ATTACHMENT C

A1080230

Orange County
PMS Standardization Recommendations

Submitted to
Orange County Transportation Authority
550 South Main Street
Orange, California
92863-1584

Submitted by
Nichols • Vallerga & Associates
16052 Beach Boulevard, Suite 214
Huntington Beach, California
92647

25 ches
1 county
- 25 total

TABLE OF CONTENTS

INTRODUCTION

Orange County Transportation Authority (OCTA), through Nichols • Vallerga and Associates (NV&A) of Huntington Beach, recently completed the *Countywide Pavement Condition Assessment Study*. One of the study's objectives was to work with local agencies to recommend improvements to current pavement management plan procedures.

The report submitted to OCTA in March, 1998 recommended that agencies within Orange County should standardize the way pavement condition is assessed (including the types of data collected and the way pavement condition surveys are performed) as well as standardize basic reporting. To assist agencies in this regard, OCTA contracted NV&A to continue the work as recommended in the *Countywide Pavement Condition Assessment Study* final report. In particular NV&A was contracted to:

- Develop an inventory of systems currently used by agencies within Orange County;
- Identify information currently collected by agencies for pavement management system purposes;
- Identify minimum information needed for a implementing a pavement management system;
- Recommend options for standardizing data collection and assessment and basic reporting; and
- Identify and assess currently available pavement management system software packages.

This report provides details regarding these activities as well as standardization recommendations.

AGENCY SURVEY

Survey Overview

To determine what software package each agency is using, if any, and what information is currently being collected for PMS purposes NV&A developed, in collaboration with OCTA staff, a comprehensive questionnaire that was sent to each agency in Orange County (See Appendix A). The information that was requested included:

- Software package in use (e.g., Micro PAVER, MTC, etc.) and version as well as database type/file format (e.g., dBase, Access, FoxPro, etc.), reporting capabilities, export capabilities, etc.;
- Information currently collected including, but not limited to:
  1. Pavement section parameters (e.g., length, width, area, traffic level, functional classification, pavement surface type, pavement structure, etc.);
  2. Field data collected to determine condition (e.g., surface distress, ride quality, non-destructive testing, etc.);
  3. How condition index is determined. Is the condition index based solely on surface distress or are other parameters such as ride quality also included?;

4. Basis for determining a qualitative description of pavement condition (e.g., very good, good, fair, etc.).

In total, 29 agencies responded to the questionnaire. A summary of the findings are provided in Appendix B and narrated below.

Survey Results

Only one of the 29 agencies that responded to the questionnaire indicated that they do not use software for the purposes of pavement management. The survey results indicate that nearly half (14 of 29) of responding agencies use proprietary software for pavement management whereas a few use in-house systems (i.e., spreadsheets), and nearly one-third (9 of 29) use non-proprietary software (i.e., Micro PAVER or MTC). Nineteen of 23 agencies indicated that their system could export data to an ASCII format file.

Regarding the types of distresses collected during pavement condition surveys of asphalt concrete pavements, 27 agencies responded. Two-thirds of these (18) include alligator/fatigue cracking, longitudinal cracking, block cracking, edge cracking, transverse cracking, rutting, bleeding/flushing, raveling/weathering, and patching/utility cuts. Over half of the responding agencies also collect slippage cracking (15), depressions (16), and shoving (14). Less than half of the responding agencies collect corrugations (12), polished aggregate (9) and only a few responding agencies collect reflection cracking (3), shrinkage cracking (1), surface texture (2), bumps/sags (2), railroad crossings (2), lane/shoulder drop-off (2), swelling (2), excessive crown (1), and map cracking (1).

Regarding the types of distresses collected during pavement condition surveys of portland cement concrete pavements, 9 agencies responded. All of these (9) include longitudinal and transverse cracking and more than one-half include durability cracking (6), corner breaks (6), joint sealant damage (7), joint spalling (7), patching/utility cuts (8), faulting (7), popouts (7), shrinkage cracking, blowups (5), scaling (5), polished aggregate (5), settlement/punchouts (5), and shattered slab (5). Less than half include map cracking (4), pumping (4), divided slab (1), and raveling/distortion (1).

In addition to the above distresses, two agencies also include surface texture, 15 agencies include a ride/comfort index, five agencies include a drainage index, and one agency includes wavy pavement, specific crack location, skid resistance, structural adequacy, and deflection testing as additional information for rating pavement performance.

Asked how these data are collected, six agencies indicated manual surveys only, 12 agencies indicated windshield surveys only, four agencies indicated both manual and windshield surveys, 2 agencies use a manual plus automated method, and two agencies use fully automated surveys.

In one question of the survey agencies were asked to rank specific features of pavement management software. The features indicated in the questionnaire were based on common

features provided by many PMS software programs as well as input from the Steering Committee. Agencies were asked to use a value of one (1) to represent most important and greater values to represent lesser importance. Agencies were also instructed to indicate those features being "not important" by assigning a value of zero (0) to the feature. The values provided by the 26 agencies that responded to the question were averaged and are provided in Table 1. Values equal to zero (0) were not included in the mean but are noted.

Table 1. Agency Ranking of Importance of PMS Software Features.

PMS Software Feature	Rank (Mean of Values Provided by Agencies)	Number of Agencies Indicating "Not Important"
Ease of use/operation	1 (1.7)	0
Ease of startup/ implementation	2 (2.9)	0
Ability to configure as desired	3 (4.4)	1
Technical support	4 (5.0)	0
Stability of software/ product support	5 (5.1)	0
Cost	6 (5.2)	0
Windows 95/Windows NT compatibility/ 32-bit architecture	7 (5.3)	0
Ability to link to GIS	8 (5.5)	1
Public domain software	9 (6.4)	7
Ability to include "roadway furniture"	10 (6.9)	0
User group meetings	11 (8.4)	7

The results indicate that, on average, agencies within Orange County regard ease of use/ operation, ease of startup/implementation, and ability to configure as desired as being the top three features, respectively, of PMS software packages. This is not surprising but it should be noted that being provided with the ability to configure the software as desired usually means that ease of startup/implementation is made more difficult. However, the results also indicate that cost is ranked as sixth out of a possible eleven which may indicate that the financial burden of

startup/implementation is regarded as part of the cost of purchasing the software package (i.e., the software vendor is made responsible for implementing the software package). Also, it is interesting to note that one agency regarded the ability to configure the software as desired as being not important.

Based on the results, technical support is also quite important, on average, to agencies in Orange County. Most software vendors charge a fee for such a service in terms of a service contract or an annual subscription fee; the former preferred by vendors of proprietary software, the latter preferred by vendors of public domain software. However, this feature also ranks, on average, as being of greater importance to cost. This most likely indicates that agencies are willing to pay an extra fee for technical support but does not indicate how much extra agencies are willing to pay. However, it should be noted that the cost of technical support service contracts can be substantial.

It is also interesting to note that, on average, agencies in Orange County regard stability of software/product support as being more important than cost, but only marginally so. This most likely indicates that agencies want a product that they can rely on and are willing to pay a bit extra for it. In other words, this may indicate a collective mentality of "you get what you pay for."

The ability of the PMS software package to be Windows 95/Windows NT/32-bit architecture was not, on average, regarded by agencies in Orange County as being as important as those features previously mentioned. However, this feature was ranked closely behind cost, stability of software/product support, and technical support, respectively.

The ability to link the database to a geographical information system (GIS) was also not regarded, on average, as being as important as those features previously mentioned. However, this feature was ranked closely behind Windows 95/Windows NT/32-bit architecture, cost, stability of software/product support, and technical support, respectively.

The results also indicate that, on average, public domain software, ability to include roadway furniture, and user group meetings are of least importance, respectively, to Orange County agencies.

PMS SOFTWARE

NV&A identified and objectively compared currently available PMS software packages as candidates for use by Orange County agencies. Comparison of the software included factors such as software cost, proprietary versus public domain, technical support, analysis methodology, and capabilities. The purpose of this assessment was to provide OCTA with a concise and objective comparison of available PMS software packages such that selection of a particular package could be made on an objective basis. A summary of this comparison is provided in Appendix C.

RECOMMENDATIONS

The ultimate goal of this project is to provide recommendations for standardizing the way agencies collect and assess data for the purposes of determining pavement condition throughout the County as well as to provide recommendations for standardizing the way these are reported. The following recommendations are made for consideration by OCTA Staff, the Steering Committee members, and Technical Advisory Committee members.

Data Collection

To assess the surface condition of any pavement, the type, severity, and extent of distresses present are needed. Thus, standardizing the way data is collected involves standardizing what types of distresses are to be considered, how severity of the distresses are determined, and how the extent (or quantity) of the distresses are determined.

Distress Types

Figure 1 shows the types of asphalt pavement distresses collected by the agencies in Orange County as well as the number of agencies (out of 27 who responded to the survey question) that collect each type of distress. Assuming these results represent the entire County, the majority of agencies collect the distresses listed in Table 2. Thus, based on these results, it is recommended that all agencies in Orange County collect at a minimum the distresses listed in Table 2 for asphalt pavements.

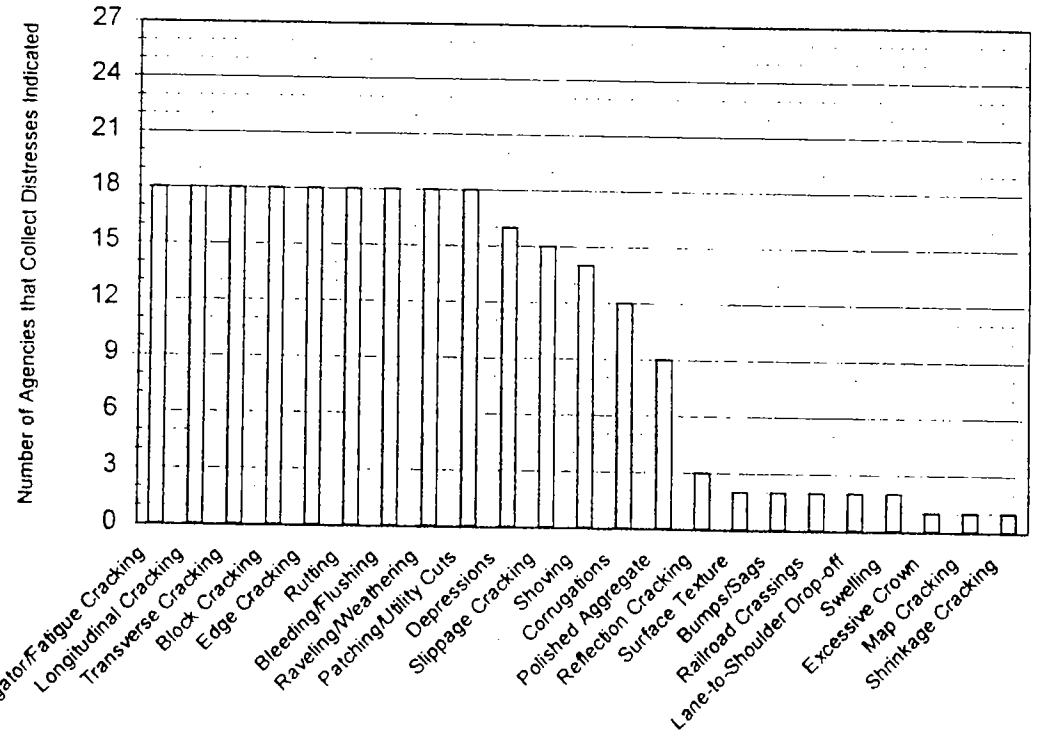


Figure 1. Number of agencies that collect the distresses indicated for asphalt pavements.

Table 4. Recommended Criteria for Determining Severity Levels and Extent of Distresses in Asphalt Pavements.

Distress Type	Low Severity	Moderate Severity	High Severity
Alligator/ Fatigue Cracking	An area of cracks with no or only a few interconnecting cracks. Cracks are not spalled. Pumping is not evident.	An area of interconnected cracks forming a complete pattern. Cracks may be lightly spalled or sealed. Pumping is not evident.	An area of moderately or severely spalled, interconnected cracks forming a complete pattern. Pieces may move when subjected to traffic. Cracks may be sealed. Pumping may be evident.
How to measure extent: Measured in square feet of surface area affected. If two or more severity levels exist and can be easily distinguished, they should be recorded separately. If they cannot be easily distinguished, the entire area should be rated at the highest severity present.			
Longitudinal/ Transverse Cracking	A crack with a mean width ≤3/8 in.; or a sealed crack of any width with sealant material in good condition.	Any non-filled crack with a width between 3/8 and 3 in.; or a non-filled crack with any width up to 3 in. surrounded by light and random cracking.	Any crack filled or non-filled surrounded by medium- or high-severity random cracking; or a non-filled crack > 3 in.; or a crack of any width where a few inches of pavement around the crack are severely broken.
How to measure extent: Measured in linear feet. Length and severity of each crack should be recorded. If crack has more than one severity, each portion of the crack should be recorded separately.			
Block Cracking	Blocks are defined by low-severity cracks. (Refer to Longitudinal/Transverse cracking definitions).	Blocks are defined by medium-severity cracks. (Refer to Longitudinal/ Transverse cracking definitions).	Blocks are defined by high-severity cracks. (Refer to Longitudinal/ Transverse cracking definitions).
How to measure extent: Measured in square feet of surface area affected. Usually occurs at one severity level in a given pavement section; however, any areas of the pavement section having distinctly different levels of severity should be measured and recorded separately.			
Edge Cracking	Low or medium cracking with no breakup or raveling.	Medium cracks with some breakup and raveling.	Considerable breakup or raveling along the edge.
How to measure extent: Measured in linear feet of length of pavement affected.			
Rutting	Mean Rut Depth between 1/4 in. and 1/2 in.	Mean Rut Depth between 1/2 in. and 1 in.	Mean Rut Depth > 1 in.
How to measure extent: Measured in square feet of surface area affected and its severity is determined by the mean depth of the rut.			

Table 4. Recommended Criteria for Determining Severity Levels and Extent of Distresses in Asphalt Pavements (Continued).

