



Pennsylvania ASphalt Improvement Network
Construction Pilots' Implementation Report
(Phase 1)

Submitted to:
PennDOT Deputy Secretary for Highway Administration
and
Pa Asphalt Pavement Association

By:
Eastern Industries Inc., and HRI Quality Managers,
PAPA, & PASIN Implementation Resource Team
Date: January, 2008

TABLE OF CONTENTS

Table of Contents	i
Executive Summary	1
Overview	6
PASIN Results	12
Conclusions & Recommendations	14
PASIN Implementation Process	18
HMA Production & Paving Plan Development.....	21
Gap Analysis	25
HMA Production & Paving Plan Implementation.....	27
Internal & External Audits.....	29
Metrics	31

EXECUTIVE SUMMARY

Introduction

Pennsylvania ASphalt Improvement Network (PASIN) is an initiative to *develop, pilot and implement an ISO 9000-2000 based Quality Management System (QMS) from pavement design through qualification, procurement, manufacture, delivery of materials, installation, acceptance testing, and maintenance of asphalt pavement.* The PASIN initiative started in 2004. During 2006, the PASIN Team continued to formalize the QMS documentation, conducted analysis with the guidance of the Pennsylvania Asphalt Pavement Association (PAPA) to determine the readiness of the Asphalt Industry to participate on pilot projects, and developed the following: *PASIN Quality Manual and Quality Procedures, and Asphalt Industry Baseline Assessments.* During the 2007 construction season, two construction pilot projects were implemented as Phase 1.

Purpose

The objective of the Phase 1 PASIN Pilot effort is to test the construction portion of the overall Asphalt Pavement Delivery Process during the 2007 construction season. Two pilot projects were selected: ECMS No. 57791, Jefferson Co. SR 28 Section 510 in District 10-0, Game School Road 3R, and ECMS No. 75816, Schuylkill County I 81-07M in District 5-0. PASIN implementation requirements were compensated in *Item 9409-9999 Pilot Asphalt Quality Systems Implementation* and a Special Provision was included to specify PASIN requirements.

PASIN Implementation Process

Upon execution of the construction contract, the contractors proposed a Quality Manager meeting the PASIN Special Provision requirements and qualified to implement the process. The PASIN Steering Team approved these individuals. The PASIN Implementation steps were:

1. **Develop HMA Production and Paving Plan (HMA Plan)** - The Quality Managers described how the use of the Production Best Practices (74 in total) and Paving Best Practices (42 in total) will be recorded and how the key controls will be monitored. Also included in each HMA Plan was the deployment of the following Quality Management Systems Components: *Management Review, Customer Focus, Internal Audit, Corrective and Preventive Actions, Control of Nonconformances, Control of Documents, and Control of Records.*
2. **Conduct Gap Analysis** - The PASIN Implementation Resource Team conducted a Gap Analysis of the contractors' operations that paralleled the PASIN processes.
3. **Implement HMA Production and Paving Plan** - The contractors implemented the HMA Production and Paving Plan ([Chart I-2](#)) developed by training the plant and field personnel on the Best Practices and Key Control Points. The Quality Managers also developed and provided training on new checklists, log reports, maintenance of records, etc.
4. **Conduct Internal and PASIN Audits** - Internal audit team composed of contractor employees and trained by the PASIN Steering Team members, conducted audits within the company's operations. The PASIN External Audit Team conducted external audits.

PASIN Results

Implementing PASIN in the Pilot Projects for the contractors was overwhelming, and difficult, at times, particularly due to the fact that the effort was new to the asphalt industry, as well as for PennDOT. The contractors developed a plan for implementing Quality Management System, and Best Practices for production and paving processes. Contractors implemented the HMA Plan, during the paving itself, and will continue to implement additional improvements, in the coming months, to benefit their companies. Internal and External Audits were also completed.

PASIN Gap Analysis questions were helpful to the contractors, as it made them think more deeply about their processes, documentation, training, etc.

Overall, PASIN Projects in Schuylkill and Jefferson Counties were considered successful in piloting the PASIN effort. The PASIN Core Team determined that implementation is possible on future projects and can result in improvements to asphalt production and paving operations.

Recommendations

The PASIN Core Team, upon evaluation of Phase 1 PASIN pilot projects, proposes the following recommendations for PASIN implementation, as shown in *Chart E-1-PASIN Implementation Recommendations*.

CHART E-1-PASIN IMPLEMENTATION RECOMMENDATIONS

Calendar Year	Recommendation	Requirements
2008	<p><u>Phase 2 Pilots</u> Conduct two (2) pilots:</p> <ul style="list-style-type: none"> ✓ District 3-0 Lycoming County, SR 15-121, MPMS #79105. ✓ District 12-0 SR 0021 - 07R MPMS # 80092 	<ol style="list-style-type: none"> 1. Update <i>PASIN Orientation Session</i> and provide training. 2. Revise Special Provision for PASIN requirements. 3. Continue to provide support to contractors by the PASIN Implementation Resource Team.
2009	<p>Conduct pilot project in every District.</p>	<ol style="list-style-type: none"> 1. Implement revisions based upon learning from Phase 2 pilot projects.
2010 and Beyond	<p>Incorporate PASIN requirements for all paving projects.</p>	<ol style="list-style-type: none"> 1. Develop PASIN Quality Management System Certification requirement. 2. Incorporate PASIN Certification requirement in all paving projects. 3. Link a Warranty PASIN Project.

Barriers

Barriers to implementing the Recommendations stated above and the Action Plan for overcoming these barriers are stated in *Chart E-2-Barriers and Action Plan*.

CHART E-2-BARRIERS & ACTION PLAN	
Barriers	Action Plan
❖ Possible lack of commitment at the District PM field staff level, possibly due to unfamiliarity with the PASIN Implementation.	❖ Will develop a communication plan to address, by end of third quarter in 2008.
❖ Possible lack of commitment at the BOCM QA level, due to unfamiliarity of effects of PASIN implementation.	❖ Will continue to inform Director, Bureau of Construction & Materials, to communicate progress of PASIN pilot projects, following each PASIN Core Team meetings (typically held bi-monthly).
❖ Possible lack of familiarity with PASIN when the Department's Executives staff changes.	❖ Communicate successes of PASIN with specific details to Department Executives after a change.
❖ Possible lack of approval by FHWA to implement PASIN.	❖ Will continue to inform and involve FHWA through the PASIN Core Team meetings (bi-monthly). ❖ Mike Rafalowski has been identified as the FHWA contact to aid in the development of 23 Code of Federal Regulations compliant specifications.
❖ Resistance from contractors due to total unfamiliarity with the PASIN concepts.	❖ Will provide educational clips in PAPA newsletter, quarterly.
❖ Lack of recognition that the current acceptance methods do not necessarily yield quality pavements; yet, the Department continues to perform acceptance processes, in the same manner.	❖ As pilots continue to show success, we can communicate comparisons of results in the PASIN Pilot Report, to be published by end of first quarters, in 2009 and 2010.
❖ The contracting industry wants the Department to define a lesser	❖ Through the efforts of the pilot projects, establish that the contractor's processes can

