Richmond City Council

The Voice of the People. *Richmond, Virginia*

OFFICE OF THE CITY AUDITOR

REPORT # 2012-04

AUDIT

Of the

Richmond City Department of Public Works
Roadways Maintenance

November 2011

OFFICIAL GOVERNMENT REPORT

Richmond City Council
OFFICE OF THE CITY AUDITOR
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Committed to increasing government efficiency, effectiveness, and accountability on behalf of the Citizens of Richmond.

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Executive Summary

The City Auditor's Office has completed an audit of the Roadway Maintenance and Capital Improvement Plan (CIP) Paving functions within the Department of Public Works (DPW). This audit was conducted in accordance with generally accepted government auditing standards.

Introduction

Besides public safety, one of the most important tasks of a local government is to construct and maintain the infrastructure within its jurisdiction. These assets not only have an impact on the quality of life citizens enjoy, but also serve to showcase municipalities seeking economic development opportunities. DPW is responsible for maintaining and managing the City's more than 1,860 moving lane miles of roadways to ensure that people, goods and services can travel safely and economically.

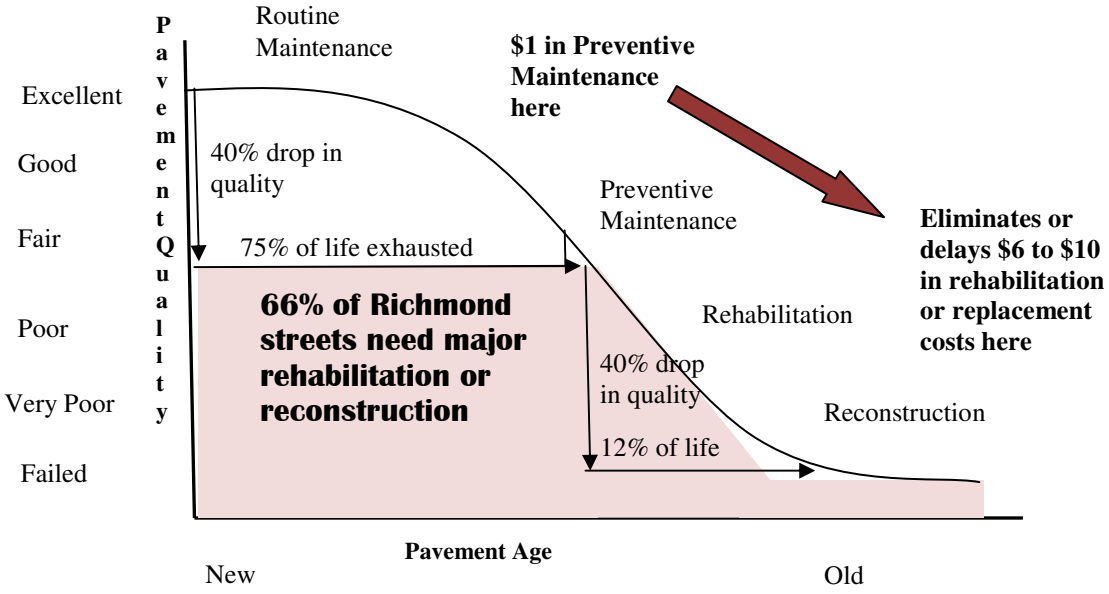
According to DPW management, the infrastructure of the City of Richmond is several hundred years of age. Traditionally, the types of maintenance performed during these years were reduced to limited preventive maintenance with no rehabilitation or reconstruction practices applied. This resulted in the continuous deterioration of the pavement infrastructure. The City also inherited substandard streets in the early 1970's through the annexation from neighboring counties.

Salient Findings

Industry standards recommend certain procedures based upon the age and condition of the roadways. Under ideal funding conditions, multiple roadway maintenance procedures should be used. Due to inadequate funding, DPW is unable to follow the accepted industry practices to

the full extent needed. Instead, the roadways in poor condition are selected and subjected to a limited maintenance such as pothole patching, slurry sealing and thin milling and overlay.

The National Center for Pavement Preservation indicates that every $1 spent on pavement preservation when pavements are in good condition eliminates or delays spending $6 to $10 on rehabilitation or reconstruction later when the pavement quality has deteriorated badly. Currently, the majority of the City's roads are in fair or poor conditions, and need maintenance that is more expensive. The following diagram explains this issue:



At present, DPW is able to perform mostly preventive maintenance on the roadways that may qualify for rehabilitation or reconstruction. Auditors found Road conditions in two neighborhoods deteriorated after a few months instead of the industry standard of 5 to 7 years, after the slurry seal application (a preventive maintenance procedure). Therefore, subjecting the streets in poor condition to very limited maintenance procedures resulted in very limited benefits. A portion of the $1.4 million spent on these projects could have been better utilized.

Funding

The roadway maintenance function is not adequately funded. A dramatic funding gap exists between the needs and the budget appropriations for maintaining roads and pavement reconstruction. The funding needs as of FY 2010 are demonstrated in the following table:

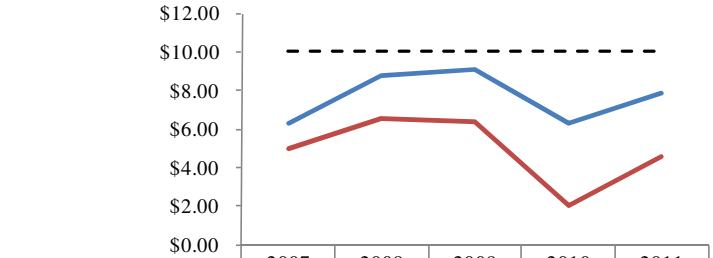
Pavement Condition	Rating Scale	Treatment	# of Lane Miles	Total Funding Needed
Excellent	100-91	-	121	-
Good	90-71	Slurry seal	497	$ 12,828,564
Fair	70-51	Milling/Overlay	657	$ 46,635,831
Poor	50-21	Reconstruction	492	$ 190,492,560
Very Poor	20-0	Reconstruction	69	$ 26,715,420
Total			1,836	**$ 276,672,375**

Source: DPW and the 2010 pavement assessment

This is a very significant issue for Richmond. Currently, the City does not adequately fund the maintenance of good roads, which could result in the deterioriation of the entire roadway system, including the 33% of roadways in good condition. Once the roads are completely deteriorated, the funding required to cure the situation will be significantly higher than the current estimate of $277 million.

DPW has consistently requested inadequate funding for roadway maintenance from the City Council and the Administration. The auditors were told that the request for funding is based on assumptions about the amount of funding likely to be approved, rather than the actual needs identified. The actual funding appropriated was significantly lower than the perceived needs. This situation is depicted in the following graph:

Inadequacy of Funding (in Millions)



	2007	2008	2009	2010	2011
Requested Funding	$6.30	$8.74	$9.10	$6.33	$7.83
Approved Budget	$5.00	$6.50	$6.35	$2.00	$4.58
Perceived Needs	$10.00	$10.00	$10.00	$10.00	$10.00

This disparity has forced DPW to use only two preventive maintenance methods to maintain all roads, irrespective of their age and condition, which is not a desirable approach.

Auditors learned that DPW intends to request $11 million annually for roadway maintenance beginning in the FY2013 budget cycle. Considering the magnitude of the backlog, funding at this level will take several decades to address the backlog. Meanwhile, an additional backlog may develop due to further deterioration, making this process perpetual. To alleviate this situation, it may be necessary to identify additional funding sources such as reallocation of meals tax, repayment of the RMA loan proceeds, issuing bonds, etc.

What should the City do to remedy this situation?

- DPW does not show that they have a complete inventory of roads they are responsible for maintaining. Currently, the Department has an inventory of moving lane miles that is reimbursed by the State. This inventory does not include parking and/or turning lanes, which are not reimbursable by the State. The State does not reimburse maintenance on these lanes, however, the City still has a responsibility to maintain them.

  DPW needs to implement an asset management approach. This strategic and systematic approach strives to provide the best return for each dollar invested by maximizing system performance, improving customer satisfaction, and minimizing lifecycle costs.

- Richmond's assessment of road conditions consists of limited visual observations that trained vendor employees make while driving on the roadways. The streets are visually inspected to identify the frequency and severity of pavement distresses (e.g. patching and cracking) that are pre-defined by the City. This type of assessment is less reliable, as it does not provide a true assessment of the structural integrity of roadways. It only reveals the apparent, visible symptoms of deterioration. However, a long-term maintenance strategy cannot be based on these results. The City needs to use alternative, more effective methods to assess roadway conditions, including the structural defects.

Management Issues

- Based on the results and findings of the audit methodology employed, auditors concluded that internal controls for effective management of the roadway maintenance and CIP Paving operations need improvement.
- DPW does not have an accurate accounting of the total pavement area that the City is responsible for maintaining. This situation prevented the auditors from verifying if DPW has planned for the the total scope of their work.
- Management oversight of these operations needs improvement. Quality assurance in this operation is critical to achieve a uniform surface finish. The inspection process must ensure vendor compliance with project plans and specifications. The auditors found several roads that were slurry sealed during 2010 and 2011 that had pavement defects, which coincide with the quality control issues cited in the "Pavement Preservation Treatment Construction Guide" issued by the Federal Highway Authority (FHWA). Several instances were noted where pavement surfaces were not treated.

  The pavements exhibited the following conditions described in the FHWA guide:
  - Segregation and delamination, technical terms for work defects
  - Low quality transverse and longitudinal joints
  - Poor quality edges and shoulders
- Due to lack of documentation, it was not possible to verify the appropriateness of vendor payments. This situation represents a break down in the internal control procedures.
- The Roadway Maintenance Division has a work order system, but they do not utilize it to its full potential. The Division does not capture sufficient information to manage costs or to determine if the work was completed appropriately.
- DPW processed a change order totaling $50,240 for additional preparation work for the slurry seal project. Auditors could not verify if management appropriately authorized the change order and if the additional work was essential.

