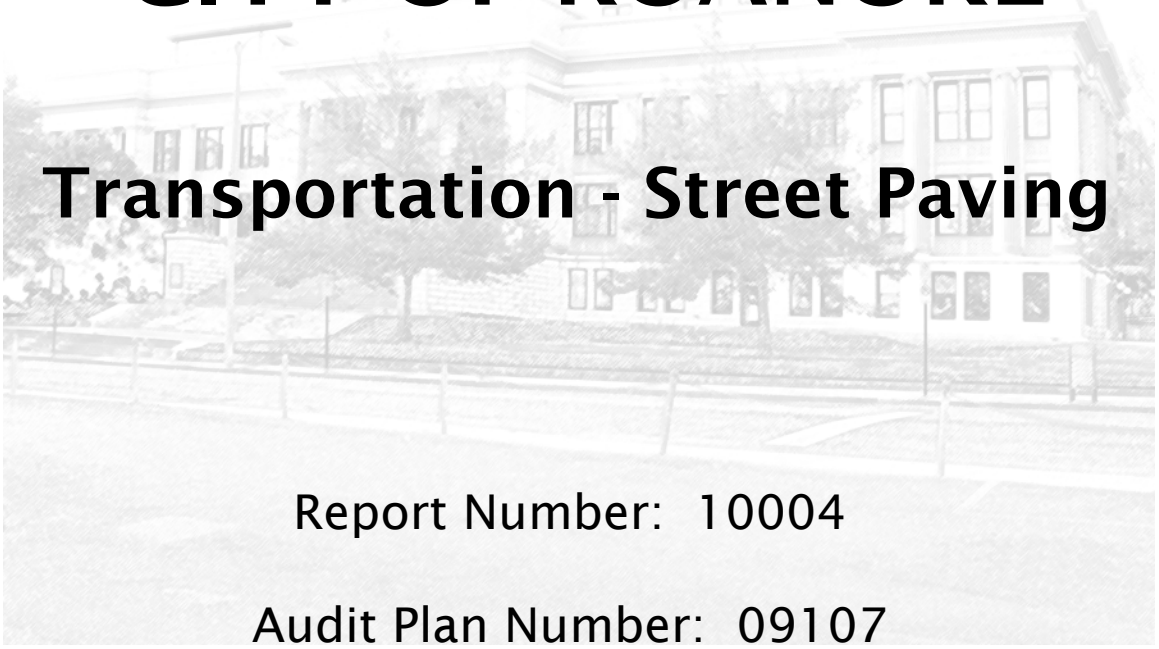
MUNICIPAL AUDITING REPORT

CITY OF ROANOKE



Transportation - Street Paving

Report Number: 10004

Audit Plan Number: 09107

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BACKGROUND

The City of Roanoke includes approximately 1,200 lane miles of streets that require regular maintenance to prevent or slow deterioration. The Transportation Division is responsible for maintaining the quality of Roanoke's transportation infrastructure. Specific responsibilities include Traffic Engineering & Operations, Paving, Street Lighting, Snow Removal and Street Maintenance. The Paving Program is responsible for the "resurfacing of City streets to provide safe, rideable roads for motorists, bicyclists and transit to enhance the quality and livability of the City" [Resource Allocation Plan Adopted for FY 09-10, Transportation – Paving Program].

The Virginia Department of Transportation, through the Urban Construction and Maintenance Program, allocates funding to the City for street maintenance. These funds are generally derived from state and federal gas taxes, sales tax, and vehicle licensing fees. They are intended to cover or supplement ordinary street maintenance and repair defined as: "activities which pertain to the preservation of each type of roadway structure and facility as near as possible to its condition when constructed."

The total funding is based on the number of qualified lane miles as of July 1 of each fiscal year, as determined by the Virginia Department of Transportation. A lane mile is equivalent to one linear mile of one travel lane; therefore one mile of a two-lane road equals two lane miles. In order to qualify, the street must meet the requirements of Virginia State Code 33.1-41.1: "Payments to cities and certain towns for maintenance of certain highways."

