

Annual Inventories and Priorities for the Highway Program

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It should be apparent that the conventional approach to our highway problem has not provided an effective solution. We can find lots of reasons for our highway situation—rising prices, increasing numbers of vehicles, curtailment of work during World War II, diversion of highway funds, etc.—but we find no consistent and effective answer in the current approach to the highway problem.

In many states, the engineers have developed fine comprehensive programs, aimed at modernization of the entire road and street system. These have met with a variety of dispositions. In some cases, they have been largely ignored. In others, they have been used as justification for increasing highway taxes, but without provision for revenue distribution to effect the needed highway improvements. Even under the best circumstances, where conscientious effort was made to finance a comprehensive program, we have found the program ineffective because of inflation and increasing traffic demands.

It is apparent that we need a new approach, one that will overcome the difficulties we have been experiencing. It must be clear-cut and widely understood to assure that legislative actions will fulfill the needs of the program. It must be an approach which has both flexibility and continuity. Only thus, can there be recognition of changing prices and growing or shifting traffic, as well as a consistent year-to-year scheduling of work aimed at an overall integrated highway plan.

In the present period, when we find great emphasis being placed on getting a businesslike approach to government, it may be that we can see ways for bringing business practices to give an effective solution to the highway problem. Certainly, many, if not all, of the difficulties we have been experiencing in dealing with the highway situation, exist in one form or another in business. Stockholders must be informed in simple, convincing reports. Inventories of goods must be maintained. Expansion of the plant must be directed towards getting first things first, and of fitting this year's work to a long-range

plan of development. Flexibility and reappraisal, regularly, are essential in business, just as they are in the highway problem.

AN ANNUAL INVENTORY

Inventorying is a regular and an essential business practice. It is an activity which needs to be incorporated in the solution to our highway problem. We need to know how our road and street system stacks up against the job it has to do.

Most states have at one time or another made comprehensive inventories which evaluate and record the characteristics and condition of each road section, as well as the traffic served. But, only to a limited degree have steps been taken to establish the operation as a regular highway department function. And, it is only when inventories are made periodically that they serve their purpose fully. Then, there is obtained, not only an evaluation of the road system, but also, a determination of the trend in its condition or adequacy. Each year, it can be seen whether progress has been made in the development of adequate roads. Each year, it is made clear just what effect traffic increases or cost trends are having on the program.

In the past, one of the deterrents to the year to year inventorying of our highways and streets has been the lack of accepted standards of evaluation which could be applied uniformly throughout the road system, and readily maintained from year to year. Such inventories as were made, were generally on a "one-shot" basis. They were good when made, but quickly became outdated and ineffective in reflecting the status of the road systems. However, in recent years, highway organizations have developed methods of rating the sections of highways and streets in a way that lends itself admirably to the inventorying process. The method has evolved out of the so-called "sufficiency rating" of highways. Because of its importance to the inventorying process and because it is the key also to other aspects of getting business practices into the government function of building and maintaining highways, I shall describe the sufficiency ratings in some detail.

SUFFICIENCY RATINGS

The theory of sufficiency ratings is extremely simple. A completely adequate section of highway rates 100. All road sections that have deficiencies of any kind in their structural make-up, their effectiveness in serving traffic, or their safety, are marked down from 100, according to formulae and procedures. The lower the rating, the poorer the road is.

Sufficiency ratings are reviewed each year to take account of the various changes in traffic and road conditions.

In the mechanics of establishing sufficiency ratings, various elements are evaluated to get a measure of condition, safety and service. These elements are then combined to give the overall rating. Arizona, as an example, assigns par weightings to different elements as follows:

Structural adequacy	17
Estimated life	13
Maintenance economy	5
CONDITION	35
Roadway width	8
Surface width	7
Safe stopping sight distance	10
Consistency	5
SAFETY	30
Alignment	12
Passing opportunity	8
Surface width	5
Sway	5
Roughness	5
SERVICE	35
GRAND TOTAL	100

There are variations between the procedures used in different states for making the sufficiency ratings. This is to be expected. The importance of different major factors—condition, safety and service, as well as the individual elements such as width, curvature, etc.—may change from state to state and likely will vary from primary to secondary to tertiary systems within a state, and between urban and rural systems. Basically, the approach is the same, however. It is aimed at determining how and to what degree the individual existing road and street sections stack up in comparison with completely adequate facilities.

The establishment of sufficiency ratings requires a combination of office and field evaluations. Office records provide information on traffic and widths and ages of surfaces, as well as roadway width, curvature and gradient. In some organizations, there is also good and significant record data on accidents and maintenance cost. These data provide a basis for much of the evaluation of a road section in relation to the characteristics of a completely adequate facility. How-

ever, a field survey is required properly to appraise the structural condition and to make additional evaluations which cannot be effected from record data. Various means have been used in different states to reduce as far as possible the influence of personal judgment and to assure uniformity where application of such judgment is necessary. Obviously, the operation must be directed toward getting an unbiased evaluation throughout the road system.

