Elemental versus Composite Ratings

M. EARL CAMPBELL, Staff Engineer
Highway Research Board

IN THE MATTER of determining a final percentage rating for an appraisal section, a very real difficulty is involved in deriving a figure that portrays the true index of character of the combined varied elements. It is equally difficult to derive a figure that portrays the true index of character of each element (which contains variable components) before combination into a composite index.

To illustrate by analogy, consider the problem of deriving a weather-index figure to portray the degree of temperature of a locality. For example, the average annual temperature may be 55 F. but this one index figure gives no indication that the average monthly temperatures may vary from 35 F. in winter to 75 F. in summer, nor do the monthly average figures reveal that the maximum and minimum daily temperatures may range respectively from 10 F. in the winter to 95 F. in the summer.

A textbook on statistics makes this statement: "It is not the average that is significant, it is the differences." This premise leads to two conclusions:

First, each appraisal section should be so chosen that each of structural geometric, and traffic characteristics remain nearly constant throughout the length of the project. Second, some means should be devised for showing the deviation from the mean,or composite rating.

The so-called control sections will provide a valuable device for selection of appraisal sections. An examination of each control section should be made to see that it meets the basic requirement of homogeneity.

An instantaneous appraisal point by point is obviously impracticable. At the other extreme, it is of questionable merit to set up for rating, sections, whose length exceeds the normal length of a normal construction project. In a recent application of the sufficiency rating procedures the highway routes were generally divided into mile-long sections. Some compromise is necessary in the selection of appraisal sections, but the basic requirement of homogeneity should not be departed from to the extreme. A unit for appraisal might well be limited to a length that would be covered by one design standard.

Admittedly, then, a most difficult problem is that of combining the ratings of the several elements into a composite percentage rating. The ratings for the elements of structure, service and safety have no common denominator, and the relative weight of each of these elements is a matter of judgment and not subject to rational analysis at this date.

In order to obviate this difficulty there may be prepared a four-column listing to summarize the ratings determined for the appraisal sections. Under this procedure the rating may be shown for each of the three elements of each section as well as the composite rating.

Whereas a composite rating of 70 percent (60 percent in some states) is commonly accepted as the minimum passing rating for a section, it is regarded good practice to consider each element for a construction warrant, for it is possible to obtain a warrant for construction in the individual element because of its low rating, yet find that the composite rating is higher than 70 percent. Therefore, the analysis for warrant may be determined from the rating of the individual elements, and the priority for programming is determined both on basis of composite rating and number of construction warrants for each section determined on basis of element warrants.

A possible solution to the problem of retaining the index of each element in the composite rating is suggested as follows:

An index would be designed which would show each component element as an identity. For example, a three-digit index could be devised which would enable the retention of identity of each of the three elements with their sufficiency rating to

the nearest 10 percent. Suppose, for example, that the following ratings were obtained from basic data:

	Basic Rating	Assigned Weight	Converted Rating Basis of 100%
Structure	= 21	40	53
Service	= 28	30	70
Safety	= 35	30	87
		Total	210
		Average	70

Using the nearest 10 percent in these ratings, the resulting three-digit index would be 579. This would supplement the composite rating of 70 which would be obtained by the present method.

This proposed three-digit index shows the range of sufficiency and retains the identity of each element. In this case it shows a construction warrant for the structural element. In the composite rating, however, the good safety rating makes up for the poor structure rating to the extent that the construction warrant is lost sight of.

If we identify each digit by appropriate symbol (possibly by slope of the digit) we can rearrange the digits in any order desirable and still maintain the identity of each element and its rating. By rearranging the digits to an ascending order we can list each index number in order of priority, or the digits can be arranged in the same order by elements, i.e., structure, service and safety, and then followed by the composite rating which would determine the order of listing on the priority schedule.