



CITY OF RICHMOND
CITY AUDITOR

DATE: March 2, 2020

TO: Ms. Lenora Reid
Acting Chief Administrative Officer

FROM: Louis Lassiter *LL*
City Auditor

SUBJECT: Department of Public Works (DPW)
Heat Scarification Contract audit

The City Auditor's Office has completed the DPW Heat Scarification Contract audit and the final report is attached.

We would like to thank the DPW staff for their cooperation and assistance during this audit.

Attachment

cc: The Richmond Audit Committee
The Richmond City Council
Robert Steidel, DCAO of Operations
Bobby Vincent, Director of DPW

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City of
RICHMOND
Office of the City Auditor

Audit Report# 2020-11

**Department of Public Works
Heat Scarification Contract**

March 2, 2020



Audit Report Staff

Louis Lassiter, City Auditor
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Highlights

Audit Report to the Audit Committee, City Council, and the Administration

Why We Did This Audit

The Office of the City Auditor conducted this audit as part of the FY20 audit plan approved by the Audit Committee. The objectives for this audit were to evaluate the controls over monitoring the vendor's quality of work and assess compliance with contract terms and conditions.

What We Recommend

Capital Project Manager Senior:

- Develop and implement standardized inspection procedures including documentation requirements.
- Develop and implement standardized billing and payment procedures.
- Research and resolve the billing discrepancies identified during the audit.
- Research the identified flagmen invoices to determine if overbillings occurred and recoup overpayments (if applicable).
- Ensure the contractor raises the utilities prior to starting the heat scarification process in compliance with the contract terms.

Capital Project Manager Senior and Pavement Inspectors:

- Ensure the contractor cleans off the utility and manhole covers prior to issuing payment.



Heat Scarification

Background

The Department of Public Works is responsible for maintaining 2,400 lane miles of roads throughout the City of Richmond. One of the paving techniques used in the City is heat scarification, which is a hot-in-place recycling of the existing asphalt. This process consists of heating and scarifying (lifting) the existing asphalt, adding a rejuvenate agent and repaving the recycled mix. The City has been using this technique for five years and has scarified approximately 1.5 million square yards of pavement throughout the City. The heat scarification work is conducted by a contractor.

Works Well

- The auditor reviewed all 17 invoices totaling approximately \$3 million that were processed for the contract under review. All line items were billed at the correct bid unit prices.
- Approximately, 600,000 square yards of pavement was heat scarified between April 2018 and May 2019. The auditors visited 12 locations for which 69,000 square yards of pavement was heat scarified and generally noted that the repairs were in good conditions with a few minor areas where the pavement is starting to fail, which is not believed to be attributed to the repair quality.

Needs Improvement

Finding #1 –Inconsistencies in the Inspection Process

Standardized inspection procedures were not in place. As such, inconsistencies in the inspection process and documentation were noted.

Finding #2 –Billing Inconsistencies

The auditor traced the billed quantities for all 17 invoices that were processed for the contract under review, which totaled approximately \$3 million, to the daily logs and other supporting documentation and noted billing discrepancies.

Finding #3 –Quality of Repairs

The auditors observed at least one manhole/utility cover that was paved over for 67% of the reviewed locations.

Finding #4 –Utility Adjustments

Per the contract scope of work, utility adjustments should be completed prior to heat scarification. However, some of the utilities were adjusted after the heat scarification work was conducted.

Management concurred with 5 of 6 recommendations. We appreciate the cooperation received from DPW management and staff while conducting this audit.

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BACKGROUND, OBJECTIVES, SCOPE, METHODOLOGY, MANAGEMENT RESPONSIBILITY and INTERNAL CONTROLS

This audit was conducted in accordance with the Generally Accepted Government Auditing Standards promulgated by the Comptroller General of the United States. Those Standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on the audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on the audit objectives.