It is the practice, after the sufficiency ratings have been determined, to make what is called a traffic adjustment. This is done to give weight to the traffic importance of the road section. As the basic rating is made, low traffic volume roads are rated against standards appropriate for the traffic served and high traffic volume roads are rated against appropriate standards for them. The end rating is comparable—i.e., a 70 basic rating on a 100 vehicle-a-day road is just as good in its service for the 100 vehicles as a 70 rating road carrying 1,000 vehicles a day. However, it is obvious that the benefits associated with improvements of high traffic roads would be greater than for a similarly rated low traffic road. In recognition of this, a traffic adjustment factor is applied to the basic rating to get the final sufficiency rating. The adjusted or final rating provides values which can be set up in order of magnitude to reflect priority of need for improvement, recognizing that where traffic is greater, urgency for action is greater.

A great many states—29 as of July last year—have adopted sufficiency ratings. The situation in Illinois and Colorado is unique in that the legislatures have passed laws requiring that there be developed an annual list of proposed highway improvements in their relative order of urgency, and that the list be published. This requirement is met by using sufficiency ratings. The U. S. Bureau of Public Roads has established the sufficiency rating procedure as a part of their maintenance inspection of Federal-aid highways. It is understood that as a result, they now have ratings for all sections of the Federal-aid primary system. In addition to utilizing the sufficiency ratings as a part of the maintenance inspection reporting, the BPR has been supporting its requests for critical materials for highway work with the sufficiency rating of sections on which work is to be done.

When an entire road system has been rated, it is immediately evident which are the worst road sections. There is an indication, too, through the magnitude of the rating, of just how critical the inadequacy is on specific road sections. Interested individuals and groups, even though they have no familiarity with engineering, find

that sufficiency ratings provide a simple, readily understandable evaluation of the highway system. It shows them clearly where the critical highway needs are and the magnitude of the problem of correcting the deficiencies.

States which are making sufficiency ratings are in a position to develop annual inventories from these ratings. Arizona, where the procedure was developed, has done an extremely effective job of making annual inventories of the Federal-aid primary and secondary highway systems since 1947. The data are formed into a report each year and provide an excellent example of the value of such an inventory.

From each year's inventory, Arizona makes a listing of all sections of each road system in order from the lowest rating section. This, together with a map which symbolizes the ratings along every section of highway, shows clearly where the worst road sections are and how bad they are, in comparison with all other road sections. In addition, the annual Arizona report shows a comparison with the situation in previous years indicating the degree to which progress is being made in improvement of the system. The miles of highway below critical sufficiency rating values (50 and 60) are reported for each year. The situation for the Federal-aid primary system below 60 points, was shown, as follows, in 1952:

<i>As of Jan. 1</i>	<i>Mileage at or below 60 points</i>
1947	650
1948	564
1949	601
1950	538
1951	479
1952	448

Another state which gives promise of developing an excellent continuing inventory is Colorado. In its report of 1952, they initiated a tabulation which illustrates the great potential value of these inventories in presenting the highway situation in most significant form—*dollars*. For both the Federal-aid primary and secondary systems, tabulations are made to show the mileage of road sections in each system, which are in critical sufficiency rating groups (35-39; 40-44; etc.), and the cost of making the necessary road improvements. The following is the table for the Primary system:

<i>Net Rating Group</i>	<i>No. of Miles</i>	<i>Cumu- lative Miles</i>	<i>Needs Cost for Group</i>	<i>Cumulative Needs Cost</i>
Proj.	21.3	21.3	\$3,980,220	\$3,980,220
35-39	8.3	29.6	1,846,085	5,826,305
40-44	51.6	81.2	7,535,906	13,362,211
45-49	70.7	151.9	11,002,480	24,364,691
50-54	95.1	247.0	12,438,026	36,802,717
55-59	108.9	355.9	12,517,808	49,320,525
60-64	355.4	711.3	39,158,265	88,478,790
65-69	444.4	1,155.7	33,284,652	121,763,442
Total	1,155.7		\$121,763,442	

When this sort of a tabulation is brought up-to-date each year, it will show not only the status of the system mileage-wise, but also what the cost requirement for modernization is.

PRIORITY PROGRAMS

Business must have its program for plant improvement or expansion set up to take care of first-things-first, but at the same time, geared to an overall long-range program. That is essential in good highway practice, too, and, in one way or another, what highway administrators have been shooting for over the years.

