IMPACT COMPLIANCE & TESTING

AIR EMISSION TEST REPORT

Report Title:	Test Report for the Verification of Air Pollutant Emissions from Hot Mix Asphalt Manufacturing Processes
Test Date(s):	October 29, 2020
Report Date:	December 10, 2020

Facility Information	
Name:	Superior Asphalt, Inc.
Street Address:	6900 East Paris Industrial Court
City, County:	Caledonia, Kent
SRN:	N8295

Facility Permit Information	
Permit No.:	154-09A
Emission Unit:	EUHMAPLANT
EGLE District Office	Grand Rapids

Testing Contractor	
Company:	Impact Compliance & Testing, Inc.
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Project No.:	2000157

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TEST REPORT FOR THE VERIFICATION OF
AIR POLLUTANT EMISSIONS FROM HOT MIX ASPHALT MANUFACTURING PROCESSES

SUPERIOR ASPHALT, INC
CALEDONIA, MICHIGAN

Test Date(s): October 29, 2020

1.0 INTRODUCTION

Superior Asphalt, Inc (Superior) has been issued Permit to Install (PTI) No. 154-09A by the State of Michigan Department of Environment, Great Lakes, and Energy-Air Quality Division (EGLE-AQD), for the operation of its hot mix asphalt (HMA) manufacturing processes located in Caledonia, Kent County, Michigan (State Registration No. (SRN) N8295).

The testing and sampling conditions of PTI No. 154-09A specify that:

- *Within 60 days after achieving the maximum production rate, but not later than 180 days after commencement of trial operation, the permittee shall verify particulate emission rates from EUHMAPLANT, as required by federal Standards of Performance for New Stationary Sources, by testing at owner's expense, in accordance with 40 CFR Part 60 Subparts A and I.*

Air emission testing was performed October 29, 2020 by Impact Compliance & Testing, Inc. (ICT) personnel Blake Beddow, Clay Gaffey, and Andrew Eisenberg. EGLE-AQD representatives, Mr. Matt Karl and Ms. April Lazzaro, were on-site to observe the compliance test event.

A Stack Test Protocol was submitted to EGLE-AQD prior to the testing project, and a Test Plan Approval Letter was issued by EGLE-AQD. The following items provide information required in EGLE-AQD *Format for Submittal of Source Emission Test Plans and Reports*, dated November 2019.

Appendix A provides a copy of the EGLE-AQD Test Plan Approval Letter.

Questions concerning this emission report should be directed to:

Testing Procedures	Blake Beddow Project Manager Impact Compliance & Testing, Inc. 37660 Hills Tech Drive Farmington Hills, MI 48331 Blake.Beddow@ImpactCandT.com (734) 464-3880
Site Operations	Mr. Nate Voruganti Plant Manager Superior Asphalt, Inc. 669 Century SW Grand Rapids, MI 49503 (616) 451-3200 nate@superiorasphalt.com

This Test Report was prepared by ICT based on the field sampling data collected by ICT. Certain analyses were contracted to and performed by third parties and the results are presented in this Test Report and its appendices. Facility process data was collected and provided by Superior employees or representatives.

Report Prepared By:

Blake Beddow
Project Manager

Responsible Official Certification

This Test Report has been reviewed by MI Paving representatives and is approved for submittal to EGLE-AQD.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this Test Report are true, accurate and complete.

Nate Voruganti
Plant Manager
Superior Asphalt, Inc.

2.0 SUMMARY OF TEST RESULTS

The exhaust gas from the HMA baghouse stack (emission unit EUHMAPLANT) was sampled and analyzed to determine the concentration of nitrogen oxides (NO_X) and filterable particulate matter (PM) content and emission rates using USEPA Methods 7E and 5, respectively. Exhaust gas opacity observations were performed on the emission unit exhaust (EUHMAPLANT) using USEPA Method 9.

The air pollutant emission test data were converted to units necessary for comparison to the allowable emission limits specified in PTI No. 154-09A.

Table 2.1 presents a summary of measured air pollutant emission rates and visual emission opacity readings for the process.

Test results for each one-hour sampling period are presented at the end of this Test Report in Section 6.0 and Tables 6.1 and 6.2.

