Hot-Mix Asphalt Sampling Techniques and Methods of Acceptance – State DOT’s Practice

Duplication for publication or sale is strictly prohibited without prior written permission of the Transportation Research Board

Title: Hot-Mix Asphalt Sampling Techniques and Methods of Acceptance – State DOT’s Practice

Authors: Mostafa A. Elseifi, James Trepanier, Hal Wakefield, William J. Pine, and Abdul Dahhan

Transportation Research Board
88th Annual Meeting
January 11-15, 2009
Washington, D.C.
Hot-Mix Asphalt Sampling Techniques and Methods of Acceptance – State DOT’s Practice

Mostafa A. Elseifi  
Assistant Professor  
Department of Civil and Environmental Engineering  
Louisiana State University  
3506 Patrick Taylor Hall, Baton Rouge, LA 70803  
e-mail: elseifi@lsu.edu

James Trepanier  
HMA Operations Engineer  
Bureau of Materials and Physical Research  
Illinois Department of Transportation  
Springfield, IL  
email: James.Trepanier@illinois.gov

Hal Wakefield  
Infrastructure Team Leader  
Federal Highway Administration, Illinois Division  
Springfield, IL  
email: Hal.Wakefield@fhwa.dot.gov

William J. Pine  
Research Engineer  
Heritage Research Group  
Indianapolis, IN  
email: bill.pine@heritage-enviro.com

Abdul Dahhan  
Mixture Control Engineer  
IDOT Region One  
Schaumburg, IL  
email: abdul.dahhan@illinois.gov
ABSTRACT

Hot-mix asphalt (HMA) sampling is a critical step in quality control and quality assurance (QC/QA) programs to ensure that the tested material is representative of the installed product. Samples of HMA in Illinois are currently taken from a truck at the plant. This sampling method allows for a quick turnaround time since the QC laboratory is usually located at the plant. However, it may be difficult to obtain a representative sample since most of the sample is taken from the top of the pile and on the side closest to the sampling platform. In addition, this sampling method does not account for any additional asphalt absorption taking place during transportation and placement. The concept of moving the sample location to the job site offers the potential to address the weaknesses cited above. However, there are a number of different approaches, each with advantages and disadvantages. The objective of this study was to produce a review of successful methods and practices currently used to sample HMA during production and installation. This included visiting other states and collecting sufficient data to draw a final recommendation for the optimum technique to be adopted for HMA sampling in Illinois. The conclusion of the field visits is that sampling behind the paver is being successfully conducted by many states without difficulty. Based on the site visits conducted in this study, the roadway sampling procedure adopted by Michigan DOT was recommended for possible implementation in Illinois. In addition to this sampling technique, sealed bags adopted by Iowa DOT may be used, if necessary, to safely transport samples from the field to the laboratory.

Keywords: HMA sampling, quality assurance, quality control, HMA acceptance.

Word Counts: 5310 + 8 Figures = 7310
INTRODUCTION

Adequate QC/QA practices are the key to obtain a satisfactory product and to ensure that the installed HMA is what the designer specified. Years of experience also support that deviation from either material or construction specifications often lead to premature pavement failure (1). Although significant attention has been devoted to the development and improvement of QC/QA specifications, the collection and sampling process of the installed product has not been given the same consideration. Moreover, even though the testing can be conducted according to specifications, sampling is equally important to ensure that the tested material is representative of the installed product. In recent years, various techniques have been suggested to properly collect HMA samples. This includes samples taken either at the plant from a loaded truck, or on the roadway behind the paver. However, because segregation and contamination of the collected samples can easily occur, a strict and clear protocol needs to be established to ensure success of the sampling process. In addition, to develop effective specifications for HMA sampling, baseline data need to be established and documented based on the experience of practitioners in the field and states.

Differences in practice exist among state highway agencies on methods of HMA sampling and acceptance. With the downsizing that occurred within many DOTs in the early 1990s, the majority of state agencies have transferred the responsibility of HMA quality control to the contractors. While federal guidelines have allowed states to use results of the QC test program conducted by the contractors as part of the acceptance process, DOTs are required to verify the quality of the installed product. Several different statistical quality measures are used to determine the quality of the installed HMA; however, some of these parameters are not statistically robust.