Distress Type	Low Severity	Moderate Severity	High Severity
Bleeding/ Flushing	Bleeding has occurred only to a very slight degree and is noticeable only during a few days of the year. Asphalt does not stick to shoes or vehicles.	Bleeding has occurred to the extent that asphalt sticks to shoes and vehicles during only a few weeks of the year.	Bleeding has occurred extensively and considerable asphalt sticks to shoes and vehicles during at least several weeks of the year.
How to measure extent: Measured in square feet of surface area affected. If bleeding is counted, polished aggregate should not be counted.			
Raveling/ Weathering	The aggregate or binder has begun to wear away but has not progresses significantly. Some loss of fine aggregate.	Aggregate and/or binder has worn away and the surface texture is becoming rough and pitted; loose particles generally exist; loss of fine aggregate and some loss of coarse aggregate.	Aggregate and/or binder has worn away considerably and the surface texture is very rough and severely pitted; pitted areas are <4 in. in diameter and <1/2 in deep; loss of coarse aggregate.
How to measure extent: Measured on square feet of surface area affected.			
Patching/Utility Cuts	Patch/utility cut possesses low severity distresses of any type.	Patch/utility cut possesses moderate severity distresses of any type.	Patch/utility cut possesses high severity distresses of any type.
How to measure extent: Measured in square feet of surface area affected. If a single patch has areas of differing severity, these areas should be measured and recorded separately. No other distresses are recorded within a patch.			

Table 5. Recommended Criteria for Determining Severity Levels and Extent of Distresses in PCC Pavements.

Distress Type	Low Severity	Moderate Severity	High Severity
Longitudinal/ Transverse Cracking (Non-reinforced slabs)	Non-filled cracks ≤ 1/2 in. or filled cracks of any width with filler in satisfactory condition. No faulting exists.	One of the following conditions exist: 1) Non-filled crack between 1/2 and 2 in. 2) Non-filled crack of any width up to 2 in. with < 3/8 in. of faulting or 3) Filled crack of any width with > 3/8 in. of faulting.	One of the following conditions exist: 1) Non-filled crack with a width > 2 in. 2) Filled or non-filled crack of any width with >3/8 in. faulting.

How to measure extent: Once the severity has been identified, the distress is recorded as one slab. If two medium-severity cracks are within one slab, the slab is counted as having one high-severity crack. Slabs divided into 4 or more pieces are counted as divided slabs. In reinforced slabs, cracks < 1/8 in. wide are counted as shrinkage cracks. Slabs longer than 30 ft are divided into approx. equal length "slabs" having imaginary joints assumed to be in perfect condition.

Longitudinal/ Transverse Cracking (Reinforced slabs)	Non-filled cracks 1/8 to 1 in. wide; filled crack of any width with the filler in satisfactory condition. No faulting exists.	One of the following conditions exist: 1) Non-filled crack between 1 and 3 in. 2) Non-filled crack of any width up to 3 in. with < 3/8 in. of faulting or 3) Filled crack of any width with > 3/8 in. of faulting.	One of the following conditions exist: 1) Non-filled crack with a width > 3 in. 2) Filled or non-filled crack of any width with >3/8 in. faulting.

How to measure extent: See Longitudinal/Transverse Cracking (Non-reinforced slabs).

Popouts	Not applicable; however, popouts must be extensive before they are counted as a distress. Average popout density must exceed approximately 3 popouts per square yard over the entire slab area.	N/A	N/A

How to measure extent: The density of the distress must be measured. If any doubt that the average is >3 popouts per square yard, at least 3 random 1 square yard areas should be checked. When the average is greater than this density, the slab should be counted.

Joint Sealant Damage	Sealant generally good condition throughout section. Sealant performs well with only minor amount of one of the following types of damage: 1)stripping of sealant, 2)extrusion of sealant, 3)weed growth, 4)hardening of filler, 5)loss of bond, and 6)lack or absence of sealant.	Sealant is in generally fair condition over the entire surveyed section, with one or more of the previously listed types of damage occurring to a moderate degree. Sealant needs replacement within 2 years.	Joint sealant is in generally poor condition over the entire surveyed section, with one or more of the previously listed types of damage occurring to a severe degree. Sealant needs immediate replacement.

How to measure extent: Joint sealant damage is not counted on a slab-by-slab basis, it is rated based on the overall condition of the sealant over the entire area.

Table 5. Recommended Criteria for Determining Severity Levels and Extent of Distresses in PCC Pavements (Continued).

Distress Type	Low Severity	Moderate Severity	High Severity
Shrinkage Cracking	Not applicable. No degrees of severity are defined. It is enough to indicate that shrinkage cracks are present.	N/A	N/A

How to measure extent: If one or more shrinkage cracks exist on a particular slab, the slab is counted as one slab with shrinkage cracks.

Joint Spalling	One of the following conditions exist: 1) Pieces of material cannot be easily removed. 2) If some pieces are missing and the length of the spall is <2 ft. 3) Most or all pieces are missing and the length of the spall is <2 ft. and the width of the spall is <4 in.	One of the following conditions exists: 1) Length of spall <2ft., most or all pieces are missing and the spall width>4 in. 2) Length of spall >2 ft, pieces can be removed or are missing, and the spall width <4 in.	Length of spall >2 ft. and width of spall >4in. with most or all pieces missing.

How to measure extent: If spall is along the edge of one slab, it is counted as one slab with joint spalling. If the spalling is on more than one edge of the slab, the edge having the highest severity is counted and recorded as one slab. If spalling is on the edges of two adjacent slabs, each slab is counted as having joint spalling.

Durability ("D") Cracking	"D" Cracks cover less than 15% of slab area. Most of the cracks are tight, but a few pieces may have popped out.	One of the following conditions exist: 1)"D" cracks cover <15% of the area and most pieces have popped out or could be easily removed. 2)"D" cracks cover >15% of the area. Most of the cracks are tight, but a few pieces may have popped out or could be removed easily.	"D" cracks cover >15% of the area and most of the pieces have come out or could be removed easily.

How to measure extent: When the distress is located and rated at one severity, it is counted as one slab. If more than one severity level exists, the slab is counted as having the higher severity distress.

Corner Breaks	Break is defined by a low-severity crack and the area between the break and the joints is not cracked or may be lightly cracked.	Break is defined by a medium-severity crack and/or the area between the break and the joints has a medium crack.	Break is defined by a high-severity crack and/or the area between the break and the joints is highly cracked.

How to measure extent: Distressed slab is recorded as one slab if it contains a single corner break, contains more than one break of a particular severity, or contains two or more breaks of different severities (only the highest severity should be recorded).

Deduct Values and Condition Index Calculation

Not all agencies currently use the PCI method; however, 16 (at least half) of the agencies do. Thus, this is the procedure recommended for standardizing the way all agencies determine the condition index value of a pavement section.

Once distress types and quantities are accumulated and recorded, the quantity of distress (linear feet, square feet, or number of slabs) is divided by the total feet, area, or slabs in the sample unit. The values are then multiplied by 100 to obtain the percentage of density per sample unit for each distress type and severity. Deduct values are then determined for each distress through use of deduct curves located in Appendices B and C of *Pavement Management for Airports, Roads and Parking Lots*. These values are used to determine the corrected deduct value (CDV) which is subtracted from 100 to arrive at the PCI value. The procedure is explained in further detail with examples for AC, PCC and unsurfaced roads in the textbook.

Survey Form

Sample survey forms were prepared based on the distress codes used in Micro PAVER. Two forms for AC pavements and two forms for PCC pavements were prepared. One form for each pavement type contains all the distress types and codes that are used in the Micro PAVER software (Figures D1 and D3 in Appendix D). For both AC and PCC pavements, there are 19 distress types and codes. From these, one form for each pavement type (Figures D2 and D4 in Appendix D) was prepared based only on the distresses listed in Tables 2 and 3 that the majority of the agencies use. These forms allow the type, severity, and the quantity of each distress to be easily recorded in the field.

Pavement Quality Categories

The overall quality rating of a pavement section depends on the condition index value. The questionnaire asked each agency to provide condition index ranges for rating pavements in terms of the quality indicators of "very good," "good," "fair," "poor," and "very poor." Table B2 in Appendix B was generated to list each agency's index range corresponding to these quality indicators. It should be noted that the condition index ranges for some agencies were combined to fit into the five categories indicated above. For example, some agencies provided condition index ranges for seven pavement quality categories. In these cases, the two highest categories were combined, as were the two lowest categories. Also, some scales were mathematically converted from a scale other than a 0-100 scale to the 0-100 scale, but only if the conversion did not result in loss of accuracy.

The objective of this analysis is to develop a standardized PCI range for categorizing all pavement sections for every agency in Orange County. Based on the results of this analysis, it is recommended that the condition index ranges shown in Table 6 be used to represent the pavement quality categories for all future countywide analysis.

Figure B1 in Appendix B graphically represent the data listed in Table B2. These were prepared to graphically compare each agency's range for each category (i.e. "Very Good", "Good", "Fair", "Poor", and "Very Poor"). The bold horizontal lines indicate the minimum value of each range based on the survey results (Table 6).

Table 6. Recommended Condition Index Ranges for Pavement Quality Categories.

Pavement Quality Category	Ranges based on Survey Results	Recommended Ranges
Very Good	100 – 86	100 – 86
Good	85 – 74	85 – 75
Fair	73 – 58	74 – 60
Poor	57 – 41	59 – 41
Very Poor	40 – 0	40 – 0

In comparison to Table 2 of the *Countywide Pavement Condition Assessment Study* conducted previously, the condition index ranges are quite different. Table 2 of the previous study was generated based on only 4 individual agency's responses. In this study, there are 16 agencies that use a scale of 0-100 and 4 other agencies that use a 0-10 scale that can easily be converted to a scale of 0-100. As a result, Table 6 of this report was generated based on the responses of 20 agencies. Statistically, a data set of 20 responses is much more representative than a data set of 4 responses.

Table 2 in the previous study is considered more aggressive in terms of treatment trigger limits. The amount of backlog is the amount of money necessary to treat pavements that are currently in a "poor" or "very poor" category and improve their quality to "fair" or better. According to Table 2 in the previous study, any pavement that possesses a condition index value less than 72 falls into the backlog list and should be treated. The treatments to improve these sections are rehabilitation techniques such as thick overlays or complete reconstruction, both of which are very expensive.

Table 6 in this study suggests that pavements possessing condition index ranges less than 57 will fall into the backlog list. Using this value instead of a value of 72 would result in substantially less money required to eliminate backlog as reported in the previous study.

Converting Non-Standard Scales

For those agencies that do not presently use a 0 to 100 scale (or a 0 to 10 scale with at least one decimal point), a conversion method will need to be implemented in order to standardize the condition categories. If the condition indices from various management systems are to be compared with each other, they should be normalized based on some actual data.
To accomplish this, it is recommended that several sections be established in the vicinity of the

communities to be included in the comparison. The surface condition of these sections should vary between very poor and very good. Each of the participating agencies should then rate the sections using their rating procedure. The condition indices generated by each system could then be compared statistically to develop conversion factors or equations. This calibration procedure should be performed periodically to refine the conversion factors/equations with time. The procedure would also need to be kept as simple as possible to foster participation amongst the various agencies needing to convert their scale to the 0 to 100 scale.

Alternatives to this recommendation should also be considered by agencies in Orange County. However, as a minimum, it is strongly recommended that all agencies adopt a standard pavement condition scale of 0 to 100. A few options are discussed in further detail in the following paragraphs.

One possible alternative is adoption of the 0 to 100 scale without adoption of standardized deduct values. This option would allow agencies discretion in determining how the condition index is calculated. For example, if ride quality were considered important to a particular agency, this option would allow that agency to include ride quality as a determining factor in calculating the overall condition index. Another example would be inclusion of some sort of structural adequacy factor in determining the overall condition index of pavement sections. This option would minimize the effort afforded by agencies to conform to some form of standardization. Conformance could be as simple as mathematically converting non-standard scales to the (standard) 0 to 100 scale. Although this would be (theoretically) relatively simple, it would require various assumptions that may lead to inaccurate conversion factors or equations. It should be noted that this option would not necessarily facilitate easy (or representative) comparison of the condition indices reported by one agency with the condition indices reported by another agency if either different methods of assessing condition or simple mathematical conversions are employed.

A simple improvement on this option would be to have all agencies adopt the 0 to 100 scale as the standard scale plus base the condition index on only those distresses listed in Tables 2 and 3 of this report. Even if agencies used different deduct values for the various distresses, this option would, potentially, provide for more accurate comparison of pavement quality amongst agencies. This option would allow agencies to collect information about distresses in addition to those listed in Tables 2 and 3, but would require that the condition indices of pavement sections reported to OCTA be based on only those distresses listed in Table 2 and 3.

Still another option could be that agencies retain their current system but also maintain a second system that complies with that adopted by all agencies within Orange County for the purposes of reporting network health to OCTA. Although this option may require agencies to maintain dual systems, it would allow agencies to retain and maintain systems they currently use that are different from that adopted as the "standard system."

Reporting Standards

Effective and efficient assessment of countywide pavement conditions requires that certain information be provided by all agencies in a standardized manner. As a minimum, this would entail reporting the percent of the agency's network, by area, in each pavement quality category by functional classification (e.g., the percent area of arterial streets in "good" condition, the percent are of local roads in "poor" condition, etc.). Pavement quality categories should be based on the 0 to 100 scale and uniform amongst all agencies as proposed in Table 6 of this report.

Alternatively, agencies could simply provide a report indicating the condition (on a scale of 0 to 100) of all pavement sections within the agency's network. However, with this type of report, additional minimum information would be required including functional classification (either local or arterial road) and area of each pavement section.

Wherever possible, it is also recommended that agencies in Orange County report separately the condition of pavements in the agency's jurisdiction that are part of the Master Plan for Arterial Highways (MPAH).

It is further recommended that reports be generated in both paper and electronic format. Reports in electronic format should be comma or tab delimited ASCII text files.

Software

Most agencies in Orange County have a software package that is used for pavement management purposes. However, not all software packages conform to the recommendations made above. Based on these recommendations, options are presented below and the software used by agencies should conform to the option selected. Appendix C provides a comparison of software packages so that an agency can quickly and objectively choose a particular package that conforms to the option selected.

