Performance Audit

# DEPARTMENT OF PUBLIC WORKS
## Street Maintenance Program

Report by the
Office of City Controller


**MICHAEL E. LAMB**
**CITY CONTROLLER**

Douglas W. Anderson, Deputy Controller

Anabell Kinney, Management Auditor

Gloria Novak, Assistant Management Auditor

Jeff Khadem, Performance Auditor



January 2009

January 28, 2009

To the Honorables: Mayor Luke Ravenstahl
and Members of Pittsburgh City Council:

The Office of City Controller is pleased to present this performance audit of the ***Department of Public Works Street Maintenance Program*** conducted pursuant to the Controller's powers under Section 404(c) of the Pittsburgh Home Rule Charter.

## EXECUTIVE SUMMARY

The Department of Public Works (DPW) divides the City into six areas or divisions to better manage its street maintenance program. An effective street maintenance program allows pedestrians and vehicles to safely navigate the public right of ways. Previous performance audits of DPW's Street Repair and Maintenance Program and Snow and Ice Removal Program were released in 1996 and 1999, respectively. This audit assesses the Department's programs for street resurfacing, street repair and snow and ice removal.

### Findings and Recommendations

Winter Street Maintenance

Streets are plowed and salted according to route priority designation. According to DPW's website, primary routes are main business arteries that are salted first and receive treatment as required to maintain traffic flow. Secondary routes are residential areas that are salted after the primary routes have been completely plowed and salted. Tertiary routes, streets and alley that have little traffic on a regular basis, are plowed and salted after the secondary routes are completed.

Effectiveness of Snow Routes and Snow Removal

A good indicator of DPW snow removal effectiveness is the number of complaint calls to the City's 311 center. Theoretically, divisions with the least complaints have the best snow removal.

**Finding:** Snow complaints increased in every division this past snow season (December 2007 through March 2008), implying poorer snow removal than the previous snow season (December 2006 through March 2007).

Fourth Division

Complaints about snow removal in the Fourth Division, which includes the South Side Slopes, Carrick, Brookline and Beltzhoover, were a major impetus for City Council to request an audit of DPW's snow and ice removal program in January 1999.

**Finding:** Comparative complaint data analysis indicates that the Fourth Division is still not removing snow at a satisfactory level. This Division had the most complaints over the last two snow seasons.

**Finding:** Because more than one person can call a complaint on the same day, the gross number of complaints is not the best indicator of unsatisfactory snow removal frequency. A better indicator of unsatisfactory snow removal frequency is the number of days a street has not been treated.

Fourth Division Complaints by Neighborhood and Street Frequency

**Finding:** The Carrick and Brookline neighborhoods had the most streets (44 and 24 streets, respectively) with 2 or more complaints this past snow season. Last snow season, the rankings were reversed: Brookline had 28 streets and Carrick had 25 streets with two or more complaint days. Complaints ranged from 2 to 6 days for one street.

Streets with 2 or more complaint days were compared to the 4$^{th}$ Division snow routes to determine the street's priority for snow treatment.

**Finding:** Fourth Division salt route streets are designated as primary, secondary or 'pick-up salt route'. There were no streets designated as 'tertiary routes'. Many of the streets with multiple complaint days were not listed on any salt route.

**Finding:** All Fourth Division priority roads are not receiving priority snow removal and treatment. These roads are not 'continuing to receive salt treatment as required in order to maintain traffic flow'.

**Recommendation:** DPW should do a similar multiple complaint day analysis for all Divisions to determine which streets are being chronically neglected or missed. This type of analysis and the inclusion of all divisional streets into the salt route details would help the new snow coordinator develop a fair and comprehensive snow removal plan.

De-icing Materials Usage

Winter operations research from PennDot indicates that the use of liquid calcium chloride results in a 20% to 30% reduction in salt usage. The effectiveness of the salt also increases because the pre-wetting 'jump-starts' the salt's melting process.

**Finding:** According to the Director, calcium chloride is only used when the temperature is less than 17 degrees Fahrenheit because rock salt alone cannot melt snow and ice below 17 degrees.

**Finding:** If DPW had used calcium chloride with all rock salt applications, the City would have saved approximately $304,492.70 in salt costs in 2006-2007 and $428,509.84 in 2007-2008.

**Recommendation:** In future, DPW should consider pre-wetting rock salt with calcium chloride at all temperatures. This would enable the salt to better adhere to the road surface at all temperatures and would reduce the City's rock salt costs.

Winter Materials Storage

**Finding:** Deficiencies with DPW's salt storage facilities that were found in the Controller's previous audit have not been remedied.

**Finding:** DPW is still storing salt in uncovered piles that are open to the elements. Precipitation can cause salt run off and salt hardening. Run off wastes salt, is detrimental to the environment and hardening makes salt difficult to spread.

**Recommendation:** With the current emphasis on environmental concerns and alternative green technologies, it is disheartening to realize that an unhealthy and wasteful stock piling of salt still exists in the City. Salt storage facilities without a dome should be immediately covered or eliminated.

**Finding:** Five out of six storage areas lack warning signs to alert motorists of the loading and unloading zone.

**Recommendation:** DPW should install additional warning signs and lights alerting motorists of entering and exiting vehicles at the Divisions 1 and 3 and 4 and Seldom Seen storage areas.

**Finding:** The salt dome in the fourth Division is still in bad condition. There are holes and cracks in several locations on the dome. This Division is located very close to the neighboring residential area and was scheduled for relocation prior to the1996 performance audit.

**Recommendation:** Relocation of the Fourth Division is long over due. DPW should seriously consider relocating this Division as soon as possible. The Administration should check the availability of Federal Environmental Protection Agency and State Department of Environmental Resources money for salt dome projects. Because it is a matter of public health and environmental welfare, the City might qualify for grants.

