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AN OVERVIEW ON PAY ADJUSTMENT FACTORS FOR ASPHALT CONCRETE MIXTURES

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by

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ABSTRACT

In the fall of 1979, the Oregon State Highway Division and Oregon State University with participation from the University of Washington initiated a research project to study the impact of variations in material properties on asphalt pavement life. This study is aimed at developing a rational approach to assess the effects of variations from specification limits so a firm basis can be established for the development of pay factors.

In an effort to collect information on the status of quality control procedures and the use of pay adjustment factors, a questionnaire was distributed to all state agencies, the District of Columbia, and the Federal Highway Administration. Each agency was asked to respond to questions describing their current method for acceptance or rejection of asphalt concrete paving materials and related pay adjustment factors.

This report summarizes the results of the questionnaire. Analysis of results indicate:

1) Most state agencies will accept one or more property characteristics of asphalt concrete that are outside specification tolerances.
2) Most state agencies apply a pay adjustment factor to accepted materials which are outside specification tolerances.
3) Only 26 percent of the state agencies consider their pay factors to be proportional to reduced pavement serviceability.
4) Approximately one-half of the agencies consider the use of pay

factor plans as effective in encouraging compliance with specifications.

5) There is a wide disparity in the pay adjustment factors used by the different agencies.

ACKNOWLEDGMENT

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AN OVERVIEW OF PAY ADJUSTMENT FACTORS FOR ASPHALT CONCRETE MIXTURES

INTRODUCTION

In the fall of 1979, the Oregon State Highway Division and Oregon State University initiated a research project to study the impact of variations in material properties on asphalt pavement life. The University of Washington is cooperating in the study with Oregon State University. The questionnaire was prompted by the increased occurrence of pavement problems during recent years and in the proportion of pavements constructed with a significant amount of material outside of specification limits (1). The effect of construction noncompliance on pavement serviceability has been questioned by highway agencies and has resulted in frequent controversy with contractors on the assessment of pay adjustments. The general result is reduced pay to the contractor for material which is determined to be outside the specification tolerances. The current study is aimed at developing a rational approach to assess the effects of variations from specification limits so a firm basis can be established for the development of pay factors.

The AASHO Road Test (1958-60) emphasized to the highway industry the significance of the relationship of the variability of material test properties to highway specifications (2). As a result, many agencies have been developing and experimenting with various combinations of statistically based specifications to provide a more accurate evaluation of the end products and to allow acceptance of noncompliance work in conjunction with a reduced payment for that work. In 1976, 33 states were using or had tried some form of statistically oriented end-result specifications (3).

In an effort to collect current information on the status of quality control procedures and the use of pay adjustment factors, a questionnaire was developed and distributed to all state agencies, the District of Columbia, and the Federal Highway Administration in November, 1979. Questionnaires were returned by all except four states, resulting in a 92 percent response rate. Each agency was asked to respond to seven questions with reference to their current method for acceptance or rejection of asphalt concrete paving materials. The items of emphasis on the questionnaire include:

1) acceptance of noncompliance construction and materials with or without pay adjustments.
2) identification of properties tested for acceptance and the method of test used.
3) pay adjustment factors used in relation to each tested property.
4) rationale used in establishing pay adjustment factors.
5) relationship of pay adjustment factors to pavement serviceability or other criteria.
6) effectiveness of pay adjustment factors in encouraging compliance with specifications.
7) summary opinions regarding the use of pay adjustments.

While the required information could be placed on the questionnaire, the states were encouraged to include copies of supplemental information which would assist in the overall evaluation. Most states did provide supplemental materials.

Emphasis in this paper is placed on the results of current state practice; although, a rational approach is presented and discussed which shows significant promise in developing pay factors. The rational development of pay factors is based on selected material properties which can be developed in the laboratory.

Preliminary test results and corresponding pay factors are shown for one recent paving project constructed in the State of Oregon.

QUESTIONNAIRE RESULTS

Seven primary questions were contained in the questionnaire. The results received for each of these questions are presented separately.

Question 1

"Do you accept asphalt concrete pavement construction and materials that do not satisfy specification requirements?"

The responses to this question are summarized in Figure 1. Of the 47 agencies which responded, only four indicated that they do not accept construction work or materials which are below specification. All the remaining agencies (91 percent) accept some aspects of the work or materials when they are below specifications.

The key concept illustrated is that 82 percent of the agencies use some form of pay adjustment factors when accepting one or more of the evaluated criteria. However, only four states indicated a possible acceptance of below specification work or materials on every evaluated property considered in the questionnaire. All other agencies identified certain criteria which would not be accepted if below specification limits. A detailed discussion of these criteria is included in the analysis of Questions 2 and 3 of the questionnaire. The 18 percent labeled "combination acceptance" indicate agencies which accept below specification work and materials using a combination of pay adjustment and no pay adjustment depending on the criteria being considered.

Question 2

"What properties do you evaluate to establish the acceptability of an asphaltic pavement?"

The questionnaire listed eight properties commonly evaluated during or at the completion of construction. These properties were thickness, smoothness, compaction, asphalt content, asphalt properties, aggregate quality, mix moisture content, and mix gradation. Each agency was asked to identify which properties are evaluated and controlled by their specifications and to indicate the method of testing used. Figure 2 summarizes the data received concerning which properties are evaluated. The data for the method of testing are discussed in conjunction with Question 3 dealing with the use of pay factors. All property criteria except the mix moisture content are evaluated by at least two-thirds of the agencies.

Question 3

"What are your pay adjustment factors for each of the properties identified in Question 2?"

The data summaries relating to pay adjustment factors and methods of testing are shown in Figures 3 through 10. Each figure depicts a different property and is discussed individually.

A review of the questionnaire results indicates that the basis for applying pay factors can be broken into five categories. These categories are:

1) Statistical. The concepts of random sampling are used in collecting test data. The statistical methods employed to evaluate the measurements can include the use of simple averaging, a range of measurements, the normal distribution, and the student's t distribution.
2) Guide in Specification. The agency makes use of a pay adjustment factors guide, usually in tabular form, which is part of the specification in which statistical methods are not used.

3) Schedule--not in Specification. The agency has established guidelines for use in applying pay factors, but they are not a part of the specifications. For example, one state has a "Price Adjustment Committee" which determines pay adjustments for each case individually. The state has a guide of pay factors which may be used at the committee's discretion.

4) None. Materials below specification are not accepted, thus no pay factors are involved.

5) Negotiated. The agency accepts below specification work and materials based on negotiations with the contractor. These negotiations include pay adjustment.

It is important to note that many of the agencies which make use of pay adjustment factors retain a process of decision making by the agency's project engineer. The pay factors are applied only if the below specification work or material is accepted.

Thickness. Figure 3 is provided to summarize the questionnaire information for thickness evaluation. Thirty-one agencies evaluate the thickness of the finished pavement with 74 percent of this total using cores for measurement of the final thickness. The remaining agencies use other methods such as measuring the uncompacted thickness at the paver and applying a predetermined coefficient based on density to determine final thickness. Though not indicated, all state agencies probably evaluate this property either by direct or indirect evaluation procedures.

Almost half of the agencies do not accept a pavement thickness below specification tolerances. Most of these agencies specify that an overlay is

required to bring the thickness up to specification with all costs born by the contractor. The remaining agencies accept final thicknesses which are below specification in conjunction with some form of pay adjustment.

Smoothness. Figure 4 is used to show the data summary from the questionnaire regarding smoothness. Thirty-seven of the agencies evaluate the smoothness of the finished pavement surface and of these 70 percent use a straightedge as the basis of their measurements. While 11 percent did not identify a method of testing, the remaining 19 percent use either the profilograph or roadmeters such as the PCA Roadmeter.

Similar to the thickness evaluations, approximately one-half of the agencies accept pavements which do not meet the smoothness specification tolerances. Most of these apply a pay adjustment factor to account for the increased maintenance requirements. The other half of the agencies do not accept pavement surfaces outside the tolerance limits but most of them allow a contractor to bring the surface up to specification with placement of an overlay at the contractor's expense.

Compaction. The results of the questionnaire data relating to compaction are shown in Figure 5. Of the 43 agencies which evaluate compaction, 60 percent use nuclear gage methods and 7 percent use pavement cores. The nine percent using their own procedural specification gave detailed procedures of the test requirements without reference to any of the standard test methods.

Almost two-thirds of the agencies accept pavement sections which have not been compacted to specification requirements. Note that both statistical and nonstatistical based pay adjustment factors are used equally. While 37 percent of the agencies indicated they would not accept pavement which was improperly compacted, the available information was insufficient to identify procedures used to remedy the deficiency.

Asphalt Content. Figure 6 shows the summary of the testing methods used and the basis for pay adjustment factors applied when accepting out of specification material. Forty-three of the agencies evaluate the asphalt content with three-fourths using extraction methods. The remaining agencies use other methods such as tank sticking.

Approximately one-third of the agencies do not accept material outside the tolerance limits of the specifications. Most of those agencies check the asphalt content on a regular basis during construction so that adjustments can be readily made without great losses of time or materials. Therefore, pay adjustments are often not needed. The majority of the agencies accept materials with asphalt contents outside specification tolerances. The most commonly used basis for pay adjustment factors by these agencies is statistical in nature.

Asphalt properties. Forty-four agencies or 94 percent of those responding to the questionnaire provide for the evaluation of the asphalt properties in their specifications. A summary of test methods and pay adjustment factors used by these agencies is shown in Figure 7. The majority (70 percent) use a combination of various AASHTO test methods to evaluate the individual characteristics of the asphalt.

Slightly over one-third of the agencies do not accept asphalt with properties outside the specification tolerances. These agencies evaluate the asphalt properties before use in mixes; thus, unacceptable asphalt can be rejected with little loss in time or money. The remaining two-thirds of the agencies accept asphalt with properties which do not meet specification tolerances. The majority of these have a pay factor guide included in their specifications but only 18 percent base their pay factors on statistical concepts.

Aggregate Quality. Thirty-nine of the agencies responding provide for evaluation of the aggregate quality in their specifications. Several agencies indicated they do not evaluate the aggregate quality as part of the contractor's specifications because the aggregate source is supplied by the state. Figure 8 shows the test methods and basis of pay factors currently used. Of those agencies evaluating aggregate quality, 72 percent make use of the AASHTO test procedures.

Over two-thirds of the agencies do not accept aggregate below specification quality. Since most testing is achieved prior to delivery of material to the construction site, there is seldom a need to accept inferior aggregate. For the few situations where below specification aggregate is accepted, there is no dominant method of developing pay adjustment factors.

Mix Moisture Content. Less than half (45 percent) of the agencies evaluate the mix moisture content as part of their specifications. The test methods and the basis for pay factors used by these agencies are summarized in Figure 9. Very little information relating to the test methods was given in the responses for this property. Most of the agencies simply indicated the use of standard moisture tests.

Of the agencies using mix moisture content as a specification criteria, 71 percent do not accept material outside the tolerance limits of the specification. This is a property which can be controlled during the construction process, often with little loss in time or materials, thus no pay adjustments are necessary. For the few situations where below specification materials are accepted, there is no dominant method of developing pay adjustment factors.

Mix Gradation. All but two of the forty-seven agencies which responded evaluate mix gradation as part of their acceptance criteria. Figure 10 shows

a summary of the questionnaire results concerning the test methods and basis for pay factors used in evaluating this property. An extraction test followed by a sieve analysis is used by most of the agencies.

