

Balancing of Physical and Economic Ratings With Other Considerations to Establish Project Priorities

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Balancing of a system of physical and economic ratings, such as sufficiency ratings, which may be expressed numerically with financial and other very important but in many instances controversial considerations, presents many difficulties. There are several factors which must be given consideration in the development of the over-all program for a given period whether it be for a year, biennium or decade.

Without endeavoring to indicate relative importance, the following are some of the factors which must be given consideration in developing construction priorities: availability of funds, distribution of funds by system or class of highway, statutory directives, financial requirements of activities other than highway construction, various programs within the over-all construction program, completion of usable segments and route improvements, ability to complete plans, ability to acquire necessary rights-of-way and coordination with community plans.

Sufficiency ratings, or other rating procedures, may be used to establish a relative need for improvement. If possible, such ratings should provide a statewide comparison. The analysis of these ratings would provide the administrator with a desirable basis for allocation of funds if other factors did not intervene. The physical ratings provide a guide which may be modified to develop a realistic program of construction. Subdivisions of the statewide ratings, either by systems or areas, provide guides in their respective fields for administrative decision along with financial, political and economic considerations.

AVAILABILITY OF FUNDS

Many governmental units, states, counties, cities and towns, have sources of funds specifically designated for highway purposes. In some areas, funds are provided by appropriation from total resources including general and highway users revenues. In other areas, there may be a combination of these sources.

It must be recognized that the establishment of priorities and the determination of funds for construction are, in many instances, interdependent. A system of priorities may be the basis for establishing the requested appropriation for highway construction. Conversely, the amount and manner in which funds are appropriated may affect the priority of construction.

For example, there are the procedures used in Connecticut to determine the amount available for appropriation for highway construction. By statute, certain revenues are made available to the highway commissioner for administration, maintenance and construction of highways within the state. These revenues are made available through legislative appropriation for various phases of the department's activities. Such appropriations are requested by the highway commissioner in his biennial budget. Within the limit of funds available, the commissioner must administer the activities of the department, adequately maintain the highway system, apportion funds to the 169 towns for maintenance and improvement of the network of highways maintained by the local governments, and maintain roads and drives under the jurisdiction of other state agencies. The available revenues, after allowance for the above-mentioned functions, are then appropriated for the "Construction and Reconstruction of Highways and Bridges". This amount is appropriated for construction projects, including engineering and

acquisition of rights-of-way as determined by the highway commissioner. The legislature usually does not appropriate for specific projects. Therefore, the commissioner has wide discretion in the selection of projects. Here then is the need for determining priorities of construction within the funds available.

STATUTORY DIRECTIVES

Perhaps the most commanding factor affecting priorities is that of statutory directive from the state legislature or assembly, depending upon the form of government. Such legislation may be mandatory or advisory that the indicated project be constructed in accordance with the statute. Many problems may arise from such legislative acts, either from the standpoint of location, traffic capacity, or other restrictive clauses which may not conform with the needs of the motorists nor be to the best advantage of the community or communities in the area of the project. Generally, it is better legislative procedure to have a project designated between or through one or more communities without defining the precise location, thereby allowing the planners and engineers to develop the location of greatest advantage to the one or more communities involved in the project by providing adequate traffic service and, at the same time, avoiding the disruption of the community, unnecessarily destroying taxable properties and disrupting or isolating segments of the community and also coordinating the project with the long range objectives of the community planners.

SYSTEMS PRIORITIES

The establishment of priorities by systems also presents a problem of prime consideration. Every state has its Federal-aid program. The distribution within each state of Federal-aid primary, secondary, urban and interstate apportionments together with the matching requirements and time limit on availability of Federal funds establishes a financial limitation on these portions of the over-all program.

Integration of projects on the Federal-aid systems and other classes of highways is also a prime consideration in order to provide a safe and economical transportation system.

If a large portion of the highway financing is undertaken on a 100 percent state basis this phase of establishing priorities is not of great importance. However, the program should assure that the state will be able to take advantage of any Federal apportionment available to it.

In other areas, the coordination of the Federal programs into the financial plan is dependent upon the classification of accounts or appropriation under which the funds are available for financing such projects. It is of interest that in some states specific amounts of money are appropriated for the construction of specific highway systems. There are generally the four categories of Federal aid available to the states plus the state monies which may be appropriated for highway construction purposes with or without regard to use of Federal aid and the accounts established under various bonding proposals. These latter monies may provide for the construction of special bridges, toll facilities or certain specific highway construction projects.

For example, in 1959, the Connecticut General Assembly authorized the sale of bonds to finance an accelerated program of construction on the Interstate and ABC systems provided the projects were eligible for Federal participation. This financial program revised radically the priorities of a great number of projects in the long-range program.

SUBSIDIARY PROGRAMS

There are also the subsidiary programs which must be developed and integrated into the annual construction program, such programs as bridge replacement, drainage betterments, minor sight line improvements and surface betterments. In addition to these programs, projects financed from special funds or accounts frequently require other construction to supplement and make more effective these special projects. Such additional projects invariably require adjustment of the priorities in the statewide construction program.

COORDINATION WITH ADJACENT STATES AND STATEWIDE DISTRIBUTION

Two other major considerations are the distribution of the highway construction program throughout the state and the coordination of proposed projects with contemplated improvements in adjoining states at their respective boundaries. It is recognized that people do not confine their trips to the relatively small area of the communities in which they live and work but have need for facilities throughout the state and the nation not only from the standpoint of personal transportation but from the standpoint of better transportation facilities for commerce and industry.

Projects distributed on a statewide basis may be scheduled to provide better transportation facilities between communities, to generate and to promote growth in areas of potential development, to distribute the work load of the highway department and that of the commercial producers and contractors located throughout the entire state. The distribution of the work load is desirable to maintain a uniform work force in the field or district offices.