**Finding:** Storage yards in the First and Second Divisions are not maintained well. In the Second Division storage yard, there is a heap of garbage and used tires around the yard and next to the dome. Environmental Services uses this site as a transfer site for trash but is creating a potential health hazard for other City workers due to its unsanitary condition. The auditors observed the trash there near the end of the work day.

**Recommendation:** Environmental Services must not allow trash to accumulate or linger in transfer areas, especially in areas used by other City personnel.

**Finding:** The auditors did not observe any type of drainage or runoff containment area for calcium chloride tank spillage or overflow at any of the storage sites.

**Recommendation:** DPW should investigate installing drainage or runoff containment provisions under its calcium tanks, especially if runoff and spillage is a chronic occurrence.

Effectiveness of Pothole Patching

**Finding:** DPW does not replace all cold patched potholes with a more permanent hot mix patch as weather allows. Hot patch is used only on cold patch repairs that have failed. Hot mix can be used at the earliest in early April, when production of hot mix begins by the City's asphalt vendor.

**Finding:** DPW does not follow semi-permanent hot patch best practices. DPW's hot mix method for most potholes consists of trying to "square off" the pothole with a shovel, rather than squaring off the hole into sound pavement. The hole is filled with hot mix and the asphalt is tampered with a hand held roller or tamper. DPW does not seal the patch edges.

**Finding:** The pothole request data kept by 311 does not adequately capture the number of pothole repairs. DPW reports back to 311 when the pothole requests received through them have been completed. Other potholes repaired are not reported to 311 or anyone else.

**Finding:** DPW does not keep any record of the total number of potholes filled by Division crews each day. The Assistant Director of Maintenance estimates each crew fills 60 potholes but has no documentation to support this estimate.

**Finding:** A pothole per tonnage formula provided by DPW indicates that DPW filled 6178 more potholes than indicated by 311complaint data.

**Finding:** DPW does not appear to be using optimal pothole repair methods. The number of repeat pothole repairs would be a good indicator of the effectiveness of DPW patching methods. Currently, there is no way to determine how many potholes are repeat repairs.

**Recommendation:** DPW should conduct a cost analysis of its pothole repair program. Data collected should include the actual number of potholes patched, the numbers of repeat repairs, the cost of cold patch/hot mix, travel costs to pick up asphalt and labor costs for all of the above.

The auditors' research found a product called 'EZ Street', a high performance permanent polymer cold patch that is PENN DOT approved. Manufacturer's information indicates that EZ Street can be applied with little pothole preparation but the cost is nearly 10 times that of regular asphalt.

**Finding:** On its face, EZ Street appears cost prohibitive. However, if it works as a permanent patch as well as claimed, it would eliminate the need for repeated pothole repairs and could be cost effective.

**Recommendation:** DPW should purchase a quantity of EZ Street for test purposes and test it against traditional asphalt.

**Recommendation:** In the alternative, DPW should attempt better semi-permanent repairs on heavily traveled roads. The Department should invest in proper squaring tools. Optimally repaired potholes will reduce the likelihood of repeat repairs.

Street Paving/Resurfacing

**Finding:** The majority of City streets have been resurfaced over the original cobblestone or brick base. Many streets contain imbedded trolley tracks. Bricks and cobblestones shift and cause cracking in the asphalt surface. Trolley tracks are another cause of premature surface cracking. Resurfacing over this type of base is not the optimal way to ensure street longevity but is the most cost effective paving method.

Street Evaluations and Selection for Paving

**Finding:** Each Division's final paving list for 2008 contained streets that were not on the street evaluation master list for that Division. Some of these 'additional' streets on the paving list had no rating listed.

**Finding:** Half of the streets on the final paving list were not part of the DPW original street evaluation list.

**Finding:** The worse rated streets are not always selected for paving. However, many of the streets with less severe condition ratings selected for paving are primary roads. This seems to confirm DPW's commitment to keeping the City's primary roads in good condition.

**Finding:** As of September 18, 2008, only 35.18 miles have been paved. Rising crude oil costs increased the cost of paving to $315,000 per mile.

**Recommendation:** As seen with the volatility of oil prices this year, Council and the Mayor should encumber a certain amount of "oil inflation funds" to protect the paving schedule. This would allow streets to be paved on time and optimize use of the new software paving management system being purchased.

**Finding:** DPW's paving selection system is subject to fluctuations and changes. Seventy seven percent (77 %) of the streets paved were from the original 2008 paving list and 23% of the streets were not on the original list.

Paving Management System

**Finding:** As described, DPW's new Paving Management System will use objective quantifiable criteria to select streets for paving. If used as indicated, this should eliminate undue influence in the City's paving program.

**Finding:** Information from the foremen reports will not accurately report pothole repairs because repairs made "as needed" in the field are not recorded.

**Recommendation:** Divisions should track all pothole repairs, not just those referred by 311. The number of times a pothole is replaced should also be tracked. This will provide the Paving Management System with more accurate street condition information.

## Milling and Paving Contracts

The City has two milling contracts with Swank Associated for calendar years 2006, 2007 and 2008. One contract is for Community Development Block Grant (CDBG) eligible areas and the other is for non-CDBG areas. The price differential for the contracts is due to the requirement that the contractor must pay prevailing wage rates to his employees if he is paid with CDBG monies. As noted in the audit introduction, CDBG monies are a major source of funds for street paving.

**Finding:** Bid sheet totals for the two contracts indicate a savings to the City of $167,115.00 at the non CDBG rate over the three year contract term. The bid for CDBG area milling is approximately 6% higher than non CDBG areas.

**Finding:** Milling and paving costs for each street depends on the total square yards of the street to be resurfaced. When the square yardage of CDBG and non CDBG streets is compared, the amount of CDBG and non CDBG milling and paving is almost equal: CDBG streets 49.3% and 50.6% non CDBG.

**Finding:** It appears that the City has not bid separate contracts for paving for some time. It is noted in Russell Standards' paving contract for years 2001, 2002 and 2003 that this contract is "to include CD Areas".

