
**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION**



FINAL

Plasphalt Project

**The Performance Evaluation of Hay Terrace
Plasphalt Project**

District 5-0, Wilson Borough

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Apex Companies, LLC

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1.0 INTRODUCTION

Under the Strategic Recycling Program, PennDOT provides assistance to Districts in the selection, performance evaluation of recycled materials and demonstration projects that incorporate recyclable materials. This report provides an overview on the paving operations and a 5-year performance evaluation of Hay Terrace Plaspalt Project performed in the Borough of Wilson, Pennsylvania. This report is intended to satisfy the demonstration project reporting requirements of the PennDOT Bureau of Construction and Materials (BCM).

The Borough of Wilson awarded two contracts to Lehigh Valley Site Contractors Inc. to perform Plaspalt paving of three residential streets within the Borough: Hay Terrace (2002), 21st Street and Jefferson Street (2003). This report provides the evaluation for the Hay Terrace plaspalt project; separate reports will be issued for the 21st Street and Jefferson Street plaspalt projects following the completion of the 5th year evaluation (2008).

1.1 Plaspalt Project Requirements

Hot mix asphalt concrete containing Treated Recycled Plastic Aggregate (TRPA) is referred to by the trade name PlaspaltTM (Plaspalt). TRPA material is composed of ground recycled thermoplastic, treated with a proprietary process to improve the bond strength between the plastic and asphalt binder. For the Wilson Borough project, TRPA materials were provided by Telecan International, Inc., Albuquerque, New Mexico, through a local plaspalt representative. At this time there is limited available research on the performance-related properties of plaspalt. Some initial studies suggest that plaspalt, when used as a pavement surface, has the potential to prevent or lessen the severity of rutting.

Local governments in Pennsylvania have been interested in the use of Plaspalt material for several reasons including: Liquid Fuels monies can be used to fund Plaspalt on

municipal projects; the resistance to rutting is reported in research, and there is a real and perceived potential benefit to the Commonwealth in the use of recycled plastic materials.

To address this interest in plaspalt use, PennDOT BCM developed use guidelines for municipalities and other entities interested in Plaspalt paving. These guidelines, *Instructions to Local Governments who agree to use Plaspalt Hot Mix Asphalt (HMA) Pavement Courses* and Plaspalt HMA Pavement Course Specifications are provided in Attachment 1.

Plaspalt specifications call for the use of hot mix asphalt (HMA) with some of the conventional aggregate substituted with treated recycled plastic aggregate (TRPA) to a maximum of 1.5% substitution. Because Plaspalt paving projects are considered experimental, BCM requires performance evaluations to compare them to standard paving mixes. As provided in Attachment 2, PennDOT Engineering Technology & Information (ETI) Division, Bureau of Construction Materials, provided Plaspalt specifications and a Draft Work Plan for Evaluation of Plaspalt Recycled Aggregate Substitute in HMA for Municipality Use and Specifications.

The use guidelines recommend that a minimum quantity of 600 tons, or 7,040 square yards (approximately one lane mile at 12 feet wide land at 1 ½” depth) of Plaspalt HMA Pavement course to be used to compare against a standard Superpave 9.5 mm pavement wearing course (control section). These guidelines also call for evaluations that involve crack and rut inspections on both control and plaspalt sections. Along with the crack surveys, string line or straightedge rut measurements, photo logs, and recording the dates and the severity of pavement are required to be taken and maintained throughout the five-year evaluation period.

Although minimum quantity requirements guidelines were not followed by the District, the application was monitored for performance.

2.0 HAY TERRACE PLASPHALT PROJECT

2.1 Plaspphalt Paving (2002)

The Hay Terrace Plaspphalt project was performed in District 5-0, Wilson Borough, between S. 18th to S. 20th Streets in Northampton County. This reconstruction project was performed as a Municipal Service Project #02-48-418-01, awarded to Lehigh Valley Site Contractors, Inc. Attachment 3 provides the Wilson Borough Plaspphalt Project contract information and Site Location Map.

The Hay Terrace project involved the installation of 6 inches compacted 2A Modified Subbase, 2.5 inches of ID-2 Binder, and the installation of 1.5 inches (9.5 mm) Superpave, 0.0-0.3 ESALs of Plaspphalt wearing course. Plaspphalt was prepared at the Hellertown Materials Asphalt Plant, Hellertown, PA. As noted in Section 1.0, PennDOT's BCM did not require control (non-plaspphalt) sections in this job. It was agreed by all parties, that field evaluations of the placement of materials and yearly visual inspections would be performed.

Plaspphalt paving was conducted on August 16, 2002, by Lehigh Site Contractors, Inc. (Lehigh). Representatives of PennDOT Bureau of Construction and Materials (BCM), District 5-0 Municipal Services, and the Pollution Prevention Section representatives were present during the paving operations and at the asphalt plant. Wilson Borough officials, including Mr. Greg Drake, Superintendent of Public Works, and plaspphalt representative, Mr. Terry Crouthamel, Sr. were also present intermittently for the paving activities. Approximately 400 tons of plaspphalt was used for this project. Batch ticket delivery slips show 9 batch deliveries, including 701 lbs. of TRPA (plastic) incorporated into the HMA. The TR1461 Field Evaluation Form and photographs of the operation are provided in Attachment 4.

Equipment used for paving included a Barber Green Model 211. For compaction, Lehigh used the Dynapac 422 (large roller), Ingersoll Rand Model DD34HF (small roller) and

Dynapac Model CC122 (small roller). The roller pattern for the wearing course was never established, leaving “rips” in the mat. Mix delivery temperature for plaspalt ranged from 295-315°F. Movement/displacement under roller was noticed at 210°F surface temperature. The first two loads may be been at the upper limit temperature, as conveyed by the Plant Inspector, and this may have contributed to the displacement observed. The larger roller (Dynapac 422) was substituted with two smaller rollers (halfway through the first lane of paving, in the direction of 18th to 19th Street). The larger roller was put back on the mat at about halfway through the second lane, with the small roller being used as a finish roller.

Density was not being achieved during paving. Non-nuclear density gauge reading was performed by BCM.

In conclusion, no rolling patterns were established for this project. Some rips were visually observed in the mat while rolling. It is undetermined whether the plastic component with the HMA mix contributed to the problem, or if it was due to the upper limit temperatures of first batch loads (Load #2 temperature at 325°F). It should be noted that standard mix asphalt may be tender at the same temperatures.

2.2 Asphalt Plant Production

PennDOT District 5-0 State Material inspectors, Mr. Dean Altamose and Mr. Keith Fink were present at the Hellertown Plant during plaspalt production. Standard aggregate dosing equipment was determined to not be functional for introduction of Treated Recycled Plastic Aggregate (TRPA) material into asphalt mixes in earlier projects. The Hellertown Asphalt Plant addressed this by adding a separate auxiliary hopper with pneumatic injection, and a separate dosing machine, specifically for the introduction of TRPA into the asphalt mix. TRPA was added to the hopper from cardboard boxes via a small front-end loader. Although adequate for this scale of operations, this method of TRPA addition would not be adequate for larger scale plaspalt projects. No problems were observed during production. Per batch slips, approximately 700 lbs of TRPA

material was used for the asphalt mix. See Attachment 5 for photographs of TRPA material and plant hopper systems. Attachment 6 provides plant job mix results and plaspfalt Test Results provided by contractor.

2.3 Plaspfalt Test Results

Three sets of three loosebox samples were collected from uncompacted mat and were analyzed by PennDOT BCM using a solvent extraction procedure (Immerex Extraction) using PTM No. 1, identified as A, B, C. Sample results in Attachment 6 show that the asphalt met specifications.

3.0 EVALUATIONS

3.1 First-year Performance Evaluation (2003)

The first-year evaluation was performed on August 28, 2003 by Mr. Joseph Kretulskie, District 5-0 Municipal Services and Jelena Vukov, Apex Companies, LLC (Apex) representing PennDOT Pollution Prevention Section – EQAD. The following summarized the key findings of the one-year visual evaluation. Attachment 7 provides photographs of the inspection.

- In general, the plaspphalt paving sections show good aging. No rutting or surface impairment was observed. Photos YR1-1 and YR1-2 show wearing surface conditions.
- Three turn locations, as shown in Attachment 7 on Critical Monitoring Areas figure, were identified to be closely monitored in future evaluations for possible rutting or pavement distress.
- The plaspphalt paving course (wearing) is predominantly dense in structure, with the exception of a portion at the very beginning of Hay Terrace and 18th Street. This portion was noted as being hand placed during initial paving operations.
- As expected, asphalt binder has worn off the wearing surface, showing coated aggregate and some plastic (TRPA) pieces.
- The predominant colors of TRPA visible are: red, yellow, and some blue. Plastic pieces are still embedded in the asphalt wearing coat, with no visible pieces dislodged along the road sides, along curbs. Grey and clear plastics were the predominant colors of plastic pieces (TRPA) introduced in the design mix. It is undetermined whether these predominant plastics color pieces have melted or are not visible at the surface.

3.2 Second-year Performance Evaluation (2004)

The second-year evaluation was performed on May 10, 2004 by Mr. Joseph Kretulskie, District 5-0 Municipal Services and Ms. Jelena Vukov (Apex). The following summarize

the key findings of the second-year visual evaluation. Attachment 8 provides photographs.

- In general, the plaspalt paving sections show good aging. No rutting was observed (see Photo YR2-1) at intersections or turn lane areas.
- A longitudinal crack (along 19th Street) was observed developing approximately 200 feet from Hay Terrace/19th Street intersection (see photo YR2-2).
- Close-ups of Hay Street/19th Street cracking shown on Photos YR2-3 and YR2-4. Maximum width approximately 1 inch and maximum depth at 1/8 – 1/4 inches.
- As expected, asphalt binder has worn off the wearing surface, showing coated aggregate and some plastic (TRPA) pieces. No visible difference to the paving surface in terms of exposed TRPA material was discernable from the previous inspection (first-year evaluation).
- Some staining, appearing to be vehicle oil/hydraulic fluid was observed along Hay Terrace between 18th and 19th Street. This is along shoulders, typically occupied by parked vehicles.

3.3 Third-year Evaluation (2005)

The third-year evaluation was performed on June 27, 2005 by Mr. Joseph Kretulskie, District 5-0 Municipal Services and Jelena Vukov (Apex) on behalf of the PPD-EQAD. Photographs are provided in Attachment 9. The following summarizes the key findings of the walkthrough and visual observations:

- Pavement shows normal wear.
- No rutting was observed at the entrance of Hay Terrace & 18th Street (as shown on Photo YR3-1).
- Slight rutting was observed approximately 205 feet from Hay Terrace/18th Street (beginning of paving – across from residential home addressed 1821 Hay Terrace). A deflection between 1/8” and 11/64” are shown on Photo YR3-2.

- The longitudinal crack (along 19th Street), first identified in second-year evaluation, was expanded at the 19th Street/Hay Terrace intersection (see Photo YR3-3). Close up of crack shown on Photo YR3-4. Maximum width of crack measured approximately 1 inch, maximum depth of crack ½ inches.
- Some painted utility markings observed at Hay Terrace/19th Street intersection (see photo YR3-5).
- No other signs of rutting or cracks observed on all other areas of plaspfalt pavement.

3.4 Fourth-year Evaluation (2006)

On-site evaluation was not performed at Hay Terrace plaspfalt project in 2006.

3.5 Fifth-year Evaluation (2007)

The fifth-year evaluation was performed on July 7, 2007 by Mr. Joseph Kretulskie, District 5-0 Municipal Services and Jelena Vukov (Apex) on behalf of the PPD-EQAD. The Following summarizes the key findings of the walkthrough and visual observations, with photographs provided in Attachment 10:

- No rutting was observed at turn lane along Hay Terrace/18th Street intersection (Photo YR5-1).
- Some cracking was visible along joint seal at the start of Hay Terrace (from 18th Street, as shown on Photo YR5-2). This was also the area of initial high temperature batch load.
- Some cracking was observed starting parallel to joint seal (see Photo YR5-3), within the high temperature batch load section. Location approximately 200 feet from Hay Terrace/18th Street intersection.
- Some surface fines loss was noted along traffic paths (less on sides where parking generally occurs).

- Pitting of surface was observed in vehicle parking areas (along curbs); this was identified in prior inspections as the “parking stained areas”, shown on Photo YR5-4.
- Cracking further expanded and deepened at Hay Terrace/19th Street intersection (see Photo YR5-5). Photo YR5-6 shows close up of expanded crack, largest depth at ½ inches, largest width approximately 1 inch measured.
- A series of new cracks observed formed along Hay Terrace, close to Hay Terrace/19th Street intersection towards. The location is approximately 20 feet from right curb, length of cracks, 20 feet and 46 feet, respectively.
- No rutting or cracking was observed at Hay Terrace/20th Street intersection.

4.0 CONCLUSIONS

The performance evaluation of plaspalt on Hay Terrace in Wilson Borough was performed over a 5-year period (2002-2007). Hay Terrace is considered a low ESAL residential street. Critical monitoring areas were selected to be closely observed during the evaluation period. The evaluations included asphalt testing and visual observations and measurements. Because of the paving quantities, no control sections were installed to compare the performance of plaspalt vs. conventional standard asphalt.

In general, the plaspalt pavement shows comparative aging to standard conventional asphalt mixes. Some cracking and minimal rutting has been observed during the five-year performance evaluation period. Long cracks observed on Hay Terrace (near 18th Street intersection) during the fifth year evaluation are likely a results of higher temperature loads placed in this area. The same failures are common for conventional asphalt mixes. Shorter cracks observed at 19th Street and Hay Terrace intersection were observed forming as early as the second year evaluation. This intersection has a concentration of utilities, which may contribute to this type of performance failure even for standard mixes.

It should be noted that TRPA material is no longer available to the Commonwealth for projects since 2003. It is recommended that any future plaspalt paving projects in the Commonwealth continue to undergo the performance evaluation process as stipulated in PennDOT BCM Use Guidance Document. Some general recommendations include:

- Plaspalt should only be used at site locations where it's promoted characteristics can be fully tested.
- Reject high temperature plaspalt loads.
- Obtain manufacturer certification on TRPA material, including production date and "shelf life" use restrictions.
- Require density testing and cores of base course for project documentation.

5.0 ACKNOWLEDGEMENTS

This 5-year evaluation and has been funded by the Pennsylvania Department of Environmental Protection through the Strategic Recycling Program as administered by PennDOT Pollution Prevention Section - EQAD.

A special appreciation is extended to Mr. Joseph Kretulskie, District 5-0 Municipal Services for his technical assistance and continual support on the Hay Terrace Plaspphalt project. Mr. Kretulskie has been instrumental in compiling test and technical information on plaspphalt materials, and assisting the Pollution Prevention Section – EQAD in performing the yearly performance evaluations on this project.