URBAN ARTERIALS AND EXPRESSWAYS

The development of urban arterial and expressway systems are also prime considerations in the establishment of a program for highway construction. In the past the state highway departments aided and abetted by Federal statute constructed rural highways up to the political boundary of the city or incorporated village and deposited their vehicular load at the gateway to the town, leaving to the community the provision of streets through the residential and business area and to the motorists the determination of a way through the community or to their destination.

As a result of many urban studies it was noted that only approximately 10 percent of the traffic approaching an urban area of approximately 1 million can be bypassed around the area and that as much as 50 percent of the traffic approaching a community of approximately 50,000 wishes to enter the central area of the community. The development of the urban programs to provide arterial and expressway construction has provided traffic relief in many of the urban areas. Many more facilities of this type are needed. Consideration must be given to the location of these expressways and arterials to provide access to the heart of the urban areas. Such construction can be a benefit to the community inasmuch as motorists are attracted to a central area if they are able to readily reach the central business district to conduct their affairs. The construction of such highways without exception requires wider right-of-way than that provided by the usual city street. Undoubtedly, many objections will be raised by the owners of property within the required rights-of-way for these expressways. The determination of the location must take into consideration the factor of removal of buildings, small businesses or industry, and the relocation of those residing in the right-of-way of the expressway. Such removal may constitute a major disruption of the community activities.

The coordination of urban highway location and subsequent construction with redevelopment agency operations in older communities has become a contributing factor in establishing programs and priorities. By close cooperation with the redevelopment agency, a time table of operations can be developed benefiting both the highway department and the redevelopment agency so that each can obtain the benefit of the other's activities through the construction and development of traffic facilities located to serve the relocated traffic generators.

COMPLETION OF USABLE SEGMENTS AND PARTIALLY COMPLETED IMPROVEMENTS

A very important factor which influences the priorities of construction is the necessity of completing usable segments and partially completed route improvements. Planning studies may cover large route segments or entire routes recommending improvement and relocation. Most of these major projects can not be financed within a year or biennium. A section is selected for improvement and once such a start is made, it is almost mandatory that the route be progressively improved to completion. Recently,

an estimate was made of the cost of completing construction on Connecticut's major routes on which some expressway construction has been accomplished. This estimate indicated \$238 million of added construction would be required. Improvements requiring this magnitude of work must be given great consideration in program development.

STATUS OF PLANS AND RIGHTS-OF-WAY

The status of the development of plans and specifications and the acquisition of rights-of-way will also affect the priority of projects in the construction program. This is particularly so under a program of accelerated construction. If plans can not be made available, if rights-of-way required can not be acquired for a project or group of projects for any of several reasons, that project or group must be deferred or, in other words, rerated at a lower priority.

Even a legislative directive, unless plans and funds are available to execute the directive, is not sufficient to give immediate top priority to such projects.

CONNECTICUT PROCEDURE

To illustrate some of the procedures to be used for establishment of a construction program, a review of the situation in Connecticut is presented.

Shortly after the biennial budget is submitted at about this time every other year, the department has available a list of projects which are believed feasible of accomplishment within the appropriation requested. This list is not intended as a program but may include minor project groupings which do not identify individual projects.

After review of all material available to it, the legislature appropriates from the revenues available to the highway commissioner the amounts required for the several activities of the department, including the construction account. With this latter appropriation and other legislation enacted, the department reviews the project listing to include legislative requirements. Then begins the establishment of project priorities.

Inasmuch as the appropriations are made for the fiscal year and not for the individual projects, the status of each project must be reviewed with an estimate made of whether all or part of each project can be included in the biennial program. Projects which it is anticipated can not be processed through the various engineering and acquisition of rights-of-way stages within the 1- and 2-year time limit are eliminated from the program of contract construction for that year or years but are still considered for engineering and rights-of-way priorities.

As previously indicated, this condition may apply to legislated projects if the scope of the project is such that considerable planning work is required before determination of the detailed route location prior to design.

Following the review of project status, simultaneous reviews are made of the project listings relative to several other factors which must be considered.

Using the sufficiency rating as guides, the projects are then analyzed with respect to location on the Federal-aid systems, eligibility for financing under the several classes of Federal aid and availability of funds in each of the several classes; taking into consideration the balances of the apportionments and the apportionments anticipated to be available during the period of the program.

At this time, consideration is also given to the availability of funds to provide the state's share of the cost of the selected projects.

Simultaneously, consideration is given to the inclusion of projects which will complete usable sections of highways and to close gaps in partially completed routes, construction on which was started under programs of previous periods. These projects, of course, fall into more than one of the Federal-aid categories and thus receive consideration under more than one phase of the priority analysis.

Similarly, a review is made of projects involving coordination of construction activities at the state boundaries. In recent years, this group of projects, although not large in number, has caused many revisions in the construction schedule in order to cooperate with our neighbor departments.

For some of the lesser programs, an arbitrary selection of a maximum annual ex-

penditure may be made and the most urgent projects in these categories are then designated for inclusion in the annual program up to the limit of funds assigned.

Conferences with local planning and/or redevelopment agencies may indicate the desirability of advancing or deferring projects in urban areas to coordinate the highway program with the program of the urban area.

Legislation enacted in 1959 authorized the 4-year bond financing of the state's share of the cost of Federal-aid projects on the primary and secondary systems and the state's matching share of the projects on the Interstate System, plus the Federal share of the cost of Interstate projects constructed in conformance with the Federal regulations and in anticipation of future Federal-aid apportionments.