In order to clarify the proper use of contractor test results in the acceptance of installed HMA, the Federal Highway Administration (FHWA) published the Technical Advisory T6120.3 in 2004 (2). Under this technical advisory, federal regulation requires the use of independent samples for verification in the acceptance program. Such verification sampling and testing should be conducted by state personnel or their representative. In addition, to ensure that the contractor test results come from the same population as the state results, a statistical comparison process known as the F&t test is recommended. After validation, the material can then be accepted based on either the combined test results or the contractor QC test results. State DOTs are expected to comply with this technical advisory as it interprets acceptable procedures under 23CFR637 “Quality Assurance Procedures for Construction.”

With the publication of the technical advisory and concerns about QC/QA programs, many states are currently revisiting and modifying their existing HMA QC/QA programs. The objective of this paper is to present a detailed review of successful methods and practices currently used to sample HMA during production and installation and popular procedures of HMA acceptance. These baseline data are currently used by the Illinois Department of Transportation to improve HMA sampling practices in the state. To achieve this objective, a survey of current DOTs practices with respect to adopted HMA sampling techniques was conducted. Based on the results of the survey, sampling practices in five highway agencies were evaluated through field visits (Kansas, Iowa, Ohio, Michigan, and Ministry of Transportation of Ontario). Three of these agencies specify roadway sampling, while one agency is experimenting with a new generation of mechanical sampling device and another agency samples directly from
a Material Transfer Device (MTD). The availability of this information will benefit state highway agencies and contractors by providing a review of state of practices in HMA sampling and methods of acceptance.

**BACKGROUND**

**HMA Sampling Techniques**

Two major factors usually control the success of HMA sampling operations: the acquiring method and the selection of the sample location. The following sections present an overview of some of the most common techniques used to achieve successful sampling operations. Samples of HMA are normally obtained either from a loaded truck, at the plant, or in the roadway behind the paver. The non regulatory supplement to 23CFR637, FHWA recommends obtaining a sample as close to incorporation in the work as possible. In the case of HMA, this means that roadway sampling should be used for acceptance if possible. However, it does not prohibit the use of truck sampling or sampling at the plant for quality control purposes (3).

Regardless of the adopted acquiring method, collected samples should be representative of the installed mixture in order to assess the actual variability of the construction process. If the obtained sample is not an accurate representation of the installed mixture (e.g., segregated sample), invalid results and decisions may be made with respect to mix adjustments. To ensure that the collected samples provide an accurate representation of the mixture being installed, a random method of sampling HMA is normally used in accordance with ASTM D3665 (Standard Practice for Random Sampling of Construction Materials, 4). This procedure ensures that intentional or unintentional bias on the part of the person taking the sample is eliminated. This specification has been adopted by many state agencies such as the Utah DOT, South Carolina DOT (SC-T-101), and Michigan DOT, and was reported successful in reducing bias and large ambiguous variability in HMA testing.

**Roadway Sampling**

As previously noted, samples acquired after placement of HMA are recommended by FHWA in order to account for variability introduced by the paving equipment. On the other hand, contractors usually prefer to avoid this sampling procedure because it disrupts the final surface of the installed pavement and may penalize them during smoothness testing. Another concern raised by practitioners is whether fines can be retrieved from milled surfaces when certain roadway sampling procedures are used.

There are generally three methods to acquire sample after paving. The Ring and Plate method uses a metal plate placed in front of the paver prior to HMA placement. After the laydown of the material and before compaction, a circular template is pushed into the mat until it comes in contact with the metal plate. The ring, plate, and HMA sample are then pulled out from the pavement surface (5). The Shovel and Plate sampling method is similar to the ring and plate procedure with the exception that it uses a specially designed square-pointed shovel instead of the ring to create a sample area with vertical faces. A wire is used to position the plate perimeter but the paver may shift the plate such that there are HMA materials under it. In this case, the sampling process should be repeated. The third sampling method behind the paver uses only a shovel to acquire the HMA materials. The main disadvantage of this technique is that fines may be lost to the underlying texture if it is used in a milled surface. The hole caused by
the sampling process must be always filled with loose HMA. Care should also be taken to avoid disruption of the pavement mat and contamination of the sample with underlying materials.

Previous research has shown that the ring and plate method provides similar accuracy to the shovel and plate method (5). On the other hand, variability of the shovel method is usually greater than the other two methods indicating that this sampling technique is usually less consistent than the ring and plate or the shovel and plate methods. One disadvantage of the ring and plate method is that it is time-consuming and difficult to conduct without appropriate training. However, sufficient field data are needed to back the selection of one procedure over another.