Slightly over two-thirds of the agencies accept mixes with a gradation that does not satisfy specification tolerances. Of these, the majority base their pay adjustment factors on statistical concepts. The 31 percent which do not accept below specification mixes indicated control of the gradation during material preparation. This allows rejection and modification of mixes on a continuing basis resulting in small losses of time or material. Therefore, no pay factors are necessary.

Question 4

"How were your pay adjustment factors established?"

This question was used in an effort to identify the background for justification and development of pay adjustment factors. The four categories listed were laboratory results, field studies, experience and other. Each agency indicated which categories they relied on in accepting below specification work or materials and determining the pay adjustments. The data shown in Figure 11 summarizes the background characteristics used by the various agencies in their specification development.

Experience is predominant in the development of pay factors as indicated by 60 percent of the agencies. The remaining background categories are about equally used by the agencies. Since several agencies have relied on more than one background category, the total precentage is greater than 100 percent of the 47 agencies responding.

Also note that a fifth category is added to the results in Figure 11 to account for those agencies which do not use pay factors. The 21 percent shown includes the four agencies which do not accept anything below specification

and the six agencies which occassionally accept one or more properties below specification on a negotiated basis.

Question 5

"Is your pay adjustment proportional to the value of reduced pavement serviceability resulting from specification noncompliance?"

This question (as well as Questions 6 and 7 which follow) required the person responding to the questionnaire to express an opinion on behalf of that agency. It is important to note that the response from an agency may be a function of who answered the questionnaire, i.e., opinions vary within an agency. Therefore, the corresponding data and figures should not be considered as absolute agency policy and thus viewed accordingly.

Figure 12 presents a summary to the question regarding the relationship of pay factors and pavement serviceability. Twenty-six percent of the agencies indicated they believed their pay adjustments are proportional to reduced pavement serviceability. However, several of those agencies also indicated that they used engineering judgement and experience to develop that rationale and they could not verify it in terms of engineering principles. Forty-eight percent of the agencies claim little relationship between their pay factors and pavement serviceability and the remaining 26 percent did not respond to this question.

Figure 13 gives a summary of the responses to the second part of this question identifying other rationale for establishing pay adjustment factors. The 23 agencies that responded with a "no" on the first question gave six different rationales for determining pay factors. Thirty percent use pay factors in their specifications to discourage noncompliance. Another 22 percent are following recommendations made by FHWA (4).

Question 6

"Do you feel your pay adjustment factors are effective in encouraging compliance with specifications?"

The responses to this question are summarized in Figure 14. Slightly more than half of the agencies indicated they felt their pay adjustment factors are effective in encouraging compliance with specifications. This is contrasted with 17 percent which are uncertain about their effectiveness.

Question 7

"Summarize your opinion regarding the need for pay adjustments or the success of your method for acceptance of paving materials."

The opinions given in answer to this question cover the full spectrum from "don't believe in pay factors" to "end-result sepcifications are the way to go". The wide range of positive and negative comments, with few agencies concurring, illustrates the controversial nature of this topic and the need to develop a rationale which is consistent with engineering principles acceptable to a majority of the agencies and equitable to all parties. Some of the advantages and disadvantages identified by the responding agencies are listed below.

Advantages

1) contractors improve quality control
2) creates a uniform procedure for accepting noncompliance work
3) reduces problems associated with contract administration
4) reduces litigation
5) requires fewer state personnel

Disadvantages

1) needs to be based on sound engineering approaches
2) contractors resist

3) contractors may increase bids

4) may result in poor quality work if pay factors not severe

5) can not measure reduced serviceability

6) administration problems

EXAMPLES OF CURRENTLY USED PAY FACTORS

In responding to Question 3 of the questionnaire, each agency was requested to identify pay adjustment factors for the eight properties listed (thickness, smoothness, compaction, asphalt content, asphalt quality, mix moisture content and mix gradation). A majority of the states included either a tabulation of their current pay factors or partial sections from their specifications. Some of the agencies did not submit detailed information. With this in mind, examples and comparisons of pay factors for the two material properties of compaction and asphalt content are made. These two factors are selected because of their relative importance in the production of quality asphalt concrete and to reduce the number of properties discussed to provide an overview of the kind of data received and summarized. Detailed presentations of pay factor information will be available in a subsequent project report.

There are several general considerations which affect the application of pay adjustment factors regardless of the property being evaluated. These considerations include lot size, identification of contract pay items affected by pay adjustments and the effects of multiplicative relationships of pay adjustments. As important as these considerations are, a detailed treatment will not be provided in this papar.

Compaction

Twenty-three state agencies submitted information on their use of pay adjustment factors for noncompliance with compaction requirements. There is

a wide disparity between the agencies with ten different approaches used for determination of level of compaction. In addition, the agencies using the same approach have widely varying values for the pay factor applied to a common level of compaction.

The ten approaches used are listed below. The number in brackets is the number of agencies using that approach.

1) Percent of reduction in contract price computed by a formula based on statistics [3]
2) Pay factors for percent of target density [7]
3) Pay factors for percent of control strip density [4]
4) Pay factors for percent of voidless density [1]
5) Pay factors for daily mean air void content [1]
6) Pay factors based on deviation of air void content [1]
7) Price adjustment for percent of deficiency [1]
8) Pay factors based on a computed quality level [2]
9) Pay factors based on a computed quality index [1]
10) Pay factors for percent within limits [2]

There is little value in comparing the various approaches and their effect on the contract unit price unless the actual, required data necessary for each are obtained on a common sample. Unfortunately, this is beyond the scope of the existing research. However, the tendency for wide divergence within approaches can be demonstrated. It is this divergence which may cause confusion and dissatisfaction among paving contractor's which undertake work in several states.

The use of pay adjustment factors determined by comparing the in-place density to the target or lab density appears to be the most common approach (seven agencies). The in-place density is typically determined with a nuclear

gage and the target or lab density determined from samples prepared by the Marshall or Hveem mixture design procedures. The percent of the target density achieved is then compared to predetermined values in the agency's specifications. This concept is demonstrated in Table 1 for the State of Mississippi.

Figure 15 shows a comparison of three target densitites (percent basis) for the seven state agencies which can be compared. For 100 percent of target density all seven agencies provide for full pay (100 percent pay factor) as would be expected. For 95 percent of target density the amount of pay received by a hypothetical contractor could range from 90 percent to 100 percent. This variability increases significantly for 90 percent of target density. The percent pay received by a contractor could range from a low of zero percent up to 90 percent depending upon in which state the contractor was performing the work.

The information resulting from the analysis of the questionnaire further reveals that for most of the seven agencies cited achievement of at least 95 percent of target density qualifies for full payment for the material in a given lot. If the target density is in the 90 percent range, a number of agencies either apply severe (low) pay factors and/or require the project engineer to make further evaluations as to whether the lot should be accepted at reduced pay or receive total rejection. Most agencies also give the contractor an option of accepting the pay adjustment or removing and replacing the material at their own expense in an effort to achieve work which is in compliance.

Asphalt Content

Information on pay adjustment factors for asphalt content was submitted by 25 agencies. This material characteristic also has a wide dispaity of pay factors among the state agencies with eight different approaches being used.

These eight approaches are listed below:

1) Percent of reduction in contract price computed by a formula based on statistics [3]
2) Pay reduction for percent out of tolerance [3]
3) Pay factors for the average deviation from the job mix [13]
4) Pay factors for the deviation of the sample average as percent [1]
5) Pay reduction for the deviation of the sample average as percent [1]
6) Pay factors based on the deviation of the mean above or below the mix tolerances [1]
7) Price adjustment computed by a specified procedure based on percent of asphalt above or below the mix design tolerance [1]
8) Pay factors for the degree of nonconformance of the moving average [1]

Again, there is little value in comparing the various approaches due to the lack of supportive data. However, similar to the compaction criteria, the tendency for significant divergence within approaches can be demonstrated.

The use of pay adjustment factors determined by computing the average deviation of the asphalt content from the job mix criteria appears to be the most common approach (13 agencies). The target value established for asphalt content is then used for comparison with the actual asphalt content of the lot samples. This concept is demonstrated in Table 2 for the State of Nebraska. Note that an equal pay adjustment is applied when the deviation is either above or below the job mix target value.

Figure 16 shows a comparison of three levels of average deviation from the job mix target for the 13 state agencies using this evaluation method. For an average deviation of 0.20 (e.g. asphalt binder content range of 5.8 to 6.2 percent for a 6 percent target content), 11 agencies provide for full pay (100 percent pay factor); one agency provides a pay factor of 105 percent, which involves a bonus for high uniformity; and one agency provides a pay factor of 90 percent.

For an average deviation of 0.40, the amount of pay received by a contractor could range from a low of zero percent up to 100 percent; although, the majority of the state agencies would provide payments of at least 95 percent. At an average deviation of 0.55 the payment provisions vary from zero percent to 100 percent, but the majority of the agencies severely penalize the contractor. In fact, the pay factor specifications for five of the agencies do not include data for deviations as high as 0.55. These agencies could either reject the material at zero pay or accept the noncompliance material at a negotiated pay factor.

RATIONAL PAY FACTOR DEVELOPMENT

In an attempt to develop more rational pay factors, work is currently underway to evaluate the effect of known mix variations on pavement life. With knowledge of these effects, pay factors can be assigned. Currently being evaluated at Oregon State University are the effects of density, gradation (particularly minus 0.074 mm), asphalt content and aggregate quality.

The procedure being used to develop pay factors is to evaluate the performance of asphalt mixes in fatigue and permanent deformation. The diametral test (5) is used to evaluate these properties. For each mix combination fatigue (ε_E - N) and permanent deformation (ε_p - N) curves are developed. An example of one fatigue curve is given in Figure 17 showing the effect of density on fatigue life.

Once developed, pay factors can be determined for any strain level as shown in Table 3. At the top of the table, the pavement life (repetitions) associated with various mix densities is provided. The lower portion of the table shows the pay factors developed with respect to some standard (in this case 96 percent of maximum density). As indicated, the pay factors developed range from about 5 to 45 percent for poorly compacted specimens ($\sim$90 percent

of maximum) to 45 to 65 percent for specimens compacted to 92 percent of maximum. Note also, specimens compacted to 100 percent would yield fatigue levels about 3.5 to 4 times greater than the standard condition; however, these mixes may have a greater tendency to bleed or rut. This effect is still being studied.

The important point is that improved mix evaluation methods can lead directly to pay factors if noncompliance in a mix exists. These pay factors should more accurately reflect how a mix will perform in the field than the methods presently being used. A detailed presentation of the development of pay factors using this approach will be available in subsequent project reports.

SUMMARY AND CONCLUSIONS

Summary

The pay factor questionnaire, prepared and distributed by the Oregon State Highway Division, has proved to be extremely useful in evaluating the current status of quality control procedures and the use of pay adjustment factors in the construction of asphalt concrete pavement projects. The 92 percent response rate by the state agencies is a key factor in the value of this report and is also an indication of the intense interest in this aspect of the construction process.

Conclusions

The data from the questionnaires was summarized and the analysis of the results indicate that:

1) Most state agencies (91 percent) will accept one or more properties in the construction and materials of asphalt concrete pavement that are outside specification tolerances.

