Highway Performance Monitoring System Analytical Process Application to Kentucky's Adequacy Program

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The usefulness and applicability of the Highway Performance Monitoring System (HPMS) analytical process to Kentucky's Adequacy Rating program were examined. Noncompatibility of final ratings of highway sections from the Adequacy Rating and the HPMS program was a major concern resulting in the loss of credibility of either program for use in planning and programming. Therefore, the ratings from the HPMS and Adequacy programs were compared using highway sections from the HPMS and Adequacy data files to determine the similarities in methodologies in order to select one common tool for systems- and project-level analysis. Appraisal rates and weights for the different components of rating from the HPMS software were changed in relation to design standards and technical project selection criteria. Four scenarios with different weights and critical accident rate as a separate data element were chosen. Ratings for 21 HPMS samples from each scenario and the Adequacy program were reviewed by an expert panel to select the most appropriate scenario for use by the Kentucky Department of Highways as the standard procedure for the HPMS and Adequacy Rating program. The expert panel recommended using Scenario 1 without the critical accident rate as the standard procedure.

Highway Performance Monitoring System (HPMS) data contain current and accurate information about the geometric and operational characteristics of the highway systems sampled at random to conduct meaningful system analysis with known precision. FHWA uses the national HPMS data for various purposes: for preparing a biennial report to Congress, apportioning I-4R, and determining highway condition, performance, and needs. The use of HPMS data by FHWA to furnish pertinent information to Congress about the nation's highway condition, performance, and needs with different scenarios was very similar to some of the work performed by the Kentucky Department of Highways in providing necessary data to the Kentucky General Assembly. The process of assessing the condition and performance of the system relative to available or expected funding convinced Kentucky Transportation Cabinet management personnel about its potential and usefulness to the cabinet. Therefore, the HPMS program in Kentucky received necessary support for the implementation and expansion to include other systems (state primary and federal aid). The HPMS program was reviewed in detail by the U.S. General Accounting Office (GAO) and found to be a reliable tool for monitoring highway performance using nationally accepted engineering standards.

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The HPMS analytical package encompasses most of the geometric and operational data elements substratified and assigned with relative weight, depending on the functional ability of the system. The software computes the overall composite index using the main data elements of condition, safety, and service that have been stratified and assigned numerical weights. In addition, roadway sections are ranked according to existing and future deficiencies with reference to the composite index.

OBJECTIVE

State highway agencies have used adequacy ratings for a long time to help priority rank highway projects. The first ratings were obtained in Kentucky in 1949 and were used for planning a 5-year construction program. Since then updates have been infrequent. A field procedural manual was prepared in 1963, and survey ratings were provided by the highway districts thereafter. Documented revisions to Kentucky's Adequacy Rating procedures were compiled as a research report in 1976. The field inventory form and manual were revised in 1979 for conformance with the HPMS data reporting requirements.

"Adequacy" is defined as being sufficient for a specific requirement or standard. Adequacy ratings are used to provide a systematic procedure for periodically rating highway sections or projects for improvement programming. Using the adequacy rating technique, highway sections or bridges are assigned numerical ratings that indicate their relationship to established design standards. Kentucky's rating procedure includes the elements of condition, safety, service, and operation. Several subelements make up the main elements, and relative weights are represented by maximum points for a total of 100.

The compatibility of Adequacy Ratings with the HPMS ratings became a concern in Kentucky because the system's analysis and needs were determined with HPMS software and because individual project ratings were obtained from the Adequacy Rating program for prioritization. The department's management personnel believed that it would be highly useful and appropriate to use common criteria for both the HPMS and the Adequacy Rating programs. One common tool with uniform criteria further eliminates the possibility of any disagreement between the composite indexes of any roadway segment computed from HPMS and Adequacy Rating. There was also some uncertainty about the appropriateness

of the data items and their corresponding weights in the HPMS software for use in Kentucky. Elimination or minimization of personal judgment data items in the Adequacy Rating was considered to be essential in obtaining consistent or uniform ratings (indexes).

The objective of this analysis was to evaluate the HPMS data elements and weighting factors and compare them with the data elements and weighting factors of the Kentucky Adequacy Rating program and to decide whether the department could use HPMS software with appropriate weights for the various data elements as the standard tool for Adequacy Rating in Kentucky. The basic aim was to investigate the feasibility of using one tool for determining performance, analyzing needs, and prioritizing projects.

