Research Report
KTC-04-27/SPR243-01-1F

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EVALUATION OF CURRENT INCENTIVE/DISINCENTIVE PROCEDURES IN CONSTRUCTION

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Evaluation of Current Incentive/Disincentive Procedures in Construction

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I. Introduction

This study was initiated to take an in-depth look at the current time and material incentive/disincentive program associated with highway construction projects in Kentucky. The current incentive/disincentive program was first initiated in the mid to late 90's. However, not until recently had some of the original mechanisms of the program been revisited and/or up-dated.

From the early stages of this study it was anticipated that many of the concerns regarding the use of both time/material incentives and disincentives on highway construction projects in Kentucky would be addressed. Therefore, at the onset of this project the study advisory committee made a tremendous effort to devise a working plan for this study that would evaluate both the time and material incentive and disincentive program. In addition to the evaluation of the program, tremendous effort was also undertaken to answer some age old questions regarding the quality of projects that have received time incentive bonuses in the past.

II. Methodology

To properly evaluate the time and material incentive/disincentive program for highway construction projects in Kentucky, each individual component of the program had to be looked at on a detailed level. After taking this in-depth look at each of the components, the program in its entirety was then looked at on a much larger level to see if an obtainable balance could be achieved between both time and material incentive/disincentives. In addition, a thorough literature review was conducted to investigate incentive/disincentive procedures currently being practiced by other state transportation departments. It was hoped that any applicable information gained through the literature review could possibly be incorporated into the current incentive/disincentive program being used in Kentucky. The remainder of this report will step through the process that was used to evaluate each of the components of the incentive and disincentive program.

III. Evaluation of Time Incentives/Disincentives

It has been determined that traffic volumes are continuing to rise on many of the major roads throughout the state of Kentucky. With rising traffic volumes, highway capacities during certain periods of the day are nearing if not already exceeding their design capacity. Any disruption to the traffic flow during these periods, namely the presence of a construction zone, can have a dramatic impact on the flow of traffic. These disruptions in the traffic flow often lead to highway delays which are accrued to the user as increased costs to use the facility. These increased costs are commonly referred to as user delay costs. User delay costs are defined in dollars-per-hour-per-vehicle by combing lost personal time, increased vehicle maintenance, and additional fuel costs absorbed by the traveling public when travel times are delayed due to the presence of a construction zone.

In efforts to help reduce the economic burden to the traveling public, it has been suggested that a time incentive/disincentive be offered to a contractor so that the construction phase of highway project may be expedited in a more timely fashion. However, it would be impractical to assign a time incentive/disincentive to every highway project in Kentucky. Deciding when to and when not to apply a time incentives/disincentive (I/D) has been the subject of much discussion for Cabinet officials in the past. The following will include a discussion as to when a time I/D may be appropriate for a highway construction project.

A.) When to Consider a Time Incentive/Disincentive for a Highway Construction Project

As stated by researchers at the Texas Transportation Institute time I/D's for highway construction work should be limited to special situations. They go on to say that time I/D's should be reserved for projects that are considered special cases of great urgency, of relatively short duration, with a clean set of plans, and with little chance of field changes."[1] Thus, indicating that a transportation agency has to look at time I/D's for highway projects on a case-by-case basis. Unfortunately, no magical formula will be able to answer whether a time I/D should or should not be applied to a particular project. However, there have been several studies conducted that identifies when a time I/D maybe appropriate for a highway construction project.

The Federal Highway Administration (FHWA) has provided a few guidelines they consider necessary to determine if a project is a candidate or not for a time I/D. They consider projects for a time I/D if they meet one of the following criteria: projects that have high traffic volumes that are generally found in urban areas, work that will complete a gap in the highway system, major reconstruction or rehabilitation on an existing facility that will severely disrupt traffic, major bridges that will be placed out of service due to rehabilitation, and projects that impose lengthy delays on the traveling public.[2] Other sources consider I/D provisions appropriate for, but not limited to, the following situations.

1.) Projects that create high motorist costs during construction or maintenance. [3]
2.) Projects that impair emergency services to an area for an extended period of time. [4]
3.) Projects that jeopardize the safety of the road users and/or the contract workers. [4]
4.) Projects that severely impact the traffic flow on a major arterial. [4]
5.) Projects that produce detours on sub par road surfaces. [4]
6.) Projects that impose severe monetary losses to adjacent commercial enterprises.[4]

Any or all of the above mentioned items may be taken into consideration when deciding whether or not to use a time I/D on a highway construction project. However, this is only the first step in this decision process. The next step is to consider the financial implications of administering a time I/D.

B.) Financial Considerations for Using a Time Incentive/Disincentive

Although a particular project meets one or many of the above criteria the financial impact of honoring a time I/D may determine whether a time I/D is feasible or not. In some cases the financial impact may determine when you may or may not have a time I/D for a particular project instead of one of the items listed above.

One of the most utilized practices in determining the financial impact of administering a time I/D is by measuring road user delay costs. Researchers have defined road user delay costs as the estimated incremental daily costs to the traveling public resulting from the construction work being performed. [5] These costs are typically the aggregation of three separate cost components for three different vehicle types. The three different cost components are; vehicle operating cost (VOC), user delay costs, and crash/accident costs. The three different vehicle types are; passenger cars, single-unit trucks, and combination trucks. [1]

During this research project and a subsequent research project titled "The Cost of Construction Delays and Traffic Control for Life-Cycle Cost Analysis of Pavements" performed by the Kentucky Transportation Center, a computer program has been developed to assist Cabinet officials calculate road user delay costs. The road user delay costs program has been titled the Kentucky User Costs Program (KyUCP), and it has been tested within the Division of Design since 2001 with much success.

The KyUCP program is based on earlier research conducted by the FHWA under Demonstration Project 115 (DP-115). Results provided by the KyUCP program identifies the monetary impact imposed on the traveling public due to a restriction in lane capacity. One can easily calculate both the daily and total project delay costs with minimal user input. Once an analysis has been performed using the KyUCP, one can then determine the feasibility of whether a time I/D is appropriate. However, the responsibility of comparing the financial benefit to the user of the facility by accelerating the construction schedule verses the increased construction costs still lies within the transportation agency. As stated in the report "Development of Criteria for Incentives/Disincentives in Highway Construction" the cost of the incentive payments to the contractor must be economically justified by the reduced road user costs.[2]

In most cases, a transportation agency will have to consider placing caps or ceilings on the amount of incentive to be paid out. Majid Jaraiedi states in his research, "Incentive/Disincentive Guidelines for Highway Construction Contracts", that the federal government will pay the same portion of the incentive payment as it pays for regular construction. That is if the incentive amount does not exceed five percent of the total project cost.[4]

Other financial considerations regarding the assignment of a time I/D must include the financial impact felt directly by the transportation agency. In most cases, the transportation agency will have to match the effort the contractor is required to exert to meet the project's schedule. [8] Most often the agency will need to increase both field and district-level support to help the contractor meet his/her accelerated schedule.

Note: When assigning time I/D's in urban areas, the use of the KyUCP alone will not be sufficient. A detailed traffic analysis will need to be performed to accurately define all traffic disruptions throughout the area adjacent to the construction project.

C.) How Time Incentives/Disincentives have been Utilized in both Kentucky and Other States

From January of 1999 through December of 2002, approximately 32 highway construction projects in Kentucky were selected to include time I/D's as part of the contract documents. From these 32 projects approximately $10,868,395 was paid out as time incentives, and $21,500 was collected as time disincentives (Appendix C). Both the incentive and disincentive amounts were based on user delay costs calculated from the procedures outlined in FHWA's Demonstration Project 115. [6] Hence, the amount paid out to the individual contractors can be viewed as a savings to the traveling public.

Some might argue that there is an economic imbalance between user delay costs and construction costs. In most cases there always will be. Time I/D's are used as motivational tools to encourage the contracting community to work faster, schedule more accurately, and manage the construction process better. However, one has to remember that highway projects are typically awarded to the lowest bidder in a competitive bidding environment. When asked to accelerate a construction schedule this usually implies additional resources have to be supplied to the project. At that point it is a contractor's decision as to whether the risk of spending more money on manpower/equipment today will prove to be profitable at a later date. Upton D. Officer portrays this situation very appropriately in his paper titled "Using Accelerated Contracts with Incentive Provisions for Transit Way Construction in Huston". [7]

> "As an incentive for better performance Metro offered a bonus of $5,000 per day for each day the AVL portion was completed early for a maximum of $450,000, which could be earned if completion occurred 90 days early. In spite of the tight schedule and support problems the contractor finished this portion of the contract in 269 days and earned the full bonus of $450,000. The contract performance period for this part was reduced from 975 to 269 working days, which was a reduction of 706 days or more than 23 months. How much of the $450,000 bonus was profit? According to the contractor only about $100,000 was realized as profit to the company; the remainder was absorbed in increased costs for accelerating the construction schedule."

Other states have used time I/D's on highway construction projects successfully as well. David Arditi states that all twenty-eight highway construction projects, let by the Illinois Department of Transportation between 1989-1993, were completed ahead of schedule. [9] Of these twenty-eight projects, approximately 79% received full incentive payments and approximately 21% received partial incentives. The maximum incentive amount allowed per project was 5.13% of the contract amount and the average incentive amount paid per project was 4.71% of the contract amount. [9] In a comparison analysis Mr. Arditi also followed the completion status of 29 non-time I/D projects during this same time period. His results indicate that only 41.4% were completed ahead of schedule, the remaining 58.6% projects were either completed on time or after the expected completion date.

Another researcher, Samer F. Abu Hijleh, states in the "Journal of Construction Engineering and Management" that projects with time I/D clauses typically achieved productivity improvements in the range of 25%-30% and schedule improvements in the range of 15%-25%. [10] The majority of Mr. Hijleh work was performed in California. In addition to the above referenced material, Mr. Ralph W. Plummer surveyed 39 nine states in his report titled "Development of Criteria for Incentives/Disincentives Highway Construction Contracts", to determine how effective time I/D's had been in other states. The following is a summary of his findings.

1). In Maryland, the time I/D projects that were completed in time to receive an incentive payment reduced the contract time by up to 200 days.

2.) In Virginia, of the 16 time I/D projects reviewed all received a time incentive bonus. The time savings ranged from 4 to 199 days.

3.) According to the Iowa study on time I/D projects, 35 states said they had used I/D clauses on some of their highway contracts. Thirty-two states said that their contractors had received some form of incentive payment, and 22 of the states said that they had paid the maximum incentive 90% of the time. "This indicates that projects are being completed ahead of schedule when I/D provisions are included in the contracts."[2]

D.) Some Disadvantages of Using Time I/D's

Although many of the states have been successful in using time I/D's to motivate the contracting community to finish projects sooner, there have been several published articles indicating the disadvantages of using time I/D's. One such instance has been reported by the Florida Department of Transportation. Since engineer's time estimates are used to determine project durations based on the average contractor performance rate, a good competitive contractor can reduce contract time with little or no additional commitment of resources. [11] Therefore allowing the contractor to take advantage of the time bonus free of charge. In efforts to avoid this situation Florida DOT has since reduced contract times by 20% in recent years without witnessing any major delays in project completion dates. [11]

In Maryland, department of transportation officials have experienced contractors filing legal claims against the state when a project runs past the completion date. Most often, when a change is necessary to the contract documents that deviate from the original construction plan, contractors will use this as grounds for dismissing the disincentive amount. Hence, the Maryland DOT has never collected a disincentive payment.[2] Unfortunately, the Maryland State Highway Officials that were surveyed in the report "Development of Criteria for Incentives/Disincentives in Highway Construction Contracts" expressed concerns that a disincentive will never be successfully assessed due to the nature of changes in construction planes which gives the contractor grounds for a claim when the project runs over. Therefore, the Maryland State Officials felt the time I/D contracts were most effective when placed only on a critical portion of the project.[2]

Other states have encountered problems when trying to administer time I/D's on highway construction projects as well. Problems typically arise from what has been labeled as "external sources". External sources have typically been utility companies in the past. Often times when a utility line needs to be relocated for highway construction purposes, the project is at the mercy of the utility company. Unfortunately, most Departments of Highways do not have the legal recourse to force the public utilities to do the required work within a specified time frame. In one reported case in Maryland, a highway construction project was halted by almost two years because of the slow performance on the utility company's part. [2]

E.) Other Options to Consider Instead of Time I/D's

Another way to address accelerating a construction schedule and receiving a quality product is through A + B + C bidding. Many states have adopted this style of bidding for the flexibility in comparing bids based on labor/materials, time, and warranty. The A component refers to the cost of labor and materials. The B component refers to the dollar amount of user delay costs associated with the construction project. The C component requires the contractor to provide a warranty on the work performed. Traditional bidding procedures consider the A component in the bidding process only. When comparing bids in a A + B + C bidding scheme one can select the lowest bidder based on adding the A + B components together. The whole idea is to get contractors off the road as quickly as possible and to build a pavement that last longer.[12]

Lane rental is another type of time I/D mechanism used to motivate contractors to perform more expediently. This was first introduced by the Colorado Department of Transportation in 1993. The concept set a daily rental rate for motorist inconvenience as an incentive for the contractor to complete the work more quickly. In this scenario the contractor would bid the number of lane rental days after the transportation agency set a dollar amount for the use of the lane on a daily basis. The contractor would then be responsible for paying the agency this amount for each day the lane of traffic was disrupted due to the construction process.