2) The specific properties accepted outside of specification tolerances

by a large majority of agencies, generally with a pay adjustment, are compaction asphalt content, asphalt properties, and mix gradation. The pavement thickness and smoothness are additional properties accepted outside of specification tolerances by approximately half of the agencies.

3) Most of the agencies which accept construction and materials outside of specification tolerances apply a pay adjustment in reducing the compensation to the contractor. It is significant that the current philosophy is to penalize the contractor for properties which are below specification. A few agencies are considering the provision of a bonus for properties which are found to be above specification and provide increased pavement serviceability or life. Illinois appears to be the only state agency which currently provides a bonus for high quality and uniform work.

4). The background relied on for establishing pay factors is predominately experience.

5) Only 26 percent of the agencies consider their pay factors to be proportional to reduced pavement serviceability. Other widely used rationale for pay factors are to discourage noncompliance by application of the penalty and to comply with recommendations of the FHWA.

6) Approximately one-half of the agencies consider the use of pay factor plans as effective in encouraging compliance with specifications. The remaining agencies either will not use specified pay factors or they do not believe the plans currently available are sufficient.

7) There is a wide disparity in the pay adjustment factors currently used by the different state agencies. There are several approaches used for determination of pay factors for each material property evaluated. In addition, agencies using the same approach have widely varying values for the pay factor applied to a common level of material quality.

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TABLE TITLES

Table 1. Mississippi Compaction Pay Factors for Percent of Target Density

Table 2. Nebraska Asphalt Content Pay Factors For the Average Deviation From the Job Mix

Table 3. Estimated Reduction in Pavement Life and Pay Factors Based on Fatigue Criteria and Varying Mixture Densities

Table 1. Mississippi Compaction Pay Factors for Percent of Target Density.

Percent of Target	Percent Pay (Pay Factor)
94.9 - 100	100
94.2 - 94.8	90
93.5 - 94.1	70
92.8 - 93.4	50
< 92.8	0

Table 2. Nebraska Asphalt Content Pay Factors for the Average Deviation from the Job Mix.

Average Deviation	Percent Pay (Pay Factor)
0.0 - 0.31	100
0.32 - 0.37	95
0.38 - 0.41	90
0.42 - 0.45	80
0.46 - 0.49	70

Table 3. Estimate Reduction in Pavement Life and Associated Pay Factors Based on Fatigue Criteria and Varying Mixture Densities.

	Percent Compaction	Mix B.S.G.	STRAIN LEVEL	
			Heavy Duty	Primary
			50 με	100 με
Pavement life	96%	2.31	1.62×10^6	0.0406×10^6
	100%	2.41	6.44×10^6	0.148×10^6
	92%	2.22	1.04×10^6	0.0182×10^6
	91%	2.19	0.0788×10^6	0.013×10^6
Pay Factor	96%	2.31	1.00	1.00
	100%	2.41	3.98	3.65
	92%	2.22	0.64	0.45
	91%	2.19	0.05	0.47

FIGURE TITLES

Figure 1. Accpetance of Construction Work and Materials That Do Not Satisfy Specification Requirements

Figure 2. Properties Tested To Evaluate the Acceptability of an Asphaltic Pavement

Figure 3. Requirements for Thickness of Pavement

Figure 4. Requirements for Smoothness of Pavement

Figure 5. Requirements for Compaction

Figure 6. Requirements for Asphalt Content

Figure 7. Requirements for Asphalt Properties

Figure 8. Requirements for Aggregate Quality

Figure 9. Requirements for Mix Moisture Content

Figure 10. Requirements for Gradation of Mix

Figure 11. Predominant Method for Establishing Pay Factors

Figure 12. Pay Adjustment Proportional to Reduced Pavement Serviceability

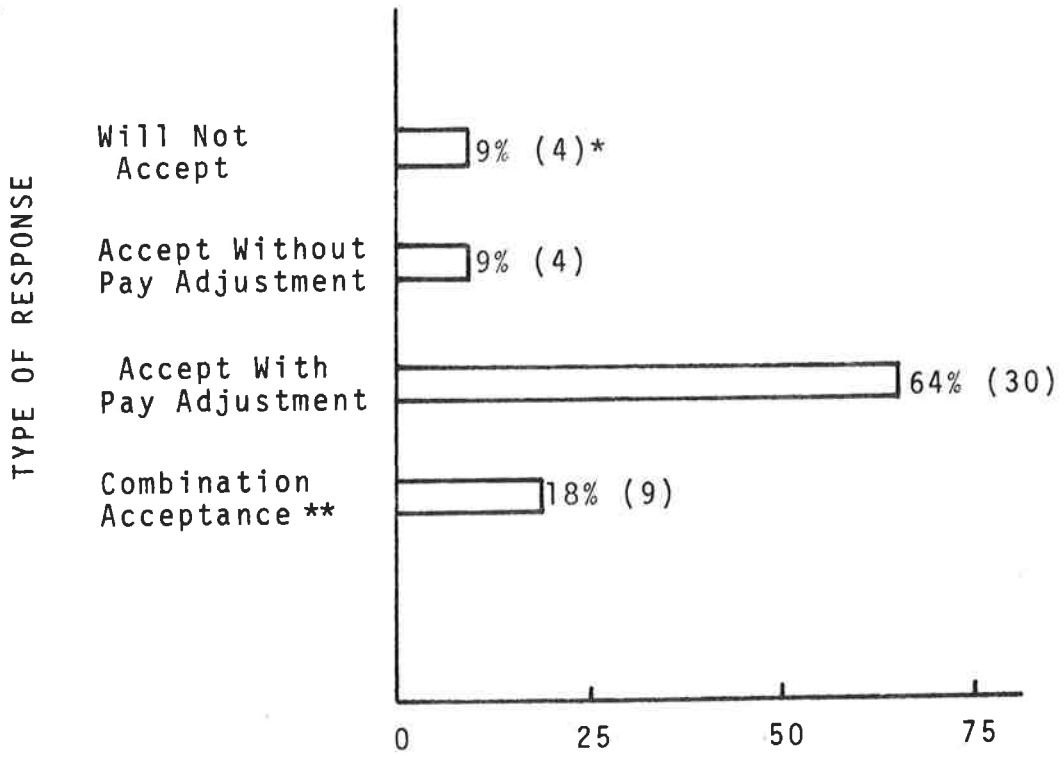
Figure 13. Other Rationale For Determining Pay Factors

Figure 14. Pay Factors are Effective

Figure 15. Comparison of Compaction Pay Factors for Seven States at Percent of Target Density of 100, 95, and 90.

Figure 16. Comparison of Asphalt Content Pay Factors for Thirteen States at an Average Deviation From Job Mix of 0.20, 0.40, and 0.55.

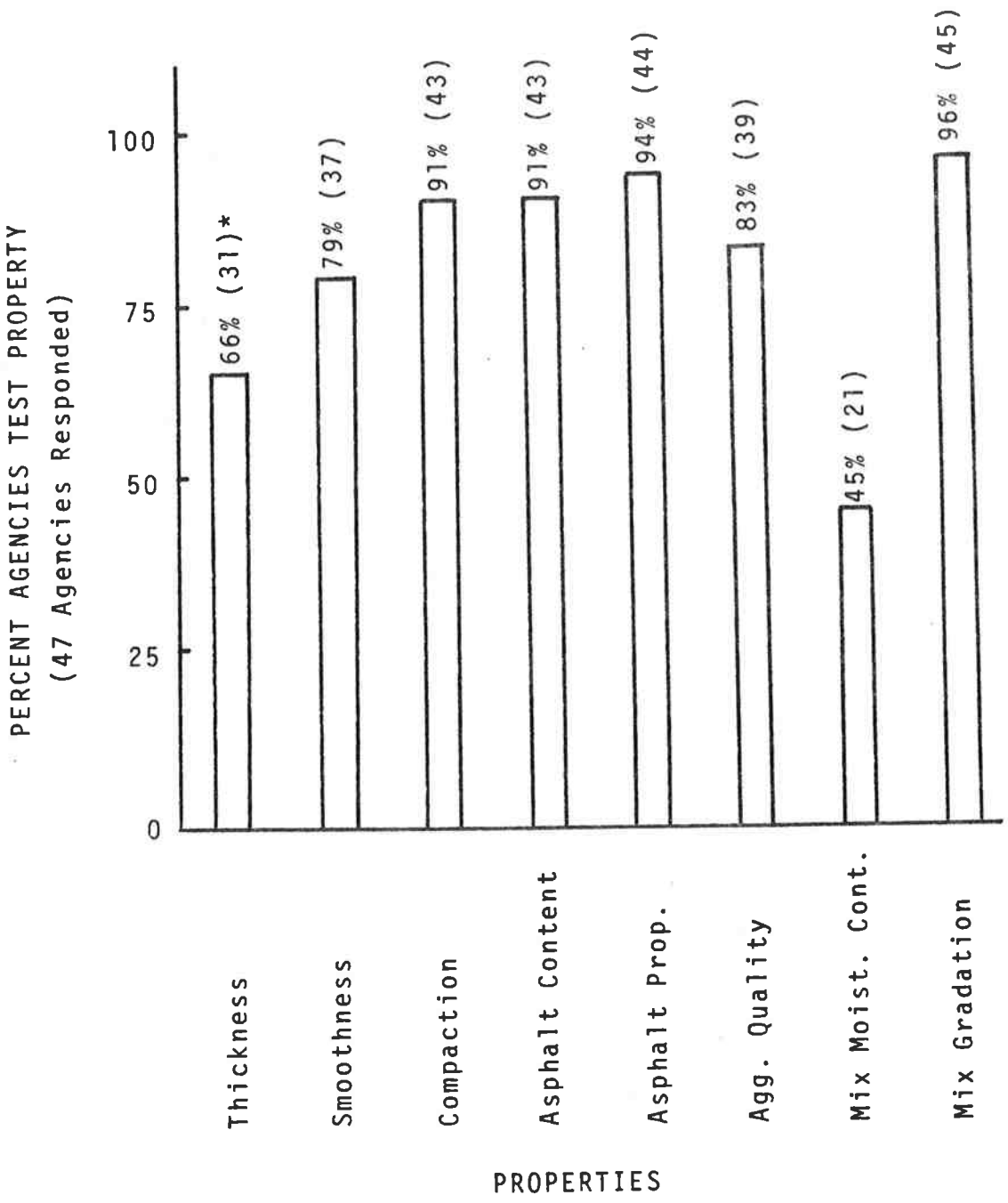
Figure 17. Influence of Mix Density on Fatigue Life



(47 Agencies Responded)