ATTACHMENT 1

Instructions to Local Government on Plasphalt Pavement Courses
Plasphalt HMA Pavement Course Specifications

Instructions to Local Governments who agree to use Plasphalt HMA Pavement Courses as an experimental feature.:

1. Following the guidelines in PENNDOT Pub. 242 (Pavement Policy Manual), specify the appropriate Superpave Asphalt Mixture Design, HMA Pavement Course(s) for the selected roadway.
2. In the contract, specify separate Construction Item Numbers and Quantities for the regular Superpave pavement course (control section) and the Plasphalt pavement course (experimental section). The local government will need to make a decision on how many tons or square yards of Plasphalt HMA Pavement Course are to be placed on the project. It is suggested that a minimum quantity of 600 tons or 7040 square yards (approximately 1-lane mile at 12 feet wide lane at 1½" depth) of Plasphalt HMA Pavement Course).

Example:

Item No. 0409-0484 Superpave Asphalt Mixture Design, HMA Wearing Course, PG 64-22, 0.3 to < 3 Million ESALs, 9.5 mm Mix, 1½" Depth, SRL-M

Item No. 2409-0484 Superpave Asphalt Mixture Design, HMA Wearing Course, PG 64-22, 0.3 to < 3 Million ESALs, 9.5 mm Mix, 1½" Depth, SRL-M (Plasphalt)

3. Include the attached bid document language, Plasphalt specifications, and Work Plan into the contract.
4. Indicate in the project plans or have the Engineer direct the Contactor to place the control sections and experimental sections in a typical evaluation pattern on the roadway (see attached workplan)
5. Notify Mr. Robin Sukley, of the PENNDOT ETI Division, when projects using Plasphalt will be constructed. Phone (717) 787-3137 or Email sukleyr@dot.state.pa.us

Include in Bid Documents:

Experimental Use of Plasphalt HMA Pavement Courses.

Where indicated on the plans or directed by the Engineer, place Plasphalt HMA Pavement Courses as an experimental feature. Construct Plasphalt HMA pavement courses in accordance with the attached Specification for Experimental Use of Plasphalt HMA Pavement Courses. Provide a Job Mix Formula for the Plasphalt HMA Pavement Course that uses the same materials and has the same or very similar aggregate gradation and asphalt content as the control section.

Where indicated on the plans or directed by the Engineer, place Superpave Asphalt Mixture Design, HMA Pavement Courses as a control section. Construct Superpave Asphalt Mixture Design, HMA Pavement Courses as specified and in accordance with Pub. 408, Sections 309 and/or 409.

HMA Producers are to contact a Plasphalt representative for technical assistance in developing job-mix formulas and producing Plasphalt HMA Pavement Courses.

**SPECIFICATION
PLASPHALT HMA PAVEMENT COURSES**

DESCRIPTION - This work is the construction of hot mix asphalt (HMA) using a combination of virgin aggregate and treated recycled plastic aggregate (TRPA) materials. Use a maximum of 1.5 percent TRPA material consisting of shredded, granulated, and treated recycled plastic from Plasphalt Project, LLC. Construct Plasphalt courses as specified in Sections 309 and 409 except as modified or supplemented as follows.

MATERIALS – Section 309.2 or 409.2 with additions and modifications as follows:

(b) Aggregate

5. Treated Recycled Plastic Aggregate (TRPA) Material. Provide TRPA material from Plasphalt Project, LLC. Provide TRPA material meeting the physical and chemical properties as recommended by the manufacturer. Include a description of the plan to control TRPA in the quality control plan. Keep all TRPA material free of foreign materials.

(d) Composition of Mixtures. As required by Section 309 or 409.2(d) and as follows:

The Plasphalt HMA mixture consists of the TRPA material, virgin aggregate(s), and bituminous material. Obtain samples of the TRPA material from the stockpile, as required in the quality control plan, and determine the average TRPA gradation. Maintain records of the testing of TRPA gradation and make available for review when directed. Determine the average stock gradations of virgin aggregate to be blended with the TRPA material. Determine the proportions of the TRPA and virgin materials to meet the specified mix composition requirements of virgin mixes. Prepare and test Superpave gyratory specimens as directed in Bulletin 27, Chapter 2A, and have the job-mix formula reviewed.

CONSTRUCTION - Section 309.3 or 409.3 with additions and modifications as follows:

(b) Bituminous Mixing Plant. Add the following:

1. Batch Plant. Modify the batch plant to allow measuring the mass (weight) of the treated recycled plastic aggregate (TRPA) material prior to incorporation into the pug mill. Design the cold feed bin, conveyor system, charging chute(s), and any special bins, if used, to avoid segregation and sticking of the TRPA material.

2. Drum Mixer Plant. Modify the drum mixer plant to prevent direct contact of the TRPA materials with the burner flame and/or overheating of the TRPA material in the process.

MEASUREMENT AND PAYMENT - Section 309.4 or 409.4

ATTACHMENT 2

PennDOT Draft Guidelines for Plasphalt Project Evaluations

By:

Date:

WORK PLAN

EVALUATION OF PLASPHALT RECYCLED PLASTIC AGGREGATE SUBSTITUTE IN HMA FOR MUNICIPALITY USE

INTRODUCTION: Plasphalt is a treated recycled plastic aggregate substitute for hot-mix asphalt (HMA) materials. Local government roadways in the state of Pennsylvania are interested in field use of Plasphalt material. The Plasphalt material potentially will prevent or lessen severity of rutting in hot-mix asphalt and also provides a potential use for recycled plastic.

OBJECTIVE: The objective of this research is to evaluate this Plasphalt for performance as compared to that of a standard paving mix.

(Set limits of the project include location map of projects)

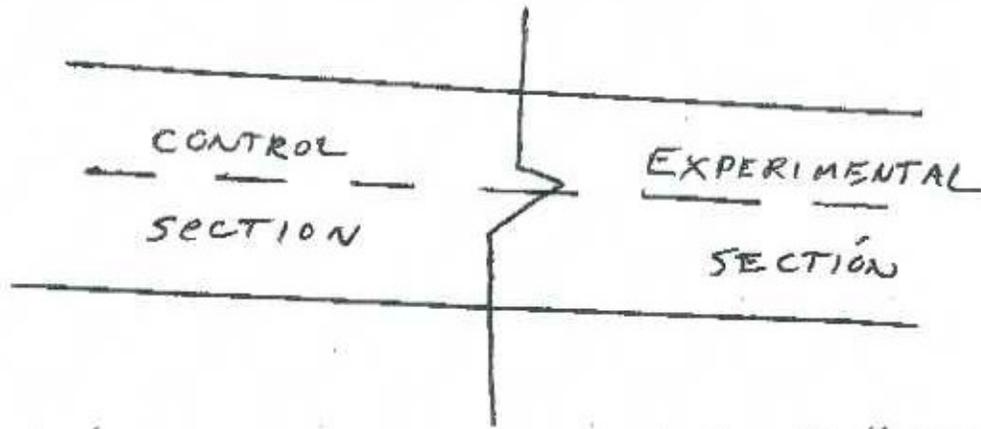
PLAN OF STUDY: The plan of study will be to compare Plasphalt pavement wearing course to standard Superpave 9.5 mm pavement wearing course (control section) on low trafficked roadways owned by various local governments. A control section of a standard Superpave 9.5 mm paving mix must be placed at the same time the Plasphalt pavement course is placed for proper comparison. The study will involve crack and rut inspections of both the Plasphalt and control sections. Inspections are to be conducted twice a year, for five years. Form TR 1461 (8-99) is to be filled out for each project site during each inspection. Along with the crack surveys, string line or straightedge rut measurements, photo logs recording the dates and the severity of pavement are to be taken and maintained.

Updates from these 20-30 projects by the Bureau of Municipal Services will be forwarded to Robin Sukley, Engineering Technology & Information Division, yearly, on the number, locations and status of all the municipal project sites.

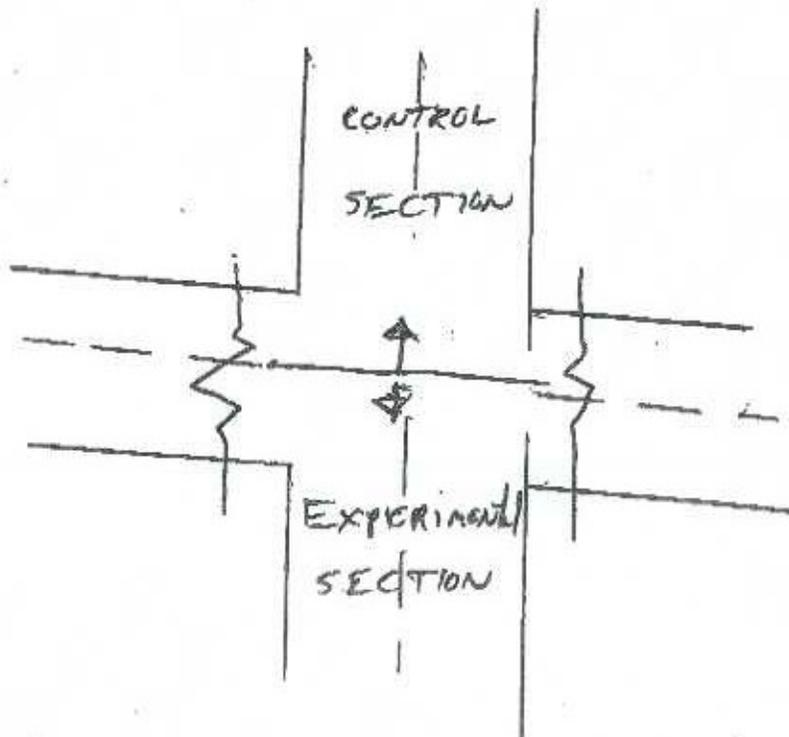
STAFFING: Research Project Manager: Pat Sullivan of the Department's Bureau of Municipal Services will be the centralized data collector for all local government projects and ensure that the biannual crack and rut inspections are performed on each project site.

REPORTING: A combination construction and final report will be written by the Research Project Manager within 90 days of collecting the final data at the end of the five-year evaluation period. The report will provide the findings, conclusions, and recommendations for potential implementation of Plasphalt pavement courses.

SCHEDULE: This will be a five-year evaluation.



Typical Roadway Evaluation Pattern



Typical Intersection Evaluation Pattern
 MODIFY FOR FIELD CONDITIONS



FIELD EVALUATION FORM

Information for project and product identification for use with FHWA Form 1461

Product/Technology Name* _____

Project Name* _____

Construction Project No.* _____

District Contact Person _____ Phone No. _____

Location*: District _____ County _____
SR# _____ Segment _____ Offset _____

Anticipated Date of Construction _____

Date Work Plan Approved _____ Date Feature Constructed _____

Date Evaluation Scheduled to End _____ Actual End of Evaluation _____

Construction Quantity _____ Units _____ (sy, cf, lf, m², m³, m, etc.)

Material/Technology Purpose/ Use* _____

Product PE# (if known) _____

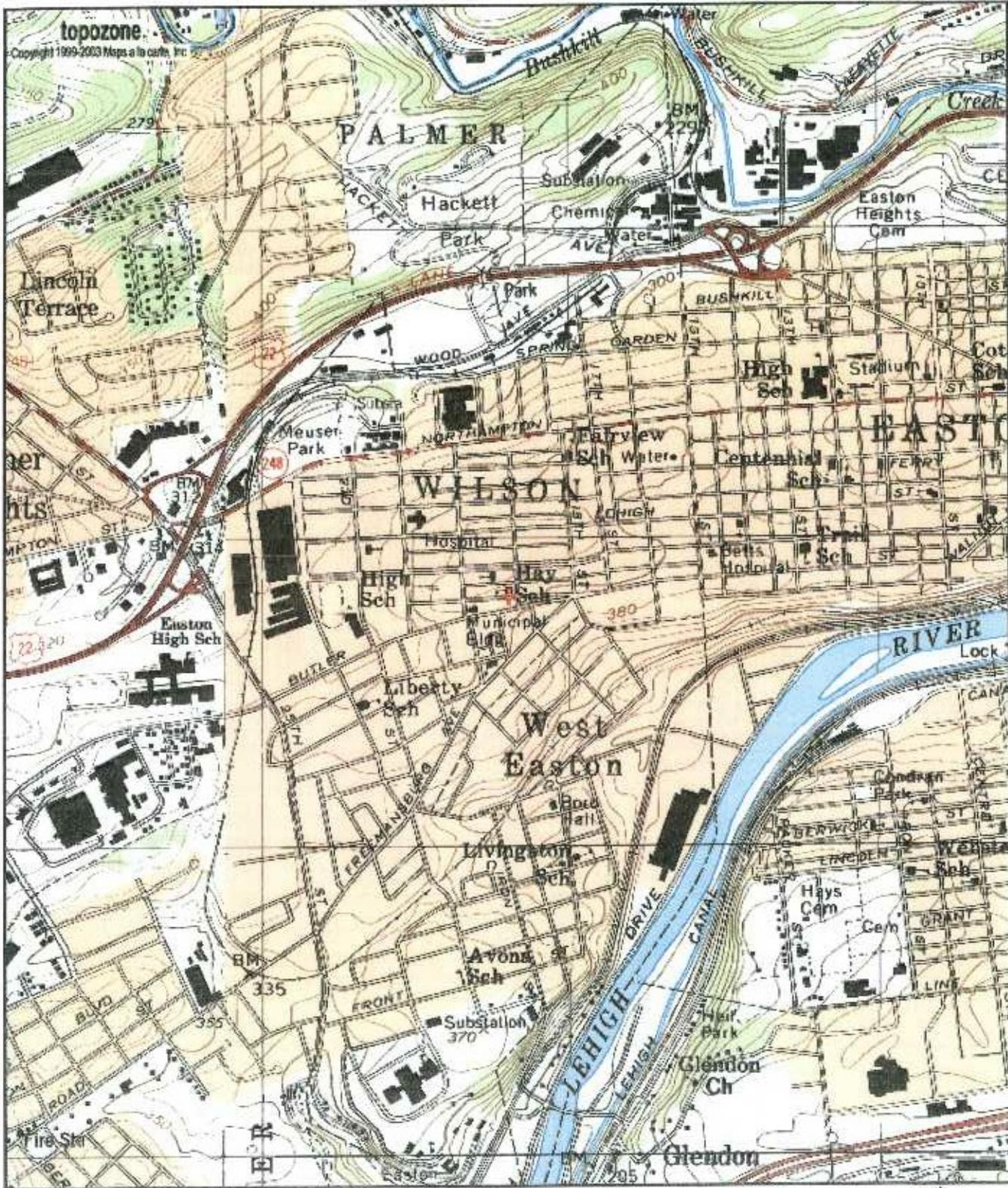
Comments

*Denotes minimum information required. Other information to be provided if available at time of notification or initiation.