The state code was initially enacted in 1949 and last modified in 1985. The current code requires a street to have at least a fifty foot right-of-way with at least 30 feet of hard pavement. During the mid-1980's, a Virginia Department of Transportation representative qualified City streets to be included in the state's street inventory. Each year, the City reports street additions, closures and modifications to the Virginia Department of Transportation for review and approval. The City had 997 lane miles in fiscal 2010 that qualified for state funding [**Exhibit 1**].

Based on figures obtained from the Transportation Division, the average cost to pave one lane mile each of the last three fiscal years was:

- FY 2008 $58,000
- FY 2009 $77,146
- FY 2010 $74,949

These costs take into consideration the actual width of the travel lane including any shoulder, parking or bike lanes, as well as asphalt and milling. The increase in costs can generally be attributed to increased costs for liquid asphalt.

As reported by the Transportation Division, the following lane miles were resurfaced over the last five years:

- 05 – 06 41 lane miles
- 06 – 07 51 lane miles
- 07 – 08 35 lane miles
- 08 - 09 35 lane miles
- 09 – 10 43 lane miles

The City Council has established a goal to repave all city streets within a 20-year cycle. To determine how many lane miles would have to be completed annually to achieve this goal, the Transportation Division had to estimate the average life expectancy for each type of street classification, as follows:

- Arterial streets which serve the highest volumes of vehicles; for example, Orange Avenue and Hershberger Road. The pavement surface on these types of streets typically has an eight (8) to ten (10) year life expectancy.

- Collector streets which feed into arterial streets; for example, Cove Road and King Street. The pavement surface on these types of streets typically has a 12 to 15 year life expectancy.

- Central Business District (CBD) streets between 5th Street SW, 3rd Street SE, Norfolk, and Elm Avenues. The pavement surface on these types of streets typically has a 12 to 15 year life expectancy.

- Residential streets where pavement surfaces can typically have a 20 year life expectancy.

A paving target of 79 lane miles per year was established based on the number of lane miles in each classification. Assuming repaving costs remain at current levels, the paving program would require approximately $6 million annually to achieve its target.

Paving priorities are established by Transportation employees who maintain an inventory of streets by type. Street segments are selected for paving based on several factors including the street condition, logistics, equity, other city priorities, and available budget. The 2010 paving program emphasized repaving arterial and collector streets, which were allocated 80 percent of the paving budget. Streets within the Central Business District were allocated 10 percent and residential streets were allocated the remaining 10 percent.

A paving contract is awarded annually in conjunction with the beginning of each fiscal year. There are a limited number of paving contractors in the Roanoke Valley; and for the past six years, Roanoke's largest paving contractor, Adams Construction, has been awarded the paving contract. Adams Construction has a clear advantage over other paving contractors because they specialize in "Superpave" asphalt pavement types that are recommended by the Virginia Department of Transportation and preferred by the City. Adams Construction also owns the quarry that is the only local source of "non-polishing" aggregate. This type of aggregate does not wear as quickly as other limestone; thus, it provides better traction for a longer period of time than does "polishing" aggregate. Paving for fiscal 2010 began during the month of July 2009 with paving substantially completed at the end of November 2009.

Transportation's annual paving activities are overseen by a full-time Construction Inspector who is responsible for being on-site during the milling and paving process to ensure that streets are paved in accordance with the terms of the contract.

OBJECTIVES, SCOPE, AND METHODOLOGY

Objectives:

1. To evaluate the design and operation of internal controls over the City's paving program.

2. To determine if the Virginia Department of Transportation has a complete listing of city streets on which to base its annual allocation to the City for street maintenance and construction.

Scope:

We evaluated the design of the controls in place at May 31, 2009, and the street inventory reported by the Virginia Department of Transportation as of June 30, 2009.

Methodology:

We interviewed and observed various Transportation employees to obtain an understanding of their process for administering the City's paving program. We used process outlines to document and evaluate these processes, and to develop our testing program.

We gathered information from various sources, including the City's geographic information system, the Virginia Department of Transportation Urban Maintenance Inventory, and the Engineering Division's Street Name database. We utilized audit software and Microsoft Access to extract, join, and compare data in an effort to identify streets that were not included on the paving inventory. Due to variations in how street descriptions were formatted and organized, we were unable to make valid conclusions.