BACKGROUND

The Department of Public Works is responsible for maintaining 2,400 lane miles of roads throughout the City of Richmond. One of the paving techniques used in the City is heat scarification, which is a hot-in-place recycling of the existing asphalt. The City has been using this technique for five years and has scarified approximately 1.5 million square yards of pavement throughout the City. Henrico County has used this process for over a decade. The heat scarification process allows a locality to maximize pavement coverage with existing maintenance funds, is 100% recyclable and has an estimated useful life of five to seven years. Prior to using heat scarification, a thin asphalt overlay was applied to the pavements in preparation for the sealant. The Capital Projects Manager Senior estimates the use of heat scarification saves the City \$3 per square yard.

The heat scarification process is conducted by a contractor and consists of four steps:

- The existing asphalt is heated to a temperature of 300 degrees to soften the pavement;
- 1 to 1.5 inches of the asphalt is scarified (lifted);
- A rejuvenate agent is mixed into the asphalt; and
- The recycled asphalt mix is repaved and compacted on the street surface.

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The heat scarification process is generally used on neighborhood roads to remove surface distresses (i.e. such as cracks, raveling, holes, and ruts) to smooth out the pavement surface and improves the road ride ability. A sealant is applied after the roads are scarified.

Below are photos of roads before and after treatment.



Whitby Road from Brook Road to Lamont Street

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Rennie Avenue from Loxley Road to Brook Road

The City entered into a contract in March 2018 to conduct the heat scarification work for a maximum contract amount of \$1,285,570. The contract included:

- Equipment mobilization and traffic control;
- Street sweeping and utility adjustments prior to scarification process and relaying the pavement; and
- All of the labor, materials, equipment, needed to heat and scarify the existing pavement, add rejuvenate agent to the asphalt, and to spread and level the recycled mixture.

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There have been several changes orders/modifications made to the contract. The contract details are listed in the chart below:

American Asphalt Surface Recycling Inc.							
Year	Effective Date	Contract End Date	Contract Increase/Decrease	Contract Amount	Line Item Increase	Type of Modification	No. of Modification
2018	3/9/2018	7/8/2018	-	\$ 1,285,570.66	-	Original Contract	
2018	7/8/2018	7/7/2019	\$ 1,637,450.00	\$ 2,923,020.66	127%	Contract Extension ¹	Modification #1
2019	4/9/2019	7/7/2019	\$ 410,335.00	\$ 3,333,355.66	14%	Change Order ²	Modification #2
2019	7/11/2019	8/8/2019	\$ 379,505.67	\$ 3,712,861.33	11%	Change Order ³	Modification #3
Notes							
1 Extended the contract period and increased the contract amount to allow contractor to continue providing services. Contract extension was ratified on September 4, 2018 and made retroactive.							
2 Increased contract amount to allow for the additional work that was added to repave streets where DPU performed utility upgrades.							
3 Increased contract amount for additional quantities of repairs beyond estimate due to abnormal amount of utility adjustments and asphalt patching. Administrative extension of contract period to allow for the invoice processing for completed work.							

OBJECTIVES

To evaluate the controls over monitoring the vendor's quality of work and assess compliance with contract terms and conditions.

SCOPE

Repair projects completed under contract 18000018625 and corresponding payments were reviewed for compliance with contract terms and conditions and the quality of the repairs were assessed. The contract period was March 9, 2018 – August 8, 2019.

METHODOLOGY

The auditors performed the following procedures to complete this audit:

- Interviewed management and staff;
- Reviewed the contract term and conditions, scope of work and tested for compliance;

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- Conducted site visits to assess the quality of repairs;
- Traced billed services and quantities to supporting documentation; and
- Performed other tests, as deemed necessary.

MANAGEMENT RESPONSIBILITY

City management is responsible for ensuring resources are managed properly and used in compliance with laws and regulations; programs are achieving their objectives; and services are being provided efficiently, effectively, and economically.

INTERNAL CONTROLS

According to the Government Auditing Standards, internal control, in the broadest sense, encompasses the agency's plan, policies, procedures, methods, and processes adopted by management to meet its mission, goals, and objectives. Internal control includes the processes for planning, organizing, directing, and controlling program operations. It also includes systems for measuring, reporting, and monitoring program performance. An effective control structure is one that provides reasonable assurance regarding:

- Efficiency and effectiveness of operations;
- Accurate financial reporting; and
- Compliance with laws and regulations.

