AN INFORMATIONAL GUIDE ON PROJECT PROCEDURES

A Guide for the Reviewing of Certain Administrative, Inspection, and Documentation Practices in use by State Highway Departments

With Particular Attention to

CONTRACT CONSTRUCTION

PAVEMENT TYPE SELECTION

and

RIGHT OF WAY ACQUISITION

Prepared by the Special Committee on Project Procedures

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PAVING TYPE DETERMINATION AND DOCUMENTATION

The highway engineer or administrator does not have at his disposal generally acceptable theoretical or rational methods that give an absolute and indisputable comparison of the competitive pavement types for set conditions.

Prerequisites for such an evaluation procedure would, of course, with other things, involve the development of improved scientific structural design methods for both rigid and flexible pavement structures to render comparable service under similar traffic and weather conditions.

It would also involve the availability of reliable cost accounting data on the maintenance costs of the two pavement types for those comparable conditions. Here again factual information in complete desirable form is not presently available. Even though information is being developed through research it will not be wholly applicable on a national basis without modifications to adjust for the various soil and climatic conditions encountered.

Past, current and proposed major research undertakings such as the Maryland Road Test, the WASHO Road Test and the current AASHO Road Test research project, and its proposed satellite projects, together with road life and maintenance studies underway in the several State highway departments all contribute to fill in, gradually, some of the gaps.

The AASHO Committee on Design is currently in the process of converting the basic scientific relationships of pavement performance and applied loads, as developed on the AASHO Road Test, into improved rational design methods for pavements.

Pending the development of better tools, the State highway departments must rely on those that are available. Certain assumptions must be made and an empirical approach used, based on the best professional highway engineering judgement and experience available.

In other words there is no magic formula, where certain figures can be inserted and a definite answer as to pavement type required will result.

Governing Factors

To avoid criticism, if that is possible, any decision as to paving type to be used should be firmly based. Judicious and prudent consideration and evaluation of the governing factors will result in a firm base for a decision on paving type.

A list of such factors comprises the following items:

1. Traffic
2. Soils characteristics
3. Weather
4. Performance of similar pavements in the area
5. Economics or cost comparison
6. Adjacent existing pavements
7. Stage construction
8. Depressed, surface, or elevated design
9. Highway system
10. Conservation of aggregates
11. Stimulation of competition
12. Construction considerations
13. Municipal preference and recognition of local industry

14. Traffic Safety
15. Availability of and adaptations of local materials or of local commercially produced paving mixes

In the following pages, these factors are discussed and grouped, one group including all those which may be considered to have major influence, and the second, those which have lesser, or only occasional influence. The order of magnitude of influence is to be considered interchangeable within the groups and between the groups, as no single order is held to apply in all cases.

PRINCIPLE FACTORS

I. Traffic

The volume of passenger cars generally affects only the geometric or lane requirement. The percentage of commercial traffic and frequency of heavy load application generally has the major direct effect on the structural design of the pavement. Existing heavy-duty highways constitute sufficient evidence that both flexible and rigid pavement designs can meet requirements under given conditions.

If a cost comparison between competitive paving types is to be of value, it is imperative that the structural designs compared have equal capacity to carry loads. Since the matter is one of basic economics, the cost comparison must also include not only the cost of original construction, but that of needed periodic repairs and routine maintenance over the service life of the pavement, and an estimate as to what its probable useable salvage value will be at the end of that time.

It must be conceded that in these important areas, some assumption still must be made pending the results of current and further research developments not already available in guide form. When such assumptions are made, they must be made by the best qualified personnel available.

Present legal load limits are, to all intents and purposes, frozen by the Federal-Aid Highway Act of 1956, and will remain until certain studies are presented to the Congress for its consideration and further action.

Even accepting this restriction, it is reasonable and proper to make allowances in the structural designs of pavements for possible future modest legal load increases as well as the occasional overloads, whether moving by special permit or illegally, that are likely to use the pavement.