IV. EVALUATION OF MATERIAL INCENTIVES/DISINCENTIVES

A.) Background on the Comparison of Construction Quality for Time I/D's Projects in Kentucky

A second concern this research intended to address was whether time I/D's had an influence on the construction quality. Many have questioned if contractors are sacrificing construction quality in order to acquire a time incentive bonus. If so, then an investigation of how lower quality may impact a road's long-term performance and lifecycle cost will be necessary. However, if no degradation of construction quality is found on projects with time I/D's when compared to projects without time I/D's, then it may be assumed that incentives paid on these projects truly buy the benefits of their early deliveries.

The method of evaluating the overall quality of time I/D projects used in this study was to compare material qualities between projects with and without time I/D clauses. In addition, a comparison was made between the initial roughness values of the paved surfaces between projects with and without time I/D's. Note: Because most of the projects contained in the available databases were asphalt pavements, this research study concentrated on asphalt projects only.

Material quality data used in this report were obtained from the Kentucky Materials Information Management System (KMIMS). According to the Kentucky Standard Specification for Road and Bridge Construction Edition of 2000 (Section 402), four material properties are used for lot pay adjustments based on quality standards. These include asphalt content (AC), air voids (AV), voids in mineral aggregate (VMA), and density. Note: the lot pay adjustment schedule has been changed in the Standard Specification 2004, in which the lane density and joint density for surface mixture are treated separately. However, because there is no way to differentiate the lane density from joint density in the KMIMS database, the material quality characteristics in the new specification was not employed in this study.

B.) Projects Used to Evaluate Material Qualities between Time and Non-time I/D projects

A total of 51 projects were analyzed in this study, 26 of which had time I/D's and 25 which did not have time I/D's. The project IDs and their descriptions may be viewed in Appendix A. The number of data records used for comparing each material characteristic between the two project types may be viewed in Table 1.

Table 1: Number of Samples for Comparison of Material Qualities

Material Quality Characteristics	No. of Samples from Time Inc./Dis. Projects	Number of Samples from Non Time Inc./Dis. Projects
Asphalt Content	2592	1135
Air Voids	2586	1124
Voids in Mineral Aggregate	2579	1124
Density	6483	3084

C.) Statistical Techniques and Parameters Used to Compare Material Quality between Time and Non-Time I/D Projects

Various statistical plots and analyses were made to compare material qualities between time and non-time I/D projects. Histograms and cumulative distribution plots were used to compare sample distributions. A T-test was used to compare average values of material characteristics between the two groups. Note: although asphalt content (AC), Air Voids (AV), Voids in Mineral Aggregate (VMA), and density can be queried from the KMIMS database, not all of them can be used directly for comparison. For instance, the target asphalt content depends on the job mix formulas (JMF). Different JMF may specify different AC. It is not appropriate to compare the average values of AC from the two groups; instead, it is the deviation of AC from target value that matters. Therefore, the deviation from target material properties was used for comparison purpose.

D.) Comparison of Asphalt Binder Content

Target asphalt contents vary for different mixtures. The difference between tested AC and target AC for projects with/without time I/Ds was plotted on a histogram (Figure 1). The X axis of the histogram is the deviation of AC from JMF AC, while the Y axis shows the proportion of samples within a particular range (Figure 1). The cumulative distributions of the tested AC and target AC for projects with/without time I/Ds are shown in Figure 2. The X axis of the cumulative distribution shows the absolute value of the deviations from target AC, while the Y axis shows the cumulative proportions from the lowest value to the largest value (Figure 2). Both the histogram and the cumulative distribution plots indicate that non-time incentive projects have a slightly higher percentage of samples with lower deviations. It may appear that the samples from non-time incentive projects are better focused on the target AC.

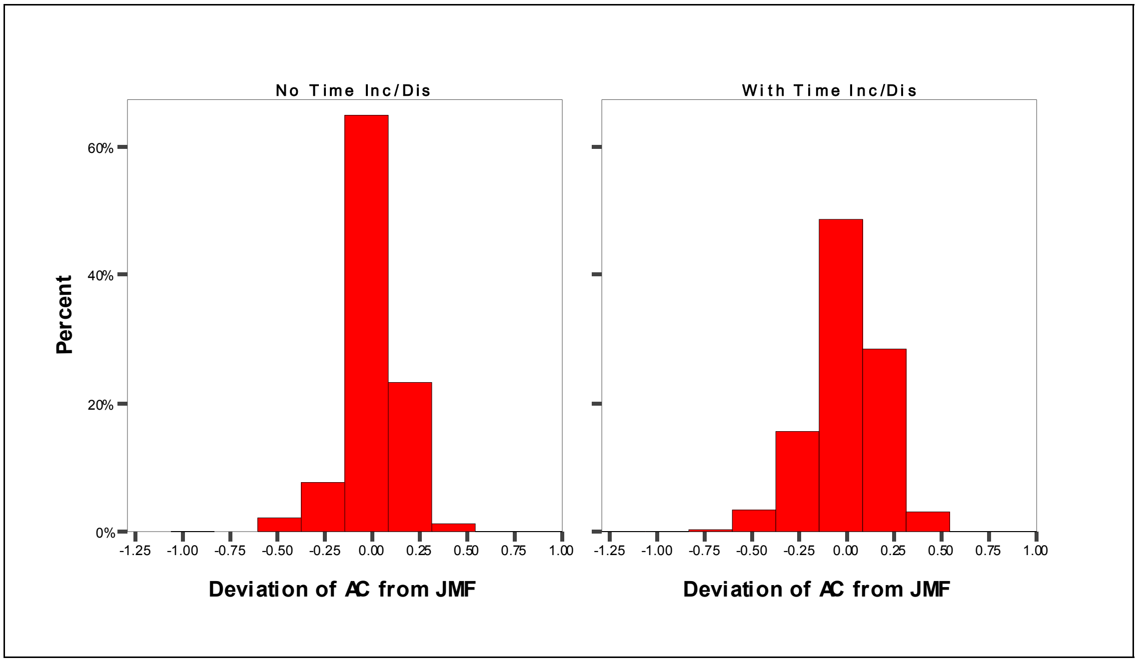

Figure 1: Histogram of Deviations of AC from JMF

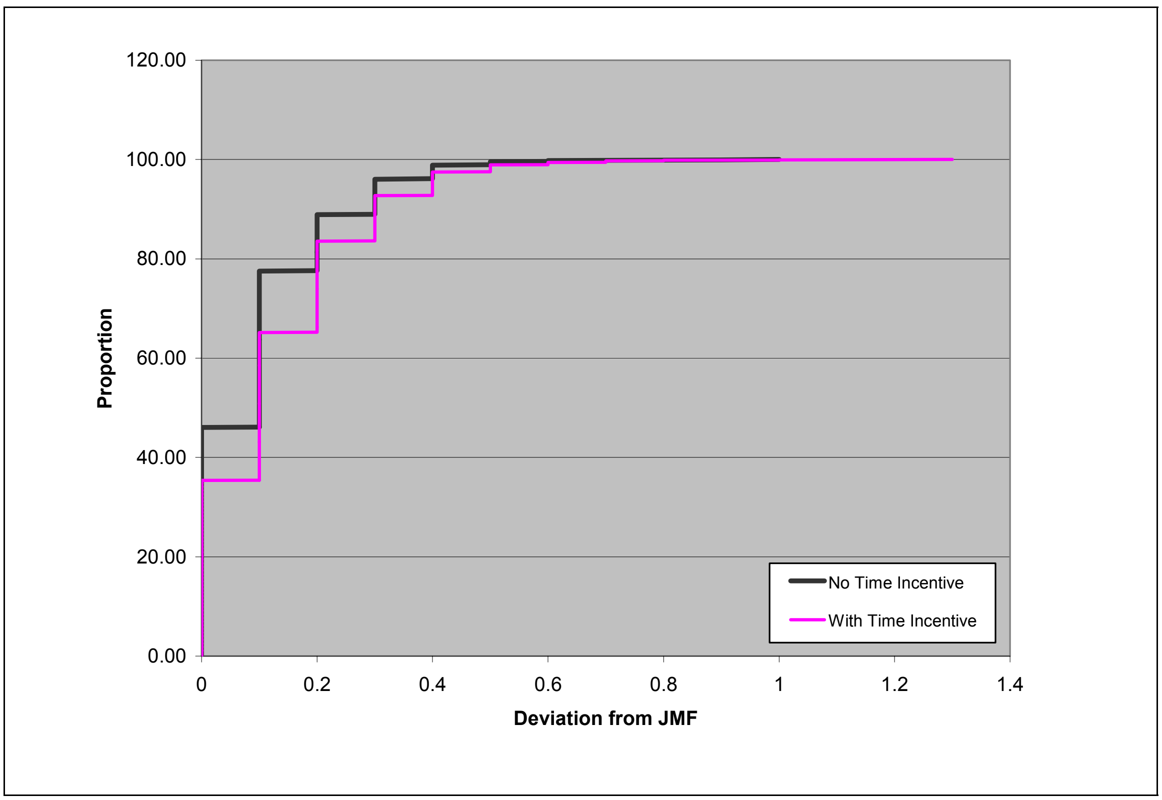

Figure 2: Cumulative Plot of Deviations of AC from JMF

However, to better investigate the possible difference between the two groups of samples, statistical significance tests were conducted. The T-test was used to test if the average values of the two groups are significantly different (Table 2). Additionally, the Levene's test was used to test if the variances are significantly different (Table 3).

Table 2: Summary Statistics of the Deviation of AC from Target Values

	Time incentive?	No. of Samples	Mean	Std. Deviation	Std. Error Mean
Deviation of AC from JMF	No	1135	-.0035	.15149	0.00449
	Yes	2592	-.0108	.18879	0.00371

Table 3: Summary of T-test and Levene's Test for Comparison of AC

		Levene's Test for Equality of Variances		T-test for Equality of Means				
		F	Sig.	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Con. Interval of the Difference	
							Lower	Upper
Dev. of AC from JMF	Equal variances assumed	62.433	.000	.254	0.0072	.00635	-.00520	.01968
	Equal var. not assumed			.214	.0072	.00583	-.00419	.01867

Assuming the significant level to be 0.05, because the P-value here, either 0.254 or 0.214, is greater than 0.05, the T-test shows no evidence that the average deviations from target AC are not the same for the two groups. In other words, there is no evidence that AC is systematically higher or lower on time I/D projects than that on non-time I/D projects. However, because the P-value reported by the Levene's test is very small (<0.001), it may indicate that the variation of AC on non-time I/D projects (0.15) is less than that on time I/D projects (0.19). Therefore, it appears that the AC samples from time I/D projects are more likely to miss the target value. However, one should keep in mind that the statistical conclusion is drawn from a total of 3,727 samples; and for this reason, a small difference may result in a significant P-value. This small difference in variation may not seriously affect pavement performance. The stipulated penalty range for AC, according to the Kentucky Standard Specification (2000), is less than -0.5%, or more than +0.5% from JMF. Any variation within -0.5% and 0.5% is considered very reasonable. Using this criterion to evaluate the AC samples, the research found that only 1.08% of samples from time I/D projects and 0.35% of samples from non-time I/D projects fall into the penalty range. This implies the overall quality from either group is outstanding.

