



KENTUCKY TRANSPORTATION CENTER

**RIDEABILITY ISSUES FOR ASPHALT AND
CONCRETE SPECIFICATION MODIFICATIONS**



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Research Report
KTC-07-30/SPR 304-05-1F

Rideability Issues for Asphalt and Concrete Specification Modifications

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in cooperation with
Transportation Cabinet
Commonwealth of Kentucky

and

Federal Highway Administration
U.S. Department of Transportation

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16. Abstract Concerns have been raised regarding the differences between the incentive/disincentive determination procedures as well as the pay adjustments for rideability between asphalt and concrete projects. This report will attempt to do the following: <ol style="list-style-type: none"> 1. Address the differences between concrete and asphalt rideability specifications by looking at Kentucky's historical rideability specifications and the specifications of peer states. 2. Review the necessity to revise current specifications based on historical rideability data, peer states rideability specifications, technological advancements in placement of roadway materials, and technological advancements in measuring rideability after construction. 3. Evaluate the monetary impact of a revised rideability specification on the latest year's data. <p>Through this analysis some of the concerns regarding the differences between concrete and asphalt rideability will be addressed. In addition, the necessity to revise current specification changes will be evaluated based on the research results and recommendations offered as appropriate.</p>			
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Final Report

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EXECUTIVE SUMMARY

Pavement roughness is an important indicator of pavement performance. A road user's perception on driving quality of a pavement is primarily influenced by its roughness. Furthermore, rougher roads usually increase the operating costs to both the traveling public and the commercial trucking industry.

In efforts to decrease the roughness of a newly paved road, the Kentucky Transportation Cabinet applies incentives/disincentives on the initial rideability of both asphalt and concrete projects. However, concerns have been raised regarding the differences between the incentive/disincentive determination procedures as well as the pay adjustments between asphalt and concrete projects. This report will attempt to do the following

1. Address the differences between concrete and asphalt rideability specifications by looking at Kentucky's historical rideability specifications and the specifications of peer states.
2. Review the necessity to revise current specifications based on historical rideability data, peer states rideability specifications, technological advancements in placement of roadway materials, and technological advancements in measuring rideability after construction.
3. Evaluate the monetary impact of a revised rideability specification on the latest years data.

After items one through three above were thoroughly researched it was of the committee's opinion that Kentucky revise its current rideability specifications for both asphalt and concrete. The following revisions are suggested.

1. The current profile index (PI) specification will stay in place for concrete pavement acceptance, and (IRI) will be used for incentives/disincentives on PCCP at the discretion of the Transportation Cabinet.
2. International roughness index (IRI) data will be collected for asphalt and diamond ground PCCP paving acceptance and incentives/disincentives.
3. (IRI) data will be collected on a 0.1 mile basis per project for acceptance, incentives and disincentives.
4. The net of 0.1 mile sections will determine the overall incentive/disincentive amount for the project. It is possible that incentive sections minus disincentive sections may balance to zero on a project basis, or make the total project an incentive project or a disincentive project.

5. The IRI thresholds for acceptance, incentives, and disincentives will be applied as follows: Note: values below for un-ground PCCP will be used as incentives/disincentives only, and will be applied on per project basis at the discretion of the Kentucky Transportation Cabinet.

	Asphalt	Diamond Ground PCCP	Un-ground PCCP
IRI incentive range	Max bonus <= 30 Scaled bonus 30-39	Max bonus <= 30 Scaled bonus 30-39	Max bonus <= 60 Scaled bonus 60-69
IRI 100% pay range	40-60	40-60	71-89
IRI disincentive range	61-70	61-70	90-100
Corrective work range	71 or above	71 or above	101 or above

6. The maximum incentive/disincentive per any 0.1 mile section will be a fixed dollar amount
7. The suggested maximum incentive/disincentive amount will be +/- \$650. (Note: the incentive/disincentive amounts in the scaled range for asphalt may be found in Table 3 (page 19) and Table 4 (page 21) for concrete). This revision has been proposed since the current rideability specification awards/penalizes rideability incentives/disincentives based on a percentage of material unit-bid-price--which has varied widely over the last several years.

In conclusion, by revising the current asphalt ride specification, approximately one million dollars would be paid out in bonuses using the latest year's rideability data. This is comparable to the same amount paid out in 2005 and 2006. In addition, under this proposed ride equation with higher thresholds approximately 10% of the asphalt projects would receive max bonus, 34% would receive some bonus, 49% would receive 100% pay, 4% would receive a penalty, and 3% would need to have corrective measures using the 2006 ride data. In the event that the IRI specification were applied to 2006 PCCP rideability data, approximately 35% of the projects would receive some type of bonus, 35% would receive 100% pay, 10% percent would receive a penalty, and 20% would require corrective work. As noted throughout this report this new specification change would truly award superior riding pavements, and eliminate the potential for exurbanite incentives/disincentives amounts caused by them being tied to the unit bid price of material.

I. INTRODUCTION

Pavement roughness is an important indicator of pavement performance. A road user's perception on driving quality of a pavement is primarily influenced by its roughness. Furthermore, rougher roads usually increase the operating costs to both the traveling public and the commercial trucking industry.

In efforts to decrease the roughness of a newly paved road, the Kentucky Transportation Cabinet applies incentives/disincentives on the initial rideability of both asphalt and concrete projects. However, concerns have been raised regarding the differences between the incentive/disincentive determination procedures as well as the pay adjustments between asphalt and concrete projects. In concrete projects, two types of testing devices are employed to determine incentives and disincentives, whereas asphalt uses only one testing device. In addition, there are different thresholds for pavement incentives/disincentives for concrete and asphalt. Therefore, the scope of this study was to gain a better understanding of the differences in rideability specifications between asphalt and concrete pavements in Kentucky.

It is hoped by analyzing the history of Kentucky's rideability specifications, researching other state departments of transportation rideability specifications, analyzing historical rideability data from both concrete and asphalt, analyzing the costs associated with achieving higher ride quality for concrete and asphalt pavements, and reviewing the incentives/disincentives for rideability projects over the last two years that the concerns regarding the differences between concrete and asphalt rideability will be addressed. In addition, the necessity to revise current specification changes will be evaluated based on the research results and recommendations offered as appropriate.

II. HISTORY OF RIDE QUALITY SPECIFICATIONS IN KENTUCKY

The process of collecting ride quality data on Kentucky's interstates was initiated in the late 1960's. Prior to 1988, ride quality data was used primarily for pavement management purposes only. In 1988 the Kentucky Transportation Cabinet started to collect ride quality data shortly after construction and use the information for quality control. Currently in Kentucky, two different types of ride quality data are collected. The first type of data collected is called a profile index (PI) which is measured using the standard California Profilograph (Figure 1). This device is rolled along the pavement in a longitudinal direction and measures the vertical difference in elevation. This test is used for concrete acceptance only. The second type of data collected is called rideability data (RI), sometimes referred to as IRI (international roughness index), which is measured using a system of three to five lasers that scan the surface of the pavement for irregularities. This test is currently used for rideability incentives/disincentives for asphalt pavements on a routine basis, and an elective basis for concrete pavements.

Figures 2 and 3 and Appendix A display how both the profile index and the international roughness index specifications have changed over time in Kentucky. It can be seen in Figure 2 that the requirement for a better profile index for concrete pavements has been increased over time. However, the same cannot be said for the international

roughness index for both concrete and asphalt pavements (Figure 3). This will be discussed in further detail later in this report.