Table 2.1 Summary of measured air pollutant emission rates and exhaust plume opacity for EUHMAPLANT

	NOx	PM		6-Min. Avg. Opacity
Emission Unit	(lb/ton)	(gr/dscf)	(lb/ton)	(%)
EUHMAPLANT	0.03	0.002	0.002	0
Permit Limit	*0.18*	*0.04*	*0.027*	*20*

3.0 SOURCE DESCRIPTION

3.1 General Process Description and Type of Raw and Finished Materials

The process produces HMA material by combining aggregate and liquid asphalt cement in a horizontal, rotating counter-flow drum. Aggregate is introduced into the drum at the end opposite of the burner. The hot gases of combustion move through the drum in parallel with the Liquid asphalt cement that is introduced into the mixing zone of the drum (located behind the burner flame zone). The finished HMA material is discharged from the drum and conveyed to storage/loadout silos. The exhaust gases exit the drum and are directed to the baghouse particulate control system.

The HMA process combines aggregate with a liquid asphalt cement mixture using a counter-flow, direct-fired rotary drum. The drum is permitted to be fired by various fuels including natural gas, propane, and Nos. 1-6 fuel oils. During compliance testing, the drum was fired by natural gas for three (3) one-hour tests. The counter-flow dryer/mixer has a maximum design production rating of 500 tons per hour (tph). The typical operation of the plant runs approximately 400 tph.

3.2 Emission Control System Description

Exhaust gas from the dryer/mixer is directed to a particulate matter (PM) emission control system consisting of a primary collector and baghouse. The baghouse filter media is periodically cleaned using reverse air pulses.

The filtered process air from the baghouse is exhausted through a vertical stack to the atmosphere (SVHMAPLANT).

3.3 Operating Variables

A Test Plan Approval Letter dated October 5, 2020 requested that Superior monitor and record the following process operational data during each test period:

- Aggregate consumption (TPH);
- RAP processed (TPH);
- Asphalt cement (TPH);
- Total HMA produced (TPH);
- Fuel type and usage (gallons and/or cubic feet per hour); and
- Fabric filter (baghouse) pressure drop (inches of H_2O).

Additional operational data were recorded on a sheet that was provided by EGLE-AQD representative April Lazzaro.

Appendix B provides process and control device operating records for the test periods.

3.4 Sampling Location

Filtered exhaust gas is discharged to the ambient air through a vertical 68 inch diameter exhaust stack (EUHMAPLANT). Two (2) sample ports were installed 19 ft. (228 in.) downstream and 40 ft. (480 in.) upstream from the nearest flow disturbance. Exhaust gas was sampled from twelve (12) points across each port for a total of 24 sampling points.

Appendix C provides a drawing of the exhaust stack sampling location.

4.0 SUMMARY OF USEPA TEST METHODS

The following USEPA reference test methods and sampling trains were used to perform the emission compliance testing.

4.1 Exhaust Gas Flowrate and Air Pollutant Emissions Sampling Methods

USEPA Method 1	Velocity and sampling locations were selected based on physical stack measurements in accordance with USEPA Method 1.
USEPA Method 2	Exhaust gas velocity pressure and temperature using a Type-S Pitot tube connected to a red oil incline manometer and K-type thermocouple.
USEPA Method 3A	Exhaust gas O_2 and CO_2 content was determined using paramagnetic and infrared instrumental analyzers, respectively.
USEPA Method 4	Exhaust gas moisture determined using the chilled impinger method (as part of the particulate sampling train).
USEPA Method 5	Filterable PM was determined using isokinetic sampling procedures and analysis of the front half of the particulate matter sampling train (filter and acetone rinse).
USEPA Method 7E	Exhaust gas NOx concentration was determined using a chemiluminescence instrumental analyzer.
USEPA Method 9	Exhaust gas opacity during each sampling period was determined by a certified observer of visible emissions.

In addition to the sampling and analytical methods presented in the preceding text, USEPA Method 205; *Verification of Dilution Systems for Field Instrument Calibrations,* was used to verify linearity of the calibration gas dilution system.

5.0 DETAILED SAMPLING AND ANALYTICAL PROCEDURES

Testing was performed to verify NOx, filterable PM emission rates and opacity from the hot mix asphalt mix/dryer drum. The exhaust gas exiting the baghouse was sampled for three (3) one-hour test periods using the USEPA sampling methods specified in section 4.1 of this Test Report. NOx emissions were determined analytically and filterable PM was determined based on the amount of catch in the sample train.

