highway departments. "There are about 17,000 cities, boroughs, and villages

TABLE 4.—County, town, and township secondary road system in the United States, 1958 (mileage classified by type of surface).

Type of Surface	Mileage
Surfaced roads:	
Low-type surface	1,105,000
Intermediate-type surface	274,000
High-type surface	81,000
Total mileage of surfaced roads	1,460,000
Nonsurfaced roads:	
Primitive and unimproved	425,000
Graded and drained	445,000
Total mileage of nonsurfaced roads	870,000
Total	2,330,000

Source: U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958, p. 107.

that are engaged in construction and maintenance of the streets and highways within their limits."[1]

Like highways in the other systems, city roads and streets have varying degrees of importance. Major city streets permit access to the central business districts and industrial centers. Connecting the major city highways is a network of streets servicing the suburban and residential areas.

> The city highway departments have the same basic work to do as the counties and townships, or the State highway departments. They build, repair, and control traffic on the streets. But in the larger cities the work is difficult and complicated. Traffic is very heavy, especially during the morning and evening hours when people are going to and from work. Most of the streets have to be paved with hard surfaces. They are subject to terrific wear, and are frequently cut into for repair of underground facilities like sewer, water, and gas pipes, and electric and telephone wires. Street car and bus lines, and the loading and unloading of trucks, are complications the rural governments do not have to deal with.[2]

From Table 5 it can be determined that 67 percent, or 242,000 miles, of municipal roads have an intermediate- or high-grade surface. In many of the large metropolitan industrial areas, the major municipal highway represents one of the best-engineered

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[1] U.S., Public Roads Administration, Federal Works Agency, Highway Practice in the United States of America, pp. 6–7.

[2] Ibid., p. 7.

TABLE 5.—Municipal road mileage under local control, 1958 (classified by type of surface).

Type of Surface	Mileage
Surfaced streets:	
Low-type surface	76,000
Intermediate-type surface	116,000
High-type surface	126,000
Total surfaced mileage	318,000
Nonsurfaced streets:	
Primitive and unimproved	8,000
Graded and drained	32,000
Total nonsurfaced mileage	40,000
Total	358,000

Source: U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958, p. 107.

road systems in modern construction and design. Thousands of vehicles are rapidly channeled in and out of high-traffic-volume areas over modern limited-access freeways.

Federal roads

The federal government administers approximately 101,000 miles of roads. They are all found in national parks, national forests, and Indian reservations and are the only roads under the direct responsibility of the federal government.

> The Bureau of Public Roads cooperates with the Federal Department of Agriculture in constructing principal roads in national forests; with the National Park Service in construction of parkways and main roads in and leading to national parks; with other agencies in constructing roads through other Federal areas. . . .[1]

United States marked routes

Throughout the United States certain routes are marked with the familiar shield-shaped signs bearing the initials "US," such as US 30 or US 66. These routes have no legal or administrative significance, and do not in any way represent a federal government system of highways. These routes, by joint action of the individual state highway departments, have been designated in

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[1] Ibid., p. 22.

this manner to assist the cross-country motorist as he travels from one state jurisdiction to another.

The system was recommended by the American Association of State Highway Officials in 1925 to bring order out of the confusion that faced the interstate traveler as each state used its own signs and route numbers in designating its highways.

> At the request of the association, the Secretary of Agriculture, on March 2, 1925, appointed a Joint Board of State and Federal highway officials, "to undertake immediately the selection and designation of a comprehensive system of through interstate routes and to devise a comprehensive and uniform scheme for designating such routes in such manner as to give them a conspicuous place among the highways of the country as roads of interstate and national significance.[1]

The numbers assigned to the national routes have a special significance. Routes traversing the country from north to south were given odd numbers, while those running east and west were assigned even numbers.

Federal-aid system

A discussion of federal aid can be approached from various viewpoints, for it possesses many implications in highway

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[1]American Association of State Highway Officials, "1925—Adoption of Uniform Signs," Public Roads of the Past, pp. 119–20.

administration. In this section, only that facet relevant to highway system classification will be treated.

Federal-aid systems do not include any roads or streets that have not already been described in the preceding paragraphs of this chapter. They are made up entirely of the roads and streets that are under the jurisdiction of states, counties, townships, and cities. Even though funds are made available by the federal government for the construction and improvement of a portion of these roads, legal and administrative control is still exercised by the states or their political subdivisions.

Although the federal government had earlier appropriated funds for the construction of specific national roads, federal aid, in the modern meaning of the term, was first promulgated by the passage of the Federal-Aid Road Act of 1916. In addition to providing funds for the construction of rural post roads to facilitate the delivery of the United States mail, the act required the states, as a prerequisite to federal-aid participation, to establish state highway organizations. The act further required: (1) a limit of $10,000 per mile for construction, exclusive of the cost of bridges; (2) that funds could not be used for the maintenance

of roads; and (3) that federal-aid roads were to be free of tolls of any kind.[1]

In the Federal-Aid Highway Act of 1921, a new system of roads was designated as the federal-aid primary and was made eligible for federal-aid funds. The new system was limited to 7 percent of the total road mileage of each state, and roads in the system were required to be of an interstate nature.

The Federal-Aid Highway Act of 1944 provided for an expansion in the systems eligible for federal funds. State primary roads within urban areas and certain secondary rural roads could now qualify for federal-aid participation.

> The act further authorized establishment of a "National System of Interstate Highways not exceeding forty thousand miles in total extent to be located as to connect by routes, as direct as practicable, the principal metropolitan areas, cities and industrial centers, to serve the national defense and to connect at suitable border points with routes of continental importance in the Dominion of Canada and the Republic of Mexico."[2]

Interstate system.—The keystone of the federal-aid program is the national system of the interstate highways. This is a

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[1]Association of American Railroads, Highways (Washington: Association of American Railroads, 1955), p. 1.

[2]Ibid., p. 3.

network of superhighways having extremely high construction standards and design to facilitate the rapid movement of traffic over the most used roads in the United States.

> This would be a super-network of the most important 40,000 miles of the Primary System (now increased to 41,000 miles). It would connect more than 90 per cent of all cities with a population of 50,000 or more (209 cities in all), 42 of the 48 state capitals and all 48 continental states. Although this system amounts to only 1.2 per cent of the total rural mileage in the nation, it is expected to carry about 20 per cent of the traffic on all streets and highways.[1]

The Federal-Aid Highway Act of 1944 authorized the Bureau of Public Roads in cooperation with the state highway departments to designate the interstate system. The Federal-Aid Highway Act of 1956 increased the mileage limit from 40,000 to 41,000 and changed the name of the system to the "national system of interstate and defense highways."[2]

The structure of interstate highways may vary as follows:

> Depending on traffic demands, a freeway will be 2, 4, 6, or 8 lanes—each lane at least 12 feet in width. Shoulders will be at least 10 feet; center strips in rural areas will be a minimum of 36 feet wide. . . . These super roads will go around most towns . . . to give towns-people relief from dangerous congestion caused by through traffic. The

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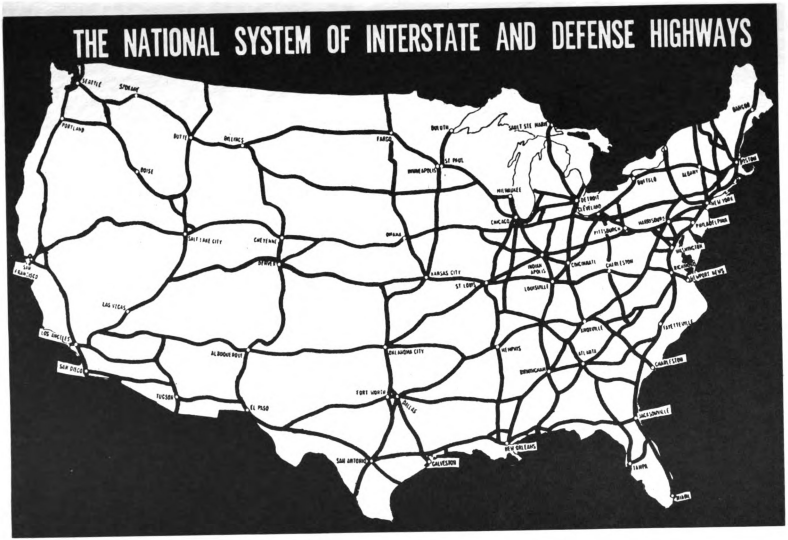
[1] Caterpillar Tractor Company, The Road Ahead (Peoria, Ill.: Caterpillar Tractor Company, n.d.), p. 5.

[2] U.S., Congress, Federal-Aid Highway Act of 1956, Public Law 627, 84th Cong., 2d Sess., 1956, pp. 5–8.

Fig. 1.—Map of the interstate system.



> freeways will be of "Planned Access" design. That means there will be no intersections. No railroad crossings. Not even driveways.[1]

Federal-aid primary system.—As of December 31, 1958, the federal-aid primary system consisted of 195,941 miles of roads and streets, exclusive of the interstate system. Of this total, 181,878 miles were rural roads and 14,063 miles were urban highways.[2] This system was initially laid out in 1921 by the states and the Federal Bureau of Public Roads. Since that time the system has been altered somewhat to conform to changing traffic patterns. It represents the most important state roads and streets, exclusive of the interstate system, and it connects all the principal cities in the states. Municipal extensions of the state primary system were brought under federal-aid participation by the Federal-Aid Highway Act of 1944. The federal-aid primary system comprises about 50 percent of the state primary mileage.

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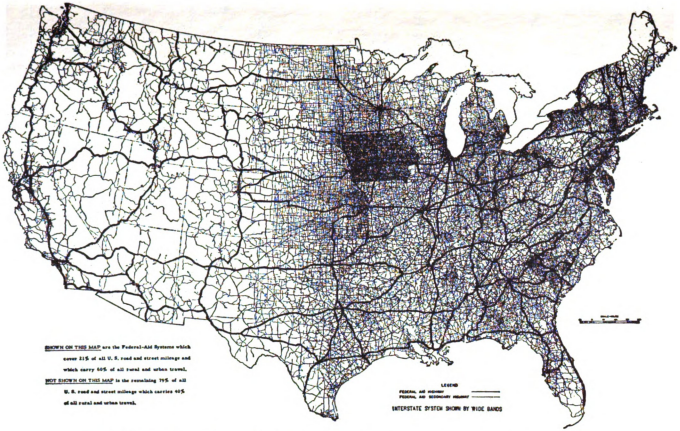
[1]Caterpillar Tractor Company, Your Stake in the Road Ahead (Peoria, Ill.: Caterpillar Tractor Company, n.d.), p. 4.

[2]U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958, p. 112.



United States Federal Aid Highways and Federal Aid Secondary Roads, June 30, 1953.

Fig. 2.—Federal-aid primary and federal-aid secondary systems. Source: A Ten-Year National Highway Program, A Report Prepared by the President's Advisory Committee on a National Highway Program (Washington: U.S. Government Printing Office, 1955).

Federal-aid secondary system.—The federal-aid secondary system was created under the Federal-Aid Highway Act of 1944, and its roads were designated by the states and coordinated by the United States Bureau of Public Roads. "The routes in this system are the most important secondary roads, feeding traffic from farms and villages into the main highways and to the market centers.[1]

As of December 31, 1958, this system consisted of 560,398 miles of roads and streets, of which 549,273 miles were rural roads and 11,125 miles were urban streets.[2]

Highway Administration

Administrative control of highways and streets in the United States is vested directly in the states and their political subdivisions. The federal government, however, exerts a certain degree of control over those road-building projects eligible for federal aid.

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[1] U.S., Department of Commerce, Bureau of Public Roads, Highways in the United States, p. 5.

[2] U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958, p. 112.

There are four governmental units directly or indirectly concerned with the administration of highways in the United States: (1) the federal government; (2) the states; (3) the counties, towns, or townships; and (4) the cities.

Federal government highway administration

Among the powers set forth in Section 8 of Article I of the Constitution is the power "to establish post offices and post roads."[1] This delegation of constitutional power specifically confers on the federal government the authority to build a system of post roads. The national government maintains a huge organization and widespread facilities to provide for mail delivery in exercising its constitutional authority under Section 8. Yet, other than building a few national roads in the early development of the United States, the federal government has always preferred to interpret its power to establish roads in a very limited sense.

> Practical considerations would seem to make unlikely any conflict between the states and Federal authorities over the right to own, construct, and maintain the public highways, or any considerable portion thereof. The Federal government

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[1]John H. Ferguson and Dean E. McHenry, The American System of Government (New York: McGraw-Hill Book Company, Inc., 1950), p. 975.

> needs an extensive mileage for the postal service and also for the purposes of national defense. The use, however, is so intermittent, and so small compared to local traffic, that it will never be economical to maintain separate systems. The needs of the national government can be achieved by the program of Federal aid, where the administration of the Federal fund, by the right to give or withhold aid is made conditional upon compliance with suitable standards.[1]

Authority for administration of the federal-aid highway program has been delegated by the president of the United States to the secretary of the Department of Commerce.[2] Within the Department of Commerce, the Bureau of Public Roads is specifically charged with the responsibility of coordinating the federal highway program with the states. The Bureau of Public Roads is headed by a federal highway administrator, with main offices located in Washington, D.C. The headquarters staff is composed of five major offices—Administration, Engineering, General Counsel, Operations, and Research. Each of these offices performs an extremely important function in the over-all pattern of federal and state participation in planning and constructing the nation's

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[1]Charles Ross, "The Highway and the Divided Constitutional Powers," Highways in Our National Life, ed. Jean Labatut and Wheaton J. Lane (Princeton, N.J.: Princeton University Press, 1950), p. 278.

[2]The Department of Commerce was established by Congress in 1903.

major highways. An enumeration of their more specific duties is as follows:

1. The Office of Administration is responsible for all financial activities undertaken by the Bureau of Public Roads, including those involving coordinated highway projects with the states. Personnel and personnel training also comprise a function performed by this office.

2. The Office of Engineering establishes policies on standards and design in construction and maintenance. Authority is exercised over the Bureau of Public Roads field representatives in regional and state offices who coordinate the federal and state activities in the preparation of construction programs. This office also has the responsibility for reporting the progress of the various projects undertaken and for determination of their proper performance.

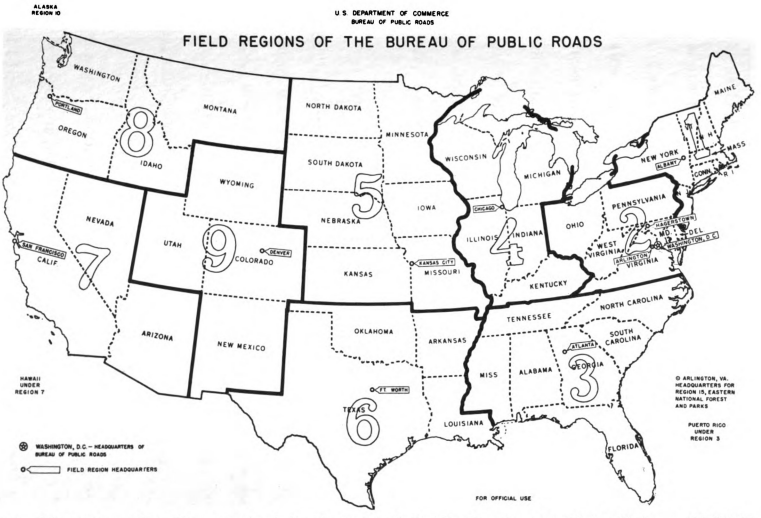
3. The Office of General Counsel is responsible for all legal matters necessary to the operation of the bureau. It has legal accountability for investigations, patents, lease agreements, and right-of-way acquisitions.

4. The Office of Operations is concerned with the national-defense aspects of the road system and for the overseas operations involving technical assistance to various foreign nations. Overseas offices are located in Ethiopia, Iran, Jordan, Lebanon, Liberia, Nepal, Philippines, Sudan, and Turkey.

5. The Office of Research performs an extremely valuable service by conducting research in all areas of highway activity. The studies cover a wide variety of topics ranging from the economic impact of road systems on individuals, groups, and communities to highway structural design.

The Bureau of Public Roads maintains direct contact with state highway departments through ten regional offices serving

Fig. 3.—Field regions of the Bureau of Public Roads.



Source: Directory, Key Personnel of the Bureau of Public Roads and State Highway Organizations (Washington: Bureau of Public Roads, 1960).

from one (Alaska) to eight states. In addition, regional offices are established to service the eastern national forest and park road system and the Inter-American Highway with offices in Costa Rica, Guatemala, Honduras, Nicaragua, and Panama.

In each state, the District of Columbia, and Puerto Rico, division offices have been established. These local offices are headed by division engineers who work directly with state highway officials in all cooperative work involving federal-aid programs. The organization of the regional and division offices parallels very closely that of the headquarters staff in Washington, D.C.

State highway departments

Each of the fifty states has a highway department which is responsible for the construction and maintenance of roads under state control. The headquarters offices are usually located in state capitals, and district offices are located throughout each state.

The organization of highway departments differs substantially at top levels of administration, but is quite similar at middle and lower levels of management. The same functional divisions are found in most state highway departments. Generally,

the only difference is in their placement in the organization structure. For instance, the construction and maintenance division may be placed under the same authority as the preconstruction division, or it may be the responsibility of an executive who also has authority over various administrative functions such as fiscal, personnel, and public relations.

At top administrative levels, various authoritative situations may prevail. The greatest dissimilarity is found in the positions and authority that exist between the governor and the executives of the various functional divisions. In certain states the line of authority extends directly from the governor to his appointed executive, who is responsible for coordinating the entire activities of the highway department. In other situations the highway department is supervised by a single executive, but a board of commissioners (or directors) may be appointed by the governor to assist the highway executive in an advisory capacity. The commissioners have absolutely no authority, whatsoever, over highway operations.

In some states the highway departments may operate under the direct authority of a board of commissioners who are appointed by the governor subject to ratification by the state senate. The board in turn appoints a chief executive to head the

highway department. The board of commissioners delegates authority to the chief administrator of the highway department. The commissioners may determine major policies, while the chief executive carries out the management of the highway department.[1]

The highway departments are organized along divisional lines and are generally composed of the following functions: administration, engineering, construction and maintenance, planning, and legal. Further decentralization is provided for as the states

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[1]In nine of the ten state highway departments visited by the writer, a general pattern of organization structure was found to prevail. The line of authority extended from the people of the state to the governor, who in turn made appointments to a board of highway commissioners comprising three to eight members, such appointments being made as vacancies arose through term expirations during the governor's tenure in office. The appointments by the governor were subject to ratification by members of the state legislature. Terms of the highway commissioners were staggered to run alternately, and state law usually required that both political parties be represented on the board. The commissioners were generally chosen from, and represented, specific districts of the state. In the nine states it was intended that the board of commissioners act in the capacity of a policy-making body, with actual administration of the highway department the responsibility of a chief executive appointed by the commissioners. However, the board of commissioners frequently concerned itself with actual operations, especially as they related to financial planning and highway programming. In one state (Nebraska) the board performed in an advisory capacity, with no line authority whatsoever. The chief administrative officer appointed by the commissioners generally carried the title of "director of highways," "state highway engineer," or "superintendent of state highways." The director was responsible for coordinating the activities of the divisional units.

are divided into districts under the supervision of a district engineer who directs the actual construction and maintenance operations in the field. An example of decentralization of state highway authority by commissioner and engineering districts is presented in Figure 4.[1]

The planning division, through its subsidiary sections, is responsible for providing statistical projections relevant to traffic volume and characteristics, highway economics, highway tax cost allocation, road life studies, and other phases of highway research necessary to advanced program planning.

The engineering division is responsible for the road and bridge plans prior to the letting of the contract. Subsidiary sections of this division are generally concerned with design, location, structures, materials, and plans of a specific road section once it has been programmed for construction.

The construction and maintenance division has the authority to direct supervision of construction subsequent to the letting of contracts to private road construction firms. The division is

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[1]Figure 4 shows the five commissioner and engineering districts for the state of Arizona. In Figure 7, on page 72, the organization structure for a district is presented.

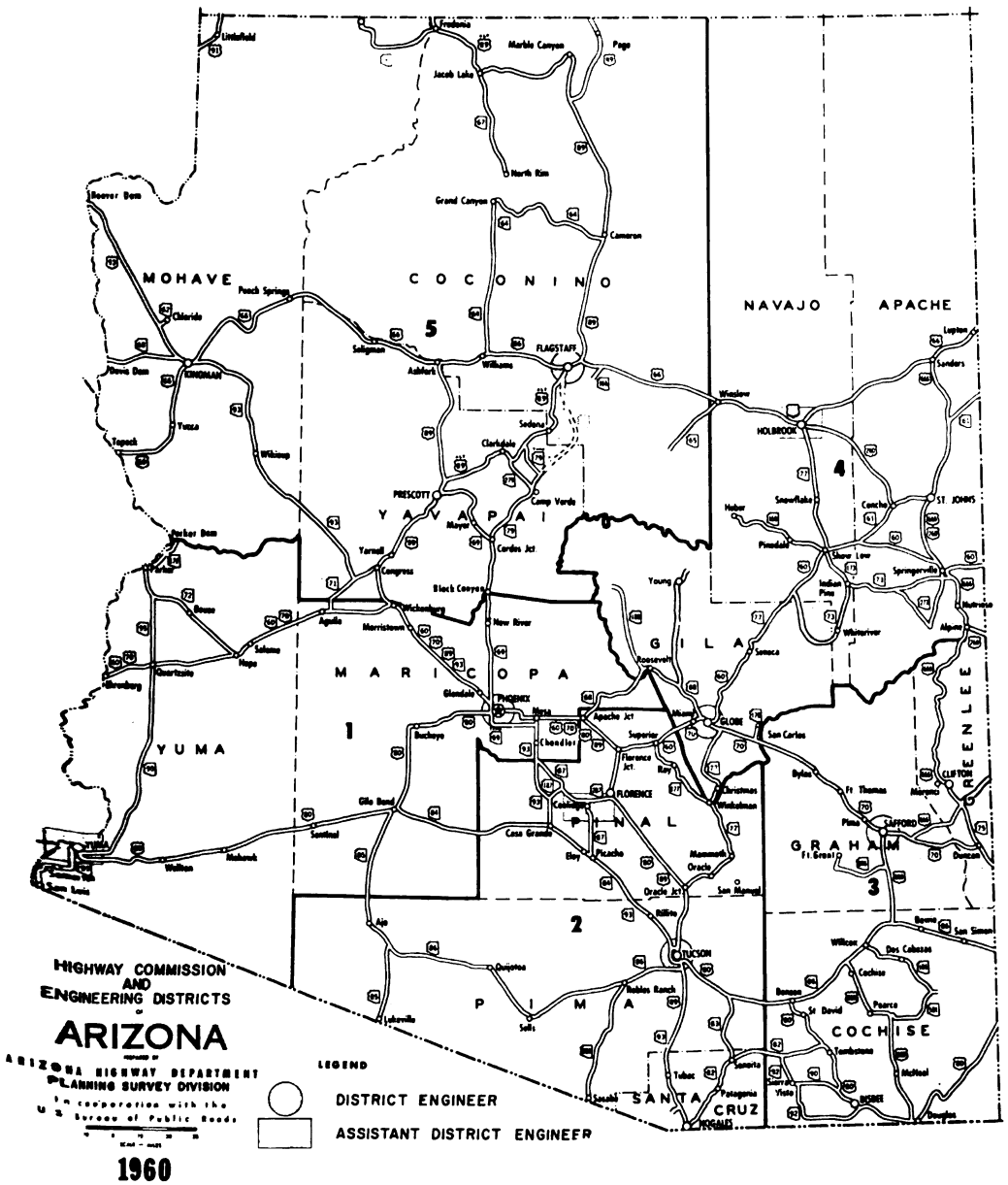

Fig. 4.—Map showing commissioner and engineering districts.

also responsible for the care and maintenance of roads in the state system.

The administration division generally includes several staff functions necessary to the proper operation of the highway organization. Under the supervision of the administrative officer are found the fiscal, personnel, procurement, and public relations departments. Occasionally several of the departmental responsibilities were combined under one supervisor, such as fiscal and personnel management, or personnel management and public relations.

The following quotation illustrates the responsibility of the legal department: "The Attorney General is the legal advisor of the Highway Department, and through the Legal Division provides such legal services as the Commission, State Engineer, Director of Highways or Department Heads may require."[1] The right-of-way section is often placed under the same administrator as the legal division because of the many legal implications in acquiring the right-of-way necessary to the construction of highways.

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[1]Arizona State Highway Department, Factual Review, A Report Prepared by the Planning Survey Division (Phoenix: Arizona State Highway Department, 1960), p. 10.

In Figures 5 and 6 the organization charts for two state highway departments are shown. Note that the divisional responsibilities of the Idaho State Highway Department have been divided into "engineering" and "operations" under the supervision of assistant state highway engineers. Utah has omitted this level of management. In Figure 7 the organization chart for a district is presented.[1]

The state highway departments are well staffed and equipped to perform the road engineering function. Their staffs consist of well-trained, highly educated engineers, accountants, lawyers, and other professional personnel.

County, town, and township administration

In the United States there is a wide variation in local highway administration:

> More than 18,000 local governmental units have an interest of some kind in the local roads. These include 2,750 counties, 14,500 towns and townships, and 950 special road districts. In New England the local roads are largely controlled by the towns, and in Pennsylvania by the townships. In the Southern and Western States the counties generally handle local road affairs. In the rest of the country, with some exceptions, the counties have charge of the more

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[1]The organization chart as set forth in Figure 7 is a general description of the district functions, authority, and responsibility. The operation may differ from state to state.

Fig. 5.—Organization chart for the State Highway Department of Idaho.

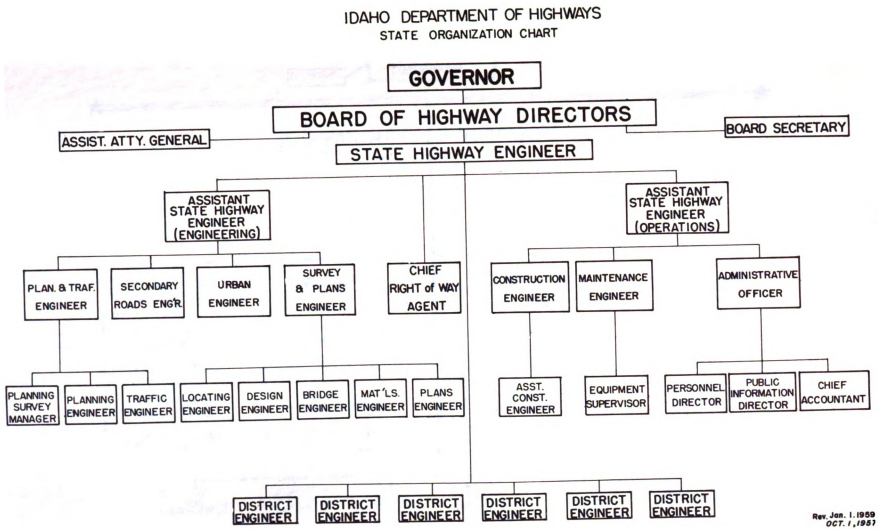


Fig. 6.—Organization chart for the State Highway Department of Utah.

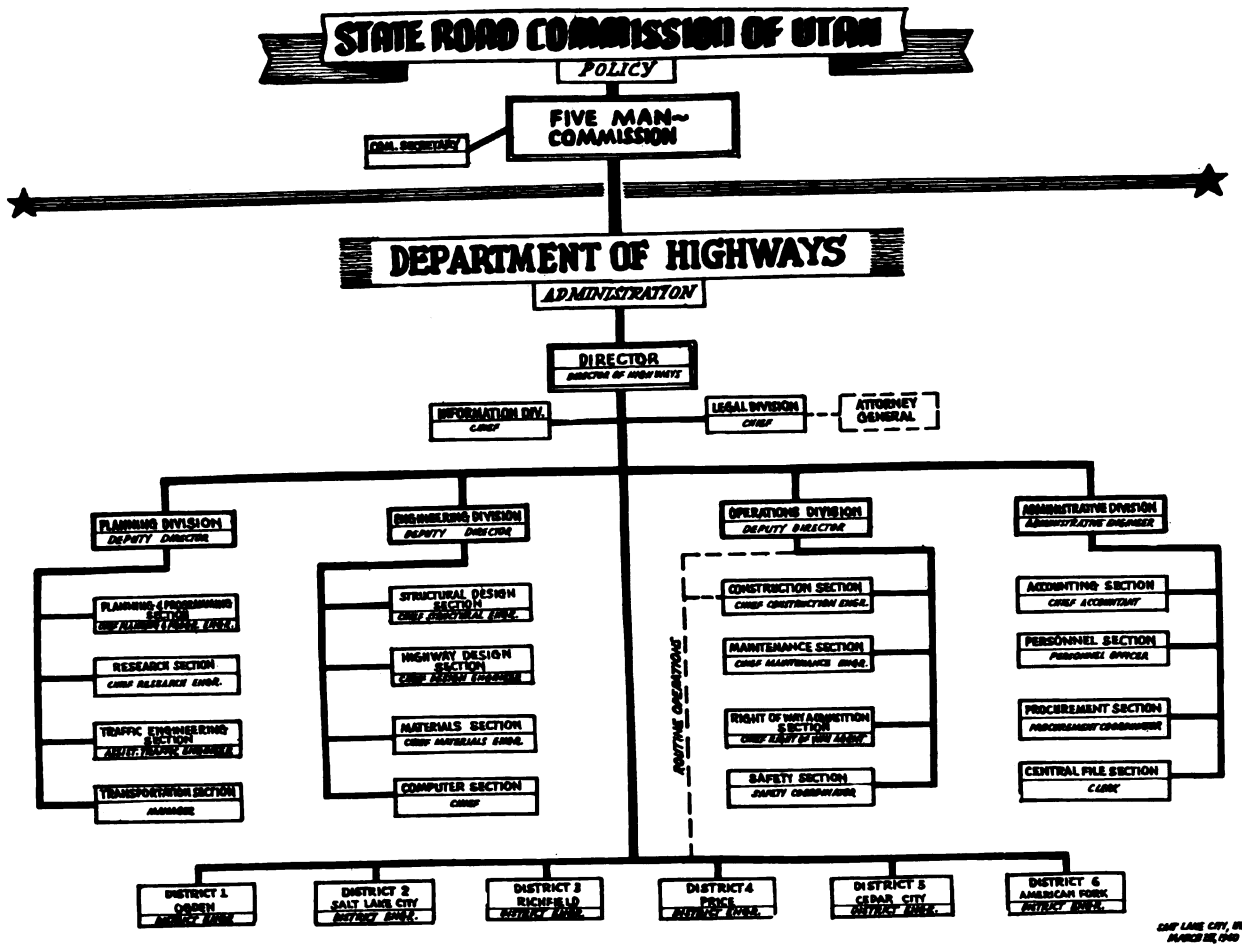
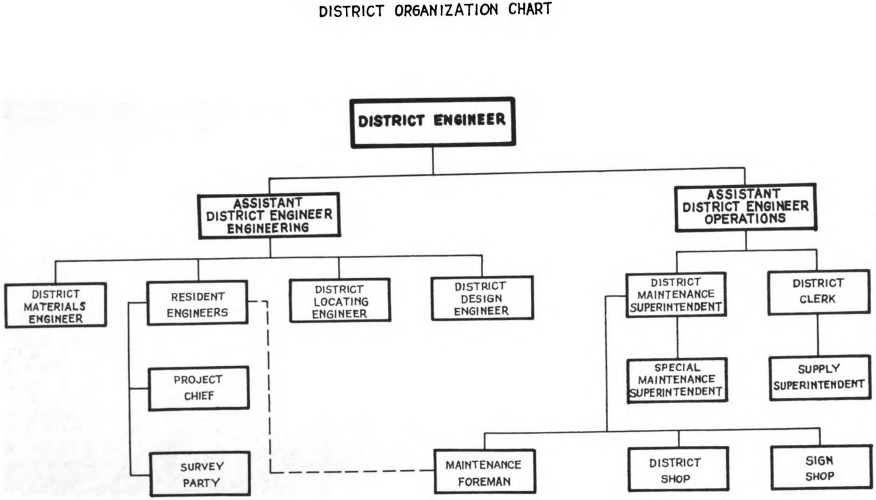


Fig. 7.—Organization chart for a district of a state highway department.



> important local roads and the townships take care of the remainder. The townships in a few States have voluntarily handed over their road responsibilities to the counties. Some States have taken the more heavily traveled local roads into their State highway systems, and in Delaware, North Carolina, Virginia (except in three counties) and West Virginia all the rural roads are under State control.[1]

In states in which the county has jurisdiction over local roads, the administrative unit is commonly known as the board of commissioners. The board may be composed of one to more than fifty members, with three to five being the most common. Each member, who generally represents a district in the county, is chosen by the electorate for a term of two to four years.

With a few exceptions, the county commissioners have complete control over local roads under their jurisdictions. The county road system may be supervised as a unit by the board or it may be supervised by three to five units operating independently within one county—each with its own organization, equipment, and funds.

In the towns, or boroughs as they are sometimes called, the mayor-council form of governmental administration is frequently utilized. Responsibility for road control is vested in a street commissioner who may or may not be an elected official.

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[1] U.S., Department of Commerce, Bureau of Public Roads, Highways in the United States, p. 6.

The governing body of the township is an elected group of officials known as a board of supervisors or board of trustees. Townships are frequently subdivisions of counties in the Western states and are generally responsible for the less important local roads not under the jurisdiction of the counties.

As in state administration, major road construction projects are let to contract, but heavy equipment is required for grading, draining, scraping, and other kinds of work necessary to maintain secondary roads. Frequently the local units lack funds to employ competent engineers to supervise the road system; hence, local roads may often be below normal standards and design.

Urban administration

Urban road development and maintenance is usually under the supervision of a superintendent of the city street department who may or may not be a qualified highway engineer. Often the appointment is political. The director is usually responsible to the city mayor or city manager.

With the rapid growth of urban population and the even greater increase in car registrations, city officials, businessmen, and residents have become more aware of the need for better

engineering, planning, and control of the street system, ". . . and there is a noticeable trend in that direction in all places, both large and small."[1]

[1] U.S., Public Roads Administration, Federal Works Agency, Highway Practice in the United States of America, p. 28.

CHAPTER IV

SOURCES AND EXPENDITURES OF HIGHWAY FUNDS

A basic and important activity necessary to the normal and effective operation of most organizations is the function of finance. Even though the financial function includes a wide variety of activities, these can be classified into two major areas —revenues and expenditures. In highway department financial operations the revenue phase of finance concerns itself with sources of funds to support the development of adequate road systems. Since the passage of the Federal-Aid Highway Act of 1956—which provided for the expenditure of more than $101 billion over a thirteen- to fifteen-year period—a great deal of emphasis has been placed upon the revenue phase of the financial function.

Fundamentally, this dissertation concerns itself more with the expenditures aspect of the financial function than with the factor of revenue. Even so, it must be recognized that the two are closely related. Generally speaking, most revenues are

provided through taxation—the tax program being related to needs. Expenditures are determined by needs as well. However, a large number of factors affect the expenditures of funds from the viewpoint of utilization of money expended. Among the more important of these factors are: (1) the effectiveness of financial planning and control of expenditures and (2) the efficiency of the operating units of highway departments. In order that the reader may have a more comprehensive understanding of the sources and expenditures of funds for highways in various governmental units, the following sections are devoted to a discussion of them.

Sources and Expenditures of State Highway Funds

Before the development of the motor vehicle, the principal source of highway revenue had been the property tax, and the funds received from this impost were expended for local roads. An increase in the range of travel resulting from technological improvements in the automobile coupled with a rapid growth in population and a phenomenal increase in car registrations resulted in the need to extend local roads to connect systems in nearby communities and, eventually, to other states. Local sources of revenue were no longer adequate to finance the high-cost road structures and the increased mileage required to carry

the heavier volumes of traffic. In addition, local road authorities did not possess the personnel and the resources necessary to plan, construct, and maintain the ever-expanding road system.

When the states first became concerned with the improvement of highways within their borders, and prior to their assumption of control of certain road systems, their course of action was to provide counties and other local governmental units with financial assistance in their highway programs. Later they relieved local highway authorities of further financial burdens by undertaking the administrative and financial control of the more important intrastate and interstate highways.

Funds for local road improvement provided by the states came almost exclusively from one source of revenue:

> The money for this highway work came from the State general funds, which were largely the receipts of property taxes. By 1906, State and local spending had reached a total of $75 million a year for local roads, and $300 million a year for city streets. Almost all of this money came from property taxes.[1]

As the automobile became popular during the first two decades of the twentieth century, state highway authorities soon recognized the possibility of road user taxes as a source of funds

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[1] U.S., Department of Commerce, Bureau of Public Roads, Highways in the United States, p. 9.

to build and maintain highways. The first motor-vehicle tax was introduced in New York in 1901 in the form of a registration fee.[1] The impost was intended as a purely regulatory fee rather than a source of revenue to support highway improvement programs. By 1925 all states were imposing highway user taxes of one form or another. Today road user taxes provide the state and federal governments with their most important source of revenue for highway use. Property taxes, in turn, have declined in importance in financing the major state highways of the United States.

State highway revenues

Revenues for highway use have been derived primarily from five sources: (1) highway user imposts; (2) road, bridge, and ferry tolls; (3) transfers from local governments; (4) receipts from the issue of bonds, notes, et cetera; and (5) miscellaneous receipts. The data in Table 6 indicate a historical summation of state sources of revenue for highway use covering a period of forty-five years from 1914 through 1958. In all but four states, in 1958, revenues for highway use were assigned to a special highway fund rather than to the state's general

[1]Henry J. Bitterman, State and Federal Grants-in-Aid (New York: Mentzer, Bush and Company, 1938), p. 93.

TABLE 6.—Summary of state highway user revenues and other receipts applicable to highways, by three-year intervals, 1914–1958 (in millions of dollars).

Years	Highway User Revenue						Road, Bridge, and Ferry Tolls	
	Motor Fuel Taxes		Motor Vehicle Registration and Motor Carrier Taxes		Total Highway User Taxes			
	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.
1914–16	–	–	56	22	56	22	–	–
1917–19	1	–	153	33	154	32	–	–
1920–22	19	1	376	29	395	30	–	–
1923–25	264	13	674	35	938	48	–	–
1926–28	751	28	911	34	1,662	62	7	–
1929–31	1,463	37	1,047	27	2,510	64	28	1
1932–34	1,593	43	944	25	2,537	68	46	1
1935–37	2,066	45	1,128	26	3,194	71	61	1
1938–40	2,452	49	1,270	26	3,723	75	84	2
1941–43	2,467	50	1,428	30	3,895	70	108	2
1944–46	2,505	51	1,465	30	3,970	81	136	3
1947–49	4,018	47	2,239	26	6,257	73	195	2
1950–52	5,419	44	3,124	25	8,543	69	318	3
1953–55	7,003	39	4,080	22	11,083	61	531	3
1956–58	8,659	39	4,968	23	13,627	62	898	4
Totals .	38,680	41	23,864	25	62,544	66	2,412	3

TABLE 6—Continued.

Years	Property Taxes		Appropriations from General Funds[a]		Other State Imposts		Funds Received from Bureau of Public Roads and Other Agencies	
	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.
1914–16	69	27	–	–	–	–	–	–
1917–19	64	13	–	–	–	–	14	3
1920–22	162	12	71	5	–	–	219	16
1923–25	63	3	93	4	2	–	259	13
1926–28	49	2	103	4	–	–	240	9
1929–31	35	1	115	3	–	–	390	10
1932–34	23	1	50	1	–	–	717	19
1935–37	5	–	12	–	1	–	833	18
1938–40	7	–	11	–	4	–	597	12
1941–43	6	–	27	1	4	–	476	10
1944–46	2	–	164	3	5	–	299	6
1947–49	1	–	149	2	43	–	1,082	13
1950–52	–	–	77	1	72	–	1,325	11
1953–55	–	–	114	1	82	–	1,799	10
1956–58	–	–	169	1	87	–	4,279	19
Totals .	486	1	1,155	1	300	–	12,529	13

[a]Included with property taxes prior to 1921.

TABLE 6—Continued.

Years	Funds Transpired from Local Government		Receipts[b] from Issue of Bonds, Notes, etc.		Miscellaneous Receipts		Total Receipts
	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.	
1914–16	85	34	42	17	–	–	252
1917–19	181	38	63	13	–	–	476
1920–22	185	14	296	22	15	1	1,343
1923–25	226	12	331	17	39	2	1,951
1926–28	240	9	362	13	38	1	2,701
1929–31	182	5	588	15	45	1	3,893
1932–34	45	1	287	8	32	1	3,737
1935–37	57	1	363	8	28	1	4,554
1938–40	42	1	468	9	32	1	4,968
1941–43	23	–	322	6	38	1	4,899
1944–46	26	1	269	5	39	1	4,910
1947–49	87	1	705	8	53	1	8,572
1950–52	150	1	1,746	14	81	1	12,322
1953–55	231	1	4,097	23	168	1	18,105
1956–58	272	1	2,708	12	268	1	22,308
Totals .	2,032	2	12,647	13	876	1	94,981

Source: U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, Summary to 1955 (Washington: U.S. Government Printing Office, 1960); U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958.

[b]Includes refunding issues.

fund.[1] This assignment enabled state highway authorities to better coordinate their financial programs.

Highway user imposts.—Highway user taxes are special levies, or fees, paid by motor-vehicle users for the utilization of the nation's highways. There are three types of road user taxes: (1) motor-fuel taxes, (2) motor-vehicle registration and associated fees, and (3) special taxes on commercial motor carriers.

Currently the states, the federal government, and certain local political units tax motor fuels. Many states expressly forbid their local governments to impose motor-fuel taxes but do distribute a portion of their revenues from this source to them on some basis generally determined by the state legislature.

> The term "motor-fuel" applies to gasoline and all other fuels coming under the purview of the State motor-fuel tax laws. "Special fuels" include diesel fuel, liquefied petroleum gases, and those known by such names as "tractor fuel" and "power fuel," when they are used to operate vehicles on the highways.[2]

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[1]These states were Delaware, New Jersey, New York, and Rhode Island.

[2]U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958, p. 1.

Motor-fuel taxes on gasoline in the various states range from three to seven cents per gallon for passenger cars and a high of nine cents per gallon, in Kentucky, for trucks or combinations with more than two axles. The variation in tax on diesel fuel is from three cents per gallon in Missouri to nine cents per gallon in New York and Montana. The relative importance of motor-fuel taxes to the states can be determined from Table 6. Over the period of forty-five years motor-fuel taxes have provided the states with 41 percent of their total revenues.

All states require that the many types of motor vehicles using their highways be registered and properly licensed. In 1958 nearly sixty-nine million vehicles, including motorcycles, were registered in the United States.[1] Among the various states, registration requirements of motor vehicles relevant to classification and tax base present a somewhat confusing picture.

> Some states register tractor-semitrailer combinations as a single unit, while others register the tractor and the semitrailer separately. Several states register buses with trucks or automobiles; many states register house and light "utility" trailers with heavy commercial trailers or semitrailers, while others do not require registration of utility trailers. There are numerous variations among the states in the registration of taxicabs, station wagons, and other special types of vehicles.[2]

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[1] Ibid., p. 14.

[2] Ibid., p. 12.

States have not followed a consistent pattern in determining the tax base. "In a few States this basis was the unrealistic 'manufacturers' rated capacity,' and in some it was on variations of net or empty weight, but for the majority, it was gross-vehicle weight."[1]

Other levies associated with registration fees are operator and chauffeur permits, certificate-of-title fees, special titling taxes, and fines and penalties. These latter sources provide a relatively small portion of the total receipts from the registration category.

Because of their relative unimportance as a source of highway revenue, the third type of road user imposts—special taxes on commercial carriers—have been combined with registration fees in Table 6. Several states have enacted laws taxing motor carriers of property and passengers. These imposts generally tax the commercial carrier on the basis of weight, mileage, or gross receipts, or a combination of the three. A description of the various methods applied to motor carriers is presented in a later section of this chapter.

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[1]U.S., Department of Commerce, Bureau of Public Roads, "Estimate of User Taxes Paid by Vehicles in Different Type and Weight Groups," Public Roads, XXVIII, No. 2 (Washington: U.S. Government Printing Office, June, 1954), 19.

The importance of road-user taxes to the states can be determined from Table 6. Over the period of forty-five years 66 percent of all revenues applicable for highway use were derived from these sources. The decline in the contribution of road user taxes from a high of 81 percent in the 1944–1946 period to a low of 61 percent in the 1953–1955 period can be attributed to the increase in borrowing as states accelerated road-building programs subsequent to World War II.

Toll receipts.—Toll charges are special levies imposed upon users of a specific highway facility. In 1958 thirty states maintained toll facilities in the form of bridges, tunnels, expressways, or ferries. Generally the toll is imposed to underwrite the costs of borrowing to construct the toll facility and to provide for maintenance during its useful life. Toll-collection procedures are very costly on many types of structures. Lengthy turnpikes, for instance, require 24-hour maintenance of collection stations at designated entrance-departure gates. Only the most heavily traveled interstate highways are conducive to the toll method of financing.

Although toll receipts provide a small percentage of highway revenue, the data in Table 6 indicate a proportional increase

from 1926 to 1958. It is doubtful whether toll receipts will ever contribute substantially to state highway revenues, since one of the requirements for federal-aid participation prohibits the use of federal funds for the construction or maintenance of toll facilities.

Property taxes.—As a source of funds for state highway use, the property tax has disappeared. Since the property tax is utilized exclusively by local governments, it will be discussed in a later section of this chapter.[1] The data in Table 6 indicate the decline of property taxes in state highway finance. Over the period of forty-five years this source contributed approximately 1 percent of total revenues. Since 1950, property tax contributions to state highway finance have been nil.[2]

Appropriations from general funds and other state imposts.—Appropriations from the general funds of the states are a rather uncommon occurrence. Most states generally direct funds for highway use into special accounts. In 1958 eleven

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[1] See infra, pp. 104–5.

[2] The Bureau of Public Roads publication Highway Statistics has not shown a property tax contribution to state highway revenue since 1950.

states made general-fund appropriations for highway use.[1] Quite frequently general-fund appropriations were used to offset state highway revenues diverted for nonhighway use.

Other state imposts.—This category includes a variety of miscellaneous state levies designated for highway use. Only nine states received funds from such sources in 1958. Among these were included a tax on lubricating oil in Alabama and Louisiana, a sales and use tax in Iowa, Missouri, North Dakota, and South Dakota, oil royalties and severance taxes in Louisiana and Oklahoma, petroleum inspection fees in South Dakota, a capitation tax in West Virginia, and a tax on butane not used in motor vehicles in Mississippi.[2]

Funds from the Bureau of Public Roads and other agencies.—Federal aid as dispensed through the Bureau of Public Roads has been an important source of revenue to the states. Through the requirements set forth in the various federal-aid highway acts, the federal government has acquired a high degree

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[1] U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958, p. 37.

[2] Ibid.

of control over the state systems eligible for participation in the federal programs. In 1956 the federal and state governments entered into an extensive road-building program that has raised federal-aid contributions to greater amounts than in the past. The effect of the Federal-Aid Highway Act of 1956 can be determined in Table 6. The federal contribution in the 1956–1958 interval represents 34 percent of all federal-aid allocations over the entire period of forty-five years.

Funds transferred from local sources.—Counties, towns, townships, and cities enter into cooperative agreements with their state highway departments in road construction and improvement programs. The data in Table 6 indicate the importance of this source of revenue which increased from 1914 to the depression years but declined thereafter.

Borrowed funds.—Borrowing funds for the purpose of carrying out highway programs is a device long practiced by state highway departments. However, its use became more prevalent as state highway officials recognized the predictable stability of road user revenue. Road construction programs could be accelerated by current borrowing. Debt service and bond retirement

were no problem as revenues increased with the ever-expanding production and public demand for the motor vehicle.

Many states have constitutional limitations on the issuance of bonds to provide funds for highway use. Nevertheless, these restrictions are circumvented by many state highway departments by the simple procedure of encouraging local political units to borrow the funds and construct the roads. Subsequently, the roads are taken over by the state highway departments along with the financial obligations, or the states give direct financial assistance to the local governments by paying off the indebtedness.

Administrative philosophy pertinent to the borrowing of funds for highway use varies in state highway departments.

> Those highway administrators who advocated the issuance of State highway bonds contended, with much justification, that the savings to highway users brought about by the acceleration of the road improvement program would more than compensate for the interest charges on the bond issues. More frugal executives in some States insisted on keeping their programs of expenditures within the bounds of current revenues.[1]

State obligations may be classified as to type of security. The latter include (1) the full-faith obligations which are secured by the general taxing power of the state in addition to the pledge

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[1]U.S., Public Roads Administration, Federal Works Agency, Highway Practice in the United States of America, p. 39.

of road user revenue for debt service, (2) limited obligations which are secured by a pledge of road user revenues, highway fund rentals, or lease payments, (3) revenue bonds which are secured only by earnings from the operation of a specific facility, and (4) reimbursement obligations assumed by the state to pay off local governmental units for bonds issued to construct roads subsequently brought under state control.[1]

Miscellaneous receipts.—Interest on highway funds in depositories, receipts from the sale of maps and other similar items, and oil royalties designated for highway use are examples of the miscellaneous grouping. The receipts from this source represent a very small fraction of the total revenues received by states for highway use. Data in Table 6 indicate that these sources have yielded a rather consistent 1 percent of total state highway funds.