CHART E-2-BARRIERS & ACTION PLAN

Barriers	Action Plan
<p>sampling and testing requirement that will be adopted once the PASIN process proves itself to be effective.</p>	<p>be statistically controlled, then establish a transition plan that hinges upon demonstration of statistical control, that will reduce sampling and testing for acceptance to a verification process. This transition plan will be developed by the end of the 2009 first quarter, following the pilots. (The verification process would need to include triggers that would keep these processes in check and revert to an alternate acceptance process when statistical control proves ineffective.)</p> <ul style="list-style-type: none"> ❖ Develop a system, jointly with FHWA, in which a portion of the contractors' QC results can be used for acceptance testing, prior to deploying 2009 pilot projects.
<ul style="list-style-type: none"> ❖ PASIN must reduce involvement in guiding the contractors through the process, as the numbers of pilot projects will increase. 	<ul style="list-style-type: none"> ❖ By end of fourth quarter, 2009, develop a transition plan for evolving to a sustained system that incorporates PASIN into the existing management structure involving industry, PennDOT and the FHWA.
<ul style="list-style-type: none"> ❖ If the contractors for each of the PASIN pilot projects do not implement PASIN requirements, it could result in a setback for the effort. 	<ul style="list-style-type: none"> ❖ Monitor the progress of the projects, bi-weekly, to focus PASIN Team's attention where it is needed most. Will add a status report as an agenda item for core team meeting regular discussion.

Introduction

Pennsylvania ASphalt Improvement Network (PASIN) is an initiative to *develop, pilot, and implement an ISO 9000-2000 based Quality Management System (QMS) from pavement design through qualification, procurement, manufacture, delivery of materials, installation, acceptance testing, and maintenance of asphalt pavement.* PASIN initiative started in 2004. In 2005, PASIN Team completed mapping of the Asphalt Pavement Delivery Process. The Team also conducted a Failure Mode and Effects Analysis (FMEA) that resulted in identifying and rating over 200 potential items that might affect the success of a paving project.

During 2006, the PASIN Team continued to formalize the QMS documentation, conducted outreach with the guidance of the Pennsylvania Asphalt Pavement Association (PAPA) to determine the readiness of the Asphalt Industry to participate on pilot projects, and completed the following:

- ❖ **PASIN Quality Manual and Quality Procedures**, which is a guidebook for operating within the requirements of the established Quality Management System, and includes process maps and Best Practices for each step of the Asphalt Delivery Process.
- ❖ **Asphalt Industry Baseline Assessments** were completed to evaluate the current status of five volunteer firms that produce Hot Mix Asphalts and pave roads to establish a baseline of industry practice in comparison to the ISO and PASIN standards. The assessment team completed a final, generic report depicting the industry's overall conformance to the ISO and PASIN standards.

Purpose

The objective of the PASIN Phase 1 Pilot Projects is to pilot the construction portion of the overall Asphalt Pavement Delivery Process during the 2007 construction season. Two pilot projects were selected: ECMS No. 57791, Jefferson Co. SR 28 Section 510 in District 10-0, Game School Road 3R, and ECMS No. 75816, Schuylkill County 81-07M in District 5-0. PASIN implementation requirements were compensated in *Item 9409-9999 Pilot Asphalt Quality Systems Implementation*. Special Provision 9409-9999 Pilot Asphalt Quality Systems Implementation, states that *this pilot project intends to test the viability of incorporating the use of ISO 9001-2001 Quality Management System requirements, into the production, transport, application, and testing of asphalt pavement in Pennsylvania.* The following are the requirements in the Special Provision:

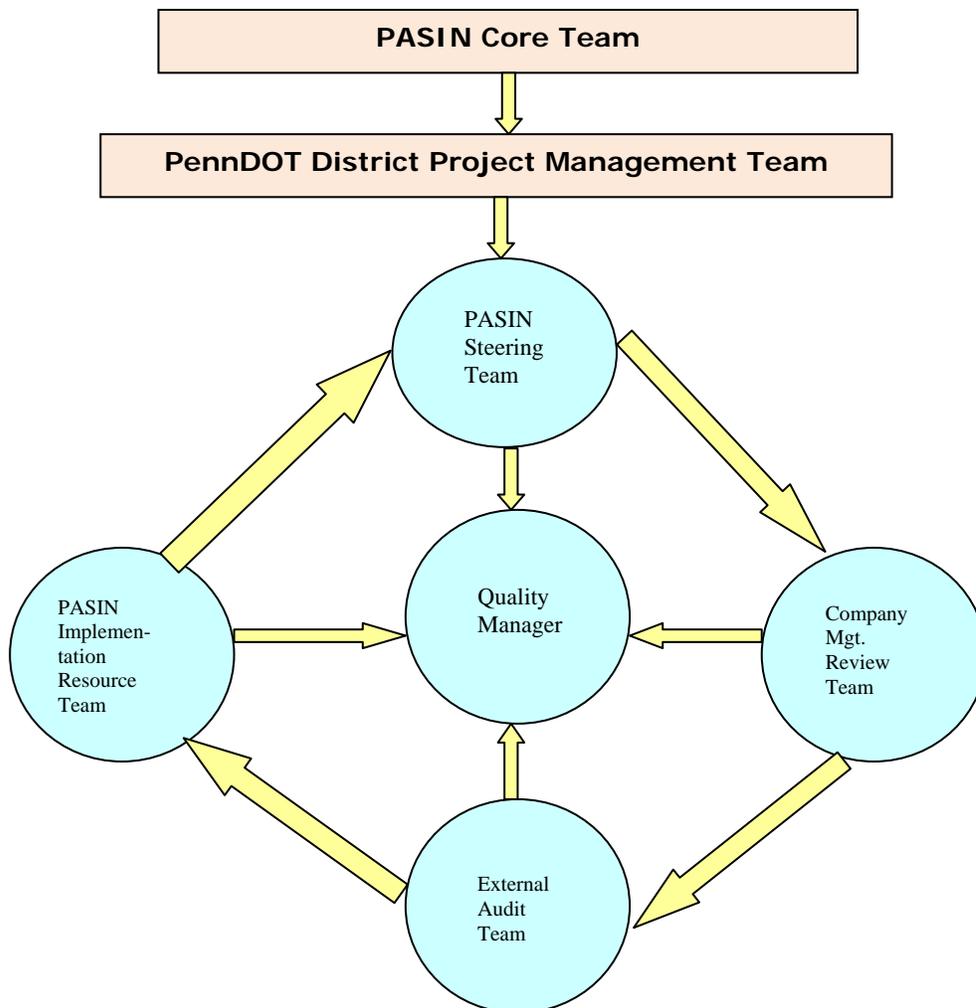
1. Develop a Hot Mix Asphalt Production Quality Control Plan (HMAQCP) that meets the minimum quality control and best practice requirements, as noted in the **PASIN Quality Manual**. Describe in the HMAQCP how you will record the use of best practices, and how you will monitor the key controls.
2. Develop a Paving Operation Quality Control Plan (POQCP) to be included as part of the Quality Control Plan required by Section 409. Address field control and evaluation of bituminous concrete paving operations. Describe in the POQCP how

you will record the use of best practices, and how you will monitor the key controls (as a minimum) as included as part of the PASIN Quality Manual.