CONCLUSIONS

Numerous recommendations have been made in this report regarding standardizing the way agencies in Orange County assess and report pavement conditions. Recommendations have been made for standardizing the types of distresses agencies should evaluate during a survey, the way in which these distresses should be quantified, the way this information should be evaluated, and the way this information should be reported. Options for implementing these recommendations are as follows:

Option 1: Utilize 100 Point Scale

Under this option all agencies in Orange County would adopt the 100-point scale (i.e., 0 to 100) for pavement condition assessment. This option would allow agencies discretion in determining how the condition index is calculated (e.g., this option would allow inclusion of factors other than surface distresses such as ride quality).

Although it is realized that this would require some agencies to modify their current pavement condition assessment methodology and PMS software, adoption of the 100-point scale would facilitate easy and objective comparison of pavement condition indices amongst all agencies in the County.

Option 2: Utilize 100 Point Scale Plus Common Distress Types/Deduct Values

Under this option all agencies would base overall pavement condition on a common set of pavement distresses and deduct values as well as adopt the 100-point scale. Further, based on the questionnaire results, the distress types considered, as a minimum, should be those listed in Tables 2 and 3. Agencies would not be constrained to collection of only those distresses listed in Tables 2 and 3 (i.e., agencies could collect additional distresses). However, the pavement condition indices reported to OCTA would need to be based on only those distresses listed in Tables 2 and 3 and a common set of deduct values for these distresses.

As with Option 1, this option would require some agencies to modify their current pavement condition assessment methodology and PMS software. Also, this option requires consensus amongst all agencies regarding the deduct values for each distress type. In other words, this option would not allow one agency to weight a particular distress differently from another agency.

Option 3: Utilize Common Software and Assessment Methodology

Under this option all agencies would utilize common software as well as a common condition assessment methodology. Although this option would be optimal for OCTA as it would allow easy analysis and interpretation countywide, it would be the most disruptive to agencies that do not presently own the "standard" software package selected.

Option 4: Do Nothing

Agencies should also consider the "do nothing" option. Although this option would be the least disruptive to agencies, it would also represent lack of progress towards improving the way pavement condition is assessed countywide. It would also require that subjectivity be used in normalizing data when making comparisons amongst agencies with differing systems.

Recommended Option

Of the four options presented above, NV&A recommend that the agencies in Orange County adopt Option 1 as a minimum. Adoption of Option 2 would be an improvement over Option 1, but it would require more effort on the part of agencies that do not presently collect all the distresses listed in Tables 2 and 3.

Although Option 3 would be best for OCTA, NV&A realize that this option is not realistic and, therefore, is not recommended. Option 4 is also not recommended, as this would represent lack of progress towards improving the way condition is assessed countywide.

Reporting Pavement Quality

NV&A recommend that the agencies in Orange County adopt the condition index ranges listed in Table 6 for the purposes of reporting pavement quality to OCTA. It should be noted that this recommendation does not imply that agencies need to adopt these ranges for their own purposes, but it would require that these ranges be used whenever pavement quality is reported to OCTA.

APPENDIX A
Questionnaire

PAVEMENT MANAGEMENT SYSTEM QUESTIONNAIRE

INTRODUCTION

The Orange County Transportation Authority (OCTA), through Nichols•Vallerga & Associates (NV&A) of Huntington Beach, is conducting a study for developing pavement management system standardization recommendations. The objectives of this study are to:

1. Develop an inventory of systems currently used by agencies within Orange County;
2. Identify information currently collected by agencies for pavement management system purposes;
3. Identify minimum information needed for a implementing a pavement management system;
4. Recommend options for standardizing data collection and assessment and basic reporting; and
5. Identify and compare currently available pavement management system software packages.

To assist the OCTA in accomplishing the first two objectives, your agency is respectfully requested to complete and fax this questionnaire to Paul Rodriguez by **May 27, 1998**.

Paul Rodriguez
Orange County Transportation Authority
550 South Main Street
P.O. Box 14184
Orange, California
92863-1584
Fax: (714) 560-5794

Please note that information provided is for research purposes and will not affect funding in any way.

QUESTIONS

1. Please provide the following details about yourself:

   Name: _____

   Position: _____

   Agency: _____

   Phone number: _____

   Fax number: _____

2. Does your agency use a software package for the purposes of pavement management?

___ Yes (please continue with Question 3) ___ No (please skip to Question 12)

3. Please indicate the software package used by your agency for the purposes of pavement management.

___ MicroPAVER (U.S. Army Corps of Engineers, CERL); Version ___
___ MTC (Metropolitan Transportation Commission); Version ___
___ dTIMS (Deighton and Associates); Version ___
___ ITX Stanley System; Version _____
___ Carte Graph System; Version _____
___ PCS/LAW System; Version _____
___ TRDI System; Version _____
___ Woodward-Clyde Consultants System; Version _____
___ ERES Consultants System; Version _____
___ CHEC System; Version _____
___ IMS System; Version _____
___ Other (please specify) _____

4. Please indicate the database/file format, if known, utilized by your pavement management software:

___ ASCII text files
___ dBASE
___ RBASE
___ Microsoft Access
___ FoxPro
___ Oracle
___ Other (please specify) _____

5. Can the results of an analysis be exported to an ASCII text format file?
___ Yes ___ No

6. Please indicate the pavement section inventory data you collect and include in your pavement management software (check all that apply):

___ Section length
___ Section width
___ Section area
___ Pavement surface type
___ Traffic volume (Average Daily Traffic)

6. Continued

___ Functional classification:

Can the roads be aggregated into only local roads and arterials?
___ Yes ___ No

Can arterials included as part of the MPAH be readily identified?
___ Yes ___ No

7. Do you use a scale of 0 (zero) to 100, with 100 indicating "perfect" condition, to indicate pavement quality?
___Yes ___ No

If you answered "No," please indicate the scale you use (e.g., 0 to 25) and what the highest or lowest value represents in terms of pavement quality (e.g., 25 indicates "perfect" condition):

_____
_____
_____
_____
_____
_____
_____
_____
_____

8. Please indicate the values you would assign to divide the following qualitative descriptors of pavement quality:

Maximum value ("Perfect Condition")

Very Good ___

Good ___

Fair ___

Poor ___

Very Poor

0 ("Completely Failed")

9. Please indicate how pavement quality or condition is determined:

___ Windshield survey
___ Manual survey
___ Manual survey plus some automated measurement (e.g., ride)
___ Fully automated survey; system used _____
___ Other (Please specify): _____

If you use a windshield or manual survey, please provide a copy of your survey form(s) as an attachment to this questionnaire.

10. Please indicate the types of pavement distresses collected during the survey process:

a. Asphalt pavements:

___ Alligator/Fatigue cracking
___ Block cracking
___ Edge cracking
___ Longitudinal cracking
___ Slippage cracking
___ Transverse cracking
___ Corrugations
___ Depressions
___ Other _____

___ Rutting
___ Bleeding/Flushing
___ Shoving
___ Polished aggregate
___ Raveling/Weathering
___ Patching/Utility cuts
___ Potholes
___ Other _____
___ Other _____

b. Concrete pavements:

___ Durability cracking
___ Longitudinal cracking
___ Transverse cracking
___ Map cracking
___ Corner breaks
___ Joint sealant damage
___ Blowups
___ Joint spalling
___ Patching /Utility Cuts
___ Other _____

___ Scaling
___ Polished aggregate
___ Faulting
___ Pumping
___ Popouts
___ Settlement/Punchouts
___ Shattered slab
___ Shrinkage cracking
___ Other _____
___ Other _____

c. For each distress you have indicated above, your pavement management software will/ should have deduct values based on extent and severity. These should be documented within the software manual and/or software help system as tables or charts and some programs may output these as a report. If possible, please provide these deduct values as an attachment to this questionnaire.

11. Please identify additional information other than that listed in Question 10 (e.g., ride quality, skid resistance, etc.) that factors into the way your agency determines pavement quality:

_____
_____
_____
_____
_____
_____

12. Please rank the following features of pavement management software in order of priority with 1 (one) representing most important and greater numbers (e.g., 2, 3, etc.) representing lessor importance; use 0 (zero) to represent "not important" or "not applicable":

___ Cost
___ Ease of use/operation
___ Ease of startup/implementation
___ Technical support
___ Public domain software
___ User group meetings
___ Stability of software/Product support
___ Windows 95/Windows NT compatibility/32-bit architecture
___ Ability to configure as desired (e.g., custom prediction models, condition indices, etc.)
___ Ability to readily interface with a Geographical Information System (GIS)
___ Ability to include roadway "furniture" (e.g., sidewalks, curb and gutter, etc.)
___ Other (please specify) _____

13. With the ultimate objective of this study being the development of recommendations for standardizing the way pavement condition is determined by all agencies in Orange County, please include any comments you may have that have not been addressed in this survey.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

APPENDIX B
Survey Results

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

1 Fill in following information	Agency	Anaheim	Brea	Buena Park
	Name	Mark Komoto	Bill Higgins	Rudy Cisneros
	Position	Principle Civil Eng	Maint. Serv. Manager	Street Superintendent
	Phone number	(714) 765-5259	(714) 990-7698	(714) 562-3703
	Fax number	(714) 765-5225	(714) 671-1493	(714) 562-3669
2 Does agency use PMS software?		Yes	Yes (in-house)	Yes
3 Software package used		IMS version 5	PMS Combo	Microcomputer
4 Database/File format		FoxPro	Microsoft Access	Custom DOS
5 Can results be exported to ASCII text?		Yes	No	No
6 Section Inventory included in PMS: check if applicable				
	Section length	X	X	X
	Section width	X	X	X
	Section area	X		X
	Pavement surface type	X		X
	Traffic volume (Avg. Daily Traf)	X		X
	Functional classification	X	X	
Can roads be aggregated into only local or arterials?		Yes	Yes	Yes
Can arterials included as part of MPAH be readily ID?		Yes	Yes	Yes
7 Indicate scale used (worst-best) example: 0-100		0-100	1-10	0-100
8 Assign value ranges to descriptors:	Very Good	90-100	9-10	93-100
	Good	85-89	6-8	83-92
	Fair	80-84	4-5	51-82
	Poor	70-79	2-3	0-50
	Very Poor	0-69	0-1	
9 Indicate how survey is performed (e.g. manual)		Manual	Manual/ Windshield	Windshield
If manual or windshield, is a distress form provided?		Yes	No	No
10 Check pavement distress type collected during survey				
Asphalt pavements	Alligator/Fatigue cracking	X	X	X
	Block cracking	X		
	Edge cracking	X		
	Longitudinal cracking	X	X	X
	Slippage cracking	X		
	Transverse cracking	X	X	X
	Corrugations			
	Depressions		X	
	Rutting	X	X	X
	Bleeding/Flushing	X	X	
	Shoving	X		
	Polished aggregate			
	Raveling/Weathering	X	X	X
	Patching/Utility cuts	X		X
	Potholes		X	
	Other			Shrinkage crack
PCC Distresses	Durability cracking			
	Longitudinal cracking	X		
	Transverse cracking	X		
	Map cracking			
	Corner breaks	X		
	Joint sealant damage			
	Blowups			
	Joint spalling			
	Patching/Utility cuts	X		
	Scaling			
	Polished aggregate			
	Faulting			

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

	Anaheim	Brea	Buena Park
Pumping			
Popouts			
Settlement/Punchouts			
Shattered slab			
Shrinkage cracking	X		
Other			
Were deduct values given as an attachment form?	Yes	No	No
11. Additional information used such as ride quality, skid resistance, ect.	Specific crack location	---	---
12. Rank following features of PMS software in order of priority with 1 (one) being most important and greater numbers being of less importance; use 0(zero) for "not important" or "N/A"			
Cost	8	3	3
Ease of use/operation	1	1	1
Ease of startup/implementation	3	2	2
Technical Support	2	---	11
Public domain software	10	---	5
User group meetings	11	---	6
Stability of software/Product support	6	---	7
Windows 95/Windows NT compatibility/32 bit	5	---	8
Ability to configure as desired (e.g., custom pred. models, cond. indices, etc.)	4	---	9
Ability to link with GIS	7	---	10
Ability to include roadway "furniture" (e.g., sidewalks, curb and gutter, etc.)	9	---	4
Other (please specify)			
13. Comments on standardizing the way pavement condition is determined by all agencies in Orange County that are not covered in this form.	Highly advisable to evaluate the AHS separate from local street	All of the Eng. Info is being requested by elected officials This issue should be addressed	

--- Means that the question was not answered

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

1. Fill in following information	Agency	City of Orange	Costa Mesa	County of Orange
	Name	Philip Pierce	Ernesto Munoz	Peter Allen
	Position	Street Division Manager	Assistant City Engineer	Supervising Eng. Technician
	Phone number	(714) 532-6480	(714) 754-5173	(714) 567-6283
	Fax number	(714) 532-6444	(714) 754-5028	(714) 567-6340
2. Does agency use PMS software?		Yes	Yes	Yes
3. Software package used		ITX Super PMS V1.31H	ITX Version 1.31	Lorick Assoc
4. Database/File format		FoxPro/Windows 95	FoxPro	Microsoft Access
5. Can results be exported to ASCII text?		Yes	No	Yes
6. Section Inventory included in PMS: check if applicable				
	Section length	X	X	X
	Section width	X	X	X
	Section area	X		X
	Pavement surface type	X	X	X
	Traffic volume (Avg. Daily Traf)	X	X	X
	Functional classification	X		X
Can roads be aggregated into only local or arterials?		Yes	Yes	Yes
Can arterials included as part of MPAH be readily ID?		No	Yes	Yes
7. Indicate scale used (worst-best) example: 0-100		1-10	0-10	0-100
8. Assign value ranges to descriptors	Very Good	9.3-10	8.1-10	
	Good	8.3-9.2	5.5-8.0	91-100
	Fair	6.1-8.2	4.1-5.4	75-90
	Poor	5.0-6.0	3.1-4.0	60-74
	Very Poor	0-4.9	0-3	0-59
9. Indicate how survey is performed (e.g. manual)		Fully Automated	Windshield/ Manual	Windshield
If manual or windshield, is a distress form provided?		No	No	Yes
10. Check pavement distress type collected during survey				
Asphalt pavements	Alligator/Fatigue cracking	X	X	X
	Block cracking	X	X	
	Edge cracking	X	X	
	Longitudinal cracking	X	X	X
	Slippage cracking	X		
	Transverse cracking	X	X	X
	Corrugations		X	
	Depressions	X	X	
	Rutting	X	X	X
	Bleeding/Flushing	X	X	
	Shoving	X	X	
	Polished aggregate			
	Raveling/Weathering	X	X	X
	Patching/Utility cuts	X	X	X
	Potholes	X	X	
	Other	Excessive Crown Map Cracking	Wheel Track Rutting Distortion	
PCC Distresses	Durability cracking			
	Longitudinal cracking	X		
	Transverse cracking	X		
	Map cracking			
	Corner breaks	X		
	Joint sealant damage	X		
	Blowups	X		
	Joint spalling	X		
	Patching/Utility cuts	X		
	Scaling	X		
	Polished aggregate	X		
	Faulting	X		