Based on the audit test work, the auditors concluded that the internal controls over the heat scarification contract need improvement. Improvement opportunities exist to standardize the inspection and payment processes to ensure procedures are carried out as intended. These internal control enhancements are discussed throughout this report.

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FINDINGS and RECOMMENDATIONS

What Works Well

Contractor Payments

The auditor reviewed all 17 invoices totaling approximately \$3 million that were processed for the contract under review. All line items were billed at the correct bid unit prices.

Repair Quality

The auditors visited 12 locations for which 69,000 square yards of pavement were heat scarified and generally noted that the repairs were in good condition with a few minor areas where the pavement started to fail, which is not believed to be attributed to the repair quality.

What Needs Improvement

Finding #1 –Inconsistencies in the Inspection Process

The paving inspectors within DPW are responsible for monitoring the scarification projects to ensure the work is conducted in accordance with the contract terms and conditions and paving standards. The inspectors create daily logs to document the work that is completed and the corresponding quantities (e.g. square yards of heat scarification). The auditor reviewed 367 daily logs from five different inspectors and noted the below inconsistencies in the inspection process and documentation as standardized procedures were not in place.

- Different forms were used to track the daily inspections, completed work and quantities.
- The amount of details captured for the repairs varied by inspector. Sufficient details were not always captured on the daily logs to readily identify what work was completed and where.

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- Cross streets and street directions (i.e. north, south) were not always captured making it difficult to determine the specific locations of the completed work. Some streets were completed in segments over multiple days. Also, some streets run in multiple directions and/or are located in multiple areas of the City. For example, 21st Street is located in the Eastend, the downtown area and the Southside of the City.
- Reports were missing details to explain why gaps or breaks occurred in repair timeframes and the need for additional work. For example, 5,014 square yards of pavement were heat scarified on Albany Avenue in May 2018. An additional 2,786.67 square yards were scarified in April 2019.
- The length and width and calculated square yards were provided for some of the repair locations. In other cases, only the calculated square yards were provided. The length and width of the repairs provides additional information that can be used to gauge the reasonableness of the reported square yards.
- Tickets for the rejuvenate agent were not obtained for some of the repair locations. These tickets contain the start and stop gauge amounts for the rejuvenate agent that are used to calculate the number of gallons used.

The lack of standardized inspection procedures and lack of details captured on the daily logs could result in the City being inappropriately billed for services.

Recommendation(s):

- 1. We recommend the Capital Project Manager Senior develop and implement standardized inspection procedures including documentation requirements.***

Finding #2 –Billing Inconsistencies

The inspectors' daily logs are forwarded to the Capital Project Manager Senior who then keys the daily log quantities into a spreadsheet to track the completed work. According to the Capital Project Manager Senior, he reconciles the billed quantities to the spreadsheet totals prior to

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approving the payments. The auditor traced the billed quantities for all 17 invoices for the contract totaling approximately \$3 million to the daily logs and other supporting documentation and noted the below discrepancies.

Bid Line Item	Billed Qty	Daily Log Qty	Difference	\$ Difference
Heat Scarification	552,766.78	554,152.42	(1,385.64)	\$ (4,544.90)
Rejuvenating Agent	61,236.00	60,001.00	1,235.00	\$ 4,322.50
Asphalt Patch 1	2,527.06	2,610.33	(83.27)	\$ (16,654.00)
Asphalt Patch 2	1,835.22	2,175.70	(340.48)	\$ (34,048.00)
Reset Small Utility	192.00	161.00	31.00	\$ 22,165.00
Reset Large Utility	24.00	21.00	3.00	\$ 3,645.00
Reset Sewer Manhole	86.00	71.00	15.00	\$ 15,150.00
Net \$ Difference				\$ (9,964.40)

The daily log and billed quantities differed for the above bid line items. The daily log quantities for heat scarification, asphalt patch one and asphalt patch two were larger than the amounts billed by the contractor. In some cases, the daily logs included completed work for streets that were not billed at all or could not be easily attached to a particular invoice. The billed quantities for the remaining line items were larger than the daily log quantities.