With the assistance from the Street and Landscape Maintenance Superintendent and Construction Inspector, we developed a checklist to enable our auditor to rate the condition of streets [**Exhibit 2**]. We selected a geographically diverse sample of 48 city street segments to be graded. We drove each segment, frequently walking sections to photograph and measure conditions indicating degradation of the paving

surface. We recorded our measurements and observations on our checklist, which we later graded and compared to the City's street inventory.

We traced our sample of 48 street segments to the State's Urban Maintenance Inventory to ensure they were listed. We also selected five (5) neighborhoods geographically dispersed across the city as an additional test of the state's inventory. Using the City's neighborhood plans and GIS data, we were able to estimate the dimensions of streets and right-of-way easements, as well as construction dates, to enable us to determine if streets qualified for maintenance funds under past and current state regulations. We traced all streets from four (4) neighborhoods and 30 streets from a fifth neighborhood to the State's Urban Maintenance Inventory.

We reviewed inspection records and observed the inspection process in order to evaluate the effectiveness of controls over paving contract performance.

We did not evaluate the procurement process for the annual paving contract.

RESULTS

Observation 1: Paving Program Inventory

The "Paving Master Spreadsheet" is an Excel based file used by the Transportation Division to inventory street segments included in the City's paving program. In fiscal 2008, Transportation staff invested significant time and effort into improving the master spreadsheet. Streets are now organized as follows:

- Arterial/Collector
- Central Business District (CBD)
- Residential History
- Three (3) Year Residential Paving Candidate List

All streets included on the Arterial/Collector, CBD, and Three (3) Year Residential Paving Candidate List were evaluated in early 2009. Streets were divided into logical paving segments, measured, and rated as to the condition of the pavement.

Rating each street segment involves examining the severity of any asphalt distress including surface defects, deformations, cracks, patches, and potholes. The rating scale is A1 through D3, with A1 being the most severe condition. This scale provides for 12 possible condition ratings.

We noted the following issues with the inventory:

- The data is not complete since some of the paving history is not documented and some residential street segments are missing.

- The residential streets are not on a routine schedule for reevaluation resulting in obsolete condition data.

- The criteria used to distinguish between ratings have not been defined or documented.

- There is no form used to document the various elements observed when assessing streets and assigning ratings.

A complete inventory of paved streets is an essential component of any process for prioritizing street paving and preventative maintenance. While residential streets do not engender the same safety concerns as arterial and collector streets due to their lower speeds and volumes of traffic, they are a significant capital investment for the City. Residential streets account for approximately 71 percent of the City's qualified lane miles, as reported by the Virginia Department of Transportation. Relying on a complaint driven process to address maintenance needs of residential streets will result in streets requiring more extensive, costly repairs.

Recommendations: Establish a long-term strategy for updating and maintaining the paving master spreadsheet. All streets, including residential streets, should be driven and rated periodically as to the condition of pavement surface.

Using the checklist developed for the audit as a starting point, develop a form for rating streets that supports consistent ratings.

Management's Response:

We agree that a complete inventory quantifying the City's total paving costs would be beneficial. There has been a recognized lack of funding available to address paving needs and limited availability of personnel to ride all streets. The Transportation Division asks its street maintenance crews and right-of-way inspectors to identify streets with potholes and utility cuts when observed during the course of their routine work. Snow plow drivers are asked to identify issues with raised manhole covers. These efforts will continue and will help the division to identify streets in need of immediate repairs. We will develop a formal strategy for updating and maintaining the paving master spreadsheet by June 30, 2011.

We also agree that a formal process for rating streets would be beneficial. The division will develop and implement a form to be used for the 2011 evaluation of streets. We believe that a pavement management system that would automate the process through the use of appropriate software should be considered.