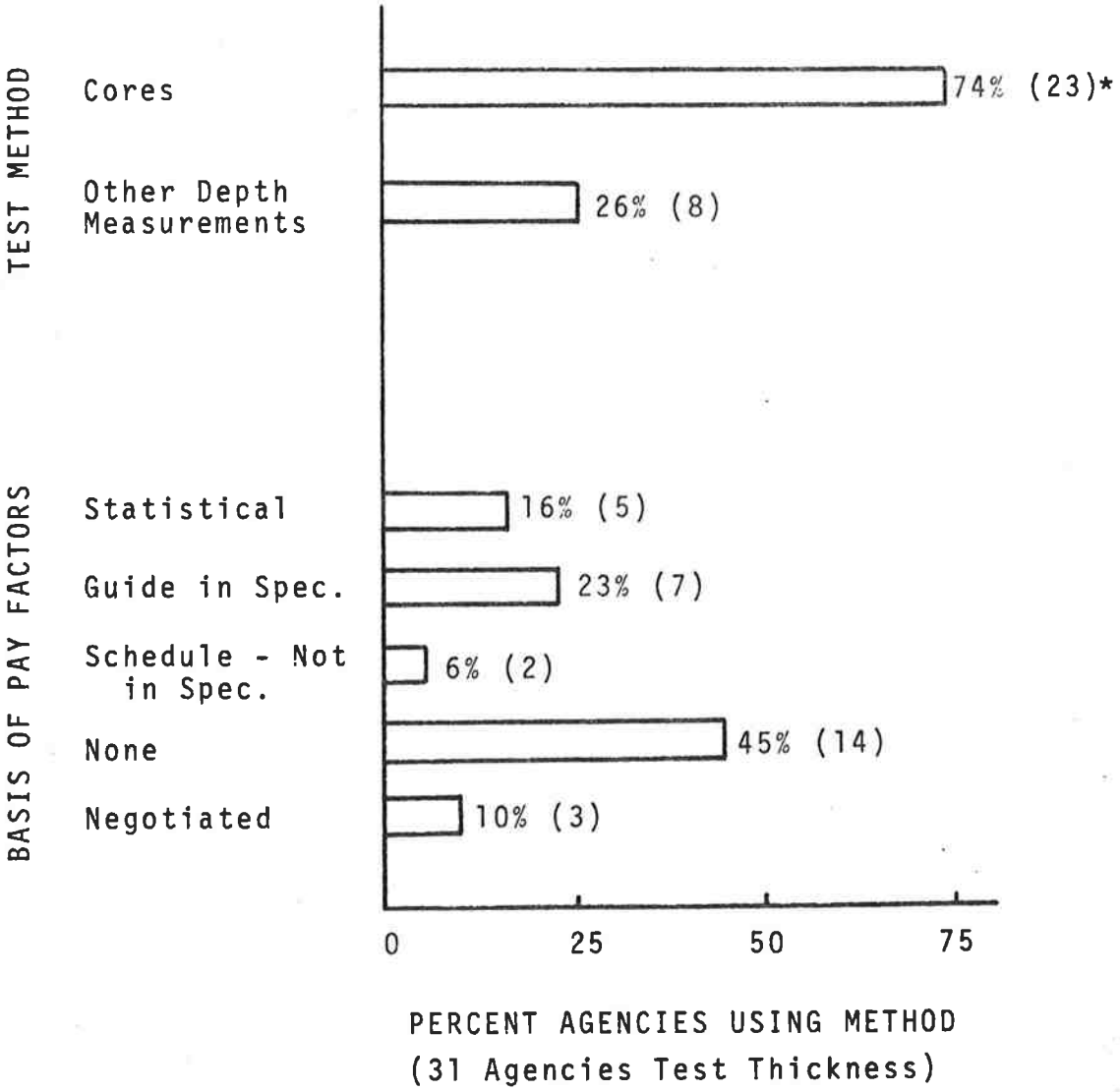
*Number in parentheses is number of agencies
**Acceptance of some items without pay adjustment and some items with pay adjustment

Figure 1. Acceptance of Construction Work and Materials That do not Satisfy Specification Requirements



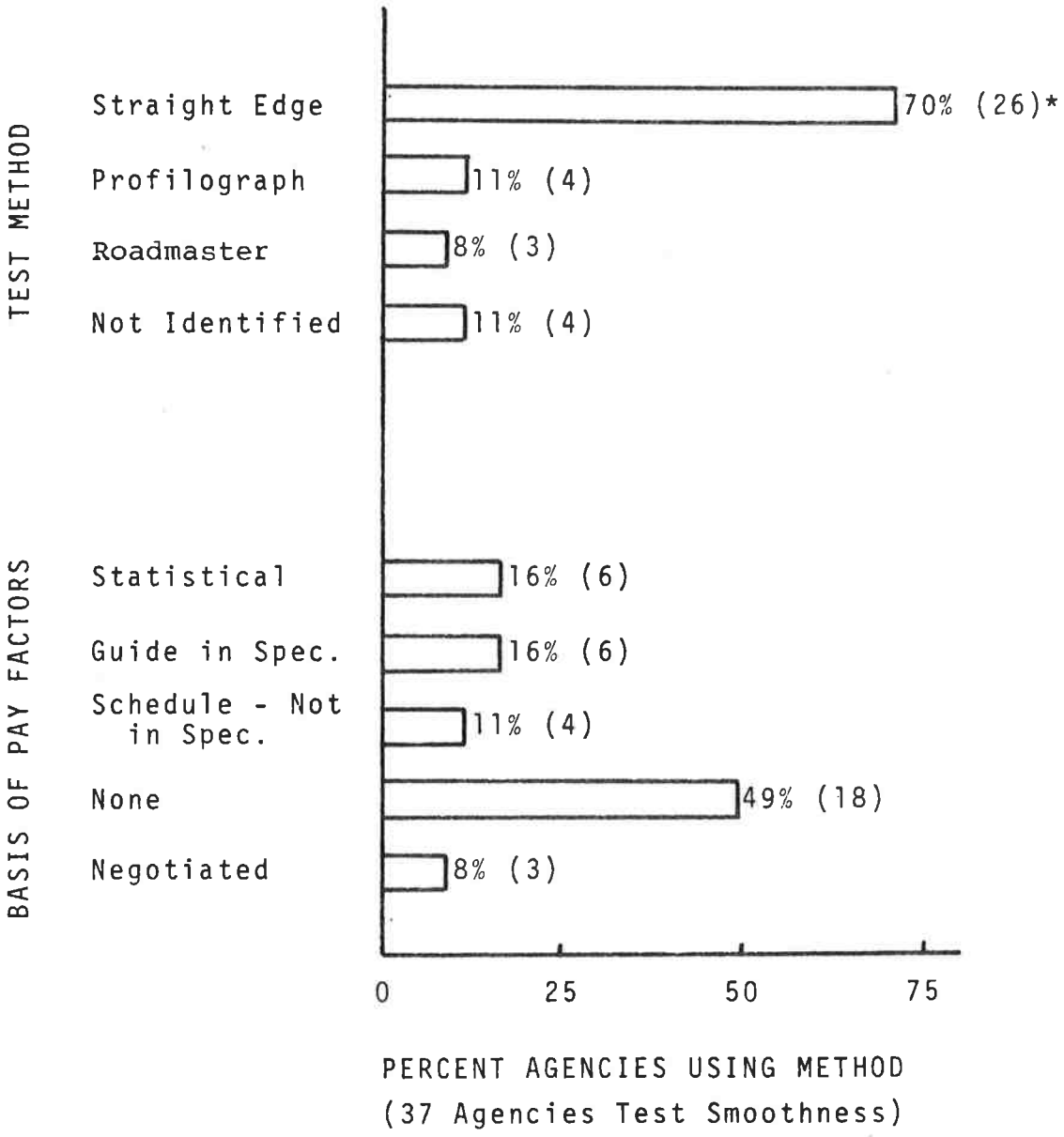
* Number in parentheses is number of agencies

Figure 2. Properties Tested to Evaluate the Acceptability of an Asphaltic Pavement



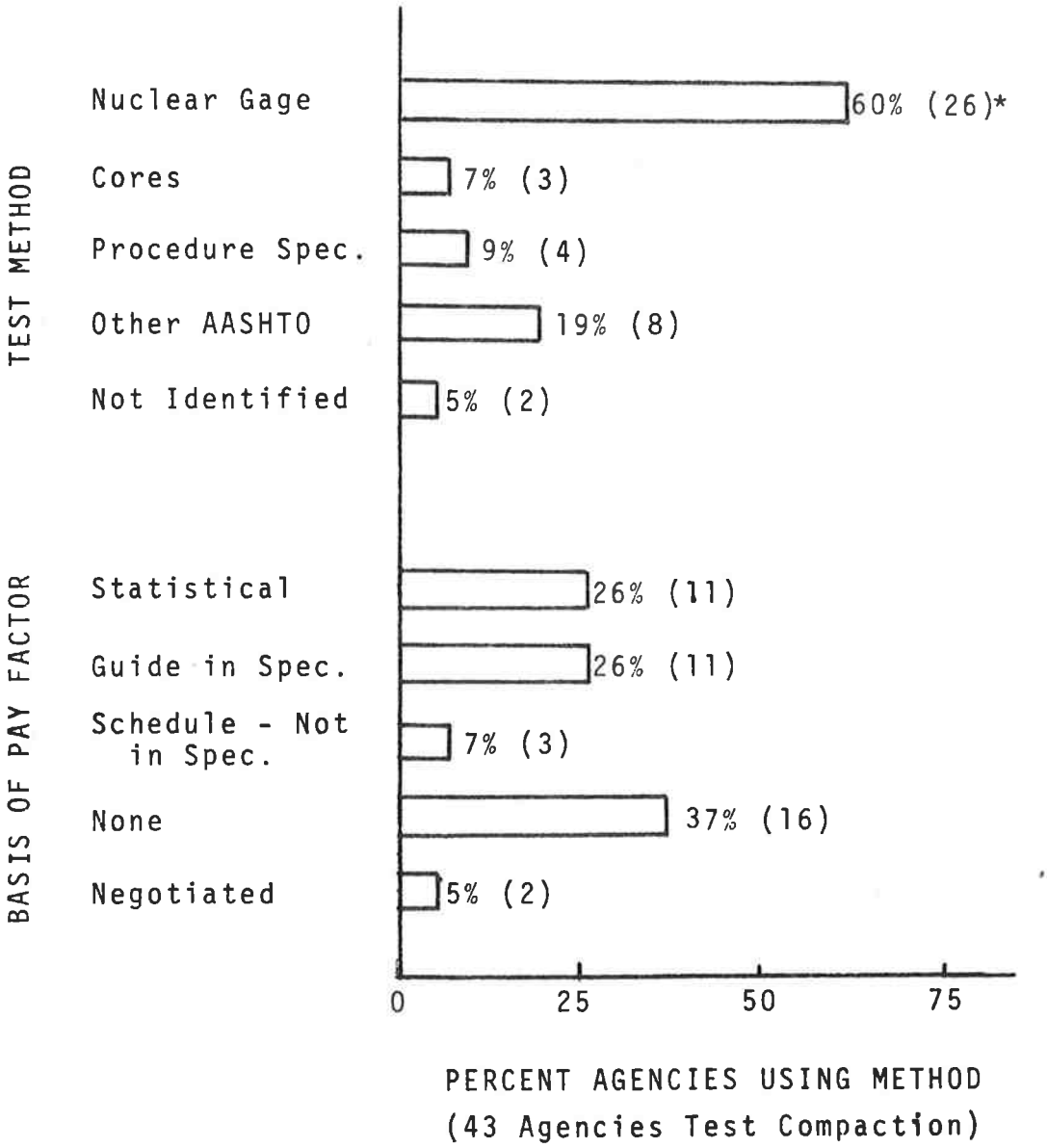
* Number in parentheses is number of agencies