**Truck Sampling**

Truck sampling is usually conducted by first removing approximately one foot of material from the outside of the mass. Using a square shovel, one-third of the sample size is obtained from the quarter points around the circumference of each pile in the bed of the truck. Each sample should be obtained in three increments, which should be taken from more than one truckload. Some states simplify this procedure by allowing the sample to be obtained in a single increment. However, this may result in creating a significant source of errors in the extracted sample by segregating the material while sampling. Coarse aggregates coated with asphalt binder tend to roll down the side of the pile of HMA mixture and accumulate next to the sides and the ends of the truck bed. If a sample is segregated, coarse mixture may indicate low asphalt binder content during testing due to the low surface area (6). A suitable sampling platform shall be also provided on which the inspector is able to stand and sample the material in the truck bed adequately and safely. This sampling method allows for a quick turnaround time since the QC laboratory is usually located at the plant. It is also inexpensive since it only requires a shovel, bucket, and sampling platform. However, it may be difficult to obtain a representative sample since, in actual practice; most of the material is typically taken from the top of the pile and on the side closest to the sampling platform (7). In addition, this sampling method does not account for additional asphalt absorption taking place during transportation and placement.

**FHWA Technical Advisory T6120.3**

In 2004, FHWA published a technical advisory to provide regulation and recommendations on the proper method for the use and verification of contractor’s QC test results for acceptance and payment adjustment of produced HMA mixtures and identification of the contractor and department risks (2). Through this technical advisory, state departments are allowed to use QC test results in the acceptance of the installed HMA under the condition that these results are validated by the state verification test results. Sampling and testing of results used in the validation process should be obtained by state personnel and cannot be split samples. The validation process compares statistically the QA test results to the QC test results in order to ensure that both data sets come from the same population. The validation process is not required if the state department conducts all the testing and does not allow to use the contractor’s test results in the acceptance process of the installed HMA.

The FHWA technical advisory recommends using the F&t statistical procedure to compare both the variance and the means of the two data sets. The F-test compares the variances of the two data sets. The objective of this test is to determine whether the differences in the variability of the contractor’s tests and the department tests are greater than what might be expected if they came from the same population. On the other hand, the t-test compares the
means of the two data sets to assess whether they are statistically different. The t-test can be used to compare equal or unequal number of contractor vs. state sample sizes. Upon completion of the validation process, the installed HMA can be accepted based on either the combined QA and QC test results, the combined QC test results excluding the data of the split sample and the QA split test results, or only the contractor QC test results.

Some sources of concerns in the FHWA suggested procedure relates to the timeliness of the acceptance process. It was reported that the verification process would take an average of 12 days including transportation of the samples from the field to the laboratory (8). In addition, if large discrepancies arise between QA and QC test results, the process may end up in claims situation. FHWA has identified the QC/QA programs of the states of Kansas and Georgia as examples of reasonable implementation of the federal requirements (9). In Kansas, an F&t test statistical procedure was implemented.

SURVEY OF DOT’S PRACTICES

A simple questionnaire was developed to assess DOTs practices with respect to the used HMA sampling techniques and to determine current DOTs practices with respect to the adopted process for asphalt mixtures acceptance. The overall response rate to the questionnaire was 70%. In total, 37 responses were received including 34 states, the Porto Rico Highway and Transportation Authority, the Ministry of Transportation of Ontario, and FHWA Western Federal Lands.

Survey Results

HMA Sampling Techniques

Figures 1(a and b) present the sampling techniques specified by highway agencies for QC and QA activities. It is noted that in total, 55 responses were received since many agencies allow for multiple sampling techniques in their specifications.
As shown in these figures, the majority of highway agencies are using truck sampling (27 and 23 responses for QC and QA, respectively). Only two states are allowing the use of the mechanical sampling device. Among the different roadway sampling techniques, the shovel and plate is the most popular. As previously mentioned, this method is relatively straight-forward and provides better repeatability than the shovel method. It appears also that the ring and plate method is only used in the Midwest and Western regions of the U.S. On the other hand, truck sampling is widely used in the Eastern regions of the U.S. No major difference was noticed between DOTs practices for QC and QA applications, although roadway sampling seems to be slightly favored for QA sampling.

In the “others” category, one agency stated that the contractor mainly relies on the results of the QA program and another agency stated that the contractor is responsible for QC sampling without supervision from the state. In the “others” category, two agencies specify sampling directly from the paver hopper. An innovative approach that is currently used by the Ministry of Transportation of Ontario consists of directly sampling from the MTD conveyor into a sampling hopper mounted in a pick-up truck, and then reducing the diverted material to an appropriate size using splitting equipment. This sampling technique is further described in the following sections of this paper.