3. Participate in a gap analysis of the firm's current quality control system as it relates to the PASIN Quality Management System standard and the PASIN Pilot Project Quality Management system.
4. Complete implementation in 2008 of the PASIN Quality Systems Manual.

Roles

PASIN projects required several key roles to facilitate implementation, as shown on *Chart OV-1 PASIN Implementation Roles*. Contractors submitted names of Quality Managers for approval by the PASIN Steering Team, as a requirement of the Special Provision. Quality Managers were responsible for implementation of the PASIN requirements.



**Chart OV-1 Item 9409-9999
PASIN IMPLEMENTATION ROLES**

Responsibilities

Responsibilities of the various PASIN Implementation members are noted in *Chart OV-2-PASIN Responsibilities*.

CHART OV-2-PASIN RESPONSIBILITIES			
TEAM	ROLES	RESPONSIBILITY	MEMBERSHIP
PASIN Core Team	Provide direction and guidance on PASIN implementation with asphalt industry.	<ol style="list-style-type: none"> Assemble industry partners and PennDOT team members together to: <ul style="list-style-type: none"> ✓ Provide direction and guidance on ISO 9000 implementation. ✓ Review progress on assigned tasks. ✓ Review progress on phase 1 pilot projects. 	<ul style="list-style-type: none"> ❖ Pa Asphalt Pavement Association ❖ PennDOT ❖ Consulting Engineers ❖ PA Turnpike ❖ Federal Highway Administration ❖ CITGO ❖ PACA ❖ AMRL
PennDOT District Construction Project Mgt.	Monitor construction project.	<ol style="list-style-type: none"> Provide monitoring of construction project, to ensure compliance with contract documents. Communicate questions regarding PASIN Item to PASIN Steering Team. Interpret contract specifications for Project. Document and make payment to contractor. Provide feedback on Pilot Project. 	<ul style="list-style-type: none"> ❖ Assistant. District Executive-Construction ❖ Inspector-In-Charge ❖ Inspection Staff ❖ District Materials Managers ❖ Bureau of Construction and Materials QA staff
Company Quality Manager	Responsible for entire implementation, at a hands-on level, to ensure success of pilot project.	<ol style="list-style-type: none"> Develop Hot Mix Asphalt Production and Paving Plan (HMA Plan). Monitor accomplishment of HMA Plan. Report progress and status to Management Review Team. Manage internal audits and prepare internal audit report. Participate in External Audits. 	<p><u>District 5-0,</u></p> <ul style="list-style-type: none"> ❖ Gregory Brouse, EII <p><u>District 10-0,</u></p> <ul style="list-style-type: none"> ❖ William Smith, HRI
PASIN Steering Team	Ensure success of PASIN Project.	<ol style="list-style-type: none"> Provide direction for successful completion of PASIN Projects. Interact with District Construction Project Management Team on PASIN Item. 	<ul style="list-style-type: none"> ❖ George McAuley, PennDOT, PASIN Team Leader ❖ Frank Colella, PAPA ❖ Brett Brenize, Gannett Fleming

CHART OV-2-PASIN RESPONSIBILITIES

TEAM	ROLES	RESPONSIBILITY	MEMBERSHIP
Company Management Review Team	Ensure successful completion of Special Provision, "Item 9409-9999- Pilot Asphalt Quality Systems Implementation"	<ol style="list-style-type: none"> 1. To monitor status of PASIN Pilot Project, bi-weekly, or as needed. 2. Provide direction and resources for successful completion of PASIN Pilot Project. 3. Assess effectiveness of changes to processes. 	<u>District 5-0</u> ❖ Neal Smith, Vice President, EII, Leader <u>District 10-0</u> ❖ Jeff Reeder, Vice President, HRI, Leader
External Audit Team	Provide audit of actions implemented by companies to meet PASIN Quality Management System.	<ol style="list-style-type: none"> 1. Manage PASIN audits, by preparing a procedure, schedule, implementing audits, and keeping records. 2. Publish PASIN Audit Reports. 3. Communicate results of audits to PASIN Steering Team. 	❖ Steven Lester, Urban Engineers ❖ Steve Marsinko, District 12-0 ❖ William Wilson, ms consultants
Implementation Resource Team	Provide support and guidance to Quality Manager, throughout implementation.	<ol style="list-style-type: none"> 1. Provide implementation support to Quality Manager. 2. Perform as liaison between Quality Manager, PASIN Steering Team and District Construction Project Management Team. 3. Conduct gap analysis. 4. Provide internal auditor training and mentoring 	❖ Frank Colella, PAPA, Leader ❖ William Gordon, MTD ❖ Eric Burson, MTD ❖ Terry Ash, PSU ❖ Brandon Mummert, WVU ❖ Ryan Kelly, PSU ❖ Mark Heinbaugh, Raudenbush Engineering <u>Gannett Fleming</u> ❖ Richard Kercher ❖ Doug Foltz ❖ Michael Lohenitz ❖ Sumathi Ravindraraj ❖ Jesse Love ❖ Mark Weller
HRI-Plant & Paving Crews and Internal Audit Team	Complete production and paving operations	<ol style="list-style-type: none"> 1. Produce HMA material at the plant. 2. Complete paving operations in the field. 3. Conduct internal audits. 	<u>Plant Crew</u> Plant Foreman- Al Snell Loader Operator-John Caltagaronne Plant Operator-Craig Lindemuth Plant Technician-Tim Confer Plant Laborer-Alvin McCracken Area Materials Foreman-Richard Weaver <u>Paving Crew</u> Paving Foremen-Randy Henry Certified Field Technician-Cheyne Griggs

CHART OV-2-PASIN RESPONSIBILITIES

TEAM	ROLES	RESPONSIBILITY	MEMBERSHIP
			Roller Operators-Barry Knupp, Alby Hagan, Michael Kranick Paver Operator-Bradley Butson Screed Operators- David McKinney, Ron Racchini MTV Operator-Gary Fertal <u>Internal Audit Team</u> Jeff Reeder, VP, Construction Jake Smith, Project Manager Bill Smith, Quality Control Manager
Eastern Industries-Plant & Paving Crews and Internal Audit Team	Complete production and paving operations	1. Produce HMA material at the plant. 2. Complete paving operations in the field. 3. Conduct internal audits.	<u>Plant Crew</u> Neil Klinger, Plant Superintendent John Colyer, Plant Technician Michael Ely, HMA Plant Operator Russell Hubler, Loader Operator David Moyer, (Assistant) HMA Plant Operator Lisa Wetzel, Technician Greg Brouse, Quality Control Manager Steve Grim, Study - Plant Technician <u>Paving Crew</u> Carey Lepley, Paving Operations Manager Dave Haines, Project Superintendent Ronald Lenhart, Paving Foreman Kenneth Carl Sr., Screed Operator Kenneth Carl Jr., Looter John Hepner, Paver Operator Christopher Rhodes, Laborer William Riccardi, Roller Operator Darryn Reiner, Laborer Marlin Snyder Sr, Roller Operator Aaron Campbell, Field Technician John Erdley, Study - Compaction Testing Nicholas Zechman, Study - Compaction Testing Joe Whitcome, Study - Compaction Testing <u>Internal Audit Team</u> Galen Smith, Construction Superintendent Steve Grim, Plant Technician Bill Valentine, Plant Technician Mike Swartz, Project Manager Jim Dry, Quality Control Manager Read Bachman, Construction Manager