If you have any questions concerning this form, please call the Engineering technology and Information Division, Bureau of construction and materials at (717) 787-36580. This information can be faxed to ETI at (717) 783-5955

ATTACHMENT 3

Project Contract
Site Location Map



0 0.3 0.6 0.9 1.2 1.5 km

0 0.1 0.2 0.3 0.4 0.5 mi

UTM 18 479761E 4503589N (NAD27)
Hay School, USGS EASTON (NJ) Quadrangle
 Projection is UTM Zone 18 NAD83 Datum

M = 12,397
 G = -0.156

GREG DRAPE
BOARD SUPER

MS-44 (6-89)



PROPOSAL & CONTRACT
(WHEN EXECUTED)

Instructions on Page 4

(THIS PROPOSAL INCLUDES
INSTRUCTION TO BIDDERS)

A. DEPOSIT OF PROPOSALS:

All envelopes containing Bid proposals shall
be clearly marked "Bid Proposal for Letting of

DATE

MUNICIPALITY (NAME & TYPE)

Sealed Proposals will be received on or before
on the above Letting Date.

TIME

SECRETARY

Bids will be opened and read at approximately
on the above Letting Date.

TIME

ADDRESS

PROPOSALS MUST BE MAILED OR OTHERWISE
DELIVERED TO THE ABOVE ADDRESS.

1. The contractor proposes to furnish and deliver all materials (including Form TR-485, Daily Bituminous Mixture Certification) and to do and perform all work on the following project as more specifically set forth in the Schedule of Prices (Attachment), in accordance with drawings and specifications on file at The Borough of Wilson as well as the supplements and special requirements contained herein and/or attached hereto and current PennDOT Specifications (Publication 408), except (a) bidders **MUST** be pre-qualified by Penn DOT (See Attachment 1A), and (b) Marshall testing of bituminous paving materials is not required (Sec. 401).
2. If designated as the successful bidder, the contractor will begin work on the date specified in the notice to proceed or as otherwise provided in the special requirements, and will complete all work within 90 working days.
3. Accompanying this proposal is a certified check or bid bond in the amount of 10% made payable to the municipality as a proposal guarantee which, it is understood, will be forfeited in case the contractor fails to comply with the requirements of the proposal.

B. PROPOSAL OF:

Lehigh Valley Site Contractors, Inc.
5143 Lower Mud Run Road
Easton, PA 18040

NAME / ADDRESS OF CONTRACTOR

CONTRACTOR'S CERTIFICATION

It is hereby certified as follows:

1. The only persons interested in this proposal as principals is (are):
Lehigh Valley Site Contractors, Inc.
2. None of the above persons are employees of the municipality.
3. This proposal is made without collusion with any other person, firm or corporation.
4. All plans and specifications referred to above and the site of the work have been examined by the contractor. The contractor understands that the quantities indicated herein are approximate and are subject to change as may be required; and that all work is payable on the basis of the unit prices listed on the Schedule of Prices (Attachment 1)

curb and gutter, construction of new curb, construction of 8 handicap ramps, removal and replacement of 4 storm sewer inlets, the excavation of the existing roadway, hauling and disposal of all excavated materials, grading and compaction of roadway sub-grade, the installation grading and proper compaction of 6 inches of 2A Modified aggregate, the installation and compaction of 2 1/2 inches of ID-2 Binder, the installation and compaction of 1 1/2 inches of Plaspalt, sealing of curb line and utilities with Polymer Modified Crack Sealant, and the placement of 4 inches of topsoil and seeding between new curb and old sidewalk.

The existing roadway to be reconstructed is approximately 1,100 feet in length and approximately 36 feet in width. The project will consist of two phases. Phase 1 will consist of completion of all described work on Hay Terrace from South 18th Street to South 19th Street. Phase 2 will consist of completion of all described work on Hay Terrace from South 19th Street to South 20th Street. No work may begin on Phase 2 until the completion of Phase 1. The reconstruction of Hay Terrace will not be completed through the intersection of South 19th Street. South 19th street will be skipped so as not to interfere with traffic.

This project is subject to prevailing wages. See attached prevailing wage sheets.

There are no plans for this project. The contractor will be responsible for all necessary construction surveying, engineering services, and stake out necessary to complete the described project.

The contractor will be responsible for maintenance and protection of traffic in accordance with Penn DOT Publication 203. Project must be accessible to local traffic upon completion of each day of work. Take all necessary safety precautions to provide for the safe passage of vehicles and pedestrians.

No portion of the work shall be sublet without the approval of the Borough and no Sub-Contractor shall be employed unless in the opinion of the Borough he is reliable, responsible and competent to do the work in accordance with the specifications. The names of all Sub-Contractors proposed to be used shall be submitted in writing to the Borough before such work is started.

It shall be the responsibility of the Contractor to exactly locate, as necessary, and in accordance with PA ACT 287 all existing utilities on the project site and to avoid all unnecessary conflicts therewith. The Borough does not guarantee the accuracy of the location of the present subsurface utility installations or structures shown on the drawing. The Contractor will be held responsible for all damage to facilities and or drainage structures caused by his operations, and

ATTACHMENT #1

LOCATION OF WORK:

The Borough of Wilson

5. The contractor will comply with all requirements of the laws and implementing regulations of the Commonwealth of Pennsylvania and the United States relating to human relations, equal opportunity and non-discrimination in employment, and will pay to workmen employed in the performance of the contract the wages to which they may be entitled.

- 4. The contractor will comply with all requirements of the laws and implementing regulations of the Commonwealth of Pennsylvania and the United States relating to human relations, equal opportunity and non-discrimination in employment, and will pay to workmen employed in the performance of the contract the wages to which they may be entitled.
- 5. The contractor will provide the municipality with a performance bond, conditioned upon the faithful performance of the contract in accordance with the plans, specifications and conditions thereof, and a payment bond, conditioned on the prompt payment of all material furnished and labor supplied or performed in the prosecution of the work, in accordance with the Public Works Contractors' Bond Law of 1967; and an affidavit accepting the provisions of the Workmen's Compensation Act of 1915, as amended.

Lehigh Valley Site Contractors, Inc.
CONTRACTOR

WITNESSED OR ATTESTED BY:

Stephen M. Nelson
TITLE: Stephen M. Nelson, Vice-Pres./Asst. Sec. (SEAL)



H. Christian Budenz
TITLE: H. Christian Budenz, Vice-Pres./Asst. Sec. (SEAL)

TO BE EXECUTED ONLY IN THE EVENT THE ABOVE PROPOSAL IS ACCEPTED

ACCEPTED ON: 3-25-02
DATE

Borough of Wilson
MUNICIPALITY

ATTESTED BY: Bet Reiss
TITLE



Karol Johnson
TITLE

TITLE

ATTACHMENT #1 A

1. SCOPE OF WORK

The Contractor will provide all labor, material, and equipment necessary to perform all work complete in-place. All work shall be in conformance with Penn DOT Publication 408, latest edition, and the specifications stated within.

The work described involves the reconstruction of 2 blocks of Hay Terrace. The reconstruction involves the removal of trees and stumps, the demolition of the existing concrete curb and gutter, construction of new curb, construction of 8 handicap ramps, removal and replacement of 4 storm sewer inlets, the excavation of the existing roadway, hauling and disposal of all excavated materials, grading and compaction of roadway sub-grade, the installation grading and proper compaction of 6 inches of 2A Modified aggregate, the installation and

ATTACHMENT #1 A (continued)

such damage will be repaired at the expense of the Contractor in accordance with applicable utility or Borough specifications.

The contractor shall be responsible for locating a site for disposal of any excavated material, which site shall be subject to the approval of the Borough, and Contractor shall also obtain written approval from the property owner for said disposal and submit a copy to the Borough prior to starting any work.

The contractor agrees to indemnify and save harmless the Borough, and all personnel from all suits and actions of every nature and description brought against them or any of them, for or on account of the use of patented appliances, products, or processes, and he shall pay all royalties and charges which are legal and equitable. Evidence of such payment or satisfaction shall be submitted upon request to the Borough as a necessary requirement in connection with the final execution of any contract in which such patented appliances, products, or processes are used.

Provide appropriate Erosion and Sedimentation Controls along project area. Including, but not limited to : supply and install silt sacks on existing and or new storm sewer inlets.

The successful bidder must provide a three-year maintenance bond (100 % first year, 75 % second year, and 50 % third year) upon completion of project.

All bidders must be pre-qualified by Penn DOT by the date and time of the bid. Bidders must be pre-qualified for the following work classification codes. PROOF OF PRE-QUALIFICATION WORK CLASSIFICATION CODES MUST BE SUBMITTED WITH THE BID DOCUMENTS.

PENN DOT PRE-QUALIFICATION WORK CLASSIFICATION CODES

- | | | |
|----|---|--|
| 1. | C | Excavating & Grading |
| 2. | E | Flexible Base Course |
| 3. | F | Bituminous Pavement |
| 4. | H | Drainage, Water Main, Storm Sewer |
| 5. | K | Curbs, Sidewalks, Inlets, Manholes, Etc. |
| 6. | M | Landscaping |
| 7. | Q | Maintenancce and Protection of Traffic |

ATTACHMENT #1 A (continued)

A. REMOVAL OF 3 EXISTING TREES AND 5 TREE STUMPS

Contractor will be responsible for removing 3 trees and 5 tree stumps in Phase 1. Trees are approximately 36 inches in diameter. There are no trees or stumps to be removed in Phase 2. Haul processed trees and stumps to suitable location for disposal in a suitable manner.

B. DEMOLITION OF EXISTING CONCRETE CURB AND GUTTER

Remove existing concrete curb and gutter in Phase 1 and 2. Concrete gutter is buried under approximately 1" of bituminous material. Remove, haul, and dispose of all debris. In Phase 1 in front of Lot # 995 approximately 50 feet of existing concrete curb does not get removed (curb was recently replaced).

C. RECONSTRUCTION OF APPROXIMATELY 2300 LF CONCRETE CURB

Construct curbing to existing curb elevation. Provide any necessary construction surveying and engineering to achieve the correct curb elevation. Curb must be installed with a slip form machine. No forming of curb will be accepted except at locations not accessible with the slip form machine. Curb dimensions shall be 18 inches in depth and 7 inches in width at the top of curb. Curb reveal shall be 7 inches. Refer to Penn DOT RC-64M for complete diagram of curb dimensions. Contractor will be responsible for replacing existing concrete driveway aprons that extend from curb to existing sidewalk, this will be considered incidental to construction of concrete curb. Take necessary precautions to eliminate cracking of curb at undesired locations. Cracked curbing will be considered defective and will be removed and replaced at no expense to the Borough.

D. CONSTRUCTION OF 8 HANDICAP RAMPS

Install 4 ramps in Phase 1 and 4 ramps in Phase 2. Be sure not to install ramps in such a location as to interfere with existing storm sewer inlets. Refer to Penn DOT drawings for detailed specifications.

E. REMOVE AND REPLACE 4 STORM SEWER INLETS

Two storm sewer inlets will be replaced in Phase 1 and two storm sewer inlets will be replaced in Phase 2. Remove the 4 existing storm sewer inlets, haul, and dispose of debris. Replace storm sewer inlets with standard size inlets. Perform all necessary surveying and engineering services necessary to obtain inlets with correct dimensions. It is not the intent of this contract to replace any of the storm sewer pipes. Should any pipe become damaged as a result of replacing the 4 storm sewer inlets in Phase 1 and Phase 2 the contractor will be required to replace the damaged pipe at no additional expense to the Borough. Any new pipe necessary for connecting new storm sewer inlet to existing pipe will be the responsibility of the contractor and will not be paid for separately.

F. EXCAVATION OF ROADWAY

Excavate existing road to 17 inches below existing curb elevation. This will allow for a 7 inch curb reveal, 1 1/2 inches of Plaspalt, 2 1/2 inches of ID-2 Binder, and 6 inches of 2A Modified aggregate. Provide for cross slopes as shown on Typical Cross Section #1. Haul all necessary material to approved site

ATTACHMENT #1 A (continued)

for disposal. Grade roadway sub-grade to within 1/2 inch of desired sub-grade elevation, after compaction. Achieve 95 % compaction and proof roll with loaded tri-axle prior to placing sub-base material.

G. INSTALLATION OF 6 INCHES COMPACTED 2A MODIFIED SUB-BASE

Install 6 inches compacted of 2A Modified aggregate. Install aggregate in 2 lifts. Be sure to apply water to sub-base material immediately prior to compaction. Achieve 95 % compaction prior to placing the second lift of aggregate. Grade roadway sub-base to within 1/2 inch of desired elevation after compaction. Prepare sub-base in such a way as to not cause segregation of aggregate. If segregation occurs and compaction cannot be achieved in the segregated area, this area will be considered defective and must be removed and replaced at no additional cost to the Borough. After completion of sub-base, compacted depth checks will be performed. If compacted depth is deficient by 1/2 inch or greater, area will be considered defective and must be removed and replaced at no additional cost to the Borough.

H. INSTALLATION OF 2 1/2 INCHES COMPACTED ID-2 BINDER

Prior to the installation of ID-2 Binder, tack coat all vertical surfaces. Provide a paver equipped with grade and slope controls so as to ensure correct cross slope is maintained and also correct curb reveal is maintained. Trucks will not be permitted to clean-out in front of paver and no piles are to be paved over. Provide trucks for a suitable place to clean-out. Remove this material from jobsite at the end of each working day. Install 2 1/2 inches compacted of ID-2 Binder. After completion of the bituminous base course, compacted depth checks will be performed. If compacted depth is deficient by 1/2 inch or greater, the project will be considered defective and must be removed and replaced at no additional cost to the Borough.

I. INSTALLATION OF 1 1/2 INCHES COMPACTED PLASPHALT

Refer to attached PLASPHALT specifications. Prior to the installation of PLASPHALT wearing course, place tack coat on existing ID-2 Binder surface. Provide a paver equipped with grade and slope controls so as to ensure correct cross slope is maintained and also correct curb reveal is maintained. Trucks will not be permitted to clean-out in front of paver and no piles are to be paved over. Provide trucks for a suitable place to clean-out. Remove this material from jobsite at the end of each working day. Install 1 1/2 inches compacted of PLASPHALT. After completion of the bituminous wearing course, compacted depth checks will be performed. If compacted depth is deficient by 1/4 inch or greater, the project will be considered defective and must be removed and replaced at no additional cost to the Borough. The final curb reveal must be 7 inches. If reveal is deficient by 1/2 inch, project will be considered defective and must be removed and replaced at no additional cost to the Borough.

ATTACHMENT #1 A (continued)

J. SEALING PROJECT AFTER COMPLETION OF OVERLAY

Sealing shall be done with a Polymer Modified Joint and Crack Sealant which meets the ASTM 3405 specification. Provide and use equipment specifically designed for the application of this material. Seal curb-line, around utilities, around storm sewer inlets, and where new PLASPHALT overlay ties into existing bituminous overlay. Sealant shall be placed 12 inches wide.