PROCEDURE

The various attributes used in analyzing a roadway section by the Adequacy Rating and HPMS programs by rural/urban with relative weights are shown in Tables 1 through 4. The Adequacy Rating program contains attributes such as surface condition, base condition, maintenance economy, drainage adequacy, and traffic control devices that are subjectively rated by highway district personnel and are prone to error and inconsistency. The program logic that computes composite index was complex, making desired adjustments difficult. Assignment of uniform weights to the main components of condition, safety, service, and operation, regardless of functional system, was viewed as inappropriate. By contrast,

TABLE 1 Adequacy Rating Elements for Rural Highways

Condition Elements (35 points)	Maximum Points
Maintenance Economy	7
Surface Condition	10
Base Condition	10
Drainage	8
Safety Elements (25 points)	
Accident Experience	5
Vertical Alignment	4
Horizontal Alignment	4
Stop Sight Distance	7
Skid Resistance	5
Service Elements (30 points)	
Ride Quality	5
Pavement Width	10
Shoulder Width	5
Shoulder Type	2
Passing Sight Distance	8
Operational Elements (10 points)	
V/C Ratio	10
Total Maximum Points	100

TABLE 2 Adequacy Rating Elements for Urban Highways

Condition Elements (35 points)	Maximum Points
Maintenance Economy	7
Surface Condition	10
Base Condition	10
Drainage	8
Safety Elements (25 points)	
Accident Experience	10
Traffic Control Devices	
Standardization	5
Effectiveness	5
Maintenance	5
Service Elements (25 points)	
Pavement Width	15
Operating Speed	10
Operational Elements (15 points)	
V/C Ratio	15
Total Maximum Points	100

TABLE 3 HPMS Rural Composite Index Weights Default Values

Data Items by Category	Item Number	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Condition		Interstate	Principal Arterials		Minor Arterials		Collectors
----------		(Total=40)	(Total=40)		(Total=45)		(Total=50)
Pavement Type	1	010	010		015		015
Pavement Condition	2	025	025		025		030
Drainage Adequacy	3	005	005		005		005
Safety		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Minor Arterials	Collectors
------			< 3 Lanes	> 3 Lanes	< 3 Lanes	> 3 Lanes	
		(Total=30)	(Total=30)	(Total=30)	(Total=30)	(Total=30)	(Total=30)
Lane Width	4	010	015	010	015	010	015
Shoulder Width	5	005	005	005	005	005	005
Median Width	6	005	000	005	000	005	000
Alignment Adequacy	7	010	008	010	010	010	010
Service		Interstate	Principal Arterials		Minor Arterials		Collectors
-------		(Total=30)	(Total=30)		(Total=25)		(Total=20)
Volume/SF Ratio	8	025	025		025		020
Access Control	9	005	005		000		000
Total Points		100	100		100		100

TABLE 4 HPMS Urban Composite Index Weights Default Values

Data Items by Category	Item Number	Group 1	Group 2	Group 3	Group 4	Group 5
Condition		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
----------		(Total=40)	(Total=40)	(Total=40)	(Total=45)	(Total=50)
Pavement Type	1	010	010	010	015	015
Pavement Condition	2	025	025	025	025	025
Drainage Adequacy	3	005	005	005	005	010
Safety		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
------		(Total=30)	(Total=30)	(Total=30)	(Total=30)	(Total=30)
Lane Width	4	020	020	020	020	030
Shoulder Width	5	005	005	000	000	000
Median Width	6	005	005	010	010	000
Service		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
-------		(Total=30)	(Total=30)	(Total=30)	(Total=25)	(Total=20)
Volume/SF Ratio	7	025	025	025	025	020
Access Control	8	005	005	005	000	000
Total Points		100	100	100	100	100

Note: Pavement condition data for all HPMS samples are obtained from Mays Ride Meter

the HPMS program has only one subjectively rated data element (drainage adequacy). The pavement condition data for all roadway sections in Kentucky is obtained by the Mays ride meter. Therefore, no subjectivity is involved in its collection. Weighting factors assignment is in accordance with the functional ability of the system. Availability of technical support from the FHWA, easy-to-use new-generation software, periodic enhancements, and flexible weight/appraisal rates are some of the advantages of the HPMS analytical package.

The Transportation Research Center at the University of Kentucky was asked to analyze the two programs' criteria and weighting factors to determine whether the HPMS software could be adopted by the department as the standard tool for analyzing adequacy, determining systems performance, and prioritizing projects. The technique used by the Transportation Research Center in analyzing the methodology and rating procedure of the HPMS and Adequacy Rating program was to determine, summarize, and compare composite indexes for the same highway sections from the HPMS and Adequacy Rating programs' data files.