Coordination of Efforts with Department of Public Utilities (DPU)

- Street cuts, if not restored properly, can lead to the premature deterioration of the pavement. Thus, it is important that such projects are properly planned, coordinated, and

inspected. Recent coordination efforts have improved communications and facilitated coordination of capital projects between DPU and DPW. However, coordination of capital projects and day-to-day operations can be improved as utility and paving projects routinely conflict. This results in pavement cuts occurring on streets that have been recently resurfaced or repaved. Some of the pavement cuts are unavoidable due to emergency repairs, new service requests from customers and private development efforts.

Pursuant to the Right-of-Way Excavation and Restoration Manual, DPW's Office of Right of Way Management is responsible for coordinating all work within the City's public right-of-ways to:

- Ensure excavation work is completed before the City begins construction and maintenance work to minimize impediments and inconvenience; and
- Minimize the frequency of pavement cuts and openings.

However, without knowledge of all of the excavation work and centralized coordination of the restorations and inspections, it is difficult for DPW to complete this responsibility. DPW should be the sole authority for utility restorations and inspections.

The City Auditor's Office appreciates the cooperation of the Departments of Public Works and Public Utilities. Please contact me for questions and comments on this report.

Umesh Dalal, CPA, CIA, CIG
City Auditor

Cc: Mr. Byron C. Marshall, CAO

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Introduction and Background

Introduction

The City Auditor's Office has completed an audit of the Roadway Maintenance and Capital Improvement Plan (CIP) Paving functions within the Department of Public Works (DPW) for the 18 month- period ended December 31, 2010. The objectives of the audit were to:

- Determine the existence and effectiveness of internal controls; and
- Evaluate the efficiency and effectiveness of operations.

This audit was conducted in accordance with generally accepted government auditing standards. Those standards require that auditors plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for their findings and conclusions based on their audit objectives. Auditors believe that the evidence obtained provides a reasonable basis for their findings and conclusions based on the audit objectives.

Methodology

To complete this audit, the auditor performed the following procedures:

- Conducted interviews;
- Reviewed relevant records, policies and regulations;
- Performed various tests; and
- Performed other audit procedures as deemed necessary.

Management Responsibility

The management of the City of Richmond is responsible for ensuring resources are managed properly and used in compliance with laws and regulations. Management is also responsible for ensuring City

programs are achieving their objectives, and services are being provided efficiently, economically and effectively.

Background

Besides public safety, one of the most important tasks of a local government is to construct and maintain the infrastructure within its jurisdiction. These assets not only have an impact on the quality of life citizens enjoy, but also serve to showcase municipalities seeking economic development opportunities. Adequate maintenance of the City's infrastructure and other assets is necessary to assure an appropriate level of service delivery and to maintain pleasant aesthetics in the City. An upcoming international bike race will bring several hundred thousand people to Richmond. The bike race will draw attention to the City's roadway system.

The conditions of the infrastructure impact quality of life and economic development in the City.

DPW is responsible for maintaining and managing the City's more than 1,860 moving lane miles of roadways to ensure that people, goods and services can travel safely and economically. The Department had the following accomplishments in calendar year 2009 and 2010:

- Daily maintenance work such as pothole repairs are completed by the Roadway Maintenance Division using general funds. The Division completed 7,817 and 11,427 pothole repairs in calendar years 2009 and 2010, respectively.
- Annual resurfacing projects are contracted out and completed through the Capital Improvement Plan (CIP) paving program using CIP, state and federal funds. In 2009 and 2010, approximately 156 and 183 lane miles were resurfaced, respectively.

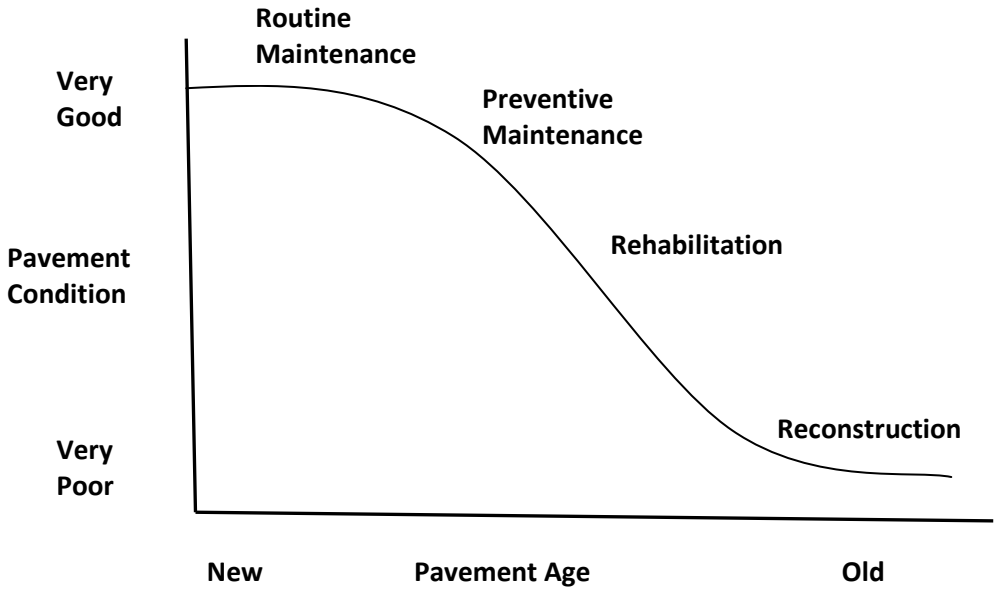
Observations and Recommendations

Chapter I – What is the current state of the City's roadways?

Introduction

The maintenance /replacement strategy must be tailored to specific road conditions.

There are four general maintenance/repair methods used for road maintenance and replacement as the road ages. The effectiveness of a City to execute these strategies plays a significant role in maintaining the City's roads in good condition for the prescribed period set forth in the road construction standards. As the road ages, it suffers deterioration. The severity and extent of the distress depends upon the amount of traffic on the road and climate conditions. Therefore, the maintenance/replacement strategy must be tailored to specific road conditions. The goal is to select the strategy that is most cost-effective and reasonable for the specific situation. The following depicts the road maintenance and replacement life cycle:



Source: Information obtained from the Pavement Management: A Guide for Local Officials (Delaware)

Industry Practices for Road Maintenance and Replacement

The following table describes the various methods of maintenance and replacement of roadways:

Component	Description	Benefit	Treatment Example
Routine Maintenance	Repairs localized distresses as they occur	Prevents premature failure of pavement	• Crack Seal • Pothole Patching • Skin Patching
Preventive Maintenance	Application of one or more treatments to retard/delay development of pavement deterioration	• Cost effective • Extend pavement service life • Improve pavement performance • Delay need for rehabilitation	• Crack Seals • Chip Sealing • Slurry Sealing • Thin Overlay • Micro-Surfacing
Rehabilitation	Correct specific deficiencies and partial depth corrective procedures	Extends the life of pavement and/or improves load carrying capability	• Thick Overlays • Full Depth Mill & Overlay Patching
Reconstruction	Removal and replacement of pavement		• Cold in-place Recycling • Full Depth Reconstruction • Full Depth Reclamation

Source: Summarized information from Pavement Management: A Guide for Local Officials (Delaware)

The age and conditions of the roadway determine the type of maintenance needed.

What are Richmond's Practices?

Due to the lack of adequate funding, DPW is unable to follow the accepted industry practices as described above to the full extent of the City's needs. The roadways in poor condition are selected and subjected to limited maintenance such as pothole patching, slurry sealing and thin milling and overlay. Under ideal funding conditions,

Due to inadequate funding, DPW is unable to follow industry best practices for roadway maintenance to the extent needed.

these treatments are implemented on roadways that are in good condition to extend their life expectancy. Therefore, the City is not getting the full benefit of the costs incurred. In the past several years, the City has not invested in maintaining good roads to assure their continued good condition. As a result, the roads are deteriorating at a faster rate. The impact of these practices is described in this report.

Public Opinion

A recent public survey (confidence level 95%) conducted by the City Auditor's Office revealed the following public perception related to the Division's performance. The results are depicted in the following table:

Citizens are very concerned about the road conditions in Richmond.

Fair or Poor Ratings	2008	2009	2010
Overall Condition of Streets and Roads	60.3%	67.5%	68.1%
Maintenance of All Major City-maintained Streets	59.2%	67.2%	66.6%

Source: 2011 public survey using VCU

The survey results discussed above indicates increasing dissatisfaction with the overall conditions of roadways. Also, in a public survey session on NBC 12, the auditors logged 158 complaints in 1.5 hours. This shows the level of citizen dissatisfaction. Clearly, the citizens are concerned about the overall condition of streets and roads and the level of maintenance on all major City streets.

Road Condition Assessment

The City conducted a limited road condition assessment in 2005 and in 2010 to identify the extent and severity of pavement distresses such as cracking. The following are the ratings of the assessed streets:

66% of Richmond streets were determined to be in fair and poor conditions in 2010.

	Good	Fair	Poor
2005 Data	23.2%	24.2%	52.6%
2010 Data	32.8%	35.3%	31.0%

The above assessment indicates that road conditions are not good but have improved between the two assessments. The improvements in 2010 may be partially attributed to:

- Surveying the roads right after the resurfacing treatment procedures were done.
- Using different methods in the 2005 and 2010 assessments. During the 2010 assessment, the pavement distresses were consolidated from ten evaluation areas to the following five: cracking, patching, ride quality, surface type, and the relative age of pavement since the last treatment.