The enactment of this legislation required a major revision of priorities of construction. The Interstate program in Connecticut calls for the construction of approximately 200 miles of expressway network connecting and passing through all of the major cities. The recently enacted legislation contemplates the construction of almost all of this highway system within a period of four years. This does not leave a great deal of discretion in selection of projects to be given a top priority in construction. A program of this nature requires that all of the mileage be initiated for engineering and design immediately if the program is to be consummated within the defined time. The integration of the program with the prior programs for construction, notably in the urban areas of Connecticut, has greatly affected the priority in which some of the urban projects are to be undertaken. The Interstate System, as located, passes through the major urban communities and, in effect, overlays many of the originally proposed expressway systems for these communities.

CONCLUSION

When consideration is given to these several factors, some affecting only a special group of highway projects, it is apparent that no firm rule can be given for establishment of priority.

One can not say that any one factor more than another, with the possible exception of funds to prepare plans and specifications, acquire rights-of-way and pay for the construction, controls the priority of construction but many interlocking factors must be recognized and the priorities retain a reasonable fluidity in order to accept the changes which occur in requirements, availability of plans and financial arrangements. Physical ratings are an important guide but must be coordinated with many other factors in the development of construction programs.

Discussion

Granum. —How many years ahead does New England program on a scheduled basis?

England. —We have set up a four-year program. That is the main basic program for our operation at this time.

Very general programing has gone as far as ten years, but not for specific projects.

Babcock. —You are going to do your Interstate highways in four years, I understand and you are going to put them through every major community in Connecticut.

I am asking if they are going to be putting expressways through all of those communities. Do you have adopted land development thoroughfare plans with the cities in each of these communities where you plan to put expressways?

England. —We do not have written agreements but understandings, with communities on practically all of the routes with the exception of the western circumferential route around the Hartford metropolitan area. Some of that has not been defined, and detailed public hearings have not been held. But on the rest of them the hearings have been held.

Babcock. —Generally have these towns and cities adopted land development thoroughfare plans?

England. —Some of them are in regional planning groups, but as for detailed plans, I would not say that most of them have.

McWane.—In order of ratings, if a project is passed up this year that has a high rating for improvement, then for some reason you reconsider it next year, and so on, where does it eventually get in programing?

England.—Some projects have come up year after year and been continually deferred. I can think of one such project. It has very poor alignment and a narrow roadway, in the western part of the state on which the traffic volume is very low. It is in an area containing fairly substantial estates. Although the sufficiency rating is very low (it would probably show it as one of the worst ratings) we have not given consideration to it in any of the programs. It has been put off because of other factors involved.

McWane.—What I had in mind was that one of the chief benefits of your sufficiency ratings is to flag those sections which have very high priority of improvement or low efficiency ratings. And then next year when the roads are rated again this particular section will also have a very poor rating.

Generally speaking, do those come up for discussion each year and are they considered each year, even though you do not include them in the program?

England.—That is correct.

Granum.—Could it be that this particular road should not even be a part of your State highway system?

England.—It could be. I see no possibility of releasing it to the town.

Campbell.—Have you made an economic analysis of it to determine what its importance is as well as its urgency?

England.—Not on that particular section.

Kimley.—Was it a study by the Bureau that prompted the floating of your bond issue?

England.—No, we do not sell them until tomorrow. We have not yet sold any. We have an authorization that these bonds may be issued, providing we conform with certain Federal aid and other conditions that are in the bond statute. It was brought before the legislature as part of an over-all improvement program for the State. It was pointed out that we all believed it would be of substantial benefit to the State economically if we could build the Interstate System in advance of the Federal program, even though we recognized that we would have to pay the interest on the money that we were borrowing.

Kimley.—You had a complete rating before you requested the bond issue, then, of all the roads in the State, and you knew where your deficiencies were?

England.—We had a sufficiency rating set up which goes back to about 1950—that we revise every two years. And the Interstate System with the Federal program seemed to be a place where we could take advantage of that program for the economic advantage of the State.

Kimley.—Your article stated that about a hundred percent of your staff and your funds were diverted to materializing this bond issue. Am I correct?

England.—I did not mean to imply that; but during the last year or so, that has been fairly generally true.

Kimley.—Has the work on the other highways in the State been more or less satisfied so you can work on the bonds?

England.—It may have to be. I will not say it has been, because we had some other monies available which supplemented the bond program. But during the current year, our non-bonded program will be very small. The bonded program will go into four categories of Federal-aid financing, which will include secondary roads.

Kimley.—Does your bond program take care of most of your inadequacies, so that you do not have to worry about too many being left over at the end, or are you getting behind?

England.—No. One of our primary needs studies indicated a need of \$1,300,000,000. This bond issue will only cover some \$410 million worth.

Kimley.—Does it cover most of your top priorities?

England.—It would cover the top priorities because it would get the top off both the Interstate and the primary and urban groups.

Swanson.—Your Federal, secondary, primary, and urban programs are going forward at the present rate. There has been no slow-down in them. And what has helped you is that you had the organization built up to carry through on the Connecticut Turnpike, and with that being completed, you could turn your efforts over to the completion of the remainder of the Interstate System in this four-year period. So you had a good

organization to carry on this expanded program of four years.

England.—That is right. In fact, the ABC program will be accelerated under this bond program, because we were not using the Federal-aid money up to the limit. We were beginning to accumulate a backlog. We will now be picking up that backlog as well as the current apportionment.

Granum.—I would like Campbell to elucidate on the suggestion in his paper that a parallel or companion analysis by economic rating would underscore the importance of the road sections under consideration, as well as the sufficiency rating underscoring the defects.

Campbell.—An economic analysis will point up the benefits which will accrue to the user by improving a system, and from that standpoint will show the importance to the user of improving that project.