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

	City of Orange	Costa Mesa	County of Orange
Pumping			
Popouts	X		
Settlement/Punchouts	X		
Shattered slab	X		
Shrinkage cracking	X		
Other	Ravelling, Distortion		
Were deduct values given as an attachment form?	No	No	Yes
11. Additional information used such as ride quality, skid resistance, ect.	Skid resist., Riding comfort index, Structural adeq. Index	Pave. quality index, Ride comfort index, Surface distress index	Ride quality rated 0-10 for arterial highways
12. Rank following features of PMS software in order of priority with 1 (one) being most important and greater numbers being of less importance; use 0(zero) for "not important" or "N/A"			
Cost	6	1	8
Ease of use/operation	1	3	1
Ease of startup/implementation	2	2	2
Technical Support	8	4	4
Public domain software	11	8	0
User group meetings	12	10	0
Stability of software/Product support	9	11	3
Windows 95/Windows NT compatibility/32 bit	10	6	7
Ability to configure as desired (e.g., custom pred. models, cond. indices, etc.)	3	5	5
Ability to link with GIS	4	7	7
Ability to include roadway "furniture" (e.g., sidewalks, curb and gutter, etc.)	7	9	6
Other (please specify)	5 (History Files)		
13. Comments on standardizing the way pavement condition is determined by all agencies in Orange County that are not covered in this form.	Deterioration curves used to predict rehab need require adjustments for each agency.	Data collection & analyses, pavement quality info, Maint., recomm., ratings & software products should be standard throughout county & cities	

--- Means that the question was not answered

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

1 Fill in following information	Agency	Cypress	Dana Point	Fountain Valley
	Name:	Mary Lazzara	Dennis Jue	Bob Kellison
	Position:	Principal Eng. Aid	Deputy City Engineer	Project Coordinator
	Phone number:	(714) 229-6747	(949) 248-3574	(714) 593-4517
	Fax number:	(714) 229-0154	(949) 248-7372	(714) 593-4498
2 Does agency use PMS software?		Yes	Yes	Yes
3 Software package used		Harris & Assoc.	Lorick Assoc	Caltrans Modified
4 Database/File format		ParaDox	Microsoft Access	Micros. Excel 97
5 Can results be exported to ASCII text?		Yes	Yes	Yes
6 Section Inventory included in PMS: check if applicable				
	Section length	X	X	X
	Section width	X	X	X
	Section area	X	X	
	Pavement surface type	X	X	
	Traffic volume (Avg. Daily Traf)		X	
	Functional classification		X	
Can roads be aggregated into only local or arterials?		Yes	Yes	Yes
Can arterials included as part of MPAH be readily ID?		No	Yes	Yes
7 Indicate scale used (worst-best) example: 0-100		25-0	0-100	?-0
8 Assign value ranges to descriptors	Very Good	10-0		0
	Good	12-10	91-100	50-1
	Fair	18-12	75-90	100-50
	Poor	25-18	60-74	200-100
	Very Poor		0-59	>200
9 Indicate how survey is performed (e.g. manual)		Manual	Windshield	Windshield
If manual or windshield, is a distress form provided?		No	Yes	Yes
10 Check pavement distress type collected during survey				
Asphalt pavements	Alligator/Fatigue cracking		X	X
	Block cracking			
	Edge cracking			
	Longitudinal cracking		X	X
	Slippage cracking			
	Transverse cracking		X	X
	Corrugations			X
	Depressions			
	Rutting	X	X	X
	Bleeding/Flushing	X		
	Shoving			
	Polished aggregate			
	Raveling/Weathering		X	X
	Patching/Utility cuts		X	X
	Potholes			
	Other	Ride, Surface texture		
PCC Distresses	Durability cracking			
	Longitudinal cracking			
	Transverse cracking			
	Map cracking			
	Corner breaks			
	Joint sealant damage			
	Blowups			
	Joint spalling			
	Patching/Utility cuts			
	Scaling			
	Polished aggregate			
	Faulting			

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

	Fullerton	Garden Grove	Irvine
Pumping			
Popouts			
Settlement/Punchouts			
Shattered slab			
Shrinkage cracking			
Other			
Were deduct values given as an attachment form?	No	Yes	Not determined
11. Additional information used such as ride quality, skid resistance, ect.	---	---	Ride quality, structural adeq.
12. Rank following features of PMS software in order of priority with 1 (one) being most important and greater numbers being of less importance, use 0(zero) for "not important" or "N/A"			
Cost	4	3	3
Ease of use/operation	5	1	1
Ease of startup/implementation	1	2	7
Technical Support	6	4	5
Public domain software	10	0	9
User group meetings	11	10	10
Stability of software/Product support	3	6	6
Windows 95/Windows NT compatibility/32 bit	2	8	2
Ability to configure as desired (e.g., custom pred. models, cond. indices, etc.)	8	5	1
Ability to link with GIS	7	7	4
Ability to include roadway "furniture" (e.g., sidewalks, curb and gutter, etc.)	9	9	8
Other (please specify)			
13 Comments on standardizing the way pavement condition is determined by all agencies in Orange County that are not covered in this form			Concerned if a stand. Syst. will be contrary to dir. from Council/ Commissions

--- Means that the question was not answered

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

1. Fill in following information	Agency	La Habra	Laguna Beach	Laguna Hills
	Name:	Ziad Mazboudi	Terry Brandt	Kenneth Rosenfield
	Position:	Civil Engineer Assistant	Director of Munic. Serv	Dir of Pub Works/City Eng
	Phone number:	(562) 905-9720	(949) 497-0340	(714) 707-2655
	Fax number:	(562) 905-9719	(949) 497-0771	(714) 707-2614
2. Does agency use PMS software?		Yes	Yes (in-house)	Yes
3. Software package used		PMI (by Harris)	Microsoft Excel	MicroPAVER 4.01
4. Database/File format		FoxPro	Microsoft Access	---
5. Can results be exported to ASCII text?		Yes	Yes	Yes
6. Section Inventory included in PMS: check if applicable				
	Section length	X	X	X
	Section width	X	X	X
	Section area	X	X	X
	Pavement surface type	X	X	X
	Traffic volume (Avg. Daily Traf)			
	Functional classification	X		X
Can roads be aggregated into only local or arterials?		Yes	Yes	Yes
Can arterials included as part of MPAH be readily ID?		Yes	Yes	Yes
7. Indicate scale used (worst-best) example: 0-100		25-0	5-1	0-100
8. Assign value ranges to descriptors.	Very Good	0	1	71-85
	Good	10-0	2	56-70
	Fair	15-10	3	41-55
	Poor	20-15	4	26-40
	Very Poor	25-20	5	11-25
9. Indicate how survey is performed (e.g. manual)		Windshield	Windshield	Windshield
If manual or windshield, is a distress form provided?		Yes	No	No
10. Check pavement distress type collected during survey				
Asphalt pavements	Alligator/Fatigue cracking	X	X	X
	Block cracking	X	X	X
	Edge cracking	X	X	X
	Longitudinal cracking	X	X	X
	Slippage cracking	X	X	X
	Transverse cracking	X	X	X
	Corrugations		X	X
	Depressions		X	X
	Rutting		X	X
	Bleeding/Flushing	X	X	X
	Shoving		X	X
	Polished aggregate		X	X
	Raveling/Weathering		X	X
	Patching/Utility cuts		X	X
	Potholes		X	X
	Other	Surface texture Ride index Drainage		
PCC Distresses	Durability cracking		X	
	Longitudinal cracking		X	
	Transverse cracking		X	
	Map cracking		X	
	Corner breaks		X	
	Joint sealant damage		X	
	Blowups		X	
	Joint spalling		X	
	Patching/Utility cuts		X	
	Scaling		X	
	Polished aggregate		X	
	Faulting		X	

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

	La Habra	Laguna Beach	Laguna Hills
Pumping		X	
Popouts		X	
Settlement/Punchouts		X	
Shattered slab		X	
Shrinkage cracking		X	
Other			
Were deduct values given as an attachment form?	No	No	No
11. Additional information used such as ride quality, skid resistance, ect.	Ride quality, Drainage	---	---
12. Rank following features of PMS software in order of priority with 1 (one) being most important and greater numbers being of less importance, use 0(zero) for "not important" or "N/A"			
Cost	9	1	---
Ease of use/operation	1	3	---
Ease of startup/implementation	1	4	---
Technical Support	1	5	---
Public domain software	2	2	---
User group meetings	3	6	---
Stability of software/Product support	1	7	
Windows 95/Windows NT compatibility/32 bit	1	8	---
Ability to configure as desired (e.g., custom pred. models, cond. indices, etc.)	1	9	---
Ability to link with GIS	1	11	---
Ability to include roadway "furniture" (e.g., sidewalks, curb and gutter, etc.)	2	10	---
Other (please specify)			
13. Comments on standardizing the way pavement condition is determined by all agencies in Orange County that are not covered in this form			"We're not changing our software "

--- Means that the question was not answered

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

1 Fill in following information	Agency	Laguna Niguel	Lake Forest	Los Alomitos
	Name:	Ken Montgomery	Bob Brock	Victor Rollinger
	Position:	Director of Public Works	Assistant City Engineer	Dir of Pub Works/City Eng
	Phone number:	(949) 362-4339	(949) 461-3484	(562) 431-3538
	Fax number:	(949) 362-4385	(949) 461-3512	(562) 493-1255
2. Does agency use PMS software?		Yes	Yes	Yes
3. Software package used		dBase w/ AutoCAD	Lorick Assoc.	MicroPAVER 4.1
4 Database/File format		dBASE	Microsoft Access	Microsoft Access
5 Can results be exported to ASCII text?		Yes	Yes	Yes
6. Section Inventory included in PMS: check if applicable				
	Section length	X	X	X
	Section width	X	X	X
	Section area		X	X
	Pavement surface type	X	X	X
	Traffic volume (Avg. Daily Traf)	X	X	
	Functional classification		X	X
Can roads be aggregated into only local or arterials?		Yes	Yes	Yes
Can arterials included as part of MPAH be readily ID?		No	Yes	Yes
7 Indicate scale used (worst-best) example: 0-100		0-100	0-100	0-100
8 Assign value ranges to descriptors:	Very Good	95-100		75-87
	Good	90-95	91-100	60-74
	Fair	80-90	75-90	42-59
	Poor	70-80	60-74	27-41
	Very Poor	0-70	0-59	0-26
9 Indicate how survey is performed (e.g. manual)		Manual	Windshield	Windshield
If manual or windshield, is a distress form provided?		Yes	Yes	No
10 Check pavement distress type collected during survey				
Asphalt pavements:	Alligator/Fatigue cracking	X	X	X
	Block cracking			X
	Edge cracking			X
	Longitudinal cracking	X	X	X
	Slippage cracking			X
	Transverse cracking	X	X	X
	Corrugations			X
	Depressions	X		X
	Rutting	X	X	X
	Bleeding/Flushing	X		X
	Shoving	X		X
	Polished aggregate			X
	Raveling/Weathering	X	X	X
	Patching/Utility cuts	X	X	X
	Potholes			X
	Other			
PCC Distresses	Durability cracking			
	Longitudinal cracking			
	Transverse cracking			
	Map cracking			
	Corner breaks			
	Joint sealant damage			
	Blowups			
	Joint spalling			
	Patching/Utility cuts			
	Scaling			
	Polished aggregate			
	Faulting			

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

	Laguna Niguel	Lake Forest	Los Alomitos
Pumping			
Popouts			
Settlement/Punchouts			
Shattered slab			
Shrinkage cracking			
Other			
Were deduct values given as an attachment form?	Yes	Yes	Refer to Shahin's
11. Additional information used such as ride quality, skid resistance, ect.	Ride quality for type of improvement	Ride quality rated 0-10 for arterial highways	---
12. Rank following features of PMS software in order of priority with 1 (one) being most important and greater numbers being of less importance, use 0(zero) for "not important" or "N/A"			
Cost	8	8	---
Ease of use/operation	1	1	---
Ease of startup/implementation	2	2	---
Technical Support	7	4	---
Public domain software	4	0	---
User group meetings	10	0	---
Stability of software/Product support	9	3	---
Windows 95/Windows NT compatibility/32 bit	11	7	---
Ability to configure as desired (e.g., custom pred. models, cond. indices, etc.)	3	5	---
Ability to link with GIS	5	7	---
Ability to include roadway "furniture" (e.g., sidewalks, curb and gutter, etc.)	6	6	---
Other (please specify)			
13. Comments on standardizing the way pavement condition is determined by all agencies in Orange County that are not covered in this form.	Commerc. Avail Reasonable price, dbf or ASCII format. Should be able to interface w/ CAD		