Currently, the AASHO Transport Committee is preparing new proposed vehicle weights and size regulations for consideration of the various States from data received from the AASHO Road Test and other appropriate sources. The Transport Committee assignment is to develop recommended size and weights to give an optimum balance between the best highway use and maximum highway life, for roads and bridges that can be furnished with the funds available for highway purposes.

In the projection of the density and weight of future traffic that will likely use the pavement during its lifetime, it is essential that not only normal increases be anticipated, but that consideration be given to the possibility of additional traffic being generated by potential industrial development or changes in land use for the area served.

The construction of a modern highway may also divert large amounts of heavy traffic, from other routes in the same broad traffic corridor, that should be considered by the designer.

II. Soils Characteristics

Of paramount importance is the ability of a native soil, which forms the subgrade for the pavement structure in cuts and on embankments, to withstand applied loads. Even in given limited areas the inherent qualities of such native soils are far from uniform, and they are further subjected to variations by the influence of weather.

The characteristics of native soil not only directly affect the pavement structure design, but may, in certain cases, dictate the type of pavement economically justified for a given location.

The evaluation of the characteristics of soils is, axiomatically, a requirement for each individual pavement structure design.

III. Weather

Weather affects subgrade as well as pavement wearing course. The amount of rainfall, snow and ice, and frost penetration will seasonally influence the bearing capacity of subgrade materials. Moisture, freezing and thawing, and winter clearing operations will affect pavement wearing surfaces as to maintenance costs, etc. These surfaces, in turn, will have some effect on the ease of winter clearing operations due to differences in thermal absorption or to the ability of the pavement to resist damage from snow and ice control equipment or materials.

In drawing upon performance record of pavements elsewhere, it is most important to take into consideration the conditions pertaining in the particular climatic belt.

IV. Performance of Similar Pavements in the Area

To a large degree, the experience and judgment of the highway engineer is based on the performance of pavements in the immediate area of his jurisdiction. Past performance is a valuable guide, provided there is good correlation between conditions and service requirements between the reference pavements and the designs under study. This factor should not be allowed to develop into blind prejudice. Caution must be urged against reliance on short-term performance records, and on those long-term records of pavements which may have been subjected to much lighter loadings for a large portion of their present life. The need for periodic reanalysis is apparent.

V. Cost Comparison

In any cost comparison of paving types, the matter of availability of local or commercially produced materials, and the existence and proximity of manufacturing or processing plants will be of significant importance.

Unavoidably, there will be instances where the financial circumstances are such as to make first cost the dominant factor in paving type selection even though greater maintenance costs may be involved later. Where circumstances permit, a better and more realistic measure would be the cost on the basis of service life or service rendered by a pavement structure. Such cost computation should reflect original investment, anticipated life, maintenance expenditures, and salvage value.

Original cost can be fairly accurately estimated. Doubt as to validity arises in the case where on type of pavement has been given monopoly status by the long-term exclusion of a competitive type.

The highly desirable determination of cost on a service life basis is presently adversely affected by some incomplete areas in needed factual information. One such area is the life expectancy of different paving types, a second, the matter of maintenance costs, and a third, the salvage value of pavements.

With our present state of limited knowledge as to the effect of frequency of heavy load applications, it is difficult to conceive of anything but an empirical approach to the determination of life expectancy of a pavement. The Bureau of Public Roads report "Lives of Highway Surfaces-Half Century Trends" shows a difference in the probable life for rigid and flexible pavements. It is not known if these trends hold for the pavements currently being constructed for the modern heavier traffic loadings, such as will be involved for the National System of Interstate and Defense Highways. The experience of the individual states as to assignment of probable life expectancy of different paving types, under the pertaining conditions, must for the present be accepted.