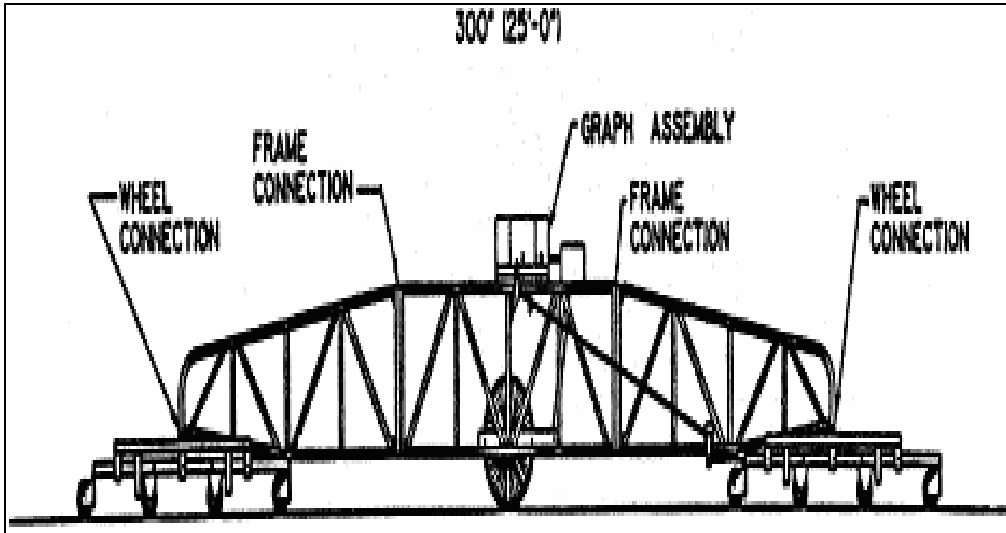


Figure 1: California Profilograph

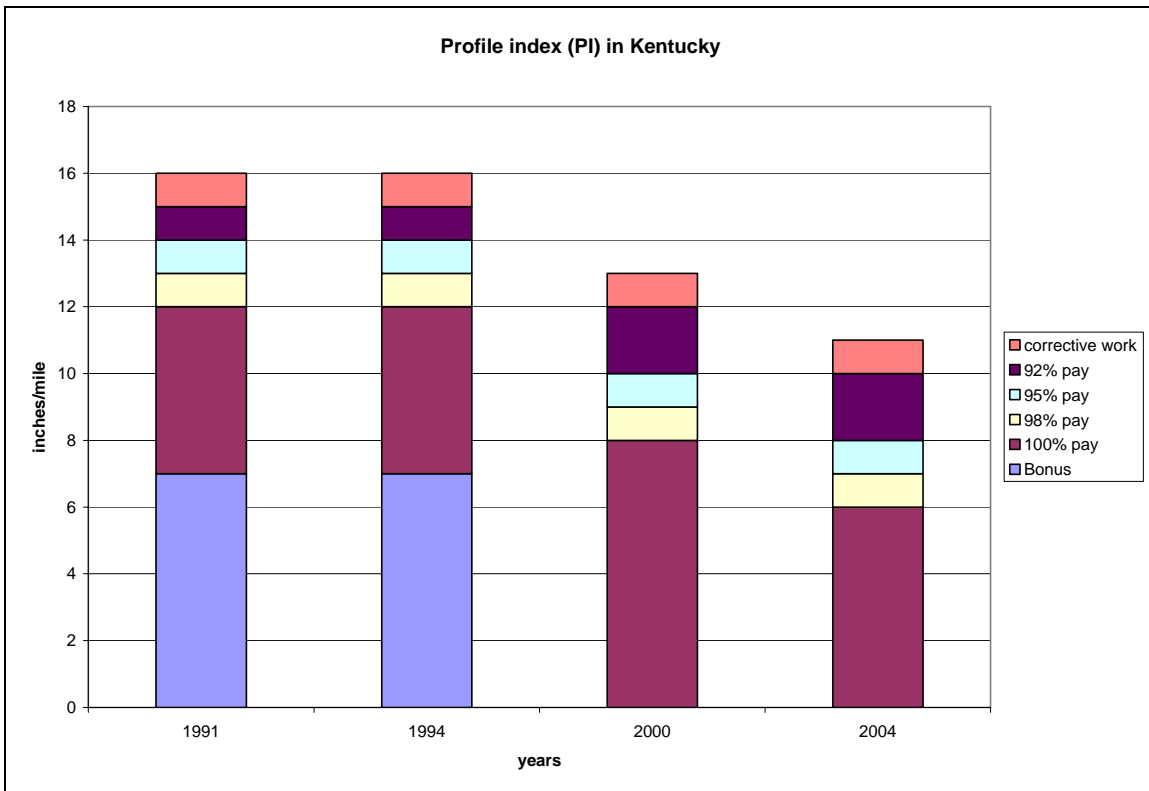


Figure 2: History of profile index (PI) for concrete pavements in Kentucky

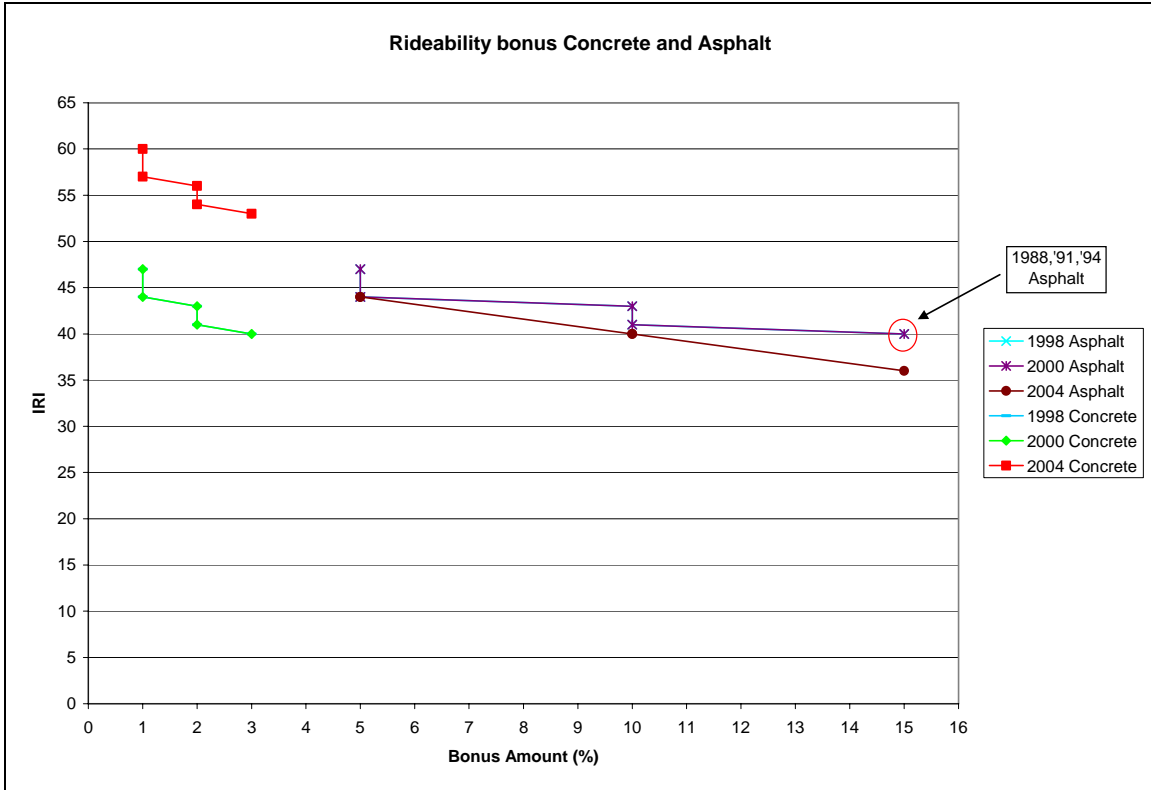


Figure 3: History of International Roughness Index (IRI) bonuses in Kentucky

III. RIDEABILITY SPECIFICATIONS IN OTHER STATES

During the research stage of this project a literature search was performed to better understand how other states have addressed ride quality concerning both concrete and asphalt pavements. A total of seven other states' ride quality specifications were reviewed and compiled. Out of the seven states surveyed only Pennsylvania uses the laser profilometer to obtain an IRI value. The remaining states use either a Rainhart or a California Profilograph.

Figure 4 below displays the latest concrete profile index specification pay scale from the polled states and shows the comparison to that of Kentucky. It should be noted that Kentucky has the 3rd highest quality control standard regarding the profile index among the seven states. The numerical values for the profile index for the polled states may be found in Appendixes B and C. Figure 5 displays the latest asphalt IRI specification pay scale from the polled states and shows the comparison to that of Kentucky. It can be seen in Figure 5 that Pennsylvania has a higher threshold for bonus payments regarding IRI for concrete, but a lower threshold for penalties than Kentucky. Kentucky's IRI quality control for asphalt pavement is more stringent than that of Pennsylvania (Figure 5).