From a summary of statewide final indexes in which HPMS and Adequacy Rating sections were compared, it was determined that the higher functional systems (Interstate, principal arterials) closely matched in their assigned ratings. The percentage of total matches decreased as the range of final indexes increased. A summary of the statewide final indexes

TABLE 5 Final Index Comparison of HPMS and Adequacy Ratings

	NUMBER OF HIGHWAY SECTIONS BY FINAL INDEX DIFFERENCE											
	<=2		>2 & <=5		>5 & <=10		>10 & <=15		>15 & <=20		>20	
FUNCTIONAL CLASS	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
RURAL												
Interstate	53	30.6%	41	23.7%	48	27.7%	20	11.5%	5	2.9%	6	3.5%
Principal Art.	75	17.9%	119	28.4%	116	27.7%	62	14.8%	21	5.0%	26	6.2%
Minor Arterial	14	6.7%	32	15.2%	37	17.6%	63	30.0%	35	16.7%	29	13.8%
Major Collector	4	2.3%	8	4.6%	21	12.1%	29	16.7%	24	13.8%	88	50.5%
Minor Collector	9	5.3%	14	8.3%	18	10.6%	32	18.9%	31	18.3%	65	38.4%
URBAN												
Interstate	27	27.8%	31	32.0%	21	21.6%	7	7.2%	3	3.1%	8	8.2%
Freeway	7	33.3%	5	23.8%	5	23.4%	3	14.1%	1	4.7%	0	0.0%
Principal Art.	33	14.4%	22	9.6%	53	23.1%	40	17.5%	33	14.4%	48	20.9%
Minor Arterial	25	9.4%	27	10.2%	46	17.3%	34	12.8%	44	16.5%	90	33.8%
Collector	5	7.4%	6	8.8%	10	14.7%	10	14.7%	6	8.8%	31	45.5%
TOTAL	252		305		375		300		203		391	

for ranges of differences for same highway sections from the HPMS and Adequacy data files using the HPMS and Adequacy program software is presented in Table 5. The results show that the ratings from the two programs match closely for the higher functional classes of road. However, the variability increases substantially for most other classes of road. The reasons for this noticeable and wide variation can be attributed to the age and quality of data on the Adequacy Rating file, influence in consistency of the subjectively rated data items, and the weighting process of the data items. The Adequacy Rating data file has not been routinely updated, particularly for lower functional systems, since 1983 because of other priorities and manpower shortages; the HPMS file, which is smaller and more manageable, is more current. Therefore, it is apparent that, although there is noticeable dissimilarity in the data component of the two programs, the final indexes would have shown good correlation because of similar methodology if the Adequacy Rating data file had been more current. Thus, it is conceivable that the HPMS analytical package can be used to determine the adequacy rating and prioritization of all highway sections instead of the Adequacy Rating software.

To analyze the effect of weighting schemes on the indexes and determine the most appropriate weighting factors for departmental use, an expert panel comprising in-house professional staff was formed and chaired by the director of the planning division. The expert panel met several times to review in detail the methodology, various data components, relative weightings, and appraisal rates. Weightings and appraisal rate changes were recommended by the panel in relation to the design standards and technical project selection criteria. Inclusion of accident rate as a separate sub-data element for emphasizing safety was suggested by the panel. Hence, four scenarios (S1, S2, S3, and S4) were developed; they are presented in Tables 6 through 13. The first three scenarios contain accident rates under safety in addition to other data items that are identical to FHWA's analysis process with recommended changes in weighting and appraisal rates by the panel. The appraisal rates are presented in Tables 14 and 15. Scenario S4 is totally different in emphasis, weighting scheme, and data items grouping for arterial and collectors. No changes were suggested for the Interstate system. Twenty-one sample sections comprising all functional systems and rural/urban were selected from the HPMS data file, and the indexes were computed manually for the four scenarios. Those sections with final composite indexes from each scenario and from the Adequacy Rating file are presented in Table 16.