Random Sampling of HMA

The majority of the states specify that random sampling of HMA must be used to select the location of the collected sample. This is particularly true for QA applications but is less predominant for QC applications (Figure 2). If the selection process varies for QC and QA applications, statistically proving that both data sets come from the same population may be challenging. Random selection of HMA samples is usually based on an in-house random sampling procedure developed by the agency. Despite the similarity between the state-developed methods and ASTM D3665, only 28% of the respondents are actually using this procedure as is. Most of the state-developed methods are acceptable, but some may not be. For instance, one state allows the project engineer to decide on the selection of a ‘random’ sample.
To be entirely unbiased, the element to be sampled must be chosen in advance and cannot be selected while the mixture is being sampled.

![Random Sampling of HMA (Quality Control)](image)

![Random Sampling of HMA (Quality Assurance)](image)

**Figure 2.** Use of random selection by different states for (a) QC and (b) QA

*Sampling Frequency*

Sampling frequency varies greatly among the different states; Figure 3. For QC, the majority of the respondents (80%) specify one sample per 500 to 1100 tons of HMA. The lowest reported sampling frequency for quality control is one sample per 1500 tons. For QA, the sampling frequency is much lower. Fifty-six percent of the respondents specify one sample per 500 to 1100 tons of HMA. In QA applications, the lowest reported sampling frequency is one sample per 10,000 tons of HMA. Some states specify the sampling frequency for QA applications as a percentage of the sampling frequency for QC applications. A rate of 5% to 10% of the QC sampling frequency was reported. On the other hand, some states specify the sampling frequency in samples per week with a reported rate of two to four samples per week.
Method of HMA Acceptance

About 43% of the respondents make use of the contractor’s test results for acceptance and for payment adjustments after verification using results of the QA program; Figure 4. However, only the state of Kansas reported using the F&t test procedure as recommended by FHWA. About 41% of the respondents do not use the contractor’s test results in the acceptance decision and rely solely on the QA test results. Sixteen percent of the respondents depend solely on the contractor’s test results without verification for HMA acceptance, which would not comply with the FHWA Technical Advisory. As it was indicated during our field trips, some states are currently in the process of revising their QC/QA programs in order to comply with federal recommendations. However, many concerns and problems are still preventing full compliance with the 2004 FHWA technical advisory. Many states are not conducting sufficient tests due to a shortage of staff and do not have a statistically-based acceptance system. This prevents sound statistical analysis. Many contractors also directly appeal if the QC results show compliance with the specifications while the QA results do not. In the states that rely solely on the QA test results, it is not unusual for 10% to 15% of the samples to get appealed (7).

FIELD VISITS

Based on the results of the survey, sampling practices in five highway agencies were evaluated through field visits (Kansas, Iowa, Ohio, Michigan, and Ministry of Transportation of Ontario). Three of these agencies specify roadway sampling, while one agency is experimenting with a new generation of mechanical sampling device and another agency samples directly from a Material Transfer Device (MTD).

Kansas Roadway Sampling Method

Kansas Department of Transportation (KDOT) has a great deal of experience with roadway sampling since this is the only method they have ever used. Roadway samples are obtained from behind the paver before compaction. A three-side template is pushed into the mat prior to compaction (Figure 4). A square shovel without sides is then used to extract all asphalt mixtures
from the selected locations. The sample is obtained from a minimum of three locations randomly selected by the KDOT personnel throughout one truck load of placed material. The selection process involves one random number for the sampled tonnage (truck load) and two random numbers for transverse and longitudinal locations. The sample is collected into a cooler with a steel lining and is then transferred to the field lab for testing. Sample size is typically 27.2kg. The sampling template has dimensions of 635mm x 508mm x 280mm. The sampling process takes approximately five minutes to complete. The sampling process was judged efficient, causing little damage to the installed mat, and providing good indication of the installed product. Loose mixture is used to fill the sampling holes. KDOT did not notice any problems with the final smoothness or performance of the mat at the sampling location. It is worth noting, however, that Kansas generally uses fine-graded mixes, which are more conducive to roadway sampling.