**Recommendation:** DPW should consider bidding separate paving contracts for CDBG and non-CDBG areas, especially if the amount of paving in non CD areas will increase. Using the price differential in the milling contracts as a basis, the City could save approximately 6% of paving costs in non-CDBG areas with separate paving contracts.

## Warranty Inspection Process

The purpose of DPW's pavement inspection program is to ensure that all remedial work is completed by the contractor within the warranty period. The Asphalt Manager provided a list of streets that were paved in 2004 and inspected before the warranty period expired in 2006.

**Finding:** The list was organized by Division and community but contained no paving completion date, warranty start date, DPW inspection date or evidence of multiple inspections.

**Recommendation:** Warranty inspection reports should include basic information such as the date when the warranty begins to run ('the date of Final Acceptance of the work') and date or dates the street was inspected. This would ensure that periodic inspections are occurring and would provide a more accurate record of the warranty inspection program.

Utility Cut Permits and Warranties

**Finding:** In addition to the permit fee, some cities charge a non-refundable degradation fee to help cover the City's cost of degradation to the life of the pavement. Degradation fees are based on a set amount per square yard of the "area of influence". The dimensions of the area of influence are usually the dimensions of the excavated opening plus 2.5 feet on each side.

**Recommendation:** DPW should consider charging a degradation fee in addition to street opening permit fees. A degradation fee would help cover the City's cost of repair work after the two year warranty has expired.

Pavement Maintenance Contract

Sealing cracks in the asphalt pavement restricts water penetration into the underlying base and sub base layers. This prevents premature pavement failures, deterioration and potholes.

**Finding:** According to DPW's asphalt division manager "crack sealing has not been recently used because we have been putting all our funding into repaving. We plan to start crack sealing next year as a maintenance item". DPW inspectors will identify cracks for sealing.

**Recommendation:** City Administration should invest in a comprehensive crack seal program. This cost effective preventive maintenance program would extend the life of City streets and reduce DPW's pothole repair costs. DPW should consider using its own crews to reduce the cost of a comprehensive crack sealing program.

Since the audit field work was completed, DPW has acquired 7 additional dump trucks and has begun equipping its snow removal fleet with Global Positioning System (GPS) units. According to the DPW Director, these GPS units will "improve snow removal operations by conveying real-time information about where the trucks are, where they've been, if they treated and/or plowed a street and where they need to go." When possible, DPW crews are now plowing and salting secondary and primary streets simultaneously. These equipment upgrades and changed snow removal protocol should increase the effectiveness of City snow removal operations.

Sincerely,

Michael E. Lamb
City Controller

## INTRODUCTION

This performance audit of the Department of Public Works (DPW) Street Maintenance Program was conducted pursuant to Section 404(c) of the Pittsburgh Home Rule Charter. Generally accepted government auditing standards established by the federal General Accounting Office were followed. Previous performance audits of DPW's Street Repair and Maintenance Program and Snow and Ice Removal Program were released in 1996 and 1999, respectively. This audit focuses on the Department's programs for street resurfacing, street repair and snow and ice removal.

## OVERVIEW

According to its web page, Public Works divides the City into six areas or divisions to better manage street and park maintenance. DPW's Director of Operations oversees the six street/parks divisions. Divisional supervisors and foremen provide day to day oversight. The six divisions are staffed by six supervisors, various foremen, full time and seasonal laborers, truck drivers, heavy equipment operators and clerks. A list of the six divisions and the neighborhoods served can be found in the Appendix.

Year round, all division crews empty City stand alone trash cans that located in commercial areas of the City. Street maintenance is seasonal. In winter, the crews perform snow removal and temporary pothole patching (cold patch). Permanent pot hole patching (hot patch) is done in spring. In summer, divisional staff is assigned to the City Redd Up crew, to park or street maintenance such as the City's in house paving crew. The in-house paving crew performs minor paving because the bulk of street paving is done by an outside contractor.

Division work shifts are also seasonal. The normal DPW work shift is 6:00 a.m. to 2:00 p.m. During snow season, shifts are adjusted to provide 24 hour, 7 day a week coverage. From December to March, half of the division employees work 10:00 p.m. to 6:00 a.m. Another 2:00 p.m. to 10:00 p.m. shift is also added.

### Street Maintenance Equipment Inventory

DPW currently has the following equipment for street maintenance: 25 ten ton dump trucks, 11 eight ton dump trucks, 3 six ton dump trucks, 11 five ton dump trucks, 2 four ton dump trucks, 15 one ton dump trucks, 13 one ton pickup trucks, 17 three-quarters ton pickup trucks, 6 quarter ton pickup trucks, 6 spreaders, 4 pavers, 1 track paver and 6 rollers. A list of equipment by division as of May 2008 can be found in the Appendix.

## Effective Street Maintenance

An effective street maintenance program allows pedestrians and vehicles to safely navigate the public right of ways. In winter, streets must be kept free of seasonal hazards such as snow, ice and potholes that arise from freeze thaw cycles. Effective paving helps ensure that streets will survive seasonal temperature and weather fluctuations. Effective paving makes streets less prone to cracking and potholes, thereby reducing future maintenance costs.

## Winter Street Maintenance

The majority of winter street maintenance is done by in-house personnel. In winter, truck drivers with CDL licenses are seasonally hired to provide extra help for snow removal. De-icing materials include calcium chloride, salt and anti-skid materials.

Streets are plowed and salted according to route priority. Streets in each Division are categorized into primary, secondary and tertiary routes. According to DPW's website, primary routes are main business arteries that are salted first and receive treatment as required to maintain traffic flow. Secondary routes are residential areas that are salted after the primary routes have been completely plowed and salted. Tertiary routes, streets and alley that have little traffic on a regular basis, are plowed and salted after the secondary routes are completed.

## Intergovernmental Cooperation Agreements

City DPW has snow/ice removal agreements with the State and County. The current agreement with the State Department of Transportation (PennDot) is effective October 15, 2006 through April 20, 2011. PennDot pays the City to maintain designated State roads within City limits. According to DPW management, the City was paid $450,000 last snow season (2007-2008). PennDot is responsible for designated bridges and roads.