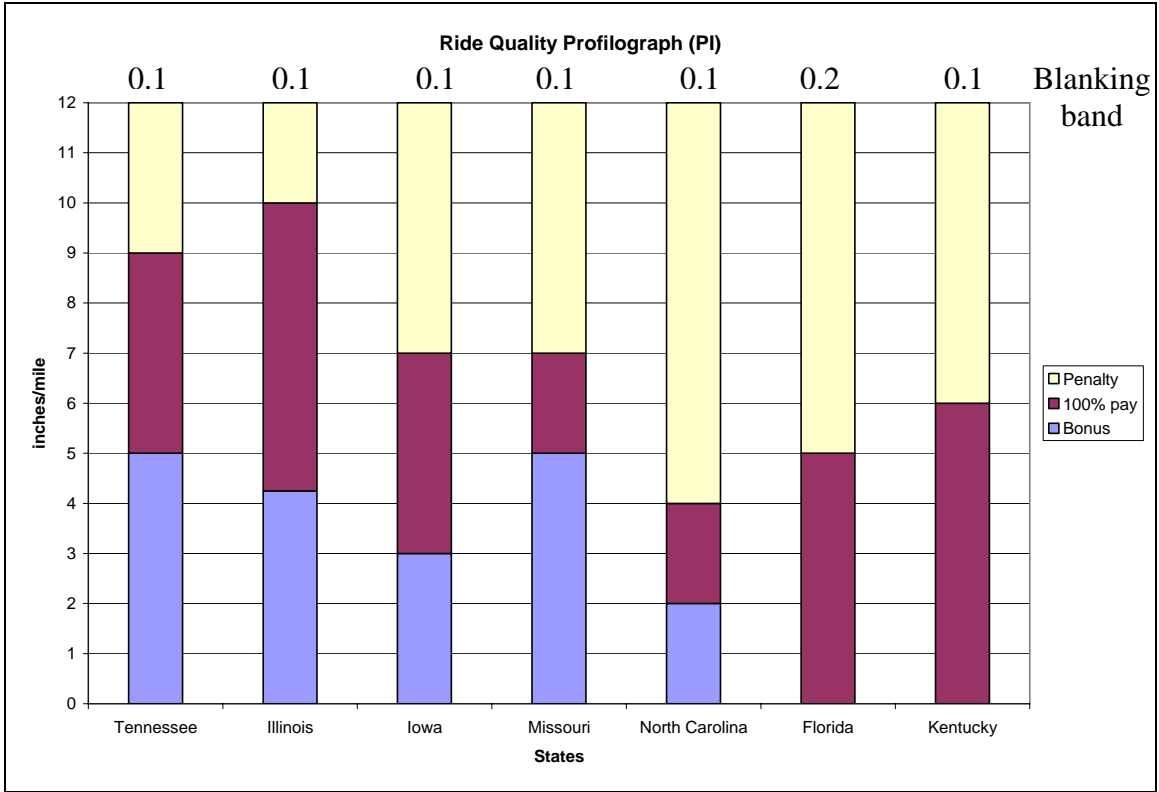


Figure 4: Profile Index quality control pay scale for Kentucky and polled states

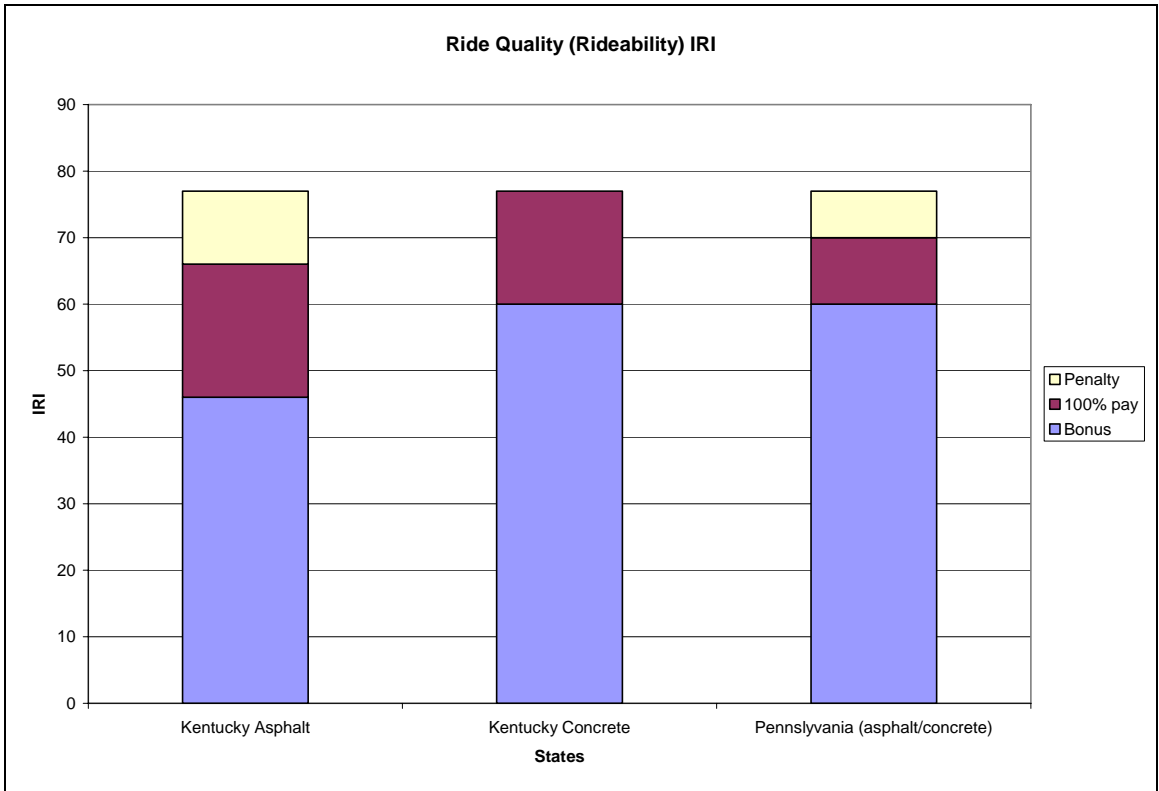


Figure 5: IRI quality control pay scale for Kentucky and polled states

IV. ANALYZING HISTORICAL RIDEABILITY DATA (IRI)

When looking at current rideability specifications and determining if the quality control thresholds are appropriate, it makes sense to analyze historical rideability data. The historical initial IRI database that is summarized in Figure 6 below was compiled from 1980 to 2004 and is maintained by the Kentucky Department of Highways Pavement Management Branch. As seen in Figure 6, only eight percent of the concrete projects over a twenty-four year period would have received a bonus with today's standards—IRI of 60 or less. However, if the concrete pavement had been diamond ground, approximately seventy percent of the concrete pavements would have received a bonus under the same standards. The economics of diamond grinding will be discussed in further detail in the section "Achieving Higher Ride Quality for Concrete and Asphalt", later in this report. The opportunity for asphalt pavements, historically, to achieve an IRI bonus in today's standards (IRI of 47) would be approximately forty-seven percent of the time (Figure 6).

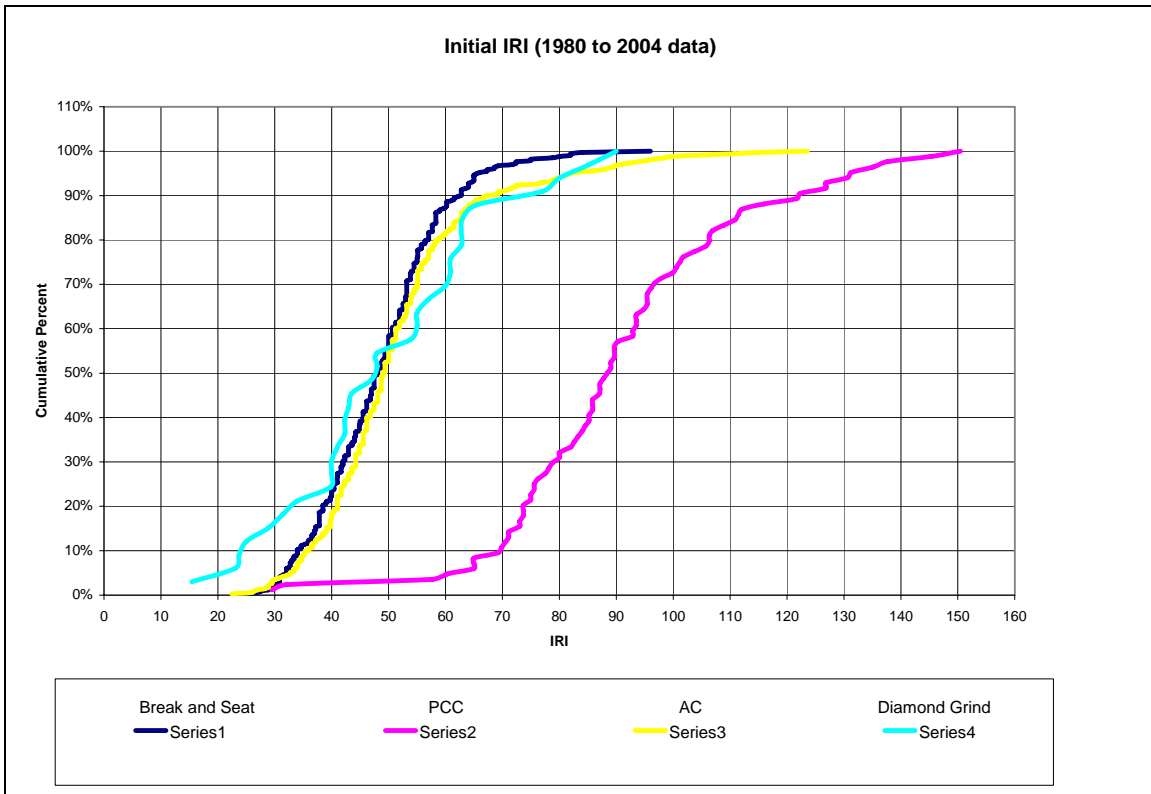


Figure 6: Historical initial IRI data for pavement types (1980 to 2004)

Figure seven below shows how the IRI data has improved over time based on the historical data. The cumulative trend line displayed in Figure 7 shows the combination of break/seat/overlay projects, asphalt pavement projects, and concrete pavement projects. These trends lines are indicative of tighter quality control standards and improvements in paving techniques.