State highway expenditures

The data in Table 7 show in some detail the expenditures by state highway departments over a period of forty-five years from 1914 through 1958. Note that the table also includes expenditures for nonhighway purposes.

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[1] U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958, p. 55.

TABLE 7.—Summary of disbursements from state highway user revenues and other receipts applicable to highways, by three-year intervals, 1914–1958 (in millions of dollars).

Years	Expense of Collection and Administration of Highway User Revenue		Disbursements for State-Administration Highways					
			Capital Outlay for Roads and Bridges		Maintenance		Administration, Engineering, Equipment, and Misc.	
	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.
1914–16	4	2	160	63	52	21	16	6
1917–19	13	3	259	54	116	24	39	8
1920–22	19	1	828	65	198	15	79	6
1923–25	34	2	1,082	56	299	15	154	8
1926–28	48	2	1,343	53	426	16	152	6
1929–31	64	2	2,101	54	531	14	116	3
1932–34	80	2	1,677	45	544	14	112	3
1935–37	112	3	1,659	38	633	14	142	3
1938–40	135	3	1,621	33	664	14	163	3
1941–43	140	3	1,196	27	677	14	130	3
1944–46	154	4	922	21	878	20	185	4
1947–49	252	3	3,384	41	1,329	16	352	4
1950–52	332	3	5,216	44	1,665	14	363	3
1953–55	425	3	8,337	50	1,944	12	467	3
1956–58	538	2	12,515	55	2,436	11	665	3
Totals .	2,350	3	42,300	46	12,391	13	3,125	3

TABLE 7—Continued.

Years	Disbursements for State-Administration Highways						Total
	State Highway Police[a]		Interest on Obligation for State Highways		Retirement of Obligation for State Highways		
	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.	
1914–16		–	–	–	1	–	223
1917–19	–	–	–	–	5	1	419
1920–22	–	–	26	2	17	1	1,148
1923–25	1	–	68	3	58	3	1,662
1926–28	3	–	106	4	82	3	2,111
1929–31	10	–	172	5	173	5	3,103
1932–34	22	–	224	6	212	6	2,791
1935–37	44	1	231	5	329	8	3,038
1938–40	75	2	238	5	510	10	3,221
1941–43	94	2	207	4	641	14	2,945
1944–46	98	2	172	4	580	13	2,835
1947–49	179	2	159	2	353	4	5,756
1950–52	264	2	207	2	571	5	8,286
1953–55	365	2	439	3	635	4	12,187
1956–58	527	2	707	3	708	3	17,558
Totals .	1,682	2	2,956	3	4,875	5	67,339

[a]Not segregated prior to 1925.

TABLE 7—Continued.

Years	Expenditures and Fund Transfers for Local Roads and Streets						
	Local Rural Roads		Local City[b] Streets		Debt Service on Highways Obligation		Total
	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.	
1914–16	20	8	–	–	–	–	20
1917–19	48	10	–	–	–	–	48
1920–22	127	10	1	–	–	–	128
1923–25	228	12	4	–	2	–	234
1926–28	367	14	20	1	4	–	391
1929–31	525	14	51	1	11	–	587
1932–34	531	14	60	2	16	–	607
1935–37	681	15	102	2	21	–	804
1938–40	791	16	151	3	24	–	966
1941–43	851	18	161	3	22	–	1,034
1944–46	842	19	155	4	12	–	1,009
1947–49	1,500	18	380	4	46	–	1,925
1950–52	1,879	16	533	5	55	–	2,467
1953–55	2,353	14	756	4	59	–	3,168
1956–58	2,931	13	1,012	4	71	–	4,014
Totals .	13,674	15	3,386	4	343	–	17,402

[b]Not segregated until 1924.

TABLE 7—Continued.

Years	Expenditures and Fund Transfers		Total Disbursements
	For Nonhighway Purposes		
	Amt.	Pct.	
1914–16	–	–	253
1917–19	–	–	480
1920–22	–	–	1,295
1923–25	18	1	1,948
1926–28	28	1	2,578
1929–31	59	2	3,813
1932–34	310	8	3,788
1935–37	484	11	4,438
1938–40	535	11	4,907
1941–43	569	12	4,688
1944–46	337	8	4,335
1947–49	526	6	8,460
1950–52	705	6	11,790
1953–55	858	5	16,638
1956–58	965	4	23,075
Totals .	5,394	6	92,486

Source: U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, Summary to 1955; U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958.

Expense of collection and administration of highway user revenues.—In levying a tax, one of the basic principles to be considered is the ease and economy of collecting the impost. The amounts in this category of expenditures include only the collection and administration expense involved in administering to highway user revenue, such as motor-fuel taxes, registration and associated fees, and motor-carrier levies.

Generally speaking, the costs of collection and administration of motor-fuel taxes are relatively small because the burden of collection, accounting, and reporting the impost is usually placed on either the retailer or the refiner. Costs attributable to registration and associated fees are slightly higher because special facilities and personnel must be provided for collection of the levies. Most motor-carrier taxes entail high costs of collection and administration, as port-of-entry stations at various state border points must be maintained to enforce payment of the tax by commercial truckers.

Disbursements for state-administered highways.—Disbursements for state-administered highways represent the outlay of funds for construction, maintenance, policing, administration, equipment, debt service, and other services of the state highway

systems. The most important area of expenditures in this category is capital outlay for roads and bridges. Study of the data in Table 7 indicates that an average of 46 percent of total expenditures from highway funds are allocated to the construction of roads and bridges over the period 1914–1958. The depression and war years resulted in drastic cuts in capital outlay on the nation's roads and bridges. A cutback in road-building expenditures during the war years, coupled with an unusually large increase in car registrations subsequent to World War II, created a construction lag that state, federal, and local highway officials are currently striving to overcome.

It is apparent from a study of the data in Table 7 that maintenance expenditures, percentagewise, have remained at a rather constant level—13 to 14 percent over the period of forty-five years. The effect of low construction outlays during the 1944–1946 period was partially offset by greater maintenance effort and expenditure. An important but not so obvious trend in maintenance should be emphasized.

Although maintenance costs have tended to stabilize at 13 to 14 percent, there has been an increase in total road mileage and in the mileage of surfaced roads. In addition, roads have been constructed to higher standards, requiring greater maintenance

outlays, and more costly modern methods of maintenance practice and equipment are being utilized. The rising price level has also created problems in establishing maintenance budgets. Yet, in the last eight years a proportionally smaller amount has been appropriated by the states for maintenance of their highways.

Unless proper consideration is given to maintenance in the future, state highway departments may find their current efforts falling far short of the short- and long-run objectives. At present, the justification for such action can possibly be attributed to the following factors:

1. Emphasis is on construction to bring the highway systems up to prescribed standards, especially the costly interstate system of roads.

2. Highway officials are concerned with contributing increasing amounts of limited revenue to match federal-aid funds for construction.

3. State highway officials are planning on a short-term basis rather than giving proper consideration to long-term ramifications of maintenance.

Over the period of forty-five years an average of 3 percent of highway revenue has been utilized for state highway administration, engineering, and equipment costs. This would seem to be a relatively small amount of total revenues for such important functions. State highway departments maintain extensive engineering staffs to determine highway location, design, and

many other preconstruction functions prior to letting the contracts to private construction companies. Equipment costs are primarily for items used in road maintenance.

Highway revenues are used to operate highway police departments in all states. The cost of maintaining this important function has averaged approximately 2 percent of total highway expenditures since 1935.

Interest on obligations issued for use in state highway programs, and funds used to retire highway obligations, have averaged 8 percent of total highway expenditures over the period of forty-five years. It is apparent from Table 7 that states retired a substantial amount of their indebtedness during the last war when they were unable to expend funds on new construction and improvement of their highways. This reduction in outstanding debt also reduced the interest charges the states were paying out of highway funds. Financially, this reduction in principal and interest on obligations left the highway departments in a better position to accelerate their construction programs subsequent to World War II.

Expenditures and fund transfers for local roads.—Most states have passed legislation requiring the distribution of

revenues from various sources to rural and city governments. For example, during the period 1942–1951 the states transferred $3,651 million to local rural units. This amount provided 46 percent of total receipts to these local units. Of this total transferred by the states to local rural units, 94.5 percent came from highway user imposts and 5.5 percent came from other state sources such as sales, severance, liquor, cigarette, chain store taxes, and other miscellaneous imposts.[1] From Table 7 it can be determined that an average of 19 percent of total state expenditures has been in the form of distribution to local and city governments over the period of forty-five years.

Expenditures and fund transfers for nonhighway purposes.— Of total revenues available from highway user imposts and other sources, expenditures and fund transfers for nonhighway use have averaged 6 percent over the period studied. These allotments represent transfers to state or county general funds, allocations for the purpose of education, retirement of nonhighway debt, and miscellaneous purposes. Transfers to state general funds do not

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[1]U.S., Department of Commerce, Bureau of Public Roads, The Financing of Highways by Counties and Local Rural Governments, 1942–51 (Washington: U.S. Government Printing Office, 1955), p. 16.

necessarily represent a diversion of highway funds as the states offset such transfers with general-fund appropriations for highway use.

Study of data in Table 7 reveals that average annual receipts over the period from 1914 through 1958 amounted to $2,110 million, while average annual expenditures were $2,055 million. Of total revenues and expenditures over the same period, approximately 55 percent were received and disbursed during the nine-year period from 1950 through 1958.

Sources and Expenditures of Local Government Highway Funds

Although this dissertation is primarily concerned with state highway finance, the reader should have a basic understanding of the relationship of revenue sources and expenditures by the local and federal governments. For this reason a cursory examination of these facets is included in this chapter.

Funds availbable to local rural units

The data in Table 8 indicate the annual receipts from various sources and the percent of annual revenues for a four-year period from 1954 through 1957. The revenue sources are divided into five major categories: (1) local revenue sources,

TABLE 8.—Receipts of the local rural units for highway use, by source of revenue, 1954–1957 (in millions of dollars).

Source of Revenue	1954		1955		1956	
	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.
Local revenues:						
Property taxes:						
Road and bridge levies	414	30	428	28	454	30
Special assessments	6	–	10	–	10	–
From general funds	106	8	101	7	107	7
Local highway user imposts	4	–	4	–	13	1
Tolls	14	1	15	1	42	3
Miscellaneous	39	3	47	3	42	3
Transfers from urban places	1	–	1	–	1	–
Transfers from state:						
Highway user imposts	627	47	651	43	698	46
Other	28	2	27	2	29	2
Transfers from federal government	18	1	16	1	21	1
Borrowings:						
Long-term	100	7	213	14	104	7
Short-term	13	1	16	1	23	2
Totals	1,370	100	1,529	100	1,517	100

TABLE 8—Continued.

Source of Revenue	1957		Total Receipts	
	Amt.	Pct.	Amt.	Pct.
Local revenues:				
Property taxes:				
Road and bridge levies . .	472	29	1,768	29
Special assessments	11	–	37	1
From general funds	111	7	425	7
Local highway user imposts	16	1	37	1
Tolls	16	1	60	1
Miscellaneous	42	3	170	3
Transfers from urban places . .	1	–	4	–
Transfers from state:				
Highway user imposts	753	47	2,729	45
Other	26	2	110	2
Transfers from federal government	27	2	82	1
Borrowings:				
Long-term	123	7	540	9
Short-term	18	1	70	1
Totals	1,616	100	6,032	100

Source: U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1954 (Washington: U.S. Government Printing Office, 1956); idem, Highway Statistics, 1955 (Washington: U.S.G.P.O., 1957); idem, Highway Statistics, 1956 (Washington: U.S.G.P.O., 1958); idem, Highway Statistics, 1957 (Washington: U.S.G.P.O., 1959).

(2) transfers from urban places, (3) transfers from the states, (4) transfers from the federal government, and (5) borrowing. In those cases where the source has been explained in preceding sections of this chapter, further discussion of the revenue source will not be made.

Local revenue sources.—Rural units receive their funds from five local sources: (1) property taxes, (2) general funds, (3) local highway user imposts, (4) toll receipts, and (5) miscellaneous sources. Of the local sources available for highway use, property taxes have provided the greatest amount of revenue.

For highway revenue purposes, property taxes of two types are imposed: (1) general levies on real or personal property, and (2) special assessments. Of the two types, the former provides the rural governments with the greatest amount of revenue from this source. The theory supporting the property tax for highway purposes is based on the principle of predominant use. Under this theory, if the road or street benefits the community in general, the construction funds would be derived from general property taxes. However, when the highway is assumed to benefit a few rather than the public at large, its cost may be borne entirely, or in part, by those few who receive

the greatest benefit from it—an example of a special assessment. Buehler defines the special assessment as "a compulsory charge on selected property for a particular improvement which presumably benefits the owner of the selected property and which is also undertaken in the interests of the public."[1]

Since 1931 property taxes have provided approximately 30 percent of total revenues available for highway use by local rural units.[2] The importance of special assessments, as apparent in Table 8, was negligible over the four-year period from 1954 through 1957; such assessments furnished only 1 percent of total revenue.

Some thirteen states make special provision for local rural units to collect highway user imposts of one variety or another. The data in Table 8 indicate that revenues collected by local rural units from such sources are relatively insignificant; they accounted for only about 1 percent of total receipts during the period covered by the data. Receipts from toll facilities

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[1]Alfred G. Buehler, Public Finance (New York: McGraw-Hill Book Company, Inc., 1948), p. 526.

[2]U.S., Department of Commerce, Bureau of Public Roads, The Financing of Highways by Counties and Local Rural Governments, 1942–51, p. 16.

maintained and operated by local rural units supplied $60 million over the four-year period. This amount is also relatively insignificant since it was approximately 1 percent of total revenues during the period.

Miscellaneous sources provided local rural units with $170 million over the four-year period. Miscellaneous receipts include revenues derived from fines, interest on funds in depositories, and road-poll taxes.

Appropriations from general funds have supplied the local rural units with 7 percent of revenues for highway use over the four-year period. The most significant thing about this source is that the general funds of the local units may be partially composed of funds derived from property taxes. Therefore, property taxes, also used in rural highway construction and maintenance, are enhanced as a source of revenue.

Transfers from urban places.—Transfer of funds from urban places represents receipts from the latter for goods and services provided by the rural governments, and for cooperative projects undertaken by the two governmental units. Analysis of the data in Table 8 indicates that this source of revenue has been insignificant in rural highway finance over the four-year period from 1954 through 1957.

Transfers from federal government.—The amounts shown in Table 8 for this category of local receipts do not include federal-aid contributions made to the states for construction and improvement of local roads in the state secondary systems. It consists of "national forest earnings apportioned to counties, payments in lieu of taxes, and other miscellaneous receipts."[1]

Borrowing.—Highway obligations issued by local rural units are of two types: (1) long-term bonds and (2) short-term warrants, or notes. From the data in Table 8 it can be determined that funds received from the issuance of local rural obligations provided 10 percent of total revenues over the four-year period.

Local rural unit highway expenditures

The data in Table 9 indicate the expenditures by local rural units during a four-year period from 1954 through 1957. Intergovernmental transfers of funds present a rather confusing picture. Transfers to states represent funds paid to the latter for cooperative programs on local rural roads, while disbursements for state highways are generally the counties' share of

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[1] Ibid., p. 22.

TABLE 9.—Disbursements by local rural units for highways, by object of expenditures, 1954–1957 (in millions of dollars).

Object	1954		1955		1956	
	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.
Local rural roads:						
Capital outlay						
Maintenance, miscellaneous	1,124	82	1,175	83	1,262	84
Interest	28	2	28	2	31	2
Transfers to states	24	2	31	2	27	2
Debt retirement . .	103	8	102	7	106	7
State highways	42	3	48	3	46	3
Urban streets	35	2	31	2	30	2
Nonhighway purposes	13	1	14	1	7	—
Totals	1,369	100	1,429	100	1,509	100

TABLE 9—Continued.

Object	1957		Total Disbursements	
	Amt.	Pct.	Amt.	Pct.
Local rural roads:				
Capital outlay				
Maintenance, miscellaneous	1,320	83	4,881	83
Interest	32	2	119	2
Transfers to states	36	2	118	2
Debt retirement	111	7	422	7
State highways	50	3	186	3
Urban streets	46	3	142	2
Nonhighway purposes	9	—	43	1
Totals	1,604	100	5,911	100

Source: U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1954; idem, Highway Statistics, 1955; idem, Highway Statistics, 1956; idem, Highway Statistics, 1957.

funds required to participate in the state federal-aid secondary road programs.

> Disbursements by the local rural units for city streets are of two kinds: Reimbursed expenditures for capital outlay and maintenance, and transfers to the incorporated places for streets. The latter consist largely of property taxes for county roads and bridges which are shared with the incorporated places, and state aids for city streets distributed to incorporated places via the counties.[1]

Study of the data in Table 9 reveals that a substantial portion of local rural unit disbursements—83 percent— was for capital outlay and maintenance over the four-year period. Seven percent of total expenditures, or $422 million, was expended for the retirement of local obligations.

Urban receipts and expenditures

Data pertinent to receipts of urban governments for street and road use are contained in Table 10, while expenditures of these political units are shown in Table 11. Basically, the only difference between urban and rural sources of revenue is that the former include revenue derived from parking meter fees.

The data in Table 10 indicate that four sources provided 86 percent of total revenue for urban roads over the four-year

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[1] Ibid., p. 10.

TABLE 10.—Receipts of urban places for highways, by source of revenue, 1954–1957 (in millions of dollars).

Source of Revenue	1954		1955		1956	
	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.
Local revenue:						
Property taxes:						
Street, bridge levies	145	11	153	10	159	10
Special assessments	77	6	87	6	99	6
From general funds	390	30	419	28	444	29
Local highway imposts	49	4	56	4	57	4
Tolls	43	3	46	3	49	3
Parking meter fees	24	2	23	2	27	2
Miscellaneous	48	4	54	4	65	4
From local rural funds	13	1	18	1	20	1
Transfers from state:						
Highway user imposts	226	17	239	16	253	16
Other	7	—	4	—	11	1
Transfers from federal government	1	—	—	—	—	—
Borrowing:						
Long-term	260	20	338	23	314	21
Short-term	32	2	47	3	51	3
Totals	1,315	100	1,484	100	1,549	100

TABLE 10—Continued.

Source of Revenue	1957		Total Receipts	
	Amt.	Pct.	Amt.	Pct.
Local revenue:				
Property taxes:				
Street, bridge levies	228	13	685	11
Special assessments	105	6	368	6
From general funds	414	24	1,667	27
Local highway imposts	68	4	230	4
Tolls	52	3	190	3
Parking meter fees	29	2	103	2
Miscellaneous	58	3	225	4
From local rural funds	29	2	80	1
Transfers from state:				
Highway user imposts	282	17	1,000	17
Other	23	1	45	1
Transfers from federal government	1	—	2	—
Borrowing:				
Long-term	376	22	1,288	21
Short-term	60	3	190	3
Totals	1,725	100	6,073	100

Source: U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1954; idem, Highway Statistics, 1955; idem, Highway Statistics, 1956; idem, Highway Statistics, 1957.

TABLE 11.—Expenditures by urban places for highways, classified by object of expenditures, 1954–1957 (in millions of dollars).

Object of Expenditures	1954		1955		1956	
	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.
Urban streets:						
Capital outlay, maintenance . . .	957	77	1,051	78	1,189	78
Interest	49	4	52	4	47	3
Transfers to state	1	–	2	–	1	–
Transfers to local rural units	2	–	1	–	2	–
Debt retirement . .	193	16	180	13	220	15
State highways	23	2	38	3	33	2
For local rural roads	–	–	–	–	–	–
Nonhighway disbursements	18	1	22	2	30	2
Totals	1,243	100	1,346	100	1,522	100

TABLE 11—Continued.

Object of Expenditures	1957		Total Expenditures	
	Amt.	Pct.	Amt.	Pct.
Urban streets:				
Capital outlay, maintenance	1,289	77	4,486	77
Interest	57	3	205	4
Transfers to state	3	–	7	–
Transfers to local rural units . .	2	–	7	–
Debt retirement	264	16	857	15
State highways	49	3	143	3
For local rural roads	–	–	–	–
Nonhighway disbursements	18	1	88	1
Totals	1,682	100	5,793	100

Source: U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1954; idem, Highway Statistics, 1955; idem, Highway Statistics, 1956; idem, Highway Statistics, 1957.

period from 1954 through 1957: (1) property taxes furnished 17 percent of the total; (2) transfers from the states, 18 percent; (3) general funds, 27 percent; and (4) long- and short-term borrowing, 24 percent.

Expenditures recorded in Table 11 indicate that the greatest amount of funds—$4.5 billion, or 77 percent of total expenditures—was spent on capital outlay and maintenance. The second largest appropriation of funds by urban units—approximately $857 million, or 15 percent of total expenditures—was devoted to the retirement of obligations.

Sources and Expenditures of Federal Government Funds

The practice of the federal government granting aid to individual states for construction and improvement of highways dates back to the enactment of the Federal-Aid Road Act of 1916. Prior to that time federal aid had been in the form of direct appropriations for the construction of the National Pike from Maryland to the Ohio River and the territory beyond.

> From 1916 up to and including the fiscal year 1957, Congress has authorized a total of $9,010,000,000 in regular Federal-aid grants (as well as additional amounts of $1,868,100,000 for collateral Federal road building activities). Regular Federal-aid funds in the period 1921 to 1954 have averaged approximately 15.1 per cent of all

highway construction expenditures in the United States by all levels of government and approximately 8.4 per cent of all highway expenditures.[1]

Federal revenues

The federal government currently taxes motor fuels at the rate of four cents per gallon for gasoline and special fuels (diesel, butane, propane, et cetera). Lubricating oil is taxed at six cents per gallon. In addition, the federal government imposes excise taxes on various vehicles and automotive accessories. Automobiles, buses, trucks, and trailers (housetrailers exempted) are taxed at the rate of 10 percent of the manufacturer's sale price, and automotive parts and accessories at 8 percent of the manufacturer's sale price.

Levies of eight cents and nine cents per pound are placed on tires and tubes, respectively. The excise tax on tread rubber is three cents per pound. The federal government also imposes a motor-vehicle use tax of $1.50 per 1,000 pounds on motor vehicles whose gross weight is in excess of 26,000 pounds.[2] The

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[1] National Highway Users Conference, Federal-Aid for Highways (Washington: National Highway Users Conference, 1956), p. 3.

[2] An article in the editorial sections of the Laramie Daily Boomerang, March 7, 1961, inferred that President Kennedy was considering newer, stiffer levies on the larger motor carriers using the roads.

data in Table 12 indicate the yield of these sources over a period of twenty-seven years from 1932 through 1958. Motor-fuel levies and excise taxes on automobiles (motorcycle taxes were repealed in 1955) have provided approximately 74 percent of all revenues received by the federal government from highway sources.

A comparison of total federal revenues to total federal expenditures for highway use over the period covered in the table reveals that approximately $33.5 billion were received and $12 billion were spent on highways. Approximately $21 billion, or 62 percent of the total federal revenues from road user sources, were diverted from highway use and placed in the general funds of the Treasury for nonhighway purposes.

Federal expenditures

Table 13 contains data relevant to federal highway expenditures classified by outlay on various road systems. It is apparent from the data that the bulk of federal highway expenditures have been made on the federal-aid systems. More than $10 billion—or 84 percent of the total expenditures—were allocated to the federal-aid systems of the period of twenty-seven years from 1932 through 1958. Of this amount, $4.3 billion were devoted to state primary systems, $2.1 billion were expended on

TABLE 12.—Federal revenue from taxes on motor fuel, lubricating oil, motor-vehicle use tax, and excise taxes on vehicles and automobile products, by three-year intervals, 1932–1958 (in millions of dollars).

Years	Motor Fuel						Lubricating Oil	
	Gasoline		Highway Special Fuel		Total			
	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.
1932–34	414	68	–	–	414	68	54	9
1935–37	562	58	–	–	562	58	91	9
1938–40	698	63	–	–	698	63	95	9
1941–43	973	54	–	–	973	54	134	7
1944–46	1,167	50	–	–	1,167	50	237	10
1947–49	1,460	39	–	–	1,460	39	238	6
1950–52	2,056	38	15	–	2,071	38	224	4
1953–55	2,749	36	63	1	2,812	37	208	3
1956–58	4,320	44	119	1	4,439	45	217	2
Totals	14,399	43	197	1	14,596	45	1,498	4

TABLE 12—Continued.

Years	Motor Vehicle Use Tax		Automobile and Motorcycle		Trucks, Buses, and Trailers		Parts and Accessories	
	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.	Amt.	Pct.
1932–34	–	–	58	10	9	1	12	2
1935–37	–	–	163	17	23	2	25	3
1938–40	–	–	152	14	21	2	28	2
1941–43	344	19	129	7	29	2	69	4
1944–46	253	11	118	5	85	3	101	8
1947–49	–	–	969	25	325	9	344	9
1950–52	–	–	1,744	32	431	8	416	8
1953–55	–	–	3,081	41	485	6	435	6
1956–58	88	1	3,349	34	593	6	475	5
Totals .	685	2	9,763	29	2,001	6	1,985	6

TABLE 12—Continued.

Years	Tires and Tubes		Tread Rubber		Total Amount
	Amt.	Pct.	Amt.	Pct.	
1932–34	60	10	–	–	607
1935–37	106	11	–	–	970
1938–40	113	10	–	–	1,107
1941–43	129	7	–	–	1,807
1944–46	301	13	–	–	2,342
1947–49	476	12	–	–	3,812
1950–52	521	10	–	–	5,407
1953–55	501	7	–	–	7,522
1956–58	697	7	30	–	9,888
Totals .	2,904	8	30	–	33,462

Source: U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958.

TABLE 13.—Expenditures by the federal government on highway systems, by three-year intervals, 1932–1958 (in millions of dollars).

Years	Federal Aid					
	Primary	Secondary	Grade Crossing	Urban	Interstate	Total
1932–34	370	–	–	–	–	370
1935–37	250	–	–	–	–	250
1938–40	350	65	120	–	–	535
1941–43	315	50	70	–	–	435
1944–46	225	150	–	125	–	500
1947–49	450	300	–	250	–	1,000
1950–52	628	420	–	350	–	1,398
1953–55	720	480	–	400	50	1,650
1956–58[a]	1,027	667	–	543	1,604	3,841
Totals .	4,335	2,132	190	1,668	1,654	9,979

[a]Expenditures for 1958 were taken from U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1958, p. 140. Expenditures in certain categories were classified in a slightly different manner from that in National Highway Users Conference, Federal-Aid for Highways. However, the federal-aid classifications were similar and no distortions should be evident in these important categories.

TABLE 13—Continued.

Years	Public Works	Defense High-ways	Forest High-ways	Public Lands	Total
1932–34	1,000	–	38	7	1,415
1935–37	–	–	21	5	276
1938–40	–	–	25	6	566
1941–43	–	320	14	5	774
1944–46	–	30	25	–	555
1947–49	–	–	25	–	1,025
1950–52	–	95	60	10	1,563
1953–55	–	–	65	5	1,720
1956–58	–	–	76	19	4,071
Totals .	1,000	445	349	57	11,965

Source: National Highway Users Conference, Federal-Aid for Highways, p. 9.

state secondary roads, and $3.2 billion were divided equally between urban extensions of state systems and to the interstate system.

During the depression of the 1930's the federal government expended $1 billion on public works programs affecting the nation's highways. These expenditures were a part of the federal government's program to inject purchasing power into the economy as an antideflationary measure.

The federal government expended funds for defense highways during the war years, 1941–1946 and 1950–1952, authorized through special appropriations by Congress. To construct and maintain its road systems in forest and public lands the federal government has expended approximately $406 million over the period of twenty-seven years.

Federal-aid funds are apportioned among the various states according to formulas established by law. Federal legislation further prescribes that an amount not in excess of 3.75 percent of the apportionment can be utilized for expenses of state highway administration and for conducting research in areas pertinent to highway construction and development.

Formulas for apportioning funds among the states utilize three factors in their computation: (1) population,

(2) land areas, and (3) mileage of rural mail routes in each state.[1]

The basis for the apportionment differs slightly for the various state highway systems:

1. Primary system funds are prorated one-third in the ratio of which the land areas of each state bears to the total land area of all states, one-third in the ratio which the population of each state bears to the total population of all states, and one-third in the ratio which the mileage of rural delivery routes in each state bears to the total rural delivery routes of all states. Each state receives at least 0.5 percent of each year's apportionment.

2. Secondary system apportionments are the same as those of the primary except that rural population is substituted in the formula for total population.

3. Urban system funds are apportioned in the ratio which the population of municipalities and other urban areas of 5,000 or more persons in each state bears to the total population in municipalities and other urban areas of 5,000 or more people in all states.

4. Interstate funds are allocated one-half in the ratio of the population of each state to the total population of all states and one-half in the manner as designated for the primary system. Each state receives at least 0.75 percent of the funds apportioned for the interstate system.[2]

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[1]National Highway Users Conference, Federal-Aid for Highways, p. 11.

[2]For a more detailed description of apportionment, see Gilman G. Udell, Laws Relating to Federal Aid in Construction of Roads (Washington: U.S. Government Printing Office, 1958), p. 247.

Federal and state matching of funds.—Federal law requires states to share in the cost of projects designated for federal-aid participation. For the federal-aid primary, secondary, and urban extensions the basis for matching is 50–50, whereby the states contribute $1.00 for each $1.00 of federal-aid funds. On the interstate system the basis for matching funds is 90–10, with the federal government contributing 90 percent to the states' 10 percent.[1] An exception to the matching procedure has been provided for states having large areas of unappropriated and unreserved public lands and nontaxable Indian lands.[2]

Where such land is greater than 5 percent of the total land area the federal government share of the cost is increased accordingly. For example, Wyoming has a substantial portion of Indian reservation and public lands within its borders. For the adjusted 50–50 basis of matching for its primary system, the federal government contributes 64.34 percent and the state of Wyoming

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[1]The federal government matches 90 percent of the interstate costs to 10 percent for the states because of the extremely high cost of the system and the urgency involved in completing it. If the states shared a greater cost in constructing the interstate system it would tie up a major portion of their construction funds to the detriment of other state highway systems.

[2]National Highway Users Conference, Federal-Aid for Highways, pp. 13–14.

contributes 35.66 percent. For Wyoming's interstate system the federal government contributes approximately 94 percent of the total cost of construction.[1]

Theories of Highway Taxation

The allocation of the tax burden to acquire funds for the construction and maintenance of our highways is a complex and controversial procedure. Since this dissertation is primarily concerned with the financial planning and control of expenditures, only a cursory examination of the broad, general problems of highway taxation can be made.

Taxation for highway purposes has been predicated primarily on the benefit theory, even though benefits received from highway facilities are extremely difficult to measure. Another major theory—"ability to pay"—has not been important as a means of determining highway tax responsibilities.

The benefit theory is based on the principle that "all the expenses of government should be apportioned among those receiving them according to the costs incurred in rendering a particular service to each person, or according to the amount

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[1] Ibid.

or the value of the benefits obtained from every service by each person."[1]

Prior to the development of the automobile as an instrument for long-distance transportation, roads were designed and constructed for local use. Financing the road system was a relatively simple procedure of placing the tax burden on the property owner.

With the technological improvement of the automobile and its companion, the truck, tax problems of a more complex nature were created. The need for greater road mileage, and new concepts in highway construction and maintenance to service the heavier, faster, and increasing numbers of motor vehicles made necessary changes in thought pertinent to financing and administering highways. A broader perspective was required to plan for highway construction, and new sources of revenue were needed to finance highways. No longer could the counties and cities provide the necessary funds to construct and maintain the road system.

Out of this need for an expanded highway system has developed a theory of taxation commonly referred to as the benefit

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[1]Buehler, p. 318.

principle. Today the highway beneficiaries are providing the bulk of the funds used in constructing and maintaining the nation's highways.

The benefit principle and highway finance

The application of the benefit principle to highway finance leaves much to be desired. So wide, varied, and changing are the benefits accruing to individuals and organizations that accurate measurement makes an equitable distribution of tax burdens almost an impossibility. In some manner or another, the highways affect the existence of every person residing in the United States.

Political benefits.—Governments at all levels use the highway as a means of acquiring efficiency and cohesiveness in the conduct of their affairs. In turn, the road system provides the means by which the public receives the benefits of government service. An example of a recent change in highway benefits can be found in the national defense picture and the interstate system that arose as a result of this demand.

Economic benefits.—The importance of the highway as a factor in the development of our economic system which encompasses the individual, the business organization, and the state is

a topic that exceeds the quantity limitations of this dissertation. A brief list of the more important benefits accruing to the individual, business firm, and the state from the highway system is as follows:

1. By opening up new or isolated areas to commercial truckers, roads bring lower prices to the consumers and are instrumental in breaking down local and regional monopolies.

2. Roads encourage greater specialization of labor by providing one of the means for greater mobility of the worker to search for employment within an expanding radius of his home.

3. Greater mobility broadens business contacts and increases individual income.

4. Land values experience a substantial increase in those areas serviced by improved roads.

5. The highway permits an extension of the markets of farm, ranch, and manufacturing units which may result in increased profits, greater employment, lower prices, and many other attendant benefits.

6. Some of the greatest industries in the nation benefit from better highways. Automobile manufacturers, petroleum producers and refineries, and a multitude of other producers and suppliers are dependent on public highways and, in turn, contribute to the wealth of the economic society.

7. Commercial carriers benefit directly from improved roads as they schedule their fleets over the nation's highways.

8. New industries have been created to cater to the needs, desires, and comfort of the highway user.

9. National resources of the state and nation are more effectively developed by adequate road systems.

Other beneficiaries.—The public in general attains a higher cultural, educational, social, political, and recreational level because of improved road systems.

In the light of the aforementioned, but not exhaustive list of highway beneficiaries, the problem of equitable and just tax allocation becomes evident. If the data in the revenue tables are correct, it is the road user who is bearing the greater burden of highway taxation. Indirect beneficiaries are contributing very little to the construction and maintenance costs of highways. Basically, the problem is a dual one with each side of the picture rife with complications. First, the problem is one of determining what portion of the highway cost is to be borne by the user and nonuser beneficiaries of the highway system. Second, the problem of allocating the cost among the users on some equitable basis is encountered.

User and nonuser roles in highway finance.—The user role occurs when a person or firm actually moves vehicles over the highways. The nonuser benefits from the movement of vehicles

by others, or benefits from the highway by its providing egress and ingress to his property.

Locklin[1] suggests two methods in allocating responsibilities between the user and nonuser beneficiaries. The two techniques are: (1) the predominant-use method, and (2) the relative-use method. Both methods recognize that highways serve three basic functions. First, highways provide a means of access to land. Without access, lands are assumed to be valueless. Second, the roads perform a "community service function." Highways provide a means for the movement of local travel as the resident of the community goes about his everyday affairs in economic, social, educational, and cultural activities. Traffic is strictly local in the second function. Third, it is a function of highways to provide the means for long-distance travel between communities and states.

Applying the predominant-use method in the light of the above functions, those systems carrying traffic from community to community or from state to state would be financed entirely from road-user taxes. Converted to highway administrations, the

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[1]D. Philip Locklin, Economics of Transportation (Homewood, Ill.: Richard D. Irwin, Inc., 1954), pp. 659–61.

predominant-use method would have the state highway systems—primary, interstate, and state secondary—supported by road-user taxes. County, town, township, and urban road systems, except for urban and municipal extensions under control of the states, would be financed from local revenue.

The relative-use method does not provide for such a sharp distinction between the use of the highway systems. Basically, all highways serve the three functions in some manner, and all highways should, therefore, be financed from both general taxes and road-user imposts on some equitable basis. Currently this theory seems to be the most popular among highway authorities. It recognizes that much of the traffic on intercommunity and interstate roads comes from local feeder roads channeling traffic onto the major highways. Most travel is of a short-distance nature, even on interstate highways.[1] Therefore, much of the travel on all highway systems may be of a local nature.

> The relative-use theory was adopted by the Federal Coordinator of Transportation in his study of public aids to domestic transportation. The Board of Investigation and Research study, made a few years later, also adopted this theory. The Federal Coordinator considered that, for the years 1933–37, motor-vehicle taxes might properly contribute

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[1] A more detailed discussion can be found in Association of American Railroads, Highways, p. 22.

> 85 per cent of the cost of state highways, 34 per cent of the cost of county and local roads, and 30 per cent of the cost of city streets. The Board of Investigation and Research study assigned to motor vehicles 85 per cent of the annual costs of the primary highway system, 30 per cent of the cost of secondary and local roads, and 40 per cent of the costs of city streets. Other studies have assigned still different proportions of highway costs to the highway user.[1]

Various studies on highway cost allocation between users and nonusers conducted by highway authorities have modified the two methods to fit the peculiarities of highway travel in their states. The Rocky Mountain states with large land areas and small populations have tax-allocation problems not entirely similar to those of the highly populated and smaller land area states.

Allocation of Highway User Tax Responsibility

Once an equitable distribution of taxation is determined for user and nonuser beneficiaries of the highways, a new and equally difficult problem is encountered—the allocation of the user share of highway costs among the different types of vehicles using the roads.

This process is not as simple as one would imagine, for it involves conflicts between various groups of highway users:

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[1] Locklin, p. 661.

commercial carriers versus passenger automobiles, and commercial carriers in competition with the railroads. The problem is too involved to enter into an extensive discussion. However, several methods of user cost allocation will be discussed briefly; they are: (1) the ton-mile method, (2) the incremental cost technique, and (3) other methods.

The ton-mile allocation of user tax responsibility

The ton-mile calculation is used more than any other method for distributing tax responsibility among highway users. Fundamentally, the ton-mile method is based upon the benefit theory.

> The underlying philosophy is that each user of the highways should pay for the benefits he receives from them. It is asserted that the product of weight times distance is a measure of these benefits; of the value of service rendered by the highway facility. Although there is no way of proving that the product is a direct measure of such value, it is obvious that the transportation of weight does provide monetary remuneration to a large segment of the motor-vehicle population—notably all trucks and buses.[1]

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[1] Montana State Highway Department, Financing Modern Highways for Montana, A Report on Highway Finances Prepared for the Montana Fact Finding Committee on Highways, Streets and Bridges (Helena: Montana State Highway Department, 1956), p. 34.

A ton-mile is defined as the movement of one ton over one mile. The ton includes both the weight of the vehicle and the weight of the load being transported. The cost per vehicle-mile increases with the weight of the truck, as would be expected. A constant tax is applied to the product of weight times distance. The ton-mile theorists claim the method results in equitable charges based on value received. They contend that it measures the two important factors of highway cost—weight and wear.

Conversely, many highway financial experts condemn it as an inequitable method of distributing tax responsibilities. They contend that it results in a maximum tax assignment against larger motor vehicles while automobiles utilized for business and pleasure escape the ton-mile tax.

Incremental cost allocation of user tax responsibility

While the ton-mile concept supposedly allocates tax responsibility on the basis of benefits received, the incremental method would attempt to charge road users according to the costs occasioned by that particular type of vehicle.

> The incremental method involves an engineering determination of the cost that vehicles of different sizes and weights incur on the highway structure, and on the geometrics of highways as gradient and curvature. It is fairly obvious that a heavy truck requires a thicker pavement

> structure to support its weight than a light truck or passenger car, and the additional thickness is measurable to a reasonable degree of accuracy.[1]

The first step involved in this process would be to determine the cost of constructing a highway to withstand the elements, and to carry the ordinary light passenger car traffic. The cost of this basic highway would then be assigned equally to all vehicles on the basis of vehicle-miles operated on the highway. If a type of vehicle requires a change in the standards and design of the road structure due to its weight, width, or speed, then that class of vehicle will be assessed the incremental costs in excess of the basic road cost requirements to construct the more expensive roadway.

The incremental method has gained a wide acceptance among students of highway finance as the most equitable method of assigning tax responsibilities. Studies are now underway in various states gathering engineering data necessary to a national cost distribution among the types of vehicles using the highways. In the past, most incremental cost studies have made recommendations assigning a proportionally smaller tax responsibility to

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[1] Ibid., pp. 37–38.

heavier vehicles than those proportions recommended by ton-mile studies.

Other methods of tax allocation among highway users

Several states tax commercial carriers on the basis of the dollar value of the load being transported. This gross-receipts tax is the equivalent of a highway use sales tax.

Another method involves the distribution of tax responsibility according to the operating cost of the vehicle using the road.

> Since highways are used for commercial purposes and for private purposes which have economic values, there appears to be a great attraction in the attempt to allocate tax responsibility on the basis of value received by the highway user.
>
> It is this reasoning which underlies the operating-cost theory proposing that motor-vehicle operating costs, which rise steadily with size of vehicle, may be taken as a measure of the value of service provided and therefore as a basis for assignment of road user tax responsibility.[1]

At present no commonly accepted solution to the problem of allocation or road-user tax responsibility has been derived. With so many vested interests involved in the controversy it is

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[1] William A. Bresnahan, Who Should Pay How Much of Highway Costs? (Washington: American Trucking Associations, Inc., 1952), p. 4.

questionable whether an answer agreeable to all parties will be found. Until additional factual data on the subject are forthcoming, decisions on road-user tax responsibility will be based substantially on human judgment.

CHAPTER V

SHORT-RUN EXPENDITURE PLANNING

Students of business recognize that there are three basic functions of management: planning, organizing, and controlling.[1] The manner in which these functions are performed determines, largely, the success or failure of the enterprise—whether it be a private profit-making business or a governmental organization.

Although there appears to be a rather general feeling that private businesses and governmental organizations are somehow "different" in their methods of management and objectives, an underlying thesis of this dissertation is that the fundamental principles and practices of management are equally applicable to these two kinds of organizations. Managers in both

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[1] Authors of management literature often add staffing and directing to the list of functions of management. However, planning, organizing, and controlling are considered universal. See Harold Koontz and Cyril O'Donnell, Principles of Management (New York: McGraw-Hill Book Company, 1959), pp. 35–38; and William H. Newman, Administrative Action (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1959), p. 4.

organizations encounter many of the same types of problems, conditions, or obstacles. Yet, because of the nature of the organizations, management may be operating in different surroundings. For example, the manager in a state highway department of necessity functions in a political environment since the organization is a part of the political structure of the state. He may find, or feel, that the policies or actions of legislators and commissions are unduly restrictive or arbitrary and prevent him from doing the best managerial job in accomplishing the objectives of the highway department. The manager in a private business organization does not usually complain of the same problems; however, he may, and often does, complain of such problems as competition, prices, and general policy established by "top brass" in his organization. The point is, managers in both kinds of organizations are confronted by problems which must be solved and by decisions which must be made in order to best achieve organizational objectives. Emphasis must be upon the formulation and achievement of organizational objectives through adherence to, and practice of, the managerial functions of planning, organizing, and controlling. Nowhere in the highway organization is the adherence and practice of these principles more important than in

the financial planning and control activity.[1] It is the objective of this and the two subsequent chapters to consider short-range planning and control as they relate to highway construction funds.

The Nature of Planning and Control

Planning and control are not modern concepts nor do they only have relevance to businesses and other formal organizations. Planning and control have been practiced in antiquity. Every rational individual in some manner or another plans and controls his activities.

Planning

Planning has been defined as "the managerial function of determining in advance what a group should accomplish and how the goals are to be attained."[2] Basically, planning is a decision-making process. It implies a selection process from developed alternatives of various objectives, policies, and procedures.

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[1] The managerial function of organizing is treated in some detail in Chapter IX; see infra, page 340.

[2] Michael J. Jucius and William E. Schlender, Elements of Managerial Action (Homewood, Ill.: Richard D. Irwin, Inc., 1960), p. 26.

Organizational objectives serve to provide the organization with direction and purpose; they are the basic guides to the enterprise. Without them, the organization (and segments of the organization) lacks the vitality which results from a consciousness of where it is going and why.

In recent years students of business theory have emphasized that the basic objective of an organization should be to provide a service and not, as many managers seem to feel, to make profits exclusively.[1] If this concept of the purpose of an organization is adhered to, there appears to be no apparent reason why it should not apply with equal force to governmental organizations—those nonprofit enterprises. Consequently it would seem to follow logically that management in governmental organizations should have the same incentives as do managers in industrial enterprises who seek to maximize the ratio of output to

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[1] For a more detailed discussion of the service objective, see L. Urwick, The Elements of Administration (New York: Harper and Brothers, Publishers, 1943), Chapter III; William H. Newman and Charles E. Summer, Jr., The Process of Management (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1961), p. 384; and William R. Spriegel and Ernest C. Davies, Principles of Business Organization and Operation (Englewood Cliffs, N.J.: Prentice-Hall Inc., 1960), p. 1.

input in the operations of the organization.[1] The same line of reasoning would seem to lead to the conclusion that administration of governmental organizations should be as diligent in the application of accepted management principles and practices as executives of business organizations.

In the highway department, as in other organizations in which the modern theories of business management are being practiced, the over-all objective is service—to create and distribute values to the public with maximum efficiency and economy. To be more specific, one of the major objectives of a highway department is to construct and maintain an adequate highway system for the people paying for and benefiting from the roads.

If the above is true, policy, procedures, systems, and programs as they relate to highway expenditures should seek to provide for maximum utility from each dollar expended on the highway plant. Procedures and systems—designed in the light of objectives and policies—should be utilized to insure that dollar placement in the highway systems will be based on the

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[1]The basic thesis here is that governmental organizations should be as interested in achieving the maximum utility from every dollar expended as profit-making organizations and should seek to develop skill in the application of management principles and concepts to this end.

most efficient methods available. These precepts, if followed, minimize the elements of human judgment, political expediency, and community pressures in the decision-making process pertinent to the expenditure of highway funds.

Today a situation exists in which highway finance experts expound on the revenue side of the finance picture while relatively little attention is given to the manner in which highway officials plan and control expenditures. In this modern era of high taxes and huge public expenditures, highway managers should carefully evaluate their methods of expenditure planning and control. They should make use of the latest and impersonal methods available in allocating highway funds. Most state highway departments possess the tools, techniques, information, and personnel necessary to provide for efficient operation in planning and controlling highway expenditures.

R. C. Davis states that "the performance of the planning function always involves some degree of futurity."[1] Since the planning process must be formulated, developed, and executed in the time dimension, it is imperative that management base its

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[1]R. C. Davis, The Fundamentals of Top Management (New York: Harper and Brothers, Publishers, 1951), p. 43.

decisions on available relevant and rational facts about the future. Organizations tend to divide the time element into two segments for the purpose of decision-making: (1) short-term planning and (2) long-range planning. Short-run planning generally covers a period of a year, depending on the specific business and its production cycle. Long-range planning is usually tempered by the long-range commitments of the firm and in the recovery of costs sunk in plant facilities.

Due to the peculiar nature of highway operations, the short-run planning period must by necessity cover several years. In programming a highway for construction, a substantial amount of advance planning is necessary before the project can be let to contract with private firms. Problems of right-of-way acquisition alone may consume months and even years if litigation is involved. Short- and long-range planning tend to become diffused in highway operations, and many highway officials believe they are performing long-run planning when, in fact, they are planning on a short-run basis.

> It is important to grasp the idea that long and short-range planning are two aspects of the same continuous process. Success in planning depends on the ability of executives to achieve an integration of the two types. Short-range planning can be successful only if carried out in a context of adequate long-range planning, so that shifts in the

long-range view may be taken into account in the short-range plans.[1]

Control

The control function can be defined as "the process of determining what's being accomplished, evaluating it, and if necessary applying corrective measures so that performance takes place according to plans."[2] As in other areas of endeavor, control is a necessary requisite to the measurement of managerial performance. Highway departments, by necessity, have geographically decentralized operations which, by their very nature, require extensive control procedures.

As in most organizations, the highway department makes extensive use of the budget as a tool for financial planning and control. Its value as a technique for control depends entirely upon the importance that highway management places upon it as a basis for planning its operations. Planning and control are inseparable: ". . . control implies the existence of goals and

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[1]Dalton E. McFarland, Management Principles and Practices (New York: The Macmillan Company, 1958), p. 72.

[2]George R. Terry, Principles of Management (Homewood, Ill.: Richard D. Irwin, Inc., 1956), p. 473.

plans."[1] If control is an important managerial function, then it is imperative that that which is controlled—namely, budgetary plans—be well conceived. If budgetary planning is faulty, budgetary control cannot be effective. Greater emphasis will be placed on the planning function as it relates to construction expenditures than on the control function because it seemed to the author during the survey that the accounting control procedures and facilities being used were adequate to provide management with sufficient information on the progress of operations.[2]

A technique for financial planning and control of construction expenditures

Planning and control are functions that are not generally spontaneous in nature. Usually a great amount of evaluation, analysis, and thought enters into the process of planning and control. Consideration must be given to the historical aspects of operations, present resources must be carefully evaluated, the

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[1] Koontz and O'Donnell, p. 578.