Figure 3. Requirements for Pavement Thickness



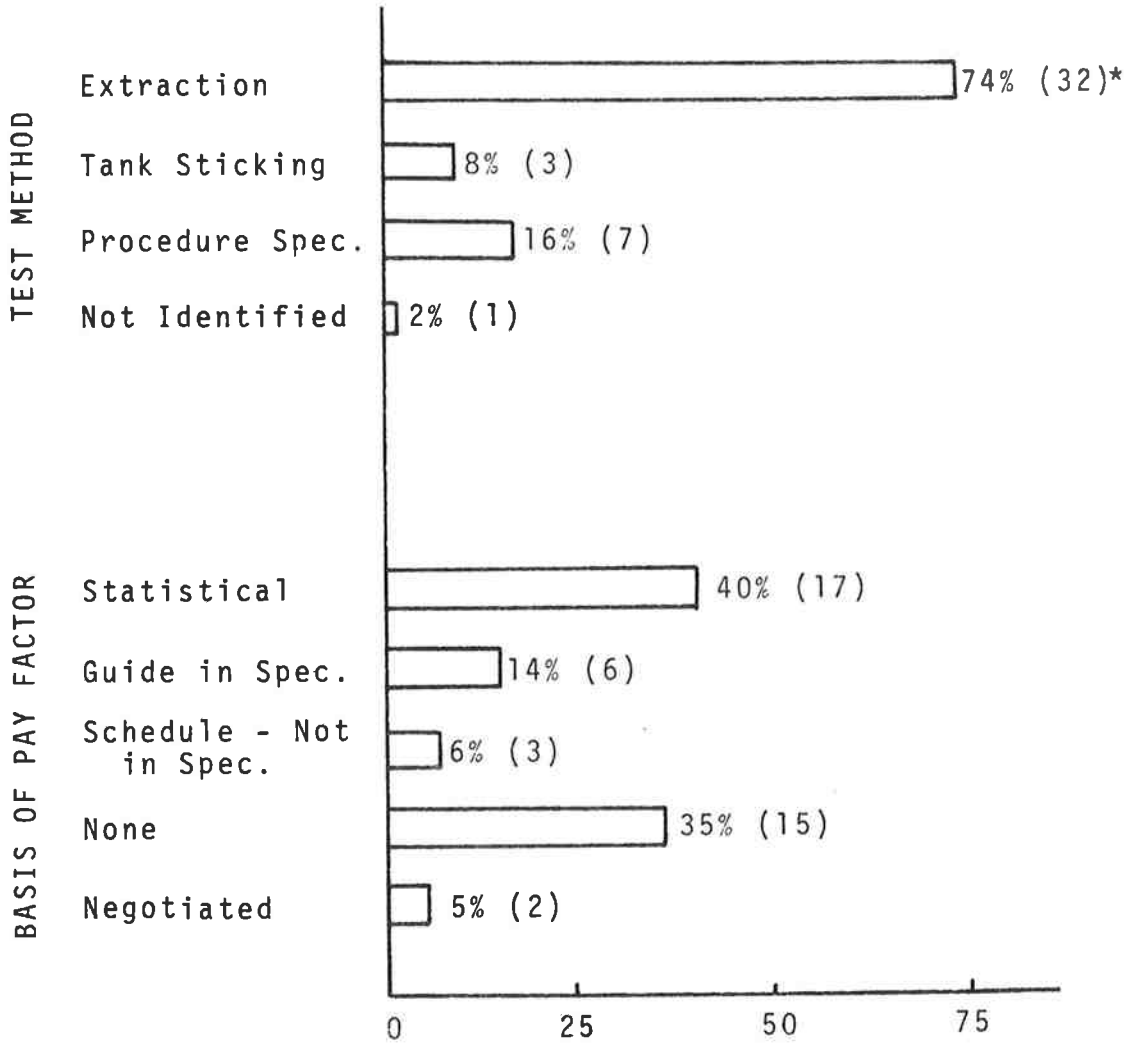
* Number in parentheses is number of agencies

Figure 4. Requirements for Smoothness of Pavement



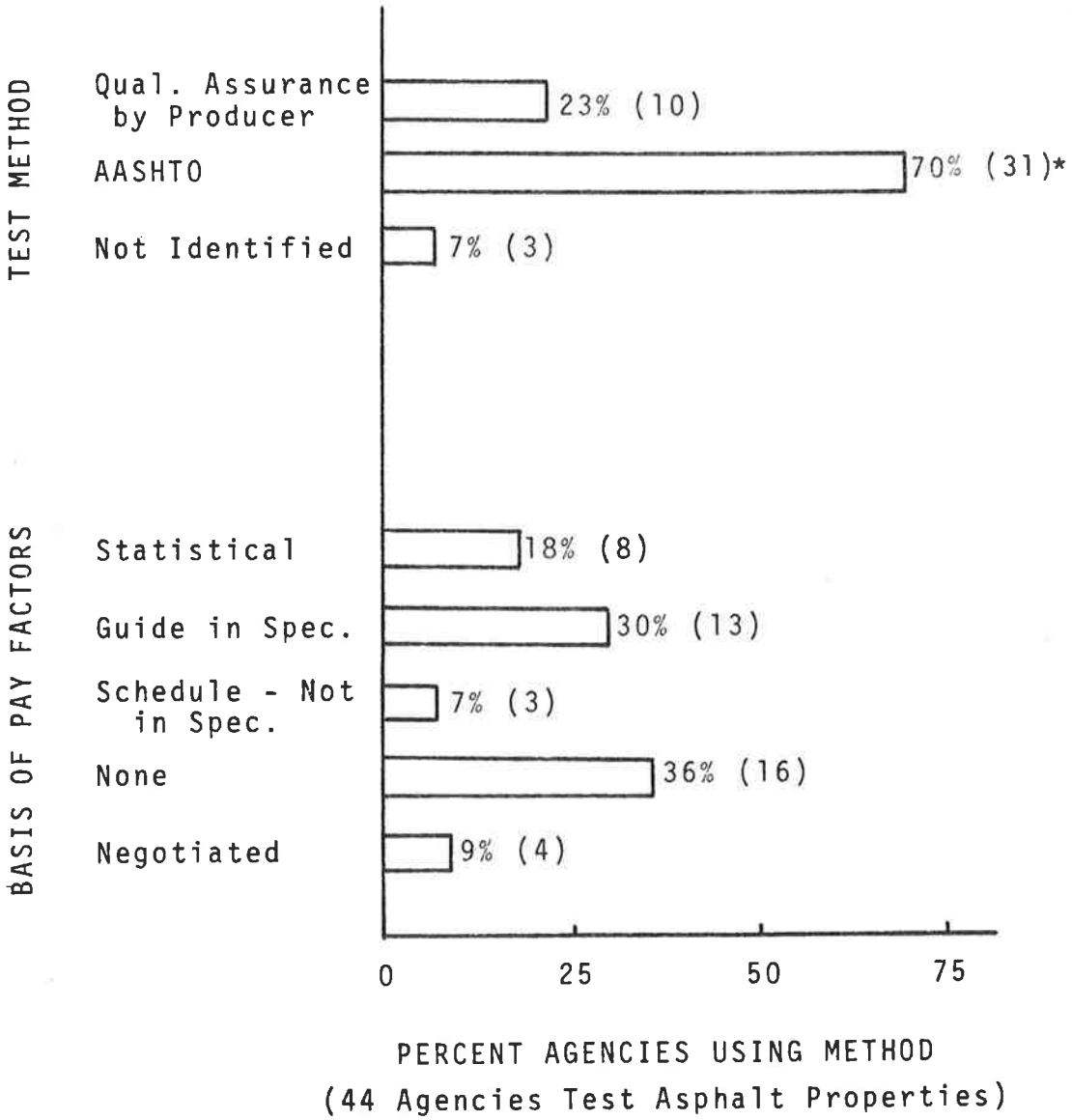
* Number in parentheses is number of agencies

Figure 5. Requirements for Compaction



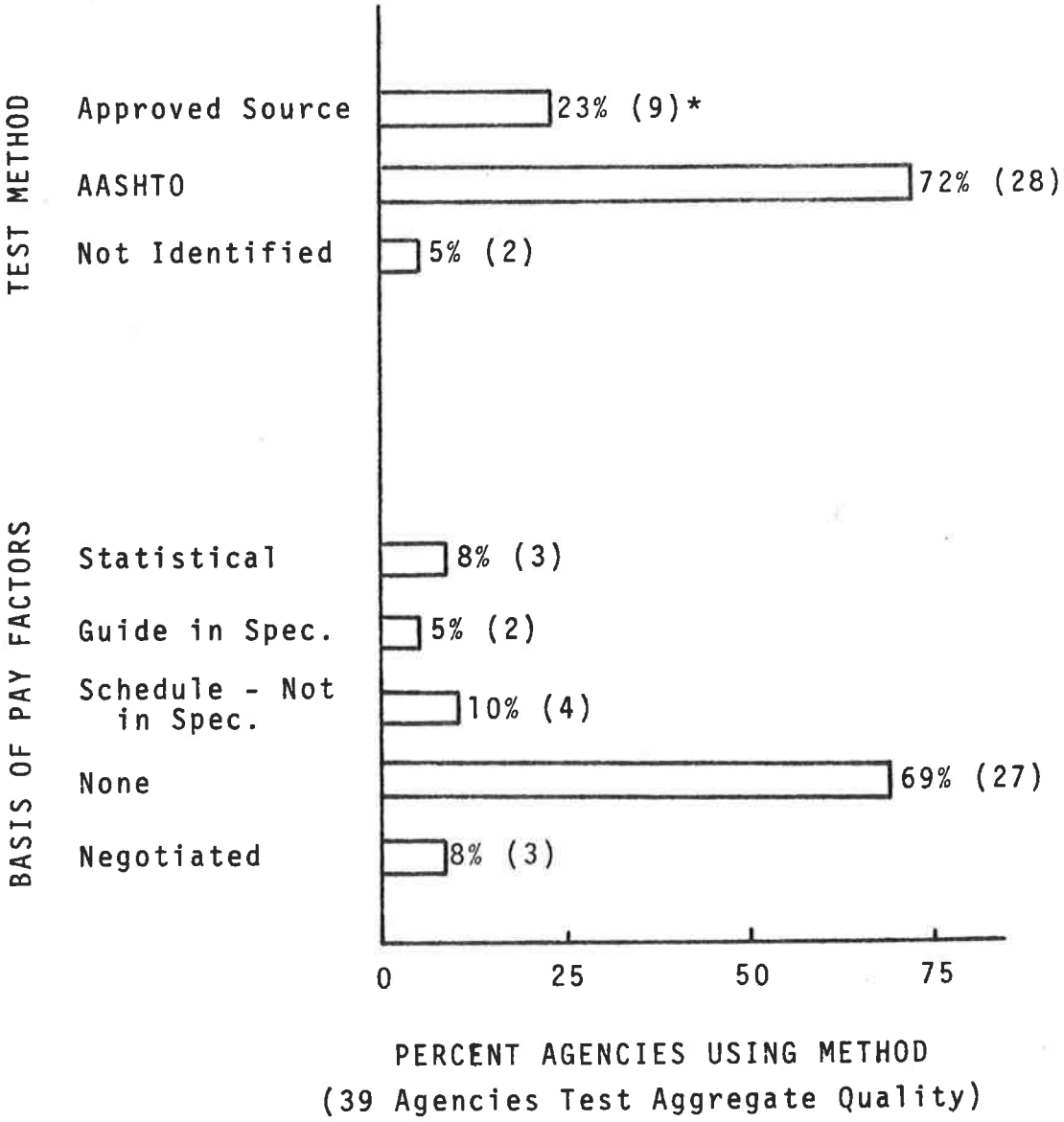
* Number in parentheses is number of agencies