At the present time it would be a potential loss until the improvement is effected. That would indicate to the user the importance of having the improvement made.

Then, if we go into the economic impact studies, which broaden out the base, showing the potential which may be expected to accrue to the abutting lands in use and value, that, also, will indicate the importance of the improvement to the general public and to the abutting property owner.

In other words, the economic analysis does establish the importance of improving a piece of highway from the standpoint of benefits. I do not know any other quantitative way to measure the importance.

On the other hand the adequacy rating, whether it be sufficiency or deficiency or any of the other adequacy ratings, tells when a road has deteriorated structurally or has become obsolescent to the point that it is in a critical condition and is not providing service that it should provide, or is costing more to maintain than it should. Of course, in constructive maintenance, we find another aspect of the importance of doing something, also; but I believe the adequacy rating speaks more about urgency, whereas economic analysis speaks more about importance.

Granum.—You visualize taking an entire road system under consideration, and making an economic rating mile by mile throughout the entire system?

Campbell.—No. The suggestion that I made was that the economic analyses be made only of those sections which were rated critically deficient; because I regarded urgency as the first thing to consider.

That may be the wrong philosophy. Maybe we should regard economic importance as first and make an economic analysis of every section of the whole system, but that would be a tremendous job. Perhaps that should not be the reason not to do it, but so far, most highway departments are not properly set up to do such a job. I think it would be well if it could be done.

Granum.—Would you intend the economic analysis to include intangibles?

Campbell.—Yes, so far as you can give some value to them, and we do give them value. I think most people rate the value of time at about \$1.35 an hour for a passenger vehicle, which may be somewhere near right or may not be very near right. Then we also have a value given for comfort and convenience which may or may not be the proper value.

Some of these values might be determined by objective research. There is another area where we need more research.

For example, you can determine what people will pay for use of a toll road to avoid some of the discomforts and inconvenience of travel on existing routes without paying toll. And there are a number of measurements that can be made to determine the objective value of time, that is, the average value—even the range of values. There have been studies made of toll bridges and toll roads to determine the value of the time, and other intangibles, of those who preferred to use the toll facility and gain these benefits as against those who preferred to go around by a free bridge and lose these benefits.

Titus.—How, in the economic analysis, would you arrive at the estimated construction cost of the project?

Campbell.—I think we all take the estimated construction cost from the design engineers. Usually we go to the design department to get the cost, unless we have an estimator in the planning division.

Paterson.—I think you are implying that a need study changes conditions, but you do not use economic quantities to arrive at it. Growth and development of industries, changing structures and patterns within the different areas—these will help to indicate where roads perhaps should go if you are taking a long-range look at the program. But this does not affect the cost. This is done by design engineers.

Titus.—But one method of arriving at your program is to determine the rate of return on the cost. I am wondering in how much detail these cost estimates should be made.

Campbell.—In how much detail are the studies that are furnished for the proposed Interstate System? They contemplate projects which may not be built for 13 or 15 years.

Winfrey.—As another item on the program which fits into the present discussion, Wiley will discuss some work on sufficiency rating systems being done in New Mexico.

Wiley.—Referring to Figure 1, I am sure that we all would recognize that a highway section meriting a rating of 100 should have a thoroughly sound structure, be free from those hazards which can be obviated by road design, and have the capacity to handle satisfactorily the traffic generated by user demand.

In order to accomplish this kind of a rating, we divided our total points of 100, quite similarly to every other rating, into a number of items which are again very similar to what are used in most other ratings.

Structural adequacy is divided into two different items, a foundation rating of 10, and a surface rating of 30. I will explain why there is such a big rating on surface.

Ten points are given to drainage, 20 points to safety, and 30 points to capacity. This is capacity to carry volumes of traffic of the type that is using the highway.

The foundation rating (Fig. 2) is done simply by observation on the ground, by one single man who is trained to do this. He does the whole system, the secondary and primary system, each year. We may not always get everything perfect, but at least we are consistent, and we do not have a dozen people doing the same job.

So foundation is rated either as being satisfactory or critical. This is by observation of whether there are depressions or distortions or any kind of distress showing up through the pavement. If the foundation is not right, you practically have to tear up the surface to make repairs so the foundation will take a rating of either 10 or zero, satisfactory or unsatisfactory.

We allowed 30 points for surface because there is quite a range of varying conditions which we want to rate.

The point to remember is that a rating of 15, which is half the points off, would indicate a surface showing first signs of deterioration. Then all points above 15, from 15 to 30, are used to indicate increasing degrees of excellence. With a rating over 15, we still have a good pavement.

From 15 down to 10 indicates progressive deterioration, but that the surface is still usable. When the rating drops to 10, we consider the highway critical.

You could set these critical points at any figure you liked, depending on how you would decide to do it in your State. We used 10 to indicate the point at which we think

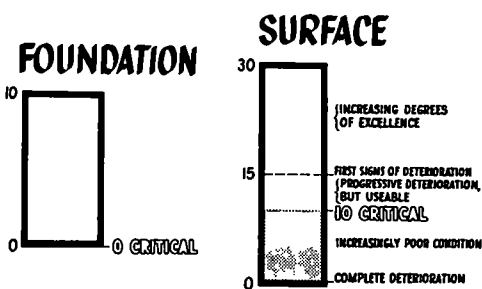
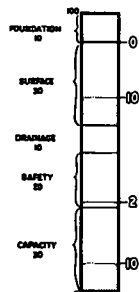


Figure 2.



A highway section meriting a rating of 100 should have a thoroughly sound structure, be free from those hazards which can be obviated by road design and have the capacity to handle satisfactorily the traffic generated by user demand.