[2] The progress reports on highways using federal-aid funds prepared by the states for the Bureau of Public Roads provide "built-in" control procedures on construction progress. The point being stressed here is that, although control procedures and facilities seemed adequate, they were rendered ineffective, more or less, due to inefficient planning of construction expenditures.

future predicted, and measurements established to determine deviations from planned operations. The basis for past, present, and future analysis is often founded on accounting data accumulated in accordance with accepted principles and practices.

In planning and controlling construction expenditures in highway operations, it is an accounting technique—the budget—that assumes a major role in the recommended processes designed to provide for greater efficiency in construction spending. The value and effectiveness of the budget depends entirely upon the manner in which (1) the annual construction projects are scheduled, (2) the procedures utilized in recording, classifying, analyzing, and reporting actual and budgeted cost data, and (3) the use made of the budget as a control and reporting device in measuring and evaluating managerial performance. It is with the first and third items above that this dissertation is concerned. Highway departments are not taking advantage of the full potential of the budget as a tool for financial administration.

Possibly it would seem more logical to approach a discussion of expenditure planning from a long-range viewpoint. However, the short-run techniques as recommended in this dissertation require the support of a long-range planning program to fill in certain gaps not adequately covered by the short-run

method. Therefore, the short-run aspects of the problem will be presented first. Long-range planning will be the subject of Chapter VIII.

Division of Responsibility for State and County Expenditure Planning and Control

A situation exists in state and county highway administration which deserves some mention, although it does not directly concern the major thesis of this dissertation—the planning and control of state highway construction expenditures. The problem came to light during interviews with state highway officials in ten state highway departments.

With the exception of five states[1] in the nation which have assumed administrative and financial responsibility for all, or part, of their county road systems, there are within each state at least three highway authorities concerned with the construction and maintenance of roads under their jurisdiction: (1) states, (2) towns, counties, and townships, and (3) urban places. State highway departments are responsible for the construction and maintenance of the interstate, primary, secondary, and urban

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[1] See supra, Chapter III, page 42.

extensions of state systems. Counties have administrative control over the rural roads not in the state systems, and urban units administer roads and streets within their jurisdictions.

Each one of the political units mentioned above supports an organization to construct and maintain its road system. From discussions with state highway officials, the following conditions were found to exist in the various states:

1. There was a complete division of responsibility between the state, county, and urban places for the planning and control of highways and streets under their jurisdictions.

2. There was some lack of coordination among the three administrative units in integrating the three separate road systems. This was especially true between the counties and the state in planning the rural road systems.

3. There was a duplication of effort in administrative practices, especially between the counties and the states.

If the above is true, there would seem to be a need for greater cooperation and coordination among the highway authorities. Due to the local nature of roads and streets in urban areas, this lack of coordination is unavoidable except in instances of the cooperative projects between state and urban officials.

County roads present an entirely different picture. They are an integral part of the rural road system of a state. It would seem from the author's interviews with highway officials

that county roads are being planned and designed for use within the area of the county rather than as a part of the over-all state system. Apparently what is needed is a planning procedure which will consider both the factors of local service and the integration of the rural county roads into the state system for the servicing of general state traffic.

To facilitate planning for an entire state rural system and to eliminate the costly duplication of effort, two alternative courses of action are available: (1) The entire county system could be placed under the administrative and financial control of the state highway department, or (2) state and county officials could establish a major system of county primary roads for which state highway officials would establish standards applicable to highway design, location, et cetera, as a requisite to sharing in highway-user revenues.

State responsibility for the complete county road system

For the state to assume complete responsibility of the county road systems, changes or amendments to the present state laws would be required. County residents would have to approve the administrative change by special elections. In spite of the administrative and legislative problems, the advantages to be

derived from such a change would by far outweigh the disadvantages.

From discussions with state highway officials the author established a pattern of poor managerial practices in county road administration:

1. County commissioners are elected officials who often possess very little knowledge of planning and controlling the functions of a highway department.

2. Decisions pertinent to road location are often based on factors other than community service and road continuity.

3. County administrators do not employ trained engineers to plan and design county road systems and to determine standards for road use and capacity.[1]

In view of the above poor managerial practices, the following advantages could be derived from the proposed recommendations: First, road standards and design, and problems of road location would be the responsibility of the highly trained state highway engineers. In planning county roads, consideration would be given to road continuity as it relates to over-all state road system planning. Furthermore, road standards and design would be correlated to future traffic needs. Roads designed for current

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[1]For example, in Montana only thirteen counties out of fifty-six employed qualified highway engineers. In some instances outside engineering consultants were employed to plan construction projects.

use soon become obsolete and deteriorate rapidly as traffic volume increases. Second, an important advantage to be derived is that highway expenditures would be more fairly distributed among the counties. At present, funds are distributed to states, counties, and urban places for highway use according to state law. The wealth of counties often varies according to the type of taxable property existing within each county. A highly industrialized county often has a broader tax base than the predominately agricultural county.[1] With the highway department planning and controlling the allocation of funds on county roads, a system could be initiated to distribute the funds on the basis of a priority listing system as determined by sufficiency ratings.[2]

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[1]An example of this situation now exists in the state of Wyoming. State law requires that counties match state fund distributions for county farm-to-market roads not on the secondary system to the extent of 7 percent of the total costs. Even though they have raised their property tax mill levy to the maximum prescribed by law, seven of Wyoming's twenty-three counties are unable to find sufficient funds to meet the 7 percent matching provision. Consequently, the rural road system in Wyoming is out of balance as far as standards are concerned.

[2]Sufficiency rating procedure is discussed in detail in Chapter VI; see infra, page 180.

Establishment of a county primary road system

A second alternative, and one that would be more acceptable to highway officials, involves a less extreme action on the part of the state in assuming responsibility for the county road system. At present all of the fifty states have 98,000 miles of rural county roads and 8,000 miles of municipal extensions under their jurisdictions in the state secondary road systems. There still remain approximately 2.3 million miles of rural roads under the administrative control of county, town, and township authorities. Counties are spreading their funds very thinly over a large road mileage. Rather than add more mileage to the state secondary road system, which requires different standards and design, or to have the state assume complete responsibility for the entire county road system, state authorities in cooperation with county officials could create a special county primary road system composed of the more important county roads. The mileage of this special system could be limited in each state to those roads that serve communities or other relatively heavily populated rural areas, and to those roads that provide connecting links in the over-all state system. Authority for the administration of this county system should remain with the county commissioners.

However, final approval for road standards and designs, location, and other pertinent factors relevant to traffic, safety, and service in highway construction would remain with the state highway department.

The special county road system would be financed entirely, or in part, from state road-user taxes. The remaining county road system should be financed from local revenues. The first distribution from the state highway revenue fund results in an allocation of monies for highway use between states, counties, and urban areas. The formula for this distribution of road-user revenue is usually determined by the state legislatures and enacted into law. Funds allocated to rural and urban units are substantial in amount, providing approximately 45 percent of total rural receipts and 17 percent of urban revenue. Under these conditions, legislation could be passed which would permit highly trained state highway personnel to direct and control the flow of these revenues into the special county primary road system in a participative program similar to that which now exists between the state and federal governments.

The benefits to be derived from such a program would be many: (1) Planning would be extended to include a major portion of a state's rural road mileage which would service the bulk of

total rural traffic; (2) the special county system would be integrated with other state systems, other than for administrative control which would still be retained by county officials, providing for greater road continuity and system design; (3) the most important roads of the county system would be constructed to higher standards; and (4) county officials would receive the services of experts in highway construction.

A similar plan has recently been recommended in a report prepared for the State Highway Commission of Wyoming by representatives of the Automotive Safety Foundation. This latter group has made many studies of highway needs for various states, and their recommendations are highly regarded. In Wyoming they recommended that a county primary road system composed of 13,000 miles of the 48,000 miles of county roads be established.[1]

In discussing the county road problem with officials in various states surveyed by the writer, it was discovered that a situation has been developing that is similar to the above recommendation but in a way detrimental to the state highway finance

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[1]Automotive Safety Foundation, A Guide for Planning Wyoming Highways, A Report Prepared for the State Highway Commission of Wyoming (Cheyenne: Wyoming State Highway Department, 1960), p. 5.

programs. Because of pressures exerted on them by county officials and community groups, state legislators are continually adding to the secondary road system mileage under the control of the state highway department. This situation favors the counties by relieving them of the cost of constructing, and possibly maintaining, the county roads added to the state system and it gives them better roads than they would otherwise construct. On the other hand, state highway departments are faced with a situation in which new mileage is brought under their control without a commensurate increase in funds to care for them. The states are forced to spread already inadequate funds over an ever-expanding road system.

In line with the proposed recommendation, state legislatures should enact legislation which would freeze the road mileage of all state highway systems. This would include the mileage designated under the special county primary system even though administrative responsibility is retained by county officials. Failure to stabilize system mileage by state law would defeat the objective of the proposal since pressure groups have a powerful influence in state political circles.

Undoubtedly the above recommendations have been somewhat simplified. The problems involved in the transition of all

or a part of the county road systems to state control would entail considerable planning and legislative approval. It would necessitate organizational changes in both administrative units. Current methods of taxation and tax allocation procedures would have to be evaluated to provide for a more equitable distribution of tax responsibilities. Standards and design would have to be devised for the low-traffic-volume county roads. It is felt that the advantages of the recommended alternatives would by far outweigh the disadvantages that are presently obvious in county road administration. However, many highway officials interviewed by the writer do not approve of such a program. They firmly believe that the systems, administratively and financially, should remain divided among the states, counties, and urban places. Yet, if one thinks in terms of over-all objectives, there is probably a need for better coordination between the highway authorities concerned with the construction and maintenance of the nation's rural highways.

Annual Budgetary Procedure

Budget methodology has been fairly well standardized in state highway departments. The Research Division of the Bureau of Public Roads has been quite active in establishing standard

procedure which has been widely accepted and put into practice by many state highway departments. Slight variations may exist in certain areas of budget preparation, but these differences are relatively unimportant according to highway officials interviewed. For example, in one state the chief maintenance engineer in the headquarters office of the highway department prepared the maintenance budget for the decentralized maintenance districts. In other cases the district maintenance engineers would prepare their own budgets which were subsequently evaluated by the chief maintenance engineer before being submitted to the highway commissioners for final approval. There would seem to be some question whether a chief maintenance engineer should prepare a budget for the district maintenance engineers, who are probably better acquainted with the maintenance needs in their districts.

In the ten survey states the author found that the facilities for excellent budgetary control existed. All of the state highway departments utilized the latest I.B.M. equipment, or its equivalent, and many possessed their own electronic computers. Budgetary reports for maintenance, administration, and other services were prepared monthly, quarterly, and annually. Every division and department head knew precisely what percentage of his budget had been expended each month. For maintenance the budget was

generally prepared on a project basis, enumerating the estimated cost, for instance, of maintaining a certain section of road within a maintenance district. The maintenance estimates were further broken down into the specific type of maintenance that would be required, such as routine and special roadway surface operations. As maintenance operations were performed in the districts, the maintenance engineers reported regularly the cost for each type of operation for each maintenance project. This information was punched on cards and periodic reports were prepared from the budgeted and actual data.

Equipment control was also facilitated by the use of mechanized bookkeeping machines. Every piece of equipment was properly accounted for. Information pertinent to equipment was recorded on punched cards indicating their assigned number, make, type, model, serial number, motor number, location, rental cost, and other pertinent factors.

Basically, the writer could find little fault with the accounting aspects of recording, classifying, and analyzing data for use in the budget. In a few instances there was a lag in actual cost accumulation for report purposes, but these cases were unavoidable. Due to legislative requirements in which all state highway expenditures are approved and dispensed through a

central state finance office rather than by the highway fiscal department, expenditures vouchers were outstanding for as long as a month to a month and a half.

Budgeting planning and control of maintenance, administration, and other highway services (other than construction) was provided for in a satisfactory manner. It is in the procedures used in planning and controlling the projects for the annual construction budget that the question arises as to whether highway officials are accomplishing organizational objectives to the highest possible degree.

It was not the purpose of this study to delve into phases of management malpractices involving fraudulent intent through collusive agreements and venality whereby scarce construction funds were diverted from the construction expenditure stream into the personal accounts of highway officials or private contractors. In describing and analyzing highway management practices pertinent to the allocation of construction funds based on political pressures and expediency, it is not the intent of the author to intimate that such practices are dishonest in any way. Quite the contrary, it is contended that the inefficient procedures utilized by highway officials are the result of (1) a misunderstanding of their responsibilities to the public, (2) a lack of understanding of

management principles and practices, (3) an adherence to custom and tradition in highway management, and (4) a general apathy on the part of the public.

Revelations over the past two years pertinent to seemingly fraudulent practices of highway management in certain states cannot be ignored. These dishonest actions have come about even though control procedures existed to prevent their happening. This phase of fraudulent highway management practices is discussed in Chapter XI.

Current state highway budget procedure

In the preceding sections of this chapter it was pointed out that the first distribution from the highway revenue fund resulted in a division of the fund between the state, counties, and urban areas. From the portion now available to the state highway department, the first budget allocation is between the four major functions—construction, administration, maintenance, and other services.

Practice among the ten survey states differed somewhat in this procedure. In one case, construction funds to match federal-aid apportionments were determined first and the residue was distributed among the remaining functions. In the other

states, maintenance, administration, and other services received prior consideration, and construction was considered last. The method used depended upon the financial condition of the highway fund. However, it is interesting to note that none of the ten states had lost a federal-aid allotment requiring state matching of funds.

Federal apportionments for construction were segregated according to the system for which the funds were to be used, such as federal-aid primary, secondary, interstate, and urban. Ten percent of the federal allocation for any fiscal year may be transferred among primary, secondary, and urban systems if such a transfer is requested by the state highway department and is approved by the governor of the state and the Bureau of Public Roads as being in the public interest.[1] The apportionments are made six months prior to the start of the fiscal year and remain available for expenditure for a two-year period subsequent to the year of authorization. Therefore, the state has at least three and one-half years in which to plan the use of federal-aid funds. As highways require a considerable amount of advance planning

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[1]National Highway Users Conference, Federal-Aid for Highways, p. 11.

for construction, this provides a degree of flexibility in the budget programming.

In planning and controlling construction expenditures, state highway officials are confronted with two major problems: First, an immense effort is being put forth on the construction of the 41,000 miles of the interstate system. It is imperative that other state systems are not neglected in any manner. In fact, greater effort and consideration should be given to programming the state primary, secondary, and urban extensions for construction and maintenance. Second, state highway departments have never possessed sufficient funds to bring roads up to standards within a short period of time.

> There has never been, nor will there ever be, the utopian situation in which a state has sufficient funds, time, personnel, and equipment to attack simultaneously all the projects required to bring its road up to standard. Choices must be made.[1]

The preceding quotation sets forth the problem very well. It is with the choice of alternatives for the placement of construction funds on road systems, and segments, that this dissertation is primarily concerned. In this phase of planning and programming

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[1]New Mexico State Highway Department, Planning Division, Ratings for Highway Improvement (Santa Fe: New Mexico State Highway Department, 1957), p. 1.

the construction budget, highway management can achieve the greatest degree of success in accomplishing the organizational objectives.

As was mentioned previously, the first allocation of the highway fund is over four basic highway functions (maintenance, construction, administration, and other services) and represents the initial distribution of the revenues available for state highway use. Administration and other services generally do not present a problem in budgeting, since the expenses tend to be fixed in nature. Administrative costs for the various departments—such as accounting, personnel, engineering, research and planning, and public relations—are rather easily determined. The same holds true for budgeting the expenditures for other services, which include such activities as the highway patrol, traffic division, property facilities, and equipment. The costs are relatively stable from year to year and needs can be readily planned.

Planning and control of maintenance operations also seem to present very little difficulty, since district maintenance engineers can estimate fairly accurately the maintenance needs within their districts. The maintenance engineers intimated rather proudly during the interviews that they knew thoroughly the maintenance needs of every mile of road within their spheres

of responsibility. If this is true, budgeted estimates of district maintenance needs as prepared by district maintenance engineers coupled with historical cost data from preceding years serve as a reasonable basis from which to plan maintenance budget requirements. The budget committee, or those officials concerned with budget evaluation and approval, should provide for an annual increase in maintenance allotments to cover increasing maintenance costs caused by the rising price level and the expanding road mileage. In the western states emergencies such as floods, heavy snow conditions, and unusual frost breakups from extremely cold winters often require adjustment to the maintenance budget. An emergency fund is generally established to care for the unusual maintenance situations that may arise.

Maintenance costs seemed to be adequately controlled and reported. Unlike administrative costs, maintenance expenditures may present a variety of alternatives for the use of the maintenance dollars.

It is in the area of planning and controlling the expenditures for highway construction and reconstruction that highway officials should devote more attention. A considerable portion of the primary and secondary roads are below acceptable standards. Because of the poor road conditions, highway officials take the

position that it does not matter where the highway dollar is spent —the highways need the improvement. Highway planning engineers and other officials work on the assumption that funds are well spent if the condition of the over-all system is raised. It is the contention of the author that this type of planning for a highway system will not result in acquiring the most efficient highway plant over the short-run period and possibly may result in failure to achieve long-range construction objectives. Every dollar expended on the highway systems should be made on the basis of priority. In every one of the state highway systems (interstate, primary, et cetera) there are roads, or road segments, which have a greater need for improvement than other roads in the same system. Spending money is not a difficult process, but spending money wisely is a feat not easily accomplished.

Fund allocation between state highway districts.—After the budget allocation has been made for the construction function and it has been further subdivided to match federal-aid appropriations for the state systems, a second distribution takes place under current practice in eight of the ten survey states. The construction funds are distributed between commissioner or some similar type of districts. This distribution is made on the basis of a

predetermined formula or by mutual agreement between the highway commissioners. Where a formula is used, the district allocation may be prorated equally or distributed between the districts on the basis of such factors as road mileage, population, or terrain found in the district. In most cases distributions were determined by agreement between the members of the boards of highway commissioners who were appointed to represent their specific districts.

From pertinent information acquired in interviews with highway officials, the distribution was eventually arrived at only after substantial discussion and concession among the commissioners. The object of the compromising agreements apparently involved two factors: (1) to have as much money as possible funneled into the represented district, and (2) to improve the road systems in the specific districts. Quite often these decisions were apparently based on rather dubious premises. For example, the interstate highways traverse certain narrow areas of a state but substantial expenditures will be made in those districts that are affected by this costly system. Therefore, the practice in at least three states apparently was to reduce the allocation of primary and secondary funds to those districts receiving large amounts of interstate funds. It would seem that such planning

practices would result in a lack of balance in primary and secondary roads in the state system.[1]

Allocation of funds among highway systems.—After funds for state primary, secondary, and urban and municipal extensions of state routes have been allocated by districts, it is then necessary to make a third distribution. The latter is for the purpose of determining the specific road or road segment which should be constructed or reconstructed within the limitations of the funds available. The decisions involved in making this allocation are extremely complex and difficult because so much of the road mileage in most state systems is below current and projected standards and design.

During the course of the survey it became apparent that the methods utilized to allocate funds to specific projects varied somewhat among the states. In eight of the ten states the final

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[1]A situation existed in another state in which two district commissioners represented the highly populous eastern sections of the state while the other four members of the six-man board were appointed from districts that were strictly rural in nature. A glance at the critical-road-deficiency map of the entire state revealed that approximately 50 to 75 percent of the deficient road sections existed in the two eastern districts. When questioned, state highway officials stated that rural commissioners often stood together as a voting bloc when the highway fund for construction was distributed among the districts.

decision as to the projects to be programmed for the budget was made by top-level administrators—generally the commissioners.[1]

Planning the construction budget generally involved a series of steps. Although the procedure differed slightly in the survey states, the ultimate results were the same: some misdirection of construction funds from high-priority projects. Usually the district engineer prepared a list of construction projects for his commissioner. The compilation of this priority list was based on the experience of the district engineer with the highways in his assigned areas. In at least one state construction planning engineers assisted the district engineers in the preparation of the priority lists.

The list was occasionally given to top-level officials for evaluation before being sent to the commissioners for further review and final approval. In addition, the commissioners were generally provided with a list of critical road deficiencies

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[1]The importance of this procedure is the fact that commissioners could, if they so desired, change the annual construction program prepared by the planning department to include projects having lower priorities. In Colorado and Nebraska, state law required that the annual construction program be determined by sufficiency ratings, which eliminated the role of the commissioners in making decisions pertinent to construction project scheduling.

determined from sufficiency ratings and prepared by the planning department to assist them in making their choice of alternatives from among construction projects. From the two reports (district engineer's list and the planning department's critical list) the commissioner determined the annual construction budget for his district. According to highway officials interviewed, it was not unusual for the commissioners to submit to pressures of community groups in programming the construction budget.

Inquiries made by the writer as to the use of priority lists prepared by the planning department revealed a wide variation among, and within, state highway departments. It was determined that highway officials who claimed a high percentage of priority projects in the annual construction budget were using a priority list that included almost the entire road mileage of each of the state systems. In preparing the list, no attempt had been made to scale down the most serious road deficiencies to match the budgeted funds for the year. Instead, the lists presented to the commissioners contained the equivalent of enough projects to match two to five years of construction budget appropriations.

Even if it were assumed that 80 percent[1] of the annual construction program contained high-priority projects, such a planning process leaves much to be desired. If one thinks in terms of a 101-billion-dollar construction program, the expenditure of a substantial portion (20 percent) of this huge amount will be made on rather dubious rationalization.

Another step in the programming process involved commissioner hearings. The commissioners met with as many as one hundred different persons, or groups, to hear their arguments or pleas as they affected highways in their specific locations. Highway officials admitted that such pressures were often effective in directing the flow of highway construction funds. The hearing procedure is a part of the democratic process as practiced in the United States. However, as a basis for allocating scarce revenues throughout the highway system it leaves much to be desired. On the other hand, there are cases involving highway relocations in which community groups should be heard, especially if the relocation will direct traffic away from the

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[1]Eighty percent was the most frequently reported figure for construction projects chosen for annual programming from priority lists prepared by the planning departments from sufficiency ratings.

community as some of the interstate highway projects are currently doing.

It should be pointed out that commissioner decisions to allocate funds to highway projects which do not have high critical needs will not necessarily result in wasted effort, since many of the highways do need improvement. However, such planning procedures will not provide the most efficient highways over the short-run period and may result in prolonging long-range objectives. It is more conducive to a patchwork and unbalanced system of highways.

A Proposed Program for Annual Budgetary Planning and Control of Construction Expenditures

In the following paragraphs a proposed budgetary system will be recommended. First, consideration will be given to the problem of allocating construction funds to commissioner and/or construction districts. Second, the system of priority listing of construction projects by the sufficiency rating procedure will be introduced. In the following chapter the sufficiency rating procedure will be discussed in detail.

Elimination of fund allocation by state highway districts

It does not matter whether funds are prorated to commissioner and/or construction districts on the basis of bargaining strength of the commissioners or by formula; both methods are inefficient as a means of allocating highway funds and are not conducive to the achievement of highway organization objectives. Any process that distributes funds by districts will result in the misdirection of the taxpayer's dollar no matter how rational the prorating procedures may seem. These methods fail to regard the highway system as a whole and they give very little consideration to highway needs. Such methods are based on the assumption that needs are the same within all districts when actually they are not. Too many variables affect the make-up of a state road system to permit personal judgment to enter into the process of allocating the highway construction funds.

Funds should be apportioned over the entire highway system on the basis of the specific needs within the system. District boundaries as a basis for the distribition of funds should be abolished entirely. Needs can be established on the basis of critical priority listings for each segment of highway as determined

by sufficiency ratings as described in the next section of this chapter.

Undoubtedly the allocation of funds by priority listings of critical highway deficiencies will result, initially, in an unequal distribution of monies among districts. However, a point will eventually be reached where every district will be receiving an equitable distribution based on critical highway needs in that district. The important factor in such an allocation procedure is that construction planning is on a state-wide basis rather than by segmental units. The system will be brought up to required standards as a whole rather than in parts. In only two states of the ten in the survey were funds allocated on the basis of highway needs rather than by districts.

Allocation of funds within state highway systems

Within each state system the problem is encountered as to what highway or highway segments should be constructed or reconstructed with the available funds. The problem is one of choice of alternatives, since many of the highway systems (interstate, primary, secondary, et cetera) are badly in need of construction programming. Within each highway system certain highways, or road sections, have a greater need for improvement

than do other highways or sections in the same system. What is needed is a procedure that will rate each segment of a highway in a manner that will permit a choice of alternatives in annual budget programming for construction and reconstruction. The best tool available today is the sufficiency rating method.

> A sufficiency rating study is the determination of relative values for the different parts of a highway system. A section of highway that is perfect is assigned a value or rating of 100. Deficiencies or inadequacies reduce that perfect rating of 100 by varying amounts, resulting in the assignment of a numerical value to each section of highway. That is called a sufficiency rating for that section.[1]

In eight of the ten states visited by the writer, sufficiency ratings were prepared by the planning engineers of the state highway departments.[2] The other two states used methods similar to the sufficiency rating method. The procedure was first developed and applied in Arizona.

> A complete method for arriving at a numerical rating of highway sections as a basis for counteracting depreciation and obsolescence, later termed sufficiency rating, was developed by Karl Moskowitz of the U. S. Public Roads Administration. In 1946 the system was applied by the Arizona State Highway Department to all Federal-aid and state routes. Popularly known as the "Arizona Method," this procedure

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[1]Idaho Department of Highways, Sufficiency Rating Study (Boise: Idaho Department of Highways, 1959), p. 1.

[2]The two states not utilizing the sufficiency rating procedure were Montana and Utah.

> for rating highways was adopted by other states. In the course of time, experience and differing conditions in some states dictated many modifications of the original system. Thirty-three of the states now employ either the Arizona method or another formula for sufficiency ratings as an administrative tool.[1]

The preceding quotation lists thirty-three states as employing the sufficiency rating methods. However, if the survey of ten states in the Rocky Mountain Region is indicative of the use of the method, only one-fifth, or seven states of the thirty-three, are utilizing sufficiency ratings to the fullest possible extent in placing funds in the highway systems. In the two survey states that made complete use of the system, the procedure in establishing priority construction lists was required by state law.[2]

Most sufficiency rating procedures have at least three points in common:

> 1. Each road section to be rated must be homogeneous in character. A section ends at a point where a new characteristic appears, and a new section is designated. Sections may therefore vary from a fraction of a mile to several miles in length.
> 2. Sufficiency ratings must be determined by field checks with other data applied to the results of the field investigation.

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[1] New Mexico State Highway Department, Planning Division, Ratings for Highway Improvement, p. 3.

[2] Colorado and Nebraska.

3. A point system is used to assign values to a predetermined set of factors, and their subelements, each having a given range of points. Any rating lower than 100 points shows the degree of a section's deficiency.[1]

Annual construction budgets can be programmed in a series of steps. First, each highway in each system (primary, secondary, et cetera) is sectionalized into segments having homogeneous characteristics such as pavement types and terrain. Once the segmentation has been performed in the initial stage of installing the sufficiency rating system, it needs only an occasional revision thereafter. Second, a set of factors based on highway geometrics and design is determined. Most systems utilize at least three features—condition, safety, and service—which are further divided into subfactors. Third, point values—generally totaling 100 points—are assigned to the major factors determined in the third step. The point weight assigned each factor is usually based on the importance of the feature to over-all road standards and design.

The fourth step involves a field survey in which each highway segment is rated by actual observation by highly trained personnel. The observer grades, or rates, each road section

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[1]New Mexico State Highway Department, Planning Division, Ratings for Highway Improvement, p. 3.

according to the predetermined weights for each factor. Fifth, from the numerical ratings a priority list of critically deficient road sections is prepared. Generally a segment of a highway having a rating of 60 to 70 or below would be considered critical and in need for correction. The sixth and final step is the preparation of the annual budget program. After certain adjustments for factors not adequately considered in the sufficiency rating procedure, construction cost estimates can be applied to the priority list projects and matched against available annual revenues for the purpose of programming construction expenditures.[1]

From the priority listings various control tools such as road-deficiency maps, tables, and charts can be prepared. Short-range future programs can be determined and advance preconstruction planning can be undertaken. The state highway department knows precisely what must be done to bring the highway system up to standard.

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[1]The factors not adequately considered in construction programming by the sufficiency rating procedure are discussed in detail in a subsequent chapter; see infra, Chapter VII, pages 266–67.

CHAPTER VI

A TECHNIQUE FOR SHORT-TERM PLANNING— THE SUFFICIENCY RATING

If past history provides a gauge for the future, it appears reasonable to say that no state highway system can be brought to 100 percent of adequacy and kept in that condition. The very nature of the economy is such that, by the time a system approaches complete adequacy, technological developments will occur that will make the system less than 100 percent adequate. Thus, highway departments are constantly confronted with problems caused by an ever-changing environment which emphasizes the need for competent planning in order to maintain the highway system at the highest peak of adequacy available. This situation makes imperative the formulation of objectives in terms of the needs of highway users. As previously stated, a fundamental requirement of objectives in the planning and control of expenditures is the development of a method or system whereby a priority of such expenditures is established. It is the purpose of this chapter to expound and discuss one of the more important procedures for

planning and controlling construction expenditures—the sufficiency rating procedure for determination of construction priorities.[1]

It should be pointed out to the reader that the sufficiency rating procedure and the subsequent priority listing is the first step in preparing the annual construction expenditure budget. Revenue for the construction budget is assumed to have been determined by the federal-state matching process, and the problem is now one of utilizing these revenues to the best advantage. The value of the construction budget as a planning and control tool is conditioned by the manner in which construction projects are scheduled. Unlike the budget goal in the private, profit-making firm which may be cost reduction,[2] proper use of the budget in highway practice should strive for maximum utilization

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[1]As was mentioned in the preceding chapter, each of the ten survey states prepared some sort of a priority list from a rating device to designate the critically deficient highway in need of improvement. The study further revealed that only two of the ten states used their systems exclusively in preparing their annual construction programs. In both of these states the use of the sufficiency rating procedure was made mandatory by state law. In the other eight states highway commissioners or other highway officials were instrumental in directing and controlling the annual highway construction program.

[2]James L. Peirce, "The Budget Comes of Age," Readings in Cost Accounting, Budgeting, and Control, ed. William W. Thomas, Jr. (Chicago: South-Western Publishing Company, 1955), p. 137.

of the construction dollar by spending it on roads which have the greatest need. In the highway department, construction projects are let to the lowest bidder among competing private contractors. This process tends to transfer the responsibility for cost reduction to the private firm.

It is imperative, then, that the scheduling of construction projects be based on the utilization of the best methods available which will reduce the personal judgment factor to a minimum. Toward this end, the sufficiency rating procedure is the best tool available at present.

Programming by priority is not a new concept in highway finance. In 1916 the federal government began the practice of allocating state-aid funds on the basis of specific highway systems, and it has continued to do so until the present. Currently, high priority is being given to the interstate system. Toll roads are another example of high-priority highways. Toll roads are extremely costly, as access roads must be limited to entrance and departure gates. Expensive overhead or underpass crossings are required on these limited-access roads. Construction of these expensive highways could easily result in utilizing a major portion of annual construction funds to the detriment of other highways in the state systems. For this reason, bond

authorizations are undertaken to provide funds for the construction of the high-volume toll facilities. In more recent years, efforts have been made to develop systems whereby priorities may be established.

> In the search for a practical approach to a priority system, some states, notably Virginia and Vermont experimented about 1940 with systems that evaluated various important elements of a highway section in relation to desirable values for the particular elements. Included in the consideration were pavement-width and type, curvature, sight restrictions and grades as well as the volume of traffic served. The results of these evaluations was a series of priority or deficiency lists based on each of the elements considered. Such data were found to be helpful in setting up programs, but they could not be reflected readily into a single, simple priority schedule.[1]

It was not until the years immediately following World War II that the sufficiency rating method for determining construction priorities was devised. During the intervening years there have been new developments and modifications of the earlier systems.

The sufficiency rating procedure is not an end in itself—it is the means to an end. It is but one of a series of steps that can result in a systematic determination of priorities for

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[1]Roy E. Jorgensen, Priorities and the Development of Annual Highway Programs (Washington: National Highway Users Conference, 1952), p. 4.

programming construction projects over the short-run period. It will be the objective of this chapter to describe and evaluate the sufficiency rating procedure as a technique for programming the annual construction budget and to indicate certain modifications in the utilization of the tools that are felt necessary to improve planning and control of expenditures.[1]

There are certain elements common to all sufficiency rating systems utilized by state highway departments today. In the ensuing discussion and analysis these common elements are considered first. Subsequently, various modifications are treated.

Segmentation

For the purpose of determining the condition of highways through the use of sufficiency ratings, the highway system is segmentized. The segments are variable in size—ranging from a fraction of a mile in some instances to ten miles in others. The major reasons for segmentation are explained below.

Possibly the major reason for segmentation is the necessity for establishing highway sections which are homogeneous in

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[1]The evaluation is based largely upon the observations and analysis of the sufficiency rating methods and techniques employed in the ten survey states.

nature; i.e., sections which are constructed to the same pavement and shoulder widths, of similar materials, the same right-of-way widths, and similar foundational characteristics. Only in this manner is it possible to develop criteria against which the condition of various segments can be evaluated and a rating determined. It is apparent that criteria are necessary for each type or kind of road in the total system.

A second major reason for segmentation is the need to establish small sections in order to insure greater accuracy in the field observations and evaluation of degree of sufficiency. For example, it is much easier to accurately grade a short segment of roadway (perhaps one-half to three miles in length) than it is to rate one twenty to thirty miles in length. In the shorter segment there are fewer variables to consider.

Some factors which are most frequently considered in establishing segments initially are as follows:

1. Differences in structural conditions such as surface material type, foundation, shoulder, pavement or right-of-way width, number of lanes, or terrain characteristics.

2. Natural (more or less) beginning and ending points such as are afforded by bridges, tunnels, intersections; city, county, district, or state boundaries; and other such easily identified points.

The sufficiency rating system envisages that the total highway system—each foot of roadway—will be a part of some segment and will be evaluated, or rated, against established standards, or criteria, at regular intervals. It is through such ratings that the degree of adequacy of the total road system, and particular segments, is derived and known.

The Criteria for Rating

There are two crucial aspects of the sufficiency rating system: (1) the development of adequate criteria to serve as standards of evaluation, and (2) the actual observation of segments and the rating accorded the segments. While the former may be formulated with a great deal of objectivity, the latter is always susceptible to the subjective judgment of individuals.

Geometric standards and design may vary considerably from state to state insofar as roads constructed strictly with state funds are concerned. However, the greater volume of road mileage in state systems is subject to federal-aid participation and must, therefore, comply with federal requirements for road standards and design. Naturally, the objective of the federal requirements pertinent to road standards is to acquire greater uniformity among the states in constructing highways.

Major factors which influence design standards are the topography, climatic conditions, traffic volume, and national defense. For example, states in the Rocky Mountain region must build roads over extremely mountainous terrain, as well as over flat and rolling terrain. Roads over mountainous areas must, of necessity, be constructed to modified standards relative to those built over flat or rolling terrain.

Climatic conditions create rather complex problems in construction designs and standards. Roads built over high passes must be designed to withstand the effects of frost penetration during cold winters, as well as the effects of moisture from melting snow. Unusually wet spring seasons with heavy moisture runoff make it necessary to design foundations to withstand these conditions.

Traffic volume, as well as the nature of the traffic, necessitate differences in road design and standards. Heavily traveled roads require wider and additional traffic lanes, wider shoulder and right-of-way widths, and fewer horizontal and vertical curvatures to impede traffic flow. Roads carrying the heavy commercial carriers require thicker foundational structures and pavement surfaces.

The interstate system is not only constructed to carry pleasure and commercial vehicles in peacetime, but in case of national emergency it is designed to provide a means of movement for military traffic and civil defense. Evacuation of civilian and military personnel from stricken areas and the movement of military personnel and supplies to strategic points will be at least partially carried out over the interstate road system.

Currently, three common features of standards and design are considered in most sufficiency rating procedures: (1) structural adequacy, (2) service, and (3) safety. It is the practice to subdivide these features into various component factors to acquire greater uniformity and objectivity in rating. A total value of 100 points is usually assigned to the three major features. They may be weighted as follows:

Structural adequacy:

Foundation	10 points
Surface	20 points
Drainage	5 points
Total	35 points

Safety:

Shoulder width	8 points
Surface width	7 points
Stopping sight distance	10 points
Consistency of alignment	5 points
Total	30 points

Service:

Alignment	9 points
Passing sight distance	9 points
Surface width	7 points
Rideability	10 points
Total	35 points

Total possible score . . . . . 100 points

Structural adequacy

Structural adequacy is concerned with the structural condition of the highway as it relates to foundation, surface, and drainage. Office records may have to be utilized in determining the foundation component if thickness is a variable to be considered.

Foundation.—The results of foundational defects, or failures, depend on the type of road being rated. Colorado uses the following procedure in rating this feature:

> A tally is kept for each section of highway rated, indicating the number of foundation failures. During the rating procedure, evidence of frost boils or heaves, distorted surfaces and shoulder puffs indicating plastic flow are found to be indicative of foundation failures under asphaltic surfaces. The failure items used in rating concrete pavements are pumping action and excessive or map-pattern cracking and surface distortion caused by unsound foundation. On gravel, or graded and drained roads, it has been determined that

> soft spots, severe ruts and evidence of plastic flow are indicative of foundation failures. . . .[1]

To assist the field rating team in acquiring uniformity for grading this feature, a table of foundation ratings has been devised (see Table 14).

Surface.—The surface feature is generally rated slightly higher than foundation. Since highways are surfaced with various materials such as gravel, temporary bituminous mats, permanent bituminous surface, and concrete, the points assigned each pavement type will differ. Surface failures take such forms as cracking, displacement, joint failures, chinking, raveling, and oxidation. In rating this factor, the number of defects per section or per mile is the basis for a high or low rating.

Drainage.—Drainage is generally weighted as the least of the factors of structural adequacy. Rating of this feature is based upon the methods of disposal of surface water by means of graded side ditches, pipes or culverts, bridges, or natural drainage facilities.

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[1]Colorado Department of Highways, Planning and Research Division, Rural Highway Sufficiency Rating Study (Denver: Colorado Department of Highways, 1954), pp. 2–3.

TABLE 14.—Foundation rating (par 10).

Foundation Failures per Mile	Foundation Rating Value
None or one	10
Two or three	9
Four or five	8
Six or seven	7
Eight or nine	6
Ten or eleven	5
Twelve or thirteen	4
Fourteen or fifteen	3
Sixteen or seventeen	2
Eighteen or nineteen	1
Twenty or more	0

Source: Colorado Department of Highways, Planning and Research Division, Rural Highway Sufficiency Rating Study, pp. 2–3.

Safety

Several factors are considered in safety: (1) shoulder width, (2) surface width, (3) stopping sight distance, and (4) consistency of alignment. Highway departments have attempted to write accident data into their sufficiency rating systems, but without much success.[1] First, a great number of accidents are not reported by the highway users to permit evaluation of the cause of the accident. Second, there has not been sufficient precision pertinent to the described location of the accident to enable highway personnel to make proper investigations. Third, there is always some question of determining whether the cause of the accident was due to driver carelessness or highway defects. In interviews with state safety engineers the writer was often informed that accident data indicated causes other than highway defects. It seemed that accident rates were high on highways having the least number of safety obstacles, while on dangerous rolling or mountainous roads having many unsafe features per mile accident rates were often quite low.

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[1] At present many of the ten survey states are conducting extensive surveys and studies into the causes of accidents. It is possible that more objective safety data for sufficiency rating purposes will be developed from these investigations.

Shoulder width.—Shoulder width is an important element in highway safety. The possibility of accidents is mitigated considerably if a stalled vehicle can be moved to a solid shoulder. For purposes of acquiring greater road safety, shoulder design requires an increase in width as traffic volume increases. This factor is also rated according to established standards; for instance, if the standard shoulder width for a highway is fifteen feet, rating procedure would provide for the point values as shown in Table 15.

TABLE 15.—Shoulder width (par value: 8 points).

Standard (feet)	Actual (feet)	Value (points)
15	15	8
15	14	7
15	12	6
15	10	5
15	8	4

Source: Wyoming State Highway Department, Planning and Research Division, Wyoming Sufficiency Study (Cheyenne: Wyoming State Highway Department, 1958), p. v.

As shoulder width standards would differ for roads in the various state systems, criteria similar to those in Table 15 would be established to reflect the differing conditions.

Surface width.—Surface width has a dual nature in most sufficiency rating systems, as it is often made a part of two of the three major features: safety and service. It is considered in safety because a wider traveled way affords the motorist greater maneuverability in avoiding collisions. Surface width is a factor in the service feature in that narrow pavements contribute to greater driver fatigue.

In determining the point rating for this factor, states may use the following formula:

$$\text{Point Value} = \text{Total Factor Rating} - \text{Standard Width minus Actual Width}$$

If the standard width for a state primary road is twelve feet, the actual width is eight feet, and the total weight applied to this feature is ten points, the rating is determined as follows:

$$10 - (12 - 8) = 6 \text{ points}$$

Traffic volume is considered in the surface-width rating procedure. Should the traffic volume justify a four-lane highway

where a two- or three-lane highway is being used, the point value for surface width would be zero. Average traffic volumes of 3,000 to 4,000 vehicles daily would probably justify a four-lane highway.

Stopping sight distance.—Stopping sight distance represents "the minimum distance required to stop safely when anything on the highway requires a stop."[1] It is measured by the number of restrictions per mile to safe stopping sight distance and considers such obstacles as horizontal and vertical curves and intersections. A point value of ten may be assigned to this feature, and Table 16 may be used as a guide for the field observation teams.[2]

Consistency of alignment.—Consistency of alignment is concerned with the gradient and alignment of the highway section. Some curvature is permitted, but only if it is well distributed. Sudden curves, or the so-called "death" curves, would reduce the rating considerably. If a point value of five

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[1]Idaho Department of Highways, Sufficiency Rating Study (Boise: Idaho Department of Highways, 1959), p. 2.

[2]Table 16 has been devised by the Kansas State Highway Commission for use in assisting its field teams in making ratings.

TABLE 16.—Stopping sight distance (par 10).

Substandard Features	Point Value
None	10
One or less per mile	9
One to two per mile	8
Three to four per mile	6–7
Four to five per mile	3–5
Six or more per mile	0–2

Source: State Highway Commission of Kansas, Highway Planning Department, Highway Sufficiency Rating Survey (Topeka: State Highway Commission of Kansas, 1958), p. 5.

is assigned to this factor, Table 17 may be used to serve as a guide in determining the rating.

Service

The third major category is service, and it includes such components as alignment, passing sight distance, surface width, and rideability. These factors are concerned with the comfort of the ride and the ability to maintain a selected speed in highway travel. Rough and narrow roads are not conducive to

TABLE 17.—Consistency of alignment (par 5).

Consistency of Alignment	Point Value
Consistency good	5
Consistency poor	4
Occasional surprises	1–3
Death curves	0

Source: Wyoming State Highway Department, Planning and Research Division, Wyoming Sufficiency Study, p. vii.

driving comfort. In addition, horizontal and vertical curves restrict constant driving speeds and limit the opportunities to pass other vehicles.

Alignment.—Alignment is concerned with horizontal curves that result in the reduction of safe speeds to those below the design speed for the road section being considered. The rating is determined by the number of substandard curves occurring within a mile. Table 18 may serve as a guide for field observation teams rating this factor.

TABLE 18.—Alignment (par 8 points).

Misalignment	Point Value
Rare (one substandard curve in three miles)	6–7
Frequent (one or two substandard curves per mile) . . .	4–5
Untenable (three or more substandard curves per mile) .	0–3

Source: State Highway Commission of Kansas, Highway Planning Department, Highway Sufficiency Rating Survey, p. 5.

Passing sight distance.—The number of restrictions to passing sight distance encountered per mile of highway is the basis for this factor. The Wyoming Highway Department weights this component six points and uses the information presented in Tables 19 and 20 as guides for its rating teams. In conjunction with Table 19, the passing sight distances listed in Table 20 are used for the various design speeds.

Surface width.—As was mentioned previously, the surface width of the service category is concerned with the fatiguing aspect of pavement width. Driving on narrow roads is extremely tiresome to the motorist. Rating this factor is the same as that

TABLE 19.—Passing sight distance (par 6 points).

Substandard Passing Sight Distance	Point Value
Rare (one restriction in three miles)	6
Occasional (one or two restrictions per mile)	4–5
Substantial (three or four restrictions per mile)	2–3
Completely (five or more restrictions per mile)	0–1

Source: Wyoming State Highway Department, Planning and Research Division, Wyoming Sufficiency Study, p. vii.

TABLE 20.—Passing sight distances based on design speeds.

Design Speeds (miles per hour)	Passing Sight Distances (feet)
30	500
40	900
50	1,400
60	2,100
70	2,900
80	3,700

Source: Wyoming State Highway Department, Planning and Research Division, Wyoming Sufficiency Study, p. vii.

for surface width in the safety category. The formula explained in the preceding section is also used in grading this factor.[1]

Rideability.—Rideability takes into account the roughness of the road surface and any other irregularities on the surface that might contribute to driver fatigue. The quality of driving comfort of the motorist is the determining factor of this feature.

Other criteria for rating

A few of the highway departments surveyed by the writer included other components of geometric standards and design in their sufficiency rating procedure. The most important of these were: (1) maintenance economy, (2) remaining road life, and (3) rating for lack of proper type of surface.

Maintenance economy.—This feature assumes that there is a reasonable balance between the cost of maintaining a road and the cost of reconstructing it. It is possible, for instance, that a road segment may have a sufficiency rating above the critical point and yet it may require a high cost of maintenance to keep it in serviceable order. By giving weight to the maintenance

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[1]See supra, page 194.

feature in sufficiency rating determination, high-maintenance-cost sections will result in lowering the total rating.

Nebraska[1] weights this factor fifteen points in its system. A reasonable cost of maintenance is determined by averaging the maintenance expenditures on sections of highway which are designed for the traffic which they carry. The average is computed over a current five- or six-year period to give consideration to the rising costs of maintenance. Reasonable maintenance costs are determined for the various surface types such as gravel, asphalt, concrete, brick, and bituminous surfaces. The highway sections are then rated on the basis of their actual average costs as compared to the state average for that type of surface. For the rating of bituminous and pavement sections, Nebraska uses a table (see Table 21) as a guide to rating this feature.

Remaining road life.—This factor is based on the road-life studies conducted by most state highway departments. The life of a road depends on many variables, such as the amount of traffic it carries, foundation, pavement thickness, and type of

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[1]Nebraska State Highway Department, Manual of Procedure for the Numerical Rating of the Nebraska State Highway System (Lincoln: Nebraska State Highway Department, n.d.), p. 15. (Mimeographed.)

TABLE 21.—Rating of maintenance economy for all bituminous pavements (par 15).

Percent of Average Cost	Point Value
Under 50	15
50–64	14
65–79	13
80–94	12
95–109	11
110–119	10
120–129	9
130–139	8
140–149	7
150–159	6
160–169	5
170–184	4
185–199	3
200–224	2
225–249	1
250 and over	0

Source: Nebraska State Highway Department, Manual of Procedure for the Numerical Rating of the Nebraska State Highway System, p. 15.

surface, to name a few. Nebraska[1] weights this feature ten points in its rating procedure. The data in Table 22 are used as the guide for rating this feature.

Rating for lack of proper type of surface.—Colorado and Wyoming use this feature in their rating systems. It is based on the principle that roads carrying certain traffic loads should have surfaces capable of handling those volumes. Because of increased traffic and changes in traffic patterns, many highways are subjected to traffic flows that are beyond their ability to properly service. Rapid deterioration sets in and the road becomes a hazard unless constructed to prescribed standards.

Adjustment for traffic volume

After the total numerical grade has been derived for the three categories, the rating is adjusted for the traffic volume using the road. For instance, if two road segments have a total rating of sixty points apiece but one carries an average daily traffice of 100 vehicles while the other carries 3,000 per day on the average, the road carrying the heaviest traffic is programmed for construction first. A formula has been devised

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[1] Ibid., p. 13.

TABLE 22.—Guide for determining the remaining road life of highways in sufficiency rating procedure.