E.) Comparison of Air Voids

Unlike asphalt content, for all projects using Supepave mixtures, the target percent air voids is 4.0%. Therefore, the recorded percent air voids can be used directly for plotting and comparison. The X axis of histogram and cumulative distribution plot shown in Figures 3 and 4 are the sample air voids at $N_{des.}$ The Y axis is the percent of samples within each range and cumulative percent, respectively.

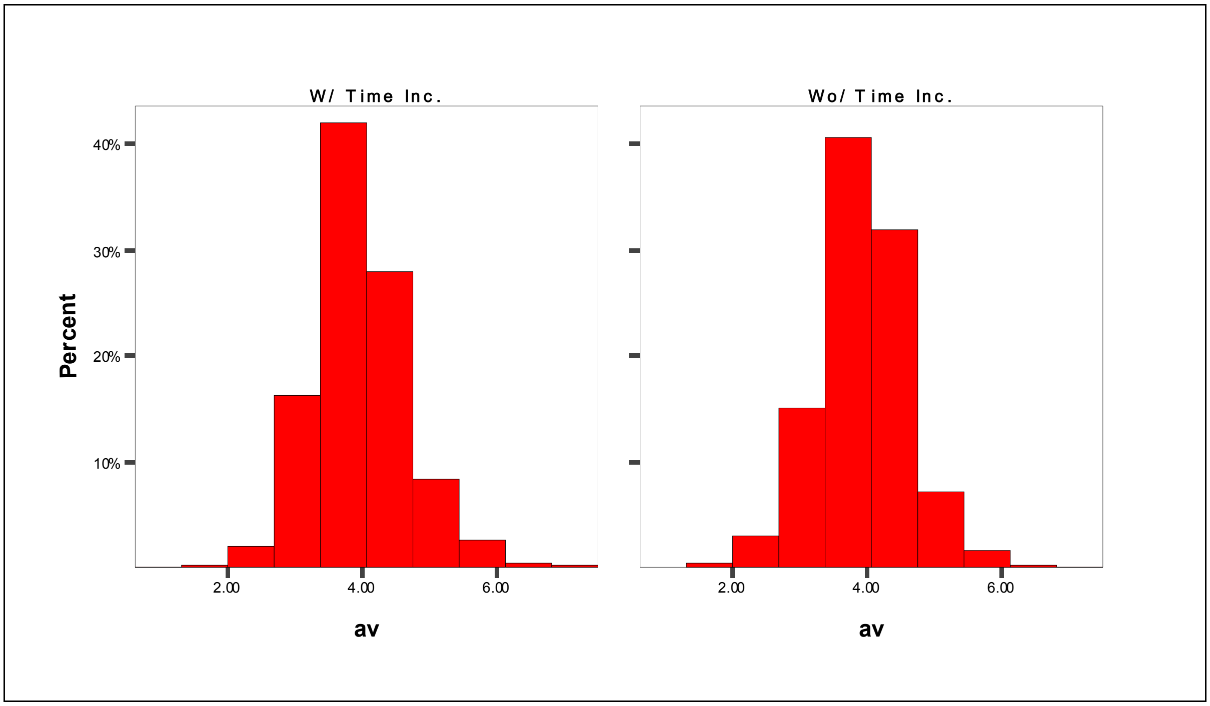

Figure 3: Histogram of Air Voids

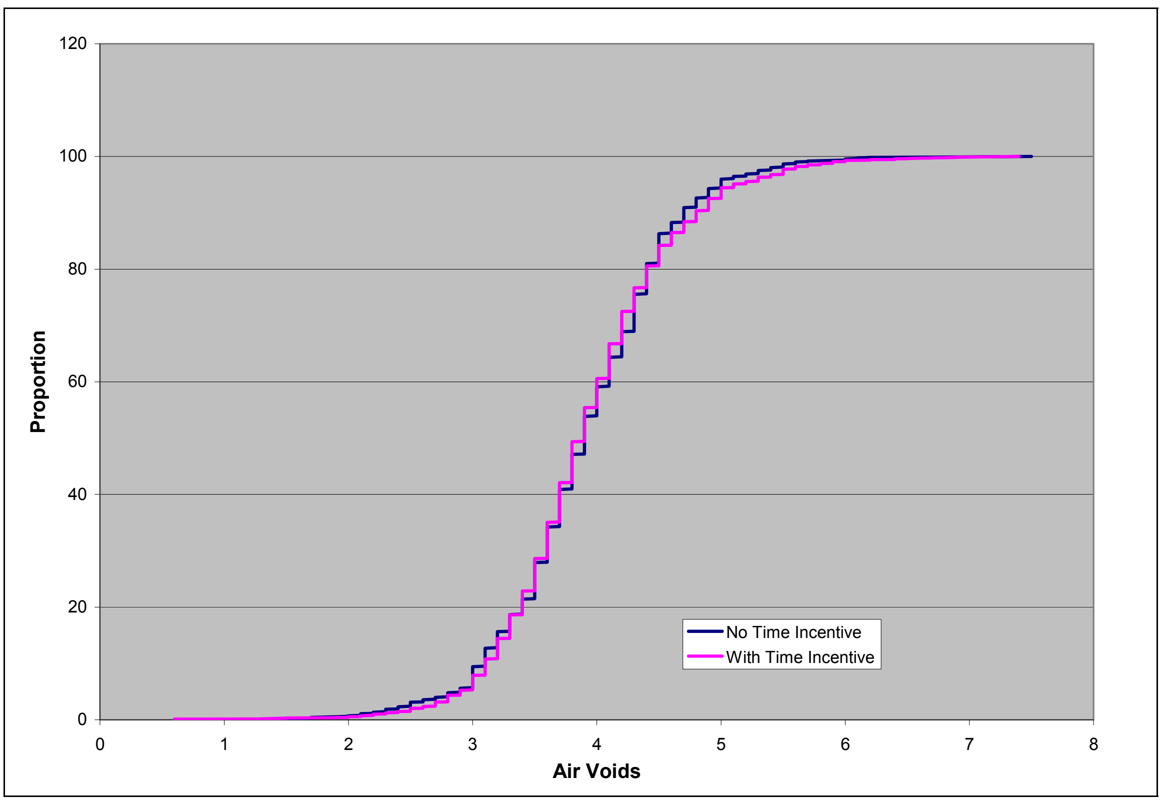

Figure 4: Cumulative Distribution Plots of Air Voids

Both the histogram and cumulative plots in figures 3 and 4 above indicate that the air voids between the two groups of samples are almost identical. Again, to further investigate their differences, statistical tests were conducted. The results of statistical analysis are shown in Tables 4 and 5 below.

Table 4: General AV Information of the two Groups of Samples

	Time Incentive	No. of Samples	Mean	Std. Deviation	Std. Error Mean
Air Voids	No	1124	3.911	.684	0.0204
	Yes	2586	3.926	.710	0.0140

Table 5: Summary of T-test and Levene's Test for AV Comparison

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Con. Interval of the Difference	
							Lower	Upper
AV	Equal variances assumed	.505	.477	.548	-.0151	.02509	-.06428	.03412
	Equal var. not assumed			.542	-.0151	.02472	-.06357	.03340

Since none of the statistics from the t-test and Levene's test are significant at the 0.05 significance level, it may be further concluded that there is no significant difference between the two groups of samples regarding percent air voids. Additionally, the following table summarizes the comparison of the two sample groups to the standard specification outlined in the Kentucky Standard Specifications manual 2000 (Table 6). As viewed in Table 6 the number of time I/D projects receiving a quality of AV bonus compared to that of non-time I/D projects is almost equal. Likewise, the percentage of the projects receiving quality of AV penalties is very similar for the two sample groups as well.

Table 6: Comparison of AV Samples According to the Specification 2000

	Time Incentive Projects	Non Time-Incentive Projects
Percent within Bonus Range	61.35%	64.80%
Percent Falling in Penalty Range	10.86%	9.69%

F.) Comparison of Voids in Mineral Aggregate (VMA)

The specification requirement for VMA in Kentucky depends on nominal maximum aggregate size, which follows the Superpave Mix Design.[14] The larger the aggregate size, the smaller the value of minimum VMA that is allowed. For example, if the nominal maximum aggregate size is 25.0 mm, then the minimum VMA is 12.0; if the nominal maximum aggregate size is 19.0, the minimum VMA is 13.0. Note: there is no upper limit for VMA in the Kentucky Standard Specification (2000). Therefore, in this research, the difference between sample VMA and the minimum required VMA has been used for comparison analysis. Figure 5 and 6 show the histogram and cumulative distribution plot of the difference between the projects with and without time I/D clauses. As shown in Figure 6, the percentage of samples that do not meet the minimum specification requirement for both groups is almost identical.

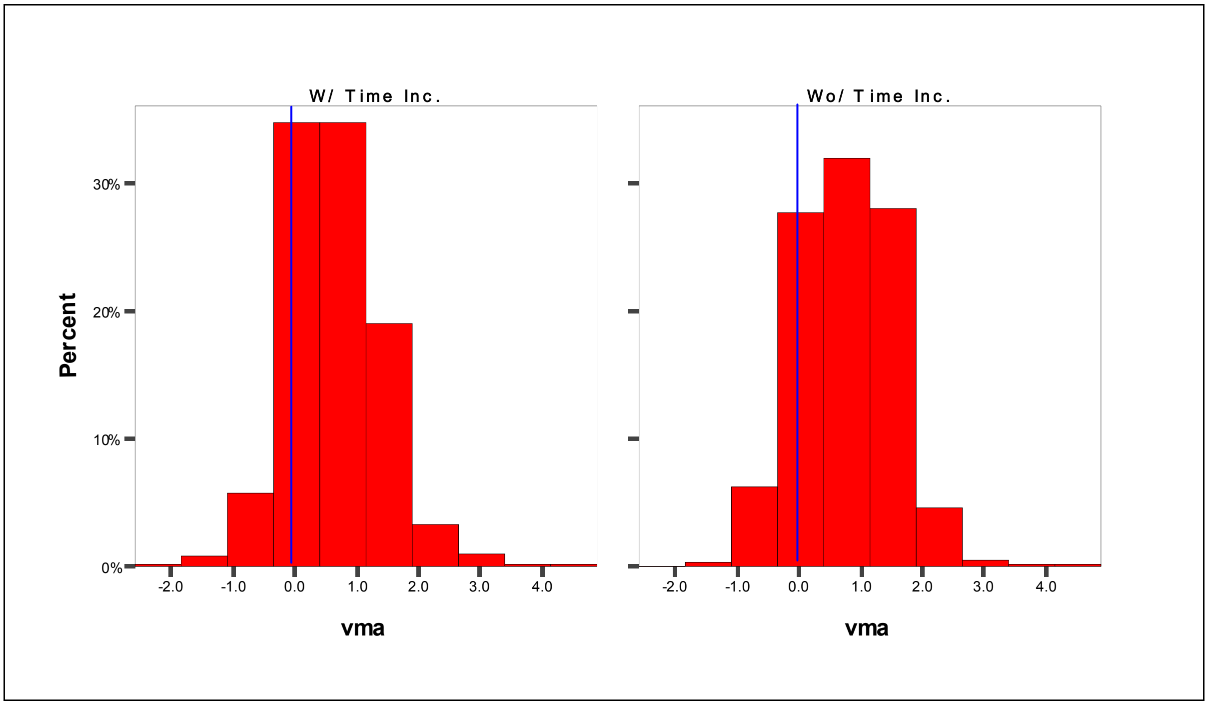

Figure 5: Histogram of the Difference between Sample VMA and Minimum required VMA