The City entered into an Intergovernmental Cooperation Agreement-Surface Maintenance agreement with the County on December 7, 1994. The original agreement was amended to include the City roads that would be treated by the county and the County roads that the City DPW would treat.

An effective snow and ice removal program requires timely plowing and proper street treatment. Dependable equipment, proper treatment materials and an effective 'plan of attack' are also required. Using the proper treatment materials is also cost effective. This audit assesses the effectiveness (efficiency and economy) of DPWs snow and ice removal program.

## Street Paving and Asphalt Maintenance

### Street Paving

Bond Funds and federal Community Development Block Grant (CDBG) money finance capital program improvements such as street paving. The three funds used for capital improvement expenditures are Bond Fund 4100, Project Fund 5100 and Fund 2610 for CDBG money. The majority of City street paving is done by outside contractors. According to information supplied by DPW, 38.8 miles of streets were paved in 2007. DPW paving lists indicate 73.3 miles scheduled for 2008 although, according to the DPW Director, funding was available to pave only 52 miles.

### CDBG Neighborhoods Street Paving

In 2007 41% (16.07 miles) of streets paved were located in Community Development Block Grant (CDBG) neighborhoods. The Federal Government provides funds for capital improvements and other projects in CDBG areas. A CDBG area is defined by low and moderate median household income. The Housing and Community Development Act of 1987 established the definition of "low and moderate-income persons" that is used to determine the eligibility of families and local governments for CDBG assistance. Under its definition, "low and moderate-income" is based on the higher of either:

- 80% of the median income for the City; or
- 80% of the median income for the entire non-metropolitan area of the County.

These determinations are made every ten years by the federal Census Bureau and can change as neighborhood demographics change. For a neighborhood to be CDBG eligible, 51% of its residents must meet these low moderate income requirements. The City “fronts” the money for CDBG area projects and is later reimbursed. CDBG paving bills are paid from Bond Fund 2610 which is reimbursed with the Federal CDBG monies. Most if not all capital work done in City CDGB areas is paid with CDBG monies. Contractors paid with CDBG monies must pay their workers the prevailing wage rate. Consequently, the amount of prevailing wages needed is factored into the contract bid for work in CDBG areas.

### Non-CDBG Neighborhoods Street Paving

Capital improvements in non-CDBG areas must be funded with City bond funds. Street paving and other capital improvements in these neighborhoods were on virtual hiatus when the City was put under Act 47 receivership in 2004. Until May 2006, when Bond refinancing provided $50 million for capital improvements and vehicle acquisition, the City had little money for non-CDBG projects.

## Street Paving Process

Street paving consists of removing old surface and applying new surface. Typically, a street is prepared for paving by removing or milling the existing surface. Partial or total street reconstruction of the underlying street base occurs only when the underlying base is too soft. This decision is made by the Asphalt/paving supervisor. The decision can be made prior to milling or after milling. Some streets have a weak sub base because the City paved over dirt without any base preparation. After a street is milled, soft base areas are discernible by indentations in the subsurface after traffic runs over the road.

## In House and Contracted Paving

The majority of paving is done by outside contractor. The City has contracts for milling, paver-laid hot mix (paving), crack sealing and asphalt. The Commonwealth has a contract for asphalt with the same vendor. The City 'piggybacks' off the State contract because the State has a better price per ton for the asphalt.

## Superpave

When buying off the State contract, the City cannot order asphalt according to its own specs but must use the State's superpave mix. Superpave is an acronym for Superior Performing Asphalt Pavements, an asphalt mixture made according to specifications developed by the Strategic Highway Research Program. Also, any asphalt bought with Liquid Fuels Tax proceeds must comply with State superpave specifications. The Liquid Fuels Tax is a State excise tax on liquid fuels, fuels and oil that is distributed to cities, boroughs, incorporated towns and townships for road, street and bridge purposes.

## METHODOLOGY

The auditors met with the DPW Director and Deputy Directors of Administration and Operations. The following documents requested from DPW were reviewed: DPW Organizational Chart, Paving Schedules for 2007 and 2008, Division snow and ice removal routes for 2007 and 2008, current vehicle list by vehicle type and year, list of current street maintenance equipment list (e.g., salt spreaders, plows for snow, etc.), foreman's report sample, 2007 and 2008 paving requests street evaluations and paving schedules.

The auditors also reviewed prior and current contracts for street milling and paving and the City 311 snow and ice complaint database for this past snow season. Internet research was conducted to obtain information on best street maintenance practices and materials. The auditors met with the asphalt testing lab staff: materials supervisor, inspector and asphalt supervisor. The auditors spent a field day with asphalt lab personnel.

To test the effectiveness of snow and ice removal, the auditors organized the 311 complaint database by street and complaint date. The auditors sorted the database by division and street to determine which division had the most complaints. This division's streets with two or more complaint dates were analyzed by route priority and season complaint frequency. The auditors requested application information for calcium chloride and salt to assess DPW's de-icing materials usage against best de-icing materials practices.

To test whether street paving selection is based on need, the auditors compared the street evaluation ratings done by DPW with the streets selected for paving in 2007 and 2008. Auditors accompanied DPW inspectors on field visits to observe paving by contractors. Streets paved in 2007 were analyzed for economy by base preparation and cost.

The Assistant Director for Street Operations was interviewed about DPW's pothole program. The auditors accompanied a Division foreman on pothole patching rounds to observe compliance with pothole patching standards. A DPW official was interviewed about utility cut permit procedures. The City's contracts for asphalt purchase, milling, paving and crack sealing were reviewed. The Commonwealth's contract for asphalt purchase was also reviewed.