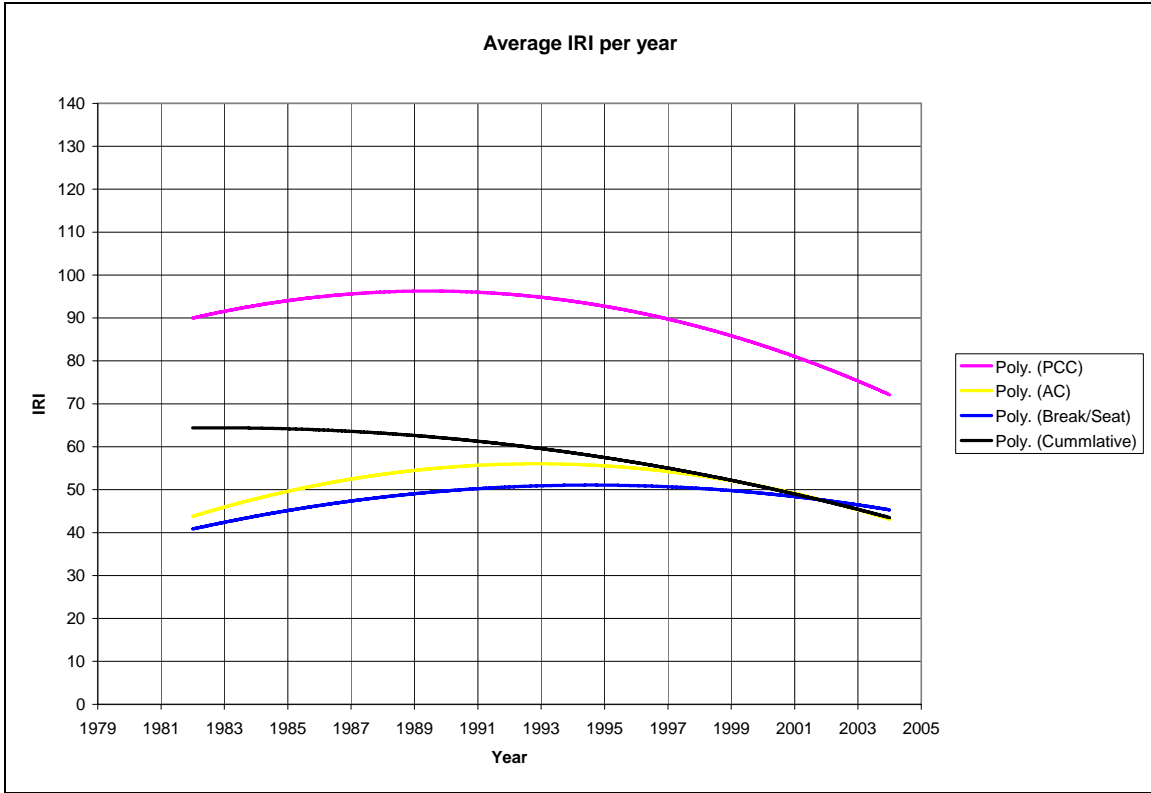


Figure 7: Average IRI over time based on pavement type

V. ACHIEVING HIGHER RIDE QUALITY FOR CONCRETE AND ASPHALT

As shown in figure 6 above, PCC pavement has the ability to be, as smooth as, if not smoother than, asphalt once it has been diamond ground. However, the costs of achieving a smoother pavement by diamond grinding outweigh the current rideability bonus amount by approximately 251%, in today’s dollars. The following illustration will demonstrate why a contractor would probably not elect to diamond grind a PCC pavement in order to obtain the current PCC ride bonus. For the purpose of this illustration, we will use a typical pavement section one-mile in length.

Length:	1 mile	(5,280 ft.)	(1,609 m)
Width:	12 ft.	(3.7 m)	
Area	63,360 ft ²	(5,886 m ²)	(7,040 yd ²)
Concrete unit bid price 2005	\$44/yd ²		
Cost of PCCP 1 mile section	\$217,794		

Initial ride bonus (IRI) 3% of material costs	<u>\$6,533</u>
Diamond Grinding unit bid price 2005	\$2.33/yd ²
Cost of diamond grinding 1 mile section	<u>\$16,403</u>
Diamond grinding vs. ride bonus	\$16,403 / \$6,533
Equals	251% cost increase

Therefore, one would only choose to diamond grind in either of the following cases: the ride bonus was equal to the costs of the diamond grinding operation; or that diamond grinding is a separate bid item. In most cases, diamond grinding is a separate bid item. But the question remains, does one pay for the diamond grinding and pay an additional bonus based on the current concrete IRI specifications? It may be said, that if a smoother PCC pavement is desirable, and this is achieved by diamond grinding, that a bonus either not be paid or that the IRI threshold be reduced to a tighter standard. It would appear that the expectation for a higher ride quality standard on diamond ground PCCP should be dictated by the historical data. As seen in Figure 6 above, diamond ground PCCP can achieve a much lower IRI value than that of un-ground PCCP.

When considering how to achieve a better ride quality in asphalt pavements, it is believed that rideability has improved with the advent of using the material transfer vehicle (MTV). This piece of equipment was a component of SuperPave paving techniques introduced nationwide around 1998. Historical data displayed in Figure 7 shows that IRI values for asphalt paving have improved since 1998. However, the threshold for achieving a rideability bonus for asphalt paving has been lowered since 1998—from 40 to 47. It would appear that some consideration should be given to revising the current rideability specification for asphalt paving. This statement is made in-part, because the use of the MTV on an asphalt paving project is considered a bid item. Currently the Transportation Cabinet pays, on average, \$1.51 per ton for the use of an MTV. It appears that the Transportation Cabinet maybe paying extra for a rideability bonus that is easily obtainable due to advancements in technology. Therefore, it could be recommended that the maximum rideability bonus (IRI) for asphalt paving be lowered from 47 to a number agreed upon by the committee that will be discussed later in this report.

In comparing the maximum ride bonus between concrete and asphalt one can see based on today's unit bid prices (concrete \$44/yd² and asphalt surface \$49/ton) that concrete has a higher return in bonus amount (see illustration below).

Typical section:
 One mile pavement section 12 feet wide

Asphalt 1.5 inch surface:

Volume:	12 ft. x 5,280 ft. x 1.5/12ft.	=	7,920 ft ³
Tons of material:	7,920 ft ³ x (125 lb/ft ³)/2,000lb	=	495 tons
15% bonus at \$49/ton:	495 T x \$49 x .15	=	\$3,638

Concrete: 12 inch thick:

Area:	12 ft. x 5,280 ft. = 63,360ft ²	=	or 5,886 m ²
3% bonus at \$37/m ²	\$37/m ² x 5,886 m ² x .03	=	\$6,533

This is a difference in value of seventy-nine percent more for concrete than asphalt. The only way for the asphalt bonus amount to equal that of concrete in dollar value, would be to increase asphalt's unit bid price from \$49/ton to approximately \$87/ton. Do to this unwanted scenario; it may be said that the bonus for both concrete and asphalt be paid in a fixed dollar amount basis only. Similar to the ride bonus found in the polled states (Appendix C)—this bonus is paid on lot basis or area basis (\$/lot or \$/lane mile).

VI. REVIEWING THE INCENTIVES/DISINCENTIVES FOR RIDEABILITY PROJECTS IN KENTUCKY 2004-2005

The intent of reviewing the incentives/disincentives for rideability projects in Kentucky over the last two years is to gain a better understanding on how the current ride bonus is being applied. Figure 8 below shows that in 2004 approximately 41% of the pavements tested received a bonus, 52% gained one-hundred percent pay, and 7% incurred a disincentive. Figure 9 below shows that in 2005 approximately 55% of the pavements tested received a bonus, 42% gained one-hundred percent pay, and 3% incurred a disincentive. This information has been broken down on a lane-mile basis and a percentage basis in Tables 2 and 3 below.