The auditor also compared the billed quantities to the Project Manager's daily log spreadsheet and noted the below discrepancies.

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Bid Line Item	Billed Qty	Project Manager Daily Qty Spreadsheet	Difference	\$ Difference
Heat Scarification	552,766.78	640,579.34	(87,812.56)	\$ (288,025.20)
Rejuvenating Agent	61,236.00	66,818.00	(5,582.00)	\$ (19,537.00)
Asphalt Patch 1	2,527.06	2,755.58	(228.52)	\$ (45,704.00)
Asphalt Patch 2	1,835.22	769.90	1,065.32	\$ 106,532.00
Reset Small Utility	192.00	197.00	(5.00)	\$ (3,575.00)
Reset Large Utility	24.00	21.00	3.00	\$ 3,645.00
Reset Sewer Manhole	86.00	74.00	12.00	\$ 12,120.00
Net \$ Difference				\$ (234,544.20)

Based upon the above analyses, it was noted that an effective payment reconciliation process is not in place. Per the Capital Project Manager Senior, if the billed quantities are within reason of the daily log totals, he approves the payments. He also indicated that he does not pay more than what is billed. However, billing discrepancies should be researched and resolved with the contractor prior to approving and issuing payments. It was also noted that a standardized billing timeframe (e.g. weekly or monthly) was not in place. The invoice break down included the repair streets but not the billing period. Quantities for some streets were captured on multiple invoices. As such, it was unclear on how the contractor was billing. Based upon the above information, the Capital Project Manager Senior needs to research the billing discrepancies identified in the audit to determine what occurred and if the City or contractor is due additional monies.

In addition to the above bid line items, the contractor also billed for off duty police officers, police vehicles and flagmen, which were used for traffic control. In accordance with the contract terms, the police officers and flagmen were billed at an hourly rate and the police vehicles were billed at a daily rate. The daily logs only captured the number of officers and flagmen onsite and not the number of hours. Also, the number of police vehicles on site were not captured on the daily logs. As such, the daily logs could not be used to reconcile the billings for these bid line items. The Capital Project Manager Senior is relying on the totals billed by the contractor. However, the

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Capital Project Manager Senior needs to develop and implement an independent means to validate the hours reported by the contractor.

As an alternative to tracing and agreeing the billed quantities for the off duty police officers, police vehicles and flagmen, the auditor conducted the below testing to gauge the reasonableness of the billed quantities.

- The off duty officers and police vehicles were obtained from the City of Richmond Police Department (RPD). The auditor obtained reports of the fees that the contractor paid to RPD for off duty officers and police vehicles during the review period. The total payments remitted to RPD were compared to the total amount billed by the contractor.
- The contractor uses flagmen services to meet the minority business goal for the contract. Monthly compliance reports and subcontractor invoices are remitted to the Office of Minority Business Development to track the payments remitted to the minority subcontractor. The auditor compared the billed flagmen hours to the subcontractor invoices.

The billed quantities for the police officers, vehicles, and flagmen were deemed reasonable given the amounts paid to RPD and the flagmen sub-contractor. However, some of the flagging services may have been overbilled. The auditor noted that there were two copies of the same invoice with different amounts that were both paid. Also, there were multiple invoices covering the same service period. In addition, the service periods were not clearly defined on several invoices; as such there may have been an overlap in billing resulting in duplicate payments.

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Below is a summary of the invoices in question.