## OBJECTIVES

1. To assess the effectiveness of current snow and ice removal protocols.

2. To assess the effectiveness of de-icing material use.

3. To assess the economy and cost effectiveness of using SuperPave for the majority of City paving.

4. To assess the City's street paving selection system.

5. To assess DPW's pothole patching program.

6. To assess the City's paving contracts.

7. To make recommendations for improvement.

## SCOPE

Audit scope for examining various street maintenance functions is December 2006 through April 2008.

## FINDINGS AND RECOMMENDATIONS

### WINTER STREET MAINTENANCE

According to DPW's website, all City streets are designated as primary, secondary or tertiary for purposes of snow removal priority. Primary routes are main business arteries that "provide access to hospitals, schools, police and fire stations". These streets are treated first and "continue to receive salt treatment as required in order to maintain traffic flow". Secondary routes are residential areas that are treated "after the primary system has been completely salted and plowed". Tertiary routes, treated lastly, are "those streets and alleyways that have little traffic on a regular basis". Division snow removal routes are organized accordingly.

**Finding:** Division boundaries vary by street maintenance function. A review of divisional snow removal routes indicates that snow routes do not follow divisional boundaries used for paving. For example, the section of Mt. Washington section bordering Allentown and Beltzhoover is included in the 4th Division snow routes while streets in this area are listed on the 5th Division's paving list.

Effectiveness of Snow Routes and Snow Removal

A good indicator of DPW snow removal effectiveness is the number of complaint calls to the City's 311 center. Theoretically, divisions with the least complaints have the best snow removal. The auditors obtained all snow and ice complaints called into 311 in 2006, 2007 and 2008. Snow and ice complaints were sorted by the last two snow seasons, i.e., December 2006 through March 2007 and December 2007 through March 2008. Table 1 shows snow and ice complaints by snow season and division:

**TABLE 1**

| DIVISION | 2006-2007 SNOW SEASON COMPLAINTS | 2007-2008 SNOW SEASON COMPLAINTS | PERCENT INCREASE (+) /DECREASE (-) |
|---|---|---|---|
| 1 | 184 | 272 | + 47.8% |
| 2 | 265 | 391 | + 47.5% |
| 3 | 254 | 471 | + 85.4% |
| 4 | 565 | 786 | + 39.1% |
| 5 | 284 | 391 | + 37.6% |
| 6 | 16 | 19 | + 18.7% |
| **TOTAL** | **1568** | **2330** | **+ 48.5%** |

**Finding:** Snow complaints increased in every division this past snow season, implying poorer snow removal than the previous snow season.

## Fourth Division Still Most Problematic Division

The Fourth Division, which includes South Side Slopes, Carrick, Brookline and Beltzhoover, has some of the City's hilliest terrain and the most complaints about snow and ice issues. Carrick, for example, is basically a mountain with a main road running along its top. Complaints about this division were a major impetus for City Council to request an audit of DPW's snow and ice removal program at its January 12, 1999 meeting. That audit, released the following October, found that the Fourth Division had not executed its snow removal plan at a satisfactory level.

**Finding:** Comparative complaint data indicates that the Fourth Division is still not removing snow removal at a satisfactory level. As indicated in Table 1, this Division had the most complaints over the last two snow seasons.

**Finding:** Because more than one person can call a complaint on the same day, the gross number of complaints is not the best indicator of unsatisfactory snow removal frequency. A better indicator of unsatisfactory snow removal frequency is the number of days a street has not been treated.

## Fourth Division Complaints by Neighborhood and Street Frequency

The auditors sorted Fourth Division complaints by snow season and street name. Streets with 2 or more complaint dates were selected to determine if certain streets are not being systematically treated. Duplicate complaints (311 calls on the same day about a street) were eliminated from the analysis. Each complaint day was counted as one complaint for this analysis.

**Finding:** The Carrick and Brookline neighborhoods had the most streets (44 and 24 streets, respectively) with 2 or more complaints this past snow season. Last snow season, the rankings were reversed: Brookline had 28 streets and Carrick had 25 streets with two or more complaints. Complaints ranged from 2 to 6 days for one street.

## Fourth Division Complaints by Route Priority

Streets with 2 or more complaint days were compared to the 4$^{th}$ Division snow routes to determine the street's priority for snow treatment.

**Finding:** Fourth Division salt route streets are designated as primary, secondary or 'pick-up salt route'. There were no streets designated as 'tertiary routes'. Many of the streets with multiple complaint days were not listed on any salt route.

**Finding:** All Fourth Division priority roads are not receiving priority snow removal and treatment. These roads are not 'continuing to receive salt treatment as required in order to maintain traffic flow'.

Tables 2 and 3 show Division Four snow complaint days by snow season and route designation. The "Pick-up Salt Route" designation was limited to streets in the South Side Slopes/Arlington neighborhoods. A breakdown by neighborhood can be found in the Appendix.

**TABLE 2**
**2006-2007 SNOW SEASON**
**FOURTH DIVISION STREETS**
**WITH MULTIPLE SNOW COMPLAINT DAYS**

| ROUTE DESIGNATION | # STREETS | PERCENT |
|---|---|---|
| Primary | 14 | 12.8% |
| Secondary | 45 | 41.2% |
| "Pick-up Salt Route" | 5 | 4.5% |
| No Route Designation | 36 | 33% |
| Primary or Secondary | 9 | 8.3% |
| **TOTAL** | **109** | **99.8%** |

**TABLE 3**
**2007-2008 SNOW SEASON**
**FOURTH DIVISION STREETS**
**WITH MULTIPLE SNOW COMPLAINT DAYS**

| ROUTE DESIGNATION | # STREETS | PERCENT |
|---|---|---|
| Primary | 14 | 9.5% |
| Secondary | 71 | 48.2% |
| "Pick-up Salt Route" | 8 | 5.4% |
| No Route Designation | 46 | 31.2% |
| Primary or Secondary | 8 | 5.4% |
| **TOTAL** | **146** | **99.7%** |

**Finding:** In both snow seasons secondary streets and streets not located on Division salt routes had the most multiple snow complaints. Neighborhoods with five or more streets

with no salt route designation were: Beltzhoover, Brookline, Carrick and the South Side Slopes.