Report

This *PASIN Pilot Projects' Implementation Report* contains the following:

- ❖ PASIN Results
- ❖ Conclusions and Recommendations
- ❖ PASIN Implementation Process
- ❖ Hot Mix Asphalt (HMA) Production and Paving Plan Development
- ❖ Gap Analysis
- ❖ Hot Mix Asphalt (HMA) Production and Paving Plan Implementation
- ❖ Internal & PASIN External Audits
- ❖ Metrics

PASIN RESULTS

Description

The PASIN Projects in Schuylkill and Jefferson Counties resulted in preliminary implementation of key Quality Management System (QMS) requirements, due to the short duration of the projects. Due to the cyclical nature of the QMS, not all aspects can be experienced during the timeframe of a single construction season. Most of the Best Practices and Key Control Points were already familiar to the contractors. Feasibility of PASIN Quality Management System implementation was tested.

Results

Implementing PASIN in the Pilot Projects for the contractors was overwhelming, and difficult, at times, particularly due to fact that the effort was new to the asphalt industry, as well as for PennDOT. The contractors developed a plan for implementing Quality Management System, and Best Practices for production and paving processes. Contractors implemented the HMA Plan, during the paving itself, and will continue to implement additional improvements, in the coming months, to benefit their companies. Internal and External Audits were also completed. Both contractors, more specifically, completed the following:

1. Identified a Quality Manager for PASIN project, who was responsible for supervision of implementation of PASIN Quality Manual.
2. Developed HMA Production and Paving Plan (HMA Plan), and submitted for review and approval, prior to commencing paving operations. PASIN Steering Team reviewed and approved HMA Plan.
3. Assigned *responsibility* for ensuring that the [Plant Best Practices](#) (74, in total) and [Field Best Practices](#) (42, in total) were implemented, as appropriate. Also provided timeframe for completion of these Plant and Field Best Practices. Internal Audit Teams conducted internal audits, to verify if HMA Plan is being implemented.
4. Provided and received approval for *HMA Plant Quality Control Plan* for the plants producing material on PASIN Projects, *Field Bituminous Paving Operation* and *Job Mix Formula Reports*.
5. Identified Management Review Team and a standard agenda for conducting meetings. Also conducted Management Review Team meetings periodically, as needed, to discuss progress of project, to ensure satisfactory completion of project.
6. Reviewed *Gap Analysis* Results presented by PASIN Implementation Resource Team.
7. Identified internal and external customers and determined methodology for obtaining customer requirements. Documented process for obtaining customer complaints/comments and identified methods to evaluate customer satisfaction. Updated existing Customer Complaint log to include complaints related to nonconformances and corrective actions.

8. Developed Internal Audit Plan and identified internal auditors with plant, paving, and management expertise. Conducted internal audits, upon receiving internal audit training from PASIN Implementation Resource Team. The contractors will develop an *Internal Audit Report* to communicate results of the internal audits, within the Company.
9. The Plant and Paving Teams, along with the Quality Manager, developed a methodology for identifying, recording, analyzing, resolving, and preventing *Corrective and Preventive Actions*, which are problems or potential problems, identified by customer complaints, project, material, or system noncompliances or inefficiencies.
10. Identified a methodology for identifying, documenting, evaluating, and disposing all *Nonconformances* and includes notification to all concerned parties. Developed a *Nonconformance Report* and system to track items until resolution is achieved. The documented nonconformances and customer complaints in this system will help the entire company, where as in the past, it may have been prevented at same location or with same crew next time, but not always shared throughout entire company.
11. Quality Managers identified a process for preparation, review, approval, distribution, and disposition of *Control of Documents*. Quality Managers, with the assistance of PASIN Implementation Team, identified, and prepared a log of existing documents required for PASIN projects. Documents were placed, electronically, in one folder, for access by project personnel. This allowed the Quality Manager to take the first steps into developing an electronic filing system which ties all plant laboratories to a central system. All files for all plants can be examined from any location, with proper access.
12. Plant, paving, and human resources personnel, along with Quality Managers, developed a process for identification, storage, protection, retrieval, retention, and disposition of *Project Records*. Plant, paving, and other *Records* were placed, electronically, in one folder, for access by project personnel.

Overall, PASIN Projects in Schuylkill and Jefferson Counties were considered successful in piloting the PASIN effort. The PASIN Core Team determined that implementation is possible on future projects and can result in improvements to asphalt production and paving operations.

CONCLUSIONS & RECOMMENDATIONS

Description

PASIN Team conducted After Action Reviews on both PASIN pilot projects, with the contractors' management staff, and field and plant crews and PennDOT Inspection staff. Summary comments from the After Action Reviews are provided in the *Conclusions* Section below. Additionally, the PASIN Asphalt Core Team discussed implementation of Phase 1 pilot projects and determined *Recommendations* for Phase 2 pilot implementation.

Conclusions

PASIN Team conducted After Action Reviews on both PASIN pilot projects, with the contractors' management staff, and field and plant crews and PennDOT Inspection staff. The following is a summary of the comments provided at the After Action Reviews:

1. *PASIN Orientation Training* was provided to all potential bidders interested in bidding on PASIN pilot projects. The *Orientation Training* provided information on Quality Management System requirements, the *Asphalt Industry Baseline Assessment*, the *PASIN Quality Manual*, analysis and the roles and responsibilities of the Quality Manager. Based upon the learning from the initial pilot projects, the Training will need to be modified, to communicate PASIN requirements more clearly.
2. Both pilot projects were awarded in time to complete paving in the 2007 construction season. Upon receiving Notice to Proceed, the contractors began developing *Hot Mix Asphalt Production and Paving Plan* for each project. The amount of time to develop the Plan was greatly compressed, due to the fact that the contractors projected that paving would begin within six weeks, instead of twelve weeks (as stated in the Department construction schedule) after the Notice to Proceed was issued. This resulted in developing the *HMA Plan*, in a shorter period of time than originally anticipated.
3. Development of *HMA Plan* was not an easy task for the contractors, as the entire PASIN concept is new to the asphalt industry. The contractors developed a plan for implementing Quality Management System, and Best Practices for production and paving processes. The contractors developed the *HMA Plan*, on time, and the PASIN Steering Team was able to provide review and approval, prior to start of paving operations, as required in the Special Provision for *Item 9409-9999*.
4. The entire PASIN effort was new to the Department, as well as the asphalt industry. PASIN terminology, such as best practices, key controls, Quality Management System tended to confuse the contractors.
5. PASIN Implementation Resource Team's support to the contractors was helpful, in developing and implementing the *HMA Plan*, and conducting Internal Audits.
6. Contractors implemented the *HMA Plan*, during the paving itself, and will continue to implement additional improvements, in the coming months, to benefit their companies. Internal and External Audits were completed.