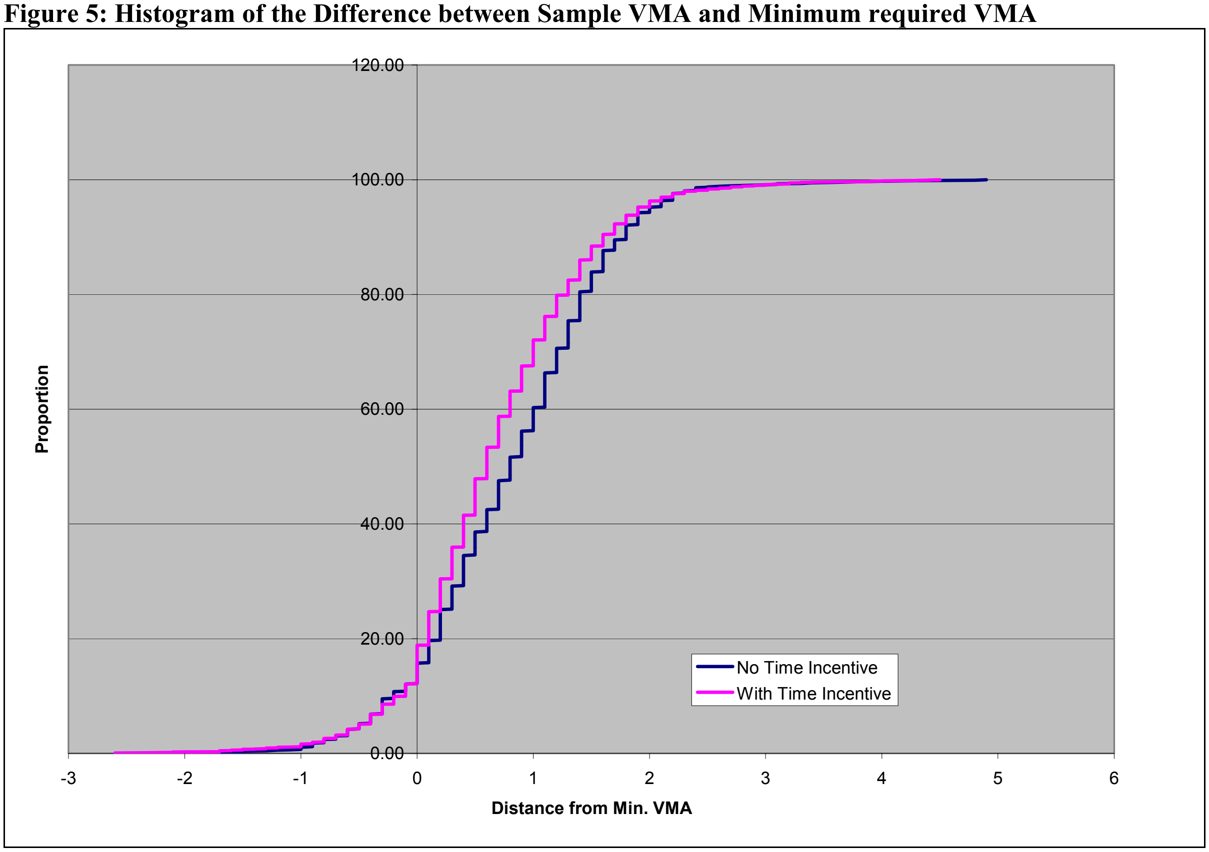

Figure 6: Cumulative Distribution Plot of the Difference between Sample VMA and Minimum required VMA

In the previous comparisons, both AC and AV have had target values. The closer the sample is to the target value, the better the material quality is. However, this is not true for the VMA, because it is a one-sided specification, one cannot conclude that the closer the sample VMA to the minimum required VMA, the better the quality. Additionally, unlike some other one-sided specifications, i.e.: concrete strength, the more distant the actual value to the minimum required value, the better the material performs. Higher VMA does not guarantee better performance. Therefore, only percentage of samples that are less than minimum required VMA is reported in this research. It is interesting to find that the VMA, judging from the Kentucky Standard Specification 2000, are very close (Table 7).

Table 7: Comparison of VMA Samples According to the KY Specification 2000

Deviation of VMA from Minimum Req.	Time Incentive Projects	Non Time Incentive Projects
Percent Falling in Penalty Range	12.05%	12.10%

G.) Comparison of Density

The density of asphalt concrete is determined from cores taken in the field. For Option A, four cores are required for each sub-lot. The department determines the density from the furnished cores according to Kentucky Method 64-442. The desired density range is between 94% and 96% (with 5% incentive); however, the contractor receives 100% pay if density is between 92% and 93.9%. The histogram and cumulative distribution plot of the densities for both projects with and without time I/D may be viewed in Figures 7 and 8. The sample density distributions for the two groups look similar, although the non-time I/D projects seem to have less low density samples. However, both groups seem to have similar percentages of samples with excessive high densities. If one treats 95% percent density as the target density, both groups have more low density samples than high density samples.

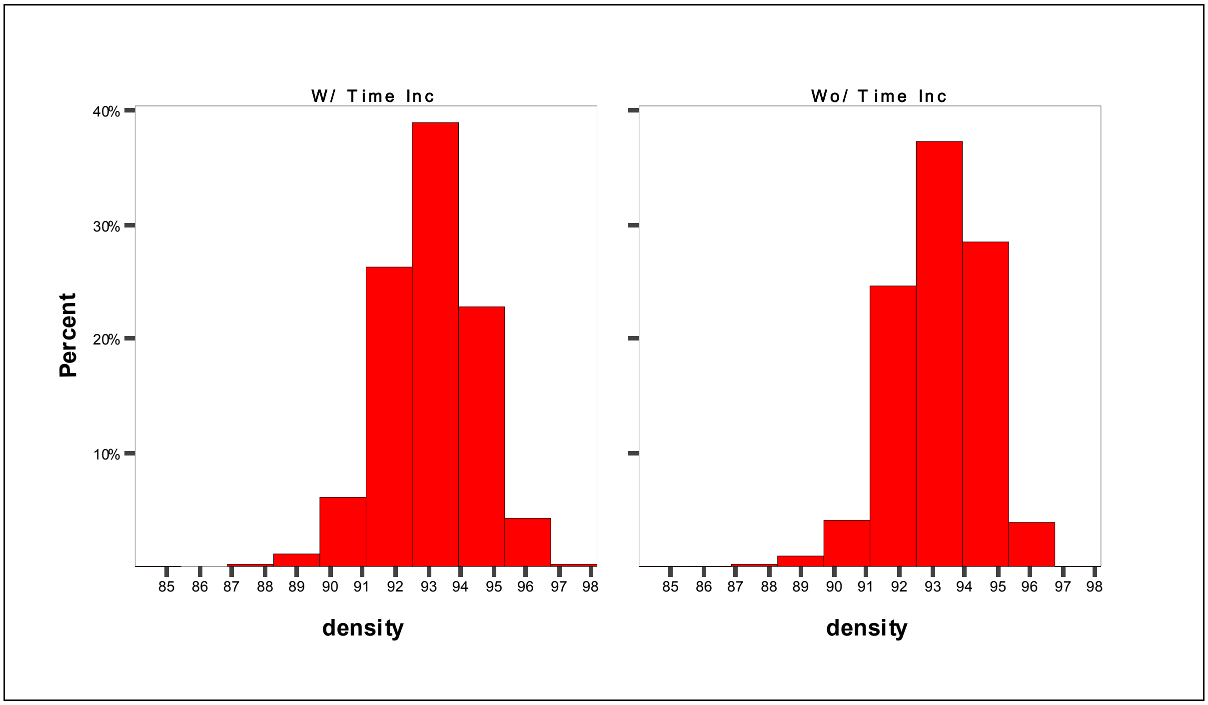

Figure 7: Histogram of AC Density

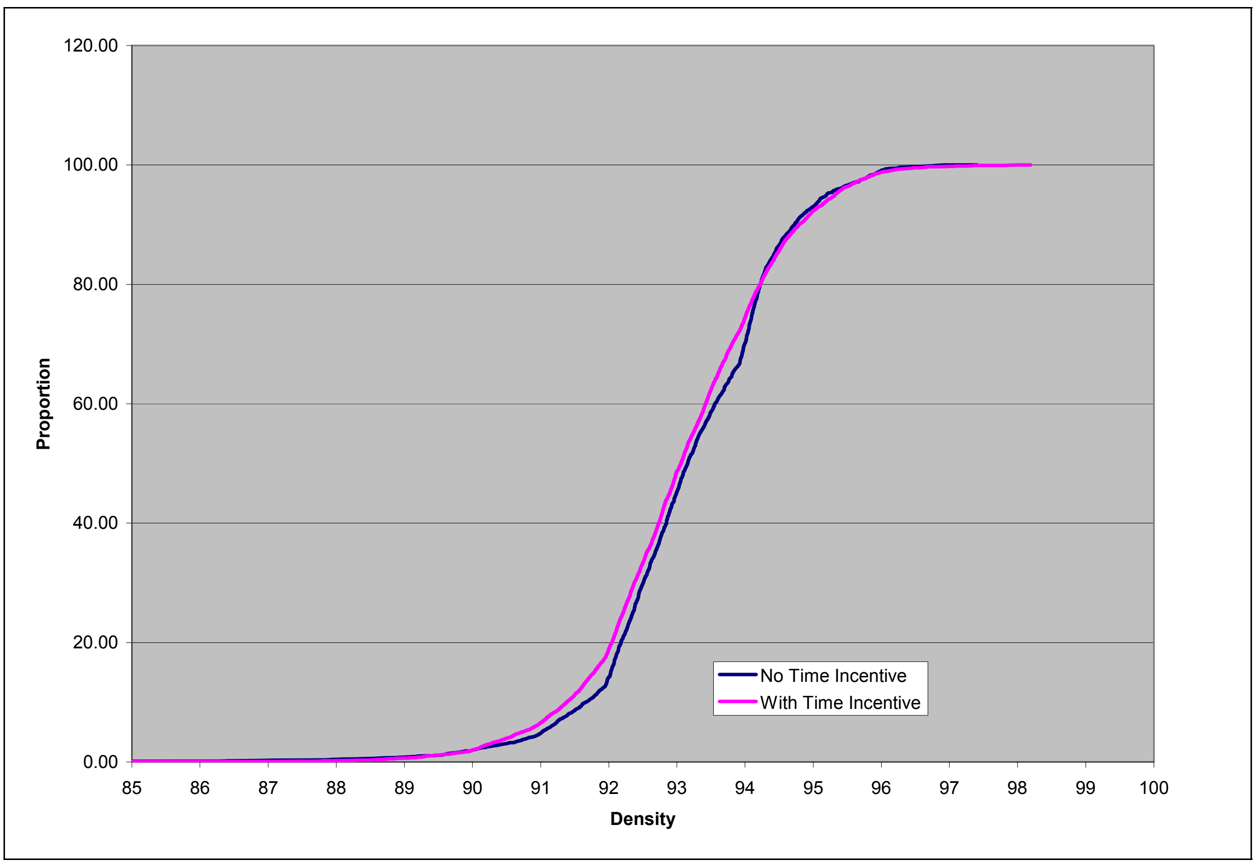

Figure 8: Cumulative Distribution Plot of AC Density

Statistical analysis indicates that, overall, the average densities on non-time I/D projects are 0.1% higher than that of projects with time I/D's (Table 8). Also, statistical analyses indicate that density variations of samples from non-time I/D projects are less than that from time I/D projects. In addition, these differences are significant at the 5% significance level. However, the magnitude of this difference between the two groups is relatively small (Table 9). As mentioned before, with large sample sizes a small difference between two groups may appear statistically significant, but it may not make sense from practical point of view.