--- Means that the question was not answered

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

1 Fill in following information	Agency	Mission Viejo	Newport Beach	Placentia
	Name	Richard Schlesinger	Marla Doyle	Chris Becker
	Position	Associate Engineer	Senior Civil Engineer	Director of Public Works
	Phone number	(949) 470-3079	(949) 644-3322	(714) 993-8245
	Fax number	(949) 470-9140	(949) 644-3308	(714) 961-0283
2. Does agency use PMS software?		Yes	Yes	Yes (in-house)
3. Software package used		MTC	MicroPAVER 4.0	Microsoft Excel
4 Database/File format		Microsoft Access	Microsoft Access	Microsoft Access
5. Can results be exported to ASCII text?		Yes	---	---
6. Section Inventory included in PMS: check if applicable				---
	Section length	X	X	
	Section width	X	X	
	Section area	X	X	
	Pavement surface type	X	X	
	Traffic volume (Avg. Daily Traf)	X		
	Functional classification		X	
Can roads be aggregated into only local or arterials?		Yes	Yes	---
Can arterials included as part of MPAH be readily ID?		Yes	No	---
7. Indicate scale used (worst-best) example: 0-100		0-100	0-100	---
8 Assign value ranges to descriptors:	Very Good	90+	75-100	---
	Good	80-89	60-75	
	Fair	70-79	42-60	
	Poor	55-69	27-42	
	Very Poor	0-54	0-27	
9 Indicate how survey is performed (e.g. manual)		Manual	Manual	---
If manual or windshield, is a distress form provided?		No	No	
10 Check pavement distress type collected during survey				---
Asphalt pavements:	Alligator/Fatigue cracking	X	X	
	Block cracking	X	X	
	Edge cracking	X	X	
	Longitudinal cracking	X	X	
	Slippage cracking	X	X	
	Transverse cracking	X	X	
	Corrugations	X	X	
	Depressions	X	X	
	Rutting	X	X	
	Bleeding/Flushing	X	X	
	Shoving	X	X	
	Polished aggregate		X	
	Raveling/Weathering	X	X	
	Patching/Utility cuts	X	X	
	Potholes	X	X	
	Other		Reflection crack	
PCC Distresses	Durability cracking	X	X	
	Longitudinal cracking	X	X	
	Transverse cracking	X	X	
	Map cracking		X	
	Corner breaks		X	
	Joint sealant damage	X	X	
	Blowups		X	
	Joint spalling	X	X	
	Patching/Utility cuts	X	X	
	Scaling		X	
	Polished aggregate		X	
	Faulting	X	X	

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

	Mission Viejo	Newport Beach	Placentia
Pumping	X	X	
Popouts	X	X	
Settlement/Punchouts	X	X	
Shattered slab	X		
Shrinkage cracking	X	X	
Other		Divided slab	
Were deduct values given as an attachment form?	No	No	No
11. Additional information used such as ride quality, skid resistance, ect.	---	---	---
12. Rank following features of PMS software in order of priority with 1 (one) being most important and greater numbers being of less importance; use 0(zero) for "not important" or "N/A"			
Cost	2	5	2
Ease of use/operation	1	1	1
Ease of startup/implementation	1	2	7
Technical Support	1	8	8
Public domain software	3	3	10
User group meetings	3	10	11
Stability of software/Product support	2	7	3
Windows 95/Windows NT compatibility/32 bit	1	9	6
Ability to configure as desired (e.g., custom pred. models, cond. indices, etc.)	3	6	4
Ability to link with GIS	2	4	5
Ability to include roadway "furniture" (e.g., sidewalks, curb and gutter, etc.)	3	0	9
Other (please specify)			
13 Comments on standardizing the way pavement condition is determined by all agencies in Orange County that are not covered in this form			Agree with stand pavement cond.. data and will support efforts.

--- Means that the question was not answered

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

1 Fill in following information	Agency	San Clemente	Santa Ana	Seal Beach
	Name	Akram Hindiyeh	Souri Amirani	Doug Dancs
	Position	Senior Civil Engineer	Senior Civil Engineer	Civil Eng / Proj. Mangr
	Phone number	(949) 498-2533	(714) 647-5640	(562) 431-2527
	Fax number	(949) 361-8316	(714) 647-5635	(562) 431-4067
2. Does agency use PMS software?		Yes	Yes	Yes
3. Software package used		ITX Stanley Sys	MicroPAVER	CarteGraph 3.2
4. Database/File format		FoxPro	Microsoft Access	Microsoft Access
5. Can results be exported to ASCII text?		Yes	No	Yes
6. Section Inventory included in PMS: check if applicable				
	Section length	X	X	X
	Section width	X	X	X
	Section area	X	X	X
	Pavement surface type	X	X	X
	Traffic volume (Avg. Daily Traf)	X		Est
	Functional classification	X		X
Can roads be aggregated into only local or arterials?		Yes	Yes	---
Can arterials included as part of MPAH be readily ID?		No	No	Yes
7 Indicate scale used (worst-best) example: 0-100		0-10	0-100	0-100
8 Assign value ranges to descriptors:	Very Good	10	89-100	80-100
	Good	8-9	79-89	50-80
	Fair	6-7	69-79	30-50
	Poor	4-5	59-69	20-30
	Very Poor	2-3	0-59	0-20
9 Indicate how survey is performed (e.g. manual)		Manual plus some Automated	Windshield	Windshield
If manual or windshield, is a distress form provided?		No	Yes	No
10 Check pavement distress type collected during survey				
Asphalt pavements	Alligator/Fatigue cracking	X	X	X
	Block cracking	X	X	X
	Edge cracking	X	X	X
	Longitudinal cracking	X	X	X
	Slippage cracking	X	X	X
	Transverse cracking	X	X	X
	Corrugations	X		X
	Depressions	X		X
	Rutting	X	X	X
	Bleeding/Flushing	X	X	X
	Shoving	X		X
	Polished aggregate		X	X
	Raveling/Weathering	X	X	X
	Patching/Utility cuts		X	X
	Potholes	X	X	X
	Other			
PCC Distresses	Durability cracking		X	X
	Longitudinal cracking	X	X	X
	Transverse cracking	X	X	X
	Map cracking	X		X
	Corner breaks		X	X
	Joint sealant damage	X	X	X
	Blowups		X	X
	Joint spalling	X	X	X
	Patching/Utility cuts	X	X	X
	Scaling	X		X
	Polished aggregate	X		X
	Faulting	X	X	X

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

	San Clemente	Santa Ana	Seal Beach
Pumping			X
Popouts	X	X	X
Settlement/Punchouts			X
Shattered slab		X	X
Shrinkage cracking	X		X
Other			
Were deduct values given as an attachment form?	No	No	Contact CarteGraph
11. Additional information used such as ride quality, skid resistance, ect.	PQI used (funct of PCI,SDI,SAI)	---	Ride, date of last construction
12. Rank following features of PMS software in order of priority with 1 (one) being most important and greater numbers being of less importance; use 0(zero) for "not important" or "N/A"			
Cost	8	2	---
Ease of use/operation	1	3	1
Ease of startup/implementation	2	---	---
Technical Support	4	4	---
Public domain software	11	10	---
User group meetings	10	9	---
Stability of software/Product support	5	5	---
Windows 95/Windows NT compatibility/32 bit	6	1	1
Ability to configure as desired (e.g., custom pred. models, cond. indices, etc.)	3	7	---
Ability to link with GIS	7	6	1
Ability to include roadway "furniture" (e.g., sidewalks, curb and gutter, etc.)	9	8	---
Other (please specify)			
13. Comments on standardizing the way pavement condition is determined by all agencies in Orange County that are not covered in this form			Agency should be able to choose software. Each agency has different strategies, therefore, standard not good

--- Means that the question was not answered

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

1 Fill in following information	Agency	Stanton	Tustin	Villa Park
	Name:	Michael Kim	Wisam Altowaiji	Gary Johnson
	Position:	Dir of Pub Works/City Eng	Associate Civil Engineer	City Engineer
	Phone number:	(714) 379-9222	(714) 573-3175	(714) 998-1500
	Fax number:	(714) 890-1443	(714) 734-8991	(714) 998-1508
2 Does agency use PMS software?		Yes	Yes	Yes
3. Software package used		MicroPAVER 4.1	IMS version 6.0	MicroPAVER
4. Database/File format		ASCII text files	FoxPro	---
5. Can results be exported to ASCII text?		Yes	Yes	---
6 Section Inventory included in PMS: check if applicable				
	Section length	X	X	X
	Section width	X	X	X
	Section area	X	X	X
	Pavement surface type	X	X	X
	Traffic volume (Avg. Daily Traf)	X	X	
	Functional classification		X	
Can roads be aggregated into only local or arterials?		Yes	Yes	---
Can arterials included as part of MPAH be readily ID?		Yes	Yes	Yes
7. Indicate scale used (worst-best) example: 0-100		0-100	0-100	0-200
8 Assign value ranges to descriptors:	Very Good	80-100	85-100	180-190
	Good	71-80	80-85	160-179
	Fair	55-71	70-80	130-159
	Poor	40-55	60-70	60-129
	Very Poor	0-40	0-59	0-59
9 Indicate how survey is performed (e.g. manual)		Manual	Fully Automated IMS, laser RST	---
If manual or windshield, is a distress form provided?		No	N/A	No
10 Check pavement distress type collected during survey				
Asphalt pavements	Alligator/Fatigue cracking	X	X	X
	Block cracking	X	X	X
	Edge cracking	X	X	X
	Longitudinal cracking	X	X	X
	Slippage cracking	X		X
	Transverse cracking	X	X	X
	Corrugations			X
	Depressions			X
	Rutting	X	X	X
	Bleeding/Flushing			X
	Shoving			X
	Polished aggregate			X
	Raveling/Weathering			X
	Patching/Utility cuts			X
	Potholes			X
	Other			Bumps/sags Railroad Cross Lane/shoulder drop Joint reflect. Crack Swelling
PCC Distresses	Durability cracking	X		
	Longitudinal cracking	X		
	Transverse cracking	X		
	Map cracking			
	Corner breaks			
	Joint sealant damage			
	Blowups			
	Joint spalling			
	Patching/Utility cuts			
	Scaling			
	Polished aggregate			
	Faulting			

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

	Stanton	Tustin	Villa Park
Pumping			
Popouts			
Settlement/Punchouts			
Shattered slab			
Shrinkage cracking			
Other			
Were deduct values given as an attachment form?	No	Yes	Yes
11. Additional information used such as ride quality, skid resistance, ect.	---	Ride quality, Deflect. Testing	Ride quality, Drainage
12. Rank following features of PMS software in order of priority with 1 (one) being most important and greater numbers being of less importance; use 0(zero) for "not important" or "N/A"			
Cost	---	6	2
Ease of use/operation	---	1	1
Ease of startup/implementation	---	7	1
Technical Support	---	4	2
Public domain software	---	0	3
User group meetings	---	0	2
Stability of software/Product support	---	3	1
Windows 95/Windows NT compatibility/32 bit	---	0	3
Ability to configure as desired (e.g., custom pred. models, cond. indices, etc.)	---	2	4
Ability to link with GIS	---	5	3
Ability to include roadway "furniture" (e.g., sidewalks, curb and gutter, etc.)	---	8	4
Other (please specify)			2 (use visual tech)
13 Comments on standardizing the way pavement condition is determined by all agencies in Orange County that are not covered in this form.		Use benchmarks for references for surface & structural condition. Compare cond. numbers statistically	

--- Means that the question was not answered

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

1 Fill in following information	Agency	Westminster	Yorba Linda
	Name	Marwan Youssef	Fernando Saldivar
	Position	City Engineer	Assistant City Engineer
	Phone number:	(714) 898-3311	(714) 961-7170
	Fax number:	(714) 895-4499	(714) 986-1010
2 Does agency use PMS software?		Yes	Yes
3 Software package used		PMI (by Harris)	MicroPAVER 4.1
4 Database/File format		dBASE	Microsoft Access
5 Can results be exported to ASCII text?		—	Yes
6 Section Inventory included in PMS: check if applicable			
	Section length	X	X
	Section width	X	X
	Section area	X	X
	Pavement surface type	X	X
	Traffic volume (Avg. Daily Traf)		X
	Functional classification		X
Can roads be aggregated into only local or arterials?		Yes	Yes
Can arterials included as part of MPAH be readily ID?		Yes	Yes
7 Indicate scale used (worst-best) example: 0-100		25-0	0-100
8 Assign value ranges to descriptors	Very Good	5-0	75-87
	Good	7-5	60-75
	Fair	11-7	42-60
	Poor	20-11	27-42
	Very Poor	25-20	27-Jan
9 Indicate how survey is performed (e.g. manual)		Manual/ Windshield	Windshield
If manual or windshield, is a distress form provided?		Yes	No
10 Check pavement distress type collected during survey			
Asphalt pavements	Alligator/Fatigue cracking	X	X
	Block cracking		X
	Edge cracking		X
	Longitudinal cracking	X	X
	Slippage cracking		X
	Transverse cracking	X	X
	Corrugations		X
	Depressions	X	X
	Rutting		X
	Bleeding/Flushing	X	X
	Shoving		X
	Polished aggregate		X
	Raveling/Weathering	X	X
	Patching/Utility cuts		X
	Potholes	X	X
	Other		Bumps/sags Railroad Cross Lane/shoulder drop Joint reflect. Crack Swelling
PCC Distresses	Durability cracking		
	Longitudinal cracking		
	Transverse cracking		
	Map cracking		
	Corner breaks		
	Joint sealant damage		
	Blowups		
	Joint spalling		
	Patching/Utility cuts		
	Scaling		
	Polished aggregate		
	Faulting		

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B1. Pavement Management System Questionnaire

	Westminster	Yorba Linda
Pumping		
Popouts		
Settlement/Punchouts		
Shattered slab		
Shrinkage cracking		
Other		
Were deduct values given as an attachment form?	No	Refer to Shahin's
11. Additional information used such as ride quality, skid resistance, ect.	Surf texture, ride index, drainage	Ride quality, drain quality, surface texture
12. Rank following features of PMS software in order of priority with 1 (one) being most important and greater numbers being of less importance; use 0(zero) for "not important" or "N/A"		
Cost	8	9
Ease of use/operation	2	5
Ease of startup/implementation	1	4
Technical Support	7	7
Public domain software	0	0
User group meetings	0	0
Stability of software/Product support	9	3
Windows 95/Windows NT compatibility/32 bit	3	8
Ability to configure as desired (e.g., custom pred. models, cond. indices, etc.)	4	2
Ability to link with GIS	6	0
Ability to include roadway "furniture" (e.g., sidewalks, curb and gutter, etc.)	5	6
Other (please specify)		1 (Reliable system)
13 Comments on standardizing the way pavement condition is determined by all agencies in Orange County that are not covered in this form.	More focus should be placed on the way pavements are evaluated.	