Figure 1.

this surface has deteriorated to where something ought to be done about it. Ratings from 10 down to zero, which indicate complete deterioration, would show increasingly poor condition.

You will notice in Figure 3 that I bypassed drainage because we do not rate a highway critical on that basis. The drainage rating indicates only what work might have to be done.

Safety, however, is another item for which we would call a highway critical if we found certain conditions. We have not used accident records for this because our investigation of accident records would indicate that it seems as if most of the accidents are occurring on the best highways and under the best weather conditions.

What can be done to make a highway safer? Simply eliminate or remove all known hazardous conditions.

So we tally such items as stopping sight distances that are too short and horizontal curves too narrow for the designed speed of the roadway. For this we use assumed design criteria. We think a design should be good on a certain roadway for certain systems. Such things as a narrow roadway and dips can be removed by construction or improvement.

If we find no more than one in 10 miles, we will rate it at par, 20. You would not rate a 10-mile section critical because it had one hazardous condition. You would correct the spot, rather than rate the whole section critical. That is the way we would treat an isolated case. But when it gets to the situation where we find one or more of these critical conditions or hazardous conditions per mile, then the rating drops to two, and anything under two, of course, is critical.

There is a definite way of tallying by a formula that is simple arithmetic in determining that particular item.

For capacity (Fig. 3) we use 30 as par. This means capacity to carry

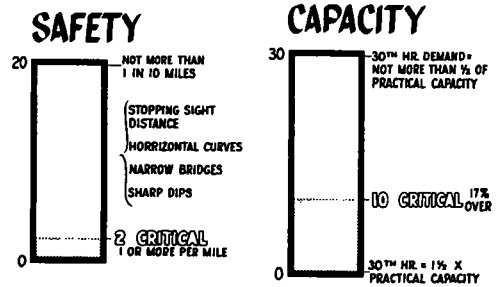


Figure 3.

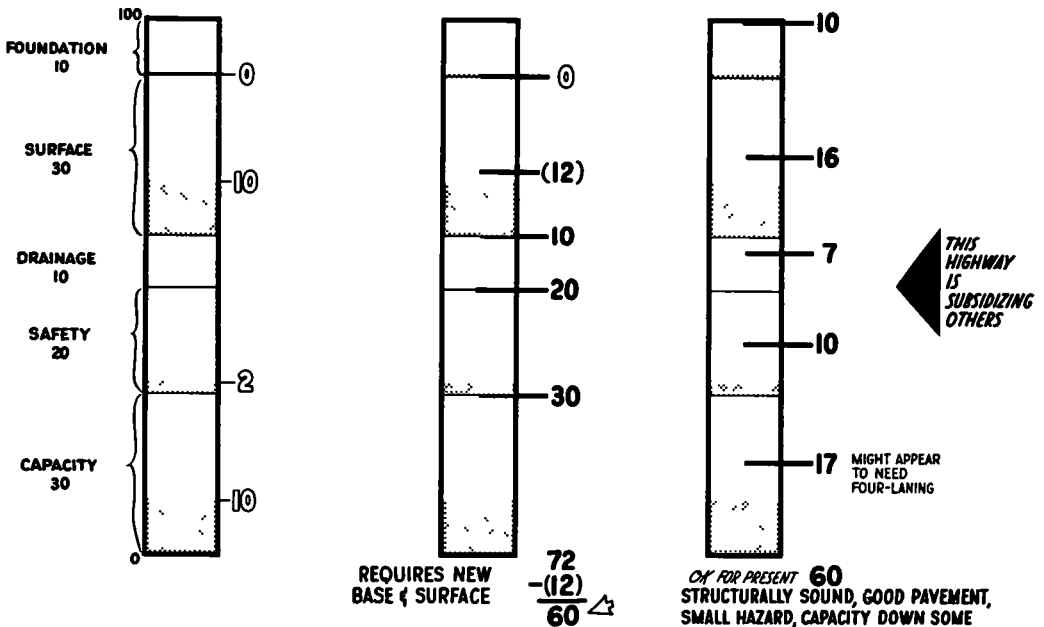


Figure 4.

vehicles under prevailing conditions and the types of vehicles that are using the highway.

If the 30th hour demand is not more than one-half of the practical capacity, the rating is 30 indicating no deficiency.

The rating goes down by use of a formula to the point where, when the 30th hour demand reaches 17 percent more than practical capacity, we rate it at 10, and it becomes a critical condition.

That 17 percent is not arbitrary; the 10 is and by coincidence came out 17 percent. That is getting to the point where some congestion begins.

Anything under 10, and down to zero at which point the 30th hour demand would be one and a half times the capacity, would indicate the point where the highway would really be choked up.

These are the points at which we would rate a highway critical. And if any one or more of these items show up as critical on a highway section, then it is rated as critical.

The bar on the right of Figure 4 is just a conventional one showing the critical points and what the items are. The hypothetical ratings are to explain certain points. I would like to explain how some of these things work.

The rating shown on the second column is for a highway on which the foundation is rated as being critical and the surface rated down to 12.

A rating of 15 is the point when distress begins. Twelve still indicates an acceptable surface. But we would reason from this that probably more money must be spent for maintenance on that highway than should be to keep it that good, under the condition that the foundation is not as satisfactory.

The drainage and safety ratings are satisfactory; capacity is up to par; but the highway is critical. When you add the ratings the total is 72.

I wanted to explain that, as in this case, if we have a foundation rating of zero, or a critical foundation rating, we do not add in the rating for the surface, because that surface can be no better than temporary, and it will be only a short time before it must be torn up, if it does not deteriorate by itself, in order to fix the foundation.

Therefore, from the rating of 72 we subtract the surface rating of 12 which leaves the total rating of 60 to show the critical section.