7. PASIN Gap Analysis questions were helpful to the contractors, as it made them think deeper about their processes, documentation, etc.
8. Thermal imagery information, to evaluate the temperature of the HMA, was considered to have much potential, by the inspectors. The equipment was available on the District 5-0 Pilot Project and the contractor indicated that the expense was not excessive.

Overall, during the implementation, the contractors stated that the effort, particularly initially, was overwhelming. Despite the fact that PASIN Team and contractors had not implemented PASIN previously, the pilot projects resulted in accomplishments, which are noted in the [Results](#) Section.

Recommendations

The PASIN Core Team, upon completion of Phase 1 PASIN pilot projects, determined the following recommendations for PASIN implementation, as shown on *Chart R-1 PASIN Implementation Recommendations*.

CHART E-1-PASIN IMPLEMENTATION RECOMMENDATIONS		
Calendar Year	Recommendation	Requirements
2008	<u>Phase 2 Pilots</u> Conduct two (2) pilots: <ul style="list-style-type: none"> ✓ District 3-0 Lycoming County, SR 15-121, MPMS #79105. ✓ District 12-0 SR 0021 - 07R MPMS # 80092 	<ol style="list-style-type: none"> 4. Update <i>PASIN Orientation Session</i> and provide training. 5. Revise Special Provision for PASIN requirements. 6. Continue to provide support to contractors by the PASIN Implementation Resource Team.
2009	Conduct pilot project in every District.	<ol style="list-style-type: none"> 2. Implement revisions based upon learning from Phase 2 pilot projects.
2010 and Beyond	Incorporate PASIN requirements for all paving projects.	<ol style="list-style-type: none"> 4. Develop PASIN Quality Management System Certification requirement. 5. Incorporate PASIN Certification requirement in all paving projects. 6. Link a Warranty PASIN Project.

Barriers

Barriers to implementing the Recommendations stated above and the Action Plan for overcoming these barriers are stated in *Chart CR-1-Barriers and Action Plan*.

CHART E-2-BARRIERS & ACTION PLAN	
Barriers	Action Plan
❖ Possible lack of commitment at the District PM field staff level, possibly due to unfamiliarity with the PASIN Implementation.	❖ Will develop a communication plan to address, by end of third quarter in 2008.
❖ Possible lack of commitment at the BOCM QA level, due to unfamiliarity of effects of PASIN implementation.	❖ Will continue to inform Director, Bureau of Construction & Materials, to communicate progress of PASIN pilot projects, following each PASIN Core Team meetings (typically held bi-monthly).
❖ Possible lack of familiarity with PASIN when the Department’s Executives staff changes.	❖ Communicate successes of PASIN with specific details to Department Executives after a change.
❖ Possible lack of approval by FHWA to implement PASIN.	❖ Will continue to inform and involve FHWA through the PASIN Core Team meetings (bi-monthly). ❖ Mike Rafalowski has been identified as the FHWA contact to aid in the development of 23 Code of Federal Regulations compliant specifications.
❖ Resistance from contractors due to total unfamiliarity with the PASIN concepts.	❖ Will provide educational clips in PAPA newsletter, quarterly.
❖ Lack of recognition that the current acceptance methods do not necessarily yield quality pavements; yet, the Department continues to perform acceptance processes, in the same manner.	❖ As pilots continue to show success, we can communicate comparisons of results in the PASIN Pilot Report, to be published by end of first quarters, in 2009 and 2010.

CHART E-2-BARRIERS & ACTION PLAN

Barriers	Action Plan
<ul style="list-style-type: none"> ❖ The contracting industry wants the Department to define a lesser sampling and testing requirement that will be adopted once the PASIN process proves itself to be effective. 	<ul style="list-style-type: none"> ❖ Through the efforts of the pilot projects, establish that the contractor’s processes can be statistically controlled, then establish a transition plan that hinges upon demonstration of statistical control, that will reduce sampling and testing for acceptance to a verification process. This transition plan will be developed by the end of the 2009 first quarter, following the pilots. (The verification process would need to include triggers that would keep these processes in check and revert to an alternate acceptance process when statistical control proves ineffective.) ❖ Develop a system, jointly with FHWA, in which a portion of the contractors’ QC results can be used for acceptance testing, prior to deploying 2009 pilot projects.
<ul style="list-style-type: none"> ❖ PASIN must reduce involvement in guiding the contractors through the process, as the numbers of pilot projects will increase. 	<ul style="list-style-type: none"> ❖ By end of fourth quarter, 2009, develop a transition plan for evolving to a sustained system that incorporates PASIN into the existing management structure involving industry, PennDOT and the FHWA.
<ul style="list-style-type: none"> ❖ If the contractors for each of the PASIN pilot projects do not implement PASIN requirements, it could result in a setback for the effort. 	<ul style="list-style-type: none"> ❖ Monitor the progress of the projects, bi-weekly, to focus PASIN Team’s attention where it is needed most. Will add a status report as an agenda item for core team meeting regular discussion.

PASIN IMPLEMENTATION PROCESS

Special Provision Requirement

PASIN implementation requirements were specified in Special Provision 9409-9999 Pilot Asphalt Quality Systems Implementation, which states that “*this pilot project intends to test the viability of incorporating the use of ISO 9001-2000 Quality Management System requirements (ANSI/ISO/ASQ Q9001-2000), into the production, transport, application and testing of asphalt pavement in PA*”. The following are the requirements in the Special Provision:

1. Develop a Hot Mix Asphalt Production Quality Control Plan (HMAQCP) that meets the minimum quality control and best practice requirements, as noted in the **PASIN Quality Manual**. Describe in the HMAQCP how you will record the use of (production) best practices, and how you will monitor the key controls.
2. Develop a Paving Operation Quality Control Plan (POQCP) to be included as part of the Quality Control Plan required by Section 409. Address field control and evaluation of bituminous concrete paving operations. Describe in the POQCP how will record the use of (paving) best practices, and how you will monitor the key controls (as a minimum) as included as part of the PASIN Quality Manual.
3. Complete implementation in 2008 of the PASIN Quality Management Systems (QMS) Manual, for the pilot project only, and not necessarily company-wide.
4. Participate in a gap analysis of the firm’s current quality control system as it relates to the ISO 9001 standard and the PASIN Pilot Project Quality Management System.