--- Means that the question was not answered

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table B2. Pavement Condition Index Ranges for each Agency

	Anaheim	Brea	Buena Park	Costa Mesa	County of Orange	Cypress	Dana Point	Fountain Valley	Fullerton*	Garden Grove	Huntington Beach*
Very Good	90-100	81-100	93-100	81-100	---	0-9	---	0		71-100	
Good	85-89	51-80	83-92	55-80	91-100	10-12	91-100	50-1		56-70	
Fair	80-84	31-49	50-82	41-54	75-90	13-18	75-90	100-50		41-55	
Poor	70-79	11-30	0-49	31-40	60-74	19-25	60-74	200-100		26-40	
Very Poor	0-69	0-10	---	0-30	0-59	---	0-59	>200		0-25	

	Irvine*	La Habra	La Palma*	Laguna Beach	Laguna* Hills	Laguna Niguel	Lake Forest	Los Alamitos	Mission Viejo	Newport Beach	Orange
Very Good		---		1		95-100	---	75-100	90-100	75-100	93-100
Good		0-10		2		90-95	91-100	60-75	80-90	60-75	83-92
Fair		11-15		3		80-90	75-90	42-60	70-80	42-60	61-82
Poor		16-20		4		70-80	60-74	27-42	55-70	27-42	50-60
Very Poor		21-25		5		0-69	0-59	0-27	0-55	0-27	0-49

	Placentia*	San Clemente	San Juan Capistrano*	Santa Ana	Seal Beach	Stanton	Tustin	Villa Park	Westminster	Yorba Linda
Very Good		81-100		90-100	90-100	80-100	85-100	90-100	2-5	75-100
Good		61-80		80-89	80-89	71-79	80-84	80-89	6-7	60-75
Fair		41-60		70-79	50-79	55-70	70-79	65-79	8-11	42-60
Poor		21-40		60-69	30-49	40-54	60-69	30-64	12-20	27-42
Very Poor		0-20		0-59	0-29	0-39	0-59	0-29	21-25	0-27

* Not Reported

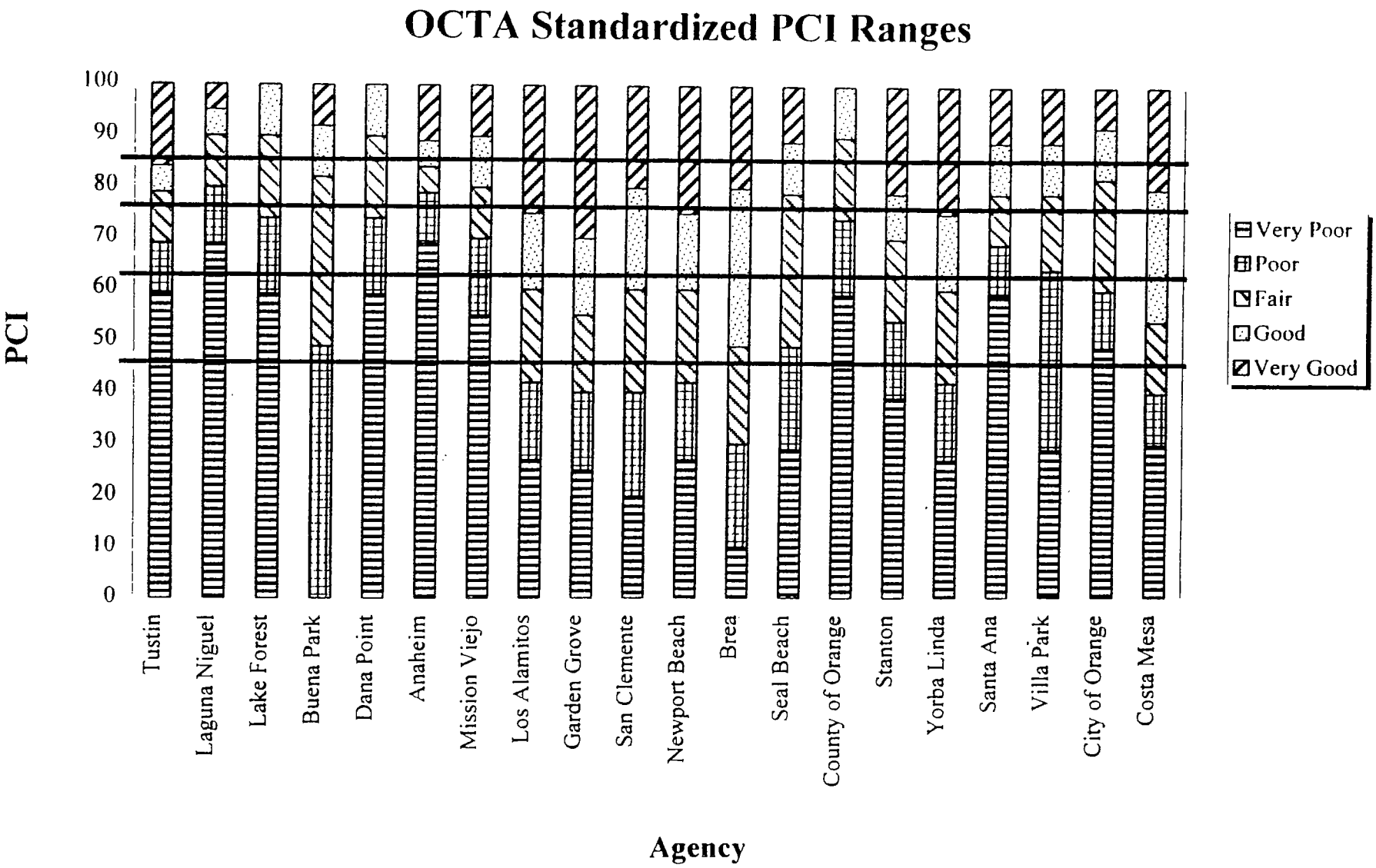


Figure B1. OCTA Standardized PCI Ranges

APPENDIX C
Software Comparison

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table C1. Software Comparison Results

Software Attributes / Features	Metropolitan Transportation Commission (MTC)	MicroPAVER	dTIMS
General			
Vendor / Manufacturer	MTC	U. of Illinois / Amer. Public Works Assoc. (APWA)	
Windows Version	Yes	Yes	Yes
Cost	Free	<$500	$14K - $29K
Annual support costs	Free	<$500	$2.000
Technical Support	MTC/NCE	U of Illinois/APWA	NCE
Software Upgrades	Free	Free	Annual support
User's meetings	3/year	1/year	1/year
Ease of operation/use (1-3)	1	1	2
Level of effort: impln/operations (1-3)	1	2	3
Private/Public domain	Public	Public	Private
Budget related			
5-20 year budgets	Yes	Yes	Yes
Constrained budgets	Yes	Yes	Yes
"What-if" scenarios	Yes	Yes	Yes
Packaging of projects	No	Yes	Possible
Committed projects	No	No	Yes
Backlog/Deferred costs	Yes	Yes	Yes
Stop-gap costs	Yes	Yes	Yes
Technical			
Pavement Inventory	Yes	Yes	Yes
Inventory on non-pavement elements	No	No	Yes
Structural Information	No	Yes	Yes
Deflection Information	No	Yes	Yes
Condition surveys - distress types	7 AC / 7 PCC	19 AC / 19 PCC	Custom
Manual surveys	Yes	Yes	Yes
Automated surveys	No	No	Yes
Condition indices	PCI	PCI	Custom
M&R strategies	Yes	Yes	Yes
single treatments	Yes	Yes	Yes
multiple treatments	PM only	No	Yes
M&R decision tree	Yes	Yes	Yes
Customizable unit costs	Yes	Yes	Yes
Life cycle costs	No	No	Yes
Performance prediction models	Bay area curves	Default & Custom	Custom
Optimization techniques	Yes	No	Custom
GIS tie-in	Beta	Yes	Yes
AutoCAD tie-in	DOS only	No	Yes

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table C1. Software Comparison Results

Software Attributes / Features	Carson City Pavement Management Syst. (CCPMS)	Long Beach Pavement Management Syst. (LBPMS)	PASER
General			
Vendor / Manufacturer	Univ. of Florida	Univ. of Florida	U. of Wisconsin
Windows Version	No. DOS	No. DOS	No
Cost	$50 + $10 for docs	$40 + $10 for docs	$50
Annual support costs	No	No	No
Technical Support	Univ. of Florida	Univ. of Florida	U. of Wisconsin
Software Upgrades	No	No	No
User's meetings	No	No	Yes
Ease of operation/use (1-3)	2	2	1
Level of effort: impln/operations (1-3)	2	2	1
Private/Public domain	Public	Public	Public
Budget related			
5-20 year budgets	Yes	Yes	Yes
Constrained budgets	Yes	Yes	Yes
"What-if" scenarios	Yes	Yes	Yes
Packaging of projects	No	Yes	Yes
Committed projects	No	No	Yes
Backlog/Deferred costs	No	No	No
Stop-gap costs	No	No	No
Technical			
Pavement Inventory	Yes	Yes	Yes
Inventory on non-pavement elements	No	No	Yes
Structural Information	Yes	No	Yes
Deflection Information	Yes	No	No
Condition surveys - distress types	3 AC / 0 PCC	5 AC / 3 PCC	13 AC / 19 PCC
Manual surveys	Yes	Yes	Yes
Automated surveys	No	No	No
Condition indices	CCPMS (Custom)	Long Beach (Custom)	PASER (1-10)
M&R strategies	Yes	Yes	Yes
single treatments	Yes	Yes	Yes
multiple treatments	Yes	Yes	Yes
M&R decision tree	Maybe	Maybe	Maybe
Customizable unit costs	Yes	Yes	Yes
Life cycle costs	Yes	No	No
Performance prediction models	No	No	Custom
Optimization techniques	No	No	Yes
GIS tie-in	No	No	No
AutoCAD tie-in	No	No	No

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table C1. Software Comparison Results

Software Attributes / Features	Pavment Mgmt. Forecasting Model (PMF)	PMS-Institute for Trans. Research & Educ. (PMS-ITRE)	Road Surface Mgmt. System (RSMS)99
General			
Vendor / Manufacturer	(Planning Tool) Univ. of Florida	North Carolina State Univ.	Univ. of New Hamphshire
Windows Version	No. Lotus	Yes	Yes
Cost	$40 + $15 for docs		$150
Annual support costs	No		No
Technical Support	Univ. of Florida	NCSU - ITRE	U. of New Hamp.
Software Upgrades	No		Yes (Nominal)
User's meetings	No	No	No
Ease of operation/use (1-3)	1	1	2 (training nec)
Level of effort: impln/operations (1-3)	1	1	3 (training nec)
Private/Public domain	Public	Public	Public
Budget related			
5-20 year budgets	Yes	Yes	Yes
Constrained budgets	Yes	Yes	Yes
"What-if" scenarios	Yes	Yes	Yes
Packaging of projects	No		Possible
Committed projects	No	No	No
Backlog/Deferred costs	No	No	No
Stop-gap costs	No	No	No
Technical			
Pavement Inventory	Yes	Yes	Yes
Inventory on non-pavement elements	No	No	Yes
Structural Information	No	Yes	Yes
Deflection Information	No		No
Condition surveys - distress types	0 AC / 0 PCC	8 AC / 0 PCC	7 AC / custom PCC
Manual surveys	Yes	Yes	Yes
Automated surveys	No	No	No
Condition indices	Subjective (Custom)	ITRE (Custom)	PCI
M&R strategies	No	Yes	Yes
single treatments	No	Yes	Yes
multiple treatments	No	Yes	Yes
M&R decision tree	No		Yes
Customizable unit costs	Yes	Yes	Yes
Life cycle costs	No	No	No
Performance prediction models	Custom	No	No
Optimization techniques	No	No	Yes
GIS tie-in	No	No	No
AutoCAD tie-in	No	No	No

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table C1. Software Comparison Results

Software Attributes / Features	Asset Control Technology (ACT)	Automated Road Image Analyzer-PMS (ARIA-PMS)	CTL PMS
General			
Vendor / Manufacturer	VEMAX Management, Inc.	MHM Associates, Inc.	Ohio State Univ.
Windows Version	Yes	Yes	No. Foxpro
Cost	$7000 (vol discounts avail)	$25.000	Free
Annual support costs	15% of Orig. Purchase	$795/yr + $3875 training	No
Technical Support	VEMAX	MHM Associates	Ohio State Univ.
Software Upgrades	Varies	Included in ann. support	No
User's meetings	Seminars	No	No
Ease of operation/use (1-3)	2	1	1
Level of effort: impln/operations (1-3)	2	1	1
Private/Public domain	Private	Private	Private
Budget related			
5-20 year budgets	Yes	Yes	Yes
Constrained budgets	Yes	Yes	Yes
"What-if" scenarios	Yes	Yes	Yes
Packaging of projects	Yes	Yes	No
Committed projects	No	No	Yes
Backlog/Deferred costs	No	No	No
Stop-gap costs	Yes	Yes	No
Technical			
Pavement Inventory	Yes	Yes	Yes
Inventory on non-pavement elements	Yes	No	Yes
Structural Information	No	Yes	Yes
Deflection Information	Yes	Yes	No
Condition surveys - distress types	6 AC / 7 PCC	5 AC / 8 PCC	7 AC/ 6 PCC
Manual surveys	Yes	No	Yes
Automated surveys	No	Yes	No
Condition indices	ROCOND 90. (can use others)	PCI	PCI
M&R strategies	Yes	Yes	Yes
single treatments	Yes	Yes	Yes
multiple treatments	Yes	Yes	Yes
M&R decision tree	Yes	No	No
Customizable unit costs	Yes	Yes	Yes
Life cycle costs	Yes	No	No
Performance prediction models	Yes	No	Yes
Optimization techniques	Yes	Yes	No
GIS tie-in	No	No	No
AutoCAD tie-in	No	No	No

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table C1. Software Comparison Results