Timing and methodology used in 2010 may have skewed the results to indicate road conditions were better than they actually were.

Surveying roads recently slurry sealed may make them appear in good condition as the treatment may conseal the visible symptoms of distress. Cracking in roadways indicates distress. The type of crack indicates the extent of the distress. For example, alligator cracks would indicate higher distress compared to a hairline crack. Combining all cracks in one category may lessen the extent of damage and result in a higher rating. This would impact DPW's ability to select the appropriate treatment methodology as the type, extent and severity of the pavement distress may not have been captured in the assessment.

The 2010 road condition assessment survey identifed that 66% of the City's roads were in fair to poor condition. The roads exhibited pavement distresses such as cracking, patching, potholes, loss of surface texture and increased roughness that affect both the ride quality and motorists' safety. The following pictures depict a few examples of roads in poor condition:

Jefferson Street from Main to Cary – Rating = 6

Dinwiddie Avenue from East 7th Street to East 8th Street – Rating = 7

Chapter 2 – What caused the poor road conditions?

Legacy Issue

According to DPW management, the infrastructure of the City of Richmond is several hundred years old. Maintenance performed during many of the past years was reduced to limited preventive maintenance with no rehabilitation or reconstruction procedures applied. This resulted in the continuous deterioration of the pavement infrastructure. The City also inherited more responsibility for substandard streets in the early 1970's through the annexation from Henrico and Chesterfield Counties.

Funding

The roadway maintenance function is not adequately funded to maintain and preserve the roadway infrastructure and address the pavements that need to be rehabiliated or reconstructed as depicted in the following table:

A total of at least $277 million is needed to bring the Richmond roads to good conditions.

Pavement Condition	Rating Scale	Treatment	# of Lane Miles	Total Funding Needed
Excellent	100-91	-	121	-
Good	90-71	Slurry seal	497	$ 12,828,564
Fair	70-51	Milling/Overlay	657	$ 46,635,831
Poor	50-21	Reconstruction	492	$ 190,492,560
Very Poor	20-0	Reconstruction	69	$ 26,715,420
Total			1836	**$ 276,672,375**

Source: DPW and the 2010 pavement assessment

The above estimate may be understated because it is based on skewed assessment procedures.

The funding estimate was calculated based upon the per lane mile costs and the 2010 road condition assessment data provided by DPW. The following assumptions were made:

- Roads in excellent condition are not treated. Therefore, no costs are incurred on these roads.

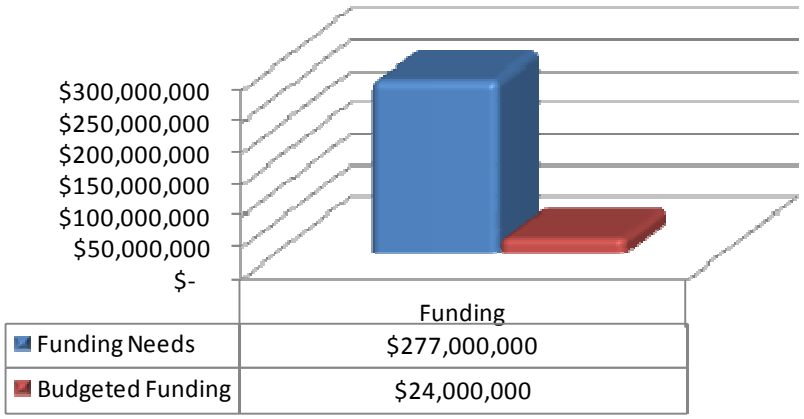
- Pavements in poor and very poor condition will be reconstructed. (Note: Although it may be possible to restore some roads in these categories, it was not possible to identify them).
- Slurry sealing, thin milling and overlay will be continually utilized, but treatments will be applied to the right roads at the right time. (Although there are numerous preventive maintenance and rehabiliation treatments that could be used, the auditors only had cost estimates for the above treatments. Rehabilitation treatments such as full depth milling and overlay could cost significantly more than the above estimates.)

The above estimate may be understated because it is based on limited assessment procedures. This method only addresses the surface conditions and is not able to identify any structural integrity problems. A road may appear to be in adequate condition for a short period of time after a limited procedure such as slurry sealing. However, if the road structure does not have integrity, the limited procedure will not cure the defects. Conducting a more thorough assessment is necessary to determine a more realistic picture of the condition of the City's roadways.

A dramatic funding gap exists between the needs and the budget appropriations for maintaining roads and pavement reconstruction, as demonstrated in the following graph:

The funding for roadway maintenance in the past 10 years appears to be inadequate.

Disparity Between Funding Needs and Budget for the Last 10 Years



	Funding
Funding Needs	$277,000,000
Budgeted Funding	$24,000,000

Note: The numbers include only pavement treatment costs.

The City needs a more comprehensive plan for addressing all the road maintenance issues.

The City does not have substantial resources to address the situation completely. Currently, the City's plan needs to be enhanced to address this critical, significant public service and asset maintenance issue.

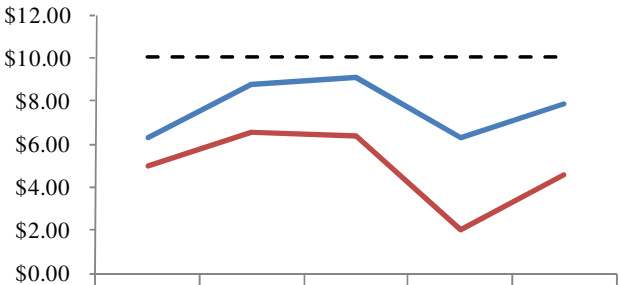
In 2010, DPW estimated an annual funding need of $10 million for the next five years. According to DPW, this estimate included only preventive maintenance procedures. Since all types of maintenance needs were not addressed, this estimate unrealistically understated actual funding needs. It should be noted that even good streets require preventive maintenance to avoid deterioration. Therefore, DPW has to incur costs to maintain all the streets. Currently, not all good streets are being subjected to maintenance procedures, as prescribed by the industry standards.

DPW has consistently requested inadequate funding for roadway maintenance from the City Council and the Administration. The

DPW requested significantly less funding than the perceived needs. The City appropriated even less funding, creating a significant shortfall.

auditors were told that the request for funding is based on assumptions about the amount of funding likely to be approved, rather than the actual needs identified in the road condition assessment. The actual funding appropriated was significantly lower than the perceived needs. This situation is depicted in the following graph:

Inadequacy of Funding (in Millions)



	2007	2008	2009	2010	2011
Requested Funding	$6.30	$8.74	$9.10	$6.33	$7.83
Approved Budget	$5.00	$6.50	$6.35	$2.00	$4.58
Perceived Needs	$10.00	$10.00	$10.00	$10.00	$10.00

Funding disparity may have forced DPW to maintain roadways with limited applications.

This disparity has forced DPW to use only two preventive maintenance methods to maintain all roads, irrespective of their age and condition.

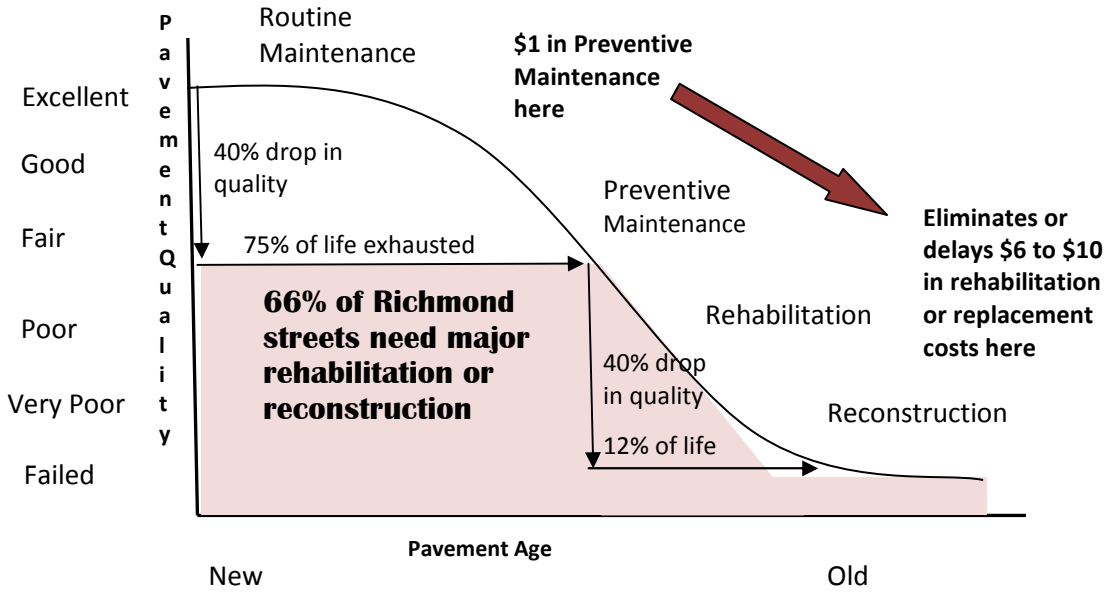
Impact of Inadequate Maintenance

Approximately 10% of the City's streets are currently being slurry sealed and milled/overlaid annually. With 66% of roads in fair and poor conditions, these inadequate procedures will not improve the overall road conditions. **Limited funding compels DPW to utilize economical procedures to maximize the number of lane miles that are treated annually.**

According to FHWA, $1 spent timely on proper maintenance could prevent expenditures of $6 to $10 in the future.