**RECOMMENDATION NO. 1:**

DPW should do a similar multiple complaint day analysis for all Divisions to determine which streets are being chronically neglected or missed. Streets with no route designation or a 'pick up salt route' designation must be included in the new salt route details. This type of analysis and the inclusion of all divisional streets into the salt route details would help the new snow coordinator develop a fair and comprehensive snow removal plan.

De-icing Materials Usage and Winter Material Storage

Pre-wetting

Pre-wetting is the addition of a liquid chemical to the winter material (salt) prior to treating the road way. According to PennDot's Local Technical Assistance Program (LTAP) fact sheet #129, "Not only does this method (pre-wetting) improve the roadway conditions, it has also been proven to decrease costs through a reduction in material use."

Winter operations research from PennDot indicates that the use of liquid calcium chloride results in a 20% to 30% reduction in salt usage. Again to quote PennDot's fact sheet "Dry material bounces or blows off the road, resulting in some loss. Because pre-wetting causes more material to stick to the road, 20 to 30 Percent less material may be used". The effectiveness of the salt also increases because the pre-wetting 'jump-starts' the salt's melting process.

Table 4 shows the amount of salt used and cost of salt per and calcium chloride per gallon in 2007 and 2008.

**TABLE 4**
**CITY SALT AND CALCIUM CHLORIDE**
**USE AND COSTS**

| | **2006-2007** | **2007-2008** |
|---|---|---|
| Salt usage | 34,702 tons | 48,398 tons |
| Cost of salt per ton | $41.83 | $42.89 per ton |
| Cost of Calcium chloride | $.68 Per gal. | $.755 Per gal. |
| Rate of calcium chloride application per ton | 3.3 gal. | 3.3 gal. |

**Finding:** According to the Director, calcium chloride is only used when the temperature is less than 17 degrees Fahrenheit because rock salt alone cannot melt snow and ice when the temperature falls below 17 degrees.

PennDot's pre-wetting savings formula can be used to estimate the cost savings if DPW pre-wetted all rock salt prior to application. The formula assumes 25% (an average of PennDot's 20-30% savings range) less salt would be used. Factoring in the cost of the calcium chloride, the City's approximate cost savings can be determined as follows:

**2007:**
Amount of salt saved and amount of savings:
34,702 tons x .25 = 8,675.5 tons x $41.83 (cost per ton) = $362,896.16

Remaining tons treated with calcium chloride . . . . 34,702 x .75 = 26,026.5 tons

Rate of calcium chloride application and cost:
26,026.5 x 3.3 = 85,887.45 (gallons) x $0.68 = 58,403.466

Annual net material savings ……..…… $362,896.16- $58,403.46= **$304,492.70**

**2008:**
Amount of salt saved and amount of savings:
48,398 x .25 = 12,099.5 tons x $42.89 (cost per ton) = $518,947.55

Remaining tons treated with calcium chloride……...48,398 x.75 =36,298.5

Rate of calcium chloride application and cost:
36,298.5 x3.3 = 119,785.05(gallons) x $0.755 = $90,437.71

Annual net material savings $518,947.55 - $90,437.71 = **$428,509.84**

**Finding:** If DPW had used calcium chloride with all rock salt applications, the City would have saved approximately $304,492.70 in salt costs in 2006-02007 and $428,509.84 in 2007-2008.

**RECOMMENDTION NO: 2**

In future, DPW should consider pre-wetting rock salt with calcium chloride at all temperatures. This would enable the salt to better adhere to the road surface at all temperatures and would reduce the City's rock salt costs.

Salt Storage Facilities

Table 6 shows storage capacity for salt and calcium chloride by storage location.

**TABLE 6**

| STORAGE CAPACITY FOR SALT AND CALCIUM CHLORIDE BY DIVISION OR LOCATION | | | |
|---|---|---|---|
| **DIVISION** | **SALT DOME BY TON** | **SALT PILE** | **CALCIUM CHLORIDE BY GALLON** |
| 1 | 5,000 | no | 3,000 |
| 2 | 5,000 | no | 3,000 |
| 3 | no | yes | 3,000 |
| 4 | 1,200 | no | None |
| 5 | 5,000 | no | 4,000 |
| 6 (HEAVY Equipment in Strip District) | no | yes | 3,000 |
| Seldom Seen on Rt. 51 | 5,000 | no | 3,000 |

**Finding:** Not all salt storage facilities are covered. DPW is still storing salt in uncovered piles that are open to the elements. Precipitation can cause salt run off and salt hardening. Run off wastes salt, is detrimental to the environment and hardening makes salt difficult to spread.

**RECOMMENDATION NO. 3:**

With the current emphasis on environmental concerns and alternative green technologies, it is disheartening to realize that an unhealthy and wasteful stock piling of salt still exists in the City. Salt storage facilities without a dome should be immediately covered or eliminated.

The 1996 Controller's audit examined storage facilities for accessibility and safety concerns. The auditors applied the same standards used in the previous audit to current Division storage facilities. Table 7 shows the field work results.