It became apparent as soon as the job of building America's highways was getting started, that there was a need for giving priority for improvement. The first state-aid to local governments in some states and the first Federal-aid to state governments in 1916, did not impose requirements as to routes on which the funds were to be expended. As a result, the first projects were not laid out so as to lead to a continuous route improvement, even from community to community within the states. There was a need then for giving priority to certain routes. Recognition of this was not long in developing, and provision made by legislation that the funds be spent on a specific, designated, interconnected system of roads. The system designation established a priority in that funds were directed toward improving the system as an integrated unit.

The system designations gave a general priority to selected routes, even though they did not give a specific project priority. Further refinement of this approach (usually an undesirable one) has been

effected by state legislatures when they have enacted laws directing the improvement of specific projects or routes presently in a system or to be added to a system. This process of getting priority has generally not been good because it discourages an objective engineering approach to the development of the highway system, and encourages programming by pressure rather than by plan. It represents one of the strongest arguments for a sound priority programming procedure, accepted and supported by the public. With a sound, well-established procedure the legislature is not so likely to go long with bills for special projects.

A variety of procedures have been used by highway officials to establish priorities for highway programs. But, only with the development and use of sufficiency ratings, has it been possible to set up priorities on a first-things-first basis that the public, highway users and the legislature can understand. The ratings show in a single numerical value the degree of adequacy of each road section and permit ready relationship of the need for improvement on any section to the need of all others.

It might be assumed that the answer to all our programming problems is provided with the development of sufficiency ratings—that programs can be prepared simply by taking the funds available for each road system (primary, secondary, tertiary and urban) and going down the list of road sections from the poorest, to the next poorest, etc., as far as the funds will go. However, there are considerations which will not permit going right down the list, project by project.

In the first place, it will be found that certain projects must go ahead, regardless of the rating of the road section, in order to make previously initiated work fully effective. These may be elements in stage construction or essential highway connectors.

In addition, it will be found that emergency or near-emergency conditions will necessitate inclusion of highway and bridge projects in the program, regardless of where they stand in an over-all sufficiency rating appraisal. A bridge failure, or a bridge in imminent danger of failure, must be scheduled for replacement if it cannot be restored properly by maintenance operations. Likewise, when a road surface reaches a state of structural deterioration such that it cannot be effectively maintained, replacement or reconstruction must be scheduled regardless of the total rating of the road section.

It can be seen from the foregoing that the establishment of the annual highway improvement program must take account of a number of demands before programming on a priority list basis can be started. However, when commitments of funds have been made for emergency jobs, etc., the balance of the programming can be done using the

listings as a guide to assure as nearly as possible, the taking care of the worst road sections first. In this process, there cannot be a strict following of the listing, but there should be a selection such that work is concentrated on road sections which rate poorly. The reasons that the list cannot be followed rigidly, include:

1. The cost of improvement is not reflected in the sufficiency rating. Budgetary limitations may force postponement of a job. Or, the economics of the situation may be such that several less costly improvements for the same money, will do more to bring up the overall level of adequacy of the road system.
2. Distribution of work throughout the state may be necessary. Engineering forces should be set up to meet the needs in different areas of the state over a period of years. It is not practical to make major shifts from year to year to assure a strict section by section following of a state-wide sufficiency rating list.
3. Right of way problems, design difficulties or other procedural problems may necessitate passing over certain road sections.

It should not be concluded from the foregoing that there are so many exceptions as to make the use of the rating lists ineffective. The case of Arizona is a good illustration of this. It is reported by State highway officials that over 80 percent of the work programmed, since the adoption of the sufficiency rating procedure, has been directed toward road sections rating less than 60. Furthermore, the balance of the program was not indiscriminately set up, but, to a large extent, in accordance with established policy, involved the bituminous surfacing of previously unstabilized state highway surfaces.

This discussion of priorities has been based on the development and use of sufficiency ratings. It has proven to be a practical approach to the evaluation of the road systems under jurisdiction of state highway departments. Representatives of a number of counties have expressed a strong interest in establishing sufficiency ratings for county road systems, but, to date, I know of none in which it is being done. It is apparent that the large road mileages under county administration make the sufficiency rating job one of considerable magnitude, particularly in view of the limited technical personnel available. Possibly, if the way could be found to do the initial job, many counties could handle the annual revision which would not be too difficult once the first inventory were made, forms were set up, and a routine established. I am hopeful something will develop along this line, possibly with state cooperation.

In the meantime, the show must go on, and priorities are being set for county highway improvement programs. In at least one instance,

a simple rating scheme has been developed to provide an acceptable guide. It is a code system which fixes improvement priorities in Harford County, Maryland, and is described in some detail in the February issue of *Better Roads*. It's a simple, straightforward, factual approach that seems to do the job in that county. Possibly other counties will find the Harford system adaptable to their problems, with or without modifications. Harford County has 320 miles of so-called "unimproved road" which are fairly uniform in their structural characteristics. The County has funds to improve about 16 miles a year and the question is, "which 16 miles shall it be?"