According to the Federal Highway Administration (FHWA) website, if preventive maintenance is not performed, pavement quality drops 40% from excellent to fair within the first 15 years. This increases the life cycle costs. The National Center for Pavement Preservation indicates

that for every $1 spent on pavement preservation when pavements are in good condition, eliminates or delays $6 to $10 of spending on rehabilitation or reconstruction later when the pavement quality has deteriorated badly. The following diagram explains this issue:



Impact on Pavement Renewal Costs

Lack of maintenance of good roads could result in their rapid deterioration.

According to the above information, deferring maintenance costs may have resulted in increasing the City's costs significantly, as at least 66% of the roadways now need rehabilitation or replacement. It is possible that some of the roadways may have exceeded their expected life.

This is a very significant issue for Richmond. Currently, the City does not adequately fund the maintenance of good roads, which could result in the rapid deterioriation of 33% of the roadways. Once the roads are completely deteriorated, the funding required to cure the situation will be significantly higher than the current estimate of $277 million.

Direct Additional Cost to Citizens:

Roads in poor condition may be costing the average Richmond motorist $343 annually in additional vehicle operation costs.

According to TRIP, a national research firm, driving on roads in disrepair increases vehicle ownership and maintenance costs due to the increased wear and tear, the need for additional maintenance and the consumption of more fuel. The September 2010 report issued by TRIP noted that roads in poor condition cost the average Richmond motorist $343 annually in additional vehicle operation costs.

As of 3/31/11, payments totaling approximately $25,000 were paid for property damages that occurred between July 1, 2008 and July 30, 2010, which resulted from road conditions (e.g. potholes). The City was deemed liable because the potholes were previously reported and not fixed.

Impact of Utilizing Economical Procedures

The auditors selected several City streets in three neighborhoods that were slurry sealed between August and November 2010. These streets were evaluated by the vendor assessing the street conditions soon after the slurry sealing. They found the streets to be in good condition, but the ride quality on the newly slurry sealed streets was mediocre.

Road conditions in three neighborhoods deteriorated after a few months instead of the industry standard of 5 to 7 years, after the slurry seal application.

The slurry seal, when properly utilized, is expected to extend the service life of the pavements for five to seven years. The auditors inspected these streets in August and September 2011, approximately one year after being slurry sealed. The auditors found these streets in poor condition. Pavement distress, such as rutting, raveling, and cracking, as well as pavement scarring, was evident as depicted in the pictures below.

N 30th Street

N 30th Street

N 30th Street

P Street and N 33rd Street

N 27th Street

Stockton Street

W Graham Road

W Graham Road

Clearly, the City did not receive the appropriate benefit for these expenditures compared to the expected life of the treatment. A portion of the rapid decline in the appearance of the roads can be attributed to utility cuts that were conducted after the streets were treated. However, some of the remaining decline was because slurry seal was not applied to the appropriate roads at the appropriate time.

A comparison of the slurry sealed streets with the streets that were not subjected to maintenance is depicted in the following photographs:

N 35th St and P St – no treatment

N. 30th and M St Street – slurry sealed in 2010

P St and Chimborazo Blvd - No treatment

P St and N 33rd St – slurry sealed in 2010

Apparently, the slurry sealed streets looked similar to the streets with no maintenance and in poor condition just a few months after the City spent money on their maintenance. Therefore, subjecting the streets in poor condition to very limited maintenance procedures resulted in very

limited benefits. A portion of the $1.4 million spent on these projects could have been better utilized.

Chapter 3 – What should the City do to remedy this situation?

Inventory of Roadways

The responsibility to manage roadway maintenance has been assigned to DPW. Currently, the Department has an inventory of moving lane miles, the maintenance of which is reimbursed by the State. This inventory does not include parking and/or turning lanes. The State does not reimburse maintenance on these lanes, however, the City still has a responsibility to maintain them.

DPW did not have a complete inventory of roads they are responsible for maintaining.

In order to identify adequate funding needs and effectively manage the pavement infrastructure, DPW needs to implement an asset management approach. According to the VDOT website, this strategic and systematic approach strives to provide the best return for each dollar invested by maximizing system performance, improving customer satisfaction, and minimizing lifecycle costs.

The City needs to use an asset management approach similar to the one used by VDOT.

VDOT currently employs an asset management approach, which includes a needs based budgeting process to systematically identify maintenance needs, develop the annual budget request, and to guide the allocation of available resources across maintenance activities and districts. According to VDOT, the needs based budgeting approach includes the following steps:

- **Inventory and condition data collection –** assessment of asset condition to build better information over time on asset age, detailed inventory characteristics, and resource utilization.
- **Business rules application-** The business rules, including decision logic, for suitable maintenance treatments to be applied based on asset characteristics and condition to restore

serviceability and minimize life cycle costs. Business rules also include deterioration/life cycle and cost models.

- **Needs analysis –** It is conducted to estimate the current maintenance backlog (total needs) and the cost to maintain assets at their current condition level.
- **Development of budget requests and resource allocation strategies –** These strategies address the identified needs to move towards greater balance in the backlog of maintenance needs across districts over time.
- **Tracking of work accomplishments –** Provides improved accountability over expenditures.

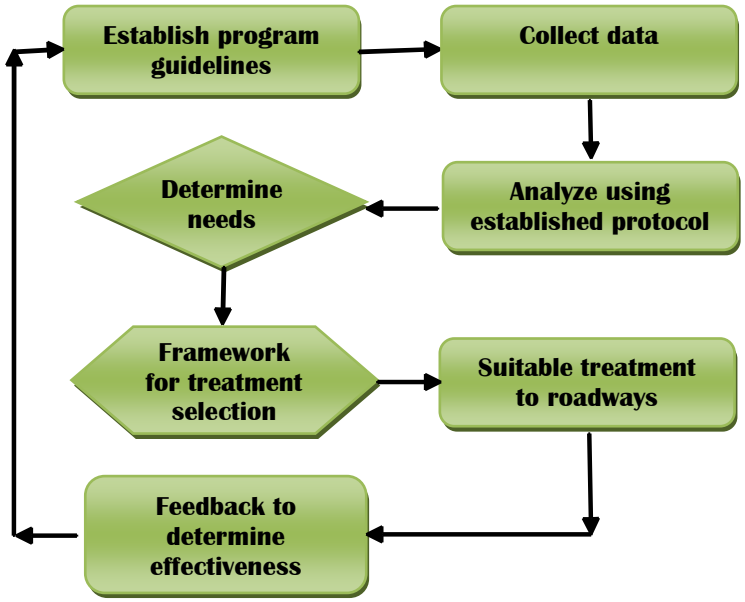
Pavement Management System

DPW purchased a pavement management system (PMS) called Cartegraph in 2005. According to the CIP Administrator, DPW has not used the system since the former Pavement Engineer retired in 2007. Currently, no one in the Department has the credentials (password, user ID, etc) to access the system, so the system is not being used. DPW purchased the application for $9,000 with annual maintenance fees of $1,800, resulting in total spending of $20,000 thus far. Although the Department may have received some benefit from the system during 2006 and 2007, non-utilization of the system for the past several years represents an under utilization of public resources.

The Pavement management system purchased by DPW has not been used since 2007.

DPW needs to redeploy the PMS since it is an effective planning tool. A PMS collects and monitors information on current pavement conditions, and evaluates and prioritizes alternative maintenance, rehabilitation and reconstruction (repair) strategies. When properly implemented, it can provide the necessary information for decision-makers to be well informed and to understand the long-term

consequences of short-term budgeting decisions. With this tool, decision-makers can act to preserve the roads. The following model can be used for making effective decisions and conducting roadway treatments:



Road Condition Assessment

Richmond's assessment of road conditions consists of limited observations that trained vendor employees make while driving on the roadways. The streets are visually inspected from a vehicle to identify the frequency and severity of pavement distresses (e.g. patching and cracking) that are pre-defined by the City. Point values are assigned for the frequency and severity of each assessed pavement distress. The streets are assigned a rating between 100 (excellent) and 0 (very poor) for each street segment. This type of assessment is less reliable, as it does not provide a true assessment of the structural integrity of roadways. It only reveals the apparent, visible symptoms of deterioration. However, a long-term maintenance strategy cannot be

The City hires contractors to visually inspect roadways to assess their conditions. This method does not detect structural integrity issues.

based on these results. The City paid approximately $125,000 for the 2010 road condition assessment.

VDOT uses a more advanced approach to assess roadway conditions.

VDOT collects pavement condition data using continuous digital imaging and automated crack detection technology. The vendor hired for this purpose uses vehicles equipped with special cameras to capture downward pavement images for crack detection, and a forward perspective view. The process simultaneously captures data about roughness and rutting of roadways with the sensors mounted on the van. Downward images collected during the survey are processed with specialized automated crack detection software (Wise-Crax). The digital images are further analyzed to identify other distresses. In 2009, VDOT paid approximately $71 per lane mile for primary streets and $79 per lane mile for secondary streets to conduct the assessment. This method provides more reliable results than the method used by the City.

VDOT has a separate program to measure the structural strength of pavements and sub-grades on interstate and primary highways through a "Falling Weight Deflectometer" machine. VDOT identified the following advantages of its automated process:

- Data can be collected at highway speeds and requires no traffic interruption;
- Images are captured for data processing at the office;
- Processed data is consistent and repeatable;
- Images captured are available for citywide use for viewing throughout the year, reducing the need for field visits in many cases; and

- The collection of other asset data is possible using the same images.

These methods gather more appropriate data and can provide a more thorough assessment, including information on structural defects that would provide a more realistic picture. This will enable the City to identify the streets suitable for:

- Limited preventive maintenance such as slurry seal;
- Limited and extensive rehabilitation; and
- Replacements.

Identify Funding Sources

The City will be able to estimate the total funding needed to bring its roadways to an acceptable condition. Once the City has a good estimate of funding needs, it will be able to identify funding sources.