K. TOPSOIL PLACEMENT AND SEEDING

Place 4 inches of screened topsoil between new curb and old sidewalk on left and right side of Phase 1 and Phase 2. Install Kentucky Blue Grass seed or equivalent to manufactures specifications. Provide necessary protection of soil until germination of seed occurs. Contractor will be responsible for re-seeding if failure occurs.

THIS PORTION TO BE COMPLETED BY THE MUNICIPALITY

LOCATION OF WORK: The Borough of Wilson
Hay Terrace
From South 18th Street to South 20th Street

DESCRIPTION OF WORK:
The work will be performed complete in-place including maintenance and protection of traffic. The project consists of removal and replacement of the existing concrete curb, installation of 8 handicap ramps, removal and replacement of 4 existing storm sewer inlets, excavation of existing bituminous roadway, hauling and disposal of all excavated materials, installation of 6 inches of 2 A Modified, installation of 2 1/2 inches of ID-2 Binder, installation of 1 1/2 inches of Plaspfalt, Sealing along curb and around utilities with Polymer Modified Crack Sealant, top soil and seeding.

THE SUCCESSFUL BIDDER MUST PROVIDE A THREE-YEAR MAINTENANCE BOND (100 % FIRST YEAR, 75 % SECOND YEAR, 50% THIRD YEAR) UPON COMPLETION OF CONTRACTED WORK.

ESCALATOR CLAUSE :

| SCHEDULE OF PRICES | | | | | |
|---|---------------------------|----------|---|---------------|--------------|
| 1. Item No. | 2. Approximate Quantities | 3. Units | 4. *Description | 5. Unit Price | 6. Total |
| 1 | 1 | LUMP SUM | TOTAL BID FOR WORK DESCRIBED ABOVE AND IN ATTACHMENT #1 A | | \$186,065.80 |
| *DESCRIPTION: Must include ADT on wearing surfaces. USE OF CUTBACK ASPHALT IS PROHIBITED BETWEEN MAY 1st AND OCTOBER 31st EXCEPT AS NOTED IN BULLETIN NO. 25. | | | | | \$186,065.80 |
| TOTAL AMOUNT OF BID | | | | | \$186,065.80 |

SPECIFICATION PLASPHALT HMA PAVEMENT COURSES

DESCRIPTION - This work is the construction of hot mix asphalt (HMA) using a combination of virgin aggregate and treated recycled plastic aggregate (TRPA) materials. Use a maximum of 1.5 percent TRPA material consisting of shredded, granulated, and treated recycled plastic from Plasphalt Project, LLC. Construct Plasphalt courses as specified in Sections 309 and 409 except as modified or supplemented as follows.

MATERIALS - Section 309.2 or 409.2 with additions and modifications as follows:

(b) Aggregate

5. **Treated Recycled Plastic Aggregate (TRPA) Material.** Provide TRPA material from Plasphalt Project, LLC. Provide TRPA material meeting the physical and chemical properties as recommended by the manufacturer. Include a description of the plan to control TRPA in the quality control plan. Keep all TRPA material free of foreign materials.

(d) Composition of Mixtures. As required by Section 309 or 409.2(d) and as follows:

The Plasphalt HMA mixture consists of the TRPA material, virgin aggregate(s), and bituminous material. Obtain samples of the TRPA material from the stockpile, as required in the quality control plan, and determine the average TRPA gradation. Maintain records of the testing of TRPA gradation and make available for review when directed. Determine the average stock gradations of virgin aggregate to be blended with the TRPA material. Determine the proportions of the TRPA and virgin materials to meet the specified mix composition requirements of virgin mixes. Prepare and test Superpave gyratory specimens as directed in Bulletin 27, Chapter 2A, and have the job-mix formula reviewed.

CONSTRUCTION - Section 309.3 or 409.3 with additions and modifications as follows:

(b) Bituminous Mixing Plant. Add the following:

1. **Batch Plant.** Modify the batch plant to allow measuring the mass (weight) of the treated recycled plastic aggregate (TRPA) material prior to incorporation into the pug mill. Design the cold feed bin, conveyor system, charging chute(s), and any special bins, if used, to avoid segregation and sticking of the TRPA material.

2. **Drum Mixer Plant.** Modify the drum mixer plant to prevent direct contact of the TRPA materials with the burner flame and/or overheating of the TRPA material in the process.

MEASUREMENT AND PAYMENT - Section 309.4 or 409.4



An Equal Opportunity Employer

LEHIGH VALLEY SITE CONTRACTORS, INC.

Excavating & Paving, Residential • Commercial • Industrial

5143 LOWER MUD RUN ROAD - EASTON, PA 18040

Telephone
(610) 515-9000
FAX
(610) 515-9768

March 27, 2002

Borough of Wilson
2040 Hay Terrace
Easton, PA 18042
Attention: Walter Boran

RE: Reconstruction of Hay Terrace

Dear Mr. Boran:

We thank you for the opportunity of working with you on this project. We find that the key to a successful project for both parties is good communications.

In an effort to maintain a good system of communications, we offer the following:

1. If you have any concerns with project progress, manpower, and the day to day field operations:
 - a. Contact Jim Kertsmar, Supervisor in charge on site at 1-215-588-2375.
 - b. You may also contact Lehigh Valley Site Contractors, Inc. at 610-515-8700 and ask for our dispatchers, Al Albrecht or John Doran. They will either address your concerns directly, or have Jim Haines, our outside Superintendent, return your call in a prompt manner.
2. For changes to the scope of the contract work, change order requests, or any other pricing changes you may need, please call Steve Gooley at 610-515-9000.

It is the intent of Lehigh Valley Site Contractors, Inc. to give all of our customers the utmost satisfaction and respect. If, for any reason, you are not satisfied with the service you are receiving, please contact me at your earliest convenience.

Respectfully yours,

A handwritten signature in black ink, appearing to read 'Steven Gooley', is written over a horizontal line.

Steven Gooley
Project Administrator

SG/ams

ATTACHMENT 4

Initial Paving Field Evaluation Form

Initial Paving Photographs



FIELD EVALUATION FORM

Information for project and product identification for use with FHWA Form 1461

Product/Technology Name* PLASHALT (9.5 mm), Hellertown Materials

Project Name* Wilson Borough, Reconstruction of Hay Terrace from 18th to
South 20th St.

Construction Project No.* Municipal Services Project #02-48-418-01

District Contact Person Joseph Kretulskie Phone No. 610-798-4229

Location*: District 5-0 County Northampton
SR# Hay Terrace Segment _____ Offset _____
(18th -20th) Street

Anticipated Date of Construction 08-16-02

Date Work Plan Approved 08-15-02 Date Feature Constructed 08-16-02

Date Evaluation Scheduled to End 8-16-02 Actual End of Evaluation 08-16-02 (next in 6 mos)

Construction Quantity 400 Units tons (sy,cf,lf,m², m³, m, etc.)

Material/Technology Purpose/ Use* See Design Mix

Product PE# (if known) Robin Sukley, Bureau of Const. & Materials (717) 787-3137

Comments

Difficulty in obtaining compaction, possibly due to high temperatures of delivered materials. No rolling pattern established. Movement/displacement of the material under roller (large) observed - possibly due to high temperatures. Large roller left "rips" in the mat while rolling flat. No plastics visible in mix. Contractor's test results ran at Hellertown and Coopersburg indicate material met specifications.

*Denotes minimum information required. Other information to be provided if available at time of notification or initiation.

If you have any questions concerning this form, please call the Engineering technology and Information Division, Bureau of construction and materials at (717) 787-36580. This information can be faxed to ETI at (717) 783-5955

If you have any questions concerning this form, please call the Engineering technology and Information Division, Bureau of construction and materials at (717) 787-3137. This information can be faxed to ETI at (717) 783-5955

Construction Record

CONTRACTOR/PRODUCER Lehigh Valley Site Contractors Inc.

(Please attach a copy of the JMF's)

LIST TOOLS/EQUIPMENT USED

Paving equipment: Barber Green Model 211

Compaction Equipment: Dynapac 422 (large roller)

Ingersoll Rand Model DD34HF (small roller)

Dynapac Model CC122 (small roller)

ROLLER PATTERN never establish ROLLER PICK-UP yes no

Roller left "rips" in the mat while being rolled flat.

MIX DELIVERY

TEMPERATURE N/A control 295-315°F Plasphalt

WEATHER Hot and humid, temp. mid 90's, foggy (Ambient 87-93°F
@8-11:30 AM

List any problems during

construction? Movement/displacement under roller was noticed at 211°F
surface temperature. The first two loads may have been at the
upper limit temp., as per Plant Inspector. Larger roller replaced
with two smaller rollers (halfway point in the first lane of
paving). However, density was not being achieved. *

Bi-Annual Performance Record (CONTROLS MAY NEED TO BE INSTALLED
PRIOR)

Pavement Condition Rating Form

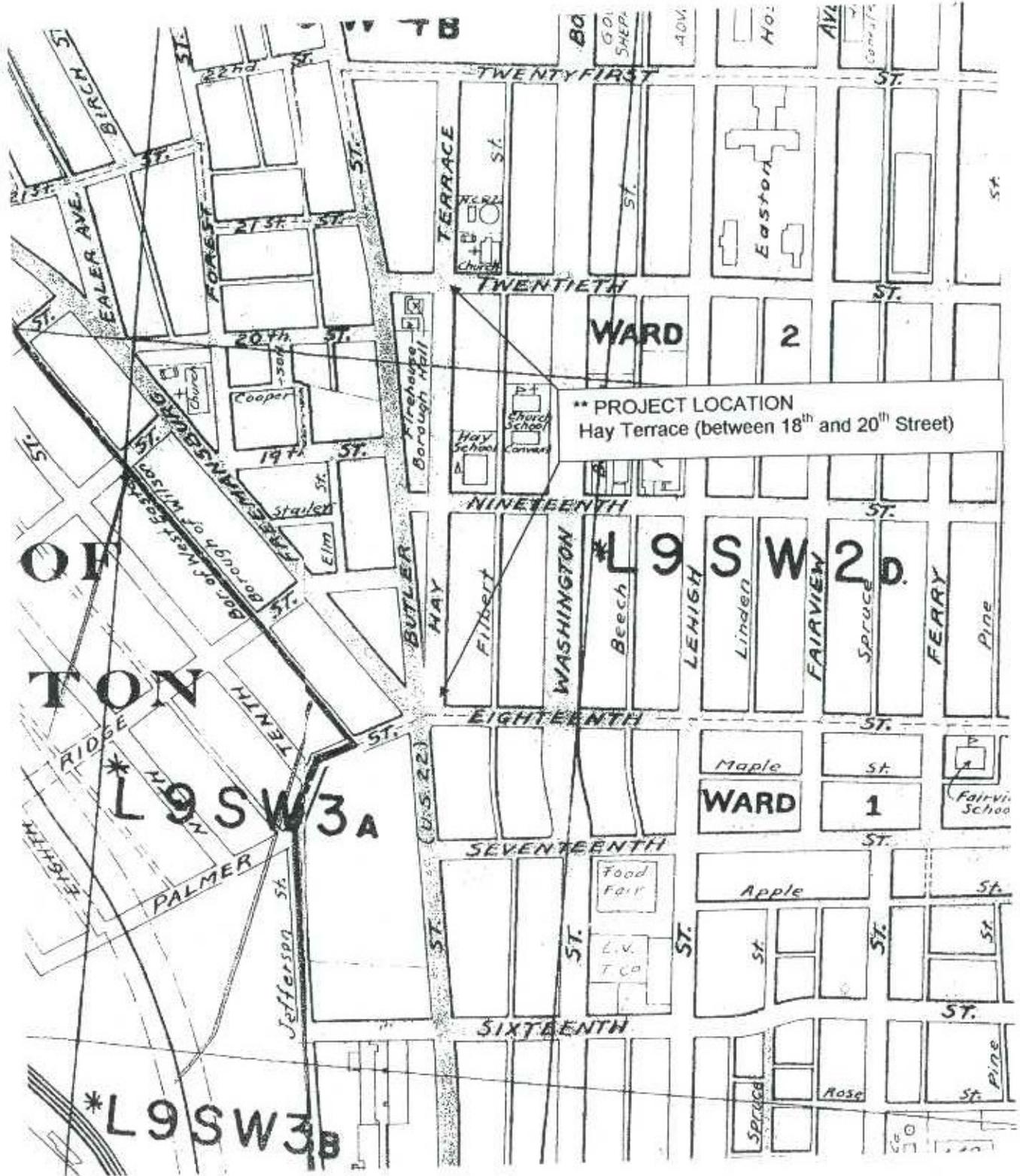
CRACKING TYPE & LOCATION (video logging may be substituted)

RUT MEASUREMENTS & LOCATION

String line or straight edge method

SHOVING? _____ EARLY AGEING? _____

*Robin Sukley noted that seven vibratory passes with larger roller were needed to achieve 92% or > density.



**** PROJECT LOCATION**
 Hay Terrace (between 18th and 20th Street)

SCALE = 1" 400'

| | | |
|--|---|---|
|  <p>220 North Park Road Reading, Pennsylvania 19610 TELEPHONE: (610) 371-8400</p> | FIGURE 1 Plasphalt HMA Paving | Contract # Project # 9023.013.03 |
| | BOROUGH OF WILSON NORTHAMPTON COUNTY MAP | Drawn/Checked: DMW CAD File Date: 2/2/03 Scale: AS SHOWN |

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

www.dot.state.pa.us
Engineering District 5-0
1713 Lehigh Street
Allentown, Pennsylvania 18103



Wilson Borough, Northampton County, Plaspalt Paving Project on 8-16-02
Municipal Services Project #02-48-418-01, Lump sum bid: \$186,065.80, Contractor: Lehigh Valley Site Contractors, Inc. 5143 Lower Mud Run Road Easton, PA 18040.

Project was a reconstruction of Hay Terrace from South 18th Street to South 20th Street. Scope of work: Removal and replacement of existing concrete curb, installation of 8 handicap ramps, removal and replacement of 4 existing storm sewer inlets, excavation of existing bituminous roadway, hauling and disposal of all excavated materials, installation of 6 inches of 2 A Modified, installation of 2.5 inches of ID-2 Binder, installation of 1.5 inches of Plaspalt. Sealing along curb and around utilities with Polymer Modified Crack Sealant, topsoil and seeding. (See contract for more details)

PIM No.1 set up to collect samples based on time. Collected 3 sets of 3 loosebox samples. The contractor's foreman scooped loose sample material out of the uncompacted mat. Samples collected at approximately the following times: #1-8:23 AM, #2-10:19 AM, #3- 11:51 AM. 3 samples collected at each time increment and identified as A, B, C.