REMAINING LIFE

Year Built	Age	Brick (30 yr. Ave. life L-5)			P. C. Concrete (24 yr. Ave. life L-5)			1/ & 2/ Mixed Bit. over 2" (17 yr. Ave. life S-1)			3/ Mixed Bit. 2" or less (10 yr. Ave. life S-1)			Armor Coat (6 yr. Ave. life S-1)			Armor Coat over old Bit. Mat or A. C. (3 yr. Ave. life S-1)
		Total life	Years to go	Points	Total life	Years to go	Points	Total life	Years to go	Points	Total life	Years to go	Points	Total life	Years to go	Points	Years to go
1956	0	30	30	10	24	24	10	17	17	10	10	10	7	6	6	5	3
1955	1	30	29	10	24	23	10	17	16	10	10	9	6	6	5	4	2.5
1954	2	30	28	10	24	22	10	17	15	10	10	8	5	6.1	4.1	3	2.1
1953	3	30	27	10	24	21	10	17	14	9	10	7	4	6.3	3.3	2	1.7
1952	4	30	26	10	24	20	10	17	13	9	10	6	4	6.7	2.7	2	1.4
1951	5	30	25	10	24	19	10	17	12	8	10	5.3	3	7.1	2.1	2	1.1
1950	6	30	24	10	24	18	10	17	11.3	7	11	4.7	3	7.7	1.7	1	0.9
1949	7	30	23	10	24	17	10	18	10.7	7	11	4.3	2	8.3	1.3	1	0.7
1948	8	30	22	10	24	16	10	18	10	6	12	3.7	2	8.9	0.9	1	0.5
1947	9	30	21	10	24	15	10	18	9.3	6	12	3.3	2	9.6	0.6	0	
1946	10	30	20	10	24	14	9	19	8.7	5	13	3	1	10.3	0.3		
1945	11	30	19	10	24	13	9	19	8	5	14	2.7	1	11.1	0.1		
1944	12	30	18	10	24	12	8	19	7.3	4	14	2.5	1	12.0	0		
1943	13	30	17	10	24	11	7	20	6.7	4	15	2.3	1				
1942	14	30	16	10	24	10	6	20	6.3	3	16	2	1				
1941	15	30	15	10	24	9	5	21	5.7	3	17	1.8	0				
1940	16	30	14	9	24	8	5	21	5.4	3	18	1.7					
1939	17	30	13	9	24	7.3	4	22	5	2	18	1.3					
1938	18	30	12	8	25	6.8	4	23	4.7	2	19	0.8					
1937	19	30	11	7	25	6	3	23	4.3	2	19	0					
1936	20	30	10	6	25	5	2	24	3.7	2							
1935	21	30	9	5	25	4.3	2	24	3.3	1							
1934	22	30.5	8.5	5	26	3.7	2	25	3	1							
1933	23	30.5	7.5	4	26	3.5	1	26	2.7	1							
1932	24	31	7	4	27	3.2	1	26	2.3	0							
1931	25	31	6	3	28	3	1	27	2								
1930	26	31	5.5	3	29	2.8	1	28	1.7								
1929	27	32	5	2	30	2.6	1	28	1.3								
1928	28	32	4.5	2	30	2.4	1	29	0.7								
1927	29	33	4	2	31	2.2	0	29	0								
1926	30	33.5	3.5	1	32	2		30									
1925	31	34.5	3.5	1													
1924	32	35	3	1													
1923	33	36	3	1													
1922	34	37	3	1													
1921	35	38	3	1													
1920	36	39	3	1													
1919	37	39.5	2.5	0													
1918	38	40.5	2.5														
1917	39	41	2														
1916	40	42	2														
1915	41	43	2														

1/Add years shown on Re-Armor Coat table with no adjustment making a rating greater than 9 points, unless originally greater than 9.
2/Use this table for hot mix on old concrete.
3/Add years shown for Re-Armor Coat - maximum by adjustment, 6 points.

Source: Nebraska State Highway Department, "Manual of Procedure for the Rating of the Nebraska State Highway Systems" (Lincoln, Nebraska, n.d.). (Mimeographed.)

to provide for the traffic adjustment. The formula used by most state highway departments is as follows:

$$Y = X + \frac{(X - 100)X}{50 \text{ Log } T_S} (\text{Log } T - \text{Log } T_S)$$

where:

Y = adjusted rating

X = basic rating

T = ADT (average daily traffic) for rating section

T_S = ADT for portion of highway system (federal-aid, primary, etc.).

From the formula, curves can be derived and charted for quick reference in the conversion. Figures 8, 9, and 10 are used to adjust sufficiency ratings for traffic volume for the interstate, primary, and secondary systems, respectively. The use of the formula is illustrated in Figure 9. Assume that a road is designed for an average daily traffic (T_S) of 1,000 and that it is currently servicing 3,000 vehicles per day (T). The basic sufficiency rating (X) for a road section is assumed to be 75. On the horizontal axis find the basic sufficiency rating of 75 (encircled) and move up the vertical line to the curve representing 3,000. Determine the horizontal line intersecting the 75 point basic rating vertical line at 3,000 ADT. The horizontal line at

FEDERAL AID INTERSTATE ROUTE NO. 80, U.S. 30 & 30S

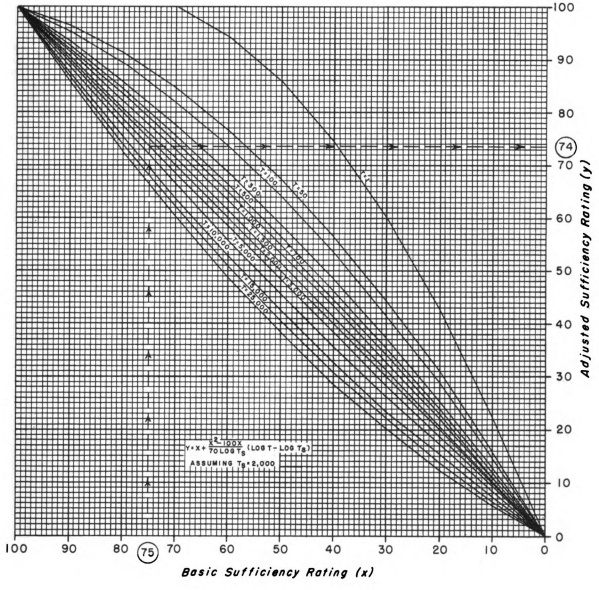

Fig. 8.—Chart to adjust sufficiency ratings for traffic volume on the interstate system. Source: Wyoming State Highway Department, Wyoming Sufficiency Study (Cheyenne: Wyoming State Highway Department, 1958).

FEDERAL AID PRIMARY SYSTEM (EXCLUSIVE OF F.A. ROUTE NO. 80)

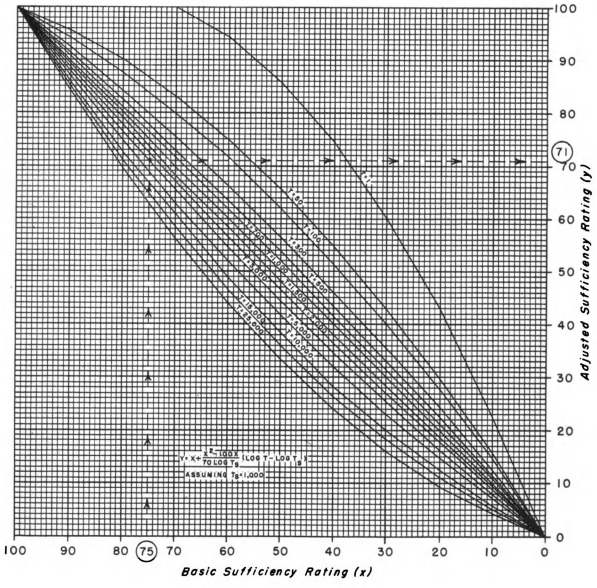

Fig. 9.—Chart to adjust sufficiency ratings for traffic volume on the state primary system. Source: Wyoming State Highway Department, Wyoming Sufficiency Study (Cheyenne: Wyoming State Highway Department, 1958).

FEDERAL AID SECONDARY SYSTEM

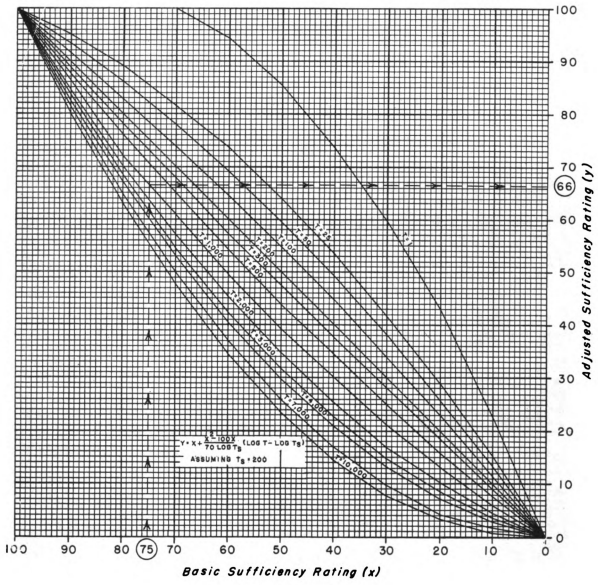

Fig. 10.—Chart to adjust sufficiency ratings for traffic volume on the secondary system. Source: Wyoming State Highway Department, Wyoming Sufficiency Study (Cheyenne: Wyoming State Highway Department, 1958).

point of intersection is the adjusted sufficiency rating; in this case the adjusted rating is 71.

Traffic volumes on the various state highway systems are determined by loadometer studies conducted on a continuing basis throughout the state. Mechanical and manual traffic counts are made at strategic locations on the state road systems. In addition to being used for adjusting sufficiency ratings, traffic studies serve as a basis for many other short- and long-term planning procedures. Further discussion of traffic studies will be made in Chapter VIII.

Special problems in the sufficiency rating procedure

At present many state highway departments surveyed by the writer do not determine sufficiency ratings for their municipal and urban extensions of state highway systems. The rating conditions differ substantially between urban and rural road sections. However, a few of the survey states are in the process of setting geometric standards and design for urban roads and will incorporate them into their rating systems in the future. In rating urban areas, Idaho used the following method:

> The rating of urban sections has been treated essentially the same as for rural sections with the traffic density and the topography controlling the standards. The space

> between the normal travelled way and the curb was taken as "Shoulder Width" although, due to the usual presence of parked vehicles, it might have the designation of "Marginal Friction" for this element. "Surface Width" was taken as the normal width of travelled way and rated according to rural standards for this element, although, the term "Medial Friction" might be more expressive in urban sections. Intersectional friction is created by cross streets and driveways to service stations, motor courts, food markets, etc. Each such cross street, alley or driveway used by the general public was counted as a stopping sight distance restriction and the road section rated accordingly under stopping sight distance.[1]

Certain structures do not lend themselves readily to the rating system. Bridges and tunnels, for instance, must be evaluated in a different manner. For example, in determining the deficiencies of bridges, factors such as carrying capacity and width are evaluated. The data in Table 23 show the method of listing deficient bridges by the Idaho State Highway Department.

In establishing geometric standards for the purpose of rating, states must give consideration to the terrain over which the roads must be constructed. The states in the Rocky Mountain area segregate their roads according to flat, rolling, or mountainous terrains. For each of these types of topography a different set of geometric standards must be prepared. The cost of

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[1]Idaho Department of Highway, Sufficiency Rating Study, p. 3.

TABLE 23.—A method of listing deficient bridges by the Idaho State Highway Department.

INADEQUATE BRIDGES ON THE IDAHO STATE HIGHWAY SYSTEM
Rated Below H-15 Loading or that Create a Hazard due to their Horizontal Clearance

Bridges are termed inadequate if the carrying capacity is less than H-15 loading or the width between curbs is less than-
14' for traffic of 200 or less vpd
18' for traffic of 201 to 1000 vpd
22' for traffic of 1001 or more vpd
The above widths are minimum and much less than design standards for new structures.

TABLE 6
Sheet No. ____

Highway	County	Name	Bridge Number	Horizontal Clearance	Present Loading	Daily Traffic Volume 1954
US 2	Bonner	Pend Oreille River	0001	20.00'	H-15	2,000
US 2	Bonner	Priest River	0068	20.00'	H-15	1,400
SH 4	Shoshone	Canyon Creek	0062	20.17'	H-15	1,400
SH 9	Idaho	Clearwater River - Kooskia Bridge	0744	18.12'	H-15	1,050
US 10	Shoshone	Coeur d'Alene River - Cottage Grove	0633	18.00'	H-15	2,786
US 10	Shoshone	Coeur d'Alene River - E of Wallace	0642	18.50'	H-15	2,786
US 10	Shoshone	Coeur d'Alene River - E of Wallace	0648	18.79'	H-15	2,786
US 10	Shoshone	Coeur d'Alene River - W of Mullan	0677	20.00'	H-15	2,570
US 10	Shoshone	Coeur d'Alene River - W of Mullan	0681	18.50'	H-15	2,570
US 10	Shoshone	Coeur d'Alene River - W of Mullan	0688	18.50'	H-15	2,570
US 10A	Bonner	Pack River	0389	18.00'	H-15	1,200
SH 15	Boise	Payette River - N of Horseshoe Bend	0222	18.12'	H-15	1,140
SH 19	Canyon	Golden Gate Canal	0099	19.25'	H-9	1,900
SH 21	Custer	Stanley Lake Creek	1187	20.00'	H-11	50
SH 21	Custer	Crooked Creek	1200	20.00'	H-5	50
SH 21	Custer	Creek	1219	20.00'	H-5	50
SH 21	Custer	Iron Creek	1220	20.00'	H-5	65
SH 21	Custer	Goat Creek	1227	20.00'	H-4	65
SH 21	Custer	Meadow Creek	1230	20.25'	H-4	65
SH 24	Minidoka	"B" Canal	0029	18.33'	H-4	925
SH 24	Minidoka	"B" Canal	0042	23.85'	H-11	925
US 30	Payette	Snake River - Ontario Bridge	0000	18.17'	H-15	6,220
US 30	Gooding	Snake River - Owsley Bridge	1636	16.67'	H-15	1,100
SH 42	Nez Perce	Catholic Creek	0138	16.50'	H-15	655
SH 45	Owyhee	Snake River - Walters Ferry Bridge	0103	14.70'	H-11	340
SH 48	Jefferson	Roberts Slough	0001	17.00'	H-13	830
SH 50	Twin Falls	Snake River - Hansen Bridge	0083	15.00'	H-10	1,450
SH 52	Gem	Payette River - Emmett Bridge	0317	18.33'	H-15	2,600
SH 68	Elmore	Dixie Canal	1244	22.00'	H-10	220
SH 68	Camas	Creek	1559	21.00'	H-10	125
SH 77	Cassia	March Creek	0088	18.50'	H-9	510
US 89	Bear Lake	Utah Power & Light Canal	0227	18.50'	H-15	1,300
US 89	Bear Lake	Bear River	0234	18.50'	H-15	1,300
US 95 - SH 19	Owyhee	Snake River - Homedale Bridge	0351	17.00'	H-15	2,235
US 95	Canyon	Boise River	0480	18.75'	H-14	1,490
US 95 - US 2	Payette	Payette River	0682	20.00'	H-15	4,720
US 95	Washington	Galloway Canal	0862	24.00'	H-7	1,140
US 95	Washington	Pine Creek	1167	16.10'	H-10	980
US 95	Washington	Spring Creek	1169	16.10'	H-9	980
US 95	Idaho	Slate Creek	2193	16.50'	H-15	715
US 95	Idaho	Whitebird Creek	2308	16.90'	H-15	850
US 95	Nez Perce	Thunderhill Overhead	3183	18.50'	H-15	1,570
US 95	Nez Perce	Spalding Overhead	3202	18.00'	H-15	1,570
US 95	Nez Perce	Clearwater River - Spalding Bridge	3203	18.00'	H-15	3,050
US 95 - US 2	Bonner	Pack River	5047	20.00'	H-15	1,450
US 95 - US 2	Boundary	Deep Creek - N. of Naples	5176	18.00'	H-15	1,428
US 95 - US 2	Boundary	Deep Creek - N. of Naples	5181	18.00'	H-15	1,428
US 95 - US 2	Boundary	Deep Creek - S. of Moravia	5205	18.00'	H-15	1,428
US 95 - US 2	Boundary	Deep Creek - S. of Moravia	5210	18.00'	H-15	1,428
US 95 - US 2	Boundary	Kootenai River - Bonners Ferry Br.	5282	20.00'	H-15	2,300
US 95A	Benewah	St. Maries River	4167	23.00'	H-5	350
US 191 - US 91	Bannock	Overhead North Pocatello	0792	18.50'	H-15	5,900

Source: Idaho Department of Highways, Sufficiency Rating Study (Boise: Idaho Department of Highways, 1958).

constructing a highway through mountainous terrain to the same standards as a highway carrying an equal traffic volume on flat topography would be burdensome. Many geometric standards such as gradient and alignment must be lowered in the construction of mountain roads.

The construction log

In establishing road segments for the purpose of rating, it is important that the procedure follow as closely as possible other records of a similar nature. The tool most commonly used in conjunction with the sufficiency rating survey is the construction log. This record sets forth a section-by-section description of each route in the state system and provides a completely detailed, historical record of the state highway systems.

As in the sufficiency rating procedure, the construction log divides the highway into segments. The purpose of such segmentation is based on differences in geometric standards among the road segments and on the date of construction of any particular section of highway.

The construction log describes each section as to geometric standards such as right-of-way width, pavement type, pavement and shoulder width, traffic lanes, and other such descriptive

data. It does not, however, set forth the condition of the various component elements; this is one of the functions of the sufficiency rating procedure. From the two techniques a trained observer can derive a complete picture of a highway section. The construction log indicates the geometric standards of the road segment, and the sufficiency rating survey reveals its condition.

To permit a better evaluation of the two techniques, Tables 24 and 25 are shown. Table 24 is an example of the construction log for the state of Arizona as of January 1, 1960.[1] Table 25 is the sufficiency rating list for the same sections of highway as found in the construction log.[2]

The Field Observation Study

In the states surveyed by the writer, sufficiency rating studies were made by highly trained, experienced state highway engineers. It was the practice of some states to have one team (usually two engineers) drive over the entire state system, making

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[1]Arizona State Highway Department, Planning and Survey Division, Log of the Arizona Highway System (Phoenix: Arizona State Highway Department, 1960), p. 8.

[2]Arizona State Highway Department, Planning and Survey Division, Arizona Highway Sufficiency for 1960 (Phoenix: Arizona State Highway Department, 1960), p. 28.

TABLE 24.—The construction log for the state highway department of Arizona.

LOG OF THE ARIZONA HIGHWAY SYSTEM

Route No.	Route Mile	Sym	Project	Yr.	Surface Type	Shldr	Length	Lns	Width Surf	Width Rdwy	Milepost	Maint Sect	FA Route	System	County
60		X	BEGIN US 60 70 AND FA RTE 6									11	10	1101	14
60		X	ST LINE CENTER COLORADO RV BR									11	10	1101	14
60		X	EHRENEERG TOWNSITE YUMA COUNTY									11	10	1101	14
60		BR	COLO RIVER BR	28	MIX BIT			5	22	20		11	10	1101	14
60	9		FLH 1 3 NONFA98	49	MIX BIT		732	2	40	40	9	11	10	1101	14
60	741		FI 98 16 17 FLH	50	MIX BIT		450	2	40	40	741	11	10	1101	14
60	1191		FI 98 20	54	MIX BIT		509	2	40	40	1191	11	10	1101	14
60	1700		FAP 98G	32	MIX BIT	BST	300	2	22	32	1700	11	10	1101	14
60	1700	EQ	MP 1791 BK EQUALS 1800 AHD								1791	11	10	1101	14
60	1854	BR	TYSON WASH	32	WOOD 191	FT				28	1863	11	10	1101	14
60	1871	BR	TYSON WASH	32	WOOD 100	FT				28	1880	11	10	1101	14
60	1901	X	QUARTZSITE UNINCORP EL 675								1910	11	10	1101	14
60	1901	X	JCT SR 95 AND FAS RTE 264								1910	11	10	1101	14
60	2000		FLH 1A	32	MIX BIT	BST	503	2	28	34	2009	11	10	1101	14
60	2602		FI 98 19	53	MIX BIT		533	2	40	40	2511	11	10	1101	14
60	3135		FLH 1A	32	MIX BIT	BST	309	2	22	26	3144	11	22	1101	14
60	3444		FAP 98F	33	MIX BIT	BST	180	2	22	26	3453	11	22	1101	14
60	3624		FAP 98F	33	MIX BIT	BST	923	2	24	32	3633	11	22	1101	14
60	4547		FAP 98E	33	MIX BIT	BST	409	2	20	32	4656	11	22	1101	14
60	4956	X	JCT SR 72 FAS RTE 265 AT HOPE								4965	11	22	1101	14
60	4956		F 98 22	56	MIX BIT		384	2	34	34	4965	10	22	1101	14
60	5340		F 022 1 1	58	MIX BIT		882	2	34	34	5349	10	22	1101	14
60	5649	X	SALOME UNICORP EL 1910								5658	10	22	1101	14
60	6194	BR	CENTENNIAL WASH	58	STEEL 504	FT				30	6203	10	22	1101	14
60	6228		NRH 98D	34	MIX BIT	GVL	1200	2	20	28	6237	10	22	1101	14

TABLE 25.—A sufficiency rating list for the state highway department of Arizona.

ARIZONA STATE HIGHWAYS ON FEDERAL-AID SYSTEM
ROUTE LOG SHOWING SUFFICIENCY RATING FOR EACH SECTION

RTE NO	ADJ RTE	MILE POST	LENGTH	PROJECT	YR	U.S. 60 LOCATION	BASIC RATING CON	SAF	SER	TOT	ADT	D
60	85		3.50	CALIF	41	BLYTHE TO EHRENBERG	24	29	34	87	4090	
60	44	0.00	0.09		28	EHRENBERG BR	18	14	13	45	4090	1
60	84	0.09	0.41	FLH 103	49	THRU EHRENBERG INSP STA	30	28	26	84	4090	1
60	94	0.50	6.91	FLH 103	49	EHRENBERG TO 7 MI E	30	30	34	94	4090	1
60	94	7.41	4.50	FI 98	50	7 TO 12 MI E OF EHRENBERG	31	29	34	94	3940	1
60	94	11.91	5.09	98 2	54	12 TO 17 MI E OF EHRENBERG	31	29	34	94	3790	1
60	69	17.00	2.01	98 G	32	2 W TO JCT 95 QUARTZSITE	18	22	29	69	3790	1
					Equation	MP 17.91 Bk. equals MP 18.00 Ahd.						
60	71	19.10	7.01	98G	32	JCT 95 QUARTZSITE TO 7 MI E	18	23	30	71	3480	1
60	94	26.11	4.39	FI 98	53	7 E JCT 95 TO PROPOSED RTE	31	29	34	94	3360	1
60	95	30.50	0.94	FI 98	53	1 W TO PROPOSED ROUTE	32	30	34	96	3360	1
60	63	31.44	4.89	FL1A 98F	33	11 E TO 17 E ST 95	16	20	31	67	3580	1
60	73	36.33	9.23	98 F	33	13 W TO 4 W HOPE	19	25	32	76	3280	1
60	63	45.56	4.09	98 E	33	4 W TO JCT ST 72 HOPE	17	22	27	66	3280	1
60	94	49.65	3.74	F 98 22	56	JCT ST 72 HOPE TO 4 E	34	27	34	95	3580	1
60	98	53.49	8.88	F022 1 1	58	SALOME WENDEN AREA	35	30	33	98	3760	1
60	59	62.37	12.05	98 D	34	CENT WSH TO MARICOPA CO	20	18	25	63	3580	1
60	53	74.42	11.13	NRH 98 C	34	YUMA CO LIN TO JCT 71	15	18	24	57	3820	1
60	92	85.55	12.71	98 21	56	JCT ST 71 TO 13 MI E	32	27	34	93	3770	1
60	86	98.26	8.43	98 18	52	11 W TO 2 W WICKENBURG	27	28	33	88	3810	1
60	90	106.69	2.31	NON 98 A	53	2 W TO WICKENBURG	31	27	34	92	5950	1
60	94	109.00	1.00	98AI NON	53	W LIM TO ADAMS ST WICKBRG	32	28	35	95	6950	1
					Equation	MP 109.90 Bk. equals MP 110.00 Ahd.						
60	92	110.10	0.23	FG 022	58	WICKENBURG U P	35	28	30	93	6950	1
60	73	110.33	0.20	84C	38	JCT 89 TO W END BR WICKBRG	23	22	30	75	6950	1
60	56	110.53	4.80FT	NRM 31	36	HASSAYAMPA RIV BR	29	12	18	59	6950	1
60	91	110.53	2.43	F022 2. 1	57	S E WICKENBURG	35	26	30	91	5520	1
60	61	112.87	8.17	59	38	WICKENBURG TO MORRISTOWN	16	22	28	66	4450	1
60	85	121.04	2.11	84D 3 2	42	MORRISTOWN TO 2 MI S E	24	30	33	87	3840	1
60	84	123.15	5.95	84D 7634	42	6 MI N W TO WITTMAN	23	30	33	86	4090	1
60	81	129.10	7.59	84 A 4	43	WITTMAN TO 8 S E	22	30	32	84	4090	1
60	81	136.69	6.06	84 A 3	42	3 NW BEARDSLEY TO 1 SE LTCH	22	29	33	84	4080	1
60	81	143.65	2.73	FL 70 2	47	SUPRISE AND EL MIRAGE	22	29	34	85	5740	1
60	57	146.38	1.28	FI 70 2	47	AGUA FRIA BR TO MARINETTE	18	15	31	64	6530	1
60	62	147.66	2.80	FA 48	48	MARINETTE TO PEORIA W LIM	25	13	31	69	6940	1
60	84	150.46	0.46	NON 48	54	PEORIA	29	24	33	86	9210	1
60	71	150.92	1.26	FA48 A 4	54	PEORIA TO U P	18	29	31	78	9010	1
60	47	152.18	0.26	48	36	PEORIA U P AND APPR	21	11	25	57	9010	1

the condition ratings. In at least one state—Kansas—two teams performed the field study but only after they had worked together for a period of one month in an attempt to acquire uniformity in the rating procedure. In one state—Nebraska—one team rated only the gravel roads, while a second team graded the paved state highways.

Generally, the study is made annually; however, a few states have converted to a biennial basis. In those instances where biennial studies were made, the states had been utilizing the sufficiency rating method for a number of years and the procedure was well established—planning and control in construction programming was highly developed.

The observation teams drive over the highways, stopping at frequent intervals to carefully evaluate the highway sections for deficiencies. Most of them carry odometers permitting them to measure the road sections to the nearest one-hundredth of a mile. Special forms have been devised to facilitate the rating procedure in the field. Figure 11 is an example of the form used by the New Mexico State Highway Department.

Currently there are several areas of controversy pertinent to conducting the study. First, some states are adamant in following the practice of having one individual or one team

Fig. 11.—A sufficiency rating form used by the New Mexico State Highway Department.

NEW MEXICO STATE HIGHWAY DEPARTMENT
Planning Division

Route No.:F.A.:_____ US/State:_____
C. S. No.:_____ Sequence:_____
Rated By:_____ Date:_____

RURAL SUFFICIENCY-RATING SHEET

Rating-Sec. No.	Speedometer (begin)	Section Termini	Length (Miles-XX.X)	Surface Type	Pavement Width	Roadway Width	Design Speed	Terrain	Sight Dist. V 1500' (%)	ADT ( )	% Heavy Commercial	Sufficiency Rating						
												10 Foundation	30 Surface	10 Drainage	20 Safety	30 Capacity	100 Total Rating	Adjusted Rating
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

Tabulations for Safety Factor

Stopping Sight Distances:	Horizontal Curves:	Narrow Bridges:
		Dangerous Dips:

perform the field rating. They feel that greater consistency and accuracy is obtained from a one-team study of the entire state system. In other states having large land areas and road mileage it may be impossible to have a one-team study. They alleviate the problem by having the two teams work together for a period of time before they separate to rate highways in assigned areas.

Second, two states—Colorado and Kansas—follow the practice of having their district engineers participate in the actual field studies by accompanying the rating teams over every mile of state highway within their districts. The reasons given for this procedure are: (1) If district engineers are allowed to participate in the rating program they will have a greater propensity to accept the results of the study as set forth in the construction program. (2) District engineers are better acquainted with the highway deficiencies within their districts and, therefore, can point out road defects that are not observable to the other members of the rating team.[1]

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[1]From a personal interview with Mr. Robert Livingston, Planning and Research Engineer, Colorado State Highway Department, March, 1960. Quoted with permission.

There is probably some justification for including district engineers in the rating study of roads in their districts. Certainly, employees are more prone to accept and carry out work assignments if they have played some part in the original decision-making process. In the preceding chapter it was mentioned that district engineers were instrumental in planning and directing the flow of construction funds in their districts. If deprived of this prerogative there may be a tendency for them to subtly become uncooperative in any program where their authority has been abrogated.

In most states surveyed by the writer, the district engineer was eliminated entirely from the rating process. It was the opinion of most state highway officials that bias could result if district engineers were allowed to participate in the study. In several of the states where the district engineer was not made a part of the field rating team, the author personally interviewed several of them with the intention of determining their attitudes toward being omitted from the rating process. Invariably they expressed approval of being relegated to a nonparticipative role in the field study. They reiterated the opinions of the state highway officials that bias could possibly enter into the rating process if district engineers were permitted to participate.

When the field rating team(s) complete the field study, the data are coded and punched on cards for the purpose of listing according to state routes or by numerical sufficiency rating order. This in itself is a job of some magnitude when it is realized that from 2,000 to 5,000 miles of state highways are rated annually.

The List of Critically Deficient Highways

States may use adjusted ratings of sixty or seventy points as the dividing line between tolerable and intolerable conditions. At least one state does not set point limits of acceptability and nonacceptability of conditions, but uses the rating list only as a means to assist the highway commissioners in programming construction projects in their districts.

At least two states—Idaho and New Mexico—do not place too much emphasis on the total adjusted rating figure. They assume that it is possible to have a section rated above tolerable limits and yet have a serious deficiency in one of the major elements: structural adequacy, safety, or service. For example, in the New Mexico system, surface is weighted thirty points but it considered only in structural adequacy and not as a component of service as many rating procedures do. The thirty-point range of surface is subdivided for the purpose of determining its

deficiency. A rating of fifteen would indicate the first signs of failure. A rating of fifteen to ten would indicate progressive failure, and a rating of ten or below is justification for replacement. A rating for surface of fifteen to thirty would indicate varying degrees of excellence of the surface.[1] Idaho uses a table of values as presented in Table 26 to determine the critical deficiencies for the three elements.

Listing critical deficiencies by elements has merit in many respects. It is possible, for instance, to have a road section with a rating of seventy-five and yet have a component of the safety element below tolerable limits. A high accident rate on the road section would point out the emergency status for removal of hazardous factors. If the road were programmed for construction according to the total adjusted rating factor, it might be several years before the safety hazards were removed. If other components of the road section were in such a condition that they could reasonably service traffic for several years in the future, and assuming it was feasible from a cost viewpoint, the road section could be programmed to remove the safety hazards only.

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[1]New Mexico State Highway Department, Planning Division, Ratings for Highway Improvement, p. 7.

TABLE 26.—Critical ratings for the three basic elements of sufficiency ratings.

Element	Par Rating	Critical Rating
Condition (structural adequacy)	35	13
Safety	30	11
Service	35	12

Source: Idaho Department of Highways, Sufficiency Rating Study (Boise: Idaho Department of Highways, 1958), p. 9.

Priority listing

The practice of listing differs among states. Some list only their critically deficient roads, while other states schedule them whether deficient or not. For the purpose of planning and reporting progress of the construction program, it is better to utilize both methods, as they tend to complement each other.

Roads are generally listed in three ways: First, roads are divided into highway systems such as interstate, primary, et cetera. An entire highway is listed in successive segments as it enters and leaves the state. The highway is broken down into its sufficiency rating sections. The data in Table 27 show the sufficiency rating listing for State Highway 34 in Idaho as it runs from the Utah state line to the Wyoming state line in a

TABLE 27.—Sufficiency rating list for State Highway 34 in the state of Idaho.

HPS FORM 643 I

Idaho State Highway System
SUFFICIENCY RATINGS

Table 1

Sheet No. 19

HIGHWAY NUMBER	MILE POST	RATING SECTION DESCRIPTION	RATING SECTION	URBAN OR RURAL	TOPOGRAPHY	COUNTY	LENGTH OF SECTION IN MILES	FEDERAL AID ROUTE NUMBER	SUFFICIENCY RATINGS: SAFETY: CONDITION	SAFETY: SHOULDER WIDTH	SAFETY: SURFACE WIDTH	SAFETY: STOPPING SIGHT DISTANCE	SAFETY: CONSISTENCY OF ALIGNMENT	SAFETY: TOTAL	SERVICE: ALIGNMENT	SERVICE: PASSING OPPORTUNITY	SERVICE: SURFACE WIDTH	SERVICE: RIDEABILITY	SERVICE: TOTAL	TOTAL BASIC RATING	TRAFFIC ADJUSTED RATING: YELLOW 85+	TRAFFIC ADJUSTED RATING: GREEN 75+	TRAFFIC ADJUSTED RATING: BLACK LINE 65+	TRAFFIC ADJUSTED RATING: RED 65-	AVERAGE DAILY TRAFFIC	SYSTEM	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
							Par Values →		35	8	7	10	5	30	12	8	5	10	35	100							
SH 33 (Cont.)																											
	201.31 - 201.78	Short Street to Driggs S. C.L.	19	U	F	Teton	0.47	52	30	8	1	4	5	18	12	8	1	8	29	77			73		2300	20	
	201.78 - 203.33	0 to 1.5 mi. S. of Driggs S. C.L.	20	R	F	Teton	1.56	52	23	6	3	5	5	19	5	-	1	7	13	55				59	650	20	
	203.33 - 209.34	1.5 mi. S. of Driggs S. C.L. to Victor N. C.L.	21	R	F	Teton	5.95	52	18	6	3	9	5	23	12	6	1	6	25	66			69		650	20	
	209.34 - 210.01	Through Victor	22	U	F	Teton	0.67	52	33	8	7	-	5	20	9	-	5	9	31	84		83			1300	20	
	210.01 - 215.13	Victor SE C.L. to Wyoming State Line	23	R	R	Teton	5.12	52	33	8	7	9	5	29	12	8	5	9	34	96	97				320	21	
SH 34																											
	0.00 - 5.62	Utah State Line to Preston S. C.L.	1	R	F	Franklin	5.62	1737	27	6	3	7	5	21	12	7	1	8	28	76		77			900	30	
	5.62 - 6.39	Preston S. C.L. to Jct. US 91	2	U	F	Franklin	0.77	1737	20	8	7	-	5	20	12	4	5	7	28	68			69		950	30	
		From this point N. to another Jct. US 91 in Preston (a distance of 1.29 mi.) SH 34 and US 91 overlap, and the section is tabulated as US 91.																									
	7.50 - 8.53	Jct. US 91 to Preston N. C.L.	3	U	F	Franklin	0.96	1779	27	2	5	4	5	16	0	-	3	8	19	62				62	1100	30	
	8.53 - 8.80	0 to 0.3 mi. N. of Preston N. C.L.	4	R	F	Franklin	0.27	1778	26	6	7	6	5	24	12	4	5	7	28	78		79			880	30	
	8.80 - 11.87	0.3 to 3 mi. N. of Preston N. C.L.	5	R	R	Franklin	2.66	1778	30	8	7	9	5	29	12	0	5	9	34	93	93				880	30	
	11.87 - 13.89	3 to 5 mi. N. of Preston N. C.L.	6	R	R	Franklin	2.16	1778	20	2	3	4	4	13	7	-	1	6	14	47				48	880	30	
	13.89 - 17.12	5 to 8 mi. N. of Preston N. C.L.	7	R	R	Franklin	3.16	1778	30	8	7	7	5	27	11	3	5	9	28	85	88				460	30	
	17.12 - 20.27	8 mi. N. of Preston N. C.L. to Treasureton Jct.	8	R	R	Franklin	3.20	1778	21	3	5	7	5	20	9	1	3	7	20	61			67		460	30	
	20.27 - 28.00	0 to 7 mi. N. of Treasureton Jct.	9	R	R	Franklin	6.82	1778	21	3	7	7	5	22	8	-	5	7	20	63			69		470	30	
	28.00 - 30.05	7 mi. N. of Treasureton Jct. to Cleveland	10	R	R	Franklin	2.28	1778	21	6	5	7	5	23	8	3	3	7	21	65			70		470	30	
	30.05 - 31.11	0 to 1 mi. N. of Cleveland	11	R	R	Franklin	1.04	1778	32	7	7	2	5	28	12	6	5	9	32	92	94				430	30	
	31.11 - 33.63	1 to 4 mi. N. of Cleveland	12	R	R	Franklin	2.52	1778	20	6	5	7	5	23	9	1	3	7	20	63			69		430	30	
	33.63 - 35.39	4 mi. N. of Cleveland to Thatcher	13	R	R	Franklin	1.76	1778	20	3	5	6	4	18	7	-	3	6	16	54				61	430	30	
	35.39 - 37.36	Thatcher to Caribou Co. L.	14	R	R	Franklin	1.97	1778	20	8	7	7	5	27	10	5	5	7	27	83	85				740	30	
	37.36 - 42.45	0 to 5 mi. N. of Franklin Co. L.	15	R	R	Caribou	4.96	1778	27	8	7	7	5	27	12	4	5	7	28	82		83			780	30	
	42.45 - 46.59	5 mi. N. of Franklin Co. L. to Grace S. C.L.	16	R	R	Caribou	4.14	1778	33	8	7	9	5	29	12	6	5	9	32	94	95				780	30	
	46.59 - 46.15	Through Grace	17	U	F	Caribou	1.59	1778	33	8	7	-	5	20	12	8	5	9	34	87	85				2200	30	
	46.15 - 48.28	0 to 0.1 mi. N. of Grace N. C.L.	18	R	F	Caribou	0.17	1778	32	8	7	-	5	20	12	8	5	9	34	86	87				860	30	
	48.28 - 52.98	0.1 mi. N. of Grace N. C.L. to Jct. US 30N	19	R	F	Caribou	4.54	1778	27	6	3	7	5	21	10	4	1	8	25	73			74		860	30	
		From this point E. to Jct. US 30N in Soda Springs (a distance of 0.67 mi.) SH 34 and US 30N overlap, and the section is tabulated as US 30N.																									
	59.51 - 59.1	Jct. US 30N to Hooper Ave. in Soda Springs	20	U	F	Caribou	0.30	1786	29	0	7	-	5	20	12	-	5	8	25	74			69		2400	30	
	59.1 - 60.24	Hooper Ave. to 3rd E. Street in Soda Springs	21	U	F	Caribou	0.43	1786	32	2	7	-	5	20	8	4	5	9	26	78			74		2600	30	
	61.24 - 61.29	3rd E. St. to Soda Springs N. C.L.	22	U	F	Caribou	1.02	1786	29	7	7	6	5	25	9	-	5	8	22	76			73		2040	30	
	61.29 - 63.31	Soda Springs N. C.L. to Monsanto Chemical Plant	23	R	F	Caribou	1.80	1792	24	7	7	9	5	28	10	4	5	7	23	77		77			1000	30	
	63.26 - 65.1	Monsanto Chemical Plant to Conda Jct.	24	U	F	Caribou	2.75	1786	29	7	7	8	5	27	12	3	5	9	29	84		84			1000	30	
	65.81 - 72.90	0 to 7 mi. N. of Conda Jct.	25	R	F	Caribou	7.32	1786	28	3	7	6	5	21	11	2	5	7	25	74		79			430	30	
	72.90 - 78.78	7 mi. N. of Conda Jct. to Henry	26	R	R	Caribou	5.93	1786	23	-	7	6	5	18	9	2	5	7	23	64			70		430	30	
	78.78 - 84.90	Henry to Gray Jct.	27	R	F	Caribou	15.22	1786	24	-	7	8	5	20	0	4	5	7	25	69		69			120	30	
	84.90 - 96.04	Gray Jct. to Wayan	28	R	F	Caribou	2.04	1786	22	4	7	0	5	25	10	8	5	7	30	77	80				90	32	
	96.4 - 99.01	0 to 3 mi. E. of Wayan	29	R	M	Caribou	3.00	1786	17	-	-	4	5	9	3	8	-	5	16	42				59	90	32	
	99.01 - 111.41	3 to 16 mi. E. of Wayan	30	R	M	Caribou	12.71	1786	16	-	-	4	5	9	-	8	-	4	12	37				54	90	32	
	111.41 - 116.25	16 mi. E. of Wayan to Wyoming State Line	31	R	R	Caribou	4.85	1786	20	4	7	6	5	22	5	8	5	6	24	66		82			90	32	
SH 35																											
	0.00 - 2.65	Utah State Line to Weston S.C.L.	1	R	F	Franklin	2.65	1771	12	6	3	7	5	21	11	5	1	6	23	56			65		300	30	

Source: Idaho Department of Highways, Sufficiency Rating Study (Boise: Idaho Department of Highways, 1959), p. 27.

northeasterly direction covering approximately fifty miles. A complete breakdown of the rating segments is shown in the table along with identifying information pertinent to the location of the road, length of section, the numerical rating for each component, the adjusted rating factor, and the road sections' daily average traffic volumes.

Second, for the various systems the road sections are shown in ascending order of the numerical ratings, listing first the lowest critical ratings. Table 28 is taken from the 1958 Wyoming sufficiency rating study. Note that the ratings for each construction district are listed, from the lowest and most critical to the highest section ratings for the state secondary system.

Third, listings can also be made according to deficiencies of the individual elements of geometric standards and design. New Mexico uses such a system, as is illustrated in Table 29. When the numerical rating for the individual factor is below the tolerable, or acceptable, point it is indicated in the column to the far right of the table.

Other Methods of Interpreting Sufficiency Rating Data

It is said that a picture is better than a thousand words, and in the case of visual presentation of sufficiency rating data the adage holds true. For the purpose of planning, controlling,

TABLE 28.—Sufficiency rating study for the state of Wyoming for the year 1958.

WYOMING HIGHWAY DEPARTMENT
PLANNING AND RESEARCH DIVISION
1958

Project Sufficiency Ratings
Construction District No. 3

INTERSTATE SYSTEM

	County	Route No.	Project	Surfaced	Length	Rating
1.	Uinta	80	FAP-E-17(AFE 2192)	1934	2.998	62
2.	Uinta	80	NRH-E-135	1934	0.227	66
3.	Uinta	80	FAP-135R	1933	0.114	67
4.	Uinta	80	FAP-E-75(AFE 2192)	1934	1.748	67
5.	Uinta	80	NRH-E-135(AFE 2192)	1944	1.390	69
6.	Sweetwater	80	SN-FAP-58A(4) Sec. I	1942	0.079	70
7.	Uinta	80	FAP-E-17(AFE 2192)	1944	0.131	75
8.	Sweetwater	80	FAP-137R(AFE 2375)	1947	4.530	75
9.	Sweetwater	80	FAP-49R Unit I	1937	15.134	76
10.	Sweetwater	80	SN-FAP-58A(4) Sec. I	1942	2.165	80
11.	Sweetwater	80	FI-58(10)	1952	0.644	82
12.	Sweetwater	80	SN-FAP-58A(4) Sec. II	1942	1.903	83
13.	Sweetwater	80	FAP-137(3)	1940	10.130	83
14.	Sweetwater	80	FAGHI-58B(2)	1947	0.568	84
15.	Uinta	80	FI-219(4) Sec. II	1950	1.041	85
16.	Sweetwater	80	SN-FAI-58A(6)	1947	0.580	86
17.	Sweetwater	80	FI-58(10)	1952	1.343	86
18.	Sweetwater	80	FAP-97(2)	1940	1.694	86
19.	Uinta	80	F-55(3)	1948	3.159	87
20.	Uinta	80	AFE-2342	1948	0.706	87
21.	Uinta	80	FI-219(4) Sec. II	1950	2.587	87
22.	Sweetwater	80	SN-FAP-58A(4) Sec. III	1942	1.800	87
23.	Sweetwater	80	FI-219(4) Sec. I	1950	9.356	89
24.	Uinta	80	FI-219(4) Sec. II	1950	1.595	90
25.	Uinta	80	FI-219(4) Sec. I	1950	1.575	91
26.	Sweetwater	80	F-58(9)	1948	0.453	91
27.	Uinta	80	FI-55(2)	1948	0.955	92
28.	Uinta	80	F-180(5)	1949	0.048	92
29.	Uinta	80	FI-219(4) Sec. II	1950	1.225	92
30.	Sweetwater	80	FI-219(2)	1948	12.180	92
31.	Uinta	80	FI-219(6)	1954	3.691	93
32.	Sweetwater	80	FI-219(2)	1948	0.878	93
33.	Uinta	80	FI-173(9)	1948	4.012	94
34.	Uinta	80	FLHPI-13(1)	1950	3.263	94
35.	Uinta	80	FLHPI-13(1)	1950	0.535	94
36.	Sweetwater	80	SN-FAI-58A(6)	1947	0.158	94
37.	Uinta	80	AFE-2862	1956	0.777	95
38.	Uinta	80	F-180(5)	1949	0.033	95
39.	Sweetwater	80	FI-190(4)(FI-190(6))	1955	4.221	95
40.	Uinta	80	FI-219(4) Non Part	1950	0.190	96

Source: Wyoming State Highway Department, Wyoming Sufficiency Study (Cheyenne: Wyoming State Highway Department, 1958).

TABLE 29.—Sufficiency rating list prepared by the New Mexico State Highway Department.

NEW MEXICO STATE HIGHWAY DEPARTMENT
PLANNING DIVISION

RURAL INTERSTATE SYSTEM

Critically Deficient Sections

F.A.P. Route & Section	U.S. or State Route No.	Location	Length	Ave. Daily Traffic (1956)	Sufficiency Ratings (1957)					Adj. Rating	Critical Deficiency
					Foundation	Surface	Drainage	Safety	Capacity		
3-5	66	Santa Rosa-Jct. US 84 (S)	2.1	4,272	0	(7)	10	2	0	11	Fdtn.-Saf.-Cap.
3-2	66	Rd. N. to Cubero-east	7.6	4,416	10	12	9	2	0	31	Saf.-Cap.
3-2	66	Jct. NM 6-west	4.4	4,145	10	11	10	2	0	31	Saf.-Cap.
3-2*	66	Grants East CL-E. to O/P	4.1	5,100	10	12	10	3	0	32	Capacity
3-2	66	Grants E. O/P-McCartys	7.1	4,639	10	13	10	4	0	35	Capacity
3-1	66	Wingate RR Sta.-east	3.5	4,115	10	12	10	7	0	37	Capacity
3-2	66	5 mi. E. Laguna O/P-east	6.1	4,105	10	10	10	10	0	38	Surf.-Cap.
3-2	66	McCartys-east	9.7	4,596	10	13	10	8	0	38	Capacity
1-5	85	Santa Fe-Jct. US 285 (S)	7.4	3,200	10	13	10	4	7	43	Capacity
1-2	85	San Marcial Jct.-south	4.9	808	0	(9)	10	1	25	44	Fdtn.-Saf.
3-5	66	Santa Rosa-west	1.2	3,910	10	12	10	1	13	44	Safety
1-3	85	Belen-north	1.5	3,008	0	(8)	6	9	30	45	Foundation
1-3	85	Los Lunas-south	0.9	3,008	0	(8)	6	9	30	45	Foundation
3-4	66	Bern./S.Fe CL-S.Fe/Torr. CL	6.6	4,134	10	20	10	7	0	45	Capacity
3-1	66	Gallup-Ft. Wingate Ord. Depot	7.4	6,400	10	14	10	20	0	49	Capacity
1-3/1	85	Bernardo-south	11.4	1,940	10	10	7	2	21	51	Surf.-Saf.
1-2	85	Jct. NM 180-T. or C.	12.2	2,100	10	15	10	2	12	51	Safety
1-1	85	Jct. NM 28 near Rad, Spgs.-north	9.7	1,170	10	13	6	1	17	52	Safety
1-2	85	T. or C.-north	5.2	1,168	10	14	10	1	13	53	Safety
3-1	66	Arizona Line-east	11.4	3,759	10	10	10	6	20	54	Surface
1-4	47	Isleta-Albuquerque	10.2	3,000	10	18	10	2	17	55	Safety
3-1	66	Gallup-west	8.6	5,000	10	11	10	17	10	55	Capacity
3-1	66	Ft. Wingate Ord. Depot-east	2.5	4,291	10	13	10	20	5	55	Capacity
3-5	66	Jct. US 84 (N)-west	3.7	3,168	10	10	10	8	20	57	Surface
1-5*	85	Las Vegas-north	8.9	2,400	0	(10)	10	20	27	58	Capacity

Source: New Mexico State Highway Department, Ratings for Highway Improvement (Santa Fe: New Mexico State Highway Department, 1957).

and reporting the condition of a state highway system, maps, graphs, charts, and tables are used.

Maps

The sufficiency rating map can take two forms: (1) The map can cover the entire state highway system, and by shading or scaling the road according to sufficiency rating intervals such as 90 to 100, 80 to 90, et cetera, the condition of the highway system becomes strikingly evident. (2) Strip or sectional maps can be utilized to portray the condition of a single highway running throughout the state, section, or district. Figure 12 is the sufficiency rating map for the state of Kansas for the year 1958. A quick inspection of the map enables a trained observer to quickly determine those roads or areas possessing critical deficiencies. When color is used instead of shading in black and gray, the deficiencies, or roads below tolerable limits, become even more obvious.