Auditors learned that DPW intends to request $11 million annually for roadway maintenance beginning in the FY2013 budget cycle. This funding will have to be used for preventive maintenance procedures on good streets, rehabilitation procedures on fair streets and reconstruction of poor streets. Considering the magnitude of the backlog, funding at this level will take several decades to address the backlog. Meanwhile, an additional backlog may develop due to further deterioration, making this process perpetual. To alleviate this situation, it may be necessary to identify additional funding sources.

The City may have to find additional funding sources for roadway maintenance and reconstruction.

The City of Arlington, Texas has used an additional sales tax as a funding mechanism for roadway maintenance. Other jurisdictions like Olympia, WA and Berkley, CA are considering the following funding sources:

- General Obligation Bonds

- Hotel/Motel Tax
- Private Utility Tax
- Public Land Trusts
- Revenue Bonds
- Gasoline Tax
- Utility Users Tax
- Parking Space Rental Tax
- City Parking Meter Revenue

The City of Richmond can consider any of the above options or reallocate some of the meals tax revenue to fund roadway maintenance and reconstruction. In addition, the City may have a one time opportunity to allocate substantial funding from the repayment of the City's loan to the Richmond Metropolitan Authority (RMA).

Recommendations:

1. Develop a strategy to improve the overall structural integrity and the surface quality of the roads for good ride quality.
2. In accordance with the above strategy, establish guidelines for maintenance, rehabilitation and reconstruction activities based on road conditions to extend the life of the roads.
3. Compile an inventory of the total number of lane miles (including turning, center, and parking lanes) and pavement surface area for which DPW is responsible for maintaining.
4. Conduct a thorough assessment of street conditions using advanced techniques that evaluate the street surface as well as the integrity of the road structure.

5. Develop estimates of total funding needed to address road improvement issues using:
    a. accurate measurements;
    b. reliable assessments of the road conditions; and
    c. appropriate cost per unit for maintenance, rehabilitation and reconstruction activities.
6. Consider various funding sources such as reallocation of meal taxes, the repayment of the RMA loan proceeds and issuance of bonds, etc. to finance roadways.
7. During the budget process, request adequate funding to eliminate the backlog over a specific period and address current maintenance needs.
8. Utilize the existing pavement management system to assist management in evaluating and prioritizing alternative maintenance and repair strategies.
9. Cross-train employees on using the pavement management system.

Chapter 4 - Management Issues

Internal Controls

According to 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. Based on the results and findings of the audit methodology employed, auditors concluded that internal controls for effective management of the roadway maintenance and CIP Paving operations need improvement. The rest of this chapter discusses these issues.

Scope of Work

DPW does not have an accurate accounting of the total pavement area that the City is responsible for maintaining. This situation prevented the auditors from verifying if DPW has planned for the total scope of their work. Without this clarity, proper management of the assigned tasks could not be verified. In addition, this situation may have an impact on the revenues received from the State of Virginia.

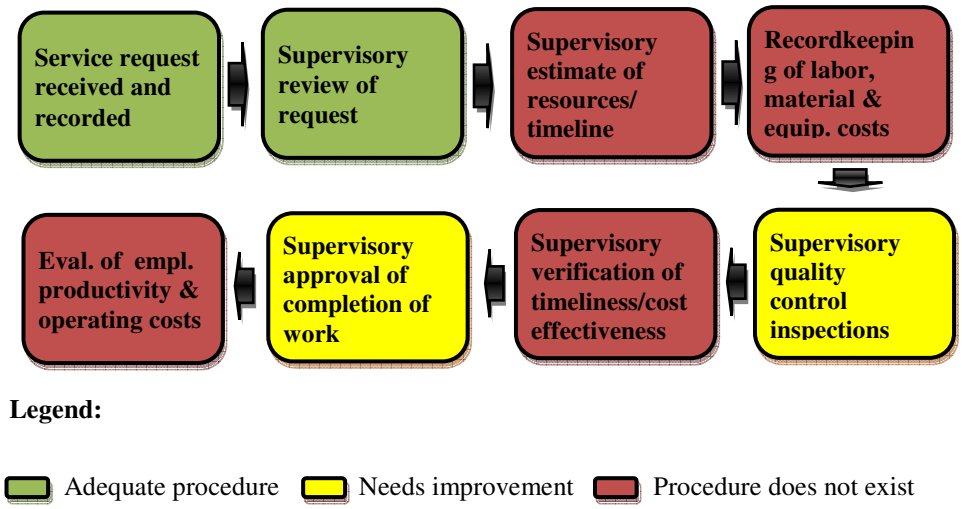
The lack of knowledge about the total scope of work prevents proper planning.

Roadway Maintenance Operations

Resources Management

The auditors reviewed the current procedures and identified several missing procedures required to manage this operation properly. The following diagram depicts the appropriate procedures for providing services in a timely and cost effective manner with proper accountability over the resources. The red color indicates missing procedures, the yellow color indicates possible improvements and the green color indicates an adequate procedure:

Several critical controls in roadway maintenance procedures should be either established or strengthened.



The auditors found that management oversight of these operations needs improvement. Several critical controls are either weak or missing. To prevent misuse or abuse of City resources, the control procedures need to be strengthened.

Lack of Oversight

The pothole repair crew spends the majority of their time in the field with minimal supervision.

Roadway Maintenance Division

The pothole repair crews spend the majority of their work hours in the field with minimal supervision. Management oversight is essential to ensure that work is completed timely, efficiently and effectively, and that only the necessary materials and supplies are used to complete the repairs. Therefore, a proper system for monitoring employee productivity and work quality is necessary to prevent losses or inadequate work.

CIP Paving Operation

DPW outsources the annual slurry seal and milling/overlay projects. Auditors found the following issues with the project oversight:

Inadequate Inspection Procedures

Quality assurance in this operation is critical to achieve a uniform surface finish. The construction inspector must ensure that the vendor adheres to project plans and specifications. The auditors conducted visual inspections of several roads that were slurry sealed during 2010 and 2011, and found:

- Pavements exhibited pavement defects, which coincided with the quality control issues cited in the "Pavement Preservation Treatment Construction Guide" issued by FHWA.
- Several instances were noted where pavement surfaces were not treated.
- Utility covers were paved over.

As depicted below, the pavements exhibited the following conditions:

- Segregation and delamination, technical terms for work defects;
- Low quality transverse and longitudinal joints; and
- Poor quality edges and shoulders.

The visual defects the auditors observed are consistent with the examples and descriptions on the FHWA website, as follows:

Segregation and delamination - conditions that result from material defects called "false slurry" that occur due to poorly designed slurry mixtures or mixtures with either low cement content or too high a water

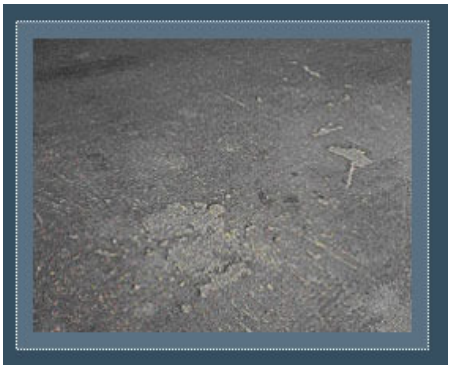
content. The materials may separate once mixing in the box has ceased. This leads to a black and flush looking surface with poor texture. Separated mixes may lead to "false slurry" where the emulsion breaks onto the fine material. In such instances, delamination may occur, resulting in premature failure. These types of mixes can be recognized as non-uniform and appear to set very slowly. Auditors found these conditions prevalent in several neighborhoods. The following pictures illustrate a small sample of auditors' observations:

Segregation

Source - FHWA

Stockton Street - Richmond, VA

Delamination



Source - FHWA

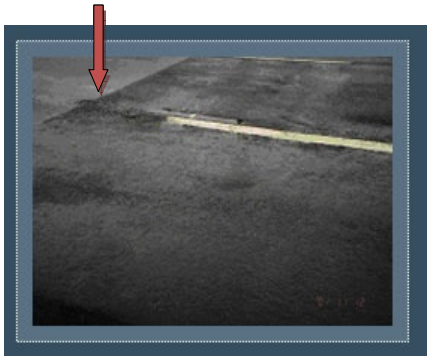
North 30th Street

"**Longitudinal joints** may be overlapped or butt jointed. They should be straight or curve with the traffic lane. Overlaps should not be in the wheel paths and should not exceed 75 mm (3 in) in width." The picture below illustrates a poor quality longitudinal joint.

Source – FHWA

Near University of Richmond

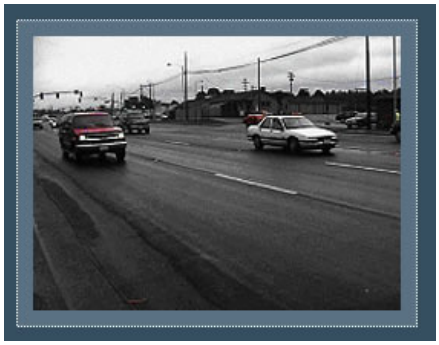
"Transverse joints are inevitable when working with batch systems; every time a truck is emptied a transverse joint is required. Transitions at these joints must be smooth to avoid creating a bump in the surface. The joints must be butted to avoid these bumps and handwork should be kept to a minimum. The main difficulty in obtaining a smooth joint occurs as the slurry machine starts up at the joint. Some contractors tend to add too much water to the mix at start-up, leading to poor texture and scarring at the joints. The picture below illustrates a low quality transverse joint.