It is apparent from Table 16 that the range of difference in indexes from Scenario S4 is appreciably higher than the other three scenarios because of overemphasis on some data attributes (lane widths, shoulder width, alignment, adequacy, accident) and the unique weighting scheme. Hence, it was unacceptable. The indexes from Scenarios S1, S2, and S3 show good correlation except for an urban collector and a rural collector section that have significant variation because of lane width emphasis. The indexes from the Adequacy Rating source also show good correlation for higher functional systems despite old data. Inclusion of accident rate under the safety item did not cause noticeable change in the final indexes, implying that some sections with very good safety rating have a high accident frequency that is due to access points, driver behavior, and weather conditions. After careful review of the

TABLE 6 HPMS Rural Composite Index Weights, Scenario 1

Data Items by Category	Item Number	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Condition		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Minor Arterials	Collectors
---		(Total=40)	(Total=40)	(Total=40)	(Total=45)	(Total=45)	(Total=50)
Pavement Type	1	010	010	010	015	015	015
Pavement Condition	2	025	025	025	025	025	030
Drainage Adequacy	3	005	005	005	005	005	005
Safety		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Minor Arterials	Collectors
---			< 3 Lanes	> 3 Lanes	< 3 Lanes	> 3 Lanes	
		(Total=30)	(Total=30)	(Total=30)	(Total=30)	(Total=30)	(Total=30)
Lane Width	4	009	013	009	013	009	013
Shoulder Width	5	004	004	004	004	004	004
Median Width	6	004	000	004	000	004	000
Alignment Adequacy	7	008	008	008	008	008	008
Accident		005	005	005	005	005	005
Service		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Minor Arterials	Collectors
---		(Total=30)	(Total=30)	(Total=30)	(Total=25)	(Total=25)	(Total=20)
Volume/SF Ratio	8	025	025	025	025	025	020
Access Control	9	005	005	005	000	000	000
Total Points		100	100	100	100	100	100

TABLE 7 HPMS Urban Composite Index Weights, Scenario 1

Data Items by Category	Item Number	Group 1	Group 2	Group 3	Group 4	Group 5
Condition		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
---		(Total=40)	(Total=40)	(Total=40)	(Total=45)	(Total=50)
Pavement Type	1	010	010	010	015	015
Pavement Condition	2	025	025	025	025	025
Drainage Adequacy	3	005	005	005	005	010
Safety		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
---		(Total=30)	(Total=30)	(Total=30)	(Total=30)	(Total=30)
Lane Width	4	017	017	017	017	025
Shoulder Width	5	004	004	000	000	000
Median Width	6	004	004	008	008	000
Accident		005	005	005	005	005
Service		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
---		(Total=30)	(Total=30)	(Total=30)	(Total=25)	(Total=20)
Volume/SF Ratio	7	025	025	025	025	020
Access Control	8	005	005	005	000	000
Total Points		100	100	100	100	100

TABLE 8 HPMS Rural Composite Index Weights, Scenario 2

Data Items by Category	Item Number	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Condition		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Minor Arterials	Collectors
---		(Total=40)	(Total=40)	(Total=40)	(Total=30)	(Total=30)	(Total=25)
Pavement Type	1	010	010	010	010	010	010
Pavement Condition	2	025	025	025	015	015	010
Drainage Adequacy	3	005	005	005	005	005	005
Safety		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Minor Arterials	Collectors
---			< 3 Lanes	> 3 Lanes	< 3 Lanes	> 3 Lanes	
		(Total=30)	(Total=30)	(Total=30)	(Total=45)	(Total=45)	(Total=55)
Lane Width	4	009	013	009	020	015	020
Shoulder Width	5	004	004	004	005	005	005
Median Width	6	004	000	004	000	005	000
Alignment Adequacy	7	008	008	008	015	015	020
Accident		005	005	005	005	005	010
Service		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Minor Arterials	Collectors
---		(Total=30)	(Total=30)	(Total=30)	(Total=25)	(Total=25)	(Total=20)
Volume/SF Ratio	8	025	025	025	025	025	020
Access Control	9	005	005	005	000	000	000
Total Points		100	100	100	100	100	100

TABLE 9 HPMS Urban Composite Index Weights, Scenario 2

Data Items by Category	Item Number	Group 1	Group 2	Group 3	Group 4	Group 5
Condition		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
----------		(Total=40)	(Total=40)	(Total=40)	(Total=30)	(Total=25)
Pavement Type	1	010	010	010	010	010
Pavement Condition	2	025	025	025	015	010
Drainage Adequacy	3	005	005	005	005	005
Safety		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
------		(Total=30)	(Total=30)	(Total=30)	(Total=45)	(Total=55)
Lane Width	4	017	017	017	030	045
Shoulder Width	5	004	004	000	000	000
Median Width	6	004	004	008	010	000
Accident		005	005	005	005	010
Service		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
-------		(Total=30)	(Total=30)	(Total=30)	(Total=25)	(Total=20)
Volume/SF Ratio	7	025	025	025	025	020
Access Control	8	005	005	005	000	000
Total Points		100	100	100	100	100