**Figure 4.** Roadway sampling process adopted by Kansas DOT

**Iowa Roadway Sampling Method**

Roadway sampling has been used in Iowa since the late 1960s to address field segregation of the mixture and in order to obtain a representative sample of the installed product. Roadway samples are obtained from behind the paver before compaction. A four-side template is forced down through the entire depth of the mat (see Figure 5a). The dimensions of the sampling template are 203mm x 203mm with a depth of 101.6mm. The larger template shown in the back left portion of Figure 5a is also accepted but is rarely used. A small square scoop is used to remove the sample from the inside of the template (Figure 5b). Attention is given to extract all the material from the template including any mixture that adheres to the scoop.

A minimum of four template samples is required in each sampling process to collect at least 13.6kg of material. Sampling is distributed over at least 27.2ton of mixture (approximately two different truckloads). Tonnage to be sampled is selected randomly by the state personnel and is only revealed to the contractor prior to collection. The sample transverse locations are selected as follows: one sample is collected at 0.3m from the left edge of the mat, one sample is collected 0.3m from the right edge of the mat, one sample is collected 0.3m from the left center of the screed, and one sample 0.3m from the right of the center of the screed.

The sampling process takes approximately 15 minutes to complete as care is given to collect all the materials inside the template. According to Iowa DOT, the sampling process is efficient, causing little damage to the installed mat, and provides a representative sample of the
placed product. Loose mixture is used to fill the sampling holes. Iowa DOT did not detect any problems with the final smoothness or performance of the mat at the sampling location. It is noted that Iowa DOT mainly uses fine-graded mixes, which are less susceptible to segregation during sampling. Collected samples are placed in carton boxes that are available for purchase by the contractor from Iowa DOT. After sampling, the state personnel will immediately take possession of one of the two boxes, secure it in a bag, seal it with a locking ID tag, and return the sample to the contractor for transportation to a District lab.

![Roadway sampling template adopted by Iowa DOT](image1.png)

**Figure 5.** Roadway sampling template adopted by Iowa DOT

**Michigan Roadway Sampling Method**

Two sampling methods are specified by MDOT: sampling with a specially-developed shovel is used when HMA is placed on top of HMA or a concrete surface; and sampling with plate and shovel is used when HMA is placed on top of an aggregate base, rubblized concrete, or a cold-milled surface. In the plate and shovel method, three plates (360mm x 720mm) with 600mm-long wires attached to them are placed prior to placement of HMA (Figure 6a). The location of the plates is selected randomly in the longitudinal direction. In the transverse direction, the three plates are staggered over the lane (two plates at 150 mm from the edges of the lane and one at the center of the lane). The wires are extended beyond the edge of the pavement to allow locating the sampling plates after the mixture is placed (Figure 6a). The plates are sprayed with a release agent prior to placement of the mixture.

![Roadway sampling equipment](image2.png)
After placement of the mix, the wires are pulled until the plate is located (Figures 6c). Once the plate edges are defined, a specially-developed shovel is used to dig downward until it comes in contact with the plate then slid forward on the plate far enough to obtain enough material to fill one-third of the specified sample container (Figure 6d). The shovel is then lifted slowly until all the material is recovered. The sample is placed directly into the sample container. This process is repeated at the other two locations. The sample is stored into a non-absorbent metal container with a capacity of at least 13.2 litters that is cleaned and reused in collecting HMA samples. The contractor then fills and levels the sampling location with prefilled 13.2-liter buckets of HMA obtained from the paver’s auger (Figure 6e). Three buckets of loose mixture are used to fill for one bucket of sample; this allows for overfilling of the hole and better compaction and restoration of the final surface. In addition, loose mixture is dumped vertically and not horizontally to avoid segregation while filling sample holes.

For QA testing, the sampling process is conducted by trained MDOT personnel present at the site. The sampling process takes approximately five minutes to complete. The sampling process was judged efficient and quick, causing little damage to the installed mat, and providing good indication of the installed product (Figure 6f). Sampling locations are marked as smoothness testing is not conducted where the samples are collected. After filling the sampling location with loose mixture, MDOT determined the thermal profile in these areas as compared to the rest of the mat. No thermal difference could be noticed. Due to the use of plates, this sampling method picks all fines from the bottom of the mat even when it used on a milled surface.