Source – FHWA

North 30th Street

Edges and shoulders – Slurry sealed edges and shoulders can be rough and look poor. The edge of the spreader box should be outside the line of the pavement and edge boxes should be used when shoulders are covered. The picture below illustrates a poor quality edge and handwork:

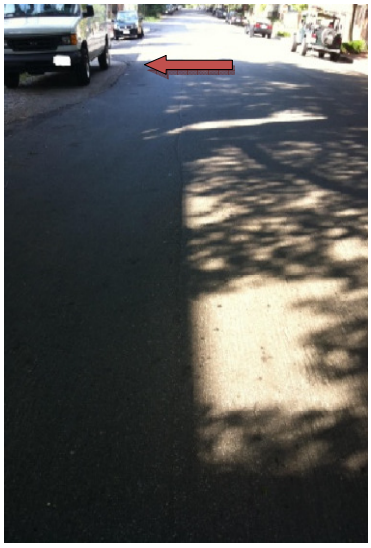


Source – FHWA

North 30th Street

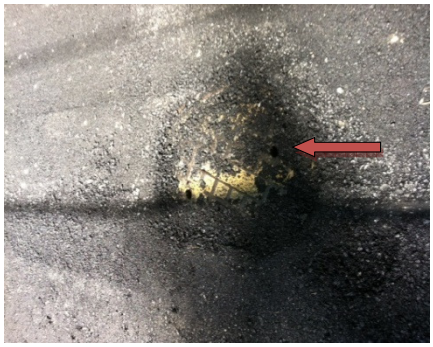
In addition to the above noted defects, DPW has already identified workmanship issues in several of the 2010 milling and overlay projects for which the vendor(s) was required to mill out sections of the pavement and replace asphalt.

In addition to the quality issues noted above, auditors also observed an instance where the vendor slurry sealed around a vehicle as well as numerous instances in which utility covers were paved over. These are clearly quality control issues that the inspector should have identified and had the vendor correct. In addition to a quality control issue, paving over the manholes or utility covers could create a hazardous situation if covers cannot be readily located during emergencies.



North 27th Street

North 27th Street



Near University of Richmond

North 27th Street

Based upon the above noted issues, it is apparent that adequate inspection procedures are not in place. Both VDOT and FHWA have issued construction checklists, which identify important aspects and components of the slurry seal and overlay processes that should be considered to promote a successful project. The checklist items should be addressed and adequately documented to demonstrate inspection efforts.

Lack of Adequate Documentation

The City invited bids to slurry seal various neighborhoods. The bid documents included maps of each neighborhood, which outlined the streets that were to be slurry sealed. Based on discussions with DPW staff, some of the outlined streets were not slurry sealed, while other completed streets were not outlined on the maps. No documentation was located that identified the deviation from the initial plan. Also, it is not clear if this change had any impact on the total number of square yards slurry sealed.

Due to the lack of documentation, it is not possible to verify the appropriateness of vendor payments.

Furthermore, DPW did not have adequate documentation of the work completed. DPW staff supervises the work done by the vendor. The Construction Inspector assigned to monitor the work is expected to collect asphalt tickets and to complete daily logs to document the amount of asphalt that was placed, square yards of milling completed, and the square yards of slurry seal placed. DPW staff use the logs and asphalt tickets to validate invoice amounts and quantities of asphalt billed to approve payments. Essentially, the logs and tickets serve as documentation supporting payments, which is a part of the internal control system. DPW could not provide all the logs for the calendar year 2010 projects. According to the Chief of Inspections and Permits,

he generally discards the logs after the end of the paving season. Therefore, the auditors could not verify the appropriateness of payments made to the vendor. This situation represents a break down in the internal control procedures.

Inconsistent Practice

The Division's procedures require staff to conduct repairs proactively if they observe additional potholes while repairing potholes reported on the work order tickets. The auditors accompanied three of the pothole repair crews. Two of the three crews followed the Division's procedures. However, one crew focused on completing the work order tickets assigned and did not proactively repair any additional potholes observed. Potholes not repaired proactively result in multiple trips to the same location, and they contribute to citizen dissatisfaction, as repairing only a few potholes will not improve driving conditions. This practice is inefficient and affects overall productivity of the Division.

One of the three crews observed by the auditors did not follow policy of proactive repairs of potholes.

Lack of Proper Use of the Work Order System

A work order system automates the process of documenting incoming maintenance requests in conjunction with recurring, periodic scheduled maintenance. The benefits of having a work order system are:

- Efficient work schedule
- Proper assignment of work to staff
- Tracking work order completion
- Monitoring the cost of labor and materials for each work order
- Generating reports that analyze employee productivity
- Evaluating quality by tracking the frequency and cost of repairs for each location

DPW does not capture sufficient information to manage costs and verify work done.

The Roadway Maintenance Division has a work order system, but they do not utilize it to its full potential. The Division does not capture

sufficient information to manage costs or to determine if the work was completed appropriately. The auditors noted the following discrepancies:

- Service requests are submitted to DPW via:
    - SeeClickFix (an automated reporting system that allows uploading pictures);
    - The Citizen Request System (CRS) (a system used for receiving all citizen complaints); and
    - Telephone.

Currently, the information from SeeClickFix cannot be transferred electronically to DPW's work order system, as a proper interface between the two systems does not exist. This situation requires manual data entry of service requests into the work order system. However, the staff responsible for the data entry did not always enter service requests in the work order system.

There are interface issues between CRS and the work order system.

- Service requests entered into CRS were not always uploaded to the work order system. The two systems are manually reconciled to identify the service requests that were not uploaded so that items can be keyed into the work order system.
- Service requests that are re-opened in CRS are not transferred to CityWorks. Thus, the requests are listed as open in CRS and closed in CityWorks.

Without adequate monitoring procedures, these interface issues could result in citizens' complaints or requests not being addressed, as items may not be entered into the work order system to initiate the inspection process. However, the Department of Information Technology (DIT) noted these items were on an intermittent basis. Also, DIT is in the process of implementing a Customer Relationship Management (CRM) system and CRS is one of the applications that would be replaced by the proposed CRM system. The new CRM system will also upload the SeeClickFix requests to the work order system.

- DPW does not generate work orders for every completed service. Therefore, the Department is not able to capture information about all costs incurred for pavement maintenance.
- Although the automated system has capabilities, the Division manually tracks labor hours, materials used and equipment costs.
- The actions taken to resolve complaints and the number and size of pothole repairs are not always noted.
- The Division does not always close completed work orders in a timely manner. This prevents them from quantifying the time required to complete service requests.
- Pothole repairs identified and proactively completed are not recorded into the work order system. Instead, staff manually tracks repairs.
- The Division does not utilize the latest version of the work order system. Four updates to the work order system have been released since the current system was implemented. This

results in less functionality for DPW since they are not utilizing the latest version.

- Based upon discussions with (DIT), DPW staff members did not receive a formal training on the system.

Not utilizing the functionalities of an automated system in favor of manual recordkeeping generally leads to errors and inefficiencies. This situation would prevent DPW management from obtaining reports that can be used for making decisions.

Lack of Supporting Documentation

A properly authorized change order for $50,204 could not be located.

DPW processed a change order totaling $50,240 for additional preparation work for the slurry seal project. This event increased the contract amount, which the City paid to the vendor. However, neither Procurement Services nor DPW staff could produce a signed copy of the change order. In accordance with the procurement policies and procedures, the Project Manager, Project Administrator/ Supervisor, Department Director and the Director of Procurement Services should have approved the change order. Auditors could not verify if the change order was appropriately authorized and if it was needed for the project.

Performance Measures

Relevant performance measures were not in place for the roadway maintenance function.

Performance measures are tools for monitoring and evaluating the performance of the function and management effectiveness. They are designed to evaluate efforts, outputs and outcomes. Auditors observed that adequate performance measures are not in place for the CIP Paving and roadways maintenance operations. Currently, DPW only reports on the number of lane miles treated annually. Performance measures such as cost per lane mile, the average street rating, cost savings and percentage of pavements in each condition category need to be in place

to enable DPW management to evaluate performance of these functions. In addition, the use of proper benchmarks may provide evidence if the procedures used are cost effective. However, DPW does not use benchmarks to evaluate the function. Without effective and relevant performance measures, it is difficult for DPW to demonstrate their stewardship of the public resources spent on roadway maintenance and paving.

Coordination of Efforts

Numerous entities, including City agencies (e.g. DPW and DPU), utility companies (Dominion, Verizon, Comcast, etc.) and private developers conduct work on and under city streets requiring numerous pavement cuts, which impacts the pavement condition. Street cuts, if not restored properly, can lead to the premature deterioration of the pavement. Thus, it is important that such projects are properly planned, coordinated and inspected.

In an effort to coordinate the excavation projects, DPW and the Department of Public Utilities (DPU) have implemented monthly Paving and Restoration meetings. Also, DPW hosts bi-monthly Utility Coordination meetings with the various entities that are working in the City's streets, including DPU. During the meetings, participants discuss current and upcoming projects and identify conflicts with DPW paving projects. These meetings also provide an avenue for DPW to address any non-compliance issues or pavement issues that have been identified.

Efforts have been made to improve communication and coordination between entities involved in excavating City streets.

The meetings have improved communications and facilitated coordination of capital projects between the various entities. DPU and DPW also initiated the use of ENVISTA utility coordinating software

Coordination of capital projects and day-to-day operations could be improved.

in 2011. Auditors did not review this application as it was outside the scope of this audit. However, coordination of capital projects and day-to-day operations can be improved as utility and paving projects routinely conflict, resulting in pavement cuts occurring on streets that have been recently resurfaced or repaved. Some of the pavement cuts are unavoidable due to emergency repairs, new service requests from customers and private development efforts. The City has an aging infrastructure with substantial utility assets beneath City streets that are being replaced or repaired on both a planned and emergency basis.

The coordination efforts still need significant improvement. The auditors identified paving projects where numerous utility cuts occurred after the streets were resurfaced as described below:

Proper planning could have saved the City at least $135,000.