**TABLE 7**
**SALT STORAGE AREA CHECKLIST**

| FEATURE | Division 1 | Division 2 | Division 3 | Division 4 | Division 5 | Division 6 | Seldom Seen |
|---|---|---|---|---|---|---|---|
| Signs are posted to warn motorists that trucks enter and leave area. | N | Y | N | N | Y | N | N |
| Outside areas are adequately lighted. | Y | Y | Y | N | Y | Y | N |
| Lights are available inside storage buildings. | Y | Y | NA | Y* | Y | NA | Y |
| Spreader trucks can easily enter and leave storage area, even during low visibility. | Y | Y | Y | Y | Y | Y | Y |
| Storage areas are large enough for front-end loaders & trucks to maneuver. | Y | Y | Y | Y | Y | Y | Y |
| Doors and other openings are large enough to permit loading & unloading. | Y | Y | NA | Y | Y | Y | Y |
| Storage yard is well maintained and clean. (No scrap material or junk piles in yard.) | N | N | Y | Y | Y | N | Y |
| Storage is covered to prevent loss of material. | Y | Y | N | Y | Y | NA | Y |
| Sites are strategically located to avoid deadheading to reload. | Y | Y | Y | Y | Y | Y | Y |
| Storage pads or flooring are on sites with proper drainage. | N | N | N | N | N | N | N |
| Storage runoff is properly contained, collected and provisions made for use or disposal. | N | N | N | N | N | N | N |

*Not working  Na -NO dome:

**Finding:** Deficiencies with DPW's salt storage facilities that were found in the Controller's previous audit have not been remedied.

**Finding:** Five out of six storage areas lack warning signs to alert motorists of the loading and unloading zone.

**RECOMMENDATION NO. 4:**

DPW should install additional warning signs and lights alerting motorists of entering and exiting vehicles at the Divisions 1 and 3 and 4 and Seldom Seen storage areas.

**Finding:** Division Four and Seldom Seen salt storage areas are not equipped with adequate outside lighting for operations. Also the lights inside Seldom Seen dome are not functioning.

**Finding:** The salt dome in the fourth Division is still in bad condition. There are holes and cracks in several locations on the dome. This Division is located very close to the neighboring residential area and was scheduled for relocation prior to the1996 performance audit.

**RECOMMENDATION NO. 5:**

Relocation of the Fourth Division is long over due. DPW should seriously consider relocating this Division as soon as possible. The Administration should check the availability of Federal Environmental Protection Agency and State Department of Environmental Resources money for salt dome projects. Because it is a matter of public health and environmental welfare, the City might qualify for grants.

**Finding:** Storage yards in the First and Second Divisions are not maintained well. In the Second Division storage yard, there is a heap of garbage and used tires around the yard and next to the dome. Environmental Services uses this site as a transfer site for trash but is creating a potential health hazard for other City workers due to its unsanitary condition. The auditors observed the trash there near the end of the work day.

**RECOMMENDATION NO. 6:**

Environmental Services must not allow trash to accumulate or linger in transfer areas, especially in areas used by other City personnel.

**Finding:** The auditors did not observe any type of drainage or runoff containment area for calcium chloride tank spillage or overflow at any of the storage sites.

**RECOMMENDATION NO. 7:**

DPW should investigate installing drainage or runoff containment provisions under its calcium tanks, especially if runoff and spillage is a chronic occurrence.

## POTHOLE PATCHING

### Effectiveness of Pothole Patching

Late winter/early spring freeze-thaw weather brings the annual scourge of Pittsburgh motorists: potholes. The primary causes are moisture and traffic. Potholes are created when moisture seeps into the pavement, freezes, expands and thaws. These freeze-thaw cycles weaken the pavement. The pavement is further weakened by traffic until the pavement eventually crumbles and pops out.

### Pothole Patching Techniques

According to the Federal Highway Administration., three methods of pothole repair are usually used, with varying degrees of effectiveness. The 'throw and go' method consists of merely filling the hole with cold patch. This is the quickest, cheapest but least effective way to repair potholes. In the 'throw and roll' method of repair, the cold patch is compacted with truck tires or a small roller. This compaction method is more effective than throwing and going.

'Semi-permanent' patching is the best of the three methods because the underlying and surrounding support for the patch is improved prior to patching. Water and debris is removed. The pothole is squared off, usually at least one foot beyond the distressed area or at least until the sides exist in sound pavement. This enlarged area is filled with hot mix and compacted. When the asphalt is dried, a ribbon of asphalt tack is applied on top of the patch edge. A layer of sand is applied to prevent tracking by vehicle tires. Sealing the edges prevents water from getting through and starting the pothole cycle over again.

### DPW Pothole Repair Program

Each Division is responsible for handling all the pothole complaints in their respective service area. Two 3 man crews (one driver and two laborers) are available for pothole repair in each Division. DPW uses 'throw and tamper' and 'semi-permanent' repair methods. During cold weather, DPW Division crews make repairs with cold patch because the weather is too chilly to use hot asphalt. Cold patch is obtained from a vendor, stock piled at the former City Asphalt Plant and used as needed. Potholes are filled with cold patch and compacted or 'tamped' down with a hand held tamper. In spring and summer, if the cold patch has not held up, the cold patch is replaced with a permanent hot mix patch.

Field Inspection of Pothole Repairs

The auditors accompanied a foreman to view hot mix patch repair by a 4th Divsion pothole repair crew. Pothole repair techniques were discussed with the foreman and observed by the auditors.

**Finding:** DPW does not follow semi-permanent hot patch best practices. DPW's hot mix method for most potholes consists of trying to "square off" the pothole with a shovel, rather than squaring off the hole into sound pavement. The hole is filled with hot mix and the asphalt is tampered with a hand held roller or tamper. DPW does not seal the patch edges.

Best practices indicate that squaring off the pothole with a power saw prior to filling with hot mix and sealing the edges with sealant provides the best semi-permanent pothole repair. According to the Assistant Director of Maintenance, DPW does not use this recommended semi-permanent method because of lack of manpower, the large number of potholes needing hot patch and to do so would cause longer traffic jams. The auditors were told by a foreman that DPW does not have the necessary equipment to properly square off potholes.

Holes that are wide and deep may require building a base with chipped gravel prior to filling with asphalt. DPW uses a chipped gravel base because it tends to lock and remain more stable under asphalt than a base of round gravel.

Pothole Repair is Complaint Driven

**Finding:** For the most part, pothole repair is complaint driven by calls to the City 311 center. Potholes also are identified by division foremen and pothole repair crews. DPW's goal is to repair all potholes referred by 311 within 3 days of receiving the complaint.