5.1 Velocity traverse locations & stack gas velocity measurements (USEPA Methods 1&2)

The representative sample locations were determined in accordance with USEPA Method 1 based on the measured distance to upstream and downstream disturbances. The absence of significant cyclonic flow was determined at the sampling location.

Exhaust gas velocity was measured using USEPA Method 2 throughout each test period as part of the isokinetic sampling procedures. Velocity pressure measurements were performed at each stack traverse point using an S-type Pitot tube and red-oil manometer. Temperature measurements were performed at each traverse point using a K-type thermocouple and a calibrated digital thermometer.

Prior to performing the initial velocity traverse, the S-type Pitot tube and manometer lines were leak-checked at the test site. These checks were made by blowing into the impact opening of the Pitot tube until 3 or more inches of water were recorded on the manometer, then capping the impact opening and holding it closed for 15 seconds to ensure that it was leak free. The static pressure side of the Pitot tube was leak-checked using the same procedure.

5.2 Measurement of carbon dioxide and oxygen content (USEPA Method 3A)

CO_2 and O_2 content in the exhaust gas stream was measured continuously throughout each test period in accordance with USEPA Method 3A. The exhaust gas CO_2 content was monitored using a Servomex 4900 infrared gas analyzer. The exhaust gas O_2 content was monitored using a paramagnetic sensor within the Servomex 4900 gas analyzer.

During each sampling period, a continuous sample of the exhaust gas stream was extracted from the stack using a stainless-steel probe connected to a Teflon® heated sample line. The sampled gas was conditioned by removing moisture prior to being introduced to the analyzers; therefore, measurement of O_2 and CO_2 concentrations correspond to standard dry gas conditions. Instrument response data were recorded using an ESC Model 8816 data acquisition system that monitored the analog output of the instrumental analyzers continuously and logged data as one-minute averages.

Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias (described in Section 5.9 of this document). Sampling times were recorded on field data sheets.

5.3 Determination of moisture content via isokinetic sampling (USEPA Method 4)

Moisture content was measured concurrently with the particulate matter sampling trains and determined in accordance with USEPA Method 4. Moisture from the gas sample was removed by the chilled impingers of the isokinetic sampling train. The net moisture gain from the gas sample was determined by either volumetric or gravimetric analytical techniques in the field. Percent moisture was calculated based on the measured net gain from the impingers and the metered gas sample volume of dry air.

5.4 Determination of PM emissions via isokinetic sampling (USEPA Method 5)

A USEPA Method 5 sample train was used to measure filterable PM. Exhaust gas from the baghouse was drawn at an isokinetic rate through a properly stainless-steel sampling nozzle, heated probe with stainless steel liner connected to the nozzle via stainless-steel union, and heated glass fiber particulate filter. Following the particulate filter, moisture was removed from the sample gas using chilled impingers and sample gas rate was measured using a calibrated dry gas meter.

At the end of each test period the PM collected in the front half of the sampling train (from the sampling nozzle to the heated filter) was recovered in accordance with the six times rinse and brush procedures often requested by EGLE-AQD for USEPA Method 5 when using stainless-steel sampling components. The impinger solutions were weighed gravimetrically for moisture content determination.

The laboratory particulate matter analyses were conducted by a qualified third-party laboratory according to the appropriate QA/QC procedures specified in USEPA Method 5 and are included in the final laboratory report provided by Enthalpy Analytical (Durham, North Carolina).

Diluent gas content (Method 3A O_2 and CO_2) measurements was performed with each of the PM sampling periods.

Appendix D provides a Method 5 sampling train diagram.

Appendix G provides a copy of the final laboratory analytical report.

5.5 Measurement of NOx by instrumental analyzers (USEPA Method 7E)

NOx pollutant concentrations in the HMA exhaust gas stream was determined using a Thermo Environmental Instruments, Inc. (TEI) Model 42c High Level chemiluminescence NO-NO_2-NOx.

Throughout each test period, a continuous sample of the HMA exhaust gas was extracted from the stack using the Teflon® heated sample line and gas conditioning system and delivered to the instrumental analyzers. Instrument response for each analyzer was recorded on an ESC Model 8816 data acquisition system that logged data as one-minute averages. Prior to, and at

the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias.