PASIN Implementation Process

Upon execution of the construction contract, the contractors proposed a Quality Manager qualified to implement the PASIN implementation. The PASIN Steering Team approved the Quality Manager's name. The PASIN Implementation steps are shown in *Figure I-1 PASIN Implementation Process*.



Figure I-1- PASIN Implementation Process

1. **Develop HMA Production & Paving Plan** - The Quality Manager, along with Plant and Production Supervisors, reviewed HMA QC Field Best Practices, HMA Plant QC Best Practices, Production and Paving Process Maps and Key Control Points. Quality Managers assigned *Responsibility* for implementing each Best Practice and Key Control Point to ensure that they will be monitored, as required by Special Provision. The Quality Managers, reviewed the requirements of the Quality Management System (QMS) in the PASIN Quality Manual, and developed implementation plan for QMS. (Refer to [HMA Production & Paving Plan Development](#) Section for additional details).

2. **Conduct Gap Analysis** - The PASIN Implementation Resource Team conducted a Gap Analysis of the processes that impacted the PASIN pilot projects. The Gap Analyses were conducted with the Quality Managers, and plant and paving teams. Gap Analysis was conducted on the following items (Refer to [Gap Analysis](#) Section for additional details):
 - a. Quality Policy and Objectives
 - b. Customer Focus
 - c. Management Commitment
 - d. Control of Documents and Records
 - e. Responsibility, Authority and Communication
 - f. Management Review
 - g. Resources Management
 - h. Product Realization
 - i. Customer Related Processes
 - j. Measurement, Analysis and Improvement

3. **Implement HMA Production and Paving Plan** - The contractors implemented the HMA Production and Paving Plan developed. This included monitoring the Best Practices and implementing Quality Management System. Refer to [HMA Production & Paving Plan Implementation](#) Section for additional details).

4. **Conduct Internal and PASIN Audits** - The internal company audit teams conducted audits within the companies and the PASIN External Audit Team conducted external audits. Internal audit reports will be developed, for distribution within the companies. PASIN External Audit Team will develop an external audit report. (Refer to [Internal and External Audits](#) Section for additional details).

HMA PRODUCTION & PAVING PLAN DEVELOPMENT

Description

PASIN Project Special Provision for Item 9409-9999 Pilot Asphalt Quality Systems Implementation, required the contractors to: Provide a [Hot Mix Asphalt Production Quality Control Plan](#) (HMAQCP), a [Paving Operation Quality Control Plan](#) (POQCP), and complete implementation in 2008 of the PASIN [Quality Management Systems](#) Manual. The contractors included all of the above requirements in a document entitled *HMA Production & Paving Plan (HMA Plan)*.

HMA Plan Development

The Quality Manager, with support from the Plant and Production Supervisors and crews, as well as the PASIN Implementation Resource Team, developed *HMA Production and Paving Plan (HMA Plan)*. The Implementation Resource Team provided a template for development of the *HMA Plan*. The HMA Plan was completed and submitted by the Quality Manager, and was reviewed and approved by PASIN Steering Team, prior to paving operations, as required.

Process Maps

The PASIN Team developed Process Maps for the following Hot Mix Asphalt Production and Laydown Processes, as provided in the *PASIN Quality Manual*. In the Process Maps, Key Control Points were noted in red text, to alert the contractors to pay particular attention to these steps in the processes, for the PASIN pilot projects. The key control points are intended to provide reliable information about the process variability of finished product quality to meet requirements on a continuous basis.

- ❖ Aggregate Storage and Handling
- ❖ Asphalt Cement Supply System
- ❖ Batch Production Operations
- ❖ Parallel and Counter Flow Drum Operations
- ❖ Silo Storage and Truck Loading
- ❖ Mix Delivery
- ❖ Mix Placement
- ❖ Paver Automatic Screed Control
- ❖ Joint Compaction
- ❖ Material Compaction

Best Practices

The PASIN Team, with leadership from PA Asphalt Pavement Association developed a list of Best Practices, which when implemented, would result in the asphalt pavement that is consistent in quality and will maximize durability. A Best Practice is defined, in the *PASIN Quality Manual*, as *...techniques, methodologies, processes, or procedures that through experience and*

research have proven to reliably lead to performance results recognized as exceeding those achieved by most organizations.

HMA Production Quality Control Plan (Plant Best Practices)

Plant Best Practices, 74 in total, were developed by experts in the production of Hot Mix Asphalt. Examples of the Best Practices for the Hot Mix Asphalt Plants are provided in *Chart D-1-Plant Quality Control Best Practices Example* (Refer to **PASIN Quality Manual** for entire list of Plant Best Practices). Key Control Points, which are points that require particular attention, are noted in red text. The Quality Managers reviewed each of the Production Best Practices and Key Control Points, and assigned:

- Action steps that were completed to develop the *HMA Plan*
- Timeframe
- Responsibility for completion

The HMA Production QCP was submitted in the HMA Production and Paving Plan, for review and approval.

Chart D-1-Plant Quality Control Best Practices Example	
Phase Activity	Best Practice
1. Aggregate Storage and Handling	<ul style="list-style-type: none"> a. Aggregates meet specifications. b. Proper sizes being produced. c. Aggregate storage satisfactory. d. Stockpiles separated properly. e. Stockpiles constructed properly. f. Stockpiled aggregate handled correctly. g. Segregation being controlled. h. Mineral filler or hydrated lime kept dry.
2. Cold Feed Operation	<ul style="list-style-type: none"> a. Cold feed set-up in compliance with specifications. b. Cold feed bins contain proper size aggregates. c. Cold feed bins properly charged. d. Cold aggregate feeders perform satisfactorily. e. Cold aggregate feeders calibrated. f. Cold aggregate feeder gates set correctly. g. Cold aggregate feeding continuously.

Paving Operation Quality Control Plan (Field Best Practices)

Field (Laydown) Best Practices, 42 in total, were developed by experts in the production of Hot Mix Asphalt. Examples of the Best Practices for the Hot Mix Asphalt Laydown Practices are listed in *Chart D-2 Laydown Quality Control Best Practices*. (Refer to **PASIN Quality Manual** for entire list of Laydown Best Practices). Key Control Points, which are points that require particular attention, are noted in red text. The Quality Managers reviewed each of the Laydown Best Practices and Key Control Points, and assigned responsibility for the field paving crew and others, for implementing Best Practices, along with a timeframe for completion. The Best Practices and Key Control Points' Implementation Plan was submitted in the HMA Production and Paving Plan, for review and approval.

Chart D-2-Laydown Quality Control Best Practices Example		
Phase	Activity	Best Practice
Prepave Meeting	1. Submit Quality Control Plan	<ul style="list-style-type: none"> a. Methods, Personnel, equipment, and trucks. b. Paving interruptions, sequencing, etc.
Construction	2. Equipment Preparation	<ul style="list-style-type: none"> a. Set up pavers to meet the needs of the particular project. b. Perform needed servicing. c. Deliver equipment to the jobsite and park in a predestinated area. d. Arrange for proper number of trucks with experienced drivers to be available, when needed.
	3. Surface Preparation	<ul style="list-style-type: none"> a. Proper surface preparation to meet contract requirements. b. Clean existing surface. c. Patch, where necessary. d. Seal, where necessary. e. Cut paving notches, where necessary. f. Use temporary cold patch material where required and remove prior to paving. g. Verity the stability of the surface to be paved. h. Paint longitudinal and transverse joints with material specified.