TABLE 10 HPMS Rural Composite Index Weights, Scenario 3

Data Items by Category	Item Number	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Condition		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Collectors	Collectors
----------		(Total=40)	(Total=40)	(Total=40)	(Total=35)	(Total=35)	(Total=30)
Pavement Type	1	010	010	010	010	010	010
Pavement Condition	2	025	025	025	020	020	015
Drainage Adequacy	3	005	005	005	005	005	005
Safety		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Collectors	Collectors
------			< 3 Lanes	> 3 Lanes	< 3 Lanes		
		(Total=30)	(Total=30)	(Total=30)	(Total=45)	(Total=45)	(Total=55)
Lane Width	4	009	013	009	020	016	025
Shoulder Width	5	004	004	004	005	005	005
Median Width	6	004	000	004	000	004	000
Alignment Adequacy	7	008	008	008	010	010	010
Accident		005	005	005	010	010	015
Service		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Collectors	Collectors
-------		(Total=30)	(Total=30)	(Total=30)	(Total=20)	(Total=20)	(Total=15)
Volume/SF Ratio	8	025	025	025	020	020	015
Access Control	9	005	005	005	000	000	000
Total Points		100	100	100	100	100	100

TABLE 11 HPMS Urban Composite Index Weights, Scenario 3

Data Items by Category	Item Number	Group 1	Group 2	Group 3	Group 4	Group 5
Condition		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
----------		(Total=40)	(Total=40)	(Total=40)	(Total=35)	(Total=30)
Pavement Type	1	010	010	010	010	010
Pavement Condition	2	025	025	025	020	015
Drainage Adequacy	3	005	005	005	005	005
Safety		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
------		(Total=30)	(Total=30)	(Total=30)	(Total=45)	(Total=55)
Lane Width	4	017	017	017	025	040
Shoulder Width	5	004	004	000	000	000
Median Width	6	004	004	008	010	000
Accident		005	005	005	010	015
Service		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
-------		(Total=30)	(Total=30)	(Total=30)	(Total=20)	(Total=15)
Volume/SF Ratio	7	025	025	025	020	015
Access Control	8	005	005	005	000	000
Total Points		100	100	100	100	100

TABLE 12 HPMS Rural Composite Index Weights, Scenario 4

Data Items by Category	Item Number	Group 1	Group 2 < 3 Lanes	Group 3 > 3 Lanes	Group 4 < 3 Lanes	Group 5 > 3 Lanes	Group 6
Condition		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Minor Arterials	Collectors
----------		(Total=40)	(Total=40)	(Total=40)	(Total=35)	(Total=35)	(Total=30)
Pavement Type	1	010	010	010	010	010	010
Pavement Condition	2	025	025	025	020	020	015
Drainage Adequacy	3	005	005	005	005	005	005
Safety		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Minor Arterials	Collectors
		(Total=30)	(Total=30)	(Total=30)	(Total=30)	(Total=30)	(Total=30)
Lane Width	4	009	010	007	000	000	000
Shoulder Width	5	004	003	003	000	000	000
Median Width	6	004	000	003	000	008	000
Alignment Adequacy	7	008	007	007	015	007	000
Accident		005	010	010	015	015	030
Service		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Minor Arterials	Collectors
-------		(Total=30)	(Total=30)	(Total=30)	(Total=35)	(Total=35)	(Total=40)
Volume/SF Ratio	8	025	010	014	007	005	000
Access Control	9	005	000	000	000	000	000
Lane Width	4	000	008	010	010	010	015
Shoulder Width	5	000	007	003	010	010	015
Alignment Adequacy	7	000	005	003	008	010	010
Total Points		100	100	100	100	100	100