To determine which of the road sections should receive first attention, the Harford County approach takes five factors into account. A residential factor allows 1 point for 5 residences or less along a stretch of roadway, to 5 points for 21 residences or more. One point is allowed for up to 50 vehicles using the road per day to 5 points for 201 vehicles or more. One point is allowed if the road is a connecting link between two hard-surfaced highways, and 1 point is given if the road is a proposed school bus route. If the road is approved for Federal-aid 2 points are allowed; if it may be approved for Federal-aid in the future, an allowance of 1 point is made.

The higher the final code ratings, the more urgent is the need for improvement.

One Harford County gravel road will be improved with a bituminous macadam surface in 1953 because its Code Rating is high—7. A breakdown of the factors and point scores follows:

11 residences	3 points
69 vehicles a day	2 "
No connecting link	0
No school bus route	0
Federal-aid secondary route	2 points
Final classification	7 points

Another road falls in a much lower code classification—rating 2. Based upon its rating this road is not included in the projected program for the next ten years. Factors establishing its relative priority were:

3 residences	1 point
20 vehicles a day	1 "
No connecting link	0
No school bus route	0
No Federal-aid secondary route	0
Final classification	2 points

The Code System was developed over a four-year period, and the statistical data used will be reviewed annually. The Harford County Highway Department has a budget of \$500,000 per year.

The press and general public of Maryland have praised the new system as one which provides a common sense approach to county road improvement and a system which gives priority to the road where immediate construction is most needed.

PROGRAM REPORTS

Most highway departments make annual or biennial reports, but they are not program reports. Probably in many cases, the reports are prepared and published to meet legislative or administrative requirements. In general, they are accounting, rather than program reports. They contain a mass of statistical data showing what monies have been spent, equipment purchased, and mileages of road types by counties or towns. They contain also, a description of the activities of the several divisions or bureaus of the highway department. Many of these reports are excellent for their purpose—an historical record of the department activities for a year or a biennium. But, they are not the kind of simple, easy-to-read report on the highway and street system that is needed to obtain and maintain an informed public.

It has been shown that we need an annual inventory of the highway system as a sound basis for a businesslike approach to highway planning and programming. But, so also, do we need a clear-cut, simple presentation of the inventory, so the public, highway users, and the legislators, can understand how the highway business stands. It needs to be made annually, so the interested individuals do not lose touch between reports, as might occur with more infrequent reporting. Annual reports are essential, too, so progress from year to year is consistently brought to the attention of everyone interested.

I call these annual reports, program reports, yet I have been talking about an inventory and laying stress on annual reporting of the inventory. I have done this, because I am convinced that the inventory is the basic essential to any good program for adequate roads. If we have a good inventory which reflects the condition and adequacy of all parts of the road system, we can be fairly confident that the annual programs will be well established and directed toward orderly development of the highway system, with proper attention to the most urgent needs. Particularly, will this be true if wide publicity is given to the annual inventory.

However, in the interests of presenting an effective picture of the highway system and its development, I suggest that the annual

program report include a listing of project accomplishments during the past year, and a listing of projects which will be undertaken in the next year. Every effort and all the ingenuity of the highway engineers should be directed toward making these listings as informative and effective as possible, illustrating what is being done, what criteria have determined the inclusion of projects and, as well, the conditions which make necessary the postponement of certain projects, even though the existing facility is critically deficient. Illustrations, particularly maps and charts, should be helpful in presenting the story in a manner that all can understand.

It is possible that in some states, it will be found necessary to get legislative authorization for annual program reporting. As previously indicated, Illinois and Colorado have a statutory requirement for a listing of the program in order of urgency. It is my thought that if such reporting is to be provided by statute, it be done in a general way. This would permit full play for new ideas and ingenuity in presentation.

The National Highway Users Conference has just announced a program of annual awards to highway departments to be given in recognition of meritorious reports on the status of road systems under their jurisdiction. It is anticipated that the awards will stimulate interest in reports both on the part of the general public and the highway departments. Public recognition will be given to the accomplishments of the highway departments in contributing to better administration and planning through the issuance of nontechnical easy-to-read reports. A number of highway departments are already doing excellent work along these lines. We are confident that others will be encouraged by the attention which will be focussed on reports by the NHUC awards.

In conclusion, it is my conviction that we can accomplish a great deal in improving our approach to the highway problem by adopting more generally, some business practices which are readily adaptable to highway planning and programming. First, let's get an annual inventory established for each of our road and street systems. Second, let's get a priority programming procedure that is simple yet effective. (Both of these goals are now readily accomplished with sufficiency ratings.) Third, let's get annual program reporting established as a regular and important highway department function. With these three business practices—inventory, priority programs, and program reports—we shall soon have the public informed about their highway and supporting and getting effective programs for adequate roads.