Table 8: General Density Information of the two Groups of Samples

	Time Incentive ?	No. of Samples	Mean	Std. Deviation	Std. Error Mean
Density	N	3084	93.17	1.341	0.017
	Y	6483	93.07	1.395	0.024

Table 9: Summary of T-test and Levene's Test for Density Comparison

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Con. Interval of the Difference	
							Lower	Upper
Density	Equal variances assumed	6.264	.012	.001	-.1002	.03015	-.15929	-.04110
	Equal var. not assumed			.001	.-.1002	.02973	-.15847	-.04192

Table 10 summarizes the distribution of density samples according to the pay adjustment schedule from the Kentucky Standard Specifications (2000). As shown in Table 10, the samples from the non-time I/D projects are 5.4% more likely to receive material bonuses and 5.1% less likely to be penalized when compared to the time I/D projects. Interestingly, the table also indicates that the overall quality of density, for both groups, is not as good as the other material characteristics. How this will potentially affect long-term pavement performance of Superpave mixtures is unknown at this time.

Table 10 Comparison of Density Samples According to the Specification 2000

	Time Incentive Projects	Non Time Incentive Projects
Percent within Bonus Range	26.01%	31.41%
Percent Falling in Penalty Range	18.57%	13.49%

H.) Comparison of Material Quality Incentives/Disincentives Paid on Time and Non-time I/D projects

In the sections above, four different material quality comparisons were made between time and non-time I/D projects. The next question would be to evaluate the overall quality of both the time and non-time I/D projects by combining the four material qualities together. In efforts to judge the overall material quality, one needs to decide the weight of importance for each material characteristic. Fortunately, the weight of importance is already reflected in the lot pay adjustment schedule outlined in Kentucky Standard Specification (2000). Therefore, this research summarized and compared the material incentives and disincentives paid and/or imposed on the sample projects.

As shown in Figure 9, the overall material quality on time I/D projects has been very good based on the Kentucky Standard Specification 2000. Of the 26 investigated time I/D projects, 21 projects or 80% have also received material incentives. However, one may notice that the amount of monies paid out for time incentives compared to that of material incentives are not of the same scale. Figure nine shows that the highest paid time incentive in the recent past has been $5,317,000, while the largest material incentive has only been $95,000. This indicates that there can be a drastic imbalance between time incentive bonuses and material incentive bonuses. It is felt that one possible way to adjust the material incentive up, to equal that of the time incentive bonus (based on user delay costs) is to perform a long-term study on Superpave projects that have been constructed with poor material quality and to quantify how the reduced quality will monetary effect the life-cycle cost of those pavements. Unfortunately this proposal would have to be carried out in another research study since almost all of the Superpave projects in place in Kentucky today have yet to go through their first rehab cycle. Hence, it is somewhat premature to determine how to calculate the reduced pavement life costs associated with those pavements at this time.

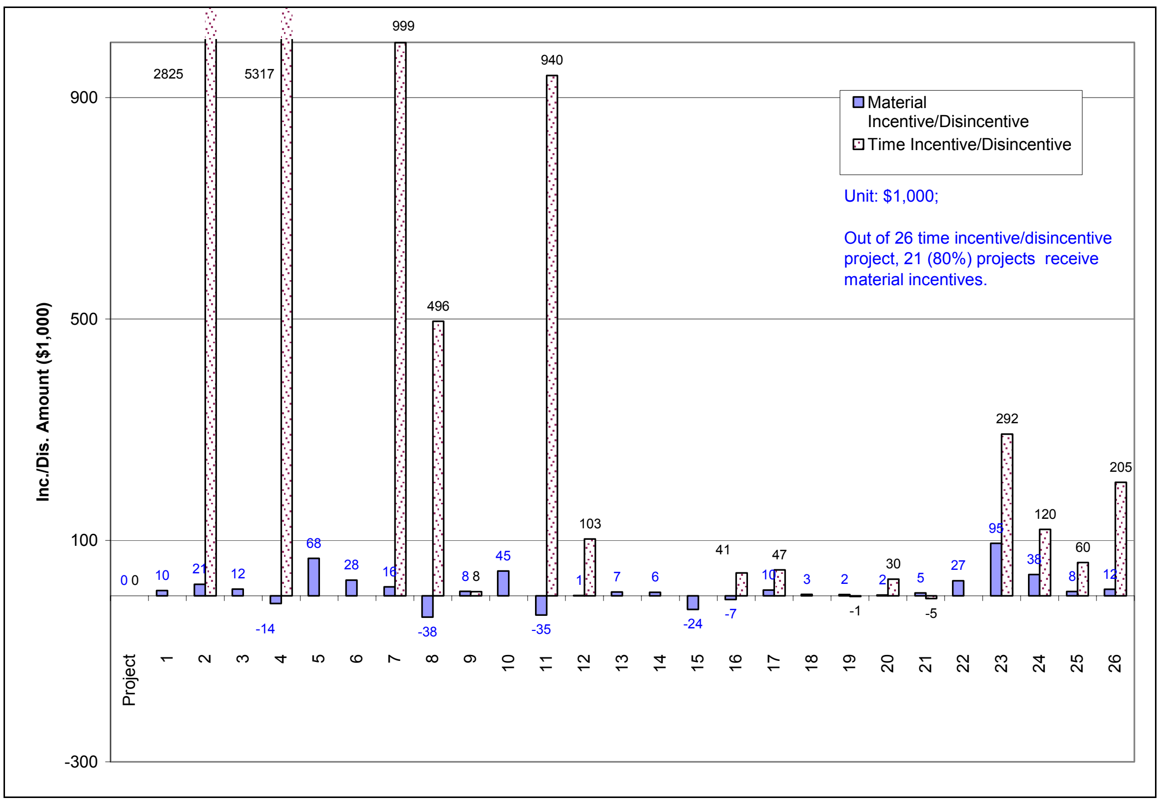

Figure 9: Comparison of Material and Time I/D's Paid-out/collected for Projects with Time I/D's

The material incentives/disincentives paid to the 25 non-time I/D projects may be viewed in Figure 10. Surprisingly, six out of the 25 projects reviewed in this study received a net material disincentive, five had a balanced incentive and disincentive, and fourteen projects received a material incentive. The percent of the non-time I/D projects receiving a material incentive was 56%. Therefore, it seems that one cannot conclude that the overall material quality on the time-incentive projects is worse than the non time-incentive projects. These findings are similar to the results documented in the report titled "Development of Criteria for Incentive/Disincentives in Highway Construction Contracts." Specifically stated, "None of the 39 states that were contacted felt that the quality of their projects had suffered from the use of time I/D's. On the contrary, the states concluded that if quality had been affected at all on these projects, it had been in a positive manner." [2]

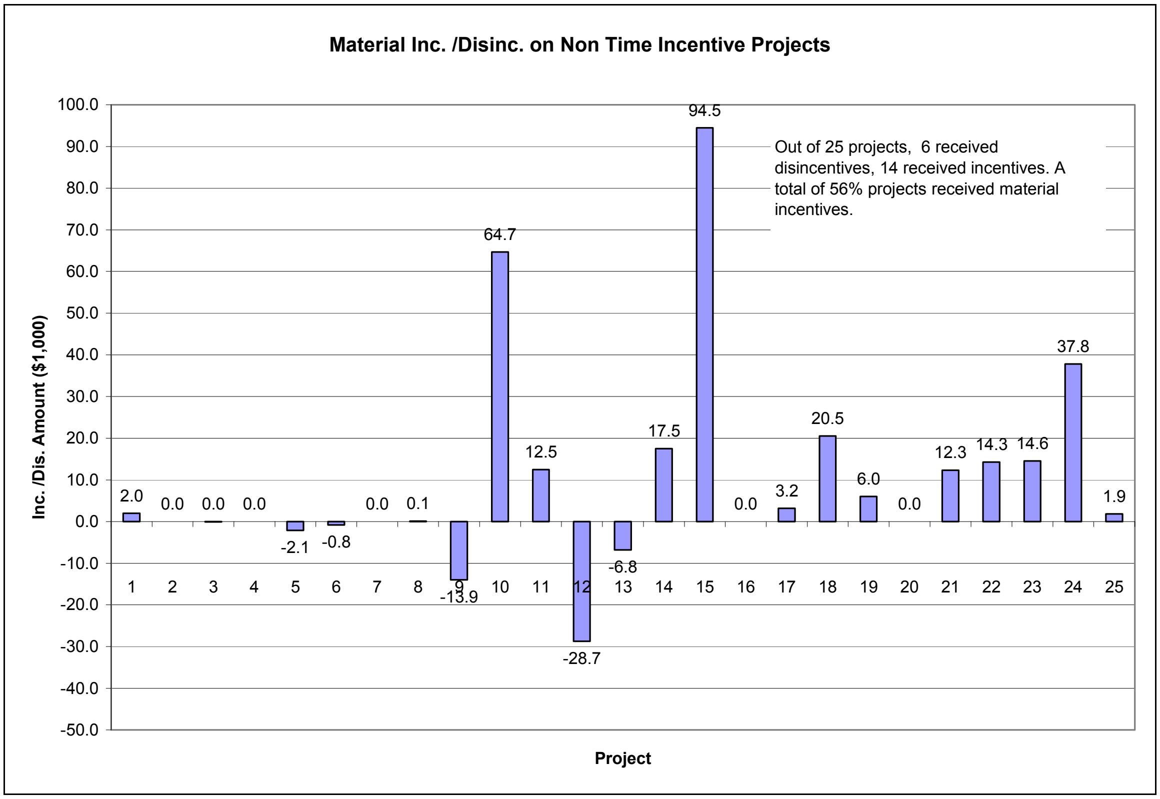

Figure 10: Comparison of Material I/D Paid-out/Collected for Projects without Time I/D Clauses

I.) Comparison of Initial Roughness for Sample Projects

Initial roughness (a.k.a. rideability) is another measure of a pavement's quality. Some researchers have indicated that the initial roughness can have an influence on a pavement's long term performance. Therefore, to better control initial roughness on newly paved highways in Kentucky, incentive and disincentives are paid based on a roughness measure. Unfortunately, initial roughness data was not available on all previously discussed projects. Only 20 of the time I/D and 15 of the non-time I/D projects were able to be evaluated (Appendix B). The initial roughness incentive/disincentive data were provided by the Pavement Management Branch of the Kentucky Transportation Cabinet. Figure 11 displays the histograms of the initial roughness incentives/disincentives (in percentage) paid on the two types of the projects. One can see that the overall distributions are quite similar for the two project types.