Appendix E provides NOx calculation sheets. Raw instrument response data are provided in Appendix I. Appendix D provides a Method 7E sampling train diagram.

5.6 Visual determination of opacity (USEPA Method 9)

USEPA Method 9 procedures were used to evaluate the opacity of the exhaust gas during each 60-minute test period. In accordance with USEPA Method 9, the qualified observer stood at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. As much as possible, the line of vision was approximately perpendicular to the plume direction.

Opacity observations were made at the point of greatest opacity in the portion of the plume where condensed water vapor was not present. Observations were made at 15-second intervals for the duration of the 60-minute testing period.

All visible emissions determinations were performed by a qualified observer in accordance with USEPA Method 9, Section 3.

5.7 Number and length of sampling runs

The emission performance tests consisted of three (3), one-hour sampling periods for NOx, PM, and opacity measurements. Exhaust gas flowrate measurements were performed at each point during isokinetic sampling.

5.8 Quality assurance/quality control procedures

Appendix E provides sampling equipment quality assurance and calibration data. A summary of these procedures is provided in this section.

5.8.1 Flow measurement equipment

Prior to arriving onsite, the instruments used during the source test to measure exhaust gas properties and velocity (barometer, pyrometer, scale, and Pitot tube) were calibrated to specifications outlined in the sampling methods.

5.8.2 Isokinetic sampling for PM

The dry gas meter sampling console was calibrated prior to and after the testing program using the critical orifice calibration technique presented in USEPA Method 5. The metering console calibration exhibited no data outside the acceptable ranges required by USEPA Method 5. The digital pyrometer in the metering console was calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

The sampling nozzle diameter was determined using the three-point calibration technique.

5.8.3 PM analyses

All recovered PM samples were stored and shipped in glass sample bottles with Teflon® lined caps. The liquid level on each bottle was marked with permanent marker and the caps were secured closed with tape. Samples of the reagents used in the test project (approximately 200 milliliters of acetone) were sent to the laboratory for analysis to verify that the reagents used to recover the samples have low particulate matter residue values.

5.8.4 Sampling system response time determination

The response time of the sampling system was determined prior to the commencement of the performance tests by introducing upscale gas and zero gas, in series, into the sampling system using a tee connection at the base of the sample probe. The elapsed time for the analyzer to display a reading of 95% of the expected concentration was determined using a stopwatch. Each test period began once the instrument sampling probe has been in place for at least twice the greatest system response time.

5.8.5 Gas divider certification (USEPA Method 205)

A STEC Model SGD-710C 10-step gas divider was used to obtain appropriate calibration span gases. The ten-step STEC gas divider was NIST certified (within the last 12 months) with a primary flow standard in accordance with Method 205. When cut with an appropriate zero gas, the ten-step STEC gas divider delivers calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 were followed prior to use of gas divider. The field evaluation yielded no errors greater than 2% of the triplicate measured average and no errors greater than 2% from the expected values.

5.8.6 Instrumental analyzer interference check

The instrumental analyzers used to measure NO_X, O_2, and CO_2 have had an interference response test preformed prior to their use in the field, pursuant to the interference response test procedures specified in USEPA Method 7E. The appropriate interference test gases (i.e., gases that would be encountered in the exhaust gas stream) were introduced into each analyzer, separately and as a mixture with the analyte that each analyzer is designed to

measure. All of analyzers exhibited a composite deviation of less than 2.5% of the span for all measured interferent gases. No major analytical components of the analyzers have been replaced since performing the original interference tests.

5.8.7 Instrument calibration and system bias checks

At the beginning of each day of the testing program, initial three-point instrument calibrations were performed for the NO_X, CO_2, and O_2 analyzers by injecting calibration gas directly into the inlet sample port for each instrument. System bias checks were performed prior to and at the conclusion of each sampling period by introducing an appropriate upscale calibration gas and zero gas into the sampling system (at the base of the stainless steel sampling probe prior to the particulate filter and Teflon® heated sample line) and verifying the instrument response against the initial instrument calibration readings.

The instruments were calibrated with USEPA Protocol 1 certified concentrations of CO_2, O_2, and NO_X in nitrogen and zeroed using nitrogen. A STEC Model SGD-710C 10-step gas divider were used to obtain intermediate calibration gas concentrations as needed.