Figure 5. Requirements for Asphalt Content



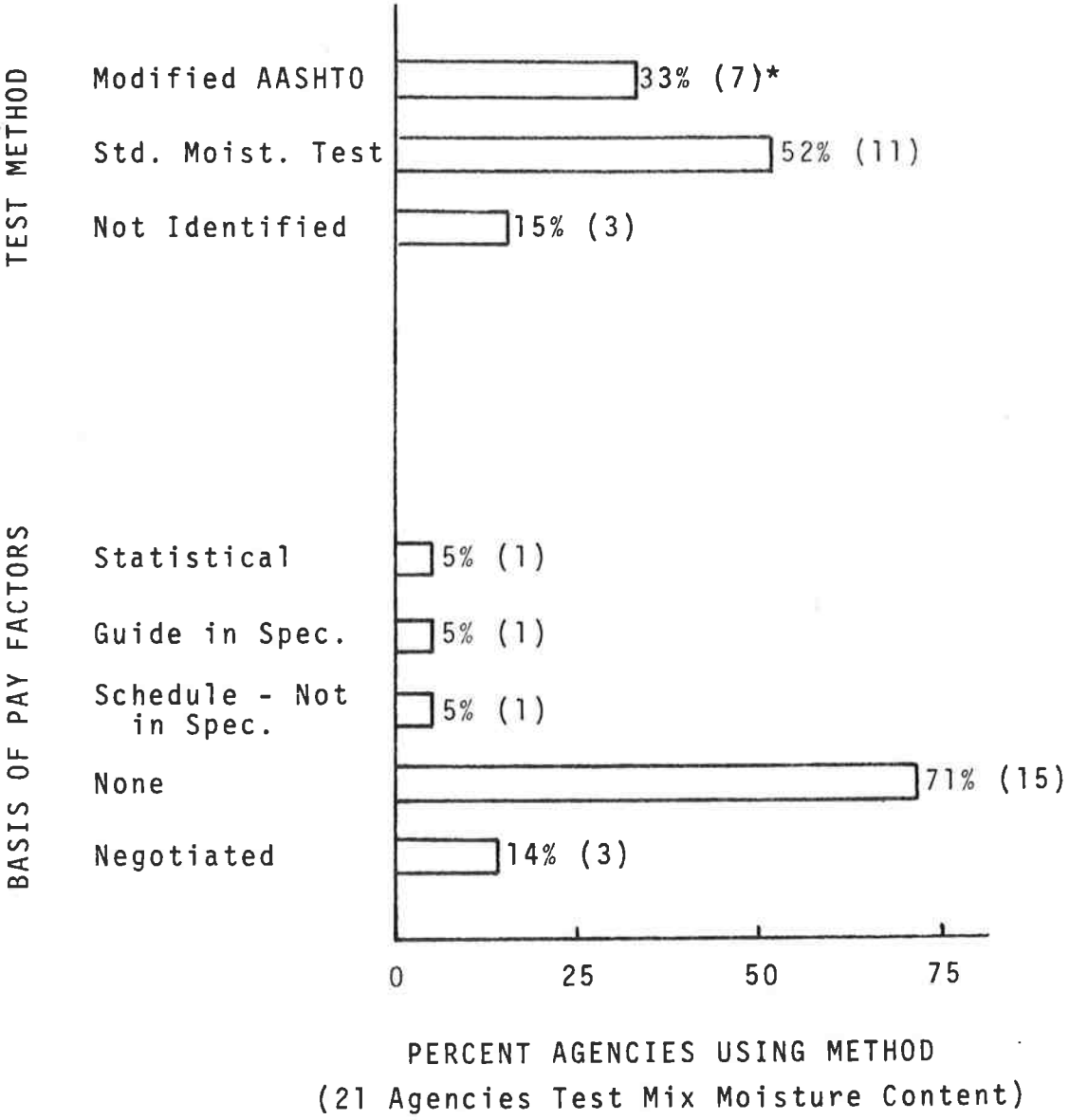
* Number in parentheses is number of agencies

Figure 7. Requirements for Asphalt Properties



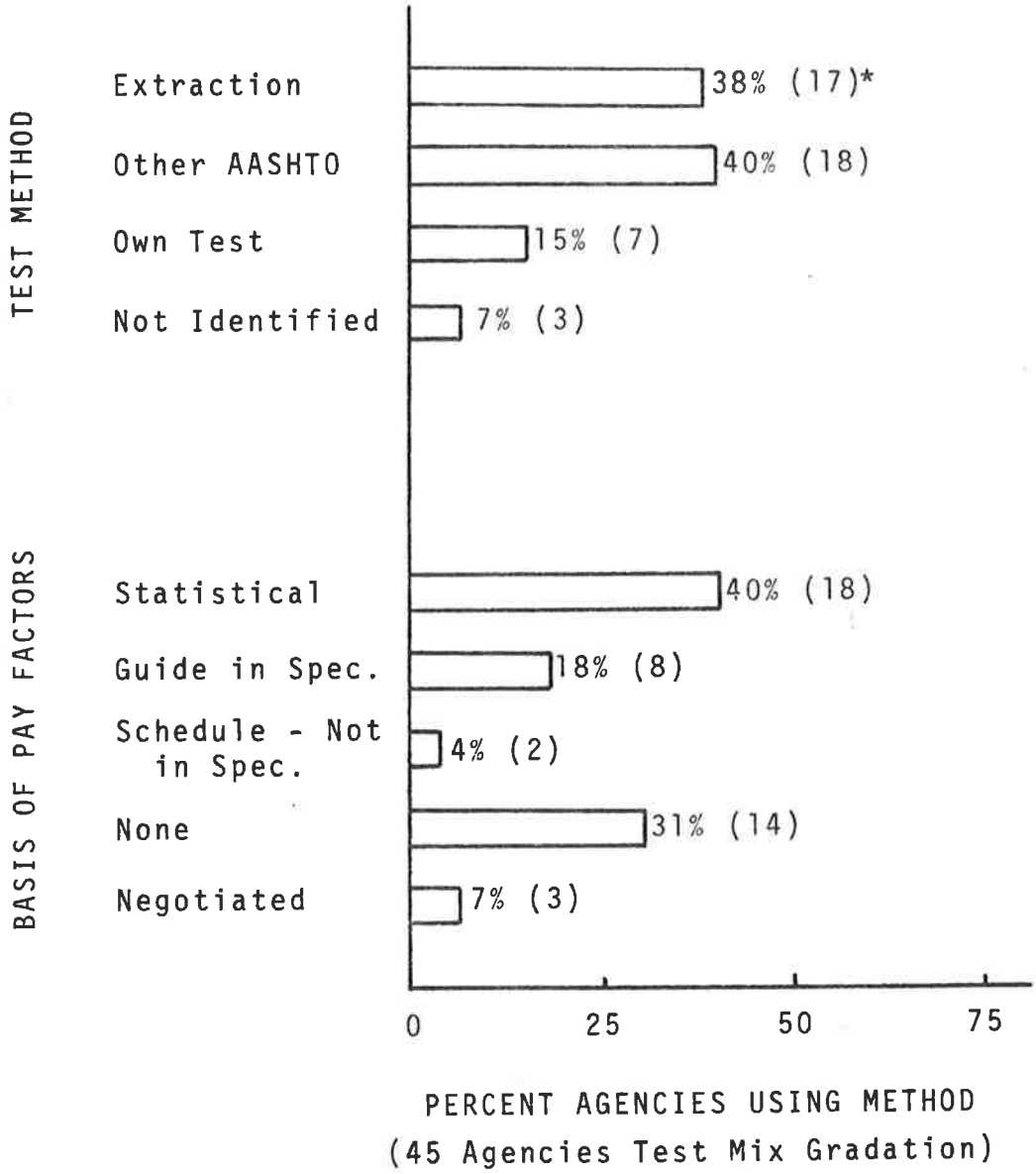
* Number in parentheses is number of agencies

Figure 8. Requirements for Aggregate Quality



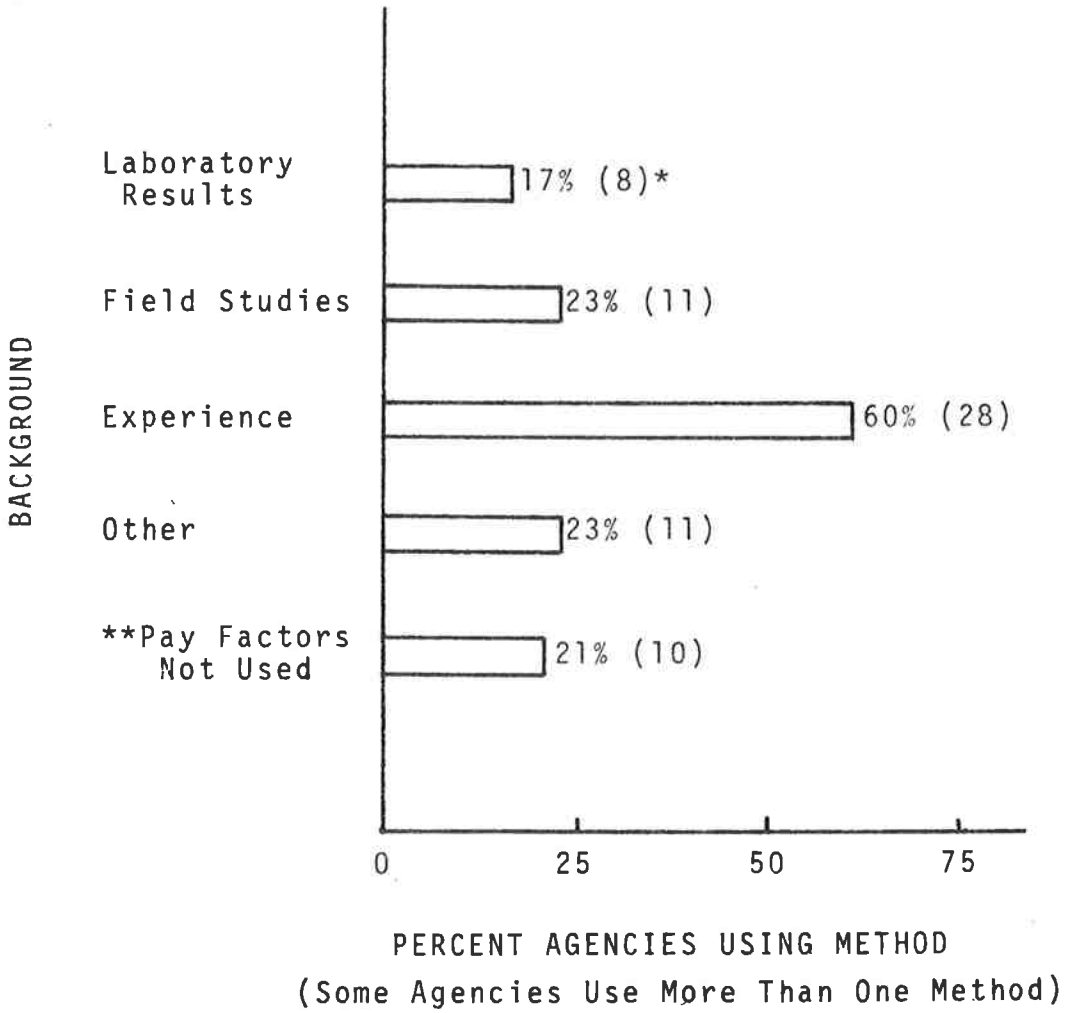
* Number in parentheses is number of agencies