Figure 13 is an example of the strip map used by the New Mexico Highway Department. This form of presentation is probably the best technique that the writer found in use in the ten survey states. It not only shows the precise location of the highway, but the road sections and the numerical ratings are set

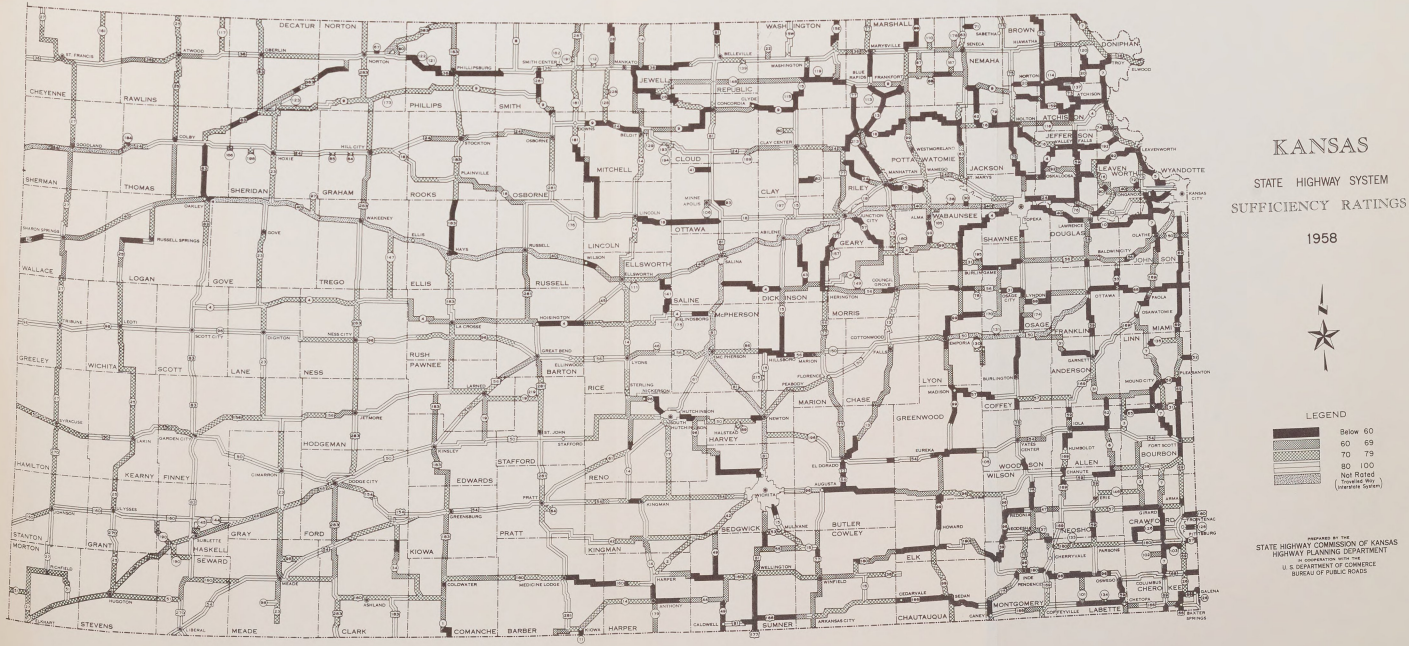


Fig. 12.—Sufficiency rating map for the state of Kansas for the year 1958.

Fig. 13.—Strip map used by the New Mexico State Highway Department to illustrate road deficiencies.

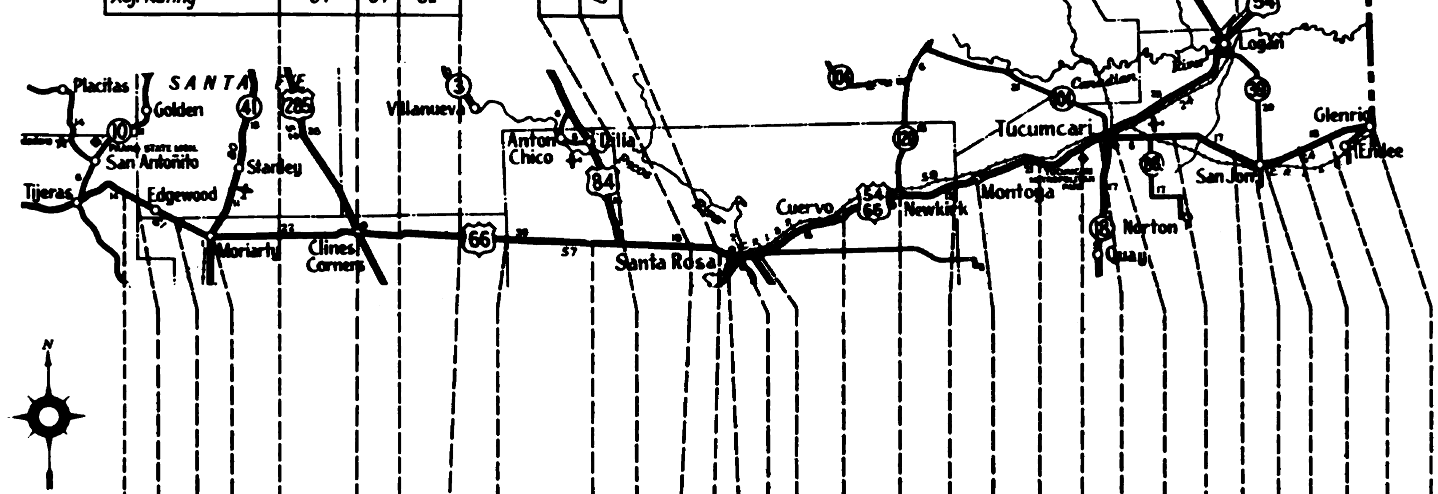
Length	11.5	4.6	9.6
Surface & Shoulder Width	32 38	32 38	24 38
ADT 1956	3779	3195	3141
Foundation & Surface	10 13	10 13	10 27
Safety	4	3	6
Capacity	30	30	30
Adj. Rating	64	64	82

Length	11.3	4.8
Surface & Shoulder Width		
ADT 1956	3581	3765
Foundation & Surface	Under Const.	Under Const.

N.M. STATE HIGHWAY DEPARTMENT
PLANNING DIVISION

SUFFICIENCY RATINGS ON PRIMARY SYSTEM 1957

FAP ROUTE NO. 3
(INTERSTATE 93)



Length	1.8	6.6	5.9	10.2	11.5	4.6	9.6	7.0	13.4	3.7	11.3	4.8	1.2
Surface & Shoulder Width	24 26	24 26	24 26	24 26	32 38	32 38	24 38		24 28	30 36			24 28
ADT 1956	4142	4134	4138	3849	3779	3195	3141	3168	3177	3168	3581	3765	3910
Foundation & Surface	10 22	10 20	10 20	10 11	10 11	10 12	10 26	Under Const.	10 12	10	Under Const.	Under Const.	10 12
Safety	20	7	20	10	3	4	8		3	8			
Capacity				12	30	30	30		15	20			13
Adj. Rating	60	45	68	51	62	64	83		49	57			44

Length		2.1	14.5	8.0	8.7	3.6	8.2	8.4	3.4		7.5	9.9	3.6		4.3	4.2	7.8
Surface & Shoulder Width	Urban	22 24	24 36	24 40	24 40	24 40	22 32	22 32	24 36	Urban	24 40	24 40	24 40	Urban	24 40	24 40	24 40
ADT 1956		4772	3418	3357	3401	3396	3420	3445	4100		4000	2957	3030		2654	2540	2442
Foundation & Surface			10 24	10 20	10 16	10 16	10 17	10 18	10 17		10 26	10 20	10 18		10 17	10 18	10 18
Safety			7	7	5	14	4		3		20	7	8		20	20	12
Capacity			21	21	19	21	17		11		18	24	24		25	24	25
Adj. Rating		11	71	67	59	70	57	41	49		83	71	69		82	82	76

For Notes See FAP Route 3 Sheet 1 of 2

forth for each of the major elements. Deficient components are shaded to indicate the specific areas of inadequacy. The condition of the entire highway can be readily visualized.

The technique used in Figure 14 indicates a slightly different way of illustrating road conditions. The narrow black lines represent a perfect road condition and one hundred sufficiency rating points. The dark or shaded sections represent varying degrees of deficiency.

Sufficiency rating maps vividly portray the condition of the road systems of a state or a section. In proper hands they are an important tool for planning and control of expenditures. In addition, they serve as an excellent means for reporting construction progress to the public.

Charts and graphs

Sufficiency rating data lend themselves well to the preparation of charts and graphs in planning and control. Figure 15 is an example of a method used by the Washington State Highway Department in interpreting sufficiency rating data. By charting each section of its highways, deficiencies are brought forth in bold relief.

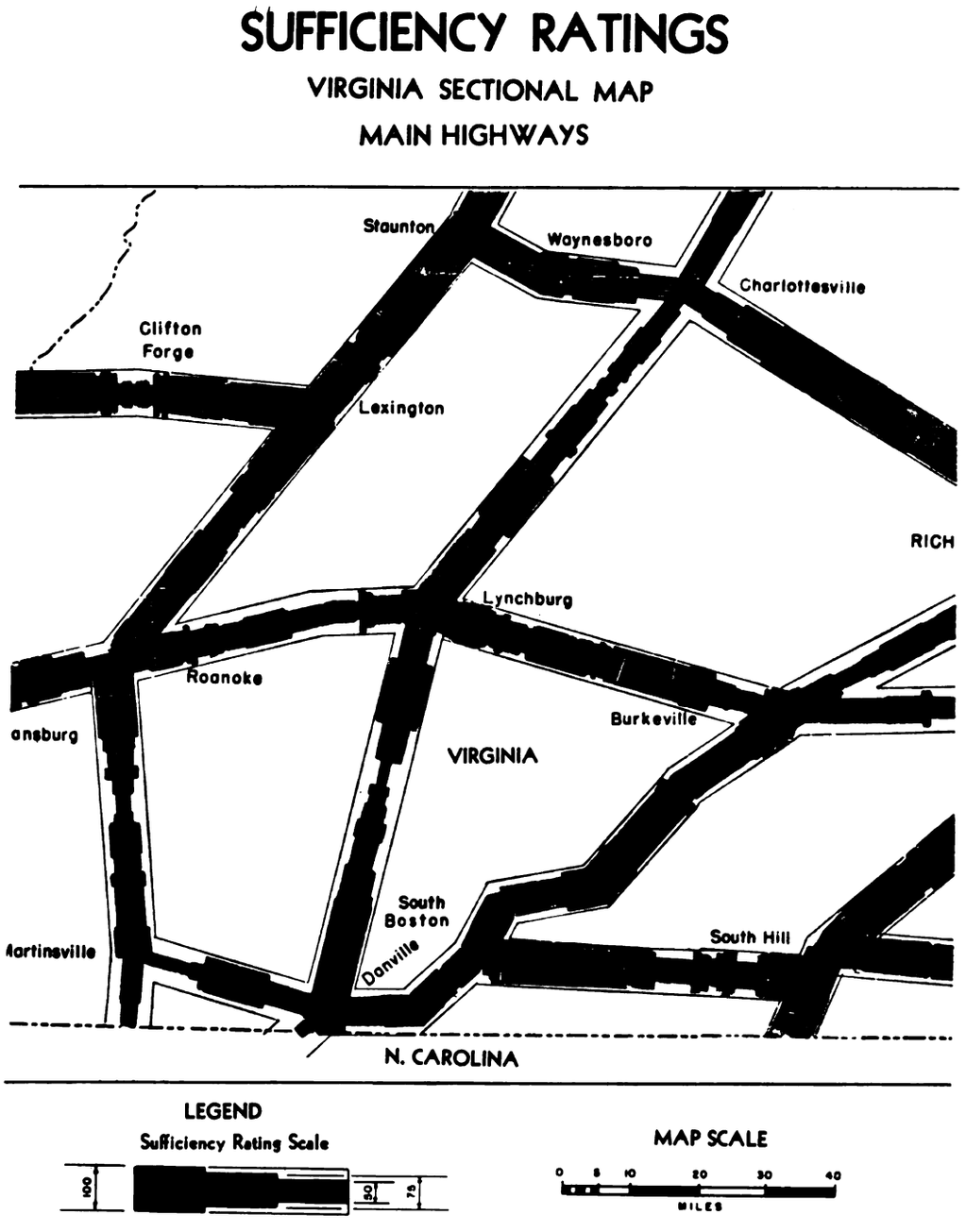


Fig. 14.—Map used by the Virginia State Highway Department to illustrate road deficiencies. Source: Roy E. Jorgensen, Priorities and the Development of Annual Highway Programs (Washington: National Highway Users Conference, 1952).

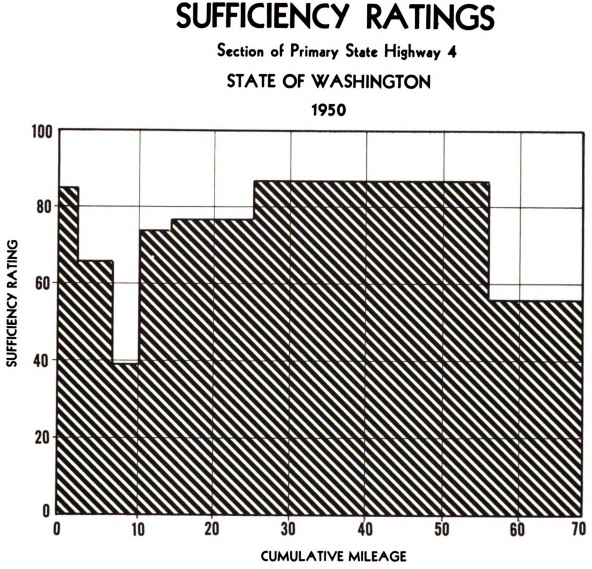


Fig. 15.—An example of a method used by the Washington State Highway Department to illustrate sufficiency rating data. Source: Roy E. Jorgensen, Priorities and the Development of Annual Highway Programs (Washington: National Highway Users Conference, 1952).

The bar charts in Figure 16 are prepared by the Kansas Department of State Highways. The charts show a comparison of all state rated roads by construction divisions for the two years 1956 and 1958. It would seem evident from the charts that the Kansas highway department is making progress in reducing its deficient road mileage having ratings below seventy points.

Among other techniques, Idaho uses a pie chart to illustrate the condition of state highways. Figure 17 is an example of this method of presentation for the year 1959. From the chart it can be determined that 24 percent of the total rated road mileage in Idaho was deficient in 1959, and an additional 22 percent could possibly soon become deficient within a few years.

Colorado prepares a bar chart to present the sufficiency rating condition of its highways. Figure 18 is an example of this technique. The bar chart is an effective method of setting forth deficiencies in the highway systems.

An Evaluation of the Sufficiency Rating Procedure

The sufficiency rating procedure is designed to introduce a degree of objectivity into a method that can be very subjective in nature. Yet there remains a certain element of subjectivity in

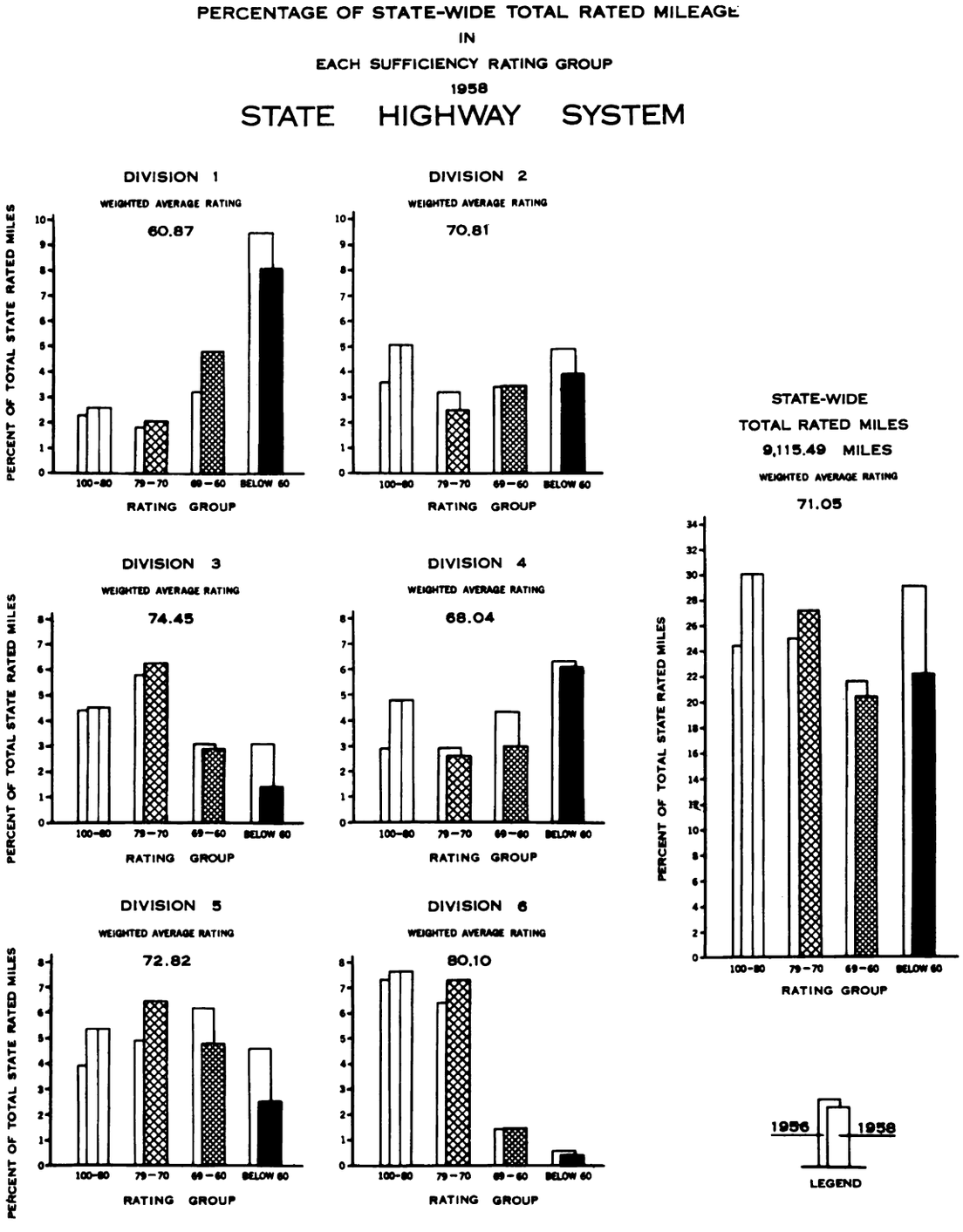
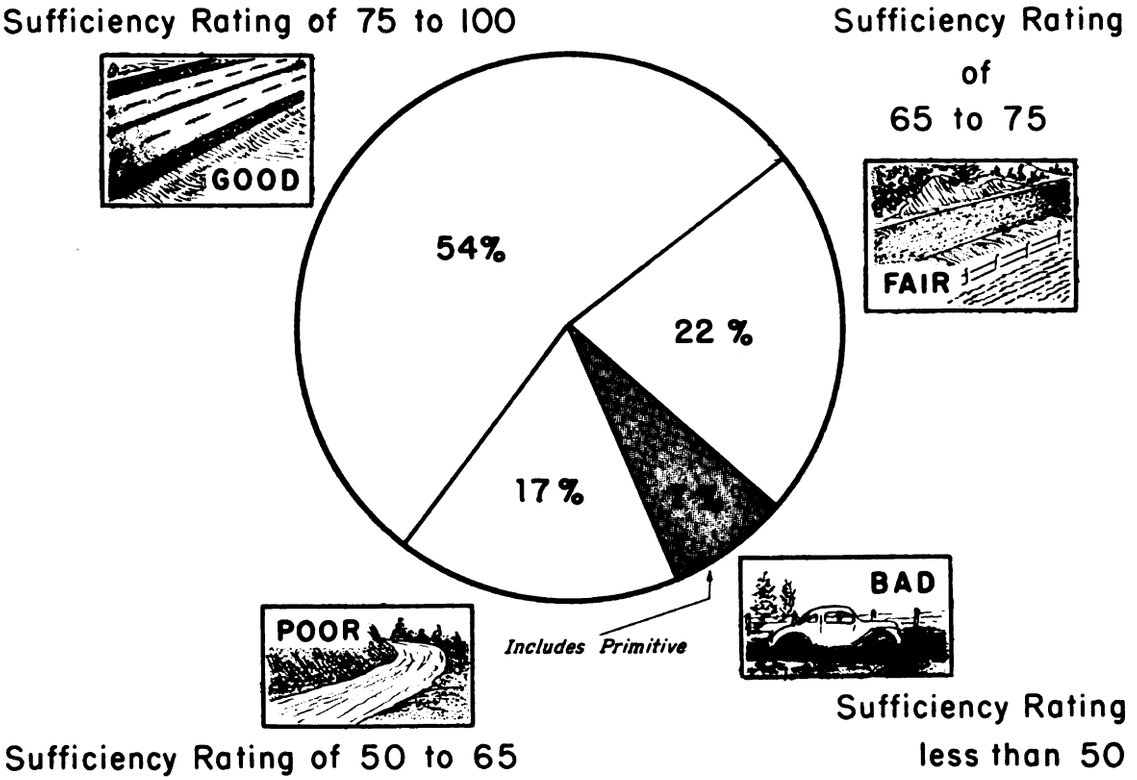


Fig. 16.—A bar chart used by the Kansas State Highway Department to illustrate road conditions. Source: State Highway Commission of Kansas, Highway Sufficiency Rating Survey (Topeka: State Highway Commission of Kansas, 1958).

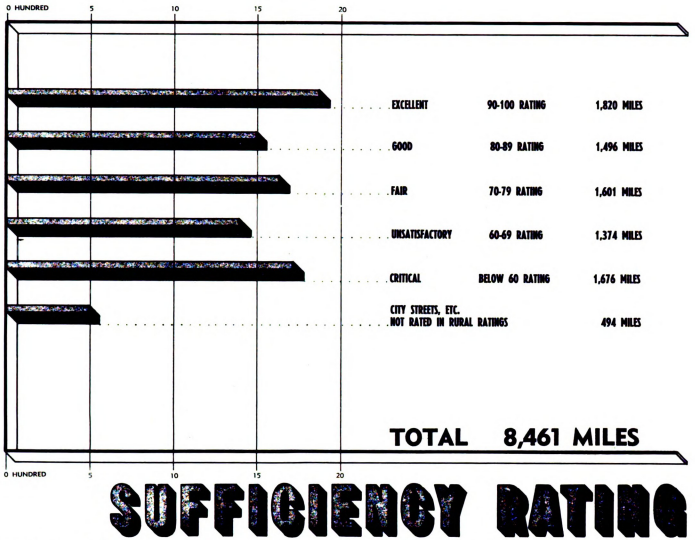
Fig. 17.—The pie chart as a method of illustrating the conditions of highways in the state of Idaho.

The 1959 study covered 4,406 miles of Rural State Highways not including 63 miles of primitive sections. Of the rated roads, 254 miles rate less than 50; 723 miles rated between 50 and 64,- thus 977 miles, (22%) scored less than 65. A total of 997 miles were rated between 65 and 74, and 2,432 miles have a rating of 75 or better.



Source: Idaho Department of Highways, Sufficiency Rating Study (Boise: Idaho Department of Highways, 1959).

Fig. 18.—The bar chart as a method of illustrating the sufficiency rating condition of highways in the state of Colorado.



Source: Colorado Department of Highways, Colorado's Annual Highway Report for 1958 (Denver: Colorado Department of Highways, 1959), p. 23.

the planning and control process as there is in any method that provides for a choice from among alternatives. So many variables must be considered in the decision-making process that confusion may be rampant unless the factual data are presented in a logical manner.

The sufficiency rating procedure attempts to provide a logical presentation of information in a manner that reduces judgment values to a minimum. Yet, its value as a tool for planning depends on a number of extenuating factors. First, its contribution to the planning and control of construction expenditures is dependent upon the prevailing philosophy of top management in highway departments. If highway managers are prone to utilize less objective methods simply because custom has given them sanction in the past, then the sufficiency rating procedure is merely an encroachment on the traditional managerial prerogatives.

Second, the elements that are written into the geometric standards and design, and the weights that are assigned the elements, are factors that must be given careful thought and consideration. The standards of measurement should provide for adequate determination of the condition of the highway components and still be understandable and simple as possible. The

weight variables should be distributed in such a manner as to give proper consideration to the importance of each element.

Third, unless carefully controlled, the field observation process may reduce the objectivity obtained in the two preceding factors. Observers should be provided an initial period of training in the art of rating and, periodically thereafter, should receive briefing sessions. The training sessions should be designed to acquire uniformity and accuracy in rating the highway segments.

CHAPTER VII

THE SHORT-RUN CONSTRUCTION BUDGET

The budget is one of the most effective tools available to management for planning and controlling its financial activities. By its very nature the budget is a forward-looking process and is concerned with future events and predicted conditions. As a tool for control, the budget requires a constant evaluation of actual results with budget goals. It exacts explanations and justification for deviations from planned objectives.

Properly used, the budget is an important and powerful tool in the fulfillment of managerial responsibilities. However, like other techniques of planning and control it can be misused or relegated to a role far below its potential.

It should be understood that budgeting has certain limitations, and these restrictions should be known and understood before undertaking a budgeting program. Welsch lists four rather self-explanatory limitations on the use of the budget:

1. The budget is based on estimates and the strength or weakness of the program depends on the accuracy with which the estimates are made.

2. The budgetary program must be continually adapted to fit changing circumstances. The budget program should be dynamic.

3. Execution of the budget will not occur automatically. It requires the effort and support of executives in achieving its goals.

4. The budget will not take the place of management and administration. The budget should be a servant, not a master.[1]

Too often the budget is viewed by management as primarily a technique for control in which the administrator must live within the bounds of department or division budget appropriations. Fundamentally, the budget has its greatest value as a tool for planning, and secondarily as a control technique.

In highway administration the budget can be the epitome of an enlightened and progressive management. A properly programmed budget can serve management in many ways. First, and most important, it is a decision-making tool which can assist management in achieving highway organization objectives. Second, as a tool for planning it can aid management in better understanding the dynamic changes that are constantly taking place in the highway organization. For instance, the federal government instituted an extremely large road-building program in 1956

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[1]Glenn A. Welsch, Budgeting, Profit Planning and Control (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1959), pp. 13–14.

which was far beyond anything undertaken by state highway departments prior to that time. Huge amounts of federal-aid funds were made available to the states. A well-planned budgeting program would have enabled any state highway department to forecast its personnel, equipment, property, and material needs to take full advantage of the accelerated federal-aid programs.

Third, the budget can serve as the basis for highway reports to the public. The budget can serve as a yardstick for measurement of managerial performance. Highway budgetary reports, especially as they relate to construction and maintenance, can reveal to the public the accomplishments of highway management. Fourth, a properly planned highway budget will alleviate the pressures of vested-interest groups and, therefore, serve as the basis for justification for managerial action. The well-programmed highway budget represents a logical presentation of facts that discourage illogical arguments.

It will be the purpose of this chapter to integrate the features of short-run construction programming into a hypothetical, but realistic, budgetary situation. The system will serve as a model to illustrate the recommended procedures of short-term planning and control of expenditures as discussed in Chapters V and VI. The discussion will be more or less restricted to the

annual construction budget and only a cursory analysis will be given to the other highway functions such as maintenance, administration, and other services. No attempt will be made to reflect the effects of long-term planning on the annual budget program. Long-term planning as it affects the annual budget will be discussed in the following chapter.

It will not be the purpose of the budget model to recommend the forms to be used in presenting the budget. Quite the contrary, the forms used in the model are designed to facilitate explanation. In many instances much of the detail of construction programming will be avoided, as it would add little to the discussion. However, when the detail is eliminated, the reader will be made aware of the situation by explanation or reference to previous citations.

A rather high degree of uniformity prevails in the methods of accounting and budgeting by state highway departments, which could be the result of action taken by the Research Board of the Bureau of Public Roads in establishing standardized procedures and systems. All of the highway departments visited by the author owned, leased, or had access to the latest mechanical tabulation equipment. With these high-speed machines the budget departments were able to prepare and disseminate budgetary

reports to highway management monthly, quarterly, and annually with no delay.

The Distribution of the Highway Fund to the Political Units

The highway fund is composed almost entirely of highway user revenues. As was illustrated and discussed in Chapter IV, revenues are received from a variety of user sources such as motor-fuel taxes, registration fees, and motor-carrier imposts. The distribution of this highway fund among the counties, cities, and the state is established by the action of the state legislature. There seems to be little uniformity among the states in the allocation of the fund between political units.

As was recommended in Chapter V, the states should exercise control over the use of the highway funds allocated to the counties. The following qualifications should be established by county and state authorities as a requisite to the receipt and use of the funds by county road authorities:

1. A county primary road system[1] composed of the more important county roads, exclusive of the state secondary system, should be established by cooperative

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[1]The county primary road system was explained and discussed in Chapter V; see supra, page 154.

agreement between county and state officials. This road system should comprise the more important roads connecting communities and major primary and secondary highways.

2. The county allotment should be used exclusively for county highways and not for nonhighway general-fund purposes.

3. At least 75 to 85 percent of the funds should be devoted to construction[1] and reconstruction of county roads. The remaining portion could be used for maintenance and administration costs. An evaluation of county maintenance costs should be made to determine actual needs. The 75 to 85 percent figures are arbitrarily determined and are used to stress the importance of prorating the greatest portion for construction purposes.

4. The state highway department should establish a set of standards and design for the county primary system. From the standards and designs, a system of establishing construction priorities should be prepared and used as the basis for planning and control of expenditures.

5. All county construction projects should be approved by state highway department personnel before funds are released. A special department should be established to administer to county needs.

6. Funds for construction and maintenance of roads not on the county primary system should be derived from local sources rather than from the highway fund.

The advantages of this proposal have already been set forth in a preceding chapter.[2] There are two disadvantages of

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[1]Construction would include expenditures for right-of-way acquisition and any other preconstruction engineering costs.

[2]See supra, Chapter V, pages 155–56.

the above recommendations that are worthy of mention: (1) The authority of the county commissioners would be restricted to the extent that approval for highway planning and control of construction expenditures would be vested in state highway authorities. (2) State highway organizations would have to be expanded to include a department of highway experts to administer the county highway programs. Considering the benefits to be derived in planning, controlling, and integrating the rural road systems, the above disadvantages would seem to be minor in importance.

The problem of planning and control over the cities' share of the highway fund is less important. Other than for the arterial highways entering and/or passing through the city, the streets are of such a localized nature that they are relatively unimportant to the over-all state system. However, to insure that proper consideration will be given to the municipal extensions of state highways, some degree of control should be exercised over the highway fund allocation to the cities. Most state highway departments already have working arrangements with cities pertinent to state highways within city limits.

Estimating highway user revenues

The first step in preparing the budget should involve the estimation of the highway revenues that will be forthcoming from state sources.[1] The data in Table 30 depict the hypothetical estimated revenue for a hypothetical state highway department for the fiscal period 1959–60. It is stressed that all statistical information appearing in the following tables are not actual data but are strictly hypothetical in nature. However, the proportional relationship of revenues and expenditures of various types have been carefully determined and are representative of actual conditions found to exist in the tax and cost structures.

Distribution of highway fund to political units

Revenue from state sources available for highway use is distributed among the political units concerned with highway finance. In the model it is assumed that state law requires that the receipts be distributed 65 percent to the state, 30 percent to the counties, and 5 percent to the cities. Allocation of the highway fund under these circumstances is presented in Table 31.

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[1] Estimating highway revenues did not seem to be a difficult process in the survey states. Highway revenues seem to have remained relatively stable from year to year.

TABLE 30.—State highway department estimated highway revenue from state sources for the fiscal period from July 1, 1959, through July 31, 1960 (amounts in thousands of dollars).

Source	Amount
Highway user revenue:	
Motor-fuel tax	49,234
Motor-vehicle registration	9,400
Mileage tax (commercial carriers)	1,806
Total highway user revenue	60,440
Other miscellaneous sources[a]	1,100
Total estimated receipts	61,540

[a]Miscellaneous revenues include motor-vehicle fines, receipts from cooperative agreements with local units, and miscellaneous collections.

TABLE 31.—State highway department distribution of the highway funds to the state, counties, and cities for the fiscal period from July 1, 1959, through June 30, 1960 (amounts in thousands of dollars).

Description	Amount
Total estimated revenue	61,540
Allocation of highway fund:	
State (65 percent)	40,000
Counties (30 percent)	18,462
Cities (5 percent)	3,078

Allocation of the State Portion of the Highway Fund to the State Highway Functions

With the funds established for state highway use, the next step is to allocate these revenues over the major highway functions. It is assumed that departmental, divisional, and district budget needs have been determined and approved by the proper authorities.[1]

Once the state matches the federal-aid appropriation, a certain amount of flexibility can be introduced into the budget. States have two years after the close of the fiscal period in which to spend federal-aid allotments.[2] This permits some degree of latitude in programming the highway construction budget.

At this point it is necessary to consider federal-aid allotments which, when added to the state highway fund, represent the total estimated revenues available for highway use. Table 32

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[1]At this point an assumption is made in the construction of the model. It is assumed that highway revenues are sufficient to meet the financial needs of fixed costs (maintenance, administration, and other services) and that adequate funds remain to meet federal-aid matching appropriations for road construction. In all but one of the survey states, revenues were available to cover fixed costs first and federal matching funds second. In the one state, they were forced to budget funds to match federal-aid construction appropriations first and to allocate the residue over the fixed costs. Because they were working on a tight budget they held maintenance, administration, and other service costs to a minimum.

[2]Udell, p. 231.

TABLE 32.—State highway department estimated revenues available to the department of highways for the fiscal year from July 1, 1959, through June 30, 1960 (amounts in thousands of dollars).

Description	Amount
State highway user revenue	40,000
Federal-aid allotment	50,000
Total estimated revenue	90,000

illustrates the total revenues available to the state highway department.

The states are restricted in the use of the federal-aid allotment. Federal funds must be used strictly for construction of roads in the federal-aid systems.[1]

From the revenues from state sources, funds are apportioned to the nonconstruction expenses. The data in Table 33 indicate the budget needs for the nonconstruction functions. These expenditures are segregated into three major classifications:

[1]The federal highway acts do provide for a small percentage of funds to be used for administrative and research purposes.

TABLE 33.—State highway department estimated operating costs exclusive of construction expenditures for the fiscal year from July 1, 1959, through June 30, 1960 (amounts in thousands of dollars).

Expenditure Classification	Estimated Expenditure
Administration:	
General administration	900
Administrative engineering	620
District engineer operations	300
Public relations	80
State employees retirement fund	470
General insurance	70
Compensation insurance	60
Total administration	2,500
Maintenance:	
District 1	3,000
District 2	1,500
District 3	1,500
District 4	2,000
District 5	2,000
Total maintenance	10,000
Other services:	
Traffic	200
Highway patrol	700
Property	600
Equipment	1,000
Total other services	2,500
Total estimated fixed expenditures	15,000

(1) administration, (2) maintenance, and (3) other services. The breakdown under these classifications should be further subdivided by object of expenditures such as salaries, wages and associated accounts, supplies, travel expense, et cetera. Estimated maintenance expenditures should have additional subclassifications by project sections and type of maintenance expenditures.

Before the remaining funds can be allocated to meet construction expenditures, two additional appropriations are generally made: the contingent fund, and debt service or bond retirement needs. The contingent fund may service a variety of needs such as litigation costs resulting from legal action over right-of-way controversies and other similar problems. Many highway departments are authorized to issue bonds, or warrants, to step up their highway construction programs. The debt must be serviced and the bonds retired.

The model provides for $100,000 to service its bonded debt and $300,000 for its contingent fund. The data in Table 34 indicate the distribution of revenues available from state sources to nonconstruction functions, the contingent fund, debt service, and the state requirement to match federal-aid construction funds.

From Table 34 it can be determined that $21,100,000 of funds from state sources must be provide to match federal-aid

TABLE 34.—State highway department distribution of estimated state highway revenues from state sources including state matching funds for construction for the fiscal year from July 1, 1959, through June 30, 1960 (amounts in thousands of dollars).

Description	Amount
Estimated state highway revenues	40,000
Estimated fixed expenditures	15,000
Contingent fund	300
Debt service	100
Total nonconstruction expenditures	15,400
Balance of state revenues	24,600
Required matching funds	21,100
Excess state revenue	3,500

requirements. It is evident from the table that estimated state funds will be sufficient to meet all state highway construction and nonconstruction needs and that an excess of $3.5 million will remain. The excess funds can be disposed of in a number of ways. First, many states construct and maintain a small road mileage that is not subject to federal-aid participation.[1] The excess funds may be used to construct and maintain these roads. Second, the states may prorate the excess monies over the major state systems for construction purposes or they may allocate the funds to one system that may be in greater need of construction. In the budget model, the excess funds will be prorated over all the systems for use in construction in the following manner:

40 percent for interstate road construction
30 percent for primary road construction
20 percent for secondary road construction
10 percent for urban road construction

From the preceding information it is now possible to construct a summary of total budget expenditures by highway functions which includes federal-aid funds. The data in Table 35 indicate the total budgeted expenditures for the fiscal period 1959–60.

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[1] In the ten survey states, nonfederal-aid state roads seldom exceeded 200 miles.

TABLE 35.—State highway department summary of estimated expenditures by the state highway department for the fiscal period from July 1, 1959, through June 30, 1960 (amounts in thousands of dollars).

Description	Amount	Percent
Administration	2,500	3
Maintenance	10,000	11
Other services	2,500	3
Debt retirement	100	—
Contingency fund	300	—
Construction	74,600	83
Totals	90,000	100

The Construction Budget

Funds available for construction are established at $74,600,000, of which $24,600,000 (including excess funds) represent the state's contribution to the program and $50,000,000 is the federal-aid apportionment to the state. In planning its federal-aid highway expenditures, Congress determines the total appropriations for a fiscal year or for a series of fiscal periods. Congress also stipulates the amount of the appropriation to be expended on each of the systems such as the interstate, primary, et cetera. For instance, the Federal-Aid Highway Act of 1956 provided the following appropriations for the interstate system:[1]

Fiscal Period Ending June 30	Amount Appropriated per Year
1957	$1,000,000,000
1958	1,700,000,000
1959	2,000,000,000
1960–67	2,200,000,000
1968	1,500,000,000
1969	1,025,000,000

For the construction of the primary, secondary, and urban systems, the Federal-Aid Highway Act of 1956 provided

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[1]Udell, p. 201.

appropriations of $125,000,000 for the fiscal year ending June 30, 1957; $850,000,000 for the 1958 fiscal year; and $875,000,000 for the fiscal year ending June 30, 1959.[1] The Federal-Aid Highway Act of 1959 further provided appropriations of $900,000,000 and $925,000,000 for the fiscal years 1960 and 1961, respectively.[2]

Both the 1956 and 1958 acts established the following ratios as the basis of distributing the total noninterstate appropriations between the three systems:

Federal-aid primary . . 45 percent of appropriation
Federal-aid secondary . 30 percent of appropriation
Federal-aid urban . . . . 25 percent of appropriation

In the budget model, the total federal aid for construction projects in all systems is $50,000,000. Of this sum, it is assumed that $32,500,000 is designated for the interstate system. The remainining $17,500,000 is divided between the primary, secondary, and urban systems in the ratio prescribed by law, which is 45, 30, and 25 percent, respectively.

The data in Table 36 indicate the total estimated construction funds for all the federal-aid systems, while the information

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[1] Ibid., p. 197.

[2] Ibid., p. 231.

TABLE 36.—State highway department estimated construction expenditures for all federal-aid systems for the fiscal year from July 1, 1959, through June 30, 1960 (amounts in thousands of dollars).

Description	Amount
Federal-aid allotment	50,000
State revenues required to match federal aid	21,100
Total federal-aid and state matching funds	71,100
Excess state revenues	3,500
Total federal aid and state	74,600

in Table 37 indicate a more detailed presentation of the estimated construction funds available for each federal-aid system.

In matching federal-aid funds, the states must adhere to federal restrictions. Federal-aid legislation requires the states to match 10 percent of the cost of the interstate system and 50 percent of the primary, secondary, and urban construction costs. As was discussed in Chapter IV, the matching cost for the state is adjusted for the amount of public and Indian lands within the boundaries of a state.[1] In the budget model, it will be assumed that no adjustment is to be made.

[1] See supra, pages 125–26.

TABLE 37.—State highway department estimated construction expenditures for the federal-aid systems for the fiscal year from July 1, 1959, through June 30, 1960 (amounts in thousands of dollars).

Description	System				Total
	Interstate	Primary	Secondary	Urban	
Federal-aid allotment	32,500	7,875	5,250	4,375	50,000
State matching funds	3,600	7,875	5,250	4,375	21,100
Total federal aid and state matching funds	36,100	15,750	10,500	8,750	71,100
Excess state revenue[a]	1,400	1,050	700	350	3,500
Total federal aid and state funds for construction	37,500	16,800	11,200	9,100	74,600

[a]Excess state revenues for construction are distributed in the following ratio: 40 percent to the interstate system, 30 percent to the primary system, 20 percent to the secondary system, and 10 percent to the urban system.

Programming the construction budget by priorities

Now that the estimated construction funds have been allocated to the various systems, the next step involves programming the highways in those systems for construction or reconstruction. At this point a recommendation made in Chapter V should be stressed.[1] Construction funds for the various systems are prorated among commissioners and/or construction districts on some arbitrary basis. The distribution may be on the basis of established formulas or by agreement among the members of the board of commissioners. It is stressed again that good planning and control of construction expenditures should not give consideration to district or other types of boundaries. Construction funds should be allocated throughout the state systems on the basis of needs as determined by priorities. This method of allocating scarce resources will place funds in state systems where the need is the greatest.

Another important factor in the prorating of construction funds is that federal restrictions become less stringent at this point. Other than for federal limitations pertinent to the letting

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[1] See supra, pages 174–75.

of contracts, prevailing wage rates, maintenance, public hearings, toll roads, advertising control in proximity to interstate highways, civil defense, and other minor restrictions, the major requirements for construction programming are few: (1) The Federal-aid funds must be used for designated federal-aid highways. (2) The construction project must meet federal requirements relevant to standards and design. (3) The construction project must be approved by representatives of the Bureau of Public Roads before the contract is let to private contractors.

Actually, the representatives of the Bureau of Public Roads very seldom interfere with the procedures of programming individual highways or highway segments by state highway officials. Unless there is a flagrant abuse of the programming privilege by state highway officials, the approval of highway construction programs involving federal-aid funds is generally given by the representatives of the Bureau of Public Roads.

In actual practice, the list of sufficiency rating segments is, by necessity, quite extensive. If the state is responsible for 3,000 miles of highways and sufficiency rating road segments averaging five miles in length, the report of deficient and adequate sections would include six hundred listings. Therefore, for the purpose of the budget model, and summary of sufficiency

ratings will be used. Deficient road mileage will be accumulated by sufficiency rating intervals of ten points, such as 0–9, 10–19, et cetera. A rating of seventy points will serve as the dividing point between tolerable and intolerable conditions. In other words, road sections having a sufficiency rating below seventy points will be either programmed for construction or will enter into the preplanning construction stage even though it may not be programmed for construction for a two- or three-year period. The data in Table 38 comprise a summary of road deficiencies, by system, for the budget model.[1]

To properly program by construction priorities, it is necessary to prepare cost estimates pertinent to each system.[2] In the various state systems, highways are constructed to specified standards and design; therefore, on the basis of actual cost records it is possible to determine the average cost of constructing highways in each system. Theoretically it would be possible to determine construction costs for each type of operation necessary

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[1]It was the practice of many of the survey states to compile the lists to include both deficient and adequate road mileage. The data in Table 38 represent a summary of road deficiencies only as taken from the detailed priority list.

[2]As a procedure for program planning, surprisingly few states made any attempt to apply estimated construction costs to road deficiencies.

TABLE 38.—State highway department summary of deficient road mileage for all highway system road sections having sufficiency ratings of less than seventy points, effective as of July 1, 1959.

Adjusted Sufficiency Rating (points)	Interstate System	Federal-Aid Primary	Federal-Aid Secondary	Federal-Aid Urban	Total Deficient Mileage
0–9	0	0	0	0	0
10–19	0	10	50	10	70
20–29	0	100	100	10	210
30–39	40	180	200	20	440
40–49	80	200	300	20	600
50–59	180	350	500	30	1,060
60–69	140	560	700	60	1,460
Total deficient mileage	440	1,400	1,850	150	4,240

to construct the roads to prescribed standards—grading, drainage, materials, and other types of costs. In addition, costs should be averaged for rural and urban highways. The cost of constructing roads, especially the interstate highways, is more in urban areas because of the extremely high prices paid for right-of-way acquisitions.[1]

On the basis of the estimated average costs per mile for highways in various systems, it is possible to determine the total costs to bring all of the state systems up to standard. In addition, if estimates of revenues can be accurately predicted, it is possible to determine the number of years required to bring the state systems up to desired standards. The data in Table 39 are useful in planning short-run construction needs.[2]

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[1]The figures necessary for a detailed breakdown of construction costs are not available to the writer; therefore, general average cost estimates will be used in the model. Cost estimates of $400,000 per mile for the interstate, $125,000 per mile for the primary, $42,000 per mile for construction of secondary roads, and $100,000 per mile for urban extensions of state routes will be used. These estimates are more indicative of the costs incurred in the ten survey states. Costs differ considerably for other areas of the United States.

[2]The data in Table 39 do not give consideration to highways having a sufficiency rating of seventy or slightly above, which will probably become deficient in the next few years; however, sufficiency ratings are determined annually or biennially, and the progress in eliminating deficient road sections can be emphasized by comparative annual reports.

TABLE 39.—State highway department estimated construction expenditures required to eliminate road deficiencies existing as of July 1, 1959.

System	Mileage below 70 Points	Estimated Cost per Mile for Con-structions	Total Cost of Con-struction	Estimated Annual Avg. Construction Expenditure[a]	No. of Years to Com-plete
Inter-state . .	440	$400,000	$176,000,000	$37,000,000	4.7
Pri-mary . .	1,400	125,000	175,000,000	17,000,000	10.2
Second-ary . . .	1,850	42,000	77,700,000	11,000,000	7.7
Ur-ban . . .	150	100,000	15,000,000	9,000,000	1.6

[a]Annual average construction expenditures is based upon the current year's appropriation.

The information in Table 39 can be used for planning revenue and expenditure needs and for determining priority by system for excess state funds available for construction. In addition, the data can be used to plan long-run requirements and as a basis for justifying demands for increasing highway user revenue by the state legislature, or for issuing bonds to accelerate the highway construction program.

From the summary of deficient road mileage in Table 38 and the cost estimates in Table 39 it is possible to derive a total estimate to bring each state highway system up to desired standards. Table 40 is an example of the construction program by sufficiency rating priority lists that are prepared for each of the systems.

TABLE 40.—Summary of deficient road mileage for the interstate system and the estimated construction costs for each sufficiency rating interval, July 1, 1959 (amounts in thousands of dollars).

Adjusted Sufficiency Rating (points)	Deficient Mileage	Estimated Cost of Construction to Standard
0–9	0	0
10–19	0	0
20–29	0	0
30–39	40	16,000
40–49	80	32,000
50–59	180	72,000
60–69	140	56,000
Totals	440	176,000

The same type of analysis would be prepared for the primary, secondary, and urban systems. Once the priorities and cost estimates have been established, the next step is to prepare the budgets for the individual systems.

Construction budgets by systems

Preparation of the final budget for each of the systems is not entirely a simple matter of programming the construction priorities having the lowest sufficiency ratings. Certain factors must be taken into consideration before programming on a priority basis. First, projects may have been programmed and the construction contracts let in the previous year with the intention that funds would have to be allocated in the subsequent year to complete the contract. These projects receive prior claim on the construction funds of the budgeted year under consideration.

Second, the sufficiency rating procedure does not provide for programming bridge or tunnel construction. These structures must be programmed separately and funds must be made available for their construction out of the funds to be provided in the budgeted year. Third, there may be essential priorities that should take precedence over highway sections having lower sufficiency ratings; for example, if all but one or two small suffiency

rating sections in a section of highway fifty to one hundred miles long have been constructed or reconstructed to standards, the few remaining segments should be programmed for construction even though their sufficiency ratings are higher than other sections in the state system.

Fourth, the sufficiency rating procedure can determine only the condition of existing highways, and cannot consider the needs for a highway that does not presently exist. If the need for a new highway is determined, it it imperative that it be programmed in such a manner that it does not disrupt the over-all construction program. The cost of building a new highway can be very great, and possibly it could require a substantial portion of one or two years' budgeted funds to the detriment of other high construction priority roads in the same system.

Since construction funds are established for each highway system, a construction budget is prepared for each system. The individual system budgets can be integrated into a total construction budget encompassing all of the systems. Tables 41, 42, 43, and 44 are the construction budgets for the interstate, primary, secondary, and urban systems, respectively.

In the budgets, consideration has been given to estimated costs of completing construction projects undertaken in prior

TABLE 41.—State highway department estimated construction budget for the interstate system for the fiscal period from July 1, 1959, through June 30, 1960 (amounts in thousands of dollars).