TABLE 13 HPMS Urban Composite Index Weights, Scenario 4

Data Items by Category	Item Number	Group 1	Group 2 < 3 Lanes	Group 3 > 3 Lanes	Group 4 < 3 Lanes	Group 5 > 3 Lanes	Group 6
Condition		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Minor Arterials	Collectors
----------		(Total=40)	(Total=40)	(Total=40)	(Total=35)	(Total=35)	(Total=30)
Pavement Type	1	010	010	010	005	005	005
Pavement Condition	2	025	025	025	020	020	015
Drainage Adequacy	3	005	005	005	010	010	010
Safety		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Minor Arterials	Collectors
		(Total=30)	(Total=30)	(Total=30)	(Total=30)	(Total=30)	(Total=30)
Lane Width	4	017	010	010	005	000	005
Shoulder Width	5	004	005	005	000	000	000
Median Width	6	004	000	005	000	008	000
Accident		005	015	010	025	015	025
Service		Interstate	Principal Arterials	Principal Arterials	Minor Arterials	Minor Arterials	Collectors
-------		(Total=30)	(Total=30)	(Total=30)	(Total=35)	(Total=35)	(Total=40)
Volume/SF Ratio	8	025	020	020	020	020	020
Access Control	9	005	000	000	000	000	000
Lane Width	4	000	005	005	015	015	020
Shoulder Width	5	000	005	005	000	000	000
Total Points		100	100	100	100	100	100

TABLE 14 HPMS Rural Appraisal Rates, Scenarios 1–4

Functional Class			Interstate	Principal Arterials		Minor Arterials		Collectors		
AADT			ALL	> 6000	<= 6000	> 2000	<= 2000	> 1000	400-1000	< 400
Data Items by Category	Item Number	Row Number	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
Condition										
Pavement Type	1									
High-Flexible		01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
High-Rigid		02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate		03	0.40	0.40	0.40	0.40	0.70	0.70	1.00	1.00
Low		04	0.20	0.20	0.20	0.20	0.50	0.50	0.70	1.00
Gravel		05	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20
Graded & Drained		06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pavement Condition	2									
4.6 - 5.0		01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4.1 - 4.5		02	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
3.6 - 4.0		03	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90
3.1 - 3.5		04	0.75	0.75	0.75	0.80	0.85	0.85	0.85	0.85
2.6 - 3.0		05	0.70	0.70	0.70	0.75	0.80	0.80	0.80	0.80
2.3 - 2.5		06	0.50	0.50	0.50	0.70	0.70	0.75	0.75	0.75
2.1 - 2.2		07	0.40	0.40	0.40	0.50	0.60	0.70	0.70	0.75
1.9 - 2.0		08	0.20	0.20	0.20	0.30	0.50	0.50	0.50	0.70
1.6 - 1.8		09	0.10	0.10	0.10	0.10	0.30	0.30	0.30	0.40
1.1 - 1.5		10	0.00	0.00	0.00	0.00	0.10	0.15	0.15	0.20
<= 1.0		11	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.10
Drainage Adequacy	3									
Good		01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fair		02	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Poor		03	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Safety										
Lane Width	4									
>= 12		01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11		02	0.60	0.85	0.90	0.95	1.00	1.00	1.00	1.00
10		03	0.30	0.70	0.80	0.85	0.80	0.80	0.90	1.00
9		04	0.00	0.50	0.50	0.50	0.70	0.70	0.80	0.90
<= 8		05	0.00	0.00	0.00	0.00	0.30	0.00	0.30	0.50
Shoulder Width	5									
>= 12		01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10-11		02	0.90	0.95	1.00	1.00	1.00	1.00	1.00	1.00
8- 9		03	0.70	0.80	0.90	1.00	1.00	1.00	1.00	1.00
6- 7		04	0.50	0.70	0.75	0.90	0.95	0.95	1.00	1.00
4- 5		05	0.30	0.50	0.60	0.70	0.80	0.80	1.00	1.00
2 -3		06	0.10	0.30	0.30	0.40	0.50	0.60	0.80	1.00
1		07	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.50
0		08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Median Width	6									
> 60		01	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00
40-60		02	0.85	1.00	1.00	1.00	1.00	0.00	0.00	0.00
30-39		03	0.70	0.70	0.70	0.85	0.80	0.00	0.00	0.00
20-29		04	0.60	0.60	0.60	0.70	0.70	0.00	0.00	0.00
10-19		05	0.40	0.40	0.40	0.50	0.50	0.00	0.00	0.00
5- 9		06	0.10	0.10	0.10	0.30	0.20	0.00	0.00	0.00
1- 4		07	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00
0		08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

(*continued on next page*)

TABLE 14 (*continued*)