The next column shows simply that you can have the same rating, but on a highway that is not critical. In this case, the foundation is satisfactory, and there is an excellent surface with a rating of 16. The drainage rating is down a little. The safety rating is down to 10, which is not too good, but not critical. The capacity rating is down to 17.

A highway like this is the kind of which your commissioner will often say, "we ought to four-lane that highway right away. It is carrying a big load of traffic." It is, at least in the western region where we live, and it may be quite natural for them to think it requires four lanes.

But that is the very highway that should not make four lanes, because it is earning money which can be spent on another highway. It is one of the earners that helps to subsidize some of the roads that cannot support themselves.

It is a good highway with a good surface and it is not yet so over-crowded as to be deficient. We should leave it as it is and do nothing more to it until its capacity drops down below the critical point, and then make it four lanes.

The point is, of course, that both of those highways rated 60. One was critical, and the other was still a very good one.

The second bar of Figure 5 shows the rating on a portion of a highway that has a good foundation, but on which the surface is critical, deteriorated to the point that something should be done. The drainage rating is all right. The safety rating is down some. The capacity rating is up to par.

It might be inferred that this road needs to have something done to it, but probably we can get satisfactory service for a good many years, considering the capacity rating, if we should put a new surface on it, which is probably all it needs because it has a satisfactory foundation.

The next portion of a highway is rated 60. The foundation is all right. It has a good

surface. The drainage is all right and it is quite safe. There might be one or two hazardous conditions there that we should correct in spots but it is not critical.

But the capacity rating is critical. It is carrying too heavy a load of traffic, with too many vehicles trying to use it. So this road which is in very good condition otherwise, is the road that we need to make four lanes because of the need for more capacity.

The last bar (Fig. 5) is the rating on a section of highway which shows a critical foundation, a critical surface, drainage rating down some, and the safety rating is critical. The capacity rating is satisfactory, but there are so many things wrong with that road that really complete reconstruction is needed.

These illustrations show some of the things that can be deduced from this rating method. And as a matter of fact, I was difficult to convince on the merits of sufficiency ratings and did not think much of them for a long time, because they did not appear to do what we wanted a rating to do. Basically we wanted to know what sections were critical. We also wanted to have a good indication in detail of what was wrong with them, and something that would give us an approximate idea of what had to be done to correct that situation. Along with that we wanted a system that, like all of the other ratings, would give us an indication of the over-all progress on the system.

This rating is added to a basic rating, and then adjusted according to the deviation from the average traffic for the system, just as is done by almost all the other ratings (Fig. 6).

For our commissioners, it was important to be able to point out that if we had three highways, each with a basic rating of 60, and the average daily traffic on one was 400 and on another 1,400 and on a third 5,000, by this method of adjustment the rating of the one that carried the heavy volume of traffic was cut down, so that in the priority list it would be raised to 51, where the one that is on the average remains at 60 and the one with the lesser volume would be raised to 68; thus giving preference to the one where work does the most good for the most people.

Whether that is a sufficient adjustment for the purpose is debatable but at least it does give preference to the highway that serves the most people.

The reason we developed this method (Fig. 7) is that first we used to put out tables that listed all of the critical sections in ascending order of their adjusted rating forming

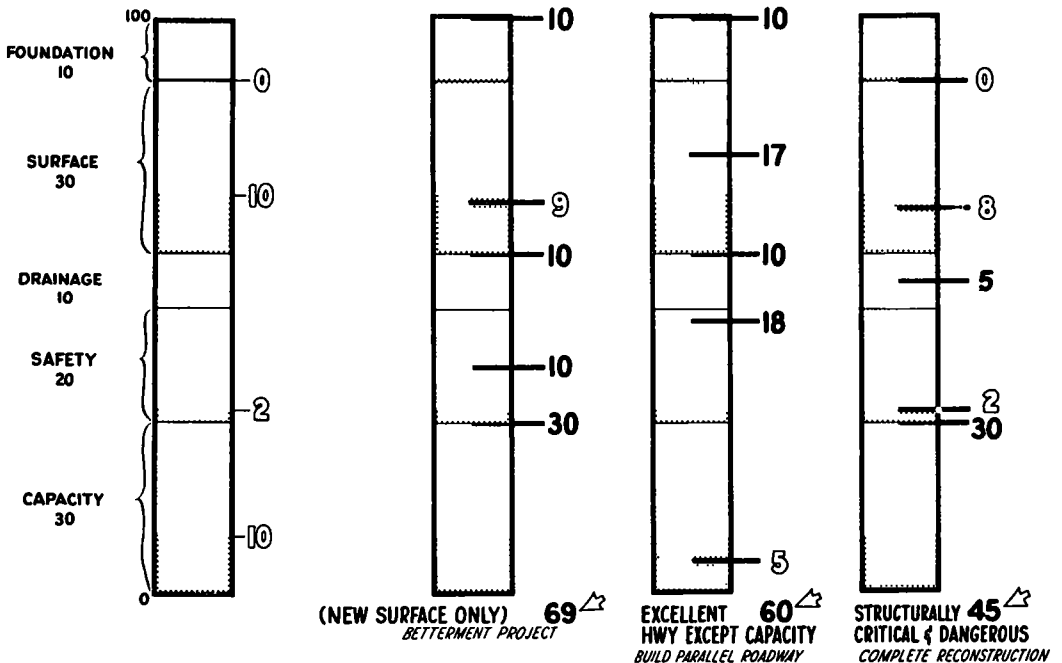
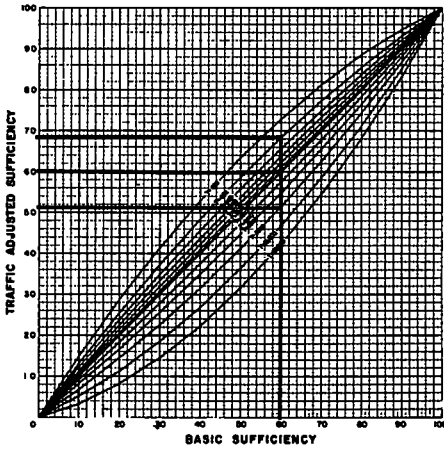


Figure 5.