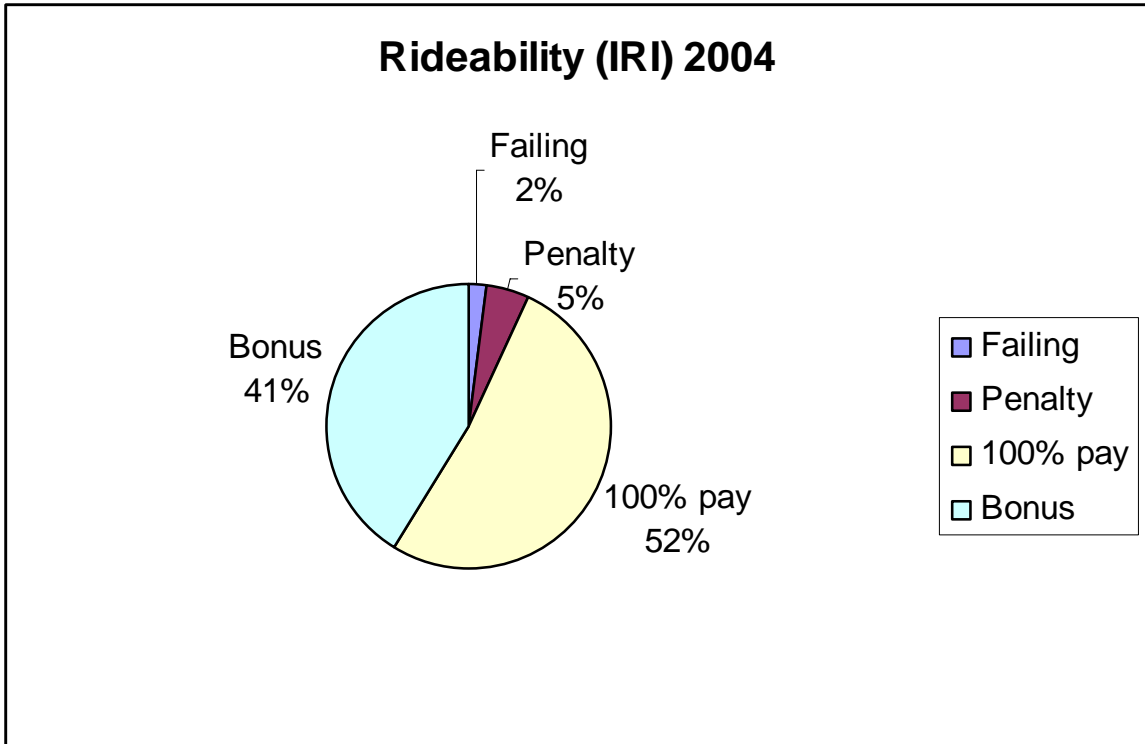


Figure 8: Rideability bonus (IRI) 2004

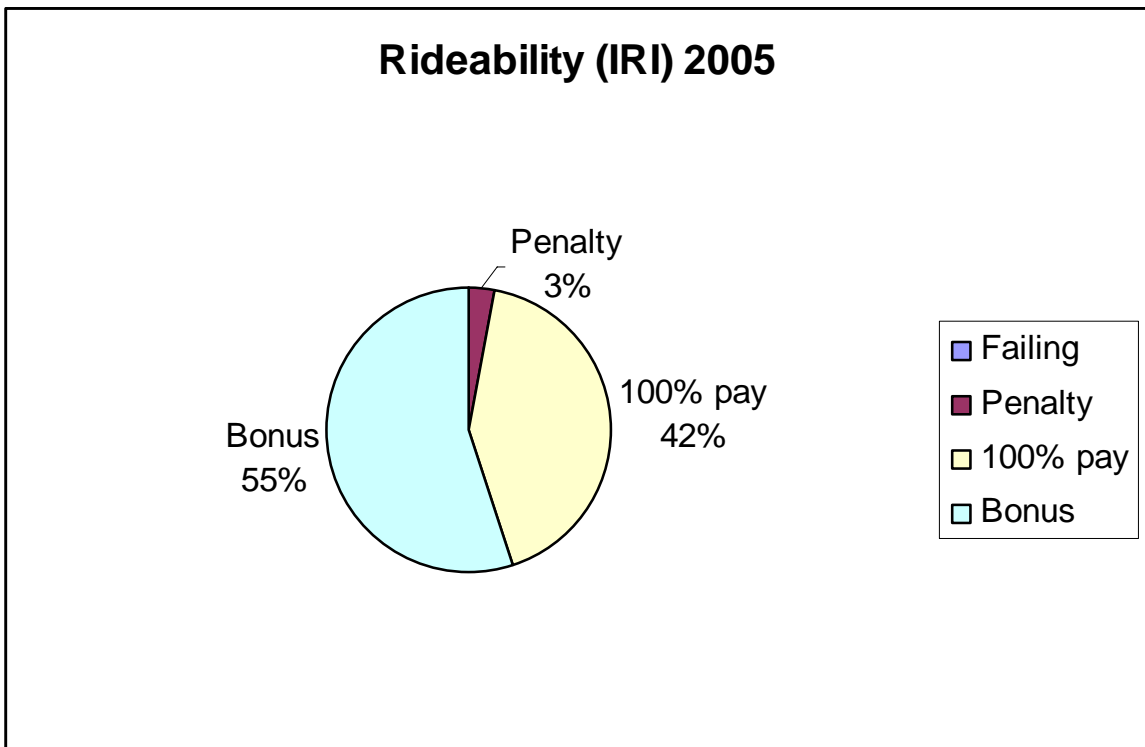


Figure 9: Rideability bonus (IRI) 2005

Table 1: Incentive/disincentive pay per lane mile 2004-2005

Year	Total Miles	Pay <85 %	Pay 85-90 %	Pay 90-95 %	Pay 95-100 %	Pay 100 %	Pay 100-105 %	Pay 105-110 %	Pay 110-115 %	Pay 115 %
2004	284	7.4	.8	3.5	10.1	146.9	17.3	21.9	19.2	56.9
2005	567	0	4.6	4.4	8.5	239.5	55.4	83	66	106

Table 2: Percentage of incentive/disincentive pay by category 2004-2005

Year	Total Miles	Pay <85 %	Pay 85-90 %	Pay 90-95 %	Pay 95-100 %	Pay 100 %	Pay 100-105 %	Pay 105-110 %	Pay 110-115 %	Pay 115 %
2004	284	2.6	.3	1.2	3.6	51.7	6.1	7.7	6.8	20
2005	567	0	.8	.8	1.5	42.2	9.8	14.6	11.6	18.6

VII. TENTH MILE IRI AND HISOTIRCAL IRI COMPARSION

With advances in rideability collection and processing equipment, the Kentucky Transportation Cabinet has started to look into collecting IRI data on a tenth mile basis instead of averaging over a one mile section. By instituting tenth mile IRI (average IRI reading for 0.1 mile or 0.2 mile) data collection over smaller paved areas will be easier to quantify. In addition, extremely rough areas of the paved surface could be identified. Figure 10 below displays the initial IRI data for AC and Concrete from 1980 to 2004. The 0.1 and 0.2 mile IRI data has also been graphed. It can be seen in Figure 10 that the tenth mile IRI data from 2006 is slightly improved from that of the IRI data collected on a project basis from 1980-2004. This can most easily be explained because of better paving techniques and the use of newer equipment such as the Material Transfer Device (MTV) (Figure 11). It can also be noted in Figure 10 below that there is not much disparity between 0.2 mile data and 0.1 mile data. Therefore, using the tenth of mile data would prove satisfactory.