Invoice Number	Invoice Date	Service Period	Invoice Amount
20120496	4/20/2019	4/15-19/2019	\$ 44,357.25
20120497	4/29/2019	4/15-19/2019	\$ 34,823.57
20120498	4/30/2019	Thur Wednesday - May 1, 2019	\$ 30,837.66
20120499	5/5/2019	5/1-5/2019	\$ 17,493.00
20120514	5/10/2019	-	\$ 24,665.13
20120517	5/19/2019	-	\$ 19,217.31
20120518	5/22/2019	Ending 5/22/19	\$ 4,673.13
20120518	5/22/2019	Ending 5/22/19	\$ 3,023.79

Recommendation(s):

2. *We recommend the Capital Project Manager Senior develop and implement standardized billing and payment procedures including:
 - a. *Researching and resolving billing discrepancies prior to approving payments;*
 - b. *Requiring the contractor to use a standardized billing period; and*
 - c. *Validating the billed quantities for off duty officers, flagmen, and police vehicles.**
3. *We recommend the Capital Project Manager Senior research and resolve the billing discrepancies identified during the audit.*
4. *We recommend the Capital Project Manager Senior research the identified flagmen invoices in question to determine if overbillings occurred and recoup overpayments (if applicable).*

Finding #3 –Quality of Repairs

Approximately, 600,000 square yards of pavement was heat scarified between April 2018 and May 2019. The auditors visited 12 repair locations with heat scarification totaling 69,000 square yards and generally noted the repairs were in good condition. There were a few minor areas noted where the pavement is starting to fail as evidenced by potholes, unraveling pavement and

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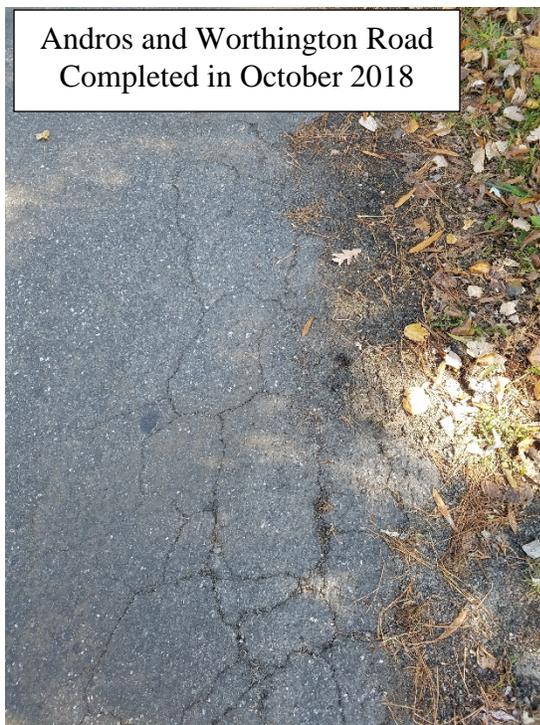
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cracking. Based upon discussion with an independent professional who is knowledgeable about the heat scarification process, it was noted that the identified pavement failures could be structural and/or sub-surface related or the road may have had an insufficient asphalt base, which was not detected prior to the heat scarification process.

Below are sample photos of the noted pavement defects.

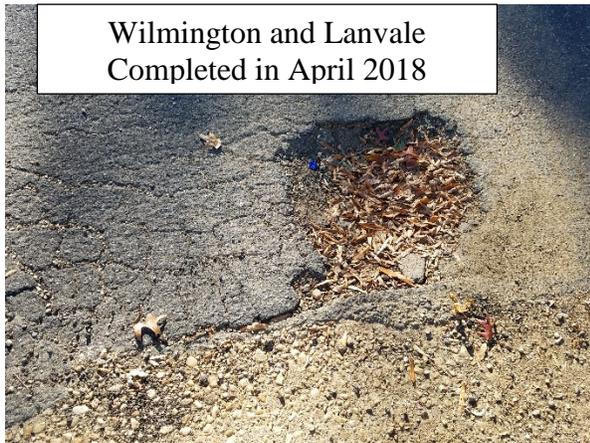


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In addition to the minor pavement failures identified, the auditors observed that at least one manhole/utility cover was paved over for 67% (8/12) of the visited sites. Per the Project Manager, the covers were paved over when the sealant was applied to the roads, which is performed under a different contract. Although, this observation is outside of the contract under review, a risk still exists that individuals may not be able to easily locate and access the utilities when needed, which could cause a public safety issue during an emergency. The pavement inspectors are responsible for ensuring the manhole and utility covers are not paved over.