CHART FOR USE IN ADJUSTING
BASIC SUFFICIENCY RATING BY ADT ON SECTION
(SYSTEM ADT=1400)

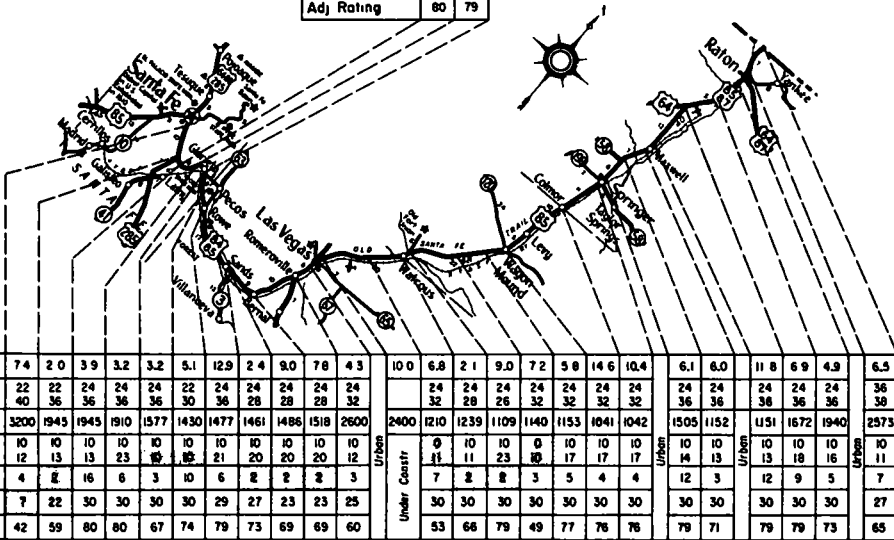


BASIC RATING	AVERAGE DAILY TRAFFIC	ADJUSTED RATING
60	400	68
60	1400	60
60	5000	51

Figure 6.

N. M. STATE HIGHWAY DEPARTMENT
PLANNING DIVISION
**SUFFICIENCY RATINGS ON PRIMARY SYSTEM
1959**

Length	3.9	3.2
Surface & Shoulder Width	24	24
ADT 1958	1945	1910
Foundation & Surface	10	10
Safety	13	21
Capacity	16	6
Capacity	30	30
Adj Rating	80	79



Length	7.4	2.0	3.9	3.2	3.2	5.1	12.9	2.4	9.0	7.8	4.3	10.0	6.8	2.1	9.0	7.2	5.8	14.6	10.4	6.1	6.0	11.8	6.9	4.9	6.5	
Surface & Shoulder Width	22	22	24	24	24	22	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	36
ADT 1958	40	36	36	36	36	36	30	36	28	28	32	2400	1210	1239	1109	1140	1153	1041	1042	1505	1152	1151	1672	1940	2573	
Foundation & Surface	10	10	10	10	10	10	10	10	10	10	10	Urban	9	10	10	6	10	10	10	Urban	10	10	Urban	10	10	10
Safety	12	13	13	23	18	21	20	20	20	12	7	7	8	8	3	5	4	4	12	3	Urban	14	13	Urban	13	18
Capacity	4	8	16	6	3	10	6	8	8	8	3	Urban	30	30	30	30	30	30	30	Urban	30	30	Urban	30	30	30
Adj Rating	7	22	30	30	30	29	27	23	23	25	53	66	79	49	77	76	76	79	71	Urban	79	71	Urban	79	79	73

LEGEND
 CRITICALLY DEFICIENT
 ADT REPRESENTS TRAFFIC IN BOTH DIRECTIONS ON DIVIDED HIGHWAY

**FAP ROUTE 1
(INTERSTATE 25)**

Figure 7.

not exactly a priority list, but a list from which a priority list can be made. The list does show the relative urgency of the various critical sections; but it is too difficult to find where these routes are. We also made a table that listed everything as it occurred chronologically along the route.

Figure 7 shows the length of the system, the surface width, the shoulder width, the ADT for the appropriate year, foundation service rating, safety rating, capacity, and adjusted rating. It shows in the shaded area which ones are critical and what about the section is critical, so that you get an idea of the continuity of the whole route.

The principal thing that we objected to about the use of some of the other rating methods was the idea of listing everything and then cutting it off at a certain level. Too