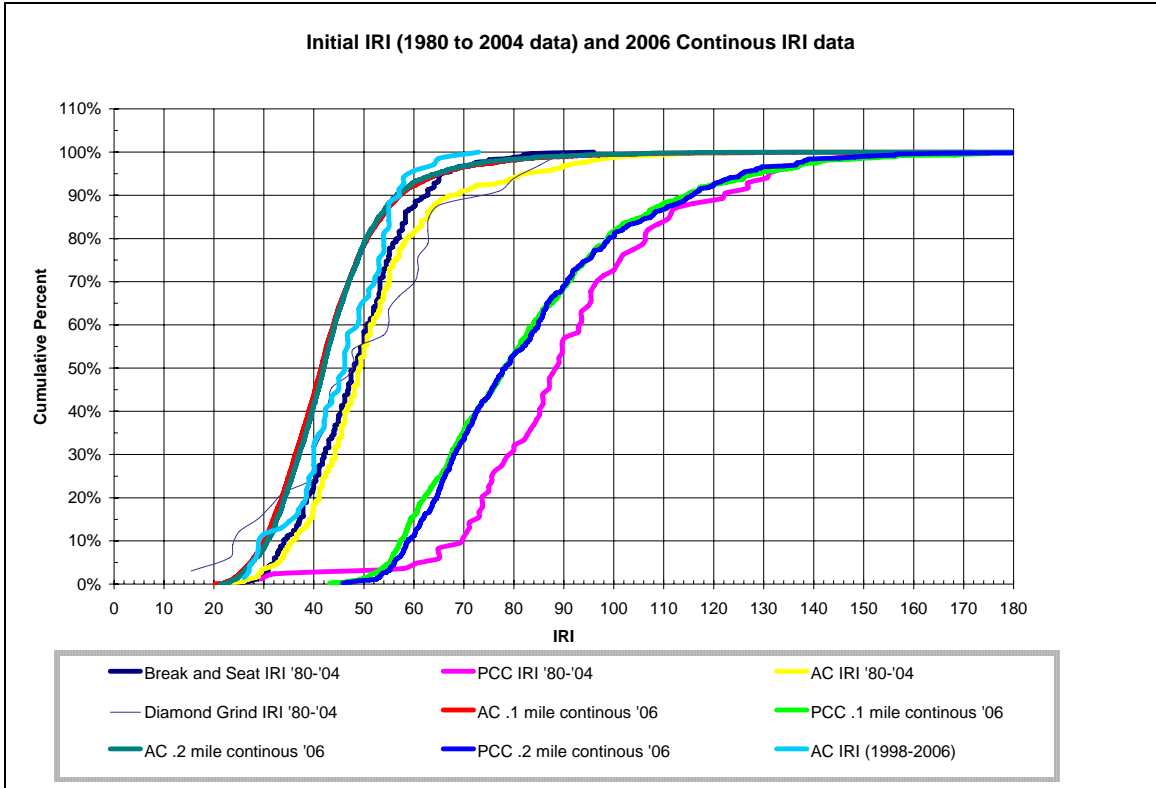


Figure 10: Initial IRI (1980-2004 data) and 2006 Continuous IRI data

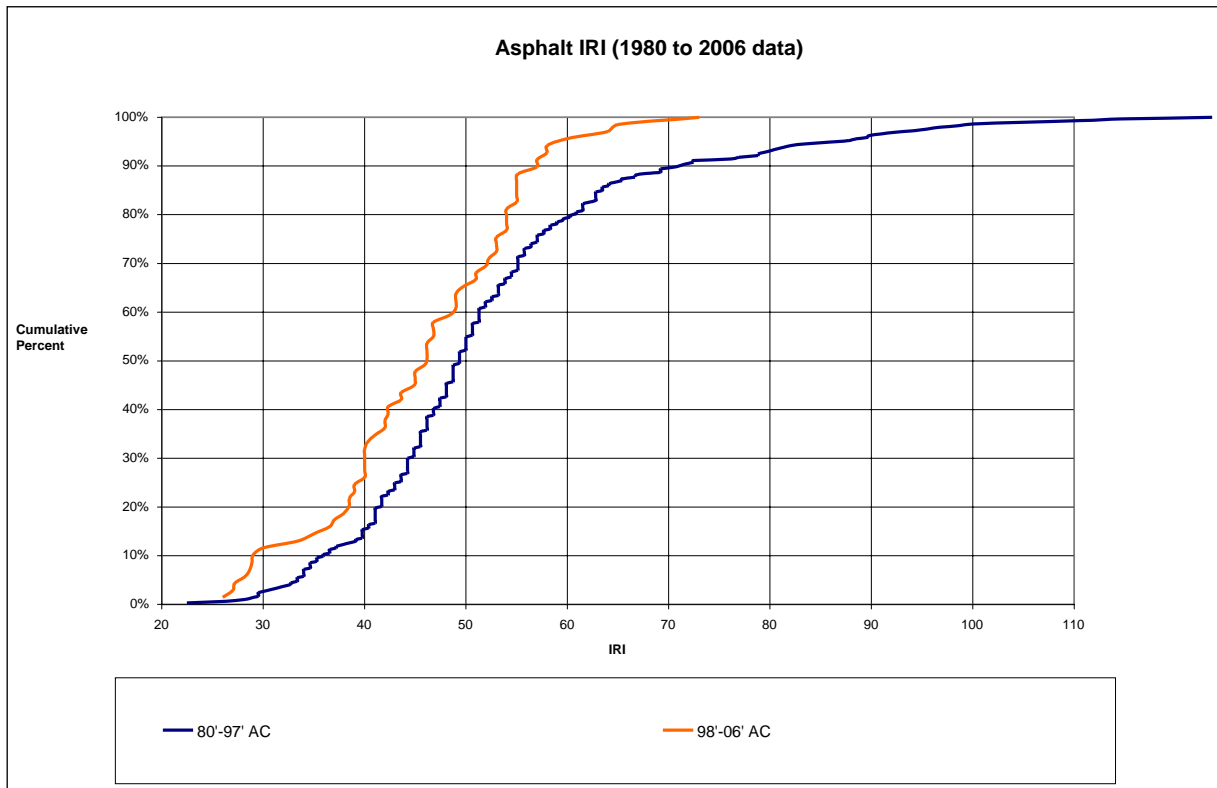


Figure 11: Comparison of Ride DATA before and after the introduction of the MTV

VIII. RECOMMENDATIONS FOR SPECIFICATION REVISION

The objective of this project was to either 1.) validate Kentucky's current rideability specification or 2.) gain a better understanding towards revising the current rideability specification. After reviewing the historical rideability specifications in Kentucky, the historical rideability data, and other states' specifications it was of the committee's opinion that Kentucky should revise its current rideability specifications for both asphalt and concrete.

The first revision would be to collect IRI data on a 0.1 mile continuous basis. The second revision would be to revise how the bonus is calculated. Since asphalt prices have varied widely over the last several years it was of the committee's opinion to tie the bonus amount into a fixed dollar amount. Two approaches were made to try and determine a new maximum bonus amount. The first approach was to review the maximum incentive per 0.1 mile section over the last two years for Kentucky. The second approach was to review what the maximum incentive has been for the polled states during 2005 on a 0.1 mile basis (Figure 12). After reviewing both sets of data it was of the committee's opinion that the 0.1 mile bonus for both concrete and asphalt for Kentucky be set at \$650/.1 mile section. The third revision that was discussed was to revise the equation that is used to calculate the ride bonus. Figure 11 above shows that under the current ride specification (bonuses starting at 47) that approximately 57% of the 0.1 mile sections would have received a bonus in 2006. It is suggested that a new equation with higher thresholds be applied so that superior riding projects would receive the highest reward (Figure 13, Table 3). The new threshold for bonuses would be set at 40 for asphalt pavements. The impact of the higher threshold on both concrete and asphalt will be discussed below.

Based on historical data, it is possible that 44% of the new asphalt paved projects could receive a ride bonus at this level with the top ten percent receiving maximum bonus.

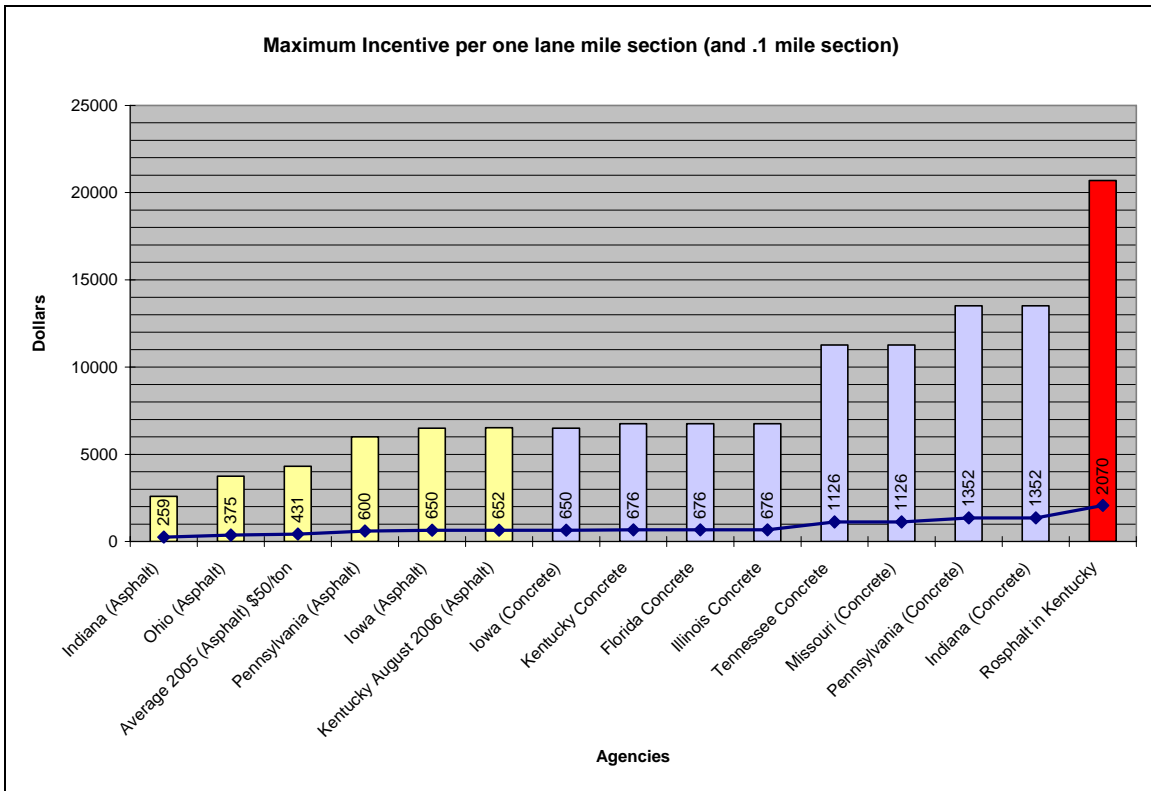


Figure 12: Maximum incentive per one lane mile section and what the equivalent 0.1 mile section bonus amount has been over the last two years

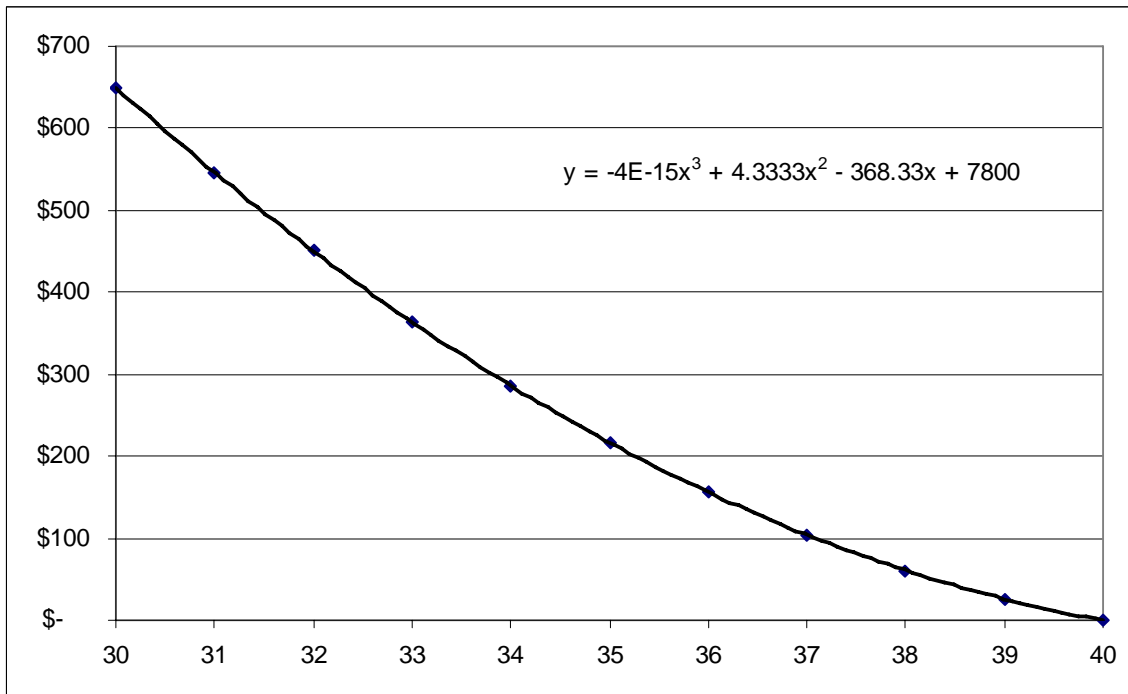


Figure 13: New asphalt bonus graph

The dollar amount recommendations to changing the rideability (IRI) bonus for asphalt paving based on the equation in Figure 13 can be seen in Table 4 below:

Table 3: Example of new IRI bonus structure for asphalt

IRI	Pay Category	Dollar Amount per .1 mile
30		650
31		546
32		451
33		346
34		286
35		217
36		156
37		104
38		61
39		26
40		0
41-60	100% pay	
61		-26
62		-61
63		-104
64		-156
65		-217
66		-286
67		-346
68		-451
69		-546
70		-650
71 or above	Corrective work	

Under this proposed ride equation with higher thresholds approximately 10% of the projects would receive max bonus, 34% would receive some bonus, 49% would receive 100% pay, 4% would receive a penalty, and 3% would need to have corrective measures taken (Figure 14).

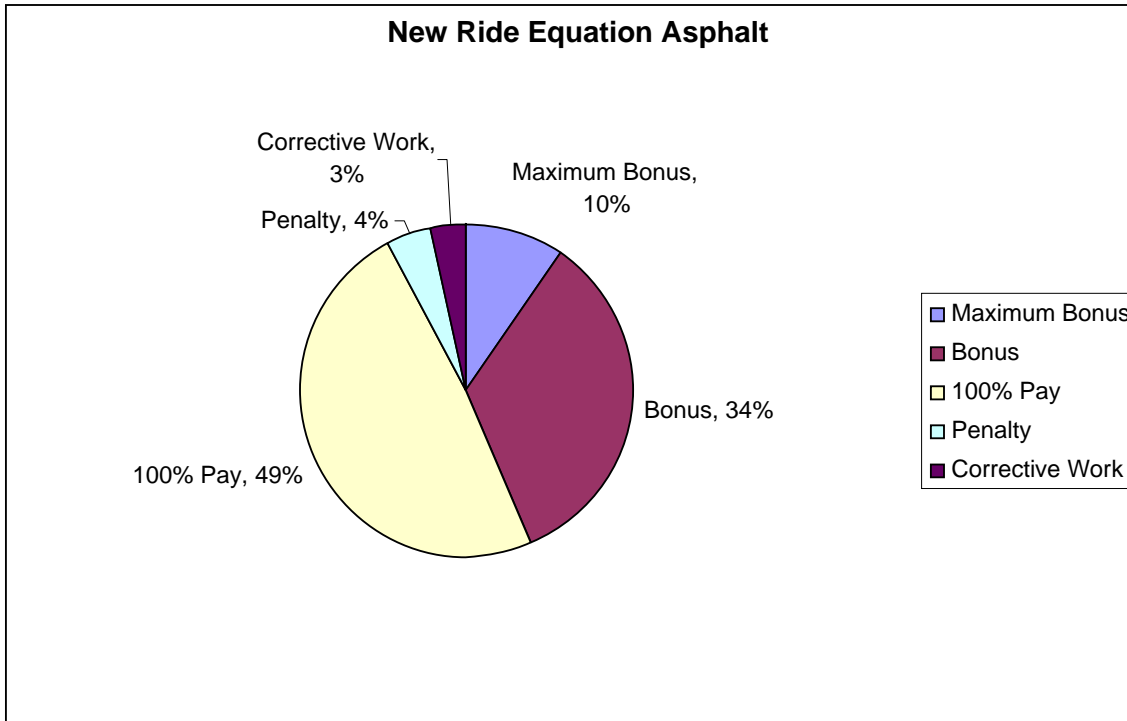


Figure 14: Rideability bonus 2006 data .1/mile sections with new equations (Asphalt).

The total bonus amount that would have been paid out with the new values in 2006 would be approximately \$1 million as compared to \$1.21 million under the older equation. As noted in Figure 14 this new equation would truly reward the superior riding projects and any discrepancy between dollar values between the two equations would be used to construct more pavements.

In regards to the rideability bonus specifications for diamond ground PCCP, it is of the committee's opinion that the same rideability specifications for asphalt paving be applied. This is supported by Figure 10 above.

In regards to concrete paving, it is believed that the current PI standard remain in place. As mentioned above, Kentucky's rideability specification rates 3rd. among the seven polled states. It is felt that the level of quality control regarding PI has been reasonably well established in the concrete paving industry. However, it is felt that a new specification should be adopted regarding the IRI specification for concrete. Figure 10 above shows that approximately 18% of the concrete paving projects would have received the maximum bonus if an IRI threshold was set at 60.

A possible recommendation for obtaining a rideability (IRI) bonus for concrete paving would be based on the same equation as that found in figure 13 above. However the threshold amounts would be changed from that of asphalt (Table 4).

Table 4: Example of new IRI bonus structure for PCCP

IRI	Pay Category	Dollar Amount per .1 mile
60		650
61		546
62		451
63		364
64		286
65		217
66		156
67		104
68		61
69		26
70		0
71-89	100% pay	
90		0
91		-26
92		-61
93		-104
94		-156
95		-217
96		-286
97		-364
98		-451
99		-546
100		-650
101 or above	Corrective Work	

Under this proposed ride equation with revised thresholds, approximately 15% of the concrete projects would receive max bonus, 20% would receive some bonus, 35% would receive 100% pay, 10% would receive a penalty, and 20% would need to have corrective measures taken (Figure 15).

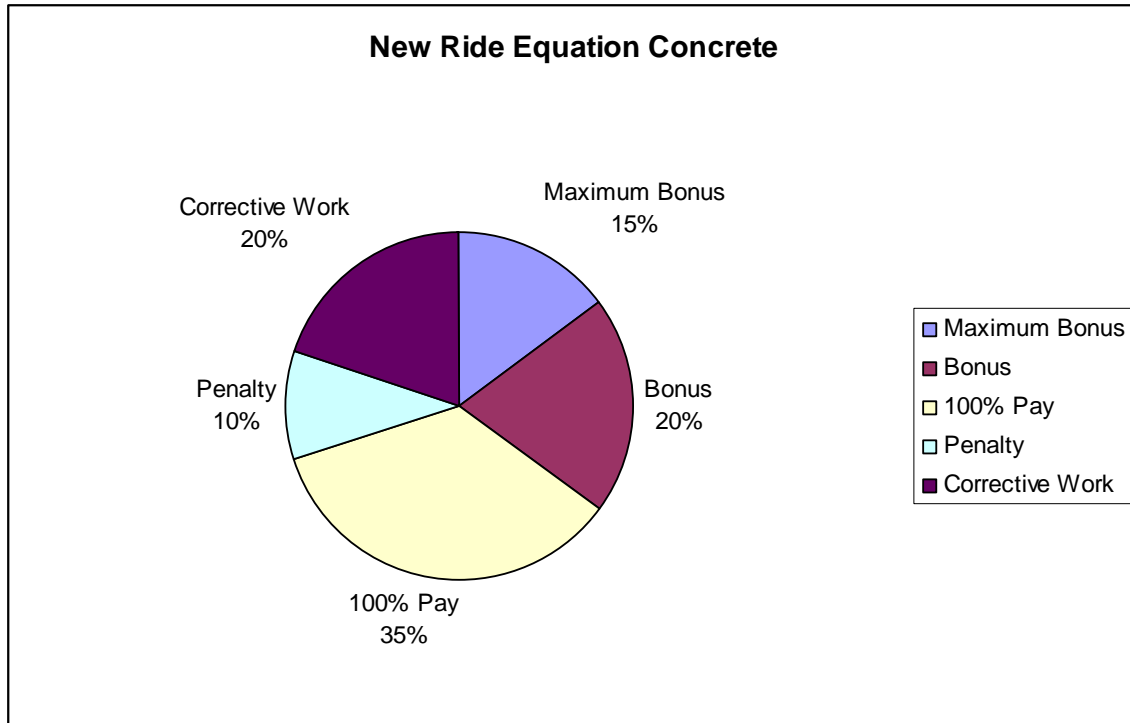


Figure 15: Rideability bonus 2006 data .1/mile sections with new equation (Concrete).

IX. CONCLUSIONS

After reviewing the historical rideability specifications in Kentucky, the historical rideability data, and the polled states it is the committee's opinion that Kentucky revise its current rideability specifications for both asphalt and concrete.