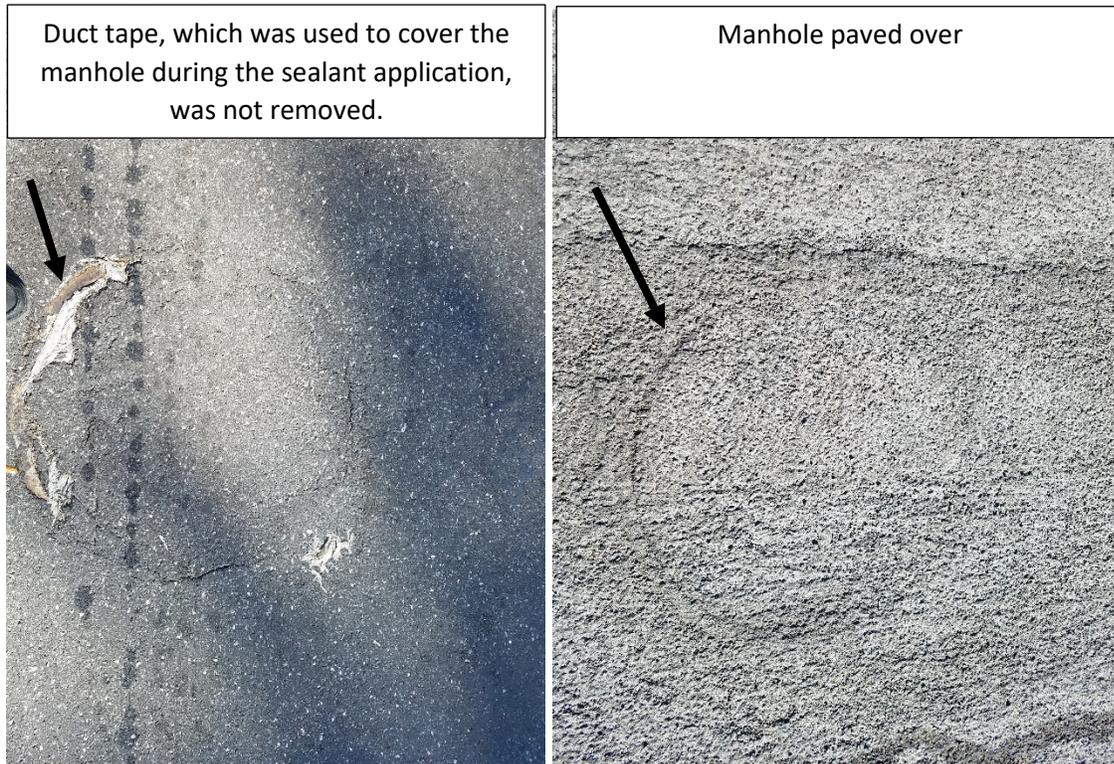
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The following are sample photos of the covered manholes.



Recommendation(s):

- 5. We recommend that the Capital Project Manager Senior and Pavement Inspectors ensure the contractor cleans off the utility and manhole covers prior to issuing payment.*

Finding #4 –Utility Adjustments

According to the contract scope of work, utility adjustments should be completed prior to heat scarification. However, some of the utilities were adjusted after the heat scarification work was conducted. Per the Capital Project Manager Senior,

- Sometimes the subcontractor is not able to complete the adjustments prior to the start of the heat scarification process; and
- In some cases, the utilities do not need to be adjusted prior to the heat scarification process but need to afterwards because they fall below grade.

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The Capital Project Manager Senior also indicated that the integrity of the repair is not affected as long as the adjustments are completed prior the sealant being placed. The auditor was unable to determine why the adjustments were made after the heat scarification process was conducted based upon the information captured on the daily logs.