Description	Amount
Estimated revenue available for construction of interstate highways	37,500
Estimated cost to complete work undertaken in prior years:	
Project number: FAI-80-162 Year initiated: 1958 Section rating: 43 Project cost: 786	
Project number: FAI-25-06 Year initiated: 1959 Section rating: 48 Project cost: 530	
Total cost	1,316
Budgeted funds available	36,184
Estimated cost of bridge construction and replacement:	
Project number: FAI-Br-164 Year constructed: 1925 Project cost: 1,050	
Project number: FAI-Br-101 Year constructed: 1933 Project cost: 250	
Total cost	1,300
Budgeted funds available	34,884

TABLE 41—Continued.

Description	Amount
Budgeted funds available	34,884
Estimated cost of essential priorities:	
Project number: FAI-80-204 Year constructed: 1938 Section rating: 62 Project cost: 1,800	
Project number: FAI-25-604 Year constructed: 1940 Section rating: 78 Project cost: 1,200	
Total cost	3,000
Budgeted funds available	31,884
Estimated cost of construction priorities:	
Project description: FA Interstate Section ratings: 30–39 pts. Estimated cost: 16,000	
Project description: FA Interstate Section ratings: 40–49 pts. Estimated cost: 15,884	
Total cost	31,884

TABLE 42.—State highway department estimated construction budget for the federal-aid primary system for the fiscal year from July 1, 1959, through June 30, 1960 (amounts in thousands of dollars).

Description	Amount
Estimated revenue available for construction of federal-aid primary highways	16,800
Estimated cost to complete work undertaken in prior years:	
Project number: FAP-166-2	
Year initiated: 1958	
Section rating: 21	
Estimated cost to complete: 540	
Project number: FAP-186	
Year initiated: 1958	
Section rating: 22	
Estimated cost to complete: 720	
Total cost	1,260
Balance	15,540
Estimated cost of bridge construction and replacement:	
Project number: FAP-Br-116	
Year constructed: 1924	
Estimated cost to complete: 420	
Project number: FAP-Br-173	
Year constructed: 1936	
Estimated cost to complete: 150	
Total cost	570
Balance	14,970

TABLE 42—Continued.

Description	Amount
Balance	14,970
Estimated cost for essential priorities:	
Project number: FAP-161 Year constructed: 1938 Section rating: 61 Estimated cost: 300	
Project number: FAP-178 Year constructed: 1939 Section rating: 65 Estimated cost: 250	
Project number: FAP-198 Year constructed: 1937 Section rating: 70 Estimated cost: 380	
Total cost	930
Balance	14,040
Estimated cost of construction priorities:	
Project number: FA Primary Section rating: 10–19 points Estimated cost to construct: 1,250	
Project number: FA Primary Section rating: 20–29 points Estimated cost to construct: 12,500	
Project number: FA Primary Section rating: 30–39 points Estimated cost to construct: 290	
Total cost	14,040

TABLE 43—State highway department estimated construction budget for the federal-aid secondary system for the fiscal year from July 1, 1959, through June 30, 1960 (amounts in thousands of dollars).

Description	Amount
Estimated revenue available for construction of federal-aid secondary highways	11,200
Estimated cost of construction work undertaken in prior years:	
Project number: FAS-98 Year initiated: 1959 Section rating: 17 Estimated cost to complete: 820	
Project number: FAS-102-3 Year Initiated: 1958 Section rating: 18 Estimated cost to complete: 400	
Total cost	1,220
Balance	9,980
Estimated cost of essential priorities:	
Project number: FAS-210 Year constructed: 1931 Section rating: 50 Estimated cost of construction: 500	
Project number: FAS-211 Year constructed: 1932 Section rating: 48 Estimated cost of construction: 300	
Total cost	800
Balance	9,180

TABLE 43—Continued.

Description	Amount
Balance	9,180
Estimated cost of construction priority program:	
Project number: FA Secondary Section rating: 10–19 points Estimated cost to complete: 2,100	
Project number: FA Secondary Section rating: 20–29 points Estimated cost to complete: 4,200	
Project number: FA Secondary Section rating: 30–39 points Estimated cost to complete: 2,880	
Total cost	9,180

TABLE 44.—State highway department estimated construction costs for the federal-aid urban system for the fiscal year from July 1, 1959, through June 30, 1960 (amounts in thousands of dollars).

Description	Amount
Estimated revenue for construction of federal-aid urban roads and streets	9,100
Estimated cost of completion of construction work undertaken in prior years:	
Project number: FAU-32 Year initiated: 1958 Section rating: 17 Estimated cost to complete: 150	
Project number: FAU-61 Year initiated: 1959 Section rating: 62 Estimated cost to complete: 310	
Total cost	460
Balance	8,640
Estimated cost of essential priorities:	
Project number: FAU-136 Year constructed: 1938 Section rating: 61 Estimated cost of construction: 420	
Project number: FAU-141 Year constructed: 1936 Section rating: 68 Estimated cost of construction: 540	
Total cost	960
Balance	7,680

TABLE 44—Continued.

Description	Amount
Balance	7,680
Estimated cost of construction priority program:	
Project number: FA Urban Section rating: 10–19 points Estimated cost to construct: 5,000	
Project number: FA Urban Section rating: 20–29 points Estimated cost to construct: 2,680	
Total cost	7,680

years, the cost of constructing bridges, and essential priorities. The last allocation of construction funds in the budget is for the established priorities as determined by the sufficiency rating study. Those roads having the highest priorities, or lowest sufficiency ratings, have been programmed for construction first. The use of such a system for programming construction by priorities can only result in the allocation of scarce resources in a manner to provide the most efficient highway system possible.

From the budgets of the individual systems, a master construction budget for all systems can be prepared. The master construction budget will set forth the total commitments for construction in the fiscal year under consideration. Table 45 is an example of the master construction budget.

What the budget model has done to this point is to allocate highway revenues on the basis of priorities. Subjective judgment has been reduced to a minimum. Of course, there is an element of subjectiveness in the determination of the sufficiency ratings for the individual road sections, but even this aspect can be alleviated by using highway engineers who have been well trained in the procedure of highway rating.

TABLE 45.—State highway department construction budget for all state highway systems for the fiscal year from July 1, 1959, through June 30, 1960 (amounts in thousands of dollars).

Description		Amount
Estimated revenue for construction of the state highway systems		74,600
Cost to complete construction work undertaken in prior years:		
Interstate system	1,316	
Federal-aid primary	1,260	
Federal-aid secondary	1,220	
Federal-aid urban	460	
Total cost		4,256
Balance		70,344
Cost of bridge construction and replacement:		
Interstate system	1,300	
Federal-aid primary	570	
Total cost		1,870
Balance		68,474
Cost of essential priorities:		
Interstate system	3,000	
Federal-aid primary	930	
Federal-aid secondary	800	
Federal-aid urban	960	
Total cost		5,690
Balance		62,784

TABLE 45—Continued.

Description		Amount
Balance		62,784
Cost of construction priority program:		
Interstate system	31,884	
Federal-aid primary	14,040	
Federal-aid secondary	9,180	
Federal-aid urban	7,680	
Total cost		62,784

Forward Planning of Construction Expenditures

The budget model has been based on the assumption that all preconstruction planning, including right-of-way acquisitions, could be completed within a year. Actually, cases may arise in which the preconstruction phase prior to letting the contract could conceivably cover a period of a year and a half or two years. It is not unusual for controversies over right-of-way values to end up in the courts, involving months of litigation.

After the initial stages of instituting the sufficiency rating system, the state highway department has the necessary information to preplan high-priority road projects two to five years in advance so that annual construction programming can readily be prepared on a priority basis.

Preconstruction engineering

A substantial amount of planning must go into the preconstruction stage of building a highway prior to the letting of the contract to a private road-construction firm. The most common deterrent to highway planning is the acquisition of right-of-ways. This is especially true for interstate highways, as they pass through urban areas. Highway officials in many states have been far-sighted in acquiring land for the construction of roads.

In many cases involving the primary, secondary, and urban construction, right-of-ways are often sufficient to meet current standards for construction.

Before the highway project is ready for final approval, two phases of preconstruction engineering are usually performed: (1) preliminary engineering, and (2) final engineering. A brief summary of the planning processes is presented in the following paragraphs.

Preliminary engineering is concerned with determining proposed locations for the construction of the highway, right-of-way appraisals based on the proposed locations, studies of intersections, rest area locations, material sources, structures such as bridges and overpassess or underpasses, roadside improvements, design and standards, road alignment, soil tests, and ground profile studies. Once completed, the preliminary plans are given to state highway officials and Bureau of Public Roads representatives for tentative approval before further action is taken.

Once approved, all the factors mentioned in the preceding paragraph are stabilized for final approval. Public utilities such as telephone, power, gas, and pipeline companies are notified if the construction will affect their operations. Locations are

chosen, final design of the roadway, structures, and rest areas are determined, and the final plans are submitted to the same aformentioned officials for approval. If approval is given to proceed with the project, the right-of-ways are acquired and the project is ready for advertising for bids from the road-construction companies.

If the construction project requires an important change in the relocation of the highway, hearings are held in those areas for people who will be affected by the location change. Interested parties are permitted to voice their opinions on the relocation proposals.

CHAPTER VIII

LONG-TERM PLANNING AND CONTROL

Business literature tends to segregate the managerial function of planning into two time periods: short- and long-term. Undoubtedly the intent is not to consider the two as separate and unrelated areas, but to differentiate them for the purpose of discussion. Fundamentally, long- and short-term planning are both parts of the same continuing process. Long-range planning may establish goals or objectives that are attainable only over the long-run period of the life of the enterprise. In the private profit-making firm, long-run goals may encompass such objectives as (1) increasing the firm's share of the national market, (2) creating a favorable image of the firm in the eyes of the public, or (3) an expansion program correlated to long-run growth trends. Long-range goals may be more specific, such as a machinery and equipment replacement program, or planning for the retirement of a long-term debt.

Long-term objectives are generally achieved through a series of short-term plans. In fact, most long-range programs

can be viewed as a series of short-run plans. In some instances management may give very little consideration to long-term planning and may operate its organizations on a short-run basis entirely. Several reasons may be suggested for this emphasis on short-term rather than long-term planning. First, the shorter the planning period the more accurate will be the estimate of the future. It may seem futile to management to plan twenty years in advance if future conditions cannot be predicted with any degree of accuracy. Second, many managers do not have the necessary information to make long-term forecasts. They may not be able to afford the financial cost of buying the services of certain organizations that have built a reputation on predicting the economic future. Third, management may have observed the errors of the so-called experts and their failure to predict even the short-run events. Fourth, even though they may have reliable data from which to make a long-term forecast, many managers may lack the ability or the staff to establish long-range plans for their organizations.

If nine of the ten survey states are any indication, long-range planning seems to be a process that is foreign to the

administrators of state highway departments.[1] There may be certain reasons, not too logical perhaps, for this lack of long-range planning, especially as it relates to finance. For example, all plans involving a change in the tax structure affecting highway revenues must be approved by state legislatures. These political bodies may not be prone to make tax changes under any conditions. Their decisions may be based on factors other than the actual long-run financial requirements of the highway department. After a series of refusals by the legislature, highway officials may be reluctant to repeat such an ordeal.[2]

Another reason why highway officials may fail to give proper consideration to long-term planning may be due to the fact that their short-run objectives and construction needs are so great that they represent the major goal in current highway planning. At present, greatest effort and funds are being channeled into interstate highway system construction.

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[1]In nine survey states the author invariably was informed that little or no long-term planning was conducted by highway officials. Only Colorado plans its revenue and expenditure needs beyond a five-year period.

[2]Officials in one state—Montana—revealed an experience in which a long-range study indicated the need for a tax increase to bring highways up to standards. Instead of approving the proposed tax increase, the state legislature reduced highway revenues substantially and the long-range plan was discarded.

Despite the above major reasons, highway officials should devote time, effort, and funds to long-term planning. Highway operations can definitely be improved by anticipating highway needs for construction and finances in the long-run period.

It will be the objective of this chapter to analyze and discuss the various long-range planning techniques available to state highway officials. The planning tools discussed in this chapter directly or indirectly affect the expenditure pattern. One of them, the traffic study, supplements the short-run construction budget based on priority listings by filling a gap not adequately provided for by the sufficiency rating procedure. There is a paucity of literature on the subject of long-range planning of financial expenditures in state highway departments. The following discussion is based, primarily, on the author's knowledge and research in the various state highway departments in the survey.

The techniques to be discussed are (1) the long-range revenue and expenditure studies, (2) traffic studies, (3) road life studies, (4) economic impact studies, and (5) urban analyses. In the light of the objectives of this dissertation, these five techniques represent the more important tools of construction expenditure planning and control. However, they are not the only

methods available to highway management in planning their financial needs.

Long-Range Highway Revenue and Expenditure Studies

It has been emphasized in the preceding chapters that the highways of many states are below current and future standards to properly service vehicular traffic. So great is the effort being put forth on the interstate system that other state systems may be neglected during this "crash" program. Due to inadequate funds, many states must by necessity plan their highway improvement programs to cover a long-range period of fifteen to twenty-five years or longer. To better understand their construction and financial needs, highway officials should conduct a long-range highway construction need study and a supporting study to determine the financial requirements necessary to undertake such a program. It is through these two studies that highway officials can make known to the public and the state legislature the construction and financial requirements necessary for an adequate state highway system. Most important, the studies serve to give direction to state highway officials over the long-run period in the accomplishment of construction objectives.

Studies should be conducted in two areas: (1) an engineering appraisal of present highway conditions and the construction requirements necessary to bring them up to future standards; and (2) an evaluation of long-term financial requirements necessary to meet the construction needs determined in the engineering appraisal. A thorough investigation of the two areas will provide highway management with a better insight into the expenditure and revenue needs over the long-run period.

The long-range construction needs study

Before the financial requirements of the long-range highway program can be estimated, it is necessary that construction and other highway costs be determined. A study of long-range construction requirements should include: (1) a clear, clean-cut definition of the objectives of the study; (2) a history of the development of the road systems in the state and of the growth of the highway organization; (3) an evaluation of the classification of the highways in the state, county, and urban systems; and (4) determination of the condition of the highways under the various political authorities and the construction needs to bring them up

to standards which will service traffic twenty to twenty-five years in the future.

Long-range objectives.—Before the long-range construction needs study is undertaken, highway management should carefully determine the objectives of the project. The report should serve highway administrators in several ways. First, if the results warrant it the study can be used to educate the public and legislative bodies as to the need for action on a progressive long-range highway program. Before state legislative bodies will take action on measures to change highway revenue laws, they must be sold on the exigency of the program.

Second, even though additional revenues may not be forthcoming by legislative action, the report should not be discarded as useless.[1] The long-range construction needs should be matched against revenues available under the present tax structure, and a long-range program should be established and followed. If funds are not provided to bring highways up to required standards over

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[1]Long-range construction need studies had been prepared for highway officials in several of the survey states. In those cases where the state legislatures did not react favorably to a revenue increase, highway officials discarded the report as a tool for planning long-range construction programs.

a relatively short period of time, highway officials are forced to plan their construction programs over an extended period. By utilizing a priority listing procedure as explained and discussed in Chapters V, VI, and VII as the basis for allocating construction funds over the short-run planning period and determining and following a long-range construction and financial program over the long span of time, the highway official can allocate scarce resources in such a manner as to achieve optimum efficiency. In addition, long-range goals are established to serve management as a guide in the accomplishment of objectives.

Third, the study should serve highway management as the basis for determining personnel, equipment, and facility requirements. Organizational resources can be marshaled, classified, and blended over the long-run period to provide for the most efficient operation.

Historical development of road systems and highway organizations.—Valuable information can be derived from an evaluation of the development of the road systems of the state, counties, and urban areas. If previous studies have been prepared indicating changes in traffic patterns and volumes, they may serve as important tools in planning future construction programs.

From the past, a correlation between road use and the development of state resources such as labor and materials can be made. The road systems of most states have developed according to the needs of the state economy.

> Significant factors in the state's economy, the farm and ranch are equally significant factors in the problems of highways and roads as the growth of the agricultural economy has had a tremendous impact on the development of the state's road pattern.[1]

During the development of the economies of many states, the highway departments were unable to keep pace with the growing demands for highways. In addition, highway programs failed to provide a system commensurate to the progress of the automotive industry. Consequently, a lag has existed between vehicular traffic and the construction designs and standards of highways conducive to safe and efficient travel.

Probably one of the most important benefits to be derived from a well-planned long-range highway program accrues to the state and its political units. The road system is an important factor in the development of the resources of a state, county, or

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[1]Nebraska Highway Advisory Committee, Nebraska Highway Needs, A Report Prepared for the Governor of the State of Nebraska (Lincoln: State Department of Roads and Irrigation of Nebraska, 1948), p. 5.

urban area. For instance, in agricultural areas, highway facilities should provide for the rapid and efficient movement of ranch or farm products to markets. Should the economy of a state enter into a period of transition from agriculture to industry, vehicular traffic types, volumes, and patterns will change drastically and rapidly. Roads which had previously serviced the traffic efficiently soon become obsolete, dangerous, and inadequate. State highway officials should provide for a constant evaluation of the development, or the potential thereof, of the resources of the state or its political units. In this respect highway officials would do well to carefully evaluate the research studies of other organizations such as the state resource board, state universities, game and fish departments, county and urban organizations, and other agencies. In fact, there may be some merit in the creation of a state department whose major responsibility would be to coordinate and integrate the long-range plans and needs of the various state agencies, counties, cities, and other local political units. The state highway administrator who fails to give adequate consideration to the long-run development of the state economy may frequently be faced with a "crash" type of program that might have been avoided if long-range planning had been considered.

As to the changing technology in the automotive and allied industries, highway officials should carefully analyze new developments in motor-vehicle engineering. Possibly greater cooperation is necessary between the two industries—highway departments and automotive firms.

Not only should road standards and design give consideration to future developments in the state economy and technological advances in automotive design, but the highway organization itself should be dynamic and flexible enough to provide for long-run changes. In the past, state highway organizations have not been able to dispatch with any degree of efficiency their long-run challenges because of certain rigidities prevalent in their organization structures. Custom and tradition have been difficult to overcome, especially at top managerial levels in the highway departments. Fortunately, some of these obstacles are being recognized and eliminated as highway administrators are becoming more management-oriented. Participation and interest of highway officials in management development programs would seem to indicate that the need for better administration is recognized in many state highway departments.[1]

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[1]From an interview with Dr. O. D. Turner, Head of the Department of Business Administration, The University of

Highway classification.—In the report on long-range construction needs, it is imperative that the highways under consideration be properly classified.

> Highway and street classification is the orderly grouping of roads and streets into systems in keeping with the amount and kind of service to be provided the public. It is the framework around which improvement programs, based on a sound and equitable finance plan, can be developed and organization and management responsibilities for each system defined.[1]

As the above quotation implies, the problems of classification are concerned with (1) the classification of roads into systems according to the volumes and kinds of traffic using them, and (2) the road authorities responsible for each of the systems. The need for an orderly grouping of highways is presented below:

1. To establish logical, integrated systems which bring together all roads and streets which should be under the same jurisdiction because of their service.
2. To group those roads and streets which require the same degree of technical competence and ability in their design, construction, maintenance and operation.
3. To assign responsibility for each class of roads and streets to the level of government having the greatest basic interest.

Wyoming. Dr. Turner has participated as a conference leader in more than twenty-five management conferences designed exclusively for state highway personnel.

[1]Automotive Safety Foundation, A Guide for Planning Wyoming Highways, p. 19.

4. To provide a basis for efficient management and intergovernmental coordination to avoid or minimize conflicts among the governmental units.
5. To establish a basis for long-range programming, improvement priorities and fiscal planning.[1]

Not only for the above reasons is highway classification important, but also because the legislatures of many states are continually adding road mileage to the classified state systems. County roads are absorbed into state highway systems without a commensurate increase in state funds to care for them. There is a definite need to "freeze" the road mileage of state highway systems. New additions to road mileage should be considered only if short- or long-range plans determine the justification for them.

State legislation should provide for clear, clean-cut definitions of authority and responsibility for the road systems. As a requisite to participating in state road-user revenues, greater cooperation and coordination should be required among the various political units.

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[1]Automotive Safety Foundation, Moving Ahead on Montana's Highways, An Engineering Study Prepared for the Montana Fact Finding Committee on Highways, Streets and Bridges (Helena: Montana State Highway Commission, 1956), p. 2.

Determination of highway condition.—With roads properly classified according to systems and segregated by authority, the next step in determining construction needs involves an evaluation of highways as to their present condition and an estimate of the cost of construction to bring them up to prescribed future standards. In making the evaluation of the condition of the highways, a set of standards and designs reflecting the highway needs twenty to twenty-five years in the future should be established. These standards and designs can be the same as those used in the sufficiency rating procedure for state highway systems.[1] However, since the needs study should cover the county and urban road systems, standards and designs should be prepared to evaluate these systems.

The engineering appraisal involves a team of experts driving each mile in the various road systems—or a substantial portion thereof—and rating the roads according to the predetermined standards and design. Road sections and structures below tolerable conditions are classified as deficient and should be treated as a backlog of construction work to be given priority in the long-range program. Roads that will become deficient during the

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[1]See supra, Chapter VI, page 180.

long-range program should also be determined and scheduled for construction.

Cost estimates should be applied to the engineering appraisal of road deficiencies. These estimates should be broken down into the individual types of construction work necessary to bring the roads up to standards, such as grading, drainage, road base, surface, and other construction operations. The basis for matching road deficiencies to cost of construction is average cost per mile for each of the highway classifications—interstate, primary, secondary, county, and urban road and street systems. The average-cost determination should give consideration to the changing price level. The Wyoming study revealed that immediate and future construction needs for the state primary system from 1961 to 1980 would entail an outlay of $176,427,000.[1] The data in Table 46 indicate the mileage and cost for rural and urban improvements.

The data in Table 47 are indicative of the cost estimates for the rural primary road system in Wyoming segregated by the type of work necessary to bring the highways up to standards by the year 1980.

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[1]Automotive Safety Foundation, A Guide for Planning Wyoming Highways, p. 54.

TABLE 46.—Wyoming State Highway Department primary system needs, including right-of-way and structures.

Primary System Needs	Miles	Pct.	Cost	Pct.
Rural:				
Needed now	978	38	$ 76,093,000	46
Future needs to 1980.	1,575	62	87,939,000	54
Totals	2,553	100	$164,032,000	100
Urban:				
Needed now	29	31	$ 3,237,000	26
Future needs to 1980.	64	69	9,158,000	74
Totals	93	100	$ 12,395,000	100
Rural and urban:				
Needed now	1,007	38	$ 79,330,000	45
Future needs to 1980.	1,639	62	97,097,000	55
Totals	2,646	100	$176,427,000	100

TABLE 47.—Wyoming State Highway Department estimated costs for primary needs, except interstate system routes, by types of work.

Type of Work	Costs	Pct.
Widening and resurfacing	$ 22,129,000	14
Base and surface	5,992,000	4
Reconstruction	47,948,000	29
New construction	45,816,000	28
Structures	26,940,000	16
Stopgap allowances	4,599,000	3
Future surface replacements	10,608,000	6
Totals	$164,032,000	100

The above analysis should be prepared for each of the state systems, county and urban roads. By this process the specific construction cost estimates for all highway needs in the state can be determined.

To complete the study, an estimate of the costs of maintenance, administration, and other services over the long-run period should be made. When they are added to the projected

construction costs, the sum represents the total estimated highway expenditures required over the long-range period for the various authorities.

Long-range financial needs study

The determination of long-range expenditures for construction and other highway functions presents only one aspect of the financial picture. To enable highway officials to make the necessary long-run decisions pertinent to construction programming, the revenue aspect of the financial function must be carefully evaluated. For instance, with long-range construction needs established, a decision must be made relevant to what "catch-up" period should be undertaken.[1] The "catch-up" period may depend upon several factors. First, the construction and financial need studies may be used by the state legislative body in making a decision pertinent to accelerating the road construction program by raising or modifying the tax rates applying to road users. If the road systems of a state are in critical condition, the studies reveal the construction and financial needs with a startling clarity. Second, if an increase in highway revenues is not approved by

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[1]The "catch-up" period is the number of years required to overcome the existing backlog of present road deficiencies.

legislative action, the report is not rendered useless. The construction program can be matched against current and projected receipts under the present tax laws and a long-range program can be established. Third, if borrowing is permitted, a road construction proposal could possibly be accelerated by the careful planning and integration of a long-term borrowing program. Although the payback period might be extended over a longer period than the proposed twenty or twenty-five year plan, immediate needs could be met and the future requirements planned.

The revenue study should cover several areas: (1) a historical development of the tax structure pertinent to highway imposts, (2) a study of current tax sources and rates and an evaluation of the benefits derived by highway users and nonusers to determine the fairness of the present tax structure, (3) a study of the past and future growth trends of the state and their effects on highway revenues, (4) a consideration of current objectives and methods of allocating highway user revenues among the various governmental authorities concerned with highway construction and maintenance, and (5) an analysis of the construction program needs and finances required to underwrite them.

Historical development of highway revenue laws.—Much can be derived from an analysis of the historical development of highway revenue laws of the state, counties, and urban places. Such an evaluation may reveal that considerable highway revenue legislation was enacted to alleviate an immediate crisis rather than as the result of long-run planning of highway needs. Many of the financial laws were enacted to correct highway deficiencies that had become intolerable due to inadequate short- and long-range planning. The following quotation serves to support this contention:

> Costs of construction and maintenance of county roads are, at present, partially financed through five different state-aid programs. Over the years the trend has been to increase support of county roads from state-aid funds, with a corresponding decrease from the counties. This policy has reached a point where in 1958 approximately 80 percent of county road construction and maintenance costs were financed from the five state-aid programs.
>
> These five programs, other than providing financial assistance to counties, have little in common either as to purpose, formulas for fund allocation or administrative responsibility. In the aggregate they represent a hodgepodge of law unnecessarily burdensome in administration and complex in objectives.[1]

Another example of poor financial planning by a state in establishing revenue legislation is exemplified in the following quotation:

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[1]Automotive Safety Foundation, A Guide for Planning Wyoming Highways, p. 22.

> Existing highway law consists of numerous measures enacted over a long period of years. Much of the law is outmoded in the light of modern highway transportation requirements. There are many cases of seeming conflicts, ambiguities and ommissions. In some cases, outmoded law seriously handicaps efficient highway management, in other cases it is merely confusing and unnecessary.[1]

A historical review of past financial legislation may reveal that original objectives which led to the enactment of the laws may now be outmoded and of dubious value in the light of current highway needs. There is undoubtedly a need for a re-evaluation of highway laws in terms of current highway objectives.

Current tax sources and highway beneficiaries.—The finance study should embody a complete analysis of the current sources of highway revenues for the three governmental units: the state, counties, and urban places. A review should be made of each of the sources of highway taxation, giving consideration to its historical development, the importance of its contribution to total highway revenues, and a comparison of each of the sources with those of other states having similar highway construction problems.

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[1]Automotive Safety Foundation, Moving Ahead on Montana's Highways, p. 35.

An analysis of revenues needed to support a long-range highway expenditure program should include an inquiry into the past, present, and future objectives, trends, and methods of allocating the cost of constructing and maintaining the rural and urban highways of a state among those who benefit from an adequate road system.[1] A review of the relationship between those who benefit from adequate roads and those who pay for them should be a continuing process in a state highway department. So frequent are the changes in highway benefits accruing to the highway users and nonusers that constant evaluation is necessary. Of course, this assumes that fairness and equity are objectives in establishing a highway tax structure.

The importance of review and revision of current highway tax structures is emphasized in the following quotation:

> Thus far the present types of taxation for highway purposes, their rates, and revenue possibilities have been discussed without any reference to the theoretical grounds upon which these taxes have been based. These taxes have been developed over the past half century, taxpayers have become accustomed to them, and it may be assumed that they have been reasonably adjusted to the existing economy. But when it comes to raising some $54,000,000 to $58,000,000 of additional highway revenue annually for the next twenty years, it

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[1] A brief, but adequate, discussion of the problems involved in highway taxation theory is presented in a previous chapter of this dissertation; see supra, Chapter IV, pages 126–38.

> will be worth while to subject the general philosophy of this field of taxation to some scrutiny and, if possible, to some clarification.[1]

As was discussed in Chapter IV, the problem of allocating the costs of constructing and maintaining highways is a dual one.[2] First, it must be determined what share of the tax burden will be borne by user and nonuser beneficiaries. Second, decisions must be made as to what share of the road-user taxes will be paid by those who use the highways for pleasure and those who use them for commercial purposes.

Although the aforementioned problems of tax allocation are difficult to resolve, they are not insurmountable. A determining factor in this facet of highway finance is that tax objectives should be fairly determined and constantly reviewed.[3]

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[1]Herbert D. Simpson, Highway Finance, A Study Prepared for the Ohio Program Commission (Columbus, Ohio: F. J. Heer Printing Company, 1951), p. 74.

[2]See supra, Chapter IV, page 130.

[3]For further discussion of the problem of highway taxation, see Richard M. Zettel and Richard R. Carll, Financing Modern Highways for Michigan, A Fiscal Report to the Michigan Legislative Highway Study Committee (Lansing, Mich.: Speaker-Hines and Thomas, Inc., State Printers, 1955), Chapter III, p. 36; Daniel J. Shea, Historical Analysis of Taxation for Highway Purposes in Montana, A Report Prepared for the Montana Fact Finding Committee on Highways, Streets and Bridges (Helena: Montana State Highway Commission, 1956), Chapter VI, p. 159; and Association of American Railroads, Highway Benefits and Cost Responsibility (Washington: Association of American Railroads, 1957).

Economic study of the state, county, and community resources.—Because highway revenues and costs are tied directly to the resources of the state and its political subdivisions, it is imperative that past, present, and future trends of the development of state resources be carefully determined in estimating highway needs. A more penetrating study should be undertaken than the usual statistical projections of population growth, income, car registrations, and tourist travel. The economic study should give careful consideration to the presently developed and undeveloped resources of the state and local areas.[1] Many states have untapped natural resources which, if developed, may create highway construction problems. If no attempt is made to anticipate economic development of a state as it relates to highway needs over the long-run period, highway management may be faced with a short-run problem of trying to write unexpected expenditures into the annual budget. A long-range economic study could alleviate many of the problems encountered by highway management in planning annual construction budgets.

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[1]Although the problem may not exist in many states, Wyoming is a prime example of the situation. Wyoming possesses huge deposits of coal, iron, and oil shale which cannot be developed at present because of the high cost of production. New technological developments, however, may make their extraction profitable.

Allocating highway revenues among governmental units.—In many states it would seem that objectives and methods of allocating revenues among the political units are in need of review and revision. As stated in a previous section of this chapter, Wyoming has five unrelated and uncoordinated programs involving state aid[1] to the counties.[2]

The objectives and methods of distributing, or allocating, highway revenues among state, county, and city governments should give consideration to the necessity for the over-all planning of the road systems of a state and the need for the political units to acquire coordination and cooperation in their road programs. Although the author of the following quotation has recognized the problem, the major implication of the issue has been overlooked—a lack of coordinated planning among the political units in constructing and maintaining the highways of a state.

> The distribution of highway revenues among state and local governments has proved almost as difficult a problem

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[1]There seems to be some doubt whether the distribution of highway revenues to counties or urban areas represents a state-aid program. Some students of highway finance regard the situation as one in which the state acts in a fiduciary capacity by collecting the imposts and distributing them to the various jurisdictions for highway use.

[2]See supra, page 301, footnote 1.

> as that of raising the revenue in the first place. Most of the present formulae are the result of historical accident, legislative pressures, and other haphazard factors. Ordinarily the distribution of public funds through such channels would lead to extravagance and waste. In the highway field the saving factor has been the fact that thus far motor revenues have not been adequate for the highway needs of all governments, and there has been no liberal margin available for wasteful expenditure. If the State should ever embark upon a policy of providing ample funds and still distribute them through haphazard formulae that have little relation to local government needs and responsibilities, the results will be disastrous.[1]

Fundamentally, the objective of the allocation should provide for an integration of highway planning among the three highway authorities. In addition, the method of allocation of funds to the political units should be on the basis of need as determined by a priority system.

Matching construction needs to revenues.—This section of the revenue study sets forth the alternatives available in establishing a long-range highway program. The choice of alternatives relates to the time period which the long-range expenditure program should cover and the manner in which it should be financed. With revenue possibilities determined, it becomes a matter of deciding whether the road construction program will

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[1] Simpson, p. 114.

be accelerated. This decision may involve two alternatives: (1) to raise additional taxes by increasing or modifying the present highway impost structure, or (2) to borrow funds to construct highways to the required standards and extend the service and pay-back period of the bonds to cover a longer period of time. Another alternative would be to stay on a "pay-as-you-go" basis which will result in extending the "catch-up" period. The problem is accentuated by the fact that present road deficiencies are so great that current and projected revenue is not sufficient to cover the cost of construction to bring the highways up to standards over the short-run period. By extending the construction program to pay for highway needs out of available revenue, roads that are now adequate to service traffic will eventually become obsolete and will increase the magnitude of the problem, depending, naturally, on the rate of obsolescence and the progress made in overcoming deficiencies.

By way of an example, a Montana study revealed the following construction and revenue needs:[1]

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[1]Source: Montana State Highway Department, Financing Modern Highways for Montana.

Catch-up Period	Total Program Cost for 20 Years[1]	Estimated Funds Available	Total Revenue Shortage
10 years	$1,580,444,000	$1,528,659,000	$51,785,000
13 years	1,580,389,000	1,528,659,000	51,730,000
20 years	1,580,274,000	1,528,659,000	51,615,000

The thirteen-year "catch-up" program was segregated by state, county, and urban needs, as shown in Table 48. An evaluation of the table indicates that $1,264,822,000 is needed to bring the state, county, and urban roads up to required standards over the thirteen-year period. Funds available over the same period amount to $1,021,361,000, leaving a shortage of $243,461,000. During the next seven years, however, the expenditure program for the three highway authorities requires only $315,567,000, while available revenue amounts to $507,298,000. The difference of $191,731,000 represents the excess of revenue over expenditures during the seven years, which reduces the previous thirteen-year deficit to $51,730,000 over the entire twenty-year program.

The alternatives are rather obvious. Some of them are as follows:

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[1]Includes construction, maintenance, and administration. In all cases the interstate system is included at thirteen years, the expressed intent of Congress.

TABLE 48.—Montana State Highway Department total needed expenditures and revenue for twenty years to implement thirteen-year catch-up period (amounts in thousands of dollars).

Unit	First Thirteen Years	Next Seven Years	Total Twenty Years
State:[a]			
Program costs	755,079	127,015	882,094
Available revenue	670,682	289,218	959,900
Revenue needed	84,397	162,203[b]	77,806[b]
County:[a]			
Program costs	434,226	155,155	589,381
Available revenue	295,714	179,910	475,624
Revenue needed	138,512	24,755[b]	113,757
City:			
Program costs	75,517	33,397	108,914
Available revenue	54,965	38,170	93,135
Revenue needed	20,552	4,773[b]	15,779
Total:			
Program costs	1,264,822	315,567	1,580,389
Available revenue	1,021,361	507,298	1,528,659
Revenue needed	243,461	191,731[b]	51,730

Source: Montana State Highway Department, Financing Modern Highways for Montana.

[a]Federal-aid secondary funds and matching revenue included under counties. Forest highway funds are under state revenues. State highways through cities are included under state.

[b]Surplus.

1. Highway user taxes could be increased for the first thirteen years to cover the deficit and reduced for the last seven years when less revenue will be required.

2. The state could borrow funds to complete the thirteen-year "catch-up" program and extend the bond payback period over a remaining number of years necessary to cover the expenditure program plus the cost of bond retirement and service charges.

3. The "catch-up" period could be extended to cover a period of twenty to twenty-five years. Over this period, revenues would undoubtedly be sufficient to enable the state to complete the long-range program on a pay-as-you-go basis without having to revert to tax increases or borrowing.

The same type of analysis should be prepared covering "catch-up" periods of ten, fifteen, and twenty years. All possible alternatives should be supported by long-run projections of revenues and expenditures.

Use of the expenditure and revenue studies

The above reports should be used by highway officials to inform the public and state legislators of the immediate and long-run highway needs. On the basis of the findings, the state legislators may take legislative action to give consideration to the dilemma. Should the state legislature fail to increase revenues or to permit borrowing, the value of the findings is nonetheless important. Highway officials should use the data as the basis for

planning their long-range highway program. Highway managers have been prone to regard the study as useless if additional funds are not forthcoming.

Traffic Studies

In order that state highway departments may better plan their long-run highway programs, it is important that they thoroughly understand the characteristics of the traffic using the highways. Traffic studies can provide for a continuing historical record of trends that tend to develop in motor-vehicle transportation. Such information is essential for both short- and long-range determination of highway needs and costs.

Traffic volumes, patterns, and composition are not static elements. Quite the contrary—they are in a constant state of change. From traffic studies valuable information can be derived for future planning. First, estimated future traffic volumes are necessary for the establishment of road standards and designs to service traffic in a safe and economical manner. Second, the location of new highways is contingent upon the understanding of past, present, and projected traffic volumes and movements. Third, the composition of traffic flow pertinent to vehicular weight and speed is necessary for planning road standards and

designs and for determining changing benefits to road users for tax purposes.

Traffic surveys

The traffic survey is concerned with traffic volumes and the movement of vehicles over the road system. The survey provides information necessary to road location and design of new highways, the more economical use of present roads, determining speed limits on highways, classification, and other important data.

It was discussed in Chapter VI that sufficiency rating systems could measure the adequacy of those roads in existence at the time the study is undertaken.[1] The sufficiency rating system cannot determine the need for a road that presently does not exist. Other means must be used to establish the need for new highways. One of the tools that can support the exigency for a new highway is the traffic survey. The situation can be illustrated by the following example:

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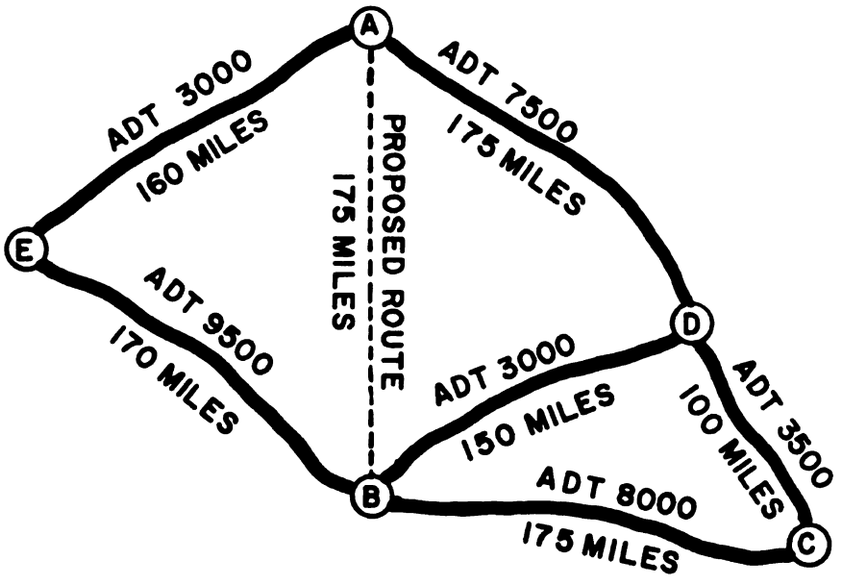
[1] See supra, Chapter VI, page 267.



A, B, and C represent three highly populated, industrialized urban centers, while D and E are smaller towns that serve as shopping and recreational centers for an agricultural population. The highway connecting C, B, and E is a nationally used interstate highway generating a high volume of through state traffic. A large portion of the traffic using the highways A-D-C and A-D-B is strictly local in nature. Traffic counters have found the average daily traffic (ADT) on the highways to be those indicated on the diagram. Additional facts may show that: (1) the entire stretch of road A-D-C was constructed to standards and design to service an average daily traffic of 4,000 vehicles; (2) the accident rate on the highway between A and D is extremely high and the surface structure is in a rapid state of deterioration; (3) the highway between B and D was constructed

to standards and design for servicing an average daily traffic of 1,000 vehicles, and, because it passes over a high mountain range, a substantial portion of the road mileage has many safety obstacles in the form of horizontal and vertical curvature; and (4) a substandard secondary highway between A and B now exists but its condition is so poor that average daily traffic over the road is limited to 100 vehicles per day.

The alternatives confronting the state highway department may be as follows:

1. To improve highway A-D to higher standards to service the very high average daily traffic. This could be a costly project, depending upon the present condition of the highway and the need to acquire additional right-of-way property.

2. If the alternative listed above is chosen, it will be necessary to reconstruct highway B-D to higher standards to properly service the traffic volume which is, at present, three times as heavy as it should be. Constructing a mountain highway to higher standards would be a very costly process. Curves must be straightened and the degree of climb lowered.

3. A third alternative might be to construct and reconstruct a new highway between A and B. No doubt a large portion of the substandard secondary highway could be improved and reconstructed to standards to service projected traffic volumes.

In evaluating the above alternatives, highway officials would have to consider other factors in making a decision. First, an origin-destination study should be undertaken whereby a statistical

sample would be made of motorists using routes A-D, D-B, A-E, and A-B. At selected road block stations motorists should be stopped and queried as to the origin and destination of their trips. If necessary, a questionnaire could be sent to a sample of motorists in the five towns to determine the annual number of trips made to other cities in the area, routes taken, time of year the trips are made, and other pertinent information. From such a study estimates could be derived as to the traffic use for the new route A-B. Also from the traffic estimates the required standards and designs for the proposed route could be determined. The survey might reveal that the estimated traffic volume over the A-B route will necessitate its being reclassified as a state primary road.

Second, the savings to the highway user must be made a part of the study.[1] Under present conditions, motorists are obviously driving over three hundred miles between A and B to reach their destinations. Some of this travel is over highly dangerous substandard mountain roads. A new highway, A-B, would certainly save the motorists considerable travel cost and travel time. Third, if a substantial portion of the traffic

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[1] See infra, page 326, footnote 1.

traveling between A and B by route A-D-B could be diverted to route A-B, the road standards and design of route A-D-B might be adequate to meet the reduced traffic volume on A-D and B-D so that further expenditure other than for routine maintenance will not be required. Fourth, if the situation is serious, an economic study should be undertaken to determine the effects upon landowners, merchants, and other groups or individuals along the routes that may suffer a loss from the reduced traffic volumes.[1] Whenever traffic is diverted from one route to another, a study should be conducted to determine the economic impact on those directly affected by the diversion. State highway departments should hold a series of hearings in the affected areas so that interested parties can make their pleas known.

In conjunction with the preceding investigations, a cost analysis pertinent to the various alternatives should be conducted. The estimated costs of the new highway should be carefully compared with the cost estimates of other alternatives. Estimates should also be prepared showing the savings to motorists by using the shorter, more direct route. With all the facts at hand,

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[1]The economic study is explained in greater detail in a subsequent section of this chapter.

decisions can be made and the project can be written into the short-run budget.

Techniques used in traffic surveys.—One of the techniques used in measuring traffic volumes and their movements is the traffic count.

> A traffic count is simply the number of vehicles passing a given point during a selected period of time, recorded by either manual tally or mechanical counting apparatus. The period may vary from a few hours to continuous operation, depending upon the purpose of the count. A single count has little meaning per se. It becomes significant only when a relationship is developed with counts at other locations. An interrelated system of different types of counts at diverse locations for varying time-periods is therefore necessary in order to obtain traffic records adequate to serve the needs of road design, economic analysis, and other functions of the State Highway Department.[1]

Traffic-recording devices differ according to permanency and automaticity. Automatic counters are permanently installed at strategic highway points and provide continuous traffic data. Others are portable and are moved to highway points as the need for data arises. For instance, they may be temporarily installed at road points that are open to travel only a portion of the year.

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[1]New Mexico State Highway Department, Planning Division, New Mexico Traffic Survey (Santa Fe: New Mexico State Highway Department, 1959), p. 9.

The equipment may be automatic roadtube counters operated by permanent electric installations if current is available, or they may be adapted to battery use. Other types may be manual in nature. Where manual counters are used, the operator is usually gathering complementary data pertinent to the composition of the traffic flow.

The data in Figure 19 indicate the location of the continuous count stations for the state of Idaho. Two types of tabulating procedures were used in that state in 1959: (1) continuous automatic counters, and (2) manual counters.

In conjunction with the traffic count at key stations, loadometer studies should be conducted. The loadometer studies furnish valuable information on commercial vehicles. The data acquired should include gross vehicle weight, the manufacturer's rated capacity of the vehicle, the width, height, and length of commercial vehicles, axle loads, commodity carried, origin and destination of the vehicle, and other relevant factors.

The information derived from loadometer studies should be used: (1) to assist in road design for surfaces and foundation,

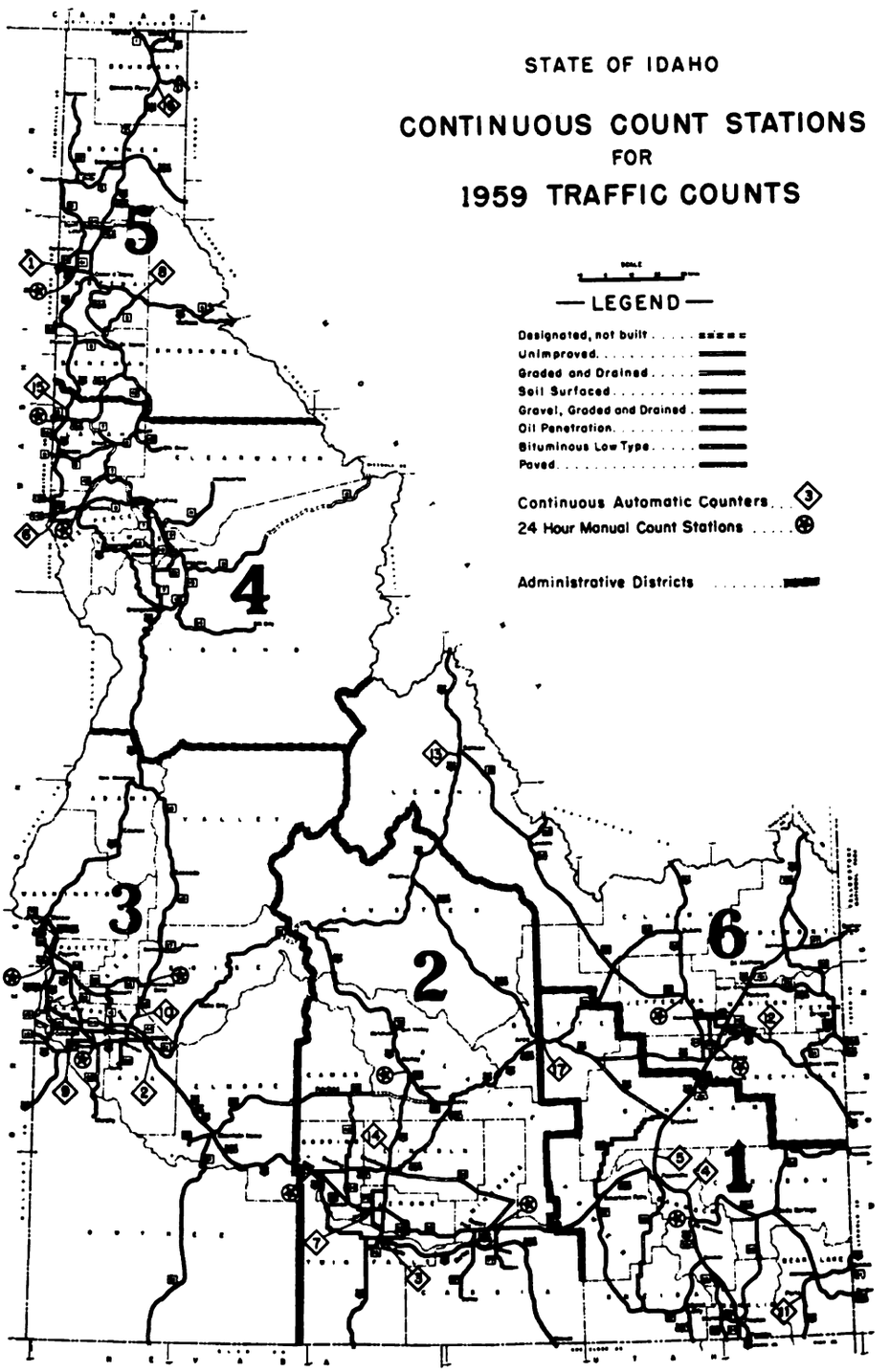

Fig. 19.—Location map of continuous count stations in the state of Idaho for 1959.

(2) to establish regulatory measures,[1] and (3) to serve as a basis for evaluation of highway benefits accruing to road users.

Motor vehicle use studies

Traffic surveys are generally concerned with the volume, movement, and weight of vehicles over the highways. In addition to this information it is also important to know the composition and characteristics of the traffic volumes.

Motor vehicle use studies should be analyzed by in-state and out-of-state vehicular traffic. The characteristics of both can reveal interesting statistics necessary to long-range planning.