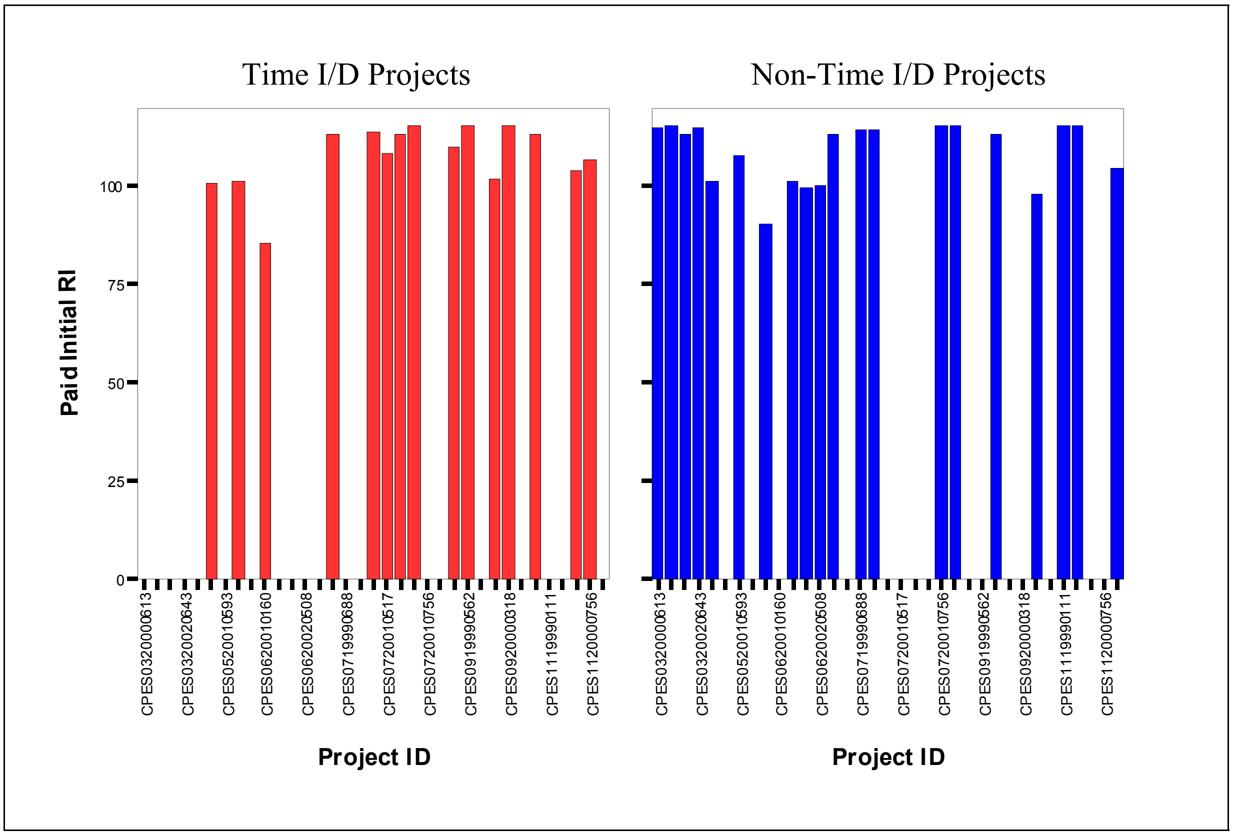

Figure 11: Incentives on the Initial Roughness between Time and Non-Time I/D Projects

Table 11 reports the average amount of paid incentives, in percentage form, for initial roughness, for both projects with and without time I/D clauses. As can be seen, there is not a substantial difference between the two categories of projects.

Table 11: Summary Statistics of Initial Roughness Incentives/Disincentives

	GROUP	No. of Observations	Average % of pay	Std. Deviation	Std. Error Mean
Paid Initial RI	Non Time Incentive Projects	15	107.4972	8.25299	2.13091
	Time Incentive Projects	20	108.5192	7.79370	1.74272

To further compare the two groups, statistical tests were conducted between the two project types (Table 12). As can be seen in Table 12, both the test for equality of variance and the equality of average values show no significant difference between the two groups. Therefore, this research concludes that the initial roughness on the time I/D projects is statistically equal to that on non-time I/D projects.

Table 12: Statistical Comparison of Initial Roughness between Time I/D and Non-time I/D Projects

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Degree of freedom	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Initial RI Adjustment	Equal variances assumed	.105	.748	-.374	33	.711	-1.0219	2.72971	-6.58	4.53
	Equal variances not assumed			-.371	29.324	.713	-1.0219	2.75279	-6.65	4.61

V. SUMMARY

This study was performed to evaluate the current incentive/disincentive procedures being used for highway construction in Kentucky. To properly analyze the entire program the study was broken into two respective components--time I/D's and material quality I/D's. After taking this in depth look at both components, the next step was to evaluate the incentive/disincentive program in its entirety based on both components to determine the necessity of balancing the time and material incentives/disincentives.

The results from the time I/D component of this study verified that the Transportation Cabinet has been following a technique supported by the FHWA for assigning time incentives/disincentives. Namely, the use of calculating road user costs to assign time incentives/disincentives as outlined in FHWA's report DP-115. During this study, this process was enhanced for Cabinet Officials use through the development of a computer program entitled Kentucky's User Costs Program (KyUCP). In addition to the KyUCP program, this study also offers the following guidelines for selecting when a time I/D should be used on a highway construction project. These guidelines, which include the following, certainly do not include the site-specific issues that may be encountered on a particular project:

1.) Projects with short durations.
2.) Projects that are considered special cases of great urgency.
3.) Projects with a clean set of plans, and with little chance of field changes.
4.) Projects that have high traffic volumes that are generally found in urban areas.
5.) Projects that will complete a gap in the highway system.
6.) Projects with major reconstruction or rehabilitation on an existing facility that will severely disrupt traffic.
7.) Projects that have major bridges that will be placed out of service due to rehabilitation.
8.) Projects that impose lengthy delays on the traveling public.
9.) Projects that create high motorist costs during construction or maintenance.
10.) Projects that impair emergency services to an area for an extended period of time.
11.) Projects that jeopardize the safety of the road users and/or the

contract workers.

12.) Projects that severely impact the traffic flow on a main road artery.

13.) Projects that produce detours on sub par road surfaces.

14.) Projects that impose severe monetary losses to adjacent commercial enterprises.

In the event that it is necessary to attach a time I/D clause to a highway construction project, it is also recommended that the following items be considered: that a 5% of construction costs cap be placed on the amount of time I/D being offered and/or other innovative bidding techniques such as A + B with or without the C component be used.

To evaluate the material and construction quality between projects with and without time I/D's a comparison analysis was performed on the material qualities used for contractor, incentive/disincentive pay found in the Kentucky Standard Specification for Road and Bridge Construction (2000). For the two groups, it was determined that there was no significant difference between the average deviations of asphalt content from the job mix formula, although the variation of AC for non time-incentive projects is slightly better controlled. Both groups were outstanding according to the Standard Specifications (2000). Less than 1.1% of the samples fall in the penalty range.

In regards to air voids, this analysis indicates that there was no statistical difference between projects with and without time I/D's. The same may be said VMA. However, preliminary results indicate that the densities from non-time incentive projects are slightly higher than those found on projects with time I/D's. The difference between the two groups is 0.1%.

When comparing the overall material quality between the two groups it was determined that 80% of the projects with time I/D's also received material incentives. The percent of the non-time I/D projects receiving a material incentive were 56%.

This research also analyzed the initial roughness of 20 projects with time I/D and 15 without time I/D. The analysis indicates that the initial roughness on the time I/D projects has been equal to that on non-time I/D projects.

VI. CONCLUSIONS AND RECOMMENDATIONS

It may be concluded that the Transportation Cabinet is currently using some of the best techniques available for assigning time I/D's on highway construction projects. Although time I/D bonuses have outweighed those of material bonuses for projects with time incentives/disincentives, the material quality has been relatively the same as that found on non-time I/D projects. Therefore, it appears that the quality of time I/D projects in Kentucky is not suffering because of the contractor pursuing a time incentive bonus instead of a material incentive bonus.

Appendix A:

Code	Time Inc./Dis	CPN	Project Description
CPES0320000613	Yes	IM-NH 65-1 (70) 26, FD52 114 0065 026-030	TENNESSEE STATE LINE-ELIZABETHTOWN ROAD (I-65). WIDEN I-65 TO SIX LANES FROM SOUTH OF THE BARREN RIVER BRIDGES TO 0.400 MILE SOUTH OF BRISTOW ROAD.
CPES0320000745	Yes	IM-NH 65-1 (71) 29,FD52 114 0065 028-042	WIDENING FROM 0.40 MILE NORTH OF BRISTOW ROAD TO 0.30 MILE SOUTH OF US 68/KY 80
CPES0320010794	Yes	IM-NH 65-2 (59) 36, FD52 114 0065 035-039	THE TENNESSEE STATE LINE-ELIZABETHTOWN ROAD (I-65) RECONSTRUCT AND WIDEN TO SIX LANES FROM 0.300 MILE SOUTH OF US 68/KY 80 INTERCHANGE (MP 35.60) EXTENDING NORTHERLY TO .30 MILE NORTH OF SMITHS GROVE-HAYS
CPES0320020643	Yes	IM-NH 65-2 (55) 40, FD52 114 0065 040-043, FD52 005 0065 042	THE TENNESSEE STATE LINE-ELIZABETHTOWN ROAD (I-65) RECONSTRUCT AND WIDEN TO SIX LANES FROM 0.300 MILE NORTH OF SMITHS GROVE ROAD (MP 40.520) TO KY 1339 (MP 43.979)
CPES0419990403	Yes	IM 65-2 (54) 58, FD52 050 0065 058-062	I-65 FROM MP 58.090 YO MP 61.200, GREEN RIVER
CPES0520000443	Yes	FE02 056 0065 131-137	NORTH-SOUTH EXPRESSWAY (I-65) BRIDGES LOCATED BETWEEN THE WATTERSON EXPRESSWAY AND I-64
CPES0520010593	Yes	CM-IM 64-2 (154) 8, FD52 056 0064 008-012	THE LOUISVILLE-LEXINGTON ROAD (I-64) FROM APPROXIMATELY 600 FEET WEST OF THE COCHRAN HILL TUNNELS EXTENDING EASTERLY PAVEMENT, TUNNEL, AND BRIDGE REHABILITATION, SIGNING, LIGHTING, AND TRIMARC
CPES0520020723	Yes	IM 264-1 (146) 0, FD52 056 0264 000-008	PAVEMENT REHAB FROM 0.152 MILE SOUTHEAST OF KY 3082 (MP 0.460) EXTENDI SOUTHEASTERLY TO 0.173 MILE WEST OF KY 1931 (MP 8.040) & US 31W FROM BEGINNING OF PCC PAVEMENT (MP 14.590) EXTENDING TO END OF PCC PAVEMENT
CPES0620000227	Yes	IM 275-9 (94) 5, FD52 008 0275 001-008, AND 059 0275 001-002	FROM I-75 EXTENDING WESTERLY TO 0.090 MILE WEST OF KY 112
CPES0620000736	Yes	IM-NH 75-7 (115) 165, FD52 041 0075 165-167	LEXINGTON-COVINGTON RD (I-75) FROM NORTH OF MOUNT ZION-CRITTENDEN RD TO SOUTH OF THE KY 491 INTERCHANGE (MP 165.87)
CPES0620010004	Yes	NH 71-3 (42) 57, FD52 039 0071 056-060	WIDEN INSIDE SHOULDER ON NORTHBOUND I-71 FROM KY 35 EXTENDING NORTHERLY
CPES0620010697	Yes	IMD-NH 75-7 (118) 160, FD52 041 0075 162-165	LEXINGTON-COVINGTON ROAD (I-75) 0.300 MILE NORTH OF KY 1994 TO NORTH OF MOUNT ZION-CRITTENDEN ROAD