Assigned maintenance costs will seriously affect the cost comparison. If these costs are to be considered wholly valid, they must be based-on accurately kept, long-term maintenance records reflecting an established maintenance standard adhered to in practice. Since traffic and structural standards in the past have been such variables, it is difficult to accurately evaluate maintenance costs. This has not been a derelication of the highway official.

It is urged that the individual states take the necessary steps to develop factual information from Interstate System of highways, which will be valuable in the years ahead. These highways are built to modern standards. Establishment of, and adherence to, a maintenance standard, supplemented by accurate cost recording, will produce for the future more reliable data on maintenance cost and life expectancy.

Salvage value to be ascribed to pavements is somewhat open to conjecture. As it were, a large proportion of highway reconstruction involves changes in alignment or gradient which negate the salvage value. Each project actually must be considered individually.

SECONDARY FACTORS

I. Adjacent Existing Pavements

Provided there is no radical change in conditions, the choice of paving type on a highway may be influenced by existing sections thereof which have given adequate service. This will result in a desirable continuity of pavement and consequent simplification of maintenance operations.

II. Stage Construction

Where financial circumstances dictate stage construction of the type of pavement, where a thinner wearing course is later brought up to design requirements by an additional course or courses of wearing course material, flexible design becomes mandatory.

III. Depressed, Surface, or Elevated Design

Depressed and surface design may involve a high water table which will influence the choice of paving type. Elevated design, as in the case of approaches to long bridges or viaducts with concrete decks, may influence the decision in

favor of rigid pavement to preserve a desirable continuity of pavement surface. A depressed design, presenting some periodic possible drainage problems, may also indicate the use of one type of pavement over another.

IV. Highway System

It is not considered good practice to let a system designation influence the choice of paving type. Merits of the individual case and economics should prevail.

V. Conservation of Aggregates

This consideration may well have influence in choosing a paving type which will involve, in the total pavement structure, less of the scarce critical material than might be required by another type.

VI. Stimulation of Competition

It is desirable that monopoly situations be avoided, and that improvement in products and methods be encouraged through continued and healthy competition among industries involved in the production of paving materials.

VII. Construction Consideration

Such considerations as speed of construction, reduction of traffic maintenance during construction, ease of replacement, anticipated future widening, need for minimum of surface maintenance in highly congested locations, seasons of the year when construction must be accomplished, and perhaps others may have a strong influence on paving type selections in specific cases.

VIII. Municipal Preference, Participating Local Government Preference and Recognition of Local Industry

While these considerations seem outside of the realm of the highway engineer, they cannot always be ignored by the highway administrator, especially if all other factors involved are indecisive as to the pavement type to select.

IX. Traffic Safety

The particular characteristics of a wearing course surface, the need for delineation through pavement and shoulder contrast, reflectivity under highway lighting, and the maintenance of a non-skid surface as affected by the available materials may each influence the paving type selection in specific locations.

X. Availability of and Adaptation of Local Materials or of Local Commercially Produced Paving Mixes

The prevalence of adaptability of local materials may influence, or the availability of commercial produced mixes particularly on small projects, may influence the selection of pavement type.

Conclusion . . .

In the foregoing, there have been listed and discussed those factors and considerations which influence, to various degree, the determination of paving types. This has brought to the fore the need, in certain areas, for the development of basic information that is not available at present. It has also served to point out that, in general, conditions are so variable, and influences sufficiently different from locality to locality, to necessitate a study of individual projects in most instances.

The public, although a critical judge, cannot be expected to be aware of the variety of considerations which influence the decisions of a highway administrator.

Consequently, whatever factors control the selection of the pavement type should be made part of the project file and should carry the identity of the person or persons involved in the entire process of making recommendations and in making the final decisions. It is very important that the reasons for reaching the decision be fully documented in the project file.

The judgment of the decision may be disputed at some subsequent time, but if the reasons are fully outlined and documented, the matter becomes only a difference of opinion and the reasons of the person or persons, who are responsible for the decision, are a matter of record for any future review or investigation.