In-state vehicular traffic.—It would seem that the bulk of the vehicle-miles[2] driven on the highways of a state are by autos and trucks registered in that state.[3] If this is true, valuable

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[1]Many states regulate the weight of trucks and penalize commercial firms by fines when overweight vehicles are found using the state highways.

[2]A vehicle-mile is the unit in which travel is expressed. Fifteen vehicle-miles could represent the travel of one vehicle for fifteen miles, fifteen vehicles for one mile, three vehicles for five miles, et cetera.

[3]For the year 1954, in New Mexico, 83 percent of the vehicle-miles driven in the state were incurred by New Mexico vehicles, while the remaining 17 percent were attributed to foreign vehicles. See New Mexico State Highway Department, Planning Division, Motor-Vehicle Use Study, 1954, Project Report (Santa Fe: New Mexico State Highway Department, 1954), I, 24.

planning information can be derived from travel characteristics and patterns, and from the habits of the operators of the vehicles.

In preparing such a study, the state should be segregated into population groups such as unincorporated open country and suburban areas, and incorporated areas by size of town. From registration data the number of passenger cars and trucks operating from each of the population groups should be determined. From manual traffic counts it can be established what road systems (interstate, primary, secondary, et cetera) were used by each of the types of vehicles.

Second, through the use of sampling techniques, questionnaires can be mailed to a cross section of the population groups requesting information on such factors as average annual mileage driven, average trip length, and purpose of trips. In addition to the preceding information, it can be established what road systems are being used by what occupational groups (professionals, farmers, business proprietors, salesmen, et cetera) and for what purposes (earning a living, social and recreational, family business, educational, civic, religious, et cetera). From these data, information essential to highway planning is derived.

> A thorough knowledge of the patterns of motor-vehicle use must serve as a basis for any long-range programming of construction and reconstruction on the various road

systems within the state, particularly with reference to the financial and economic aspects of such programs.[1]

Out-of-state vehicular traffic.—Material similar to that gathered for in-state vehicles should be accumulated from the operators of out-of-state vehicles. Interviewing stations can be established at ports of entry or departure of a state. By sampling techniques and the use of a questionnaire, vehicle operators of foreign automobiles can be interviewed as to their origin and destination, purpose for visiting the state, routes taken or to be taken in travel through the state, places of interest that the traveling unit will visit, and the number of days to be spent in the state.

From the preceding traffic studies, the complete travel characteristics of road users can be determined. The traffic volumes, movement, weight, composition, patterns, and other characteristics of vehicles and owners can be established. The information is invaluable for determining road classification, structural needs, allocation of tax burdens, and other long-range planning requirements.

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[1] Ibid., p. 1.

Road Life Studies

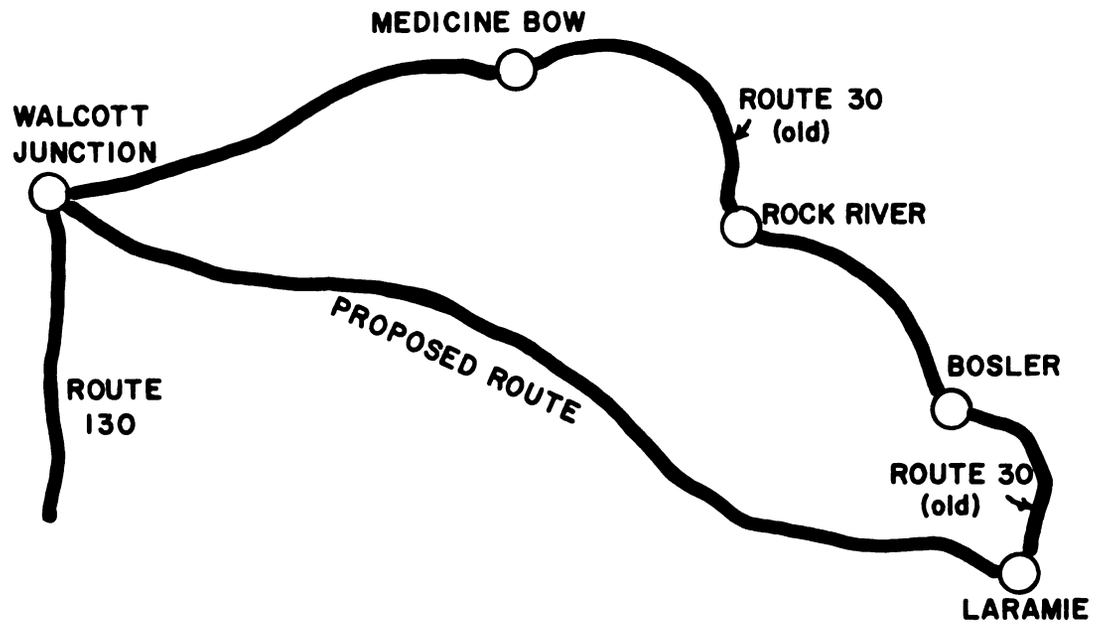
Although highways can be subjected to the same analysis as a piece of machinery pertinent to depreciation and obsolescence, the factors affecting the life of a highway are more varied and difficult to forecast. In addition to the usual wear and tear from use and obsolescence arising out of inadequate standards resulting from increased traffic volumes, unusual weather conditions, soil composition, changes in the weight and speed of motor vehicles, and other factors must be considered in determining the life of a road. Studies should be conducted constantly that can assist in reducing the unpredictability of the variables to a minimum.

It is possible to determine the average service life of the various types of road surface materials and the other elements of a highway such as the foundation, shoulders, drainage systems, bridges, and other structures. If the average life of the highway can be predicted with a fair degree of accuracy, the cost of maintenance over its useful life and its eventual replacement date can be determined and made a part of the long-range budgetary forecast.

Economic Studies

Unless they exercise extreme care, state highway and federal authorities can create considerable hardships for members of a community. A decision to relocate a road, for instance, along a different path to comply with road standards can cause economic disaster to businesses located along the old route. The problem can be quite serious in certain circumstances. For example, Route 30 traverses the nation from coast to coast. In Wyoming, the route enters Laramie from the east and turns north and west in a large semicircle. North and west of Laramie the national route passes through three small towns: Bosler, Rock River, and Medicine Bow. In these communities and along the route many businesses have been established to cater to the needs of travelers on the road.

In planning the new interstate system through Wyoming along the old Route 30, a decision was made to bypass the three small towns entirely and eliminate approximately eighteen miles of travel over the old route. The following diagram is a reasonably exact facsimile of the geographical situation:



An economic analysis was made to determine the economic impact on the three towns. The study covered several aspects: (1) the initial loss of sales to individual enterprises located along the original route if the cutoff were constructed; (2) the secondary effect on the economies of the three towns and the counties in which they are located as the incomes of the employees and entrepreneurs are reduced or eliminated and the populations of the communities contract; and (3) the savings in time, fuel, repairs, depreciation, et cetera, that should accrue to the motorists by having to travel eighteen miles less.[1] It is obvious that

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[1]The cost of operating an average passenger vehicle is estimated to be one cent per mile more on an intermediate-type pavement and two cents per mile more on a low-type pavement

it will be the individual businesses servicing the highway traffic, the communities (business and others) that do not depend on the highway traffic, and the counties that will be affected by the relocation. It is doubtful that the state as a whole will be much affected by the bypass, as the income will be distributed to other businesses, communities, and counties along the new route.[1]

Another aspect of economic impact studies should have to do with the effect on the values of lands that are serviced by the highways. Land values are substantially affected by the means of ingress and egress to the property. At present, landowners are paying little or nothing toward the construction and maintenance of the major state highways.

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than operating on a high-type pavement. The savings in time is estimated, for pleasure vehicles, at 1-1/4 and 1-1/2 cents per vehicle-minute. For further discussion of operating costs, see Eugene L. Grant, Principles of Engineering Economy (New York: The Ronald Press Company, 1950), pp. 495–501.

[1]Although the study revealed a severe economic loss to the three communities, state highway officials made a decision to construct the new bypass. For a more detailed analysis of the problem of the three Wyoming towns, see Wyoming State Highway Department, Study of Interstate System Location (Cheyenne: Wyoming State Highway Department, 1958). A further analysis of economic studies may be derived from W. Zickefoose, Economic Survey of Santa Rosa, New Mexico, 1950–1958 (Santa Fe: New Mexico State Highway Department, 1959).

Urban Analysis

One of the major problems confronting state highway and urban officials is the planning of an adequate system to service traffic in the large metropolitan centers. State highway officials are concerned because of their responsibility for urban extensions of the various state highway systems and because urban areas are participating in revenues generated by highway users. The problem has arisen out of the phenomenal growth of cities, the migration of city residents to suburban areas, and poor planning on the part of city highway officials. Each work day, traffic problems are created by the movement of commuters to and from their places of employment.

The cost of building modern multiple-lane freeways to service the metropolitan traffic is extremely high, especially as to right-of-way acquisitions. At present, much consideration is being given to urban planning. There is a need for long-range planning for construction and for financing the costly program. Future growth patterns of the urban areas should be carefully forecasted, a road system should be designed to service the anticipated traffic, and the means for financing it should be provided. Such a long-range program will require close cooperation

and coordination between state and urban officials. Failure to consider urban planning for construction and finance will result in an unbalanced road system and undoubtedly will culminate in unusual demands on highway revenues in the future. Planning the construction and financial needs of urban, state, and county road systems should be blended into one over-all program.[1]

With a few exceptions, the urban problem has not been very serious in the ten survey states. However, the rate of growth of certain cities in a few of the states would indicate that they are rapidly approaching the urban problem. Careful consideration should be given to the manner in which other urban areas are solving their problems. Urban needs should be made a part of long-range plans, and provisions should be made for the acquisition of right-of-way property—the costly aspect of urban road construction. Growth patterns of the urban areas should be carefully analyzed, interstate routes should be planned

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[1]For a further analysis of the urban road problem, see Wilbur Smith and Associates, A Major Street and Highway Plan—Phoenix Urban Area, A Report Prepared for the Arizona State Highway Commission (Phoenix: Arizona State Highway Department, 1960); and National Academy of Sciences, Highway Research Board, Highway Planning and Urban Development (National Research Council Bulletin 64, Publication 249; Washington: National Academy of Sciences, 1952).

that will bypass the city, and traffic patterns should be evaluated for planning a street system which will avoid heavy traffic congestions during rush hours.

Urban road planning is one of the most important problems facing highway authorities at the present time. Those state and urban area officials not encountering the problem at the present time should carefully evaluate and analyze the growth trends in their communities and plan to avoid the situation now faced by highway authorities in other urban areas.

CHAPTER IX

LEGISLATION, ORGANIZATION, AND PUBLIC REPORTING

Organizations, like individuals, tend to acquire personality characteristics that may resemble inherited or learned traits. When the organization is initiated it is often the representation of the philosophies of its founders. In other words, it acquires at birth seemingly inherent characteristics that represent the concerted or compromised traits of its initiators.

As the organization grows, chronologically or physically, it undergoes certain changes as it is subjected to environmental influences and pressures. For example, the organizational philosophy of firms toward their employees have modulated considerably depending on certain internal and external pressures. It is certainly true that these philosophical shifts have been the personification of the individual leaders who guide and direct the organization. The firm, nevertheless, seems to take on a personality of its own. Even the law has given a degree of individuality to the organization which exceeds that of its members.

The state highway organization is the counterpart of its prototype, the state government. In addition, it is the product of its political environment. It is required to operate in an atmosphere of custom and tradition based on political maneuvering and expediency. To bring about changes in managerial practices and other features necessary to an informed and enlightened highway management operating in an efficient manner, legislation is required to overcome the precedence of conventional practices that have become prevalent in the highway department.

It will be the objective of this chapter to discuss those factors of a highway plan that are necessary to give meaning, substance, and support to the recommendations for financial planning and control as suggested in this dissertation. To state that certain action should be taken by highway authorities in order to acquire greater efficiency in the accomplishment of organizational objectives is one thing, but to put them into practice is another.

Three features essential to the installation and use of the recommended procedures of financial planning and control are legislation, organization, and public reporting. These factors represent the minimum requirements necessary to the successful attainment of financial objectives.

Legislation

In the light of recommended financial planning and control procedures, legislation should be enacted in three areas: (1) State and county legislation should be enacted to provide for a greater degree of control over the use of highway funds for county road construction by state highway departments. (2) State law should be passed, or present law amended, to abolish commissioner districts or similar established boundaries within a state. (3) A law should be enacted that would require construction expenditures to be allocated on the basis of priority listings as determined by sufficiency ratings. (4) Legislation should require adequate public reporting.

State control over county road fund allocations

To integrate the county and state rural road systems into a coordinated unit for the purpose of over-all planning and control, the approval of the residents of the counties by popular vote would be required. In turn, the state legislature would have to pass legislation to the same effect.

It was discussed in Chapter V that two possible alternatives were available: (1) The state could assume responsibility

for the entire county road system as to financial and construction planning and control. (2) The most important county highways could be designated as a special system of primary county roads which would be integrated into the state rural road system.[1] Of the two proposals, the latter seems to be more acceptable. State highway officials seemed to be quite reluctant to assume responsibility for the entire county systems. However, many did indicate that considerable value could be derived from financial and construction planning and control over a limited primary road system by state highway departments. Since the establishment of a county road system seems to be the most feasible of the two alternatives, the following discussion will be directed toward that end.

The reader should be reminded that the first distribution from highway user revenues is made to the state, counties, and urban areas. The formulas for this allocation of highway user receipts among the political units are established by state legislatures. Legislation should be passed to provide for financial and construction planning and control of the county road systems by state highway departments; administrative control should remain with county commissioners.

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[1]See supra, Chapter V, pages 154–58.

More specifically, the legislation should provide for the following features:

1. County and state highway officials should cooperate in determining which county highways should be made part of the county primary road system subject to the approval of the state legislature. The mileage of this road system should be "frozen" and subsequent additions should be made only with the approval of state highway departments.

2. State highway departments should establish a department in their organizations to administer the county primary road needs.

3. Road standards and designs should be created for the county primary roads setting forth the requirements for structural, service, and safety features of the county system.

4. A sufficiency rating system should be designed and applied to the county primary road system for the purpose of allocating construction funds on the basis of need. The rating of the county highways should be performed by trained state highway personnel.

5. All decisions pertinent to county primary road location, construction, or reconstruction should be vested in state highway authorities subject to their approval prior to the allocation of highway funds for road projects. State highway officials should make their decisions on the basis of an integration of the county primary road system into the rural state systems.

Allocating state highway revenues by districts

The second allocation of highway funds for state road systems is made by highway commissioners among the districts

which they represent.[1] This distribution among commissioner districts is highly impracticable and unrealistic, and there is little logic to support it as a procedure for allocating highway funds. The allocation has no relevance whatsoever to needs based on road priorities competing for scarce construction funds. If the allocation among the districts is not established by formulas based on population, road mileage, or terrain, the highway commissioners distribute the construction fund among their districts on the basis of argument and concession among themselves. It makes little difference whether construction funds are allocated among commissioner (or other) districts by legislative formulas or by commissioner agreement; both methods give little consideration to construction needs in the state.

Legislation should be established that will abolish distribution of construction funds among districts—commissioner or otherwise. The need for the allocation can be established by the recommendation in the following section pertinent to the use of sufficiency ratings.

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[1] See supra, Chapter V, page 167.

Allocating construction funds
by priority listings

Traditionally, highway commissioners have been determining and approving the placement of funds on specific construction projects within their districts. Even though annual construction needs in their districts may have been established by priority lists based on sufficiency ratings, commissioners possess the authority to change, add to, or modify the construction projects as they desire. Often, in scheduling construction projects in their districts, their decisions may not be based on actual needs but may be predicated on alternatives arising out of political pressures. It has been an underlying thesis of this dissertation that decisions based on commissioner judgment will not result in the most efficient utilization of construction funds. Construction funds should be allocated on a more systematic basis, and the best technique available is the priority listing system based on a sufficiency rating procedure whereby construction projects are determined and scheduled in the construction budget according to need.

To say that the function of specific fund allocation should not be the responsibility of highway commissioners is not enough. Custom and tradition pertinent to construction fund allocation have

been so thoroughly ingrained in the commissioner function that legislation has been passed in certain states to eliminate it as a basis for decision-making. The manner in which the inefficient practices of commission action can be avoided and a more rational approach assured is to pass state legislation which will make mandatory fund allocation utilizing the most efficient procedures available. To do otherwise would render the system useless and subject to circumvention.

The legislation should encompass the recommendation offered in the preceding section of this chapter—the dissolution of district boundaries as a basis for distributing construction funds. The following are examples of similar types of legislation that have been passed in one state—Nebraska—and recommended in another—Wyoming.

> The construction, maintenance, protection, and control of the state highway system shall be under the authority and responsibility of the department except as otherwise provided in Section 39 of this act. The relative urgency of proposed improvements in the state highway system shall be determined by a sufficiency rating established by the department in-so-far as the use of such a rating is deemed practicable. The sufficiency rating shall include, but not be limited to, the following factors: (1) Surface condition, (2) Economic factors, (3) Safety, and (4) Service.[1]

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[1]Hugo F. Srb, Laws of Nebraska, 1955, 67th Sess. (Lincoln, Neb.: Journal-Star Printing Company, 1955), pp. 433–34.

In an unpublished report prepared for the State Highway Commission of Wyoming, a recommendation was made by a study group as follows:

> Section 1. The state highway superintendent, under the supervision of the state highway commission, shall establish a system for rating all roads and highways constituting the federal aid primary and secondary systems including urban extensions on a sufficiency rating basis which shall take into consideration traffic volume, composition of traffic, structural adequacy, safety and such other factors as the superintendent may determine, and shall rate all such roads and highways according to such sufficiency rating system. . . .[1]

Such legislation will place the responsibility for conducting the field observation study to rate the highways, and the subsequent preparation of the annual construction priority list, in the hands of experts in the state highway departments. Final approval for the annual construction budget should still remain with the board of commissioners. However, the legislation should forbid any changes in the construction budget by the commissioners that cannot be justified by the priority listing system.

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[1]Wyoming State Highway Department, "Financing of Modern Highway for Wyoming," An Unpublished Report on a Fiscal Analysis of Wyoming's Highway Needs Prepared at the Request of the State Highway Commission of Wyoming (Cheyenne, Wyo., 1960), p. 194.

Public reporting

State legislation should be provided to require the state highway department to prepare complete and timely reports on its activities each year and the projected action for the coming year. Probably nothing is more conducive to efficient operation on the part of highway management than the knowledge that their operations will be subjected to close scrutiny by the interested public. Public reporting is discussed in greater detail in a subsequent section of this chapter.

Organization

Before a system of financial planning and control can be made effective it is important that the organization provide the environment for the most efficient operation.[1] Although there is room for improvement in many areas of highway management and

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[1]The author has participated as a conference leader in several management conferences conducted for state highway engineers. These experiences have provided an insight into the problems encountered in state highway management. Many of their problems are the result of a lack of understanding of management principles, such as authority and responsibility relationships, line and staff concepts, a misunderstanding of the functions of a manager, and failure to establish and utilize proper objectives, policies, procedures, and systems.

organization, this dissertation is primarily concerned with those that have relevance to financial planning and control.

The most common form of highway organization at top managerial levels provides for a board of highway commissioners, or directors, whose authority and responsibility generally encompass the complete functions of construction, maintenance, and regulation of state highways. In most cases this managerial body performs in a line capacity whereby its authority is absolute to all other highway managerial and operative positions.

The board of commissioners serves in another important capacity in the highway organization other than the planning, directing, and controlling of the functional activities and assuming responsibility for their performance. The commissioner body provides a buffer between higher political authorities and the career managers of the state highway department in the performance of their activities. This organizational setup tends to alleviate a substantial portion—but not all—of the political pressure exerted by nonhighway personnel. However, even though the idea has merit, the board of commissioners tends to emasculate the principle by submitting to pressures from other external sources.

Fundamentally, the board of commissioners can be compared to the board of directors of the modern corporation. The function of such a body should be to establish objectives, determine general policies, and to plan and control the over-all activities of the organization. At no time should the board members —acting in such a capacity—be concerned with performing actual lower-level managerial functions that can be better delegated to, and performed by, specialists who are well trained and experienced in the operation of those functions. Yet this is precisely what highway commissioners do. They are instrumental in determining the actual construction projects for their districts. This function can be performed much more efficiently and expertly by highway planning engineers using the sufficiency rating procedure to determine annual construction priorities based on short- and long-run planning and control concepts.

It has already been recommended that the situation should be corrected by state legislation which will make mandatory the use of priority listings. There is at least one other alternative that should be mentioned. The board of commissioners can be placed in a staff capacity whereby their authority and responsibility are eliminated.[1] In this respect, the board acts in an

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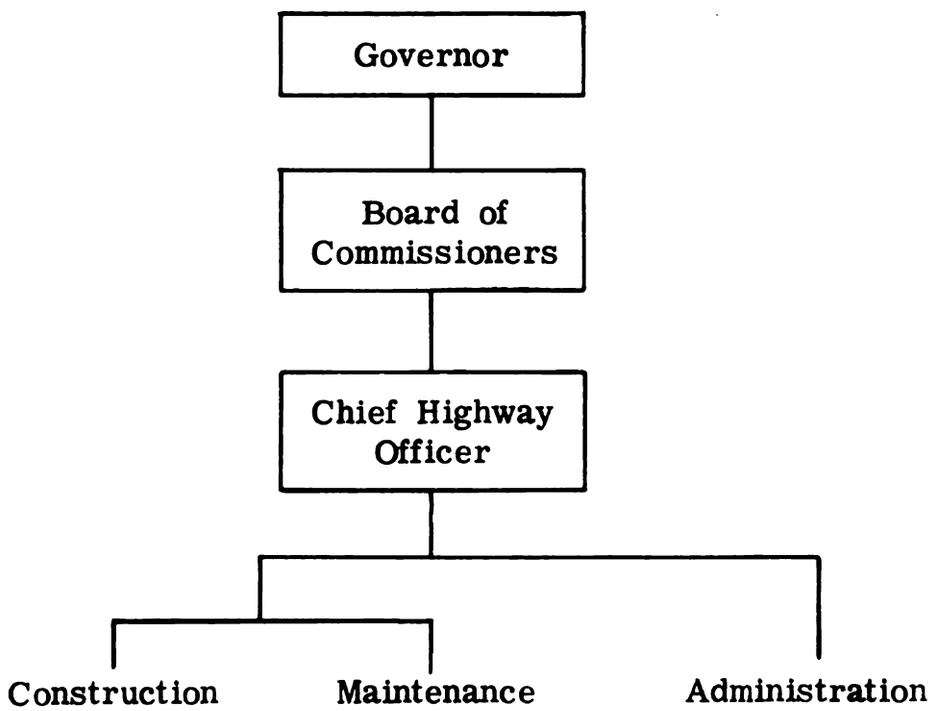
[1]The state of Nebraska utilizes this form of organization structure relevant to the board of commissioners.

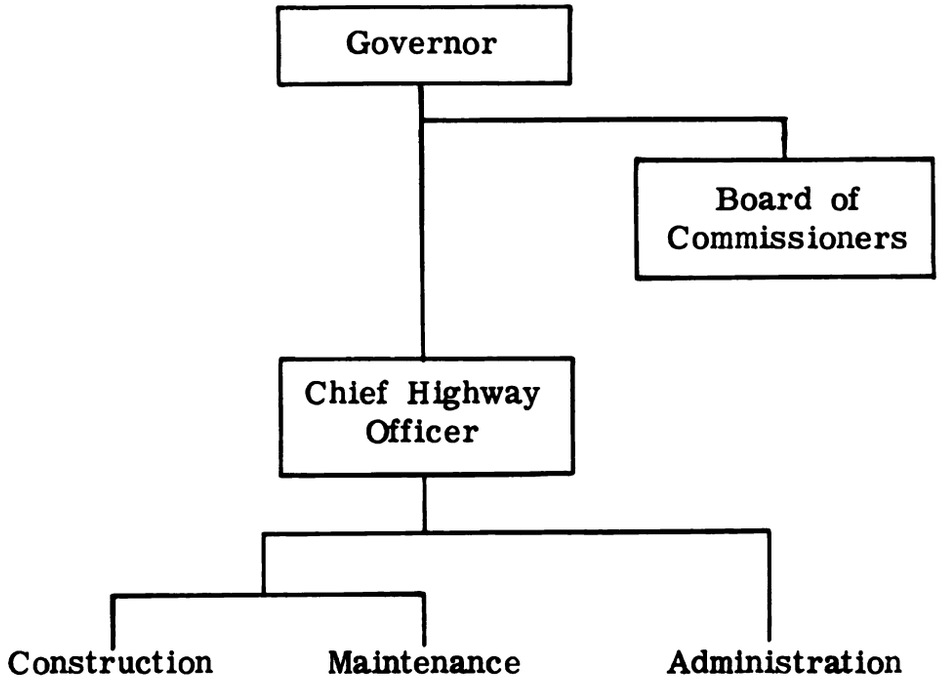
advisory capacity to the chief line officer, who now assumes the authority and responsibility for the operation of the highway functions. The line of authority runs directly from the governor to the line officer in charge of highway operations, which may make him subject to dismissal with changes in the political administration.[1] The following are examples of both types of organization:

1. The board of commissioners as line officers.



[1]This situation may be alleviated if the state has a civil service program for its employees.

2. The board of commissioners as staff officers.



If legislation cannot be passed eliminating commissioner districts and curtailing commissioner control over scheduling annual construction projects, and if the law does not delegate complete authority to the commissioner body, the second organizational structure should be used. The disadvantages of the direct line of command from the governor to the chief highway officer are more than offset by the advantages in eliminating commissioners from exerting their influence on matters pertaining to financial planning and control.

In the organization, the planning division acquires added importance in performing the function of determining the annual construction schedule. Many planning divisions are already acting in this capacity and are preparing priority listings based on some sort of rating device, but insufficient consideration is being given to their efforts. If the recommended procedures are accepted, the planning division should be enlarged to provide the staff necessary to rate county roads in addition to the state systems. Qualified highway engineers should be found and trained in the highway rating procedure in an attempt to reduce the subjective elements of the system to a minimum.

If one is not already in existence, a department should be created to coordinate the county primary road program. Close cooperation will be required between state and county officials in establishing the county primary system, and approving road location, construction, and reconstruction projects for financial approval. County road standards and design can be determined by the same highway department that establishes the construction requirements for the state highway systems.

Some state highway departments have established a policy, written or implied, that only engineers can be promoted to top-level management positions. Little or no attention is given to

managerial ability or training. Highway engineers are probably the best-trained highway technologists in the world, but this may have little bearing on good highway administration. Good engineers do not necessarily make good managers. Highway policy should be modified to include a knowledge and understanding of management principles and practices.

The requirement should also apply to commissioner appointments. Often commissioners are lacking in an understanding of both management practices and highway engineering knowledge. Consequently, they tend to perpetuate inefficient management practices rooted in highway custom and tradition.

Public Reporting

In many organizations reporting of financial information based on carefully established records and procedures has become an integral part of the requirements for management to account for its past performances. In the privately owned corporation, with its absentee ownership, it is necessary that the professional manager account for the authority and responsibility vested in him by the owners and other interested parties of the firm. In the private profit-making concern with its audited records, managerial responsibility as it relates to financial

performance can be fairly well determined. The important fact is that managers do account, in some manner or another, for their responsibilities to those who associate with the firm, internally and externally.

In state highway departments, with but few exceptions, little or no attempt is made to justify managerial action, financial or otherwise. In many states only irrelevant and immaterial information is disseminated to the public that pays for and uses the highways. Occasional news releases are made indicating contracts let to private firms, road conditions, and other similar types of information. Very seldom, if at all, is information released that would indicate the manner in which highway management is fulfilling its responsibilities. Even though the financial records of state highway departments and other state agencies may be open to the public, they often do not reveal many aspects of the failure of highway management to achieve organizational objectives.

State highway department officials are often subjected to criticism, abuse, and pressures from outside sources. Newspapers, radio, and other media often attack highway department officials on some policy or road program undertaken. The basis for such attacks may often be more emotional than logical, and

in many cases the counterarguments of highway officials may be equally lacking in logic.

Individuals, groups, or organizations may apply pressure on highway commissioners to build roads that will further their own interests. State law often requires that commissioners listen to these pleas at public hearings. It was readily admitted by highway officials in certain of the survey states that external pressures were successful in swaying the opinions of the commissioners.

Abuse and pressures on highway officials can be eliminated —or nearly so—by two of the procedures recommended in this dissertation. First, in allocating all construction expenditures by a priority listing procedure based on sufficiency ratings, construction outlays will be made on the basis of need. Sufficiency ratings permit a comparison of the condition of one highway segment with another and can furnish cogent arguments as to why one highway section should receive consideration in preference to another. Pressures can be eliminated by sheer logic rather than by irrational arguments. The priority list can be used to explain precisely why a highway section was scheduled for construction. If advance planning reports can avoid public speculation in right-of-way acquisition, the construction schedules

can be prepared for several years in the future for public distribution.

Second, legislation should be enacted to assure that the public will be informed as to the manner in which highway management is fulfilling its responsibility. An annual report should be prepared for public dissemination setting forth: (1) a brief but thorough explanation of the sufficiency rating system in terms understandable to the layman; (2) a detailed breakdown of all highway receipts and expenditures for the past year; (3) a complete description of the projects undertaken and completed during the past year, indicating the sufficiency rating, cost, and other pertinent information; (4) a summary of the condition of the state highway by classification of the road systems (interstate, primary, secondary, et cetera); and (5) a list of construction projects to be scheduled for the following year and an explanation of why they were programmed for construction. The report should be well interspersed with sufficiency rating maps, graphs, charts, and other pictorial representations that will make it more readable to the interested person.

As it would be too costly to print and distribute such a report to all residents of a state, the newspapers, radio, and other media should be utilized in disseminating the information

throughout the state. By using the mass media of communication to publicize construction project decisions based on the priority listing procedure, groups having vested interests in highways may become hesitant to apply pressure for their own interests.[1]

Copies of the report should be sent to the governor, members of the legislature, and any other interested groups and organizations that might be concerned with good highways. If highway managers are fulfilling the objectives of their organizations, the public should know about it. It is only through the use of good financial planning and control procedures and proper and timely reporting of highway activities that the general public, state administrators, and highway personnel will throw their complete support behind the highway organization. As the situation now exists in many state highway departments, failure to keep the public informed on objectives, policies, and procedures of the highway department and to give adequate, if any, indication of the performance level of highway management will result in further

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[1]A similar but less complete reporting procedure has been legislated into existence in the state of Colorado. In an interview with Mr. Robert Livingston, Planning Engineer for the Colorado State Highway Department, the author was informed that criticism of construction planning had been reduced to a minimum and that pressure groups were no longer instrumental in directing the flow of scarce construction funds.

abuse and pressure from external sources. With the extensive highway program now in effect involving the expenditures of billions of dollars, highway management has assumed an awesome responsibility to the public. Failure to inform the public as to how well they are fulfilling this responsibility will render them derelict to duty.

A Flow Chart Presentation of the Major Recommendations

With the completion of this chapter, the areas of current highway management planning and control of construction expenditures have been discussed and recommendations have been made to improve management practices. To enable the reader to better visualize the complete process, two flow charts are presented. In Figure 20, the flow of highway revenue designated for construction is depicted as it is received from the tax sources, distributed to the major highway political units, allocated to the four major highway functions (construction, maintenance, administration, and other services), prorated to commissioner or other districts by formula or commissioner agreement, and eventually expended in the districts on construction projects as determined and approved by the commissioners of the districts. Figure 20

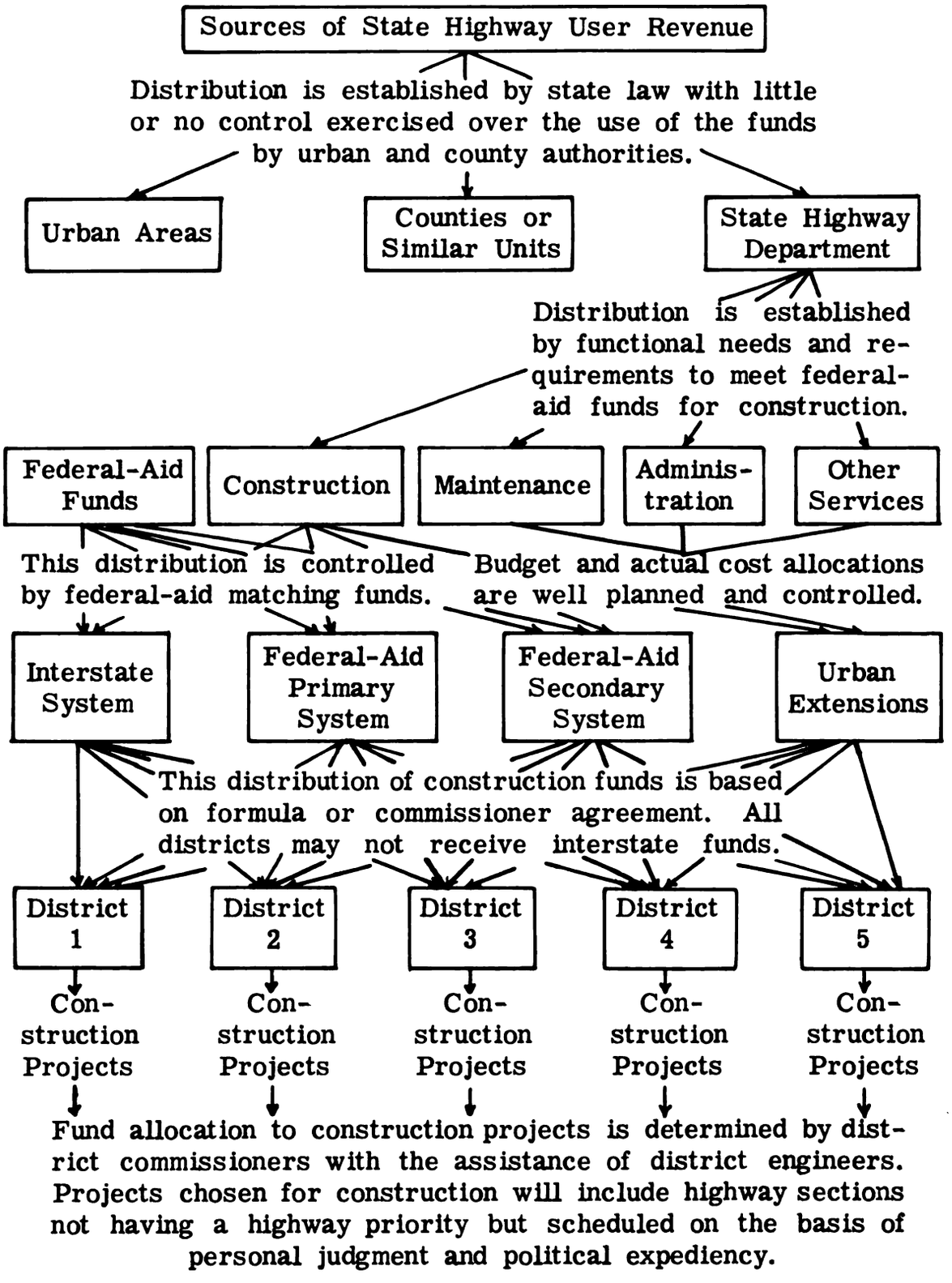

Fig. 20.—Flow of state highway revenues before the proposed recommendations.

reflects the conditions as they generally now exist and prior to the utilization of the proposed recommendations.

Figure 21 shows the flow of highway revenue designated for construction after the proposed recommendations have been installed. First, note that revenue allocations to counties are controlled by the state highway department. All county road expenditures from the highway user fund must be approved by state highway officials as described in preceding chapters. Second, commissioner or other districts have been eliminated (by legislation), and construction funds are now allocated directly to construction projects based on need as determined by priority lists prepared from sufficiency ratings. This allocation also gives consideration to long-range planning techniques. Legislation is required to enforce the use of sufficiency ratings as a basis for allocating scarce construction funds.

Third, from the long-range planning techniques, sufficiency ratings, and the construction budgets, maps, charts, and graphs can be prepared indicating the progress in overcoming road deficiencies. These maps, charts, and graphs serve not only as control techniques but are also excellent tools for future construction planning. Information is available for preparing an

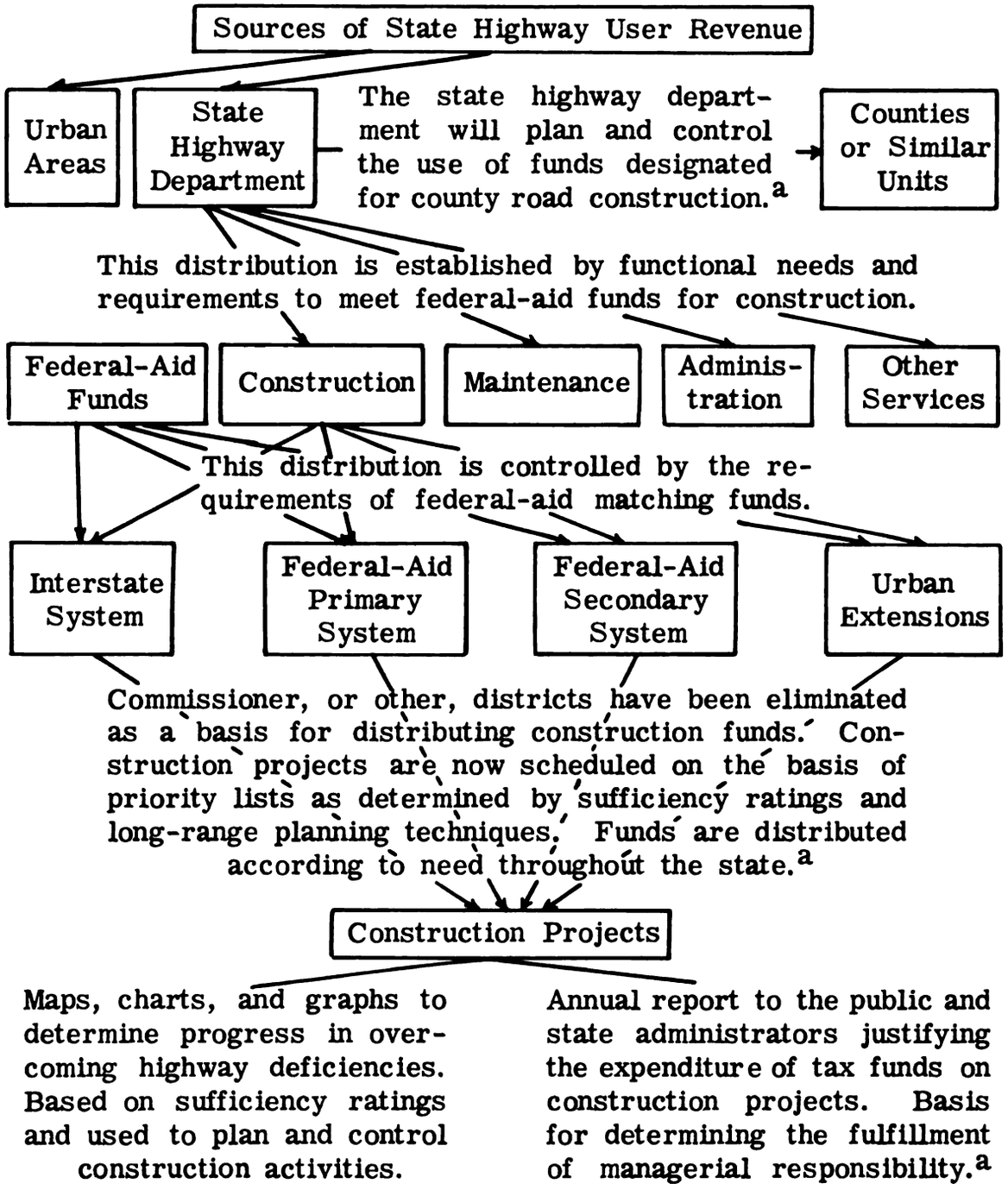

Fig. 21.—Flow of state highway revenues after installation of proposed recommendations.

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[a]Legislation will be required to give meaning to the system of financial planning and control and to prevent circumvention of its requirements.

annual report for the public justifying decisions made in budgeting scarce construction funds.

CHAPTER X

THE SURVEY

In the developmental stages of this dissertation, a survey of the current literature revealed a paucity of information on the subject of financial planning and control in state highway departments. Practically all information available was directed toward the mechanical aspects of sufficiency rating procedure, and apparently no research had ever been conducted to determine what use was being made of the system. A series of preliminary interviews with planning and research engineers in a nearby state revealed that current practices of financial planning and control of construction funds in state highway departments might leave something to be desired. With nothing more than supposition and a few facts, it was decided to conduct a survey of several highway departments to determine at first hand the methods used by highway officials in scheduling construction projects in the annual budget.

Objectives of the Survey

Due to the lack of information pertinent to highway management financial planning and control, the survey by necessity served several objectives:

1. To determine the methods or procedures used by state highway officials to plan and control construction expenditures.

2. To elicit information relevant to the use being made of the sufficiency rating procedure by highway officials in scheduling construction programs.

3. To determine practices, or lack thereof, in other areas of financial planning and control of construction expenditures.

Plan of the Survey

Once a decision was made to conduct a survey, two problems were encountered. First, what means would be utilized in gathering the information? Second, what weight should be given to statistical accuracy in the survey?

The two problems were considered together in making the final decision. If a mail questionnaire were used, statistical accuracy would be assured. If a personal interview were conducted, it would have to be limited to the financial resources of the researcher, and statistical accuracy would be sacrificed. A

decision was finally made to follow a course of action whereby statistical sampling accuracy would be ignored in favor of a series of personal interviews to be conducted in a rather limited area. The reasons for this choice of alternatives are enumerated below:

1. Due to the confidential nature of the information being gathered, a mail questionnaire would not be the proper technique to utilize because of (a) the natural reluctance of the respondents to commit themselves in writing, and (b) the inability of the individual to express himself in written form.[1]

2. The responses would have been limited to the specific questions asked on the questionnaire, and other areas of financial planning and control procedures would not have been revealed. By using the personal interview method, two additional areas that were not anticipated in the preliminary stages of the study were developed and made a part of the recommendations.

The survey states

With the decision to make an intensified study in a limited area, the problem of which states to include in the survey was

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[1]The choice of personal interviews turned out to be a wise one. At the end of an interview, questions were directed to a sample of respondents pertinent to their response if the author had sent them a mail questionnaire covering the material discussed during the interview. Invariably, the answers indicated that the respondents would have refused to give answers to confidential questions because they could not as readily deny written answers as they could verbal responses.

encountered. Rather than limit the research to the Rocky Mountain states,[1] it was decided to include three of the so-called plains states—South Dakota, Nebraska, and Kansas. The Rocky Mountain states included in the research study were Arizona, Colorado, Idaho, Montana, New Mexico, Utah, and Wyoming.

Actually, it cannot be said that the ten survey states possess, in general, any degree of homogeneity other than for their western location and the possibility that they, as a group, have large land areas and small populations when compared with states in other parts of the country.

The data in Table 49 show a comparison of the ten survey states with seven nonsurvey states as to land area, population, state-administered road and street mileage, motor-vehicle registrations, and disbursements for highway purposes for the year 1959. The data are not conducive to an analytical comparison but are included for informational use only.

Limitations of the study

Since the survey states were not chosen by a random sampling technique, statements cannot be made to the effect that

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[1]The Rocky Mountain states were deemed to include Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.

TABLE 49.—A comparison of the ten survey states with seven selected states as to land area, population, state-administered road and street mileage, motor-vehicle registrations, and total highway disbursements for 1959.

State[a]	Land Area[b]		Population[c]	
	Square Miles	Pct.	Number	Pct.
*Arizona	113,909	8	1,302,161	2
California	158,639	12	15,717,204	20
*Colorado	104,247	7	1,753,947	2
Connecticut	5,009	–	2,535,234	3
*Idaho	83,557	6	667,191	1
Illinois	56,400	4	10,081,158	13
*Kansas	82,276	6	2,178,611	3
Michigan	58,216	4	7,823,194	10
*Montana	147,138	11	674,767	1
*Nebraska	77,273	5	1,411,380	2
*New Mexico	121,666	10	951,023	
New York	49,576	3	16,782,304	21
Pennsylvania	45,333	3	11,319,366	14
*South Dakota	77,047	5	680,514	1
Tennessee	42,246	3	3,567,089	5
*Utah	84,916	6	890,627	1
*Wyoming	97,914	7	330,066	–
Totals	1,405,416	100	78,665,836	100

[a]States marked with an asterisk (*) were included in the survey.

[b]Source: Webster's New Twentieth Century Dictionary, ed. Jean L. McKechnie (Cleveland: The World Publishing Company, 1960).

[c]Source: U.S., Bureau of the Census, Eighteenth Census of the United States: 1960. Population.

TABLE 49—Continued.

State	State-Administered Road and Street Mileage[d]		Motor-Vehicle Registrations[d]		Total Highway Disbursements, 1959[d]	
	Mileage	Pct.	Vehicles	Pct.	Amount ($000)	Pct.
*Arizona	4,438	2	578,434	2	50,431	2
California	15,148	9	7,418,137	24	466,950	19
*Colorado	8,232	4	884,697	3	72,771	3
Connecticut	3,585	2	1,061,069	3	95,098	4
*Idaho	4,777	2	364,047	1	39,018	2
Illinois	12,931	7	3,678,322	11	279,717	11
*Kansas	10,439	5	1,135,657	4	96,509	4
Michigan	9,354	5	3,201,406	10	151,010	6
*Montana	11,086	6	375,592	1	50,594	2
*Nebraska	9,291	5	706,224	2	52,245	2
*New Mexico	11,806	6	446,495	1	64,532	3
New York	14,455	7	5,011,467	17	463,177	18
Pennsylvania	46,390	25	4,176,661	14	362,265	14
*South Dakota	7,316	4	348,543	1	44,874	2
Tennessee	8,840	5	1,264,255	4	111,937	4
*Utah	5,603	3	401,555	1	51,625	2
*Wyoming	5,164	3	197,621	1	41,888	2
Totals	188,855	100	31,250,182	100	2,494,641	100

[d]Source: U.S., Department of Commerce, Bureau of Public Roads, Highway Statistics, 1959 (Washington: U.S. Government Printing Office, 1961).

conditions found in the survey states apply to all states in general. In other words, the findings of the survey cannot be used to make generalizations relevant to practices of financial planning and control in other states.

The survey findings may not represent conditions existing in other state highway departments for several reasons. First, the survey states will differ from most other states in that they possess large land areas and small populations. From a financial viewpoint, this factor assumes great importance in road standards and design, highway revenues, and other pertinent problems. Second, urban road problems differ substantially in that the survey states do not have the large urban areas found in other states. Land acquisition for highway use in metropolitan areas is an extremely costly process, and in some urban areas such as San Francisco it is almost impossible to purchase land for highway purposes. In a few of the survey states this is becoming a problem; Denver and Phoenix are rapidly approaching such a situation. Third, the Rocky Mountain states encounter road-building conditions over extremely rough terrain; also, the climate at the higher altitudes presents construction problems not encountered in many other states.

Interview procedure

To accumulate the required information, it was necessary to interview personnel holding various key positions in the highway departments. Whenever possible, interviews were conducted with state highway engineers (the chief executive officer) or their assistants, planning and research engineers, chief maintenance engineers, construction engineers, public relations officers, administrative officers, district engineers, traffic engineers, safety engineers, and chief accounting officers. As summer (the interview period) is the busy season for highway activity, it was sometimes impossible to contact certain of the above-listed personnel.

Approximately three weeks prior to the actual interviewing, a letter was sent to the chief executive officer of the highway department requesting permission to interview key personnel. The letter also set a specific date and assured anonymity if so desired. On the assigned date, contact was made with the chief executive and the interviewing procedure was undertaken. In several cases the researcher was limited as to the amount of time that could be spent with highway officials, and in most instances the anonymity of both individuals and the state highway department was requested.

A practice was followed in interviewing the planning and research engineer first. There were several reasons for this procedure: (1) The planning and research engineer generally prepares the sufficiency ratings and the priority lists for the highway department. (2) Due to the nature of the position and length of service, the planning and research engineer was probably the best informed individual in the highway department as to over-all highway operations. Other than for the planning and research engineer, subsequent interviews were conducted in no particular order.

The questionnaire

To assure that the desired areas would be covered in the interview, a questionnaire was used to guide the researcher. The questionnaire was designed in such a manner that questions covering specific areas could be directed to personnel specializing in those functions. Part I of the questionnaire was devoted to top-level short-range and long-range planning and control procedures and was used in interviewing chief executive officers and planning and research engineers. Part II was concerned with practices used in reporting to the public and was directed toward planning and research engineers and public relations officers. In Part III, the questions were designed to determine the effect of political pressures on highway department personnel, use

of management training programs, and the adequacy of communications in the organization. The questions in Part IV established the use of sufficiency ratings in determining priorities for the construction budget. Part V was concerned with short-run budgeting procedures, and the questions were asked of chief accountants exclusively.