Functional Class			Interstate	Principal Arterials		Minor Arterials		Collectors		
Data Items by Category	Item Number	Row Number	Group 1	Group 2		Group 3		Group 4		
Alignment Adequacy	7									
Horizontal										
1		01	1.00	1.00		1.00		1.00		
2		02	0.70	0.70		0.70		0.90		
3		03	0.40	0.40		0.40		0.70		
4		04	0.00	0.00		0.00		0.20		
Vertical										
1		01	1.00	1.00		1.00		1.00		
2		02	0.70	0.70		0.70		0.90		
3		03	0.40	0.40		0.40		0.70		
4		04	0.00	0.00		0.00		0.20		

Functional Class			Interstate	Principal Arterials		Minor Arterials		Collectors		
AADT			ALL	> 6000	<= 6000	> 2000	<= 2000	> 1000	400-1000	< 400
Data Items by Category	Item Number	Row Number	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
Service										
Volume/SF Ratio	8									
< .20		01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
.20-.39		02	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
.40-.49		03	0.90	0.90	0.90	0.90	0.95	0.95	0.95	0.95
.50-.59		04	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90
.60-.64		05	0.80	0.80	0.80	0.80	0.85	0.85	0.85	0.85
.65-.69		06	0.75	0.75	0.75	0.75	0.80	0.80	0.80	0.80
.70-.74		07	0.70	0.70	0.70	0.70	0.75	0.75	0.75	0.75
.75-.79		08	0.60	0.60	0.60	0.60	0.70	0.70	0.70	0.70
.80-.84		09	0.50	0.50	0.50	0.50	0.60	0.60	0.60	0.60
.85-.89		10	0.40	0.40	0.40	0.40	0.50	0.50	0.50	0.50
.90-.94		11	0.20	0.20	0.20	0.20	0.30	0.30	0.30	0.30
>=.95		12	0.10	0.10	0.10	0.10	0.15	0.15	0.15	0.15
Access Control	9									
Full		01	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Partial		02	0.00	0.60	0.80	0.00	0.00	0.00	0.00	0.00
None		03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 15 HPMS Urban Appraisal Rates, Scenarios 1–4

Functional Class			Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
Data Items by Category	Item Number	Row Number	Group 1	Group 2	Group 3	Group 4	Group 5
Condition							
Pavement Type	1						
High-Flexible		01	1.00	1.00	1.00	1.00	1.00
High-Rigid		02	1.00	1.00	1.00	1.00	1.00
Intermediate		03	0.40	0.40	0.40	0.70	0.85
Low		04	0.00	0.00	0.00	0.40	0.70
Gravel		05	0.00	0.00	0.00	0.00	0.30
Graded & Drained		06	0.00	0.00	0.00	0.00	0.00
Pavement Condition	2						
4.6 - 5.0		01	1.00	1.00	1.00	1.00	1.00
4.1 - 4.5		02	0.90	0.95	0.95	0.95	0.95
3.6 - 4.0		03	0.80	0.85	0.85	0.90	0.90
3.1 - 3.5		04	0.70	0.75	0.75	0.85	0.85
2.6 - 3.0		05	0.60	0.70	0.70	0.80	0.80
2.3 - 2.5		06	0.50	0.50	0.60	0.70	0.75
2.1 - 2.2		07	0.40	0.40	0.40	0.60	0.70
1.9 - 2.0		08	0.20	0.20	0.20	0.40	0.50
1.6 - 1.8		09	0.10	0.10	0.10	0.25	0.30
1.1 - 1.5		10	0.00	0.00	0.00	0.15	0.20
<= 1.0		11	0.00	0.00	0.00	0.05	0.10
Drainage Adequacy	3						
Good		01	1.00	1.00	1.00	1.00	1.00
Fair		02	0.70	0.70	0.70	0.70	0.70
Poor		03	0.10	0.10	0.10	0.10	0.10
Safety							
Lane Width	4		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
>= 12		01	1.00	1.00	1.00	1.00	1.00
11		02	0.70	0.70	0.90	0.90	0.90
10		03	0.50	0.50	0.70	0.80	0.80
9		04	0.25	0.25	0.60	0.70	0.70
<= 8		05	0.00	0.00	0.00	0.00	0.00
Shoulder Width	5		Interstate	Freeways/Expressways			
>= 12		01	1.00	1.00			
10-11		02	0.90	0.90			
8- 9		03	0.70	0.70			
6- 7		04	0.50	0.50			
4- 5		05	0.30	0.30			
2- 3		06	0.10	0.10			
1		07	0.00	0.00			
0		08	0.00	0.00			
Median Width **	6		Prn. Arts. Barrier	Principal Arterials No Barriers	Minor Arterials Built-Up	Minor Arterials Outlying	Collectors
> 60		01	1.00	1.00	1.00	1.00	0.00
40-60		02	1.00	0.85	0.85	0.90	0.00
30-39		03	0.70	0.70	0.70	0.80	0.00
20-29		04	0.70	0.50	0.70	0.75	0.00
10-19		05	0.70	0.30	0.70	0.70	0.00
5- 9		06	0.70	0.20	0.70	0.50	0.00
1- 4		07	0.70	0.10	0.70	0.30	0.00
0		08	0.70	0.00	0.70	0.00	0.00
Service							
Volume/SF Ratio	7		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
<= .20		01	1.00	1.00	1.00	1.00	1.00
.21-.40		02	0.95	0.95	0.95	1.00	1.00
.41-.60		03	0.90	0.90	0.90	0.95	0.95
.61-.70		04	0.85	0.85	0.85	0.90	0.90
.71-.75		05	0.80	0.80	0.80	0.85	0.85
.76-.80		06	0.75	0.75	0.75	0.80	0.80
.81-.85		07	0.70	0.70	0.70	0.75	0.75
.86-.90		08	0.40	0.40	0.40	0.70	0.70
.91-.95		09	0.10	0.10	0.10	0.30	0.30
> .96		10	0.05	0.05	0.05	0.10	0.10