Quality Management System

Quality Management System (QMS) Components were required to be developed in the HMA Plan. *Chart D-3 HMA Plan- Quality Management System Components* indicates the QMS Sections, along with information regarding the Section requirements.

Chart D-3-HMA Production and Paving Plan Development Quality Management System (QMS) Components	
(Source: PASIN Quality Manual)	
QMS Section	Requirements
Management Review	<p>Management Review is established to:</p> <ul style="list-style-type: none"> ❖ Establish a quality policy and measurable goals. ❖ Ensure availability of resources. ❖ Conduct periodic management reviews of the performance, in meeting quality policy and measurable goals. ❖ Communicate importance of meeting contractual, regulatory, and legal requirements, as well as satisfying the needs of the motoring public and other customers.
Customer Focus	Contractors are committed to external and internal customer satisfaction. Processes are in place to identify and correct customer complaints and concerns and gather other information about customer satisfaction.
Internal Audit	Internal audit plan and procedures are developed to assure that results comply with pilot project requirements. Internal audits are scheduled on the basis of importance and are carried out by qualified personnel. A summary of results and associated corrective actions is maintained and items requiring action are brought to the attention of the personnel responsible for the activity that was audited.
Corrective and Preventive Actions	Contractors use documented procedures to identify, analyze, and resolve problems identified by customer complaints, project or material nonconformities, and system noncompliances for corrective and preventive actions. Records to compile nonconformance reports, initiate corrective action, and track corrective action statuses are maintained.
Control of Nonconformance	Control of nonconformances includes identification, documentation, evaluation, disposition, and notification to all concerned parties. Records are maintained of nonconformances, actions taken and concessions obtained. Corrections made to eliminate or mitigate nonconforming conditions are verified.
Control of Documents	Documents are prepared, reviewed, approved by authorized personnel, and distributed to locations where essential operations are performed. Documents are revised, and disposed, as necessary, to provide appropriate control.
Control of Records	Records are maintained to provide evidence that the asphalt pavement delivery process and resulting projects meet requirements.

GAP ANALYSIS

Description

Gap Analysis was conducted by the PASIN Implementation Resource Team for both pilot project contractors. The Gap Analysis compares an organization's Quality Management System to the PASIN Quality Management System. This included conducting a Gap Analysis on the following requirements:

- ❖ Section 4 Quality Management System - Quality documents, control of documents and records.
- ❖ Section 5 Management Responsibility - Management commitment, customer focus, Quality policy and goals, planning, responsibility and authority, internal communication and management review.
- ❖ Section 6 Resources Management - Human resources, competence, training, and infrastructure.
- ❖ Section 7 Product Design, Construction, and Maintenance - Planning, customer related processes, design of product and development of construction and maintenance processes, purchasing, construction and maintenance processes.
- ❖ Section 8 Measurement, Analysis and Improvement - Monitoring and measurement of customer satisfaction, internal audit, monitoring and measurement of processes and products, control of nonconformances, analysis of data, and continual improvement.

Methodology

The PASIN Implementation Resource Team interviewed plant and paving personnel regarding Sections 4 through 8 of PASIN Requirements. The team used an audit checklist, customized for the construction industry, to maintain the consistency of information gathered at the two pilot project Companies. The documented findings of the Gap Analysis were provided to the companies and briefed at the vice president level in each organization. The Gap Analysis findings are proprietary to the pilot contractors, and will not be released, to maintain confidentiality.

Gap Analysis Findings

The Gap Analysis was divided into two major operational areas: HMA production at the plant, and HMA paving operations at the construction site. The "Findings" of the Gap Analysis were evaluated using the PASIN Quality Management System criteria as briefly defined below:

- **Points of Pride** - Methodologies, processes, or procedures used by an organization to produce performance results that are more effective or efficient than those achieved by other organizations.
- **Observations** - Requirements of the standard have been met. The observation details opportunities for improvement.

- **Minor Nonconformance** - Evidence indicates that one or more of the following does not meet requirements: (1) a non-systemic failure of the management system, (2) an isolated occurrence, or (3) conditions not likely to result in the failure of the management system.
- **Major Nonconformance** - Evidence indicates that one or more of the following does not meet requirement: (1) systemic failure of the management system, (2) conditions that could result in the delivery of nonconforming product, or (3) conditions that could result in the failure or reduced usability of products or services.

An example of the Gap Analysis Checklist, including the audit questions and findings is shown on *Chart G-1-Gap Analysis Matrix (Example)*. The checklist had 85 key focus areas based on the PASIN Quality Management System and 117 specific audit questions to evaluate the organizations quality system in relationship to the PASIN Standard.

Chart G-1-Gap Analysis Matrix (Example)		
PASIN	Interpretation for Contractors	Checklist Items
<p>5.4.1 Quality Goals <i>PASIN</i> QRE sets annual measurable quality goals for members of the network that are consistent with the quality policy. The quality goals are established at the beginning of each calendar year and the status of each objective is periodically reviewed. Annual quality goals are developed to improve durability and cause less disruption with improved cost effectiveness. These goals are intended to support recognizable improvements in effectiveness, product reliability, and customer care.</p>	<p>Top management should establish a set of quality objectives/metrics that provide for early identification of issues/concerns regarding project performance. Such metrics should consider the various functions (that is, purchasing, project management, welding, QA), and items such as:</p> <ul style="list-style-type: none"> • Percent of material/equipment delivered • Percent work completed • Safety performance 	<p>1.0 What are its quality objectives? Finding: <i>Other than meeting specific PENNDOT specifications, the company's quality objectives are not clearly known or communicated throughout the organization. (Major Nonconformance)</i></p> <p>2.0 How does top management set goals for quality objectives and monitor progress at achieving these goals? Finding: <i>The staff was unaware of any quality goals. (Opportunity for Improvement)</i> Finding: <i>In the spring, management requests supervisors to project goals for the construction season. Subsequently, in the fall, it compares results with these goals and assesses accomplishments. (Point of Pride)</i></p>

In general, the Gap Analysis observations of the pilot project contractors were consistent with those published in [Hot Mix Asphalt industry Baseline Assessment](#) (dated December 2006) conducted during the 2nd and 3rd quarters of 2006. However, the pilot projects' Gap Analysis was more detailed and company specific.

HMA PRODUCTION & PAVING PLAN IMPLEMENTATION

Best Practices Implementation

The contractors, upon obtaining approval of HMA Plan, implemented the HMA Plan. Implementation steps of Best Practices and Key Control Points included the following:

1. Quality Managers provided training to the plant and field personnel on the Best Practices and Key Control Points, to ensure their implementation. Quality Manager also provided training on new checklists, log reports, maintenance of records, etc.
2. Members of the PASIN Implementation Resource Team reviewed the implementation of Best Practices, during the placement of the binder course and provided suggestions to the contractors, to enable deploying improvements in the wearing course.
3. During the paving of the PASIN projects, the Best Practices were audited by internal auditors, to verify implementation.
4. PASIN auditors completed an external audit of the Best Practices implementation.