Software Attributes / Features	CarteGraph™ ROADS	Decision Support Syst. for Pavements (DSS)	Low Volume Road Pavement Mgmt. Syst. (LVR)
General			
Vendor / Manufacturer	CarteGraph Systems, Inc.	ERES Consultants, Inc.	LVR Technology Management
Windows Version	Yes	Yes	Yes
Cost	<$3,000		$3,000
Annual support costs	$795/yr+$3875 training		No
Technical Support	CarteGraph	ERES	LVR
Software Upgrades	<$200		Yes ($300)
User's meetings	Yes	Annually	Yes (by appt)
Ease of operation/use (1-3)	1	1	1
Level of effort: impln/operations (1-3)	2	2	1
Private/Public domain	Private	Private	Private
Budget related			
5-20 year budgets	Yes	Yes	Yes
Constrained budgets	Yes	Yes	Yes
"What-if" scenarios	Yes	Yes	Yes
Packaging of projects	Yes	Yes	Yes
Committed projects	Yes	Yes	Yes
Backlog/Deferred costs	Yes	Yes	Yes
Stop-gap costs	Yes	No	Yes
Technical			
Pavement Inventory	Yes	Yes	Yes
Inventory on non-pavement elements	Yes	Yes	Yes (includes analysis of built-up & Low-vol. roads)
Structural Information	Yes	Yes	Yes
Deflection Information	Yes		No
Condition surveys - distress types	15 AC / 16 PCC	As many as nec.	12 AC / 0 PCC
Manual surveys	Yes	Yes	No
Automated surveys	Yes	Yes	Yes
Condition indices	PSR / PCI	PCI (Custom)	No
M&R strategies	Yes	Yes	PCI (Custom)
single treatments	Yes	Yes	Yes
multiple treatments	Yes	Yes	Yes
M&R decision tree	Yes		Yes
Customizable unit costs	Yes	Yes	Yes
Life cycle costs	Yes	Yes	Yes
Performance prediction models	Yes	Yes	No
Optimization techniques	Yes		Yes
GIS tie-in	Yes	Yes	Yes
AutoCAD tie-in	No	No	Yes

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table C1. Software Comparison Results

Software Attributes / Features	Pavement Information Management System & Database (PIMS)	Pavement Mgmt. System 3.0 & 3.1 (PMS-III)	Pavement Mgmt. System Program (PMSPro5.6)
General			
Vendor / Manufacturer	CTL Thompson, Inc.	Director of Pavement Evaluation Services	(Arcview Required) Pavement Engineers
Windows Version	Yes	Yes	Yes
Cost	$13,000	$2,500 - $3,000	<$2,000
Annual support costs	No	1st yr Free / Then Hourly	No
Technical Support	CTL Thompson	PMS-III	PMS Pro5.6
Software Upgrades	50% of software	No	Free
User's meetings	No	By Request	No
Ease of operation/use (1-3)	1	1	1
Level of effort: impln/operations (1-3)	1	1	1
Private/Public domain	Private	Private	Private
Budget related			
5-20 year budgets	Yes	Yes	Yes
Constrained budgets	Yes	Yes	Yes
"What-if" scenarios	Yes	Yes	Yes
Packaging of projects	Yes	No	No
Committed projects	Yes	Yes	No
Backlog/Deferred costs	No	No	No
Stop-gap costs	No	No	No
Technical			
Pavement Inventory	Yes	Yes	Yes
Inventory on non-pavement elements	Yes	No	Yes
Structural Information	Yes	Yes	Yes
Deflection Information	Yes	Yes	No, only Modulus
Condition surveys - distress types	13 AC / 16 PCC	14 AC / 12 PCC	8 AC / 8 PCC
Manual surveys	Yes	Yes	Yes
Automated surveys	No	No	Yes
Condition indices	PCI using SHRP	PCR	PCR, COE PCI, others
M&R strategies	Yes	Yes	Yes
single treatments	Yes	Yes	Yes
multiple treatments	Yes	Yes	Yes
M&R decision tree	Yes	Yes	Yes
Customizable unit costs	Yes	Yes	Yes
Life cycle costs	No	No	Yes
Performance prediction models	No	Yes	Yes
Optimization techniques	Yes	Yes	No
GIS tie-in	Yes	Yes	Yes
AutoCAD tie-in	No	No	No

ORANGE COUNTY TRANSPORTATION AUTHORITY

Table C1. Software Comparison Results

Software Attributes / Features	RoadManager 2000™	RoadScan	Visual/PMS™
General			
Vendor / Manufacturer	Vanasse Hangen Brustlin, Inc.	Maxim Technologies, Inc. Inc.	Texas Research & Devel. Incorporated
Windows Version	Yes	Yes	Yes
Cost	$3,800	$9,000 (discounts avail for data coll)	$50K - $200K
Annual support costs	$500/yr	Hourly charge	$14,000
Technical Support	Vanasse Hangen	Maxim Technologies	Texas Research & Devel.
Software Upgrades	2 per year	No	Annual
User's meetings	No	No	Yes
Ease of operation/use (1-3)	2	1	1
Level of effort: impln/operations (1-3)	2	2	1
Private/Public domain	Private	Private	Private
Budget related			
5-20 year budgets	Yes	Yes	Yes
Constrained budgets	Yes	Yes	Yes
"What-if" scenarios	Yes	Yes	Yes
Packaging of projects	Yes	Yes	Yes
Committed projects	Yes	Yes	Yes
Backlog/Deferred costs	No	Yes	No
Stop-gap costs	No	Yes	No
Technical			
Pavement Inventory	Yes	Yes	Yes
Inventory on non-pavement elements	Yes	Yes	Yes
Structural Information	Yes	Yes	Yes
Deflection Information	No	Yes	Yes
Condition surveys - distress types	AC / PCC	11 AC / 14 PCC	Custom
Manual surveys	Yes	Yes	Yes
Automated surveys	No	No	No
Condition indices	PCI	PCI using SHRP	Custom
M&R strategies	Yes	Yes	Yes
single treatments	Yes	Yes	Yes
multiple treatments	No	Yes	Yes
M&R decision tree	Yes	Yes (Custom)	Yes
Customizable unit costs	Yes	Yes	Yes
Life cycle costs	Yes	Yes	Yes
Performance prediction models	Yes	Yes	Yes
Optimization techniques	Yes	Yes	Yes
GIS tie-in	Yes	Yes	Yes
AutoCAD tie-in	Yes	No	No

APPENDIX D
Survey Forms

Roadway Asphalt (AC) Pavement Surface Inspection

Client _____ Date _____ (mm/dd/yr)

Branch _____ Section No. _____ Survey Team _____

Sample Unit _____ Random _____ Additional _____

Area of Sample Unit, SF (l x w) _____

All distresses are measured in square feet except 4, 7, 8, 9, 10, which are measured in linear feet

Distress Types & Codes

1. Alligator/Fatigue Cracking
2. Bleeding
3. Block Cracking
4. Bumps and Sags
5. Corrugation
6. Depression
7. Edge Cracking
8. Joint Reflective Cracking
9. Lane/Shoulder Drop-Off
10. Long./Transverse Cracking
11. Patching and Utility Cuts
12. Polished Aggregate
13. Potholes
14. Railroad Crossing
15. Rutting
16. Shoving
17. Slippage Cracking
18. Swell
19. Weathering/Raveling

Sample Unit Sketch

Distress Type, Severity, and Quantity

Type	Severity	Quantity	Type	Severity	Quantity	Type	Severity	Quantity
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	

Totals

Type	Severity	Quantity	Type	Severity	Quantity	Type	Severity	Quantity
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	

Comments: _____

Figure D1. Roadway AC Pavement Distress Survey Form

Roadway Asphalt (AC) Pavement Surface Inspection

Client _____ Date _____ mm/dd/yr

Branch _____ Section No. _____ Survey Team _____

Sample Unit _____ Random _____ Additional _____

Area of Sample Unit, SF (l x w) _____

All distresses are measured in square feet except 4, 7, 8, 9, 10 which are measured in linear feet

Distress Types & Codes

1. Alligator/Fatigue Cracking
2. Bleeding/Flushing
3. Block Cracking
7. Edge Cracking
10. Long./Transverse Cracking
11. Patching and Utility Cuts
15. Rutting
16. Shoving
19. Weathering/Raveling

Sample Unit Sketch

Distress Type, Severity, and Quantity

Type	Severity	Quantity	Type	Severity	Quantity	Type	Severity	Quantity
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	

Totals

Type	Severity	Quantity	Type	Severity	Quantity	Type	Severity	Quantity
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	
	L M H			L M H			L M H	

Comments: _____

Figure D2. Standardized Roadway AC Pavement Distress Survey Form

Roadway Concrete (PCC) Pavement Surface Inspection

Client _____ Date _____ mm/dd/yr

Branch _____ Section No. _____ Survey Team _____

Sample Unit _____ Random _____ Additional _____

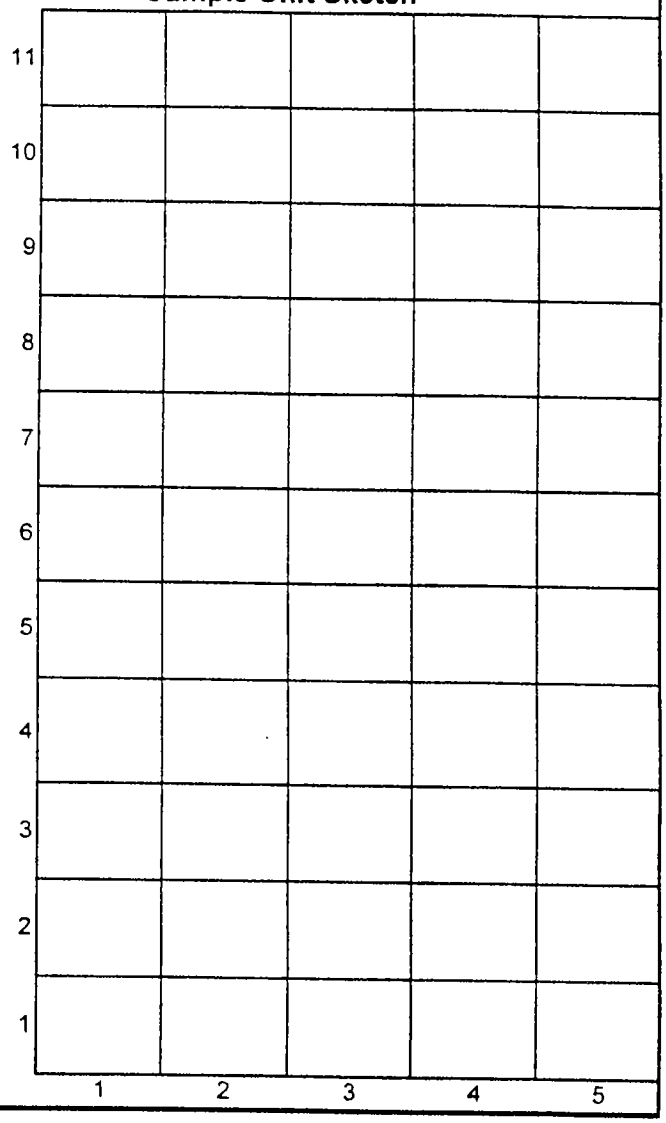
Number of Slabs in Sample Unit _____ Slab size (l x w) _____

All distresses are counted by number of slabs except 65, which is rated for entire sample unit

Distress Types & Codes

21. Blowup
22. Corner Break
23. Divided Slab
24. Durability Cracking
25. Faulting
26. Joint Seal Damage
27. Lane/Shoulder Drop-Off
28. Linear Cracking
29. Large Patch
30. Small Patch
31. Polished Aggregate
32. Popouts
33. Pumping
34. Punchout
35. Railroad Crossing
36. Scaling
37. Shrinkage Cracking
38. Corner Spall
39. Joint Spall

Sample Unit Sketch



Totals

Distress Code	Severity	No. of Slabs
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	

Comments _____

Figure D3. Roadway PCC Pavement Distress Survey Form

Roadway Concrete (PCC) Pavement Surface Inspection

Client _____ Date _____ mm/dd/yr

Branch _____ Section No. _____ Survey Team _____

Sample Unit _____ Random _____ Additional _____

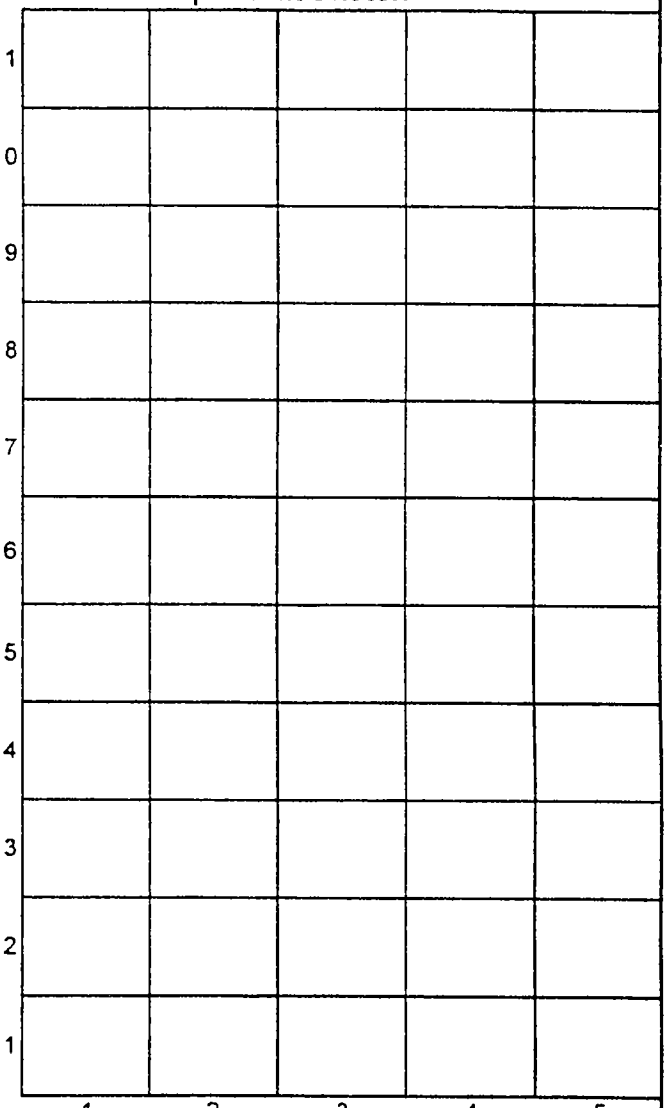
Number of Slabs in Sample Unit _____ Slab size (l x w) _____