By revising the current asphalt ride specification, approximately one million dollars would be paid out in bonuses. This is comparable to the same amount paid out in 2005 and 2006. However, asphalt projects that have a superior ride quality (less than 30 on the IRI scale) would receive a higher bonus amount. In addition, under this proposed ride equation with higher thresholds approximately 10% of the asphalt projects would receive max bonus, 34% would receive some bonus, 49% would receive 100% pay, 4% would receive a penalty, and 3% would need to have corrective measures using the 2006 ride data. It is also suggested that the same IRI ride specification revision be applied to that of diamond grinded PCCP. In regards to concrete paving, it is suggested that the current PI specification for PCCP stay the same since it is very competitive to that of its peer states and it has worked well for acceptance of Kentucky's concrete pavements. In the event that the IRI specification is applied to PCCP, a new specification, such as that in table four should be considered. This recommendation applied to the historical data would allow approximately 35% of the projects to receive some type of bonus, 35% to receive 100% pay, 10% percent to receive a penalty, and 20% would require corrective work. Again, these specification changes would truly award superior riding pavements, and deter the potential for exurbanite incentives/disincentives amounts because they are tied to the unit bid price of material.

APPENDIX A

Ride-ability Index in Kentucky (IRI)

Ride-ability Index

Year	Material Type	Min. RI	Min. IRI	Bonus RI	Bonus IRI	Bonus Amount	Penalty
1988	Asphalt	3.6	76	4.15	40	15%	Corrective work, removal, replacement
1991	Asphalt	3.6	76	4.15	40	15%	Corrective work, removal, replacement
1991	Concrete	3.6	76	-	-	-	-
1994	Asphalt	3.6	76	4.15	40	15%	Corrective work, removal, replacement
1994	Concrete	3.6	76	-	-	-	-
1998	Asphalt	3.7	69	4.05-4.09 4.10-4.14 4.15	47-44 43-41 40 or less	5% 10% 15%	3.60(76)-3.69(70) -5% 3.50(82)-3.59(77) -10% 3.45(85)-3.49(83) -15% Less than 3.44(86) - Corrective work, removal, replacement
1998	Concrete	3.55	79	4.05-4.09 4.10-4.14 4.15	47-44 43-41 40 or less	1% 2% 3%	3.50(82)-3.54(78) -1% 3.45(85)-3.49(83) -2% Less than 3.44(86) - Corrective work, removal, replacement
2000	Asphalt	3.7	69	4.05-4.09 4.10-4.14 4.15	47-44 43-41 40 or less	5% 10% 15%	3.60(76)-3.69(70) -5% 3.50(82)-3.59(77) -10% 3.45(85)-3.49(83) -15% Less than 3.44(86) - Corrective work, removal, replacement
2000	Concrete	-	-	4.05-4.09 4.10-4.14 4.15	47-44 43-41 40 or less	1% 2% 3%	-
2004	Asphalt	3.6	76	4.06-4.2 4.2	46-37 36 or less	.015x(47-IRI) 15%	3.73(67)-3.6(76) =0.015x(67-IRI) 3.59(77) corrective work
2004	Concrete	-	-	3.84-3.9 3.9-3.94 3.95	60-57 56-54 53 or less	1% 2% 3%	-

APPENDIX B

Profile Index (PI) in Kentucky

Concrete: Rainhart Profilograph (profile indexes)

Year	Blanking Band	Inches/mile 100% pay	Inches/ mile 98% pay	Inches/ mile 95% pay	Inches/ mile 92% pay	Bonus Amount	Corrective work
1991	0.1 inch	7 to 12	12 to 13	13 to 14	14 to 15	2% when less than 7 inches	Greater than 15 inches
1994	0.1 inch	7 to 12	12 to 13	13 to 14	14 to 15	2% when less than 7 inches	Greater than 15 inches
1998	-	-	-	-	-	-	-
2000	-	8 or less	8 to 9	9 to 10	10 to 12		Greater than 12 inches
2004	-	6 or less	6 to 7	7 to 8	8 to 10		Greater than 10 inches

APPENDIX C

Profile Index and Ride-ability Index in other States

Ohio:

Year	Mat. Type	Rolling straight edge	Deviation	correction
2006	Concrete	10 ft. straight edge	1/8 inch	Grind
	Asphalt	10 ft. straight edge	1/8 inch	Correct

Pennsylvania:

Year	Mat. Type	IRI	Payment
2006	Asphalt	<= 35	+300/lot
		<= 50	+150/lot
		<= 60	+75/lot
		<= 70	0/lot
		> 70	Correct to 70 inches or less/mile
	Concrete	<= 35	106%
		<= 50	104%
		<= 60	102%
		<= 70	100%
		> 70	Correct to 70 inches or less/mile

Florida:

Year	Material	Blanking Band	Inches/mile 100% pay	Bonus Amount	Corrective work
2006	Concrete	0.2 inch	2 to 5	3% when less than 2 inches	Greater than 5 inches

Year	Mat. Type	Rolling straight edge	Deviation	correction
2006	Asphalt	10 ft. straight edge	3/16 inch	Correct

North Carolina: uses a cumulative procedure with a .3 inch blanking band for both concrete an asphalt

Pay Adjustment Schedule for Cumulative Straightedge Index (CSI) (Obtained by adding SE Index of up to 25 consecutive 100 ft. (30m) sections)				
*CSI	ACCEPTANCE CATEGORY	CORRECTIVE ACTION	PAY ADJUSTMENT	
			Before Corrective Action	After Corrective Action
0-0	Acceptable	None	\$300 incentive	None
1-0 or 2-0	Acceptable	None	\$100 incentive	None
3-0 or 4-0	Acceptable	None	No Adjustment	No Adjustment
1-1, 2-1, 5-0 or 6-0	Acceptable	Allowed	\$300 disincentive	\$300 disincentive
3-1, 4-1, 5-1 or 6-1	Acceptable	Allowed	\$600 disincentive	\$600 disincentive
Any other number	Unacceptable	Required	Per CSI after Correction(s) (not to exceed 100% Pay)	

***Either Before or After Corrective Actions**

Tennessee:

Year	Material type	Blanking Band	Inches/mile 105% pay	Inches/ mile 100% pay	Inches/ mile 98% pay	Inches/ mile 93% pay
2006	concrete	0.1 inch	Less than 5	5 to 9	9 to 12 Plus grind to 9 inches/ mile	12 Plus grind to 9 inches/ mile

Year	Mat. Type	Rolling straight edge	Deviation	correction
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2006	Asphalt	10 ft. straight edge	1/8 inch	Correct
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Illinois:

Concrete		Inches/mile									Corrective work
Year	Blanking Band	103 % pay	102 % pay	101 % pay	100 % pay	98 % pay	96 % pay	94 % pay	92 % pay	90 % pay	
2006	0.1 inch	2.25 or less	2.25 to 3.25	3.25 to 4.25	4.25 to 10	10 to 11	11 to 12	12 to 13	13 to 14	14 to 15	Over 15

Year	Mat. Type	Rolling straight edge	Deviation	correction
2006	Asphalt	16 ft. straight edge	3/8 inch	Correct

Indiana:

Concrete		Inches/mile									Corrective work
Year	Blanking Band	106 % pay	105 % pay	104 % pay	103 % pay	102 % Pay	101 % Pay	100 % Pay	96 % pay	92 % Pay	
2006	0.0 inch	1.00 or less	1.00 to 1.20	1.20 to 1.40	1.40 to 1.60	1.60 to 1.80	1.80 to 2.20	2.20 to 2.60	2.60 to 2.80	2.80 to 3.00	Over 3.00

Asphalt		Inches/mile									Corrective work
Year	Blanking Band	106 % pay	105 % pay	104 % pay	103 % pay	102 % Pay	101 % Pay	100 % Pay	96 % pay	92 % Pay	
2006	0.0 inch	0.80 or less	0.80 to 1.00	1.00 to 1.20	1.20 to 1.40	1.40 to 1.60	1.60 to 2.00	2.00 to 2.40	2.40 to 2.60	2.60 to 2.80	Over 2.80

Missouri:

Concrete		Inches/mile									Corrective work
Year	Blanking Band	105 % pay	104 % pay	102 % pay	100 % pay	98 % Pay	96 % Pay	94 % Pay	92 % pay	90 % Pay	
2006		3.00 or less	3.00 to 4.00	4.00 to 5.00	5.00 to 7.00	7.00 to 8.00	8.00 to 9.00	9.00 to 10.0	10.0 to 11.0	11.0 to 12.0	Over 12.00

Iowa:

Bonus: applies to both asphalt and concrete

Single lift pavements				Multi-lift pavements		
Inches/mile	Interstate	Primary	Non-	Interstate	Primary	Non-

		routes	primary		routes	primary
0-1	\$650	\$550	\$200	\$300	\$200	\$75
1.1-2	\$550	\$450	\$150	\$250	\$150	\$50
2.1-3	\$450	\$350	\$100	\$200	\$100	\$25
3.1-7	Unit price	Unit price	Unit price	Unit price	Unit price	Unit price

Penalty: applies to both asphalt and concrete

Single lift pavements				Multi-lift pavements		
Inches/mile	Interstate	Primary routes	Non-primary	Interstate	Primary routes	Non-primary
3.1-7	Unit price	Unit price	Unit price	Unit price	Unit price	Unit price
7.1-10	Grind or \$300	Grind or \$200	Grind or \$100	Grind or \$150	Grind or \$100	Grind or \$50
10.1 and over	Grind only	Grind only	Grind only	Grind only	Grind only	Grind only

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