Paving equipment used: Barber Green model 211
Compaction equipment: Dynapac 422 (large roller), Ingersoll Rand Model DD34HF (small roller), Dynapac Model CC122 (small roller)

On site monitoring: Jelena Vukov, P.E., Apex Environmental, Inc. Phone: 610-662-7428
Robin Suckley, PENN DOT Bureau of Construction and Materials, EII Div. Phone: 610-787-3137
Carl Lubold P.E., LTAP Phone: 717- 772-1978
Joseph S. Kretulskie, PENN DOT District 5-0 Municipal Services Specialist, Phone: 610-798-4229

Also on site from time to time: Terry Crothermill Jr. & Sr. as Plaspalt representatives.

Paving started at approximately 7:45 AM and ended at about 3:00PM

Material: 9.5mm superpave, 0.0 – 0.3 ESALs, 1.5" Depth, from Hellertown Materials, (see mix design SP95). Batch ticket delivery slip: 9 batches of 5000 lbs. including 70lbs. TRPA (plastic)

Field observations:

Load #2 Temp. – 325 Deg., 295 Deg.

Load # 11 Temp – 305 Deg.

Load # 12 Temp – 315 Deg., Yield check: 44,142 lbs truck slip, paving area: 195' x 12' = 260 S. Y.
= 170 lbs/SY

Load # 14 Temp. – 315 Deg.

Movement/displacement of the material under the roller was noticed at 210 Deg. Surface Temp. At first the contractor thought the material was too hot. The first two loads may have been at the upper limit Temp as per plant Inspector. Contractor took the large roller off the mat and replaced it with two small rollers. This was done at about the half way point in the first lane of paving. But according to Contractor's nuclear technician, density was not achieved. Large roller was put back on the mat at about halfway

through the second lane with the small roller being used as a finish roller. Robin Suckley noted that seven vibratory passes with the large roller were needed to achieve 92% or > density. This seem excessive especially when I was told the large roller was set at high amplitude.

No obvious characteristics were visually noticeable in the mix. It looked like a fine graded wearing course. No plastic could be seen.

Before paving, the Contractor swept the road with a street sweeper and tack coated the road with a distributor. Curbing and joints were also tack coated.

Robin Suckley was using his electronic density gauge, but without a core density result the results were only an estimate. Robin said he might arrange to have cores cut for information density testing by PENN DOT Materials and Testing Division. Robin and Jelana were each given companion loose samples.

Contractor's test results ran at Hellertown and Coopersburg both indicate Material met specifications.

State Material Inspectors Dean Altamose and Keith Fink were at the Hellertown Plant during production. I was in communication a number of times by phone during the day. Dean provided a disc of digital pictures taken of the TRPA (plastic) addition system on the plant.

Opinion: Paving went slow, rollers never established a consistent rolling pattern, large roller left many "rips" in the mat that while rolled flat, may open up in the future.

Copies of material delivery slips were requested from the Borough twice, but as of this date were not received.

Joseph S. Bretulskie

ATTACHMENT 4 INITIAL PAVING



IP-1
Initial paving operation. Conventional paving equipment used for placement



IP-2
Batch load temperatures monitored during deliveries. Load showed elevated temperature (approx. 315°F) Placement area from intersection of Hay Terrace/18th street.



IP-3
Rips observed in high batch load placement.

**ATTACHMENT 4
INITIAL PAVING**



IP-4
Smaller rollers substituted in use due to movement/displacement observed.



IP-5
Loose box samples collected from mat for testing.

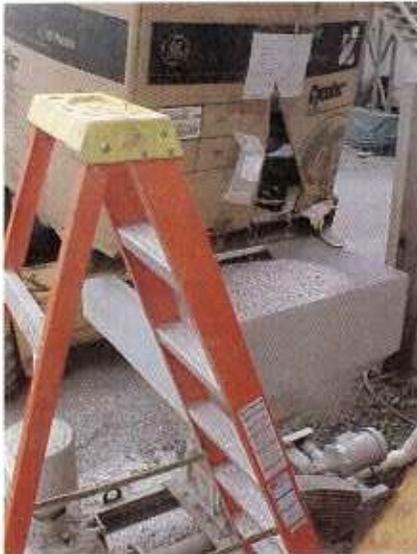
ATTACHMENT 5

Hellertown Materials Plant Photographs

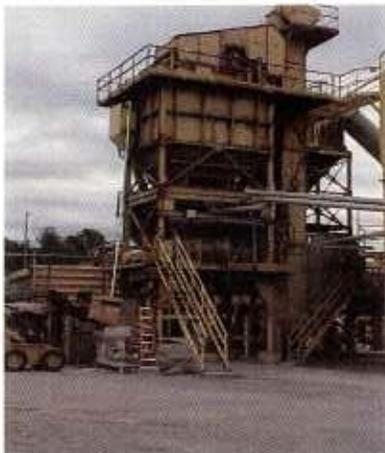
**ATTACHMENT 5
HELLERTOWN MATERIALS PLANT**



TRPA Materials provided in cardboard boxes from New Mexico manufacturer.



TRPA introduced into batch mix through separate auxiliary hopper with pneumatic injection.



Hellertown Materials Asphalt Plant.

ATTACHMENT 6

**Job Mix Formulas
Plasphalt Test Results**



JOB MIX FORMULA REPORT

JMF No.

0 2 S 0 1

SUPPLIER CODE

HEL48A41

MATERIAL CLASS

S P 9 5

AGGREGATE SRL

M

Date: July-02 Spec 9.5mm <3 ESAL Plasphalt Tons P.O.

Suppliers Name: Hellertown Materials Location Hellertown, PA

Bituminous Plant Type: McCarter-AB Daily Capacity: 5000lb. Batch Mix Time

CMS NO. SR Sec. Dry Wet

| Material Supplier Code | Material Supplier Name | Material Code | Material Class | % in Mix | Bulk Sp.Gr. | % Absorption |
|---|------------------------------------|---------------|----------------|----------|-------------|--------------|
| SCI48A14 | Stockertown Materials | 207 | B3 | 63.3 | 2.757 | 0.38 |
| SCI48A14 | Stockertown Materials | 203 | A8 | 29.0 | 2.729 | 0.7 |
| | Treated Recycled Plastic Aggregate | 203 | TRPA | 1.4 | 0.96 | |
| | Citgo | Asphalt | PG 64-22 | 6.3 | 1.031 | - |
| Alternate AC Suppliers CHEV2-15, COAS4-15, VALR1-15, TRUM3-15 | | | | | | |

JOB MIX FORMULA AND DESIGN

| | AC % | 75µm #200 | 150µm #100 | 300µm #50 | 600µm #30 | 1.18 #16 | 2.36 #8 | 4.75 #4 | 9.5 3/8" | 12.5 1/2" | 19.0 3/4" | 25.0 1" | 37.5 1 1/2" | 50.0 2" | F/A % | Pb _e % |
|-------------|------|-----------|------------|----------------|-----------|----------|---------|---------|----------|-----------|-----------|---------|-------------|---------|-------|-------------------|
| Design | 6.3 | 5.0 | 7 | 10 | 18 | 30 | 45 | 71 | 97 | 100 | | | | | 0.8 | 6.1 |
| % Virgin AC | 6.3 | | | % Reclaimed AC | | | | | | | | | | | | |

MIX CHARACTERISTICS (GYRATORY)

| Design ESALS | Gyrations @ Nini | Gyrations @ Ndes | Gyrations @ Nmax | Max Density (kg/m ³)/Sp.Gr. | Ndes Density (kg/m ³)/Sp.Gr. |
|----------------|------------------|------------------|------------------|---|--|
| < 0.3 | 6 | 50 | 75 | 2.444 | 2.345 |
| % Voids @ Nini | % Voids @ Ndes | % Voids @ Nmax | % VMA @ Ndes | % VFA @ Ndes | Weight @115mm |
| 13.8 | 4.1 | 2.9 | 17.8 | 77.3 | 4806 |

IGNITION FURNACE DATA

| Oven Make | Set. Temp. | Sample Size | A.C. Correction Factor (C _i) | #200 Correction Factor (200C _i) |
|------------|------------|-------------|--|---|
| Thermolyne | 538 | 1200 | 1.52 | 0.1 |

COMBINED AGGREGATE CONSENSUS PROPERTIES

| AASHTO T176 | AASHTO T304 | ASTM D5821 | ASTM D4791 |
|-----------------|--------------------------|-----------------------------|------------------|
| Sand Equivalent | Uncompacted Void Content | Coarse Aggregate Angularity | Flat & Elongated |
| 85.0 | 49.0 | (1 Face) 100 / (2 Face) 100 | 2.6 |

Designed by Joseph R. Smith - Asphalt Consultant Date 8/5/2002

Approved & Submitted by *Edward Morrison* Edward Morrison 125 Date 8/5/2002

Reviewed by Materials Unit *Joseph R. Smith* Sign Print Tech. ID# Date *8/12/02*

AGGREGATE GRADATIONS AND CONSENSUS PROPERTIES

| | |
|-----------------------------|-------------------------|
| Plant: Hellertown Materials | Nominal Size: 9.5 mm |
| Designed By: Joe Smith | Million ESAL: < 0.3 |
| Date: July-02 | SRL: M |
| | Asphalt Grade: PG 64-22 |

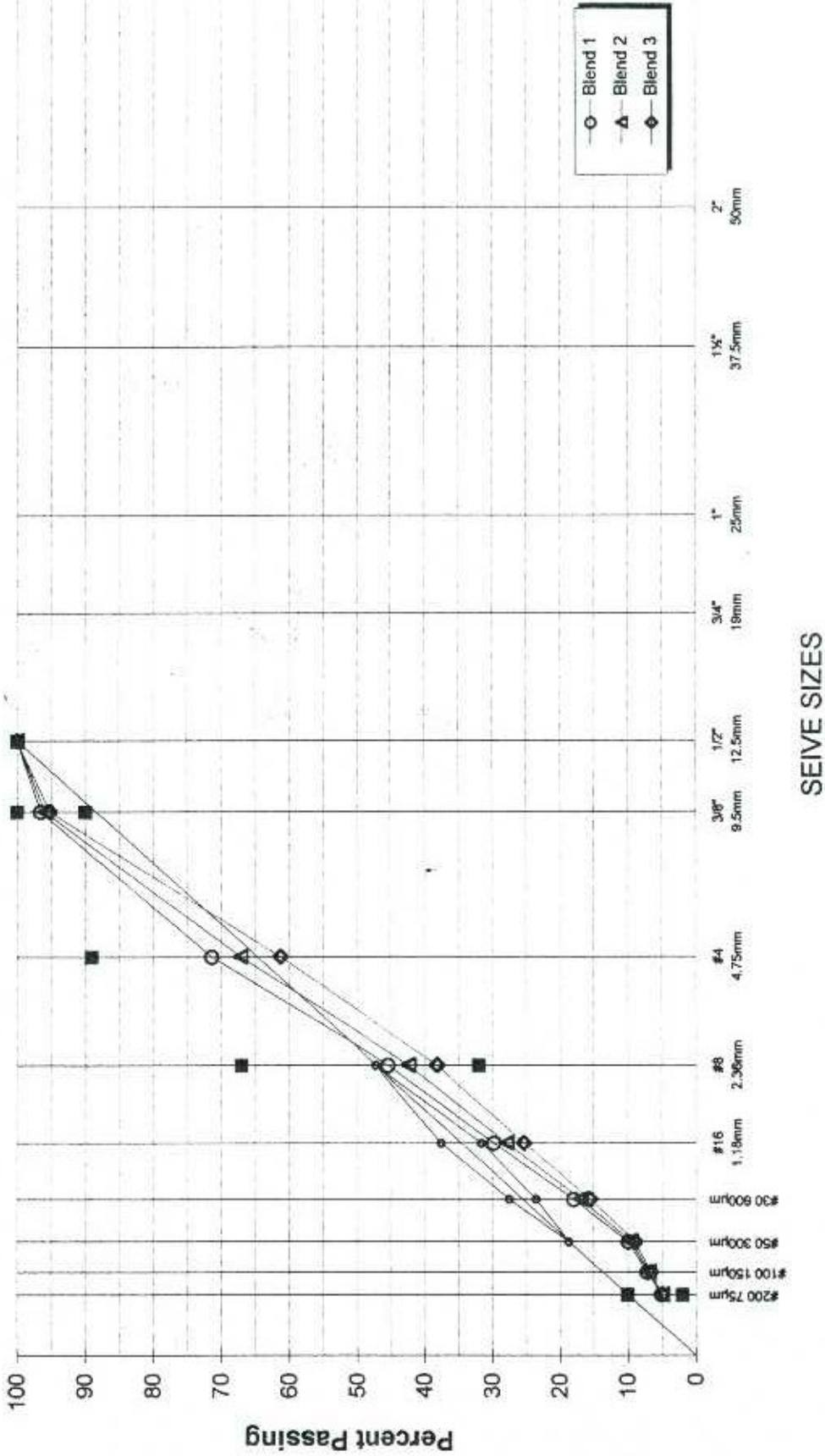
| | Supplier Name | Supplier Code | Material Code | Material Class | % In Blend | | |
|-------|------------------------------------|---------------|---------------|----------------|------------|---------|---------|
| | | | | | Blend 1 | Blend 2 | Blend 3 |
| Agg 1 | Stockertown Materials | SCI48A14 | 207 | B3 | 67.5 | 62.5 | 55.5 |
| Agg 2 | Stockertown Materials | SCI48A14 | 203 | A8 | 31.0 | 36.0 | 43.0 |
| Agg 3 | Treated Recycled Plastic Aggregate | | 203 | TRPA | 1.5 | 1.5 | 1.5 |
| Agg 4 | | | | | | | |
| Agg 5 | | | | | | | |
| Agg 6 | | | | | | | |
| Agg 7 | | | | | | | |

| Sieve Size | | AGGREGATE GRADATIONS | | | | | | | TRIAL BLENDS | | | Specification | |
|---|----------|----------------------|-------|-------|-------|-------|-------|-------|--------------|---------|---------|---------------|-----|
| Metric | Standard | Agg 1 | Agg 2 | Agg 3 | Agg 4 | Agg 5 | Agg 6 | Agg 7 | Blend 1 | Blend 2 | Blend 3 | Min | Max |
| 50mm | 2" | | | | | | | | | | | | |
| 37.5mm | 1 1/2" | | | | | | | | | | | | |
| 25.0mm | 1" | | | | | | | | | | | | |
| 19.0mm | 3/4" | | | | | | | | | | | | |
| 12.5mm | 1/2" | 100.0 | 100.0 | 100.0 | | | | | 100 | 100 | 100 | 100 | |
| 9.5mm | 3/8" | 100.0 | 89.0 | 100.0 | | | | | 97 | 96 | 95 | 90 | 100 |
| 4.75mm | #4 | 98.0 | 12.0 | 99.0 | | | | | 71 | 67 | 61 | | 89 |
| 2.36mm | #8 | 65.0 | 3.0 | 30.0 | | | | | 45 | 42 | 38 | 32 | 67 |
| 1.18mm | #16 | 43.0 | 2.0 | 6.0 | | | | | 30 | 28 | 25 | | |
| 600µm | #30 | 26.0 | 1.0 | 2.0 | | | | | 18 | 17 | 15 | | |
| 300µm | #50 | 14.0 | 1.2 | 0.7 | | | | | 10 | 9 | 9 | | |
| 150µm | #100 | 10.0 | 1.0 | 0.4 | | | | | 7 | 7 | 7 | | |
| 75µm | #200 | 6.7 | 1.3 | 0.1 | | | | | 5.0 | 5.0 | 5.0 | 2 | 10 |
| #200 Adjustment for Baghouse Fines Being Added (+) or Removed (-) | | | | | | | | | 0.1 | 0.3 | 0.7 | 2 | 10 |