Observation 2: Paving Maintenance and Replacement Strategy

The primary performance goal established for the paving program has been lane miles paved per year. The current goal of 79 lane miles is based on the following computations:

Paving Frequencies	Frequency of Paving (Years)	Times per 20 Year Cycle	Lane Miles	Lane Miles Paved in 20 Years
Principal Arterials	8	2.5	105.06	262.65
Minor Arterials	10	2.0	115.31	230.62
Collectors	13	1.5	63.25	94.87
Residential	20	1.0	998.66	998.66
Total			1,282.28	1,586.80
Miles Paved Annually				79.34

At an average of approximately $75,000 per lane mile for milling and repaving, the paving program would require $5,950,500 in annual funding. The fiscal 2011 budget is $2,682,111. Essentially all paving program funds are committed to the paving contract. There is no formal strategy for preventative maintenance of streets prior to experiencing visible deterioration.

Industry literature indicates that preventative maintenance such as sealing and thin overlays can reduce life cycle costs of pavement by up to one-third (1/3) over a 25 year life. Excluding segments categorized as “residential history,” there were 465 street segments in the paving master spreadsheet that were represented as having been rated in 2009 by division staff. There are 259 segments rated as being in poor condition [“A” rating]. At $75,000 per lane mile, the cost to repave these streets would be over $20 million.

Recommendations: Develop a preventative maintenance strategy as part of the overall paving program. Revise the goals of the paving program to place greater emphasis on preventative maintenance and reduce the lane mile paving goal to reflect extended service life estimates for surfaces.

Develop a funding proposal that provides for adequate preventative maintenance first and incrementally addresses the backlog of "A" rated streets over time.

Consider the feasibility of incorporating preventative maintenance history into the paving master spreadsheet in order to produce a complete history for each street.

Management's Response:

We agree that a comprehensive preventative maintenance strategy should be developed as part of the City's overall paving program. This strategy should include surface treatment techniques and sealing. We will also consider alternatives to milling and repaving when streets require repair. These strategies will result in significant changes in the appearance and smoothness of our streets, and will require public education and input before being adopted. Initial planning will begin in July 2010, with a preliminary concept completed by January 1, 2011.

We have previously identified the need for infrared pavement repair equipment that will enable us to eliminate joints between old and new pavement when repairing potholes, utility cuts, and adjusting manholes. This will eliminate the intrusion of water around such repairs and improve the riding surface.

Observation 3: State Funding for Street Maintenance

The Code of Virginia specifies that: "The Commonwealth Transportation Commissioner, subject to the approval of the Commonwealth Transportation Board, shall make payments for maintenance, construction or reconstruction of highways, as hereinafter provided, to all cities and towns eligible for allocation of construction funds for urban highways. Such payments, however, shall only be made if those highways functionally classified as principal and minor arterial roads are maintained to a standard satisfactory to the Department of Transportation. No payments shall be made by the Commissioner to any such city or town unless the portion of the highway for which such payment is made has an unrestricted right-of-way at least 50 feet wide and a hard-surface of at last 30 feet" [33.1-41.1].

An inventory of all City streets which qualify for state funding is maintained by the Virginia Department of Transportation and filed with the City's Transportation Division annually. The lane mileage of the streets included in this inventory is used in calculating the amount of the funding received by the City. There were 997 qualified lane-miles for fiscal 2010 representing a total annual payment of $11,542,819. This amount was subsequently reduced to $11,205,469 due to state budget cuts.

To test the accuracy of the state's street inventory, we selected five (5) neighborhoods throughout the City and, using the measurement tool in the Geographic Information System (GIS), measured the right-of-way and hard pavement width of the streets. All streets in four (4) of the neighborhoods were tested, while 30 streets in the fifth neighborhood were tested.

We noted ten (10) streets totaling approximately 2.78 lane miles which were not included on the state's inventory, that appear to qualify for reimbursement. This represents $27,832 in additional funding for 2011, and would provide additional funds to the City on an annual basis going forward.

The state code related to street maintenance and construction funding was revised in 1953, 1970, 1979, 1984, and 1985. These code changes at times changed the requirements for roads in terms of the width of the hard surface and width of right of way needed to qualify for funding. Existing streets were grandfathered under new code, so one must know the date the road was put into service and the requirements

under the code in force at that time to determine if a street qualifies for funding. The City was also annexing territory over this period of time, adding substantial numbers of streets to its inventory. Based on the results of our sample testing, there is a risk that qualified streets built before 1985, particularly in annexed areas of the City, could be missing from the state's inventory of city streets. The City maintains approximately 286 lane miles of residential streets that are not qualified by the state.