Contractors indicated that the Best Practices and Key Control Points were not new to their Companies. However, implementation of the entire Quality Management System components was unfamiliar, particularly in the documentation and resolution of the QMS Sections.

Quality Management System Implementation

The contractors, upon obtaining approval of HMA Plan, implemented the Quality Management System portion of the HMA Plan, as shown on *Chart I-2 HMA Plan Implementation-Quality Management System Components*.

Chart I-2-HMA Production and Paving Plan Implementation Quality Management System (QMS) Components	
QMS Section	Plan
Management Review	<ol style="list-style-type: none"> 1. The contractors identified a <i>Quality Policy</i> and <i>Quality Objectives</i> for the PASIN pilot projects. 2. The contractor identified a Management Review Team to review progress of the PASIN pilot project. A standard agenda was developed to guide the meetings.
Customer Focus	<ol style="list-style-type: none"> 3. Quality Manager identified the methodology of obtaining <i>Customer Requirements</i>, with both internal and external customers. The contractors also determined follow-up actions, as a result of customer complaints to improve customer focus on the PASIN projects.
Internal Audit	<ol style="list-style-type: none"> 4. The contractor identified internal names of auditors with management, plant, and field expertise in the company. 5. Internal audit training was provided by the PASIN Implementation Resource Team. 6. Quality Manager developed an internal audit plan, with plant experts auditing field operations and vice versa. Management staff also performed internal audits.
Corrective and Preventive Actions	<ol style="list-style-type: none"> 7. The Plant and Production Teams, along with the Quality Manager, determined the process for identifying, logging, improving, tracking and preventing <i>Corrective and Preventive Actions</i>. This included developing checklists, nonconformance reports, correction logs, etc.
Control of Nonconformance	<ol style="list-style-type: none"> 8. The Quality Manager determined the process for measuring and monitoring <i>nonconformances</i>. 9. Quality Manager developed nonconformance reports, and a process for logging and tracking nonconformances, in the plant and field operations.
Control of Documents	<ol style="list-style-type: none"> 10. Quality Manager identified company documents that need to be controlled. 11. Quality Manager developed a process for changes to existing documents or incorporating new documents and for removing obsolete documents.
Control of Records	<ol style="list-style-type: none"> 12. Quality Manager developed a process for identification, storage, protection, retrieval, retention and disposition of records.

INTERNAL & EXTERNAL AUDITS

Internal Audits

Implementation of Quality Management System requires conducting internal audits to assess compliance with the HMA Plan developed by contractors. Both contractors were not familiar with the process of conducting internal audits. The PASIN Implementation Team provided training on conducting internal audits to the contractors. The contractors developed an internal audit plan to assess the implementation of the approved HMA Plan. The audit teams included management, plant and paving experts auditing each other's areas. The Quality Managers developed an internal audit report, for distribution within the company.

External Audits

External audits were conducted by certified internal auditors on the PASIN External Audit Team. The audits conducted were approximately three hour overview of the key ISO requirements specified for the pilot projects. The audits were not to the level of detail of a registration audit or even a periodic audit of a registered company.

In general, both contractors displayed understanding of the PASIN requirements. The audit team was impressed with the QMS support systems developed by the contractors in the short timeframe of the projects. In fact, the reporting, monitoring and tracking systems employed for the pilot projects will become standard operating procedures for both companies. The audit team noted evidence that various Best Practices for the HMA production, transport, and laydown were accepted and the companies will use them for continual improvement efforts, as shown in the following Points of Pride:

- ❖ Top management displayed a serious commitment to the requirements of the pilot projects. Management reviews were held using a standard agenda and meetings were documented. Project objectives were communicated to key staff members.
- ❖ Management staff was involved with internal audits of the processes and audit findings were recorded. Corrective actions were recorded and tracked. Both companies developed an automated tracking system.
- ❖ Both companies developed more detailed "best practice" checklists as a reporting mechanism for production staff such as plant technicians, screed operators, roller operators, etc. The checklists were completed daily and submitted to the appropriate management person and the QM. The production staff used the form to communicate problems in the field.
- ❖ Corrective and preventive action reporting (CPAR) systems were initiated. The CPAR systems captured employee problems, customer complaints, and internal audit findings. Both companies use an automated reporting system to track recommended actions.
- ❖ Quality records for the processes audited were well organized and accessible to key management staff. One company has a fully automated system. The system will eventually connect all their HMA plants giving the Quality Manager instant access to required QC records.

- ❖ Training for key staff on the new QMS procedures was held and partially documented. The QMS will be a topic for internal winter schools.

The PASIN External Audit Team also identified Areas for Improvement for both the PASIN Team and the contractors:

- ❖ A procedure for change control should be implemented. Changes to control documents are not immediately available to key staff.
- ❖ The corrective action procedure should assess cause and effect in more detail. Problems are being identified; however, the corrective action recommendations may not include all causes. Furthermore, the recommended actions need to look at revisions to the QMS, if required.
- ❖ No evidence could be found from the contractors' standpoint that approved design revisions were communicated to persons responsible for the original design. This should be investigated in the next round of pilot projects.
- ❖ A system to document all training and the performance evaluation of employees should be developed. Both contractors used mentoring by experience staff to train new employees, but the effort is not documented and the trainee evaluated. Both companies acknowledged this deficiency.

Description

The efforts of the PASIN Construction Pilot Projects (Phase 1) are being used to develop a comprehensive set of metrics designed to drive processes that ensure quality. A project metric is defined as a system of quantitative parameters used to collect and analyze data to assess the degree of success of a project.

Metrics

The Quality Managers from the pilot projects and PAPA have reviewed and summarized performance and assisted with the development of recommended Project Metrics. Contractors monitored and measured their performance of the *Best Practices* and *Key Control Points* as follows:

1. How is the contractor using the Best Practices and Key Control Points, as implemented in the pilot, differently to improve the quality of products and processes?
2. How is the contractor collecting, recording, and monitoring data, and reacting to data to make adjustments to the HMA process?
3. How did the contractor react to recognized variances during production?
4. What Best Practices and Key Control Points have been in practice and which are new to the contractor?
5. Will the contractor implement any of the Best Practices beyond this project?

Based on the Quality Managers' assessments, the following metrics were developed for 2008 pilot projects:

Production

1. Gradation (% variation for each aggregate) for every 1000 tons.
2. HMA temperature for every fifth truck.
3. Plant shut downs.
4. Asphalt Content-Compare printed tickets to plant sample.

Laydown

1. Mat temperature behind the paver.
2. Stoppage of paver greater than ten minutes.
3. Percent improvement of pavement ride.
4. Tack sample.
5. Mat density.