All distresses are counted by number of slabs except 65, which is rated for entire sample unit

Distress Types & Codes

22. Corner Break
24. Durability Cracking
25. Faulting
26. Joint Seal Damage
28. Linear Cracking (Longitudinal/Transverse)
32. Popouts
37. Shrinkage Cracking
39. Joint Spall

Sample Unit Sketch



Totals

Distress Code	Severity	No. of Slabs
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	
	L M H	

Comments _____

Figure D4. Standardized Roadway PCC Pavement Distress Survey Form

Jim Armstrong
City Manager
City of Fullerton
303 W. Commonwealth Ave.
Fullerton, CA 92832

John Bahorski
City Manager
City of Dana Point
33282 Golden Lantern, #210
Dana Point, CA 92629

Jerry Bankston
City Manager
City of La Habra
P.O. Box 337
La Habra, CA 90633-0337

Greg Beaubien
Interim City Manager
City of Buena Park
P.O. Box 5009
Buena Park, CA 90622-5009

Frank Benest
City Manager
City of Brea
1 Civic Center Cir.
Brea, CA 92821-5732

Paul Brady
City Manager
City of Irvine
P.O. Box 19575
Irvine, CA 92623-9575

Tim Casey
City Manager
City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Bruce Channing
City Manager
City of Laguna Hills
25201 Paseo De Alicia, Ste 150
Laguna Hills, CA 92653

Robert D'Amato
City Administrator
City of Placentia
401 E. Chapman Ave.
Placentia, CA 92870

Dennis Danner
Interim City Manager
City of Newport Beach
P.O. Box 1768
Newport Beach, CA 92658-8915

Robert C. Dominguez
City Manager
City of Los Alamitos
3191 Katella Ave.
Los Alamitos, CA 90720-5600

Robert C. Dunek
City Manager
City of Lake Forest
23161 Lake Center Dr., Ste. 100
Lake Forest, CA 92630

Kenneth Frank
City Manager
City of Laguna Beach
505 Forest Ave.
Laguna Beach, CA 92651

William Huston
City Manager
City of Tustin
P.O. Box 1089
Tustin, CA 92781-1089

Dan Joseph
City Manager
City of Mission Viejo
25909 Pala, Ste. 200
Mission Viejo, CA 92691

Daniel Keen
City Manager
City of La Palma
7822 Walker Street
La Palma, CA 90623

Raymond Kromer
City Manager
City of Fountain Valley
10200 Slater Ave.
Fountain Valley, CA 92708

Fred Maley
City Manager/Public Works Dir.
City of Villa Park
17855 Santiago Blvd.
Villa Park, CA 92861

Terry Matz
City Manager
City of Stanton
7800 Katella Ave.
Stanton, CA 90680

Janice Mittermeier
Chief Executive Officer
County of Orange
10 Civic Center Plaza
Santa Ana, CA 92701

Mark J. Ochenduszko
City Manager
City of Cypress
P.O. Box 609
Cypress, CA 90630

Mike Parness
City Manager
City of San Clemente
100 Avenida Presidio
San Clemente, CA 92672

David Ream
City Manager
City of Santa Ana
P.O. Box 1988
Santa Ana, CA 92702

Allan L. Roeder
City Manager
City of Costa Mesa
P.O. Box 1200
Costa Mesa, CA 92628-1200

Dave Rudat
City Manager
City of Orange
P.O. Box 449
Orange, CA 92856-9049

Jim Ruth
City Manager
City of Anaheim
P.O. Box 3222
Anaheim, CA 92805

George Scarborough
City Administrator
City of San Juan Capistrano
32400 Paseo Adelanto
San Juan Capistrano, CA 92675

Ray Silver
City Administrator
City of Huntington Beach
P.O. Box 190
Huntington Beach, CA 92648

303 W. Commonwealth Ave.
Fullerton, CA 92832

Les M. Jones
Director of Public Services
City of Garden Grove
13802 Newhope
Garden Grove, CA 92843

Robert Beardsley
Public Works Director
City of Huntington Beach
P. O. Box 190
Huntington Beach, CA 92648

Ray Silver
City Administrator
City of Huntington Beach
P.O. Box 190
Huntington Beach, CA 92648

Robert Eichblatt
City Engineer
City of Huntington Beach
P. O. Box 190
Huntington Beach, CA 92648

James Eldridge
Public Works Director
City of Irvine
P.O. Box 19575
Irvine, CA 92623-9575

Majdi Ataya
City Engineer
City of La Habra
P.O. Box 337
La Habra, CA 90633-0337

Ismile H. Noorbaksh
Public Works Director
City of La Palma
7822 Walker Street
La Palma, CA 90623

Terry Brandt
Municipal Services Director
City of Laguna Beach
505 Forest Avenue
Laguna Beach, CA 92651

Ken Rosenfield
Director of Public Works
City of Laguna Hills
25201 Paseo de Alicia, Ste 150
Laguna Hills, CA 92653

Ken Montgomery
Public Works Dir/City Engineer
City of Laguna Niguel
27801 La Paz Rd.
Laguna Niguel, CA 92677

Robert Woodings
Director of Public Works
City of Lake Forest
23161 Lake Center Dr., Ste. 100
Lake Forest, CA 92630

Victor Rollinger
Director of Public Services
City of Los Alamitos
3191 Katella Ave.
Los Alamitos, CA 90720

Dennis Wilberg
Public Works Dir/Asst City Mgr
City of Mission Viejo
25909 Pala, Ste. 200
Mission Viejo, CA 92691

Don Webb
Public Works Director
City of Newport Beach
P.O. Box 1768
Newport Beach, CA 92658-8915

William Patapoff
City Engineer
City of Newport Beach
P.O. Box 1768
Newport Beach, CA 92658-8915

Harry Thomas
Public Works Director
City of Orange
P.O. Box 449
Orange, CA 92856-9049

Jerry Bailey
Senior Civil/Design Engineer
City of Orange
P.O. Box 449
Orange, CA 92856-9049

Roger Hohnbaum
Assistant City Engineer
City of Orange
P.O. Box 449
Orange, CA 92856-9049

Christopher Becker
Director of Public Works
City of Placentia
401 E. Chapman Ave.
Placentia, CA 92870

William E. Cameron
City Engineer
City of San Clemente
910 Calle Negocio, Ste. 100
San Clemente, CA 92673

William M. Huber
Senior Civil Engineer
City of San Juan Capistrano
32400 Paseo Adelanto
San Juan Capistrano, CA 92675

James R. Ross
Director of Public Works
City of Santa Ana
P.O. Box 1988
Santa Ana, CA 92702

Steve Badum
Public Works Director
City of Seal Beach
211 8th Street
Seal Beach, CA 90740

Michael M. Kim
Director of Public Works
City of Stanton
7800 Katella Ave.
Stanton, CA 90680

Tim D. Serlet
Public Works Director
City of Tustin
P.O. Box 1089
Tustin, CA 92781-1089

Fred Maley
City Manager/Public Works Dir.
City of Villa Park
17855 Santiago Blvd.
Villa Park, CA 92861

Brad Fowler
Public Works Director
City of Westminster
8200 Westminster Blvd.
Westminster, CA 92683

Fernando C. Saldivar
Assistant City Engineer
City of Yorba Linda

P.O. Box 87014
Yorba Linda, CA 92885-8714

Daryl K. Halls
Mgr Policy Dev. & Leg. Svcs.
League of California Cities
600 W. Santa Ana Blvd., Ste. 214
Santa Ana, CA 92701

Ignacio Ochoa
Transportation Program Manager
Orange County PF & RD
P.O. Box 4048
Santa Ana, CA 92702-4048

Jerry Bennett
Chief Engineer
Transportation Corridor Agencies
P.O. Box 28870
Santa Ana, CA 92799-8870

CITY OF COSTA MESA

CALIFORNIA 92628-1200 P.O. BOX 1200

FROM THE DEPARTMENT OF PUBLIC SERVICES/ENGINEERING DIVISION

June 21, 2002

Mr. David Elbaum, Director of Strategic Planning
Orange County Transportation Authority
550 South Main Street
P. O. Box 14184
Orange, CA 92863-1584

SUBJECT: Pavement Management System–Technical Memorandum

Dear Mr. Elbaum:

The City of Costa Mesa is pleased to submit the Pavement Management System–Technical Memorandum updated in May 2002 for the arterial streets within the City of Costa Mesa.

Should additional information be required, I can be reached at 714-754-5173.

Sincerely,

Ernesto Munoz, P. E.
City Engineer

EM/ch (Engr.2002/pmstechletteroctaem)

Attachment

c: William J. Morris, Director of Public Services
Fariba Fazeli, Senior Engineer
Ve Tran, Assistant Engineer
Donna Theriault, Management Analyst

To: Members of the Board of Directors

From: Orange County Transportation Authority S

Subject: Arterial Highway Rehabilitation Progr
Countywide Assessment Standards

---

represents pavement in need of either overlay or tot
most costly type of repair.

The study pointed out the cost-effectiveness a
comprehensive preventive maintenance program notin
the county had not taken advantage of such tools. Of t
the data collection and methodology were so diversi
analysis difficult .

As a result of the March 1998 study, the Board ap
program to assist local agencies in the effort to impro
condition with the highest daily traffic. This program
from federal funds that will be used as up to 50 percer
existing sources such as state gas tax, Measure M tu
revenue.

Additionally, the Board of Directors asked staff to w
develop standard data collection and assessmer
encourage all cities to utilize available tools for pavemen

Discussion

On May 15, 1998, local agencies vying for $17.1 mill
submitted 146 project applications requesting nearly $2
rehabilitation projects countywide. These projects
evaluated based upon Board-approved selection criteria.

The Technical Steering Committee met on July 27, 19
priority list shown as Attachment A. This list, if approve
AHRP share of 86 projects and partially fund nine proje
miles of roadway will be rehabilitated through this progra
partial funding were tied in their competitive score and v
of the $17.1 million on a proportional basis.

However, given the interest in the program, the adoption
amounts and the sequence of future funding cycles, an a
is now proposed. Staff recommends increasing the
program by advancing $5.3 million of Surface Trans ta
from Fiscal Year 2000-01 into the current AHRP cycle. A

projects with this new funding level is included as Attachment B. If approved, more than $22.4 million will be made available to fully fund the AHRP requested share for 114 projects resulting in the rehabilitation of 84.4 miles of the MPAH network.

Pavement Assessment Standards

Concurrent with the AHRP call for projects, OCTA staff has been working with representatives from Nichols Consulting Engineers and the cities to develop standards in the way pavement conditions are reviewed and reported. The results of this effort are included in Attachment C.

In order to compile the report, the consultant surveyed all 32 local agencies and received responses from all but three of them. The survey sought specific information regarding the management tools currently used for tracking pavement condition, as well as qualitative information used for the evaluation process. All but one agency countywide uses electronic data management tools to aid in the preventive maintenance planning process.

The survey results suggest several key changes to the way pavement quality is currently analyzed in Orange County. Pavement is evaluated based upon a number of criteria. Once a street segment has been evaluated, a score or value is assigned. Typically, this score is referred to as the Pavement Condition Index (PCI).

One of the challenges identified in the previous study was the difference in scoring methodology among cities. PCI scales used countywide include 4, 10, 100 and 260+ point scales. This diversity makes ongoing data collection, comparison and analysis difficult without a complex conversion process. Adoption of a 100 point PCI scale countywide is recommended to alleviate this problem.

Average qualitative thresholds used to summarize pavement condition (i.e., good, fair, poor), in the Orange County Pavement Condition Assessment Study, appear to be more conservative than originally assumed. Future reports will utilize slightly lower trigger values to denote quality.

Table 1 illustrates the proposed PCI threshold values for future consideration.

Table 1 – Pavement Condition Index Qualitative Scale

Pavement Quality	Original Threshold	Revised Threshold	Treatment
Very Good	90 – 100	86 – 100	None proposed
Good	84 – 89	75 – 85	Slurry Seal
Fair	73 – 83	60 – 74	Thin Overlay
Poor	60 – 72	41 – 59	Thick Overlay
Very Poor	0 – 59	0 – 40	Reconstruction

Pavement assessment involves the examination of pavement quality based upon a variety of factors. Although the engineering community agrees on the need for assessments, no universal standard exists. Actual criteria is determined locally. For some communities ride quality is most important, for others, appearance and still others, durability. However, the survey showed that more than half of all cities collect at least nine common categories. Table 2 represents the common distress factors recommended for inclusion in all Pavement Management Systems countywide.

Table 2 – Nine Most Common Asphalt Concrete Distresses

Alligator / Fatigue Cracking	Rutting
Longitudinal Cracking	Bleeding / Flushing
Transverse Cracking	Raveling / Weathering
Block Cracking	Patching / Utility Cuts
Edge Cracking	

The presence of these core distress indicators within all PMS reports makes comparison and consolidation of data more relevant and reflective of the system as a whole. Although the consultant recommends use of these nine categories as the sole contributors to PCI calculations, staff recommends and the Technical Advisory Committee (TAC) concurs, weighting and additional categories should be left to the discretion of individual cities. This will allow local concerns and interests to be addressed while still maintaining some consistency among all local agencies.

In light of the consultant's findings and TAC consideration, the following standards are recommended for pavement condition assessment in Orange County:

- Use of an electronic Pavement Management System.
- Employment of the qualitative thresholds shown in Table 1 of this staff report in future countywide analysis.
- Adoption of a 100-point PCI scale.
- Inclusion of the nine most common categories as shown in Table 2 of this staff report.
- Conformance to these standards by June 30, 2002.
- Participation in future competitive rehabilitation funding programs beginning July 1, 2002, contingent upon conformance to these standards.

These standards were developed with current local agency investment and processes in mind. However, it should be noted that at least half of the agencies will need to make some adjustments to their system during the next 4 years to ensure conformance. Measure M currently requires that local agencies update their systems every 2 years in order to qualify for approximately $25 million in Turnback funds annually.

Summary

A call for street rehabilitation projects was recently concluded. More than 140 applications were submitted requesting nearly $29 million in federal Surface Transportation Program funding. Staff recommends increasing the program funding from $17.1 million to $22.3 million. Additionally, countywide pavement condition assessment standards have been developed and are recommended for adoption by all local agencies in Orange County.