Recommendations: The Transportation Division should develop a work plan to validate the Department of Transportation's street inventory. The plan should target annexed areas of the City first and include residential streets. Those streets that do not meet the requirements for right-of-way or hard surface dimensions should be evaluated as to their importance to public safety, health, and welfare. These factors can be used as a basis for requesting a waiver of the requirements from the Commissioner of the Virginia Department of Transportation.

Management's Response:

We agree that a review of the state's inventory should be performed as described. The resources available within the division to complete such an assessment are limited at this time. We will first research and validate the streets identified by the audit. Based on the results of this step, we will develop a work plan that prioritizes target areas for review. The initial validation of audit results should be completed by October 31, 2010. A work plan should be developed by December 31, 2010.

The division continues to need an asset management system, which we believe would provide for more efficient and effective management of the City's street inventory. Funding and resources are not currently available to implement the DataStream asset management system used by Parks & Recreation, and Facilities Management.

CONCLUSION

We conclude that the overall design and operation of the system of internal controls over the City's paving program could be strengthened. The current staff in the Transportation Division appears to be very capable and has been making measurable improvements to its processes over the last several years. We noted that the actual paving work was well conceived and appropriately managed.

As we conducted our audit, we became aware of other factors that are positively impacting the condition of the City's streets. Changes in the city regulations requiring utilities to meet minimum standards when repairing utility cuts is an important initiative and should be continued.

We would like to thank the staff of the Transportation Division for their assistance and cooperation throughout the audit. Their candor and professionalism were very helpful in completing the audit.

In addition to the observations noted in this report, we have communicated other, less significant issues to management verbally or by memo.

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Senior Auditor

Drew Harmon, CPA, CIA
Municipal Auditor

EXHIBIT 1

VDOT Annual Funding Based on Qualified Lane Miles and Street Classification.

	FY 08-09			FY09-10		
Road Type	# Lane Miles	Rate per Lane Mile	Total Payment	# Lane Miles	Rate per Lane Mile	Total Payment
Arterial	221.35	$16,685	$3,693,225	220.37	$17,075	$3,762,818
Collector	63.25	$9,796	$619,597	63.25	$10,025	$634,081
Residential	713.37	$9,796	$6,988,173	713.81	$10,025	$7,145,920
Total	997.97		$11,300,995	996.43		$11,542,819

EXHIBIT 2

City of Roanoke – Municipal Auditing
Transportation – Paving, Road Asphalt Rating Form

Date:	
Street Name:	
Segment:	
Weather:	
Picture #'s	

Cracks				
	Width:	Rating	Rating	Notes
Transverse:	None	0		
	¼ "	1		
	½ "	2		
	¾ "	3		
Longitudinal	None	0		
	¼ "	1		
	½ "	2		
	¾ "	3		
Alligator	None	0		
	¼ "	1		
	½ "	2		
	¾ "	3		
Shrinkage /	None	0		
Block	¼ "	1		
	½ "	2		
	¾ "	3		
Total Cracks Rating:				

Rutting / Corrugation				
	Width:	Rating	Rating	Notes
Shoving:	None	0		
	½ "	1		
	1 "	2		
	1 ½"	3		
Rutts	None	0		
	½ "	1		
	1 "	2		
	1 ½"	3		
Corrugation	None	0		
	½ "	1		
	1 "	2		
	1 ½"	3		
Total Rutting / Corrugation Rating:				

Drainage		
	Rating	Notes
None	0	
Ditch	1	
Surface	2	
Subsurface	3	
Total Drainage Rating:		

Overall Ride Ability			
	Rating		Notes
Good	0		
OK	1		
Marginal	2		
Bad	3		
Total Overall Ride Ability Rating:			

Overall Rating			
Total Points:			
City Rating:	Audit Rating		
A	10 & up		
B	7 - 9		
C	4 - 6		
D	0 - 3		
Final Audit Rating Converted to City Rating			
City Rating (If road has been rated)			
Ratings Agree (Circle One):			Yes No