5.8.8 Determination of exhaust gas stratification

A stratification test was performed for the HMA process exhaust stack. The stainless-steel sample probe was positioned at sample points correlating to 16.7, 50.0 (centroid), and 83.3% of the stack diameter. Pollutant concentration data were recorded at each sample point for a minimum of twice the maximum system response time.

The recorded concentration data for the exhaust stack indicates that the measured O_2 concentrations did not vary by more than 5% of the mean across the stack diameter. Therefore, the exhaust gas was considered to be unstratified.

6.0 TEST RESULTS AND DISCUSSION

6.1 Air pollutant emission test results and allowable emission limits

HMA operating data and NOx and PM emission measurement results for each one-hour test period are presented in Tables 6.1.

Table 6.2 presents the opacity (VE) reading test results for the three (3) sampling periods.

The measured NOx and PM concentrations and emission rates, and VE readings are less than the allowable limits specified in PTI No. 154-09A.

6.2 Operating conditions during compliance tests

Testing was performed while the process operated at maximum achievable operating conditions. Superior representatives provided production data at 15-minute intervals for each test period. The average recorded Asphalt production rate was 417 tons per hour (TPH) for the three (3) test periods.

Additionally, Superior operators recorded aggregate processed (TPH), RAP processed (TPH), asphalt cement processed (TPH), total HMA produced (TPH), fuel type and usage rate (MCF), HMA discharge temperature (°F), baghouse inlet temperature (°F) and pressure drop (in. H_2O), damper position (% open), and burner position (% open).

Appendix B provides operating data collected during the compliance tests.

6.3 Variations from normal sampling procedures or operating conditions

The testing was performed as described in the approved Stack Test Protocol and reference test methods. During the test periods, the process was operated at normal routine operating conditions, at or near maximum achievable capacity, and satisfied the parameters specified in the Test Plan Approval Letter. Each one-hour test was paused for a few minutes to move the probe/sampling train from one sampling port to the next.

As with most HMA production facilities, a significant steam plume was present at the exhaust point. The certified VE reader performed the opacity observations downwind of the steam plume at the point where there was no longer visible water vapor.

Table 6.1 Measured air pollutant emission rates for the EUHMAPLANT exhaust

Analyzer and Isokinetic Test No. Test Date:	**1** 10/29/2020	**2** 10/29/2020	**3** 10/29/2020	**Average**
Test Times:	0850-0957	1040-1145	1220-1325	
Exhaust Gas Properties				
Exhaust Gas Flow (dscfm)	47,248	47,421	47,216	47,295
Temperature (°F)	246	244	243	244
Moisture (%)	26.2	26.4	26.7	26.2
Oxygen (%)	15.1	15.7	15.5	15.4
Carbon Dioxide (%)	3.57	3.33	3.32	3.41
HMA Process Data				
HMA Production Rate (ton/hr)	418	416	418	417
Isokinetic Sample Train Data				
Sample Volume (dscf)	62.2	44.0	46.2	50.8
Total PM Catch (mg)	7.6	5.0	5.0	5.9
PM Emission Rate				
PM Emission Rate (lb/ton)	0.002	0.002	0.002	0.002
PM Permit Limit (lb/ton)	-	-	-	*0.027*
PM Concentration (gr/dscf)	0.002	0.002	0.002	0.002
PM Permit Limit (gr/dscf)	-	-	-	*0.04*
NOx Emission Rates				
NOx Concentration (ppmvd)	40.7	37.6	37.7	38.7
NOx Emission Rate (lb/hr)	13.8	12.8	12.8	13.1
NOx Emission Rate (lb/ton)	0.03	0.03	0.03	0.03
NOx Permit Limit (lb/ton)	-	-	-	*0.18*

Table 6.2 Measured exhaust plume opacity results for the exhaust plume from EUHMAPLANT

VE Test No.	Test Date	Test Times (EDT)	Production (Tons)	6-Minute Average (%)	Highest 6-Minute Average (%)
1	10/29/2020	0850-0957	418	0	0
2	10/29/2020	1040-1145	416	0	0
3	10/29/2020	1220-1325	418	0	0
		Averages	417	0	0
			Permit Limit:	*20*	*27*