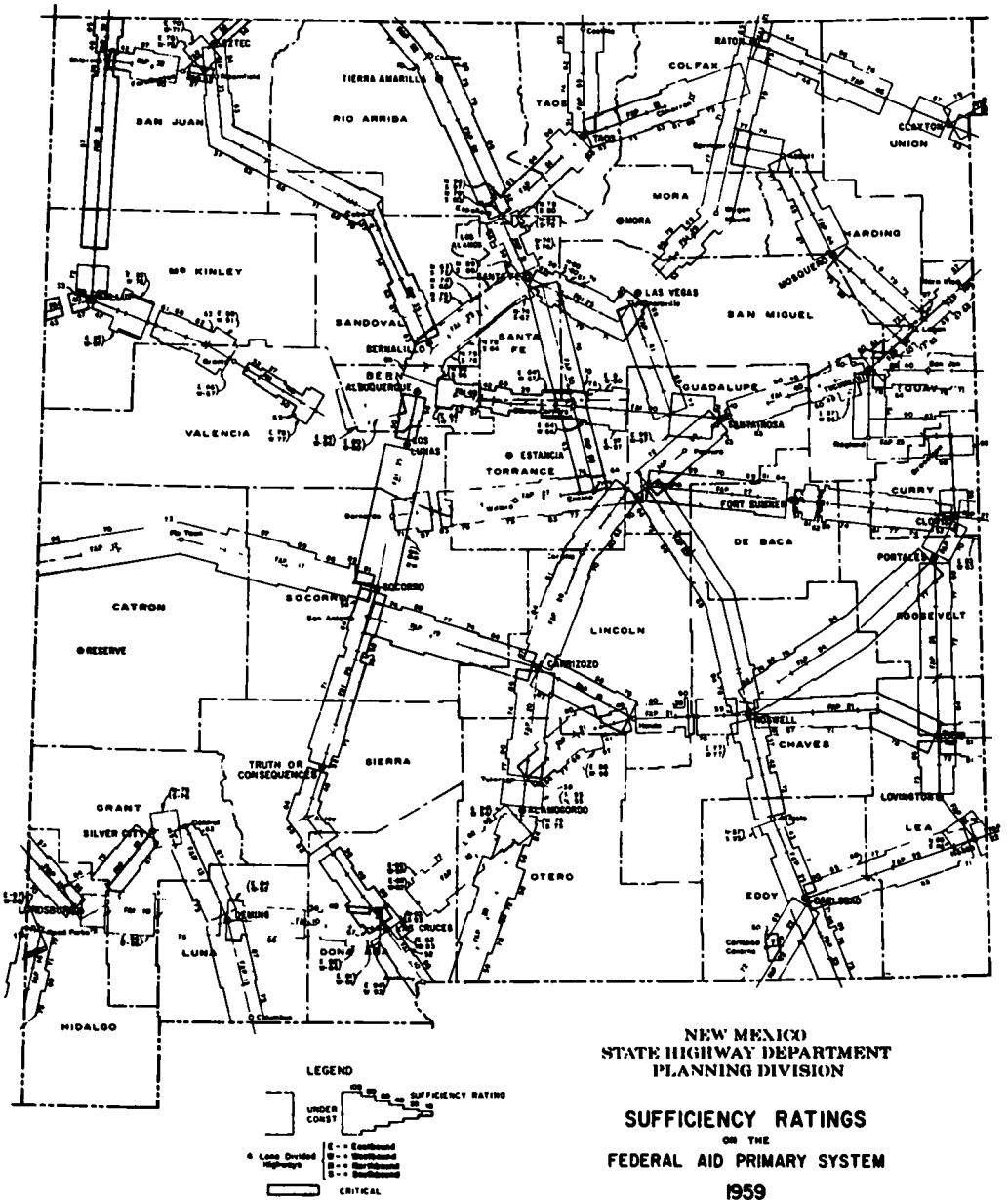


Figure 8.

many of the items that were listed under the cut-off line were tolerable and too many above the line actually had to have something done to them immediately.

So rather than put out a map (Fig. 8) that shows the ratings, Figure 7 actually shows the ratings in a shaded area for every section on the primary system that is critical. This gives us some idea of the continuity and what mileage of the various systems we still have to contend with. I believe what I have shown covers essentially what we are doing.

Babcock. —Do I understand that a road in perfect structural condition with a perfect surface, foundation, drainage, and everything else, because it was working at capacity all day long would have a rating of 70?

Wiley. —Yes.

Babcock. —It would be my impression that that ought to have a rating of zero.

Wiley. —No; because that is one of the things that would be wrong if we did it the other way; but that zero on capacity makes that road critical. The fact that the capacity rating is down to zero tells us that this is critical, and why.

Babcock. —But you also could have a section that would be critical because of its foundation.

Wiley. —That is true.

Babcock. —Which would be the more important of the two? A road with no traffic or a road that is operating at possible capacity?

Wiley. —If the road has no traffic, it is going to get quite an adjustment on the balloon chart.

Babcock. —I did not understand how you adjusted the road operating at practically full capacity for volume.

Wiley. —There is another point I wanted to make. The comparison of two different volumes is adjusted on a balloon chart. You asked which one is the most important. We would gauge that insofar as it had been measured by the rating, by the total adjusted rating.

In other words, a rating on one of them might be as low as 50, while the rating of another one might be around 60 to 70. And the one that has the lowest rating, of course, is the most important.

I am not so naive as to think that you can take such a rating and use it as a priority list; but it certainly gives you a lot of information to start with, and it helps in explaining to the public.

We have had people come in from over the State with questions as to why we do not do this on that road or another road. You can read right out of the rating tabulation to show exactly what condition that road is in. It amazes them that we know that much about the road.

Hall. —Do you use today's traffic for the design hour traffic, or forecasted traffic? And if so, why?

Wiley. —For the design hour traffic we are using today's, because we are using the traffic on the road as required for today. When we find it critical, and program it, then we project it to what we expect to have 20 years hence.

Kimley. —Can't your factors in safety be reflected in your capacity?

Wiley. —Well, of course, widths have something to do with capacity; but I think these hazardous conditions, such as vertical curves and too sharp horizontal curves, too narrow bridges, and dips, are not so much a capacity consideration as they are a safety consideration.

There is another thing we attempted to do. We tried to eliminate, as much as we could all those things that might be overlapping. You may be right to a certain extent. But some of the ratings that we studied seemed to have the same thing reflected in maybe three or four different items. We tried to eliminate that as much as we could.

I did not devise this; but I think it is good, and it has been useful to us.