| | | | | | | | | | Blend 1 | Blend 2 | Blend 3 | Min | Max |
|-------------------|-------|-------|-------|--|--|--|--|--|---------|---------|---------|-----|-----|
| Bulk SpGr (Gsb) | 2.757 | 2.729 | 0.960 | | | | | | 2.673 | 2.672 | 2.670 | | |
| App. SpGr (Gsa) | 2.786 | 2.782 | 0.960 | | | | | | 2.708 | 2.707 | 2.707 | | |
| Absorption | 0.38 | 0.70 | | | | | | | 0.47 | 0.49 | 0.51 | | |
| Sand Equivalency | 85.0 | | | | | | | | 85.0 | 85.0 | 85.0 | 40 | |
| Flat & Elongated | | 2.6 | | | | | | | 2.6 | 2.6 | 2.6 | | 10 |
| Uncompacted Voids | 49.0 | | | | | | | | 49.0 | 49.0 | 49.0 | - | |
| CA Angularity (1) | | 100 | | | | | | | 100 | 100 | 100 | 55 | |
| CA Angularity (2) | | 100 | | | | | | | 100 | 100 | 100 | - | |

| | | | | |
|---------------------------------|--|-------|-------|-------|
| Estimated % Binder of Mix (Pbi) | Gse (est.) | 2.701 | 2.700 | 2.700 |
| | Ws | 2.279 | 2.278 | 2.278 |
| | Vba (est.) | 0.009 | 0.009 | 0.009 |
| | Vbe (est.) | 0.110 | 0.110 | 0.110 |
| | Estimated asphalt contents based on ASTM PP28 calculations | 5.1 | 5.1 | 5.1 |
| | The asphalt content of the trial blends will be | 5.8 | 5.8 | 5.8 |

**TRIAL BLEND GRADATIONS
SEIVE SIZES RAISED TO .45 POWER**



Plant: Hellertown Materials
 Designed By: Joe Smith
 Date: July-02

Nominal Size: 9.5 mm
 Million ESAL: < 0.3
 SRL: M
 Asphalt Grade: PG 64-22

MAXIMUM SPECIFIC GRAVITY AND EFFECTIVE ASPHALT

Plant: Hellertown Materials
 Designed By: Joe Smith
 Date: July-02

Nominal Size: 9.5 mm
 Million ESAL: < 0.3
 SRL: M
 Asphalt Grade: PG 64-22

A. MAXIMUM Sp.Gr. OF TRIAL BLENDS (Gmm)

| Sample No. for Tested Mix | Blend 1 | | Blend 2 | | Blend 3 | | |
|---------------------------|----------------------------------|--------|---------|--------|---------|--------|--------|
| | 1 | 2 | 1 | 2 | 1 | 2 | |
| A | Dry Weight of Sample | 1597 | 1601.2 | 1559.9 | 1565.2 | 1695.1 | 1682.3 |
| D | Mass of Pyc. + Water | 7314.9 | 7314.9 | 7314.9 | 7314.9 | 7314.9 | 7314.9 |
| E | Mass Pyc. + Mix + Water | 8265.6 | 8263.2 | 8242.7 | 8245.3 | 8321.0 | 8314.1 |
| | Vol. Voidless Mix (A + D - E) | 646.3 | 652.9 | 632.1 | 634.8 | 689.0 | 683.1 |
| Gmm | Max. Sp.Gr. of Mix (A / A+D-E) | 2.471 | 2.452 | 2.468 | 2.466 | 2.460 | 2.463 |
| | | | 2.462 | | 2.467 | | 2.462 |

B. EFFECTIVE Sp.Gr. OF TOTAL AGGREGATE (Gse)

| | | | | | | | |
|-----|--------------------------|--|-------|--|-------|--|-------|
| Gmm | Max. Sp. Gr. (Rice) | | 2.462 | | 2.467 | | 2.462 |
| Pb | % A.C. in Test Mix | | 5.8 | | 5.8 | | 5.8 |
| Gb | Sp. Gr. of Binder | | 1.031 | | 1.031 | | 1.031 |
| Pmm | Percent of Total Mixture | | 100 | | 100 | | 100 |
| Gse | Eff. Gravity of Agg. | $\frac{(P_{mm}-P_b)}{(P_{mm}+G_{mm})-(P_b+G_b)}$ | 2.691 | | 2.698 | | 2.691 |

C. ASPHALT ABSORPTION OF MIX (Pba)

| | | | | | | | |
|-----|----------------------|---|-------|--|-------|--|-------|
| Gse | Eff. Gravity of Agg. | | 2.691 | | 2.698 | | 2.691 |
| Gsb | Bulk Gravity of Agg. | | 2.673 | | 2.672 | | 2.670 |
| Gb | Sp. Gr. of Binder | $100 \cdot G_b \cdot \frac{(G_{se}-G_{sb})}{(G_{sb} \cdot G_{se})}$ | 1.031 | | 1.031 | | 1.031 |
| Pba | Absorbed Asphalt | | 0.26 | | 0.38 | | 0.31 |

D. EFFECTIVE ASPHALT CONTENT IN MIX (Pbe)

| | | | | | | | |
|-----|--------------------|----------------------------------|------|--|------|--|------|
| Pba | Absorbed Asphalt | | 0.26 | | 0.38 | | 0.31 |
| Ps | % Agg. in Test Mix | | 94.2 | | 94.2 | | 94.2 |
| Pb | % A.C. in Test Mix | | 5.8 | | 5.8 | | 5.8 |
| Pbe | Effective Asphalt | $P_b - (P_{ba} + 100) \cdot P_s$ | 5.6 | | 5.4 | | 5.5 |

INITIAL TRIAL BLEND RESULTS AND ANALYSIS

| | |
|--|--|
| Plant: Hellertown Materials Designed By: Joe Smith Date: July-02 | Nominal Size: 9.5 mm Million ESAL: < 0.3 SRL: M Asphalt Grade: PG 64-22 |
|--|--|

| Blend 1 | | | | | Sample Height | | Maximum Theoretical Gravity (Gmm)= 2.462 | | | | | |
|---------|------------|-----------------|------------|-----------|---------------|----------|--|-------------|------------|-------------|-------------|-------------|
| | Dry Weight | Weight In Water | SSD Weight | Gmb @Ndes | @Nini 6 | @Ndes 50 | %Gmm @Nini | Voids @Nini | %Gmm @Ndes | Voids @Ndes | VMA @Ndes | VFA @Ndes |
| Spec. 1 | 4583.6 | 2580.6 | 4609.8 | 2.259 | 126.9 | 113.9 | 82.4 | 17.6 | 91.8 | 8.2 | 20.4 | 59.8 |
| Spec. 2 | 4596.5 | 2577.8 | 4629.3 | 2.241 | 129.1 | 116.0 | 81.8 | 18.2 | 91.0 | 9.0 | 21.0 | 57.1 |
| | | | | | | | | | | 8.6 | 20.7 | 58.5 |

| Blend 2 | | | | | Sample Height | | Maximum Theoretical Gravity (Gmm)= 2.467 | | | | | |
|---------|------------|-----------------|------------|-----------|---------------|----------|--|-------------|------------|-------------|-------------|-------------|
| | Dry Weight | Weight In Water | SSD Weight | Gmb @Ndes | @Nini 6 | @Ndes 50 | %Gmm @Nini | Voids @Nini | %Gmm @Ndes | Voids @Ndes | VMA @Ndes | VFA @Ndes |
| Spec. 1 | 4595.7 | 2588.7 | 4624.5 | 2.257 | 127.8 | 114.7 | 82.1 | 17.9 | 91.5 | 8.5 | 20.4 | 58.3 |
| Spec. 2 | 4568.4 | 2575.1 | 4612.3 | 2.242 | 128.3 | 127.8 | 90.5 | 9.5 | 90.9 | 9.1 | 21.0 | 56.7 |
| | | | | | | | | | | 8.8 | 20.7 | 57.5 |

| Blend 3 | | | | | Sample Height | | Maximum Theoretical Gravity (Gmm)= 2.462 | | | | | |
|---------|------------|-----------------|------------|-----------|---------------|----------|--|-------------|------------|-------------|-------------|-------------|
| | Dry Weight | Weight In Water | SSD Weight | Gmb @Ndes | @Nini 6 | @Ndes 50 | %Gmm @Nini | Voids @Nini | %Gmm @Ndes | Voids @Ndes | VMA @Ndes | VFA @Ndes |
| Spec. 1 | 4802.3 | 2705.7 | 4832.1 | 2.258 | 134.3 | 120.0 | 82.0 | 18.0 | 91.7 | 8.3 | 20.4 | 59.3 |
| Spec. 2 | 4603.2 | 2580.5 | 4632.1 | 2.244 | 128.9 | 115.8 | 81.9 | 18.1 | 91.2 | 8.8 | 20.9 | 57.9 |
| | | | | | | | | | | 8.6 | 20.7 | 58.6 |

| TRIAL BLEND DATA TABLE | | | | |
|-------------------------|-------|-------|-------|---------------|
| Blend | 1 | 2 | 3 | Specification |
| Asphalt Content | 5.8 | 5.8 | 5.8 | |
| Max Theo SpGr (Gmm) | 2.462 | 2.467 | 2.462 | |
| Gmb @Ndes | 2.250 | 2.250 | 2.251 | |
| %Gmm (Density) @Ndes | 91.4 | 91.2 | 91.5 | 96.0% |
| Air Voids @Ndes | 8.6 | 8.8 | 8.6 | 4.0% |
| VMA @Ndes | 20.7 | 20.7 | 20.7 | 15.0 Min. |
| VFA @Ndes | 58.5 | 57.5 | 58.6 | 70-80 |
| %Gmm (Density) @Nini: | 82.1 | 86.3 | 82.0 | < 91.5 |
| Air Voids @Nini | 17.9 | 13.7 | 18.1 | > 8.5 |
| Effective Asphalt (Pbe) | 5.6 | 5.4 | 5.5 | |
| Dust to Asphalt Ratio | 0.9 | 0.9 | 0.9 | 0.6 - 1.2 |

| ESTIMATED OPTIMUM ASPHALT TABLE | | | | |
|---------------------------------|------|------|------|-----------|
| Estimated %AC @ 4% Voids | 7.6 | 7.7 | 7.6 | 4.0% |
| Estimated %Air Voids @ Nini | 13.3 | 8.9 | 13.5 | > 8.5 |
| Estimated %VMA @ %AC | 19.8 | 19.7 | 19.8 | 15.0 Min. |
| Estimated %VFA @ %AC | 79.8 | 79.7 | 79.8 | 70-80 |
| D/A Ratio : #200/Eff. AC | 0.7 | 0.7 | 0.7 | 0.6 - 1.2 |

Selected Trial Blend - 1

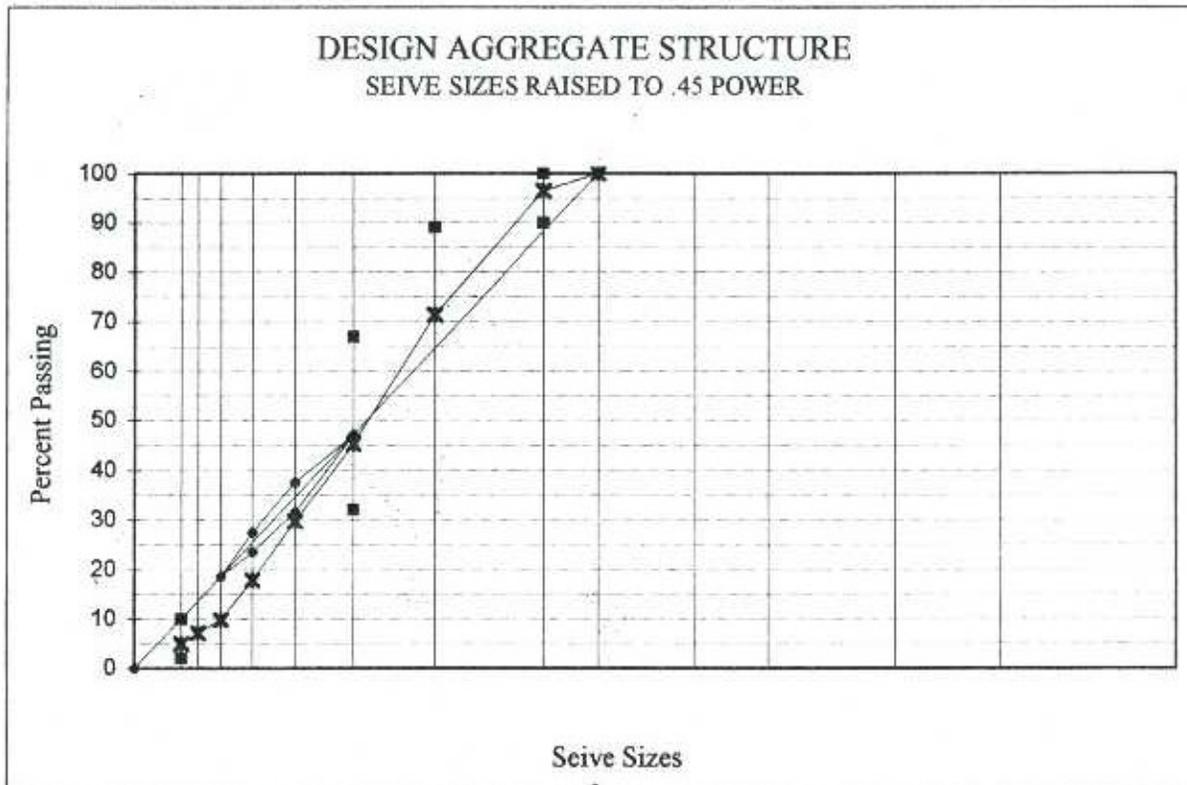
Based on the above results and best experience, Trial Aggregate Blend 1 has been selected as the design aggregate structure. Blend 1 at an Asphalt Content of 7.6 would meet all Volumetric mix requirements based on these initial calculations.