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TABLE 15 (*continued*)

Data Items by Category	Item Number	Row Number	Group 1	Group 2	Group 3	Group 4	Group 5
Access Control	8		Interstate	Freeways/Expressways	Principal Arterials	Minor Arterials	Collectors
Full		01	1.00	1.00	1.00	0.00	0.00
Partial		02	0.00	0.30	0.80	0.00	0.00
None		03	0.00	0.00	0.40	0.00	0.00

** - One-way streets always get a rating of 1.00
** - The code for median type is not "2"

TABLE 16 Summary of Composite Indexes for Scenarios 1–4 and Adequacy Rating

ROUTE	FUNCTIONAL SYSTEM	Adq.	Sc. 1	Sc. 2	Sc. 3	Sc. 4
I-64	Urban Interstate	86.00	88.35	88.35	88.35	88.35
I-75	Urban Interstate	89.40	81.30	81.30	81.30	81.30
I-64	Rural Interstate	88.00	88.35	88.30	88.35	88.35
I-75	Rural Interstate	83.00	73.35	73.35	73.35	73.35
I-75	Rural Interstate	83.00	70.85	70.85	70.85	70.85
KY 4	Urban Freeway	71.00	85.90	85.90	85.90	91.50
US 25	Urban Princ. Art.	56.00	82.30	82.30	82.30	76.15
US 60	Urban Princ. Art.	78.00	82.50	82.50	82.50	88.50
US 60	Rural Princ. Art.	71.00	81.60	81.60	81.60	81.30
US 68	Rural Princ. Art.	59.00	75.60	75.60	75.60	79.25
KY 353	Urban Minor Art.	49.00	78.80	75.20	75.90	84.50
KY 1681	Urban Minor Art.	39.00	82.55	81.25	81.00	90.00
US 60	Urban Minor Art.	76.00	90.55	91.95	90.40	91.50
US 460	Rural Minor Art.	72.00	89.00	86.25	88.50	77.05
US 460	Rural Minor Art.	54.00	81.70	78.15	77.80	59.05
KY 1267	Urban Collector	58.00	85.75	83.50	84.25	87.25
KY 1968	Urban Collector	49.00	65.75	51.00	54.75	68.40
KY 922	Rural Major Coll.	49.00	82.00	76.60	72.15	51.75
US 60	Rural Major Coll.	84.00	95.50	98.50	97.75	97.75
KY 1966	Rural Minor Coll.	55.00	77.00	72.00	66.25	66.25
KY 1268	Rural Minor Coll.	58.00	82.30	77.50	78.00	77.00

weighting factors, appraisal rates, and data attributes of the three scenarios, the panel decided to adopt S1 without accident attribute as the standard common criteria for the Adequacy Rating and the HPMS programs. The direction from the expert panel eliminated the inconsistency and variation in the final composite indexes from the two programs that were of major concern among management personnel. The first biennial Adequacy Rating report by functional system using the aforementioned criteria from Scenario S1 was to be published in December 1991.

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