Code	Time Inc./Dis	CPN	Project Description
CPES0620010754	Yes	IM-CM 275-9 (96) 7, FD52 008 0275 007-014	PAVEMENT REHABILITATION ON I-275 FROM WEST OF KY 237 (MP 7.150) OVER THE OHIO RIVER BRIDGE (MP 13.500)
CPES0620020293	Yes	NH STPR 75-7 (120) 155, FD52 041 0075 155-156	CONSTRUCT INTERCHANGE AT BARNES PIKE AND I-75
CPES0620020508	Yes	IM 75-7 (121) 179, FD52 008 0075 179-183	THE LEXINGTON-CINCINNATI ROAD (I-75) FROM SOUTH OF US 42 (MP 179.300) EXTENDING NORTHERLY TO JUST NORTH OF KY 1017 (MP 182.654)
CPES0620020592	Yes	IM 71-2 (68) 44, FD52 021 0071 043-054 FD52 039 0071 053-057	THE LOUISVILLE-CINCINNATI ROAD (KY 71) FROM 200 FEET SOUTH OF THE KENTUCKY RIVER BRIDGE (MP 43.910) EXTENDING NORTHERLY TO THE SOUTH END OF THE BRIDGE OVER KY 35 (MP 56.673)
CPES0719990688	Yes	IM-NH 75-3 (82) 84, FD52 076 0075 075-088	FROM SOUTH OF KY 876 TO DUNCANON ROAD
CPES0719990780	Yes	IM-NH 75-6 (87) 137, FD52 105 0075 138-143	WIDENING AND REHABILITATION OF I-75
CPES0720000702	Yes	IM NH 75-3 (83) 78, FD52 076 0075 078-083	TENNESSEE STATE LINE-LEXINGTON ROAD (I-75)
CPES0720010756	Yes	NH 64-5 (60), FD52 034 0064 086-089, FD52 025 0064 089-090	THE LEXINGTON-CATLESBURG ROAD (I-64) WIDEN TO SIX LANES FROM THE RECENT REHAB SECTION TO NEAR THE CLARK COUNTY LINE
CPES0720020294	Yes	IM-NH 75-3(86)71,FD52 102 0075 071-074,FD52 076 0075 073-075	WIDEN TO SIX LANES FROM 0.200 MILE NORTH OF THE JIM LAMBERT ROAD NORTH TO KY 21 NEAR BEREA
CPES0919990735	Yes	IM 64-6 (53) 117, FD52 006 0064 117-122	PAVEMENT REHABILITATION FROM MP 117.00 TO 121.50
CPES0920000329	Yes	FD04 103 0801 014-016	FARMERS-SHARKEY ROAD (KY 801) FROM I-64 NORTH TO THE INDUSTRIAL PARK
CPES1119990111	Yes	NH 75-2 (61) 38, FD52 063 0075 038-041	TENNESSEE STATE LINE-LEXUNGTON ROAD (I-75) WIDENING TO SIX LANES FROM KY 192 EXTENDING NORTHERLY TO KY 80 AT LONDON
CPES1120000276	Yes	NH 75-2 (68) 35, FD52 063 0075 034-038	WIDEN TO SIX LANES FROM NORTH OF NEW WEIGH STSTION TO KY 192
CPES1120020480	Yes	FD04 063 9006 003-009	THE DANIEL BOONE PARKWAY (PW 9006) FROM 400 FEET WEST OF KY 192 (MP 3.796) EXTENDING EASTERLY TO 0.161 MILE EAST OF KY 488 OVERPASS (MP 8.732)
CPES1220010355	No	FD GR01 0000064	

Code	Time Inc./Dis	CPN	Project Description
CPES1120000756	No	FD04 063 9006 000-004, FD04 063 0030 002-010	DANIEL BOONE PARKWAY (DB 9006) FROM US 25 (MP 0.0) EXTENDING TO KY 192 (MP 3.88) AND I-75 TO MOUNTAIN PARKWAY (KY30) RECONSTRUCTION FROM LONDON TO VIVA
CPES1120000319	No	IM 75-2 (71) 55, FD52 102 0075 055-066	FROM NORTH END OF SIX LANE RECONSTRUCTION (MP 55.744) TO PCC PAVEMENT NORTH OF MOUNT VERNON (MP 65.220)
CPES1020000420	No	FD04 097 9006 051-058	DANIEL BOONE PARKWAY (PW 9006) FROM THE LESLIE COUNTY LINE (MP 51.026) EXTENDING TO BRIDGE B-89, OVER KY 80, L AND N RAILROAD, AND THE NORTH FORK OF THE KENTUCKY RIVER (MP 57.166)
CPES0920010673	No	IM 64-7 (42) 138, FD52 103 0064 138-142	PAVEMENT REHABILITATION FROM 1.018 MILES EAST OF KY 32 (MP 138.300) EXTENDING EASTERLY TO (MP 141.50)
CPES0920010326	No	FE01 006 0064 123-129	THE LOUISVILLE-CATTLESBURG ROAD (I-64) FROM 0.347 MILE EAST OF ROSE RUN CULVERT (MP 123.562) EXTENDING EASTERLY TO BRIDGE OVER LICKING RIVER (MP 128.934)
CPES0920000318	No	IM 64-7 (39)160, FD52 022 0064 160-171	PAVEMENT REHABILITATION FROM TYGARTS CREEK EXTENDING EASTERLY TO MP 171.60 WEST OF KY 1
CPES0920000065	No	IM 64-6(54) 121, FD52 006 0064 121-124	LEXINGTON-CATLETTSBURG ROAD (I-64). PAVEMENT REHABILITATION FROM SLATE CREEK BRIDGE (MP 121.50) EXTENDING EASTERLY TO US 60 (MP 123.02)
CPES0919990562	No	IM 64-7 (36) 160, FD52 022 0064 160-167	FROM WEST END OF TAGARTS CREEK BRIDGE (MP 160.700) TO GREGORYVILLE- FULTZ ROAD OVERPASS (MP 166.217)
CPES0919990561	No	IM 64-8 (56) 190, FD52 010 0064 190-191	RECONSTRUCT US 23 INTERCHANGE AT I-64 NEAR CATLETTSBURG
CPES0819980856	No	IM-NH 75-2 (62) 50, FD52 102 0075 050-055	WIDENING FROM LAUREL COUNTY LINE TO KY 2791
CPES0720010594	No	NH 64-5 (57) 81, FDFD52 034 0064 081-086	THE LEXINGTON-CATLETTSBURG ROAD (I-64) WIDEN TO SIX LANES FROM I-75 TO END OF REHAB SECTION
CPES0720010592	No	IM 64-5 (55) 94, FD52 025 0064 094-102	PAVEMENT REHABILITATION ON THE EAST AND WEST BOUND LANES FROM 0.097 MILE EAST OF KY 1958 (MP 94.33) EXTENDING TO US 60 (MP 101.735) BRIDGE JACKING, GUARDRAIL, MILLING AND TEXTURING EDGE DRAIN ASPHALT SU
CPES0720010517	No	IM 75-5 (27) 122, FD52 105 0075 122-136	COVINGTON-LEXINGTON-TENNESSEE STATE LINE ROAD (I-75) FROM 1.100 MILES NORTH OF CAVE RUN BRIDGE (MP 122.250) EXTENDING NORTHERLY TO KY 620/LITTLE EAGLE CREEK OVERPASS (MP 135.111)

Code	Time Inc./Dis	CPN	Project Description
CPES0720010257	No	IM-NH 75-3(84)75, FD52 076 0075 075-088	LEXINGTON-TENNESSEE STATE LINE ROAD (I-75). RECONSTRUCT AND WIDEN FROM 1.020 MILES NORTH OF KY 595 TO KY 21 OVERPASS
CPES0719990404	No	IM 64-6 (52) 113,FD52 087 0064 112-116,FD52 006 0064 116-117	FROM MP 112.30 AT US 60 TO MP 117.00
CPES0620010160	No	STPR 127-1 (92), FD52 039 0035 000-003	THE SPARTA-WARSAW ROAD (KY 35) RECONSTRUCT FROM SPARTA TO I-71
CPES0619980269	No	IM STPR 75-7 (110) 168, FD52 008 0075 169-176	COVINGTON-LEXINGTON ROAD (I-75), WIDENING AND REHABILITATION FROM SOUTH OF KY 338 TO THE KENTON COUNTY LINE
CPES0520020504	No	FE01 056 0065 124-132	THE LOUISVILLE-NASHVILLE ROAD (I-65) FROM 0.802 MILE NORTH OF KY 1851 (MP 124.336) EXTENDING NORTHERLY TO 0.044 MILE SOUTH OF PHILLIPS LANE BRIDGE (MP 131.245)
CPES0520010535	No	IM 71-1 (85) 28, FD52 0071 028-031	LOUISVILLE-COVINGTON ROAD (I-71) FROM SOUTH END OF LITTLE KENTUCKY RIVER BRIDGE (MP 28.173) EXTENDING NORTHERLY TO KY 157 UNDERPASS (MP 30.980)
CPES0520010223	No	FD05 056 0064 013-019	LOUISVILLE-LEXINGTON-CATLETTSBURG ROAD (I-64) FROM I-264 (MP 13.000) EXTENDING EASTERLY TO I-265 (MP 19.000)
CPES0420010158	No	IM 65-4 (32) 90, FD52 047 0065 090-098	THE BOWLING GREEN LOUISVILLE ROAD (I-65) FROM 1.124 MILES NORTH OF ENTRANCE TO NORTH BOUND WEIGH STATION (MP 90.580) EXTENDING NORTHERLY TO BEGINNING OF PCC PAVEMENT (MP 97.540)
CPES0420000629	No	FD39 047 0065 095-104	LOUISVILLE-TENNESSEE LINE ROAD (I-65) FRO 0.945 MILE NORTH OF US 62 (MP 95.054) EXTENDING TO THE BULLITT COUNTY LINE (MP 103.308)
CPES0320020406	No	FE01 107 0065 001-003	THE LOUISVILLE-NASHVILLE ROAD (I-65) SOUTHBOUND OFF RAMP AND NORTHBOUN ON RAMP AT EXIT TWO (MP 2.00)
CPES0320010474	No	CB GR01 0000064	

Appendix B

Project Code	Time Incentive (1: y; 0: n)	Initial RI Inc./Dis.	Code Description	Project Description
CPES0320000613	1	114.479	IM-NH 65-1 (70) 26, FD52 114 0065 026-030	TENNESSEE STATE LINE-ELIZABETHTOWN ROAD (I-65). WIDEN I-65 TO SIXLANES FROM SOUTH OF THE BARREN RIVER BRIDGES TO 0.400 MILE SOUTH OF BRISTOW ROAD.
CPES0320000745	1	115	IM-NH 65-1 (71) 29,FD52 114 0065 028-042	WIDENING FROM 0.40 MILE NORTH OF BRISTOW ROAD TO 0.30 MILE SOUTH OFUS 68/KY 80
CPES0320010794	1	112.777	IM-NH 65-2 (59) 36, FD52 114 0065 035-039	THE TENNESSEE STATE LINE-ELIZABETHTOWN ROAD (I-65) RECONSTRUCT AND WIDEN TO SIX LANES FROM 0.300 MILE SOUTH OF US 68/KY 80 INTERCHANGE (MP 35.60) EXTENDING NORTHERLY TO .30 MILE NORTH OF SMITHS GROVE-HAYS
CPES0320020643	1	114.537	IM-NH 65-2 (55) 40, FD52 114 0065 040-043, FD52 005 0065 042	THE TENNESSEE STATE LINE-ELIZABETHTOWN ROAD (I-65) RECONSTRUCT AND WIDEN TO SIX LANES FROM 0.300 MILE NORTH OF SMITHS GROVE ROAD (MP 40.520) TO KY 1339 (MP 43.979)
CPES0419990403	1	100.833	IM 65-2 (54) 58, FD52 050 0065 058-062	I-65 FROM MP 58.090 YO MP 61.200, GREEN RIVER
CPES0420010158	0	100.362	IM 65-4 (32) 90, FD52 047 0065 090-098	THE BOWLING GREEN LOUISVILLE ROAD (I-65) FROM 1.124 MILES NORTH OF ENTRANCE TO NORTH BOUND WEIGH STATION (MP 90.580) EXTENDING NORTHERLY TO BEGINNING OF PCC PAVEMENT (MP 97.540)
CPES0520010593	1	107.656	CM-IM 64-2 (154) 8, FD52 056 0064 008-012	THE LOUISVILLE-LEXINGTON ROAD (I-64) FROM APPROXIMATELY 600 FEET WEST OF THE COCHRAN HILL TUNNELS EXTENDING EASTERLY PAVEMENT, TUNNEL, AND BRIDGE REHABILITATION, SIGNING, LIGHTING, AND TRIMARC
CPES0619980269	0	100.716	IM STPR 75-7 (110) 168, FD52 008 0075 169-176	COVINGTON-LEXINGTON ROAD (I-75), WIDENING AND REHABILITATION FROM SOUTH OF KY 338 TO THE KENTON COUNTY LINE
CPES0620010004	1	90	NH 71-3 (42) 57, FD52 039 0071 056-060	WIDEN INSIDE SHOULDER ON NORTHBOUND I-71 FROM KY 35 EXTENDING NORTHERLY