**Material Transfer Device Sampling: The Ministry of Ontario**

The Ministry of Transportation of Ontario (MTO) has used MTD sampling, as an option to plate sampling, since 2001. Prior to 2001, roadway plate sampling was used since 1987. The change to MTD sampling was driven by the prospect of obtaining a blended sample and reducing disturbance to the pavement final surface. Samples are obtained from the MTD during placement of HMA and prior to transferring the mix to the paver; Figure 7. If a MTD is not used in a specific project, plate sampling is used instead. For MTD sampling, the mix is dumped directly from the MTD into a specially designed funnel which splits the mix into four containers, each holding approximately 45kg of mix. The mix from one of the containers is then poured into a separate splitting apparatus, which is placed on a level surface. This apparatus splits the sample into four buckets, each with 11.3kg capacity. The split is repeated once or twice until a uniform sample is obtained. Sampled material is then transferred to carton boxes and then into bags for security sealing and shipment to the laboratory. The contractor must deliver samples to
the laboratories within two days. The success of the sampling process depends primarily on the leveling of the sampling device and should be conducted while the MTD is under full operation (sampling should be avoided if the MTD is not thoroughly heated).

Figure 7. MTD sampling process adopted by MTO

Ohio’s Experience with Mechanical Sampling Device
Ohio is currently experimenting with a mechanical sampling device that is used to automatically sample mixtures from trucks at the plant (Figure 8). The new prototype developed by HMA Lab Supply Inc., is reasonably priced and provides simple steps of operation. Using a manually-controlled hydraulic actuator, the sampling device is moved to the desired sampling location on the truck. Then, a grip is used to remove 0.3m of mixture, and to sample the produced material. The collected sample (approximately 22.7kg) is then poured into a funnel which splits the mix into four metallic buckets; Figure 8.
In general, the mechanical sampling device is promising and provides three major advantages: safety of the technician conducting the sampling process, more uniform and representative sample, and compatibility with all truck sizes and types. This device was also successfully tested in Virginia and North Carolina. Ohio DOT indicated their strong interest in expanding the use of this device. However, its use will not be required but encouraged given its aforementioned benefits.

**SUMMARY AND RECOMMENDATIONS**

The objective of this study was to provide a detailed review of successful methods and practices currently used to sample HMA during production and placement. Focus was given to Midwestern states since they encounter similar conditions to Illinois. During the course of this project, areas of improvement in the current Illinois QC/QA program were also identified. Sampling practices in five highway agencies were evaluated (Kansas, Iowa, Ohio, Michigan, and the Ministry of Transportation of Ontario). Three of these agencies specify roadway sampling, while one agency is experimenting with a new generation of mechanical sampling device and another agency samples directly from a Material Transfer Device. In general, sampling behind the paver is being conducted by many states without much difficulty. Based on the site visits conducted in this research, it was determined that the roadway sampling procedure adopted by Michigan DOT is the most appropriate for possible implementation in Illinois. This sampling procedure offers the following advantages:

- Simple sampling technique providing an adequate quantity of mixture for laboratory testing;
- Efficient and quick sampling process;
- Representative of final product including asphalt absorption;
- Fines are recovered from milled or rough textured surfaces;
Overfilling of holes (three buckets of loose mixture for one bucket of sample) allows better compaction and restoration of final surface;

To avoid segregation while filling sample holes, loose mixture is dumped vertically and not horizontally; and

Sampled surface does not seem to be substantially affected after compaction.

In addition to this sampling technique, sealed bags adopted by Iowa DOT may be used, if necessary, to safely and securely transport samples from the field to the lab. Based on the aforementioned findings, this study has determined that the current Illinois QC/QA program is in need of several modifications to ensure successful implementation of roadway sampling, to comply with the TA, and to encourage high-quality construction of HMA. Based on the results of this study, all of the districts in Illinois are being asked to jobsite sample a minimum of two projects this year (2008) to test and collect statistical data based on roadway sampled mix.

ACKNOWLEDGMENTS

This paper is based on the results of ICT-R27-8, Evaluation of Hot-Mix Asphalt Sampling Techniques. ICT-R27-8 was conducted in cooperation with the Illinois Center for Transportation; the Illinois Department of Transportation, Division of Highways; and the U.S. Department of Transportation, Federal Highway Administration. The contents of this report reflect the view of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Illinois Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation. The authors would like to acknowledge the assistance of the following members of the Technical Review Panel for ICT-R27-8: Scott Lackey, Laura Shanley, Thomas Zehr, and Patricia Broers. The authors would also like to acknowledge the assistance of David Lippert in preparing and distributing the questionnaire. The assistance of I. Al-Qadi of the University of Illinois, P. Lum of the Lafarge Group, and personnel at Iowa DOT, Kansas DOT, Michigan DOT, and Ohio DOT is greatly appreciated.

REFERENCES