DESIGN AGGREGATE STRUCTURE INFORMATION

Plant: Hellertown Materials
 Designed By: Joe Smith
 Date: July-02

Nominal Size: 9.5 mm
 Million ESAL: < 0.3
 SRL: M
 Asphalt Grade: PG 64-22

Trial Blend 1 has been selected as the design aggregate structure and an Asphalt Content of 6.3 has been selected as the Estimated Optimum Asphalt Content.



| | | | | | | | | | | | | |
|------|-------|-------|-------|--------|--------|--------|-------|--------|--------|--------|--------|------|
| 75µm | 150µm | 300µm | 600µm | 1.18mm | 2.36mm | 4.75mm | 9.5mm | 12.5mm | 19.0mm | 25.0mm | 37.5mm | 50mm |
| #200 | #100 | #50 | #30 | #16 | #8 | #4 | 3/8" | 1/2" | 3/4" | 1" | 1 1/2" | 2" |
| 5.0 | 7 | 10 | 18 | 30 | 45 | 71 | 97 | 100 | | | | |

| | |
|----------------------|-------|
| Bulk SpGr (Gsb) | 2.673 |
| Eff. SpGr (Gse) | 2.691 |
| App. SpGr (Gsa) | 2.708 |
| H2O Absorption (Abs) | 0.47 |
| AC Absorption (Pba) | 0.26 |

| | |
|-------------------|------|
| Sand Equivalency | 85.0 |
| Flat & Elongated | 2.6 |
| Uncompacted Voids | 49.0 |
| CA Angularity (1) | 100 |
| CA Angularity (2) | 100 |

A. CALCULATED MAXIMUM Sp.Gr. OF TRIAL ASPHALT CONTENTS (Gmm)

| | % A.C. (Pb) | S.G. of Binder (Gb) | Volume of Binder (Vb) = (Pb/Gb) | %Agg. in Mix (Ps) = (100 - Pb) | Vol. of Agg.(Vs) =(Ps/Gse) | Total Volume (Vt) = (Vb + Vs) | Theo. S.G. Mix (Gmm) = (100/Vt) |
|---------|----------------|---------------------------|------------------------------------|-----------------------------------|-------------------------------|----------------------------------|---------------------------------------|
| -0.5 | 5.8 | 1.031 | 5.626 | 94.2 | 35.000 | 40.626 | 2.462 |
| Est. AC | 6.3 | 1.031 | 6.111 | 93.7 | 34.814 | 40.925 | 2.444 |
| +0.5 | 6.8 | 1.031 | 6.596 | 93.2 | 34.628 | 41.224 | 2.426 |
| +1.0 | 7.3 | 1.031 | 7.081 | 92.7 | 34.443 | 41.523 | 2.408 |

VARYING ASPHALT CONTENT RESULTS

| | |
|--|--|
| Plant: Hellertown Materials Designed By: Joe Smith Date: July-02 | Nominal Size: 9.5 mm Million ESAL: < 0.3 SRL: M Asphalt Grade: PG 64-22 |
|--|--|

| 5.8 Asphalt Content | | | | | Sample Height | | Maximum Theoretical Gravity (Gmm)= 2.462 | | | | | |
|---------------------|------------|-----------------|------------|-----------|---------------|----------|--|-------------|------------|-------------|-------------|-------------|
| Blend 1 | Dry Weight | Weight In Water | SSD Weight | Gmb @Ndes | @Nini 6 | @Ndes 50 | %Gmm @Nini | Voids @Nini | %Gmm @Ndes | Voids @Ndes | VMA @Ndes | VFA @Ndes |
| Spec. 1 | 4832.3 | 2721.0 | 4855.7 | 2.264 | 131.4 | 118.2 | 82.7 | 17.3 | 92.0 | 8.0 | 20.2 | 60.4 |
| Spec. 2 | 4803.8 | 2725.8 | 4822.1 | 2.292 | 128.7 | 115.7 | 83.7 | 16.3 | 93.1 | 6.9 | 19.2 | 64.1 |
| | | | | | | | | | | 7.5 | 19.7 | 62.2 |

| 6.3 Asphalt Content | | | | | Sample Height | | Maximum Theoretical Gravity (Gmm)= 2.444 | | | | | |
|---------------------|------------|-----------------|------------|-----------|---------------|----------|--|-------------|------------|-------------|-------------|-------------|
| Blend 1 | Dry Weight | Weight In Water | SSD Weight | Gmb @Ndes | @Nini 6 | @Ndes 50 | %Gmm @Nini | Voids @Nini | %Gmm @Ndes | Voids @Ndes | VMA @Ndes | VFA @Ndes |
| Spec. 1 | 4826.5 | 2766.2 | 4829.1 | 2.340 | 129.0 | 116.1 | 86.2 | 13.8 | 95.7 | 4.3 | 18.0 | 76.1 |
| Spec. 2 | 4782.1 | 2749.1 | 4784.2 | 2.350 | 126.0 | 113.1 | 86.3 | 13.7 | 96.2 | 3.8 | 17.6 | 78.4 |
| | | | | | | | | | | 4.1 | 17.8 | 77.3 |

| 6.8 Asphalt Content | | | | | Sample Height | | Maximum Theoretical Gravity (Gmm)= 2.426 | | | | | |
|---------------------|------------|-----------------|------------|-----------|---------------|----------|--|-------------|------------|-------------|-------------|-------------|
| Blend 1 | Dry Weight | Weight In Water | SSD Weight | Gmb @Ndes | @Nini 6 | @Ndes 50 | %Gmm @Nini | Voids @Nini | %Gmm @Ndes | Voids @Ndes | VMA @Ndes | VFA @Ndes |
| Spec. 1 | 4807.1 | 2764.4 | 4809.3 | 2.351 | 126.6 | 115.6 | 88.5 | 11.5 | 96.9 | 3.1 | 18.0 | 82.8 |
| Spec. 2 | 4816.4 | 2764.4 | 4819.5 | 2.344 | 129.5 | 116.0 | 86.5 | 13.5 | 96.6 | 3.4 | 18.3 | 81.4 |
| | | | | | | | | | | 3.3 | 18.2 | 82.1 |

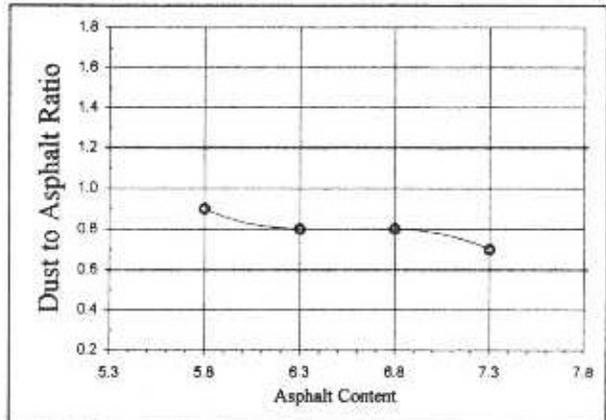
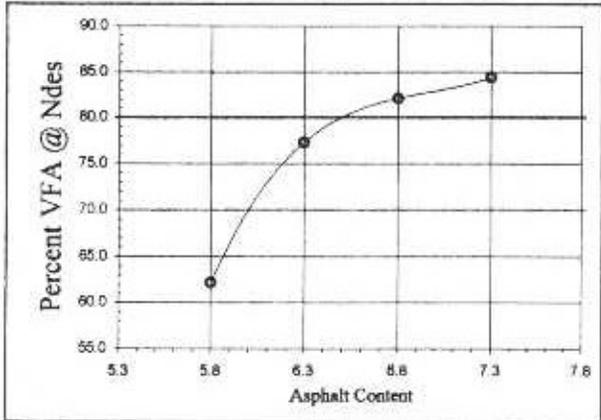
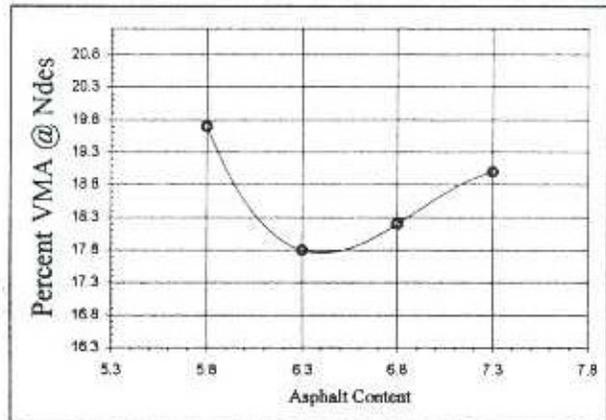
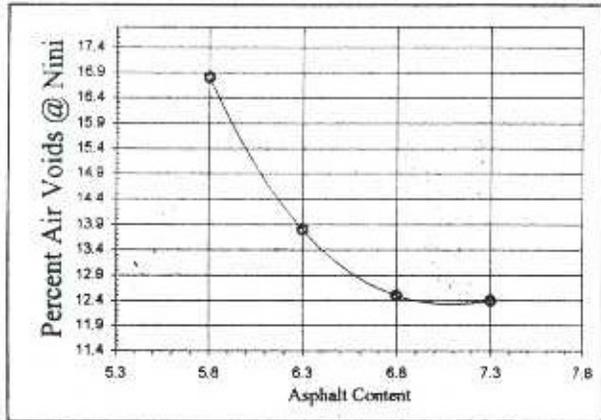
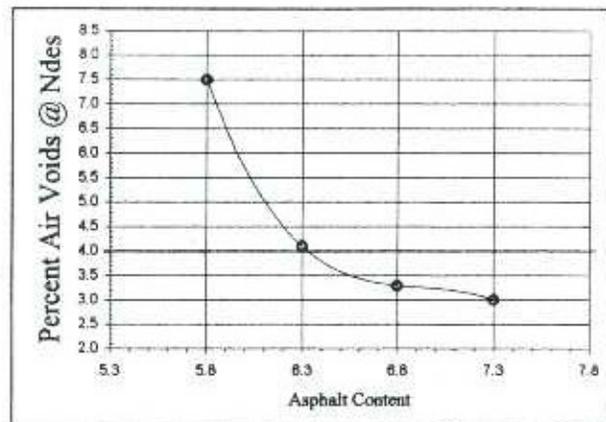
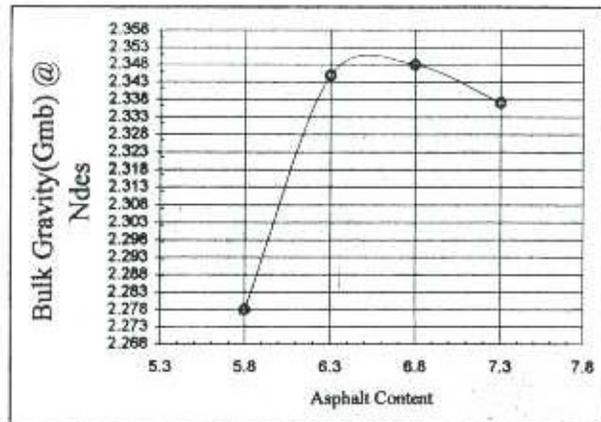
| 7.3 Asphalt Content | | | | | Sample Height | | Maximum Theoretical Gravity (Gmm)= 2.408 | | | | | |
|---------------------|------------|-----------------|------------|-----------|---------------|----------|--|-------------|------------|-------------|-------------|-------------|
| Blend 1 | Dry Weight | Weight In Water | SSD Weight | Gmb @Ndes | @Nini 6 | @Ndes 50 | %Gmm @Nini | Voids @Nini | %Gmm @Ndes | Voids @Ndes | VMA @Ndes | VFA @Ndes |
| Spec. 1 | 4814.1 | 2759.0 | 4816.8 | 2.339 | 129.1 | 116.3 | 87.5 | 12.5 | 97.1 | 2.9 | 18.9 | 84.7 |
| Spec. 2 | 4804.2 | 2749.6 | 4806.7 | 2.335 | 127.1 | 115.0 | 87.7 | 12.3 | 97.0 | 3.0 | 19.0 | 84.2 |
| | | | | | | | | | | 3.0 | 19.0 | 84.4 |

| VARYING ASPHALT DATA TABLE | | | | | |
|----------------------------|-------|-------|-------|-------|---------------|
| Asphalt Content | 5.8 | 6.3 | 6.8 | 7.3 | Specification |
| Max Theo SpGr (Gmm) | 2.462 | 2.444 | 2.426 | 2.408 | |
| Gmb @Ndes | 2.278 | 2.345 | 2.348 | 2.337 | |
| %Gmm (Density) @Ndes | 92.6 | 96.0 | 96.8 | 97.1 | 96.0% |
| Air Voids @Ndes | 7.5 | 4.1 | 3.3 | 3.0 | 4.0% |
| VMA @Ndes | 19.7 | 17.8 | 18.2 | 19.0 | 15.0 Min. |
| VFA @Ndes | 62.2 | 77.3 | 82.1 | 84.4 | 70-80 |
| %Gmm (Density) @Nini: | 83.2 | 86.3 | 87.5 | 87.6 | < 91.5 |
| Air Voids @Nini | 16.8 | 13.8 | 12.5 | 12.4 | > 8.5 |
| Effective Asphalt (Pbe) | 5.6 | 6.1 | 6.6 | 7.1 | |
| Dust to Asphalt Ratio | 0.9 | 0.8 | 0.8 | 0.7 | 0.6 - 1.2 |

VARYING ASPHALT CONTENT RESULT ANALYSIS

Plant: Hellertown Materials
 Designed By: Joe Smith
 Date: July-02

Nominal Size: 9.5 mm
 Million ESAL: < 0.3
 SRL: M
 Asphalt Grade: PG 64-22



| VARYING ASPHALT DATA TABLE | | | | | |
|----------------------------|-------|-------|-------|-------|---------------|
| AC Content | 5.8 | 6.3 | 6.8 | 7.3 | Specification |
| Gmb @ Ndes: | 2.278 | 2.345 | 2.348 | 2.337 | |
| %Air Voids @ Ndes: | 7.5 | 4.1 | 3.3 | 3.0 | 4.0 |
| %Air Voids @ Nini: | 16.8 | 13.8 | 12.5 | 12.4 | > 8.5 |
| VMA: | 19.7 | 17.8 | 18.2 | 19.0 | 15.0 Min. |
| VFA: | 62.2 | 77.3 | 82.1 | 84.4 | 70-80 |
| D/A Ratio : #200/Eff. AC: | 0.9 | 0.8 | 0.8 | 0.7 | 0.6 - 1.2 |

OPTIMUM ASPHALT CONTENT COMPACTED TO Nmax

| | |
|--|--|
| Plant: Hellertown Materials Designed By: Joe Smith Date: July-02 | Nominal Size: 9.5 mm Million ESAL: < 0.3 SRL: M Asphalt Grade: PG 64-22 |
|--|--|