Recommendation(s):

- 6. We recommend that the Capital Project Manager Senior ensures the contractor raises the utilities prior to the completion of the heat scarification process in compliance with the contract terms.*

**APPENDIX A: MANAGEMENT RESPONSE FORM
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#	RECOMMENDATION	CONCUR Y/N	ACTION STEPS
1	We recommend the Capital Project Manager Senior develop and implement standardized inspection procedures including documentation requirements.	Y	After many discussions we have developed a standard daily report with added required fields. See Attached
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	Capital Project Manager Senior		2/24/2020
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION
			New daily inspection report see attached.
#	RECOMMENDATION	CONCUR Y/N	ACTION STEPS
2	We recommend the Capital Project Manager Senior develop and implement standardized billing and payment procedures including: a. Researching and resolving billing discrepancies prior to approving payments; b. Requiring the contractor to use a standardized billing period; and c. Validating the billed quantities for off duty officers, flagmen, and police vehicles.	Y	(A) The City and the contractor will validate quantities the following week after invoice is received. (B) The Contractor will bill every two weeks with a start date and a finish date on each invoice. (C) New Inspector Daily sheet has number of Police and number of flagger with start and stop times and if there were any police vehicles used.
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	Capital Project Manager Senior		2/24/2020
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION
			The City's Inspection Team will fill out new daily report and contractor will receive a copy of said report. The Capital Project Manager Senior will validate invoice with contractor from these reports.
#	RECOMMENDATION	CONCUR Y/N	ACTION STEPS
3	We recommend the Capital Project Manager Senior research and resolve the billing discrepancies identified during the audit.	N	The City reviewed the discrepancies in question and feel that the billed quantities were correct.
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	Capital Project Manager Senior		2/24/2020
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION
			The City's Inspection Team will fill out new daily report and contractor will receive a copy of said report. The Capital Project Manager Senior will validate invoice with contractor from these reports.

**APPENDIX A: MANAGEMENT RESPONSE FORM
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#	RECOMMENDATION	CONCUR Y/N	ACTION STEPS
4	We recommend the Capital Project Manager Senior research the identified flagmen invoices in question to determine if overbillings occurred and recoup overpayments (if applicable).	Y	We reviewed the flagger invoices in question. The contractor had two crews working in the city at the same time and was billed for the flagging operation for only one crew . The Sub-contractor used the same invoice number for both crews. We informed the prime contractor that there will have to be separate invoice in the future .
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	Capital Project Manager Senior		2/24/2020
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION
			Capital Project Manager Senior verified that the contractor had two crews working at the same time and the flagging operation was only captured for one crew.
#	RECOMMENDATION	CONCUR Y/N	ACTION STEPS
5	We recommend that the Capital Project Manager Senior and Pavement Inspectors ensure the contractor cleans off the utility and manhole covers prior to issuing payment.	Y	Once a city street is complete the inspection staff will go back and inspect for all utility castings to be free of and pavement.
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	Capital Project Manager Senior		2/24/2020
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION
			Once a city street is complete the inspection staff will go back and inspect for all utility castings to be free of and pavement. If any utilities are covered the inspector will contact the contractor to have them uncovered.
#	RECOMMENDATION	CONCUR Y/N	ACTION STEPS
6	We recommend that the Capital Project Manager Senior ensures the contractor raises the utilities prior to the completion of the heat scarification process in compliance with the contract terms.	Y	Once the heat scarification work is complete, the city inspection staff will verify that all utility castings are in compliance.
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	Capital Project Manager Senior		2/24/2020
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION
			The contractor is responsible for raising the Sanitary and storm castings and DPU are responsible for raising the gas and water boxes.

Inspectors Check List & Daily Report Slurry Prep & Slurry Seal

Date _____
 Temperature _____

Street Name _____

From _____ To _____

Start Time _____

Stop Time _____

Number of Flaggers _____ Hours Worked _____

Number of Police _____ Hours Worked _____

Police Vehicles _____ Number _____

Heat Scarafication	SY
Rejuvenating Agent	Gal
Thin Lift Overlay	SY
SM-9.5D	Tons
Slurry Application	SY

	Yes	NO
Surface Prepared Properly		
Material Installed Properly		
Proper Traffic Control		
Utility Castings Adjusted prior to material Application		
Striping installed in adequate time once material has cured		
Proper Equipment		

Inspector Comments _____

Inspectors Signature _____ Date _____

Contractor Signature _____ Date _____