As the survey proceeded, it became obvious that certain of the questions were superfluous. Conversely, certain other areas were developed more thoroughly by questions which were not a part of the original questionnaire. In fact, if a respondent indicated a propensity to pursue an area of interest, he was encouraged to do so. Consequently, a substantial amount of information was gathered that delved much deeper than the answers to specific questions in the questionnaire would have revealed. A copy of the questionnaire is exhibited in Appendix A.

As several people were interviewed in each state highway department and were often asked the same questions, it was not unusual to receive conflicting answers to certain inquiries. This was especially true if the question involved an opinionated answer. For example, the respondents were queried as to the use made of sufficiency ratings in preparing the construction budget. The answers, in a few instances, varied widely. In such cases the

answers of individuals who were closest to the actual construction planning process were considered the most valid.

As to the validity of answers to the questions asked of the respondents, the researcher depended upon the veracity of the interviewees. However, a pattern of interviewing was devised to eliminate bias as much as possible. As previously mentioned, planning and research engineers were interviewed initially because their function in the highway organization had a direct correlation to the subject being researched. In many cases subsequent interviews with other highway personnel served more as a basis to substantiate the answers given in the initial interview with the planning and research engineer than as an additional source of information.

Findings of the Survey

Due to the unnecessary nature of many of the specific queries in the questionnaire and the fact that definite answers could not be given to many of the questions, no attempt will be made to present a complete tabulation of all the questions listed in the questionnaire. Instead, only those questions which directly developed the major hypotheses of the dissertation will be presented in tabular form.

Long-range planning

The first series of questions were prepared to develop information pertinent to long-range planning. The questions were designed to determine: (1) whether highway officials had established and were adhering to long-range construction and finance programs, (2) the manner in which the long-range programs had been established, (3) if the long-range constructions programs were on schedule, (4) whether revenues had been made available for financing the long-range construction plans, and (5) the provisions made to review and revise the long-range programs periodically.

Responses to the questions relevant to the establishment and use of long-range construction and finance programs are set forth in Tables 50 and 51. From Table 50 it can be determined that six of the ten state highway departments had prepared long-range plans for finance and construction of state-administered highways. The data in Table 51 indicate the use made of the long-range studies by the six states giving consideration to their long-run needs.

The reasons given by the respondents in the nine state highway departments for not conducting long-range studies or for discarding the long-range finance and construction programs

TABLE 50.—Preparation of long-range construction and finance studies by the ten survey states, August 31, 1960.[a]

Preparation	Number
Had never prepared a long-range construction or finance study	4
Had prepared a long-range construction or finance study	6
Total	10

[a]The survey states were Arizona, Colorado, Idaho, Kansas, Montana, Nebraska, New Mexico, South Dakota, Utah, and Wyoming. It should be pointed out that all of the ten survey states had prepared long-range construction reports for the Bureau of Public Roads as required by the various federal-aid highway acts, but little use was made of them for state highway planning as the information included in the reports did not contain all the necessary information for establishing long-range construction and finance programs.

TABLE 51.—Use made of the long-range construction and finance studies by the ten survey states, August 31, 1960.

Use	Number
Report was used in planning construction expenditures	1
Report was discarded and not used in planning construction needs	5
Total	6

were: (1) The legislature or the governor failed to approve of the proposed tax increase called for in the study. (2) The state legislature was continually adding county road mileage, under pressure from county commissioners or other vested-interest groups, to the state highway systems without commensurate increases in highway revenues to care for them. (3) Road standards were continually changing, which made it difficult to estimate construction costs in the future.

Only Colorado received the full amount of the proposed revenue increase asked for in its long-range construction program. The Kansas legislature provided three-fourths of the proposed long-run construction finances, while the state legislative body in Montana not only rejected the long-run construction and finance proposal but it reduced the gasoline tax by one cent per gallon for a two-year period.

Three of the four states that had never made long-range construction and finance studies were in the process of preparing them for periods covering fifteen to twenty years. At least one of the three states will use the report as a basis for acquiring additional highway revenues by legislative action.

Planning and control of construction expenditures is strictly on a short-run basis in most state highway departments

included in the survey. The data in Table 52 indicate the construction planning periods utilized by highway managers.

Colorado periodically reviews and revises its long-range construction and finance program. The purpose of this review and revision is to determine the progress made in overcoming highway deficiencies.

TABLE 52.—Length of the construction planning period for the ten survey states, August 31, 1960.

Length of the Construction Planning Period	Number
Two years	3
Two years, with a five-year tentative plan	4
Three years	2
Five years or longer[a]	1
Total	10

[a]Colorado.

Short-term planning

Of the ten survey states, eight prepared sufficiency ratings either annually or biennially. The data in Table 53 indicate the types of condition rating systems being used in the ten survey states.

TABLE 53.—Types of condition rating systems being used by the ten survey states, August 31, 1960.

Description	Number
Sufficiency rating system	8
Deficiency rating system[a]	1
Adequacy report[b]	1
Total	10

[a]The deficiency rating system as used in Montana is based on an extremely complex formula designed to show the deficiency of a highway in percent as well as the construction priority of any particular road section.

[b]Utah utilizes an adequacy study in determining its construction needs. It is very similar to the sufficiency rating procedure except that the total possible points are based on 130 instead of 100.

Of the ten states preparing condition rating lists of some sort, in only two states—Colorado and Nebraska—was the use of the procedure made mandatory by state law as a basis for allocating construction funds. In the remaining eight states the priority list based on condition ratings was relegated to a position subordinate to personal judgment or political expediency. The data in Table 54 indicate the degree of control exercised over the flow of construction funds by highway commissioners or directors.

TABLE 54.—Control over the flow of construction funds exerted by highway commissioners in the ten survey states, August 31, 1960.

Description	Number
Commissioners have complete or nearly complete control over the direction of construction funds	8
Commissioner control over the direction of construction funds is restricted by state law	2
Total	10

In all but two states—Colorado and Nebraska—construction funds were distributed initially among commissioner or other districts. The basis for this distribution was by formula or by commissioner agreement.

Public reporting

Highway officials in all ten of the survey states indicated that they had some sort of method for reporting progress to the public. However, the methods used in reporting ranged from occasional press releases to monthly, annual, and biennial reports pertinent to highway organization functions, personnel, the broad aspects of revenues and expenditures for the previous fiscal period, construction projects undertaken and completed, and other miscellaneous data. Press releases generally were concerned with road conditions, projects currently contracted for construction, and similar informational data.

Not one of the ten survey states attempted to justify construction expenditures by priority listings based on sufficiency ratings in reports to the public. Nebraska's annual report to the public probably came the closest to justifying managerial action relevant to construction planning. The report contained a map showing the road sections completed and under construction which

could be compared with another map in the report indicating the sufficiency ratings of the state-administered roads.

Politics and the highway organizations

In all ten survey states it was revealed that groups applied pressures on state highway officials to expend construction funds in certain districts or localities. In only two states—Colorado and Nebraska—were such pressures generally unsuccessful, while in the remaining eight states the practice was successful in varying degrees.

Another type of pressure common to most of the ten survey states was that in which groups—generally individual county organizations or a number of counties working together—attempted to have county-administered roads transferred to one of the state systems. When successful, it provided the counties with better roads, constructed to higher standards, and it relieved the counties of the cost of construction.

Management training

The survey revealed that only one state—Idaho—had a formal management training program in operation on a continuing basis. The program was designed to offer instruction at all levels of highway management.

All of the ten survey states had sent, at one time or another, their key personnel to management conferences conducted by organizations concerned with improving highway management performance. Several of the states had hired outside consultants to conduct conferences exclusively for their own highway personnel.

Sufficiency rating procedure

Of the eight states preparing sufficiency ratings, the procedure in determining the actual rating differed somewhat. The data in Table 55 show the procedural differences in establishing a condition rating for road sections.

Short-run budgetary procedure

Information acquired on budgetary procedure revealed that considerable uniformity existed in the methods used in preparing the annual highway budget. In nine of the ten states, state highway user revenues were sufficient to cover nonconstruction outlays first, and to match federal-aid funds for construction second. In only one of the states did the chief maintenance officer in the central office prepare the annual maintenance budget without permitting the district maintenance engineers to participate in the process. The reason given for the procedure was the difficulty

TABLE 55.—Procedures used in determining sufficiency ratings in eight survey states, August 31, 1960.[a]

Description	Number
Frequency with which sufficiency ratings were determined:	
Annually	6
Biennially	2
Total	8
Number of teams participating in the rating study:	
One team in the field	5
Two teams in the field	3
Total	8
Number of states in which the district engineer participated in the field rating study:	
District engineer did participate	2
District engineer did not participate	6
Total	8

[a]Arizona, Colorado, Idaho, Kansas, Nebraska, New Mexico, South Dakota, and Wyoming.

in meeting federal-aid matching funds from current highway revenues.

In the ten survey states, budgetary procedure for maintenance, administration, and other services was adequate. Planning and control of the aforementioned functions was emphasized and encouraged by the utilization of high-speed accounting equipment which made possible the accumulation and dissemination of timely budgeted and actual cost data.

In eight of the ten survey states, budgetary planning and control of construction expenditures was quite faulty. The scheduling of projects in the annual construction budget was not based on the best methods available to overcome road deficiencies. In many cases budgeted construction funds were not used to construct highways having the greatest priority. Personal judgment entered into the process of matching construction projects against budgeted funds.

Reports pertinent to progress in overcoming road deficiencies were lacking or were the reflection of faulty planning. In eight of the survey states, the public had no basis for measuring the performance of highway management, and the public reports of the remaining two states were not complete in the light of reporting procedures as recommended in this dissertation.

Value of the Survey

Although the major objectives of the survey were to determine the practices utilized in scheduling the annual construction budget and to establish the use being made of the sufficiency rating system, its value was far greater. First, it revealed other areas of poor managerial practices pertinent to financial planning and control. For instance, the lack of coordination and cooperation between county and state officials in planning and constructing a rural road system came to light during the survey. In addition, the dubious procedure of allocating the construction fund by commissioner or other districts was revealed. Second, it was a learning process for the writer, whose prior knowledge of financial planning and control in highway departments was limited to the reading of the meager amount of literature on the subject. Third, it disclosed that highway managers are not achieving organizational objectives as they relate to the construction function. Highway managers were still utilizing outmoded methods in the decision-making process of scheduling construction projects. A substantial portion of scarce construction funds were being expended on the basis of personal judgment.

CHAPTER XI

A CRITIQUE OF HIGHWAY MANAGEMENT

In undertaking a study such as this, the researcher must exercise extreme care in sifting, analyzing, and utilizing the information accumulated during the course of the investigation. Emotion must be separated from fact, and fact from exaggeration. To this point in the dissertation an attempt has been made to be as objective as possible in reporting the facts and in offering recommendations. It will be the purpose of this chapter to present a critical analysis of the practices of highway administrators as determined in the survey.

The Practice of Allocating Construction Funds

Two very impressive factors have come out of this study. First, huge sums of money are being channeled through state highway departments. Highway officials are responsible for directing the flow of billions of dollars of taxpayers' funds annually. Second, the procedures used in planning the expenditure of a

substantial portion of the highway funds are not based on the most efficient methods available. Highway officials are not achieving maximum effectiveness in spending the taxpayer's dollar.

The implications of the two aforementioned factors are very serious. No longer are the traditional methods of allocating scarce highway resources satisfactory. The procedures of financial planning and control used in the past are no longer adequate for the present and future. If an efficient and economical highway system is to be established, highway officials must change their philosophies of financial management, states must furnish the machinery necessary to insure efficient performance from highway officials, and the public must be provided with the necessary information to measure the success of highway managers in achieving organizational objectives.

At present, management practices are based on custom and tradition that have existed in highway departments for years. State legislatures have provided the environment within which highway management has operated. They (state legislators) were instrumental in delegating authority to highway officials without providing the necessary means to exact responsible action from them. Legislators did not enact laws that would insure the use

of the best methods of planning and control of highway finances. By creating the commissioner body, establishing districts which they would represent, and requiring that commissioners hear the pleas of vested-interest groups from their districts, the state legislators encouraged the misuse of highway funds. Perhaps the procedures were adequate in the initial stages of the creation of state highway departments, but for modern financial planning and control it is no longer conducive to efficient operation.

It is not suggested that the commissioner body in highway organization be abolished. Instead, it is recommended that legislation be enacted that will exact responsible performance from the commissioners and other highway executives.

Commissioners have not utilized the best methods available in spending scarce construction funds. They have been prone to follow established custom by allocating funds on the basis of personal judgment and political expediency. The practice utilized in allocating scarce construction funds among commissioner districts is a prime example of poor planning and control of highway finances. Whether the distribution is based on established formulas or by commissioner agreement, both methods fail to give proper consideration to highway construction needs. When commissioners divide the construction fund among their districts, very little

analysis enters into the process. Instances were found in the survey where voting blocks were established to prorate funds into rural areas to the detriment of urban areas. Such a practice created a lack of balance in the highway systems of the state concerned. One interview revealed that a great amount of animosity was created among the commissioners during and after the fund allocation process. Instead of cooperating in distributing funds according to needs throughout the state, the process is reduced to argument and compromise—a dubious means of allocating scarce construction funds.

A second practice open to criticism is the manner in which funds are allocated to specific construction projects. In most cases commissioners have the authority to determine the placement of construction funds on highways in their districts. Even though priority lists may have been prepared for their use showing the highways having the greatest need for construction funds, commissioners, and in some instances other highway officials, program their own "pet" projects before consideration is given to those highways having a high priority need. Personal judgment is a determining factor in the process, and this is often tempered by the effects of political pressure. Such a practice cannot result in the most efficient use of the taxpayers' funds.

According to respondents interviewed, this practice resulted in an allocation of from 10 to 50 percent of the funds on other than a priority basis. The situation may have been worse, for it was determined that in many states the primary, secondary, and urban extension systems were in such poor condition that most of the roads had received a priority listing. Under these conditions many of the roads would have been listed as critical; however, their comparative deficiencies were given little consideration. Sufficient consideration was not given to highways for construction on the basis of their lower sufficiency ratings (high priority).

This type of planning will only result in an unbalanced road system. Most important, faced with limited funds and great construction needs, there is no doubt that short- and long-run objectives will never be achieved. Highway departments will remain on an ever-continuing "catch-up" basis in road construction. If such practices of fund allocation have always been in existence, the lag between highway usage and road conditions is understandable.

If an evaluation was made of highway commissioners (political appointees) and highway officials (career executives) it would be difficult to justify the philosophies and actions of either

group. It has been mentioned previously that the commissioner body performs in a political atmosphere based on custom and tradition. It is highly questionable, however, that this fact can serve as an excuse for failing to fulfill public responsibility. Certainly the commissioners are aware of the fallacies of their practices and recognize the advantages to be derived from the use of a more systematic method of distributing scarce construction funds. If an executive cannot see the faults of his own procedures and make an attempt to use better practices—especially when better methods are available—then it is time to either question the abilities of such executives or to have an examination of the organization within which they operate.

With exceptions, career executives in the highway department seemed to take a rather lackadaisical attitude toward the inefficient planning and control of construction finances. Although their sympathies were not necessarily with the commissioners in the construction programming process, nevertheless, they assumed that it was useless to "buck" the system. In some cases highway officials were quite vociferous in their condemnation of commissioner practices. However, these latter officials were skeptical of any changes coming about in the system of planning and control of scarce finances. In the two cases where

action had been taken to bring about changes in construction programming practices whereby the impact of commissioner decisions had been eliminated or reduced to a minimum, it was the result of the initiative of highway career executives. They made their dissatisfactions heard and succeeded in attracting enough attention to bring about the institution of legislation to eliminate inefficient practices pertinent to financial planning and control.

In general, highway managers have the ability to assume responsibility for the fulfillment of highway organization objectives but with some qualifications. If legislation is enacted to limit or restrict the authority and thus the responsibility of the members of the board of commissioners, the functions of the board can be adequately performed by the type of personnel now being appointed to the positions. If the recommended legislation is not passed, then present methods of fund allocation will continue and highway objectives will not be achieved.

General

State legislators and highway officials do not think in terms of a coordinated county-state rural road system within a state. At present, very little cooperation exists between the two road authorities. Even though a substantial amount of funds are

being distributed to counties, little control is exercised over the disposition of these monies.

County commissioners possess complete authority in planning the county road systems for construction and maintenance. For instance, in the state of Wyoming there are twenty-three counties, each having its own road authority, facilities, equipment, and personnel. Much duplication of effort exists under the present setup, and county officials do not employ trained personnel to properly plan a highway system. It was readily admitted that county commissioners were often irrational in their decisions involving the use of highway construction funds. Furthermore, county road planning is done independently of that in bordering counties.

Many of the state highway officials interviewed expressed a complete lack of interest in integrating the two road systems. It would seem that many advantages could be derived from centralized planning and control utilizing the services of highly trained state highway engineers.

Most state highway officials are technically trained engineers with excellent backgrounds in road construction and maintenance operations. However, few of them have been trained in management principles and practices. Many state highway

departments are sending their key personnel to management development conferences which have provided the participants with a better insight into management procedures. A one-week conference, however, is not sufficient. What is needed is a continuing program where every facet of management practice and procedure is made a part of the schedule. Organizational objectives, policies, and systems should be discussed, criticized, and understood by all highway personnel. Pride of achievement in any organization can be accomplished only when the objectives are known and understood by all personnel.

The reports distributed by many highway departments do not reveal the actual practices used in planning and controlling construction outlays. The interested person has no way of knowing the manner in which funds are distributed among the districts or the procedures used in scheduling construction projects. Even though reports may indicate an annual improvement (increase) in the average sufficiency rating for each of the highway systems, this in itself may be misleading. It does not matter where construction funds are expended—the result will generally be to raise the sufficiency rating of the improved road and, hence, the average for that road system. This type of practice and reporting does not indicate to the layman whether the funds were used

to the best advantage. When roads having less than highest priority are given a place in the annual construction budget because they are "pet" projects of a commissioner, it will still result in raising the average rating of highways, but it certainly does not represent good financial planning and control of construction funds. Yet, this primacy of raising the average rating of state highway systems—no matter where construction funds are expended—seems to prevail in highway management thought. This objective has merit, but only when construction funds are expended on high-priority roads and scheduling by personal judgment and political pressures are eliminated.

At present many highway officials cannot afford to have published reports reveal the manner in which construction projects are scheduled in the annual budget. There is absolutely no justification for their decisions involving the expenditure of a substantial amount of the construction funds. Highway officials are neither meeting nor fulfilling their responsibilities to the public.

Highway Management Malpractices

When huge sums of money are involved with little or no control exercised over their use, undoubtedly fraudulent practices

will come to light. Although it was not one of the objectives of this dissertation to uncover evidences of fraud, certain federal investigations have revealed malpractices in highway finance. Through what seems to be collusion with highway officials, private contractors are defrauding the public of millions of dollars. These practices do not seem to be general at present, but are centered in a few states. Currently, one of the survey states —New Mexico—is under investigation.[1]

The malpractices have taken several forms. First, there are those cases where the evidence would indicate outright fraudulent practices. For example, on a thirteen-mile, eight-million-dollar bypass at Tulsa, Oklahoma, a grand jury and Congressional investigation have recently found evidence that one contractor, with the knowledge and assistance of state highway officials and inspectors, used substandard materials, falsified delivery weights, padded bills, and utilized other questionable practices which resulted in overpayments estimated at $524,000.[2] In addition, the road was cracking up after two years of use.

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[1] "House to Push Probe of New Mexico Roads," Denver Post, June 16, 1961, p. 19.

[2] Karl Detzer, "Our Great Big Highway Bungle," Reader's Digest, LXXVII, No. 459 (June, 1960), 50.

Another case involved a member of the State Road Board in Florida who admittedly was an unnamed member of a group that bought a tract of land in St. Petersburg for $165,000 and later resold it to the state highway department for $240,000; the board member's fee was $24,000.[1]

Second, there are cases where management decisions would seem to border on the edge of fraud but are more indicative of a complete disregard for any responsibility to the public. The following is an example of this type of managerial malpractice:

> Federal policy requires that land must be appraised before it can be purchased by the state. But many parcels of land have been bought first and appraised later. In Nevada alone, the Comptroller General's Office found what it chose to call "deficiencies" in the purchase of 29 out of 40 pieces of land. Typical was "Parcel No. 3, Project IN-001-I (14). This property was bought on April 26, 1957 for $42,000. On that same day appraisers employed by the state listed the value of the parcel at only $22,000.[2]

Mr. Meisler answers the question as to how corrupt the interstate program is:

> A veteran newsman has said that if an editor sent six reporters around the country digging up information, he would put half the country's state highway officials in jail. The statement is no doubt somewhat exaggerated. But Blatnik's

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[1]Stanley Meisler, "Super-Graft on Superhighways," Nation, CXCII, No. 13 (April 1, 1961), 278.

[2]Detzer, Reader's Digest, LXXVII, No. 459, 49.

> subcommittee, in one of the fairest and most painstaking investigations in recent years, has quietly uncovered a depressing panorama of bumbling federal bureaucrats, bribe-taking highway engineers, chiseling contractors, fat-cat state commissioners and cracking roads in the federal superhighway system.[1]

It is the unethical practices of a few unscrupulous highway officials that create a stigma that conscientious highway managers will have to labor under for years. These current malpractices should make highway officials more conscientious in fulfilling their responsibilities to the public.

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[1]Meisler, Nation, CXCII, No. 13, 276.

CHAPTER XII

SUMMARY, RECOMMENDATIONS, AND CONCLUSIONS

Summary

This has been a study of financial planning and control in state highway departments. More specifically, it has been concerned with the financial features as they pertain to construction expenditures. The revenue problems in highway finance were given a cursory analysis to provide the reader with a background to permit an evaluation of the over-all picture.

A survey was conducted to determine: (1) the practices and procedures utilized by highway officials in allocating scarce construction funds over the various highway systems, (2) the use being made of the sufficiency rating procedure in scheduling construction budgets, and (3) the methods used in other areas of financial planning and control of construction expenditures. It was shown that the survey does not in any way represent conditions existing in state highway departments that were not included

in the survey. In other words, the survey does not possess the necessary statistical accuracy to permit the use of generalizations concerning practices in other nonsurvey states. However, the findings of the survey are representative of the practices and procedures employed by highway officials in the ten states included in the study. Although it was originally intended to determine the practices of financial planning and control as they pertain to construction programming, the study revealed other facets of managerial inefficiency in highway administration.

Lack of coordination in state and county road planning

It was shown that at least three highway authorities exist within states: counties, urban areas, and state highway departments. In some states the counties may be divided into several units, each with its own highway department. In any event the urban areas, each of the counties, and the state maintained their own highway departments. There seemed to be a lack of cooperation and coordination between the three highway authorities, and much duplication of effort was evident. It was explained that little could be done about integrating urban roads and streets—due to their local nature—into the state systems with the exception of those urban roads and streets already part of the state

systems. However, the possibility that the rural highways of the counties and the state could be combined to the advantage of both political units was discussed.

Each year huge sums of highway user revenue are distributed to counties for highway purposes, and little or no control is exercised over their use. The types and amounts of funds allocated to counties and other political units are generally determined by state legislatures.

It was shown that county road authorities frequently did not possess the personal qualifications—nor did they hire trained personnel—to properly plan county road systems. Decisions pertinent to road location and construction standards and design often were based on considerations other than good road engineering practices. In many cases county road systems were in very poor condition and definitely out of balance due to poor road planning procedures, or an inequitable basis for distributing highway revenues. The important factor in the county-state relationship is the lack of coordination between the two highway authorities. County officials construct their roads for local use and little consideration is given to the place of county roads in the over-all state rural road system.

Allocation of the construction fund by districts

It was shown that the first distribution of the construction fund was among districts, commissioner or otherwise. Once the highway fund had been segregated by highway functions (maintenance, administration, other services, and construction), the amounts designated for construction were divided by the commissioners for use in their represented districts. This allocation was performed in two ways: (1) by formula, such as an equal distribution or according to population, road mileage, terrain, or some other factor within the district; or (2) the distribution of the construction fund was made by commissioner agreement whereby the commissioners by argument and compromise determined what amounts each district would receive.

It was pointed out that a distribution of the construction fund by any type of district boundary could not result in the most efficient use of highway user revenue. Such methods of allocating funds have positively no relationship to construction needs within a state. It infers that the needs within the various districts are equal or proportional, when in fact they are not. This practice is indicative of the custom and tradition that exists

in state highway departments. Of the ten survey states, only two did not follow this procedure.

It was shown that this practice can result in a lack of balance in highway systems. In most of the states the commissioners gave very little consideration to actual construction needs throughout the state when dividing the fund among districts. Such rather dubious processes as voting blocs, concessions and compromise, and other irrational procedures were used as the basis for distributing the construction fund. It was pointed out that such decisions were anything but efficient and had little relevance to actual construction needs.

Scheduling construction projects in the annual construction budget

The dissertation was primarily concerned with the manner in which construction projects, and hence expenditures, were scheduled in the annual budget. Considering state and federal matching monies, the greatest amount of highway revenues is expended on construction. Currently, high priority is being given to the completion of the interstate system. Although the major cost (90 percent or more) of this expensive system is being underwritten by the federal government from highway user revenue, the states still expend a substantial amount of their

own funds on these highways. With such great effort being directed toward the completion of the interstate system, the possibility exists that other state highway systems may receive less consideration pertinent to funds and effort. In the light of current and future highway standards and designs, much of the road mileage of the primary, secondary, and urban extension systems is in need of construction and reconstruction. With limited funds and great needs, extreme care must be exercised in directing the flow of monies into the state systems.

It was shown that a philosophy prevailed in highway practice today which would seem to serve as a rationalization for inefficiency in annual construction programming. This concept asserts that it does not matter where a dollar is spent on construction because the road systems are in such poor condition that the expenditure can only result in an improvement in highway conditions and an increase in the average sufficiency rating for the state system concerned. In other words, it does not matter which highway is scheduled for construction or reconstruction as long as the general condition of the road system is improved. Pursuing this philosophy, it would make very little difference which road sections were scheduled for construction as long as they were in need of improvement. It was shown that

methods and procedures utilized by highway officials in scheduling the annual construction budget adhered to this philosophy. Possessing the necessary authority, highway commissioners or other highway officials who received this delegation scheduled a substantial portion of the construction budget on the basis of personal judgment, which was often influenced by the pressures of political or nonpolitical groups. Even though many of these responsible officials had received priority lists indicating the roads having greatest need for improvement, these lists were relegated to a subordinate position in the construction programming process.

It was pointed out that such practices were not conducive to the maximum utilization of the taxpayers' funds. Short-run objectives were not being accomplished because the best highway system could not be provided when such procedures were utilized in preparing the construction budget. Long-term objectives would either be prolonged or not accomplished at all. The mere fact that a lag has always existed between road standards and use would seem to indicate that such procedures never were successful in planning a highway system.

Long-term planning

It was shown that state highway officials do very little long-range planning of highway needs. Plans very seldom exceed five years, and two to three years seemed to be the average for planning highway construction needs. Lack of long-term planning often was attributed to the inability to predict changes in road standards and design, road usage, and similar types of problems. It is questionable whether such pretexts have any degree of validity. The private profit-making concern faces problems of a similar nature, and such firms seem to derive some value in projecting plans into the long-range future.

Planning on a short-term basis would seem to indicate that state highway departments were devoid of long-range objectives. At present, with a substantial portion of road mileage below acceptable standards and funds limited to current revenue rates and sources, state highway officials who do not plan long-range highway construction and financial needs will never accomplish their objectives for they are not cognizant of what these objectives are. Planning on a short-run basis exclusively will result in a prolongation of the standards-use lag which has prevailed in the past and is accentuated in the present.

Public reporting

In the discussion of highway practices it was shown that highway departments were very lax in their reports on progress made to overcome highway deficiencies. In those cases where reports were rendered they were cursory in nature and often did not reveal the manner and procedures utilized in scheduling construction projects. More frequently they were devoted to an analysis of revenues and expenditures, occasional press releases pertinent to the letting of contracts, and similar types of information. In those cases where the reports used sufficiency ratings as a basis for expounding on the condition of the state highway systems, information was not revealed as to the process used in scheduling the past year's construction budget. In other words, the reports in no way provided an indication of the manner in which highway management was fulfilling its responsibility to the public.

Organization

It was shown that highway officials generally do not possess a necessary understanding of management principles and practices. They often do not make a full utilization of the most efficient methods available in planning and controlling construction

expenditures. Top-level officials often assumed the duties of highly qualified, specialized personnel in scheduling construction projects. Insufficient consideration was being given to the efforts of the staff departments that prepare the priority lists based on sufficiency ratings.

Although serious deficiencies existed in many aspects of the highway organization, only those features that relate to financial planning and control were stressed. However, other organizational problems were related during the discussion.

Recommendations

One of the major objectives of this dissertation was to make recommendations relevant to financial planning and control of construction expenditures. In this respect, the suggested recommendations will result in an improvement in current practices now being utilized by highway management. The suggestions are offered to provide highway officials with the means of fulfilling their responsibilities to the public which many of them are not achieving at the present.

Greater state and county rural road coordination

Recommendations were made involving two possible alternatives as a solution to the lack of coordination between state and county road authorities. It should be brought to the attention of the reader again that very substantial amounts of highway funds are prorated to county road officials with very little or no control exerted over their use.

The first alternative recommended that the entire county road systems be placed under the control of the state highway department. Two advantages could be derived from this action. First, control would be acquired over the funds being allocated for the construction of the county roads. The funds would be prorated according to highway needs as determined by sufficiency ratings. Second, the county roads would be integrated into the state rural road systems. Highly trained highway experts would be able to incorporate both systems into a coordinated whole for the purpose of planning and control.

The second alternative involved the creation of a county primary road system composed of the most important county roads. The specific road mileage would be determined by state and county officials and the mileage would be frozen by the state

legislature. All or a substantial part of the county allocation of highway user revenues would be devoted to the construction of this system. Construction and maintenance costs of county roads not a part of the primary system would be the financial responsibility of the counties.

If one does not presently exist, state highway officials should create a special department for county road planning and control. Standards and designs should be prepared for the county primary system for the purpose of determining sufficiency ratings and priority lists for construction scheduling. All construction expenditures should be made on the basis of priority lists determined by experienced state highway personnel. In certain respects, the relationship between county and state authorities would be similar to that now existing between states and the federal government.

Elimination of district boundaries in allocating construction funds

State law has created a situation that should be corrected by legislative amendment. It established districts (commissioner, construction, financial, et cetera) among which construction funds were to be prorated. Generally, commissioners are appointed to represent these districts, and naturally they are concerned with

having as large an amount of funds funneled into their represented districts as possible. As mentioned before, distribution of the construction fund by districts would seem to bear little relationship to state-wide allocation based on construction needs.

It was recommended that district boundaries be abolished as a basis for allocation of scarce construction funds. This would eliminate the current practice of distributing construction funds by commissioner argument, concession, and compromise. Construction funds would be distributed throughout the state by a more systematic process as explained in the following section of this chapter.

Priority listing as the basis for construction fund allocation

Not only are construction funds being distributed in a rather haphazard manner by districts, but the subsequent allocation to specific construction projects within the districts is based on practices that are anything but objective. To reduce the element of personal judgment predicated on political influence, it was recommended that a complete utilization of the sufficiency rating procedure be made to insure the accomplishment of short-run and long-run objectives.

The sufficiency rating procedure will result in an allocation of construction funds on the basis of needs and will reduce the judgment factor to a minimum. Briefly, the system is based on the application of point values to carefully established road standards and designs pertinent to various highway features such as structural adequacy, safety, service, and traffic volume. These standards are then compared to actual highway conditions by a field study. Generally, the rating for a highway perfect in every respect would be one hundred points, and highways not measuring up to acceptable standards would be assigned weights of less than one hundred points, depending upon the seriousness of their deficiencies. This procedure permits a comparison of road deficiencies of highways or highway segments throughout a specific system for the purpose of preparing construction priority lists. From the priority lists the annual construction budget can be prepared by scheduling, with a few exceptions, those roads having the lowest sufficienty ratings (highest priorities) for immediate construction or reconstruction.

Through the proper use of the sufficiency rating procedure, various reports, maps, charts, and tables can be prepared and used for planning and control. Progress in overcoming deficiencies in the various highway systems becomes evident. The system

can also be used to establish a long-range planning program by matching deficiencies against the estimated costs of bringing the various systems up to required standards. From sufficiency ratings, short- and long-range construction and financial objectives can be more easily determined.

Long-range planning

It was shown that state highway officials do very little construction and financial planning beyond a two- or three-year period. It was recommended that long-range plans be established to indicate highway construction and financial needs. By matching long-range construction costs against anticipated or proposed revenues, highway officials could put into motion plans that could result in achieving construction objectives. It was recommended that studies involving traffic surveys, and motor-vehicle use studies be undertaken on a continuing basis to support other short-run and long-run planning and control techniques. The use of road life studies, economic studies, and urban analyses were also recommended as excellent tools in establishing long-range plans.

Short-term planning is not sufficient in a situation in which construction needs are great and revenues are limited.

Planning on a two- or three-year basis when construction needs indicate a fifteen- to twenty-year program will only result in a prolongation of the road standard lag that has plagued state highway officials for years.

Legislation to enforce the recommended program

It was shown that custom and tradition are so firmly entrenched in state highway departments at top management levels that it would require state legislation to enforce the use of the methods recommended in this dissertation. It was suggested that legislation be enacted to acquire greater coordination between state and county officials. The legislation should provide for a greater degree of planning and control over the highway user funds distributed to county highway officials.

It was further recommended that state legislation be passed to abolish commissioner districts or other districts that currently serve as the basis for the initial distribution of construction funds. It was pointed out that this allocation is an unnecessary and harmful procedure.

Due to the inefficient manner in which annual construction projects are being scheduled in the construction budget, it was recommended that the use of sufficiency rating procedure be made

mandatory by the passage of state legislation. It was suggested that only by legislating the use of the sufficiency rating method would the short-run and long-range objectives of the state highway departments be achieved.

It was further recommended that legislation should require proper reporting to the public. Using the sufficiency rating procedure, progress in overcoming road deficiencies becomes evident. Proper reports would also serve the public in measuring the performance of highway management. Sufficiency rating reports would also serve as the basis for justifying the decisions of officials pertinent to construction projects. Scheduling construction projects by high priorities presents an objective basis upon which to justify decisions to pressure groups. The detrimental effects of political expediency and criticism will be eliminated through the use of the priority listing system.

Organization

Recommendations were also made suggesting changes in the organizational structure. An alternative was suggested whereby the commissioner body would be relieved of its authority and responsibility for highway operations by having them act in a staff capacity. It should be pointed out that this organization

change would also require legislation because it was through legislation that they were delegated their present authority in the first place. Their function would be to advise line officers in the performance of their duties. The planning department of the highway organization would be delegated the authority to schedule annual construction projects using the sufficiency rating procedure.

Public reporting

It was shown that many highway departments prepare inadequate reports to justify their actions. In many instances the only reports disseminated for public use generally contain irrelevant information and in no way indicate the manner in which highway management has dispatched its responsibilities.

It was recommended that highway officials should be required—by legislation, if necessary—to prepare an annual report for public dissemination that will completely set forth all the required information to evaluate their efficiency. The report should include: (1) an explanation of the sufficiency rating procedure; (2) a breakdown of revenue and expenditures for the year; (3) a complete description of projects undertaken during the year, including the sufficiency rating of the highway section, its cost,

location, and other pertinent information; (4) a summary of the condition of the state highway systems based on sufficiency ratings; and (5) a schedule of projects to be undertaken in the following year.

Copies of the report should be made available to the governor, other state and county officials, newspapers, radio stations, and other media of mass communications, and any other groups, individuals, or organizations that might have an interest in highways. Needless to say, the way to have highway managers recognize their responsibilities is to have their performance evaluated by the public. Efficient performance will be encouraged in financial planning and control of scarce construction funds.

Conclusions

Today, state highway departments are striving to overcome deficiencies existing in their highway systems. The effort is made more difficult by the emphasis being given to the completion of the interstate system, a substantial amount of deficient road mileage already existing in other highway systems, and a limited amount of revenues. Whether the current lag in highway standards relevant to use is the result of rapid technological advancements in automotive transportation, increased car

registrations, inability to construct or reconstruct highways during the war years, or the failure of highway officials to establish objectives and to plan for their accomplishment is not too important. It is the present and future condition of the highway systems and the manner in which they are planned, constructed, and maintained that is of significance. What is management currently doing to meet its responsibilities in providing an adequate highway system for the public? Is highway management furthering and encouraging progress by utilizing the most modern methods and procedures available in planning and controlling the expenditures of highway construction funds? Are highway objectives being achieved?

On the basis of this study, pessimistic answers must be formulated for the foregoing questions. Management practices in many state highway departments will not result in the most efficient use of the taxpayer's dollar. Unless there is a change in the philosophies of state legislators and highway administrators, short- and long-run objectives will never be achieved.

Highway officials—and they are not unique—must recognize their responsibilities to the public. The objectives of minority groups and the personal objectives of highway officials must be subordinated to those of the highway organization.

Perhaps the dissertation should not be concluded on such a pessimistic note. It is possible that there is a ray of hope. Within the last ten to twelve years two of the ten survey states have installed, in part, the procedures as recommended in this study. The procedures have been successful in both of the states. But, as was mentioned before, custom and tradition are powerful adversaries to overcome.

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APPENDIX A

QUESTIONNAIRE USED IN SURVEY

QUESTIONNAIRE

State_____ Date_____

Person Interviewed_____

Position in Organization_____

Duties in Organization_____

Part I. Top-Level Planning and Control

1. Does the state highway department have a long-range program for construction and reconstruction of the state highway systems?

   1.1. Yes_____

   1.2. No_____

   1.3. Other_____

   1.4. Comments:_____

2. How was the long-range program of construction and reconstruction determined?

   2.1. _____

3. What period does the long-range plan cover?

   3.1. _____

4. Is the long-range plan currently on schedule for the various highway systems?

   4.1. Interstate: Yes_____ No_____ Other_____

      4.11. If answer is no, why not? _____

      _____

      _____

   4.2. Federal-aid primary: Yes_____ No_____ Other_____

      4.21. If answer is no, why not? _____

      _____

      _____

   4.3. Federal-aid secondary: Yes_____ No_____

      Other_____

      4.31. If answer is no, why not? _____

      _____

      _____

   4.4. Urban and Rural: Yes_____ No_____ Other_____

      4.41. If answer is no, why not? _____

      _____

      _____

4.5. Comments: _____

_____

_____

5. Has the state highway department made provision for revenues necessary to finance the long-range construction, reconstruction, and maintenance of the highway systems?

5.1. Yes _____

No _____

Other _____

6. If the answer to the above question was "yes," how was the long-range program for financing determined?

_____

_____

_____

_____

7. Is the long-range program for financing construction, reconstruction, and maintenance currently on schedule for the various highway systems?

7.1. Interstate: Yes _____ No _____

Other _____

If answer is no, why not? _____

_____

_____

7.2. Federal-aid primary: Yes _____ No _____

Other_____

If answer is no, why not? _____

_____

_____

7.3. Federal-aid secondary: Yes_____ No_____

Other_____

If answer is no, why not? _____

_____

_____

7.4. Urban and rural: Yes_____ No_____

Other_____

If answer is no, why not? _____

_____

_____

7.5. Comments:_____

_____

_____

8. Were the recommendations of the finance study accepted by the commissioners, especially with respect to the total revenue needs?

8.1. Yes_____

8.2. No_____

8.3. Other_____

9. If the answer to the above question was "no" what were the major areas of nonacceptance by the commissioners?

_____

_____

10. Were the recommendations of the finance proposal accepted by the state legislature, especially with respect to the total revenue needs?

10.1. Yes_____

10.2. No_____

10.3. Other_____

_____

_____

11. If answer to above question was "no," what were the major areas of nonacceptance?

_____

_____

12. Were the recommendations of the finance study accepted by the Governor, especially with respect to the total revenue needs?

12.1. Yes_____

12.2. No_____

12.3. Other_____

_____

_____

13. If answer to above question was "no," what were the major areas of nonacceptance?

_____

_____

14. How does the highway department measure the adequacy of the existing sections of the systems?

_____

_____

15. How is the information on miles and cost to overcome deficiencies summarized?

_____

_____

16. Have you some system to measure the obsolescence of the sections of your highway system? If yes, how does the system work?

16.1. Yes_____

16.2. No_____

16.3. If yes, how does it work? _____

_____

16.4. Comments:_____

_____

17. What provisions do you have in your organization to forecast your needs 10 to 20 years in the future?

_____

_____

18. If answer to preceding question indicates that they have made provisions for forecasting future needs, then ask: What provision is made for periodic review and revision of the plan?

_____

_____

19. How is the cost for modernizing the state highway systems related to the revenue from existing sources?

_____

_____

20. How is the plan used to guide annual construction and reconstruction scheduling?

_____

_____

21. How far in advance is the annual construction schedule prepared for highway department guidance in organizing, surveys, designs, right-of-way acquisition, etc.?

21.1. Surveys: _____

21.2. Designs: _____

21.3. Right-of-way acquisition: _____

21.4. Other: _____

21.5. Comments: _____

_____

_____

22. What is done in the highway department to report progress to:

22.1. The Governor and the legislature?_____

_____

22.2. The Board of Commissioners?_____

_____

22.3. The Director?_____

_____

22.4. Comments:_____

_____

23. Does the state highway department establish performance standards for maintenance on the state highway systems? If so, how are they established?

23.1. Yes_____

23.2. No_____

23.3. How are they established? _____

_____

_____

23.4. Who establishes them? _____

23.5. Comments:_____

_____

24. How, and to what extent, are maintenance projects let to contract?

_____

_____

25. How are funds for maintenance of the state highway department determined in the annual budget?

    25.1. How are the funds determined?_____

    _____

    25.2. Who determines the maintenance funds?_____

    _____

    25.3. Comments:_____

    _____

26. Are the commissioners appointed by the Governor, or are they elected?

    _____

27. Do they devote their full time to the highway department?

    27.1. Yes_____

    27.2. No_____

    27.3. Comments:_____

    _____

28. What, precisely, are the duties and responsibilities?

    _____

    _____

29. Does the board of commissioners determine what construction and reconstruction needs are most important in the highway systems?

    29.1. Yes_____

    29.2. No_____

29.3. Comments: _____

_____

30. In the final analysis, who makes the final decisions as to what roads, or road sections, will be constructed or reconstructed in the state highway systems?

_____

31. What are the bases for the decisions made in the question above?

_____

_____

_____

32. To what extent does your top-management personnel (chief engineer, maintenance engineer, planning and research engineer) have a part in the final determination of what road or road sections shall be improved or constructed? In other words, what authority do they have in making the final decision as to highway expenditures in the state systems?

_____

_____

_____

33. In making final decisions on determining what roads, or highway sections, shall be constructed or reconstructed, what reports do you receive, or give, that assist you, or others, in making these final decisions?

33.1. _____

33.2. _____

33.3. _____

33.4. _____

33.5. _____

33.6. Comments: _____

_____

34. Do you feel that a better system of reporting needs could be devised to assist you, or others, in making the decisions as to the allocation of funds to the road sections?

34.1. Yes _____

34.2. No _____

34.3. Comments: _____

_____

35. What are the weaknesses in your present system of needs reporting? How could it be improved?

_____

_____

Part II. Reporting

36. Does the highway department have a procedure for reporting its progress to the public?

36.1. Yes _____

36.2. No _____

36.3. Other _____

36.4. Comments: _____

_____

37. If answer to above question is "yes," what is the procedure for reporting to the public?

_____

_____

38. If the state highway does report to the public, do you think it is a worthwhile procedure? Why or why not?

38.1. Yes_____

38.2. No_____

38.3. Why or why not? _____

_____

Part III. Political Pressure and Management Organization

39. Do you know of instances, in your state, where pressure has been applied by state legislators, or others, to expend funds in certain districts of the state?

39.1. Yes_____

39.2. No_____

39.3. What groups or persons apply such pressure? _____

_____

39.4. Comments:_____

_____

40. If answer to above question is "yes," is such pressure generally successful?

_____

41. How is this pressure generally applied?

_____

_____

42. If pressure is exerted which affects the flow of highway expenditures, what percentage, on the average, of the annual budget appropriation is affected?

_____

_____

43. Do you have civil service in the highway department? To what extent?

43.1. Yes_____

43.2. No_____

43.3. To what extent? _____

_____

44. Do changes in the state political administration bring about changes in top-level management in the state highway department?

44.1. In the board of commissioners? _____

44.2. In the Director's position? _____

44.3. In the State Highway Engineer's position? _____

44.4. Other top-level positions in management? _____

44.5. District Engineers? _____

44.6. District Maintenance Engineers? _____

44.7. Other positions? _____

44.8. Comments: _____

45. Do you have a management replacement training program in operation?

45.1. Yes _____

45.2. No _____

45.3. Comments: _____

46. Within the state highway department alone, do you have a planning committee composed of top-level management? If so, what departments are included?

46.1. Yes _____

46.2. No _____

46.3. Departments involved:

_____

_____

_____

47. Do you feel that adequate lines of communication have been established from top to the bottom in the organization? If not, why not?

47.1. Yes _____

47.2. No _____

47.3. If not, why not? _____

_____

48. Do you feel that adequate lines of communication exist horizontally between departments in the organization? If not, why not?

48.1. Yes_____

48.2. No_____

48.3. If not, why not?_____

_____

49. In what areas do you think that your lines of communication could stand improvement?

_____

_____

50. Do you think that the organization as a whole is designed to give the greatest efficiency and ease of operation?

50.1. Yes_____

50.2. No_____

50.3. Comments:_____

_____

51. If answer to above question was "no," what do you think could be done to improve the organizational structure to give it greater efficiency?

_____

_____

Part IV. Planning and Control Techniques

52. Do you maintain an inventory of condition of your entire highway system?

52.1. Federal-aid primary: Yes_____ No_____ Other_____

52.2. Federal-aid secondary: Yes_____ No_____ Other_____

52.3. County roads: Yes_____ No_____ Other_____

52.4. Urban: Yes_____ No_____ Other_____

52.5. Other: Yes_____ No_____ Other_____

52.6. Comments:_____

53. What use is made of the inventory?

_____

_____

54. How is the inventory taken? Personnel and procedure?

54.1. Personnel:_____

_____

54.2. Procedure:_____

_____

55. Is the highway inventory used in any way to plan state highway expenditures?

_____

_____

56. Do you prepare sufficiency ratings on your highway systems?

56.1. Interstate: Yes_____ No_____ Other_____

56.2. Federal-aid primary: Yes_____ No_____ Other_____

56.3. Federal-aid secondary: Yes_____ No_____ Other_____

56.4. County roads: Yes_____ No_____ Other_____

56.5. Urban: Yes_____ No_____ Other_____

56.6. Comments:_____

57. How are the sufficiency ratings determined? Personnel and procedure?

57.1. Personnel:_____

57.2. Procedure:_____

58. For what purpose are sufficiency ratings prepared?

_____

59. Are sufficiency ratings used in any way to plan annual highway expenditures?

_____

60. How frequently are sufficiency ratings prepared, or revised?

_____

61. Do you have a system, method, or procedure to determine the priority of fund allocation for construction, or reconstruction, within one highway system, such as the federal-aid primary? And how does it work?

61.1. Yes_____

61.2. No_____

61.3. How does it work? _____

_____

62. If answer to above question is "no," how would you determine whether to construct or reconstruct a ten-mile segment of one state primary road in preference to a ten-mile segment of another state primary road?

_____

63. If a priority system of some sort is used in allocating funds, what factors may cause you to deviate from your system of planning construction expenditures?

63.1. _____

63.2. _____

63.3. _____

63.4. _____

Part V. Short-Run Budgetary Procedure

64. What is the procedure for preparing the annual budget?

_____

_____

65. In your review of the proposed budgets of the various functions, how do you determine, or verify, the needs of the district maintenance engineers for funds to maintain the state systems?

_____

66. In requesting funds for the maintenance of state highways do the maintenance engineers send you a list of maintenance projects and the cost breakdown for the maintenance work?

66.1. Yes_____

66.2. No_____

66.3. Other_____

67. Do they send in information justifying the maintenance of various projects? And if so, in what form?

67.1. Yes_____

67.2. No_____

67.3. In what form? _____

68. Does the state legislature ever appropriate funds to the state highway department? Under what conditions would they do so?

68.1. Yes_____

68.2. No_____

68.3. Under what conditions:_____

69. Are deviations from the annual budget common?

69.1. Yes_____

69.2. No_____

69.3. Other_____

70. If budget deviations are common, are they reported immediately?

70.1. Yes_____

70.2. No_____

70.3. Other_____

71. What are the most frequent causes of budget deviations?

71.1. _____

71.2. _____

72. What budget reports are prepared and when?

72.1. _____

72.2. _____

72.3. _____

73. Do you feel that maximum utilization of the budget as a tool for planning and control is being made, and if not, why not?

73.1. Yes_____

73.2. No_____

73.3. Why not? _____

73.4. Comments:_____

74. How are funds for construction and reconstruction written into the budget?

_____

_____

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