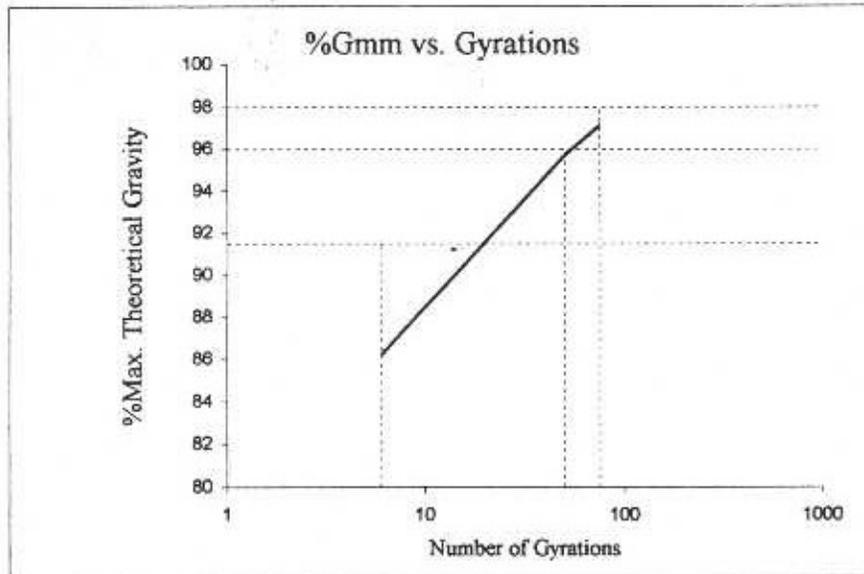
A. Selection of Optimum Asphalt Content

Based on the "vs. %Asphalt" charts, the optimum asphalt content would have the following properties.

| | | | |
|--|------|---------------------------------------|-------|
| Percent Asphalt at 4.0% Air Voids @ Ndes | 6.3 | Bulk Gravity at 6.3% Asphalt | 2.345 |
| Percent VMA at 6.3% Asphalt | 17.8 | Voids @ Nini at 6.3% Asphalt | 13.8 |
| Percent VFA at 6.3% Asphalt | 77.3 | Dust to Asphalt Ratio at 6.3% Asphalt | 0.8 |

B. Optimum Asphalt Content Compacted to Nmax

| 6.3 Optimum Asphalt Content | | | 2.444 Maximum Theoretical Gravity (Gmm) | | | | | | | | | | |
|-----------------------------|-----------------|------------|---|-----------------|-------------|-------------|---------------|-------|-------|-------------------|-------|------|------|
| Specimen Weight | | | Gmb @Nmax | Specimen Height | | | %Gmm(Density) | | | Properties @ Ndes | | | |
| Dry Weight | Weight In Water | SSD Weight | | @Nini 6 | @Ndes 50 | @Nmax 75 | @Nini | @Ndes | @Nmax | Voids | Gmb | VMA | VFA |
| 4793.5 | 2777.2 | 4795.3 | 2.375 | 128.5 | 115.3 | 113.6 | 85.9 | 95.7 | 97.2 | 4.3 | 2.339 | 18.0 | 76.1 |
| 4765.4 | 2759.2 | 4768.1 | 2.372 | 127.4 | 115.3 | 113.6 | 86.5 | 95.6 | 97.1 | 4.4 | 2.336 | 18.1 | 75.7 |
| | | | 2.374 | | | | 86.2 | 95.7 | 97.1 | 4.4 | 2.338 | 18.1 | 75.9 |



By CONTRACTOR
WILSON BORO

PLASPHALT TEST RESULTS

TESTED AT HELLERTOWN
8/16/02

| | J.M.F. | TEST #1 | TEST #2 | AVG. |
|-------|--------|---------|---------|------|
| AC | 6.3 | 6.0 | 6.9 | 6.5 |
| # 8 | 45 | 43 | 41 | 42 |
| # 200 | 5.0 | 4.4 | 5.8 | 5.1 |

TESTED AT COOPERSBURG
8/16/02

| | | | | |
|----------|-------|-------|------|------|
| VOIDS | 4.1 | 5.7 | 5.9 | 5.8 |
| VMA | 17.8 | 19.2 | 19.4 | 19.3 |
| VFA | 77.3 | 70.5 | 69.8 | 70.2 |
| MAX S.G. | 2.444 | 2.445 | - | - |

IMMEREX EXTRACTION

| | |
|-----------------------|-------|
| WT. OF BITUMENOMETER | 261.6 |
| VOL. OF BITUMINOMETER | 746.2 |
| SP. GR. OF AGGREGATE | 2.700 |
| SP. GR. OF BITUMEN | 1.030 |
| SP. GR. OF SOLVENT | 1.317 |

| | |
|-----------|-----------------|
| DATE | 08/07/03 |
| MATERIAL | 9.5mm PLASPHALT |
| CAMMS # | S 01 |
| J.M.F. AC | 6.3 |

| | |
|---------------------------|-------|
| WT. OF ORIGINAL SAMPLE | 541.0 |
| - WT. OF EXTRACTED SAMPLE | 497.0 |
| WT. OF EXTRACTION LOSS | 44.0 |

| | |
|---------------------------------------|------|
| ALGEBRAIC TERM WT. OF EXTRACTION LOSS | 97.7 |
| - WT. OF EXTRACTION LOSS | 44.0 |
| = ALGEBRAIC TERM WT. OF BITUMEN | 53.7 |

| | |
|---------------------------------|--------|
| WT. OF BITUMENOMETER AND LIQUID | 1240.7 |
| - WT. OF BITUMENOMETER | 261.6 |
| WT. OF EXTRACTED LIQUID | 979.1 |
| - WT. OF EXTRACTION LOSS | 44.0 |
| = WT. OF SOLVENT | 935.1 |
| + SP. GR. OF SOLVENT | 1.317 |
| = VOL. OF SOLVENT | 710.0 |

| | |
|-------------------------------------|-------|
| SP. GR. OF AGGREGATE | 2.700 |
| - SP. GR. OF BITUMEN | 1.030 |
| = ALGEBRAIC TERM SP. GR. OF BITUMEN | 1.670 |

| | |
|---|-------|
| VOL. OF BITUMENOMETER | 746.2 |
| - VOL. OF SOLVENT | 710.0 |
| = VOL. OF EXTRACTION LOSS | 36.2 |
| x SP. GR. OF AGGREGATE | 2.700 |
| = ALGEBRAIC TERM WT. OF EXTRACTION LOSS | 97.7 |

| | |
|-------------------------------------|-------|
| ALGEBRAIC TERM WT. OF BITUMEN | 53.7 |
| + ALGEBRAIC TERM SP. GR. OF BITUMEN | 1.670 |
| = VOLUME OF BITUMEN IN SAMPLE | 32.1 |
| x SP. GR. OF BITUMEN | 1.030 |
| = WT. OF BITUMEN IN SAMPLE | 33.1 |

| | |
|---------------------------------|-------|
| % OF BITUMEN | 6.1 |
| WT. OF ORIGINAL SAMPLE | 541.0 |
| - WT. OF BITUMEN | 33.1 |
| = WT. OF TOTAL AGGREGATE | 507.9 |
| - WT. OF EXTRACTED SAMPLE | 497.0 |
| = WT. OF FINES IN BITUMENOMETER | 10.9 |

REMARKS

| SIEVE | WT. | + FINES | % | J.M.F. |
|--------|-------|---------|-----|--------|
| # 200 | 9.1 | 20.0 | 3.9 | 5.0 |
| # 100 | 16.3 | 27.2 | 5 | 7 |
| # 50 | 30.0 | 40.9 | 8 | 10 |
| # 30 | 58.1 | 69.0 | 14 | 18 |
| # 16 | 119.2 | 130.1 | 26 | 30 |
| # 8 | 204.6 | 215.5 | 42 | 45 |
| # 4 | 335.6 | 346.5 | 68 | 71 |
| 3/8" | 480.2 | 491.1 | 97 | 97 |
| 1/2" | 497.0 | 507.9 | 100 | 100 |
| 3/4" | | | | |
| 1" | | | | |
| 1 1/2" | | | | |
| 2" | | | | |

Loose Box
 RESULTS FROM
 COMPANION
 @ PLANT

ATTACHMENT 7

First-Year Performance Evaluation (2003)

**ATTACHMENT 7
FIRST-YEAR EVALUATION PICTURES 2003**

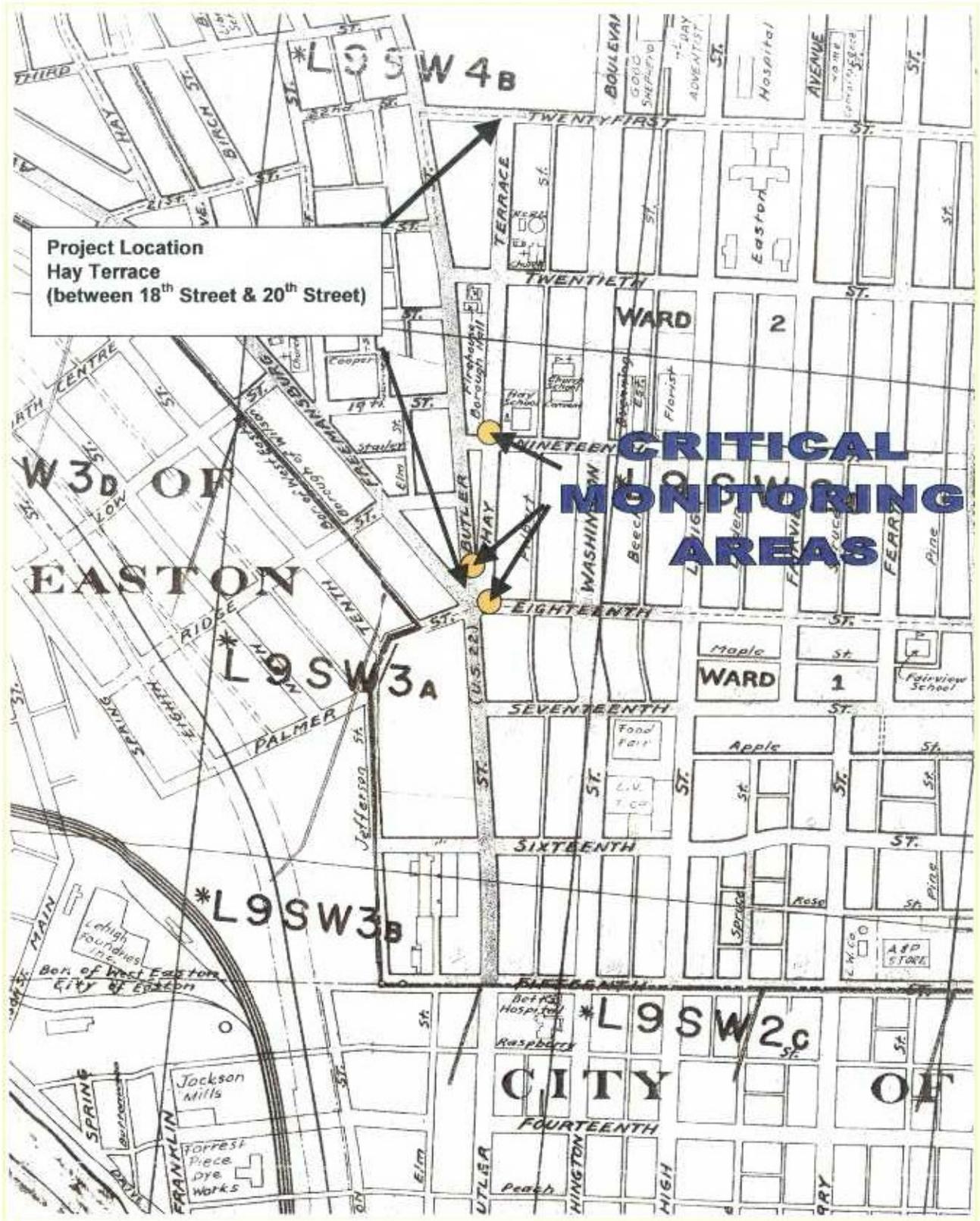


YR 1-1
Close-up of pavement. Note visible TRPA
(predominant colors red, yellow and blue)



YR 1-2
Show asphalt binder has worn off wearing
surface

HAY TERRACE
Wilson Borough, PA
CRITICAL MONITORING AREAS



ATTACHMENT 8

Second-Year Performance Evaluation (2004)

**ATTACHMENT 8
SECOND-YEAR EVALUATION PICTURES 2004**



YR 2-1
No rutting observed at critical areas (turn lanes, intersections)



YR 2-2
Longitudinal crack emerging at intersection
Hay Terrace/19th Street.

**ATTACHMENT 8
SECOND-YEAR EVALUATION PICTURES 2004**



YR 2-3
Close-up of lateral crack at Hay Terrace/19th
Street intersection. Maximum crack width
approx. 1 inch.



YR 2-4
Close-up of lateral crack at Hay Terrace/19th
Street intersection. Maximum crack depth
1/2 - 1/4 inch.

ATTACHMENT 9

Third-Year Performance Evaluation (2005)

**ATTACHMENT 9
THIRD-YEAR EVALUATION PICTURES 2005**



YR 3-1

At entrance of Hay Terrace and 18th Street no rutting observed in thru lanes or other.



YR 3-2

Slight rutting ($1/8''$ - $11/64''$ deflections) in traffic path approx 205 ft from Hay Terrace/18th Street intersection.

**ATTACHMENT 9
THIRD-YEAR EVALUATION PICTURES 2005**



YR 3-3
Deepened longitudinal crack
at Hay Terrace/19th Street intersection.



YR 3-4
Close-up of longitudinal crack (largest width
of 1 inch, biggest depth 1/2 inch).

**ATTACHMENT 9
THIRD-YEAR EVALUATION PICTURES 2005**



YR 3-5
Intersection Hay Terrace/19th Street. Observed signs of utility work.



YR 3-6
View from intersection Hay Terrace/19th Street towards 20th Street. No rutting or cracking observed.

ATTACHMENT 10

Fifth-Year Performance Evaluation (2007)

**ATTACHMENT 10
FIFTH-YEAR EVALUATION PICTURES 2007**



YR 5-1
View of intersection of Hay Terrace/18th Street.
Observed cracking starting 25 ft from curb.



YR 5-2
View of Hay Terrace from Hay Terrace/18th
Street intersection. Crack along paving joint.
(Area of high temperature batch.)

**ATTACHMENT 10
FIFTH-YEAR EVALUATION PICTURES 2007**



YR 5-3
Close-up of crack along paving joint. Approx
1/4 - 1/2 inch deep and wide.



YR 5-4
Pitting observed in area of vehicle starting
along "parking" lanes.



YR 5-5
View of intersection Hay Terrace/19th Street
cracking identified in earlier evaluations
expanding.

**ATTACHMENT 10
FIFTH-YEAR EVALUATION PICTURES 2007**



YR 5-6

Close-up view of longitudinal crack. Largest depth at 1/2", longest width of crack, 1".



YR 5-7

View from intersection Hay Terrace/19th Street towards 20th Street. No rutting or cracking observed.