Figure 9. Requirements for Mix Moisture Content



* Number in parentheses is number of agencies

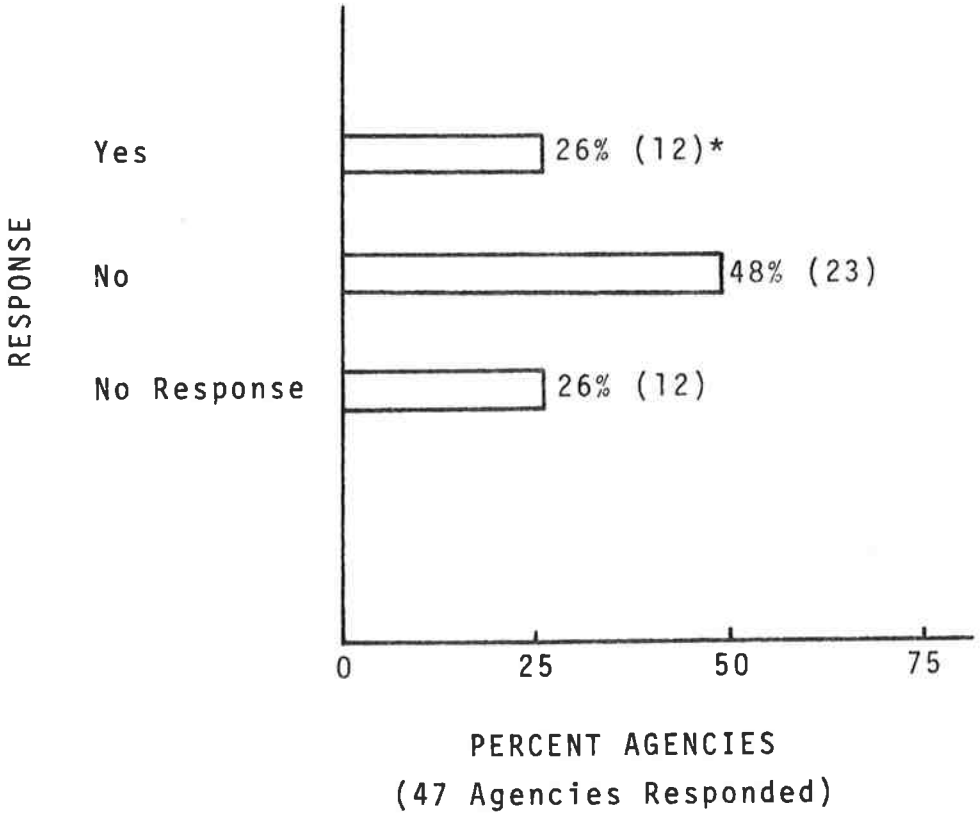
Figure 10. Requirements for Gradation of Mix



* Number in parentheses is number of agencies

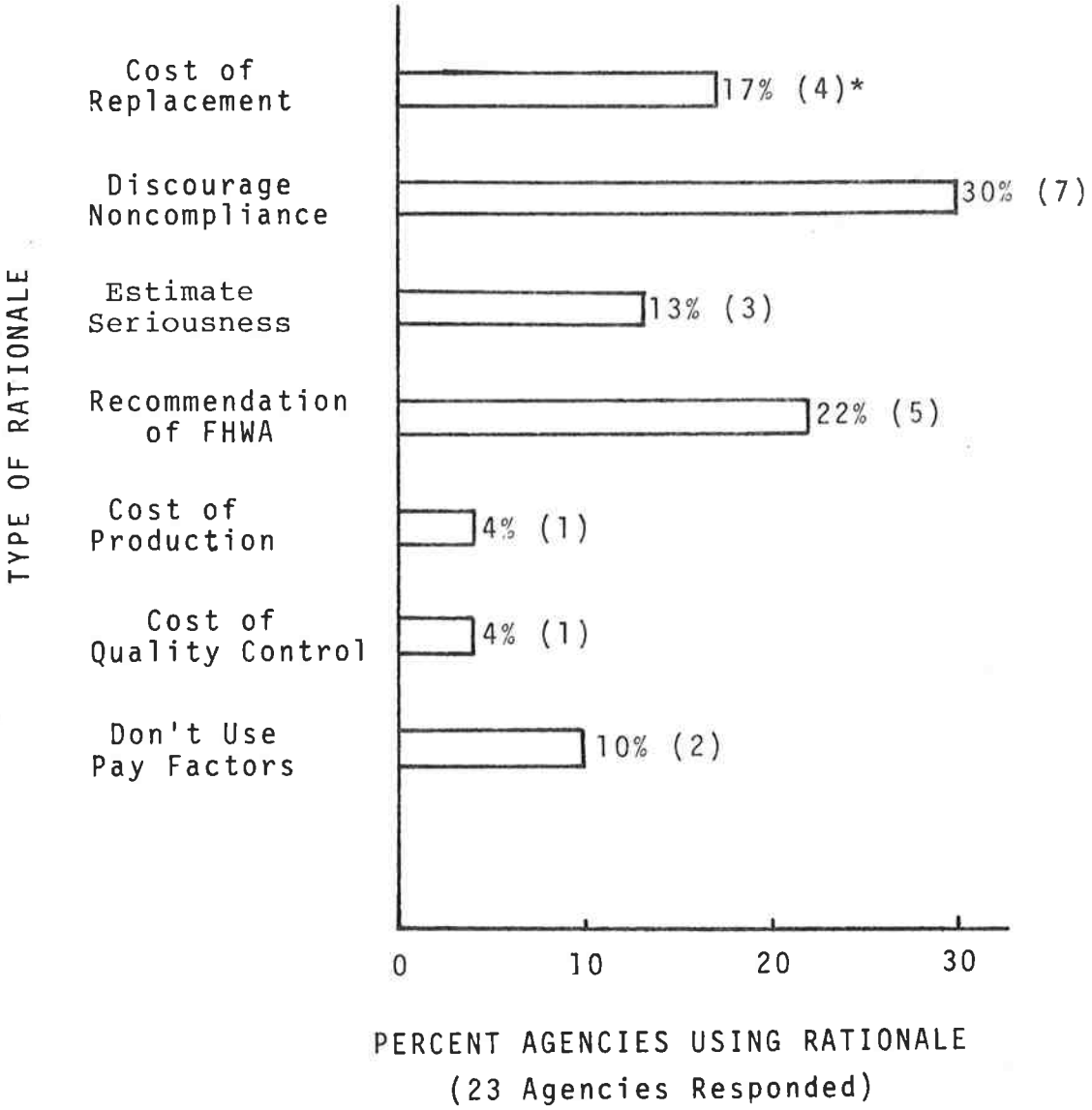
** Part of these occasionally have adjusted payment on negotiated basis

Figure 11. Predominent Method for Establishing Pay Factors



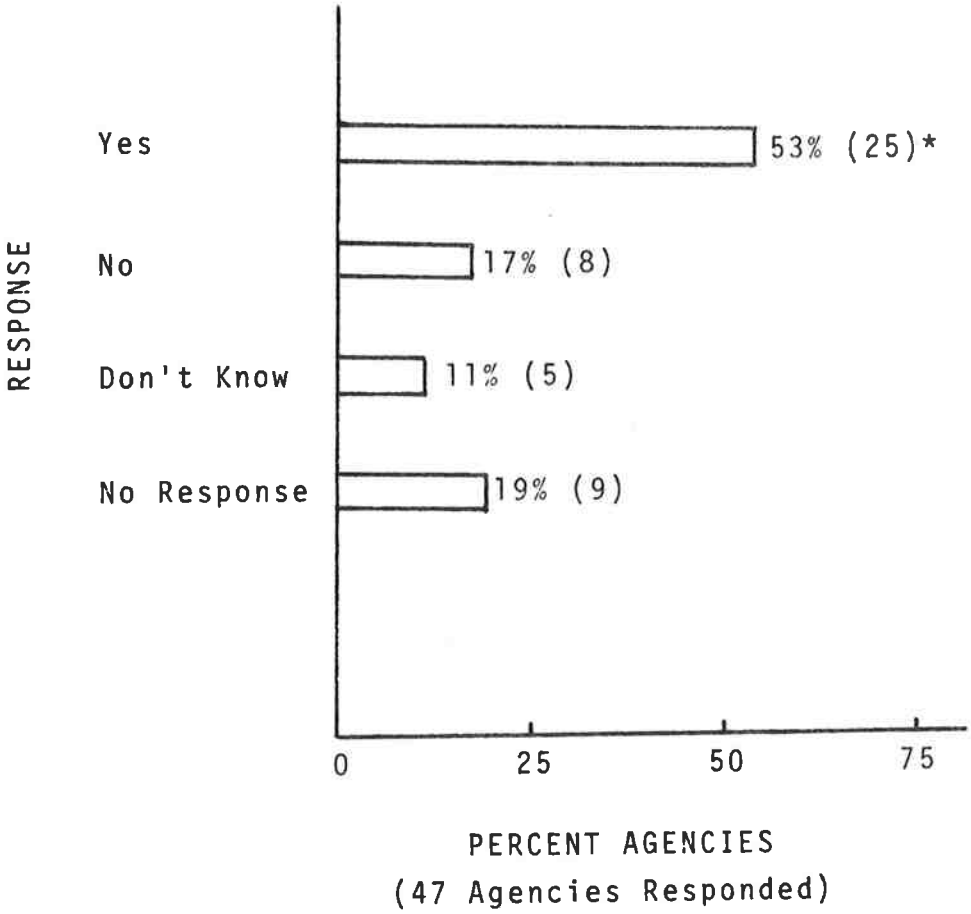
* Number in parentheses is number of agencies