Project Code	Time Incentive (1: y; 0: n)	Initial RI Inc./Dis.	Code Description	Project Description
CPES0620010160	0	85	STPR 127-1 (92), FD52 039 0035 000-003	THE SPARTA-WARSAW ROAD (KY 35) RECONSTRUCT FROM SPARTA TO I-71
CPES0620010697	1	100.833	IMD-NH 75-7 (118) 160, FD52 041 0075 162-165	LEXINGTON-COVINGTON ROAD (I-75) 0.300 MILE NORTH OF KY 1994 TO NORTH OF MOUNT ZION-CRITTENDEN ROAD
CPES0620010754	1	99.444	IM-CM 275-9 (96) 7, FD52 008 0275 007-014	PAVEMENT REHABILITATION ON I-275 FROM WEST OF KY 237 (MP 7.150) OVER THE OHIO RIVER BRIDGE (MP 13.500)
CPES0620020508	1	99.632	IM 75-7 (121) 179, FD52 008 0075 179-183	THE LEXINGTON-CINCINNATI ROAD (I-75) FROM SOUTH OF US 42 (MP 179.300) EXTENDING NORTHERLY TO JUST NORTH OF KY 1017 (MP 182.654)
CPES0620020592	1	112.843	IM 71-2 (68) 44, FD52 021 0071 043-054 FD52 039 0071 053-057	THE LOUISVILLE-CINCINNATI ROAD (KY 71) FROM 200 FEET SOUTH OF THE KENTUCKY RIVER BRIDGE (MP 43.910) EXTENDING NORTHERLY TO THE SOUTH END OF THE BRIDGE OVER KY 35 (MP 56.673)
CPES0719990404	0	113.091	IM 64-6 (52) 113,FD52 087 0064 112-116,FD52 006 0064 116-117	FROM MP 112.30 AT US 60 TO MP 117.00
CPES0719990688	1	113.999	IM-NH 75-3 (82) 84, FD52 076 0075 075-088	FROM SOUTH OF KY 876 TO DUNCANON ROAD
CPES0720000702	1	113.785	IM NH 75-3 (83) 78, FD52 076 0075 078-083	TENNESSEE STATE LINE-LEXINGTON ROAD (I-75)
CPES0720010257	0	113.328	IM-NH 75-3(84)75, FD52 076 0075 075-088	LEXINGTON-TENNESSEE STATE LINE ROAD (I-75). RECONSTRUCT AND WIDEN FROM 1.020 MILES NORTH OF KY 595 TO KY 21 OVERPASS
CPES0720010517	0	107.917	IM 75-5 (27) 122, FD52 105 0075 122-136	COVINGTON-LEXINGTON-TENNESSEE STATE LINE ROAD (I-75) FROM 1.100 MILES NORTH OF CAVE RUN BRIDGE (MP 122.250) EXTENDING NORTHERLY TO KY 620/ LITTLE EAGLE CREEK OVERPASS (MP 135.111)

Project Code	Time Incentive (1: y; 0: n)	Initial RI Inc./Dis.	Code Description	Project Description
CPES0720010592	0	112.842	IM 64-5 (55) 94, FD52 025 0064 094-102	PAVEMENT REHABILITATION ON THE EAST AND WEST BOUND LANES FROM 0.097MILE EAST OF KY 1958 (MP 94.33) EXTENDING TO US 60 (MP 101.735) BRIDGE JACKING, GUARDRAIL, MILLING AND TEXTURING EDGE DRAIN ASPHALT SU
CPES0720010594	0	115	NH 64-5 (57) 81, FDFD52 034 0064 081-086	THE LEXINGTON-CATLETTSBURG ROAD (I-64) WIDEN TO SIX LANES FROM I-75 TO END OF REHAB SECTION
CPES0720010756	1	115	NH 64-5 (60), FD52 034 0064 086-089, FD52 025 0064 089-090	THE LEXINGTON-CATLESBURG ROAD (I-64) WIDEN TO SIX LANES FROM THE RECENT REHAB SECTION TO NEAR THE CLARK COUNTY LINE
CPES0720020294	1	115	IM-NH 75-3(86)71,FD52 102 0075 071-074,FD52 076 0075 073-075	WIDEN TO SIX LANES FROM 0.200 MILE NORTH OF THE JIM LAMBERT ROAD NORTH TO KY 21 NEAR BEREA
CPES0819980856	0	109.791	IM-NH 75-2 (62) 50, FD52 102 0075 050-055	WIDENING FROM LAUREL COUNTY LINE TO KY 2791
CPES0919990562	0	115	IM 64-7 (36) 160, FD52 022 0064 160-167	FROM WEST END OF TAGARTS CREEK BRIDGE (MP 160.700) TO GREGORYVILLE-FULTZ ROAD OVERPASS (MP 166.217)
CPES0919990735	1	112.84	IM 64-6 (53) 117, FD52 006 0064 117-122	PAVEMENT REHABILITATION FROM MP 117.00 TO 121.50
CPES0920000065	0	101.25	IM 64-6(54) 121, FD52 006 0064 121-124	LEXINGTON-CATLETTSBURG ROAD (I-64). PAVEMENT REHABILITATION FROM SLATE CREEK BRIDGE (MP 121.50) EXTENDING EASTERLY TO US 60 (MP 123.02)
CPES0920000318	0	115	IM 64-7 (39)160, FD52 022 0064 160-171	PAVEMENT REHABILITATION FROM TYGARTS CREEK EXTENDING EASTERLY TO MP 171.60 WEST OF KY 1
CPES0920000329	1	97.5	FD04 103 0801 014-016	FARMERS-SHARKEY ROAD (KY 801) FROM I-64 NORTH TO THE INDUSTRIAL PARK

Project Code	Time Incentive (1: y; 0: n)	Initial RI Inc./Dis.	Code Description	Project Description
CPES0920010673	0	112.891	IM 64-7 (42) 138, FD52 103 0064 138-142	PAVEMENT REHABILITATION FROM 1.018 MILES EAST OF KY 32 (MP 138.300) EXTENDING EASTERLY TO (MP 141.50)
CPES1119990111	1	114.813	NH 75-2 (61) 38, FD52 063 0075 038-041	TENNESSEE STATE LINE-LEXUNGTON ROAD (I-75) WIDENING TO SIX LANES FROM KY 192 EXTENDING NORTHERLY TO KY 80 AT LONDON
CPES1120000276	1	115	NH 75-2 (68) 35, FD52 063 0075 034-038	WIDEN TO SIX LANES FROM NORTH OF NEW WEIGH STSTION TO KY 192
CPES1120000319	0	103.891	IM 75-2 (71) 55, FD52 102 0075 055-066	FROM NORTH END OF SIX LANE RECONSTRUCTION (MP 55.744) TO PCC PAVEMENT NORTH OF MOUNT VERNON (MP 65.220)
CPES1120000756	0	106.379	FD04 063 9006 000-004, FD04 063 0030 002-010	DANIEL BOONE PARKWAY (DB 9006) FROM US 25 (MP 0.0) EXTENDING TO KY 192 (MP 3.88) AND I-75 TO MOUNTAIN PARKWAY (KY30) RECONSTRUCTION FROM LONDON TO VIVA
CPES1120020480	1	104.412	FD04 063 9006 003-009	THE DANIEL BOONE PARKWAY (PW 9006) FROM 400 FEET WEST OF KY 192 (MP 3.796) EXTENDING EASTERLY TO 0.161 MILE EAST OF KY 488 OVERPASS (MP 8.732)

Appendix C

LETTING	FD#	TERMS OF CONTRACT	I/D terms	DISINCENTIVES	LANE RENTAL	PAID I/D	COLLECTED I/D
12/20/2002	FD52 056 0264 000-008, FD04 056 031W 014-015	Fixed completion date, A+B bidding	$25,000/day	$25,000/day $50,000/day	$1000-$5000/hour		
10/25/2002	FD52 041 0075 156-161	Fixed completion date			$300-$1000/hour		
10/25/2002	FD52 063 0075 050, FD52 102 0075 050-052	Fixed completion date			$1000-$2000/hour		
9/27/2002	FD52 114 0065 040-043, FD52 005 0065 042-044, FD52 031 0065 043-044	Fixed completion date	$10,000/day	$10,000/day	$300-$500/hour		
8/23/2002	FD52 021 0071 043-054	Lane Closure, Base failure or excavation		Contract Liquidated Damages	Contract Liquidated Damages		
7/26/2002	FD52 008 0075 179-183	Lane Closure		Contract Liquidated Damages	$1000/hr		
6/28/2002	FD04 063 9006 003-009	Lane Closure	$500/hr	$500/hr		$205,000	
5/31/2002	FD52 041 0075 155-156	Fixed Completion date			$300-$1000/hour		
5/31/2002	FD52 102 0075 071-074, FD52 076 0075 073-075	Fixed Completion date			$1300-$4000/hour		
12/14/2001	FD52 114 0065 035-039	Fixed Completion date, A-C bidding	$10,000/day	$10,000/day	$300-$500/hour	$11,500	$4,000
11/16/2001	FD52 034 0064 086-089, FD52 025 0064 089-090	Fixed Completion date			$500-$1000/hour		
11/16/2001	FD52 008 0275 007-014	Lane Closure		$5000/day	$3000/hour		
9/28/2001	FD52 041 0075 162-165	Working Days	$15,000/day		$5000/hour	$45,000	$3,700
7/27/2001	FD52 056 0064 008-012	Fixed completion date, A+B bidding	$4500/hour	$4500/hour $100,000/day	$15,000/hour	$5,316,750	
7/27/2001	FD52 034 0064 081-086	Fixed Completion date	$10,000/day	$10,000/day	$500-$1000/hour	$430,000	
6/29/2001	FE02 073 0045 B00001N	Bridge Closure	$10,000/day	$1000/hour		$27,500	
3/30/2001	FD04 039 0035 002-003	Fixed Completion date	$5,000 LS	$500/day		$5,000	
1/19/2001	FD52 039 0071 056-060	Fixed Completion Date		$5000/day	$50,000 LS		
12/15/2000	FD52 114 0065 028-042	Fixed Completion Date	$10,000/day	$10,000/day	$300-$500/hour	$500,000	$3,800
11/17/2000	FD52 041 0075 165-167	Fixed Completion Date	$6000/day	$6000/day	$300-$1000/hour	$50,000	$3,200
10/27/2000	FD52 076 0075 078-083	Fixed Completion Date	$10,000/day	$10,000/day	$1300-$4000/hour		$5,000
9/29/2000	FD52 114 0065 026-030	Fixed Completion Date	$10,000/day	$10,000/day	$300-$500/hour	$1,000,000	$800
8/25/2000	FD52 041 0075143-155	Lane Closure, Base failure or excavation		Contract Liquidated Damages	Contract Liquidated Damages		
6/30/2000	FE02 056 0065 131-137	Lane Closure	$5,000/day	$5,000/day		$102,500	
5/26/2000	FD04 103 0801 014-016	Fixed Completion Date	$2500/day	$2500/day		$60,000	
4/28/2000	FD52 063 0075 034-038	Fixed Completion Date	$5,000/day	$5,000/day		$120,000	
3/31/2000	FD52 008 0275 001-008, FD52 059 0275 001-002	Fixed Completion Date, A+B-C bidding	$25,000/day	$25,000/day		$2,825,345	
2/25/2000	FD04 056 7163	Lane Closure	$15,000/day	$15,000/day	$1300-$4000/hour	$112,350	
12/17/1999	FD52 105 0075 138-143	Fixed Completion Date	$300,000 LS	$5,000 day		$300,000	
10/22/1999	FD52 006 0064 117-122	Fixed Completion Date	$4,000/day	$4,000/day	$1300-$4000/hour		$1,000
9/24/1999	**FD52 076 0075 075-088**	**Fixed Completion Date**	**$10,000/day**	**$10,000/day**		**$292,300**	

12/2/1999	FD52 063 0075 038-041	Fixed Completion Date

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