- The Sauer Garden neighborhood, which includes the streets between Caskie Street and Antrim Avenue from West Broad Street to Monument Avenue, was slurry sealed during the summer of 2009, costing approximately $135,000. Within eight months of the slurry seal project, numerous utility cuts were performed to replace gas mains and complete service work as part of DPU's cast iron renewal project. According to DPW management, when this project was conducted the coordination efforts between DPU and DPW that exists today, was not in place. However, DPU indicated that they supported DPW's slurry sealing efforts in this neighborhood as the streets appeared to be in bad condition and their anticipated cuts would make the situation worse. Based on this information, it appears that giving high priority to the cast iron project in this neighborhood prior to slurry sealing

would have saved the City some of the $135,000. According to DPW, significant changes in procedures were implemented to prevent future occurrence.

- Based upon a review of the DPU pavement restoration work order data, auditors identified at least 18 utility cuts that occurred for the lead service renewal project. Based upon discussions with DPU staff, this was planned work. They recognized the need to do a better job planning the renewals around DPW's paving schedule.

Permits are not Required for All Excavation Work

DPU is only required to obtain annual permits for emergencies or new services. Annual permits are issued for routine or small-scale excavations in order to streamline the process for owners. However, DPU is not required to notify DPW prior to conducting excavations or report emergency repairs. With this process, DPW may not be aware of all the excavations occurring on the City streets.

Pavement Restoration

The restorations of the pavement cuts are decentralized in the City. The entity or organization conducting the excavation is responsible for completing the pavement restoration in accordance with DPW standards. DPW inspectors are responsible for inspecting the excavation work and corresponding restorations for which permits have been issued, except for DPU projects. DPW delegated inspection and approval responsibilities for the restoration of DPU utility cuts to the DPU inspectors. These inspections are conducted to ensure that pavement cuts are properly restored in accordance with DPW standards.

Restorations of DPU utility cuts are contracted out. However, based upon a review of available documentation, several quality control issues were noted:

- **Untimely Restoration:** According to the contract terms, the utility cuts were required to be restored within 30 days of the work order issuance. Auditors found 1,585 instances where the actual restoration timeframe ranged from 31 to 317 days with an average of 73 days.
- **Improper Restoration:** In one of several Paving and Restoration meetings, a DPW inspector identified 25 improper or failed pavement cut restorations. The following picture is an example observed by the auditors:

2508 Cedar Street

Pursuant to the Right-of-Way Excavation and Restoration Manual, DPW's Office of Right of Way Management is responsible for coordinating all work within the City's public right-of-ways to:

- Ensure excavation work is completed before the City begins construction and maintenance work to minimize impediments and inconvenience; and
- Minimize the frequency of pavement cuts and openings.

However, without knowledge of all of the excavation work and centralized coordination of the restorations and inspections, it is difficult for DPW to fulfill this responsibility. DPW should be the sole authority for utility restorations and inspections. Also, permits should be required for all excavations in City streets and right-of-ways. These steps will help ensure that all pavement cuts are restored properly and timely to help protect the City's investment in the street infrastructure.

DPW has the ultimate responsibility to maintain the quality of road surface and integrity of pavement structure. Utility and other cuts compromise the integrity of the pavement structure and make street surfaces uneven if not restored properly. To ensure consistency and appropriateness in restoration of pavement cuts, DPW must take the lead in monitoring and assuring appropriate restoration of cuts. It appears that the centralization of this function under DPW would improve street restoration efforts. The Cities of Anaheim, CA, Austin, TX, and Corpus Christie, TX have centralized restoration of street cuts with their respective Public Works Departments.

Street restoration resources, including inspectors and funding, need to be centralized under DPW. A review of more than 12,000 restoration work orders indicated that approximately 75% of the restoration work is related to asphalt. Currently, two DPU inspectors monitor the asphalt restoration work. Monitoring restoration of utility cuts by DPW inspectors will help ensure that all pavement cuts are properly and

timely restored in accordance with DPW standards. If the restoration work is done by one or more vendors hired by DPU, DPW could monitor proper restoration of the utility cuts. In addition, this will minimize the risk of streets being milled and overlaid shortly after the utility cuts are restored, which will prevent a waste of City resources.

Policies and Procedures

Formal policies and procedures outlining daily operational tasks do not exist for the CIP Paving function. While some procedures exist in the Roadway Maintenance function, they are outdated. Not providing written policies and procedures and communicating them to staff may lead to unclear job duties and responsibilities, and inconsistent job performance by employees. Also, policies and procedures are important to ensure continuity of operations during employee turnover.

Recommendations:

10. Develop and implement formal inspection procedures, including an appropriate checklist for inspection activities.
11. Include a requirement for supervisory review and its documentation in the procedures.
12. Require the inspectors to submit a daily report including:
    a. Details of work completed by the vendor
    b. Specific location of the work done
    c. Quantity of materials used
    d. The number of hours spent by the inspector and the vendor on the work completed
    e. Inspector and contractor's signatures

13. Maintain the inspectors' daily reports and other documentation necessary to verify work accomplished for a period of at least three years.
14. Develop performance measures for the Division and each job category. Evaluate the results periodically using appropriate internal and external benchmarks.
15. Centralize street pavement restoration resources in the Department of Public Works by transferring resources from DPU to DPW.
16. Require DPW to inspect and monitor the adequacy of permanent restoration of utility cuts made by all the entities, including DPU.
17. Require all the entities including DPU holding annual permits to notify DPW prior to making pavement cuts in City streets and public right-of-ways in non-emergency situations. Require them to notify DPW of emergency cuts within 24 hours or next business day of the cuts.
18. Develop a comprehensive policy and procedures manual for roadway maintenance activities, including the CIP Paving function and monitor for compliance.
19. Update the existing version and utilize the full functionalities of the City Works system to keep adequate information necessary to compute per unit costs. Ensure staff are adequately trained to use the system.
20. Ensure all change orders are properly approved in accordance with City Procurement Policies.

MANAGEMENT RESPONSE FORM
DEPARTMENT OF PUBLIC WORKS

ROADWAYS MAINTENANCE AUDIT - 2012-04 Appendix A

#	RECOMMENDATION	CONCUR Y-N	ACTION STEPS
1	***Develop a strategy to improve the overall structural integrity and the surface quality of the roads for good ride quality.***	Y	Initiative 1 - The Department of Public Works will identify the total number of Lane Miles within the City of Richmond inclusive of turning and parking lanes. Initiative 2 - In addition to identifying the total number of lane miles, a detailed condition assessment will be conducted utilizing advanced assessment techniques. Initiative 3 – To identify estimated cost for all maintenance functions Initiative 4 – Identify funding and track all work processes for completion analysis and monitoring of data The work stated above will be performed with an engineering consultant through the RFP Procurement Process. This process will take approximately nine(9) months to complete once the full scope of work and funding for the assessment has been provided. The results of this report will allow the division to provide an estimated cost for all areas of maintenance inclusive of proactive, preventive, rehabilitative, and reconstructive.
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	City Engineer		30-May-13
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION

#	RECOMMENDATION	CONCUR Y-N	ACTION STEPS
2	***In accordance with the above strategy, establish guidelines for maintenance, rehabilitation and reconstruction activities based on road conditions to extend the life of the roads.***	Y	Establish guidelines based on above strategy will include the prioritization of roads in accordance to each roadways functional classification and its condition based on the detailed condition assessment performed. Guidelines will be inclusive of roadway maintenance, rehabilitation and reconstruction performed in accordance to its classification and prioritization. Please find listed below how the Division will determine what maintenance activity will be provided based on the condition assessment ratings provided: Example: If the road condition index ranges from "0" or needs reconstruction, to "100" or just reconstructed, then a scale such as the one exampled below will be established and adhered to: Condition Rating — Type of Maintenance — Maintenance Action 91 – 100 — No maintenance required 71 - 90 — Proactive/Routine — Crack Seal and/or Slurry Seal 51 - 70 — Preventive — Thin Depth Roto-Milling or Slurry 21 - 50 — Rehabilitative — Thick Depth Roto-Milling 0 - 20 — Reconstructive — Full Depth Reconstruction Each maintenance action will be evaluated based on the street functional classification and additional field observations will be performed. Additionally, this process will be documented as part of the revised operating policies, procedures and guidelines.
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	Paving Manager		30-May-13
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION

#	RECOMMENDATION	CONCUR Y-N	ACTION STEPS
3	***Compile an inventory of the total number of lane miles (including turning, center, and parking lanes) and pavement surface area for which DPW is responsible for maintaining.***	Y	Identify total number of Lane Miles within the City of Richmond inclusive of turning and parking lanes Hire Consultant through RFP (RFP Awards process is nine(9) months) Identify total number of Lane Miles (9 months period by consultant from Notice to Proceed) The inventory will be completed as the first initiative outlined in the overall strategy to improve overall structural integrity.
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	Paving Manager and Paving Engineer		30-May-13
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION

#	RECOMMENDATION	CONCUR Y-N	ACTION STEPS
4	***Conduct a thorough assessment of street conditions using advanced techniques that evaluate the street surface as well as the integrity of the road structure.***	Y	Perform a detailed condition assessment of the lane miles To be performed by Consultant through RFP Nine(9) months to complete A thorough assessment of all paved surfaces will be conducted as the second initiative in the overall strategy to improve overall structural integrity.
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	Paving Manager and Paving Engineer		30-May-13
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION

#	RECOMMENDATION	CONCUR Y-N	ACTION STEPS
5	***Develop estimates of total funding needed to address road improvement issues using:*** ***a. accurate measurements;*** ***b. reliable assessments of the road conditions; and*** ***c. appropriate cost per unit for maintenance, rehabilitation and reconstruction activities.***	Y	Provide estimated cost for maintenance To be performed in conjunction with information analyzed from the consultants report concerning the inventory and assessment of the lane miles covering preventive maintenance, rehabilitation & reconstruction of the City Streets. The total cost to address maintenance needs identified from the comprehensive assessment will be calculated as the third initiative in the overall strategy to improve overall structural integrity.
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	Paving Manager and Paving Engineer		30-May-13
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION

#	RECOMMENDATION	CONCUR Y-N	ACTION STEPS
6	***Consider various funding sources such as reallocation of meal taxes, the repayment of the RMA loan proceeds and issuance of bonds, etc. to finance roadways.***	Y	Identify funding sources through the Federal, State, Local, and Private sources. Sources to be inclusive of grants and additional dollars owed to the City of Richmond through local and/or private funding. These efforts will include City Council and Mayor's office. The department currently seeks alternative funding options through regional, state and federal sources.
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	DCAO & City Administration		30-Jun-12
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION

#	RECOMMENDATION	CONCUR Y-N	ACTION STEPS
7	***During the budget process, request adequate funding to eliminate the backlog over a specific period and address current maintenance needs.***	Y	Funding for preventive maintenance is requested through the City of Richmond's Five(5) Year CIP Budget Program. The funding levels for rehabilitation and reconstruction will be requested pending the consultant study and assessment at the end of 2012.
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	Paving Manager and Paving Engineer		30-Dec-11
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION

#	RECOMMENDATION	CONCUR Y-N	ACTION STEPS
8	***Utilize the existing pavement management system to assist management in evaluating and prioritizing alternative maintenance and repair strategies.***	Y	Cartegraph will be updated with the 2010 assessment data Train staff on the utilization of Cartegraph Produce results of prioritized streets using Cartegraph Select appropriate treatment on prioritized street based on forthcoming assessment
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	Paving Engineer		30-Jun-12
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION

#	RECOMMENDATION	CONCUR Y-N	ACTION STEPS
9	***Cross-train employees on using the pavement management system.***	Y	Staff will be cross trained These measures will also be included within the revised operating policies, procedures and practices.
	TITLE OF RESPONSIBLE PERSON		TARGET DATE
	Paving Manager and Paving Engineer		31-Mar-12
	IF IN PROGRESS, EXPLAIN ANY DELAYS		IF IMPLEMENTED, DETAILS OF IMPLEMENTATION

#	RECOMMENDATION	CONCUR Y-N	ACTION STEPS
10	***Develop and implement formal inspection procedures, including an appropriate checklist for inspection activities.***	Y	Formalize inspection checklist for quality control, quality assurance, workmanship, and materials testing These measures will also be included within the revised operating policies, procedures and practices.
	TITLE OF RESPONSIBLE PERSON		**TARGET DATE**
	Paving Manager and Paving Engineer		31-Mar-12
	IF IN PROGRESS, EXPLAIN ANY DELAYS		**IF IMPLEMENTED, DETAILS OF IMPLEMENTATION**
#	**RECOMMENDATION**	**CONCUR Y-N**	**ACTION STEPS**
11	***Include a requirement for supervisory review and its documentation in the procedures.***	Y	The formalized inspection checklist and other pertinent documentation will include signature area indicating supervisory analysis has been performed. Periodic field inspections by supervisors will conducted. These measures will also be included within the revised operating policies, procedures and practices.
	TITLE OF RESPONSIBLE PERSON		**TARGET DATE**
	Paving Manager and Paving Engineer		30-Mar-11
	IF IN PROGRESS, EXPLAIN ANY DELAYS		**IF IMPLEMENTED, DETAILS OF IMPLEMENTATION**
#	**RECOMMENDATION**	**CONCUR Y-N**	**ACTION STEPS**
12	***Require the inspectors to submit a daily report including:*** ***a. Details of work completed by the vendor*** ***b. Specific location of the work done*** ***c. Quantity of materials used*** ***d. The number of hours spent by the inspector and the vendor on the work completed*** ***e. Inspector and contractor's signatures***	Y	Inspection team to complete daily logs, weekly report and maintain record of quantities, detailed work description, hours spent, and signatures. These measures will also be included within the revised operating policies, procedures and practices.
	TITLE OF RESPONSIBLE PERSON		**TARGET DATE**
	Paving Manager and Paving Engineer		30-Mar-12
	IF IN PROGRESS, EXPLAIN ANY DELAYS		**IF IMPLEMENTED, DETAILS OF IMPLEMENTATION**
#	**RECOMMENDATION**	**CONCUR Y-N**	**ACTION STEPS**
13	***Maintain the inspectors' daily reports and other documentation necessary to verify work accomplished for a period of at least three years.***	Y	Paving file cabinets are established for documentation and records to be maintained for a minimum of three years at 6th floor file area. These measures will also be included within the revised operating policies, procedures and practices.
	TITLE OF RESPONSIBLE PERSON		**TARGET DATE**
	Paving Manager		30-Mar-12
	IF IN PROGRESS, EXPLAIN ANY DELAYS		**IF IMPLEMENTED, DETAILS OF IMPLEMENTATION**
#	**RECOMMENDATION**	**CONCUR Y-N**	**ACTION STEPS**
14	***Develop performance measures for the Division and each job category. Evaluate the results periodically using appropriate internal and external benchmarks.***	Y	Establish benchmarks inclusive of lane miles paved, cost per lane mile, On-time and On-budget project tracking, updating of software to be inclusive of the impact of each project on the existing pavement system assessment. These measures will also be included within the department's balanced scorecard, as well as its' revised operating policies, procedures and practices.
	TITLE OF RESPONSIBLE PERSON		**TARGET DATE**
	Paving Manager		30-Mar-12
	IF IN PROGRESS, EXPLAIN ANY DELAYS		**IF IMPLEMENTED, DETAILS OF IMPLEMENTATION**

#	RECOMMENDATION	CONCUR Y-N	ACTION STEPS
15	***Centralize street pavement restoration resources in the Department of Public Works by transferring resources from DPU to DPW.***	TBD	Requires further discussion between the Departments of Public Works and Public Utilities to agree on this recommendation
	TITLE OF RESPONSIBLE PERSON		**TARGET DATE**
	DCAO of Operations		Update findings by March 30, 2012
	IF IN PROGRESS, EXPLAIN ANY DELAYS		**IF IMPLEMENTED, DETAILS OF IMPLEMENTATION**
#	**RECOMMENDATION**	**CONCUR Y-N**	**ACTION STEPS**
16	***Require DPW to inspect and monitor the adequacy of permanent restoration of utility cuts made by all the entities, including DPU.***	TBD	Requires further discussion between the Departments of Public Works and Public Utilities. Inspection and Monitoring by DPW will require additional 3-4 Construction Inspector staff in ROW Division to perform these duties. The Department of Public Works will enter into discussions with the Department of Public Utilities to develop an acceptable proposal to provide inspection results between each department.
	TITLE OF RESPONSIBLE PERSON		**TARGET DATE**
	DCAO and Director		Update findings by March 30, 2012
	IF IN PROGRESS, EXPLAIN ANY DELAYS		**IF IMPLEMENTED, DETAILS OF IMPLEMENTATION**
#	**RECOMMENDATION**	**CONCUR Y-N**	**ACTION STEPS**
17	***Require all the entities including DPU holding annual permits to notify DPW prior to making pavement cuts in City streets and public right-of-ways in non-emergency situations. Require them to notify DPW of emergency cuts within 24 hours or next business day of the cuts.***	Y	Develop policy/MOU between DPW and DPU for describing the work flow process to be put in place for communications between the two entities to ensure data is centrally stored.
	TITLE OF RESPONSIBLE PERSON		**TARGET DATE**
	DPW and DPU Directors		Update of findings by March 30, 2012
	IF IN PROGRESS, EXPLAIN ANY DELAYS		**IF IMPLEMENTED, DETAILS OF IMPLEMENTATION**
#	**RECOMMENDATION**	**CONCUR Y-N**	**ACTION STEPS**
18	***Develop a comprehensive policy and procedures manual for roadway maintenance activities, including the CIP Paving function and monitor for compliance.***	Y	Policy and procedures manual to be established to cover repairs, preventive maintenance, and proactive maintenance of the various roadway structures
	TITLE OF RESPONSIBLE PERSON		**TARGET DATE**
	Pavement Manager		30-Jun-12
	IF IN PROGRESS, EXPLAIN ANY DELAYS		**IF IMPLEMENTED, DETAILS OF IMPLEMENTATION**
#	**RECOMMENDATION**	**CONCUR Y-N**	**ACTION STEPS**
19	***Update the existing version and utilize the full functionalities of the City Works system to keep adequate information necessary to compute per unit costs. Ensure staff are adequately trained to use the system.***	Y	Add and train additional staff to populate Cityworks on a daily basis with all activities performed each day by Roadway Maintenance.
	TITLE OF RESPONSIBLE PERSON		**TARGET DATE**
	Deputy Director of Operations		30-Jun-12
	IF IN PROGRESS, EXPLAIN ANY DELAYS		**IF IMPLEMENTED, DETAILS OF IMPLEMENTATION**
#	**RECOMMENDATION**	**CONCUR Y-N**	**ACTION STEPS**
20	***Ensure all change orders are properly approved in accordance with City Procurement Policies.***	Y	Develop/utilize 'Change Order approval checklist' by Procurement Department for tracking Change Orders. These measures will also be included within the revised operating policies, procedures and practices.
	TITLE OF RESPONSIBLE PERSON		**TARGET DATE**
	Director of DPW and City Engineer		30-Mar-12
	IF IN PROGRESS, EXPLAIN ANY DELAYS		**IF IMPLEMENTED, DETAILS OF IMPLEMENTATION**