Figure 12. Pay Adjustment Proportional to Reduced Pavement Serviceability



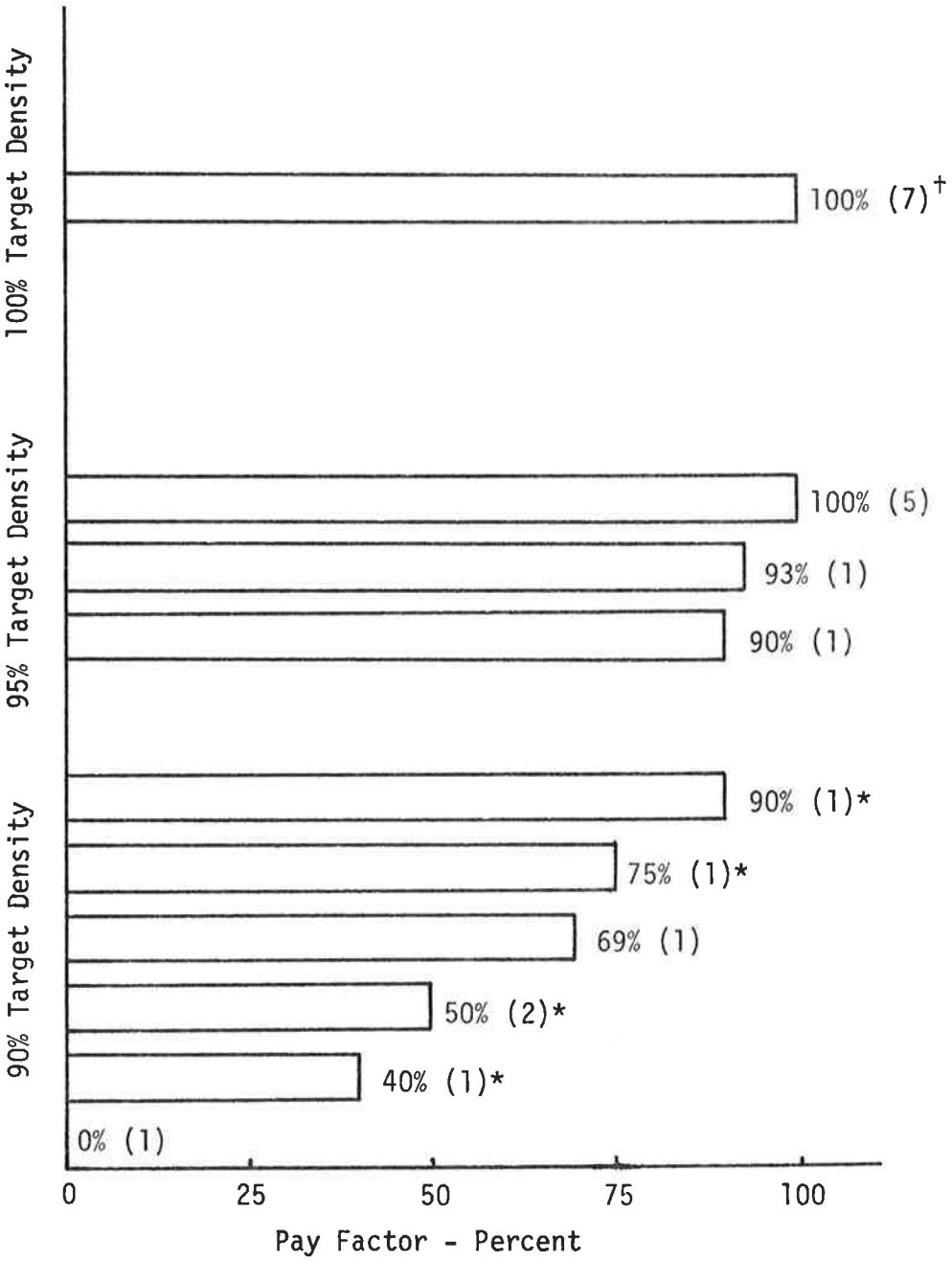
* Number in parentheses is number of agencies

Figure 13. Other Rationale For Determining Pay Factors



* Number in parentheses is number of agencies

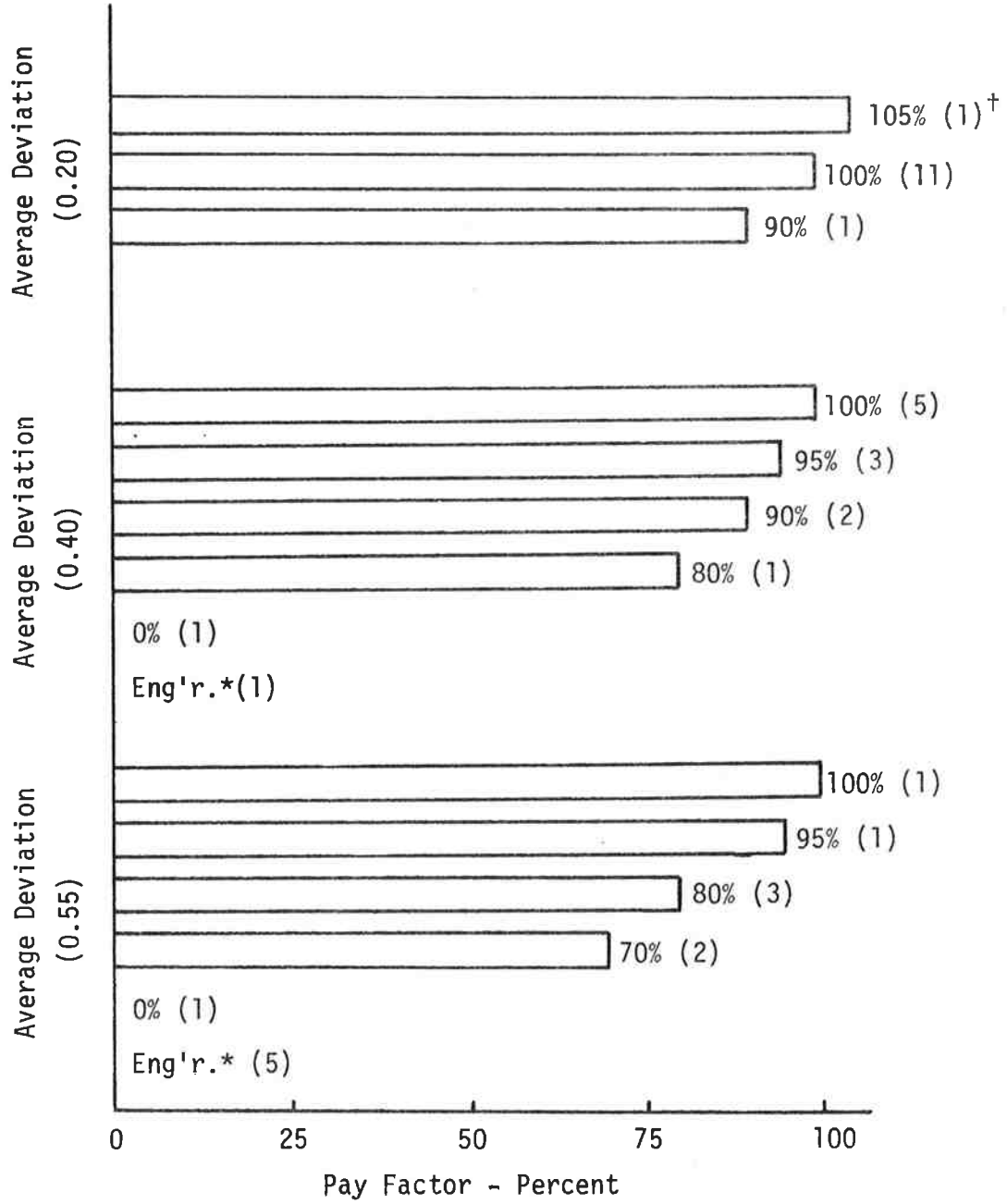
Figure 14. Pay Factors are Effective



† Number in parentheses indicates the number of agencies

* Project Engineer makes decision on acceptance at reduced pay or total rejection of asphalt concrete.

Figure 15: Comparison of Compaction Pay Factors for Seven States at Percent of Target Density of 100, 95, and 90



† Number in parentheses indicates the number of agencies.

* No pay factor given for large deviations. Options available to the agencies include total rejection or partial payment as determined by the Project Engineer.

Figure 16: Comparison of Asphalt Content Pay Factors for Thirteen States at an Average Deviation From Job Mix of 0.20, 0.40, and 0.55.

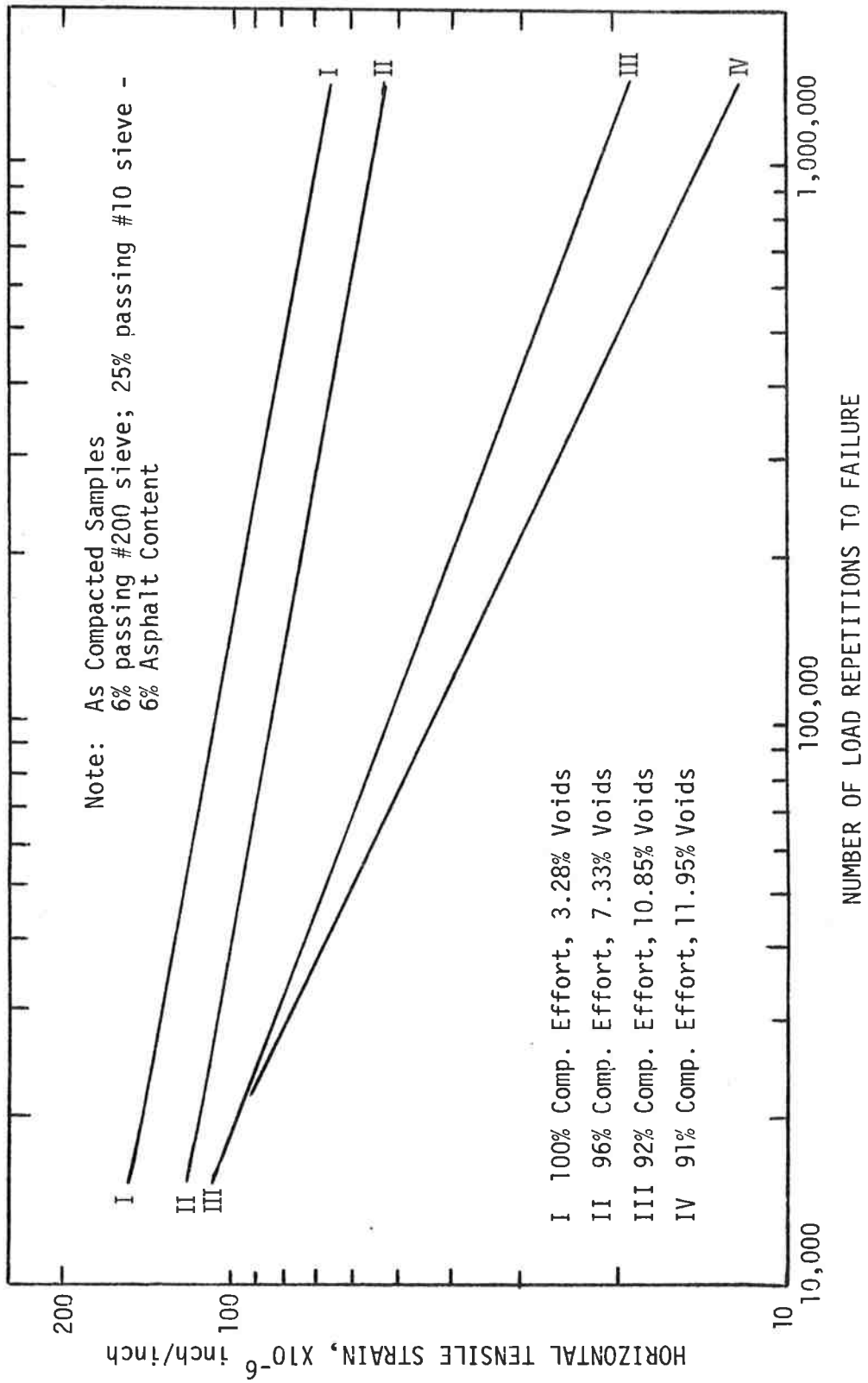


Figure 17: Influence of Mix Density on Fatigue Life