Winter Cold Patch Pothole Repairs

Most of these potholes are identified by complaints to 311. Some holes close to the site of the complaint are also filled with cold patch. Cold patch that doesn't hold must be repeatedly cold patched.

Spring and Summer Hot Patch Pothole Repairs

**Finding:** DPW does not replace all cold patched potholes with a more permanent hot mix patch as weather allows. Hot patch is used only on cold patch repairs that have

failed. Hot mix can be used at the earliest in early April, when production of hot mix begins by the City's asphalt vendor.

Each morning the Division Supervisor gives a foreman a list of pothole complaints from 311. The foreman and crew travel to the first repair site. The foreman surveys the rest of street and adjacent streets for more potholes that aren't on the list from 311. All potholes so identified are fixed before the crew moves to next pothole on the list.

DPW crews must pick up hot mix each morning from Lindy, the City's asphalt vendor. Unlike cold patch which can be stored, hot mix must be used up the day of pickup. Filling potholes discovered by the foremen help use up excess asphalt that would otherwise harden and become unusable by day's end.

**Finding:** The closing of the City Asphalt Plant and the City's inability to produce its own hot patch has not impeded DPW's hot patch pothole program. The current asphalt vendor starts producing hot mix in early April, the start of hot patch pothole repair season.

311 Pothole Complaints

Data supplied by City 311 indicates that Division crews resolved 775 pothole requests in April and 446 pothole requests in May 2008. According to 311 staff, **one request may involve more than one pothole.**

**Finding:** The pothole request data kept by 311 does not adequately capture the number of pothole repairs. DPW reports back to 311 when the pothole requests received through them have been completed. Other potholes repaired are not reported to 311 or anyone else.

**Finding:** DPW does not keep any record of the total number of potholes filled by Division crews each day. The Assistant Director of Maintenance estimates each crew fills 60 potholes but has no documentation to support this estimate.

**Finding:** A pothole per tonnage formula provided by DPW indicates that DPW filled 6178 more potholes than indicated by 311complaint data.

DPW estimates one ton of cold or hot patch asphalt will fill 7 potholes. In 2007, DPW used 1203 tons of asphalt (738.04 tons cold patch, 464.96 tons hot patch) for pothole repair. Applying the formula, DPW filled 8421 potholes. This is 6178 more potholes than the 2243 reported by the Mayor's Response Center.

**Finding:** DPW does not appear to be using optimal pothole repair methods. The number of repeat pothole repairs would be a good indicator of the effectiveness of DPW patching methods. Currently, there is no way to determine how many potholes are repeat repairs.

Effectiveness and Economy of EZ Street Pothole Repair Mix

The auditors' research found a product called 'EZ Street'. EZ Street is a high performance permanent polymer cold patch that is PENN DOT approved. Information obtained from the manufacturer indicates that EZ Street can be applied with little pothole preparation. The product works without removing debris and water from the pothole, although removal is optimal. The product can be stockpiled up to one year, thereby eliminating time to, from and waiting at the asphalt plant. A hole repaired with EZ Street can be opened immediately to traffic.

According to the EZ Street representative, this product is currently used by the states of New York, New Jersey, Maryland and Illinois. To what extent it is used is unknown, because the product is much more expensive than regular asphalt. EZ Street is sold in 50 lb bags and in bulk tons and is produced in various locations throughout the United States. Because there is no local production, the product would have to be shipped from Buffalo New York. The auditors were quoted a price of $450.00 per bulk sack ton, delivered to any DPW location. This is nearly 10 times the cost of regular asphalt.

**Finding:** On its face, EZ Street appears cost prohibitive. However, if it works as a permanent patch as well as claimed, it would eliminate the need for repeated pothole repairs and could be cost effective.

**RECOMMENDATION NO. 8:**

DPW should conduct a cost analysis of its pothole repair program. Data collected should include the actual number of potholes patched, the numbers of repeat repairs, the cost of cold patch/hot mix, travel costs to pick up asphalt and labor costs for all of the above. The Division with the most pothole complaints would be a good target for analysis.

**RECOMMENDATION NO. 9:**

DPW should purchase a quantity of EZ Street for test purposes and test it against traditional asphalt.

**RECOMMENDATION NO. 10:**

In the alternative, DPW should attempt better semi-permanent repairs in heavily trafficked roads. The Department should invest in proper squaring tools. This would enable repair crews to square off potholes like PennDot does on I-376 and other interstates. Optimally repaired potholes will reduce the likelihood of repeat repairs.

## STREET PAVING/RESURFACING

The purpose of DPW's street resurfacing program is to maintain the 1,031 miles of City roads. This street system consists of 861 miles of asphalt streets, 90 miles of concrete streets and 80 miles of brick or Belgian block stone streets. According to the Asphalt Division Supervisor, almost every City Street has some brick or cobblestone in its base and digging out the stones and putting in a new base is too costly. Consequently, most asphalt streets are really cobblestone or brick streets that have been resurfaced with asphalt.

The average life span of a new street is 20 years; of a milled and re-paved street, 10 to 12 years. Theoretically, a complete maintenance program should provide for one tenth to one twelfth of the City's streets or 86.1 to 71.75 miles respectively to be maintained every year. However, because of the underlying base, the majority of resurfaced City streets have a shorter lifespan.

**Finding:** The majority of City streets have been resurfaced over the original cobblestone or brick base. Many streets contain imbedded trolley tracks. Bricks and cobblestones shift and cause cracking in the asphalt surface. Trolley tracks are another cause of premature surface cracking. Resurfacing over this type of base is not the optimal way to ensure street longevity but is the most cost effective paving method.

Selecting Streets for Resurfacing

As noted previously, 38.8 miles of streets were resurfaced in 2007 and DPW Division paving lists indicate 73.3 miles were scheduled for 2008. City street resurfacing has been criticized as being too political, i.e., getting a street resurfaced largely depends on who you know. As recently as May 14, 2008, a City Councilmember asserted in a Pittsburgh Tribune Review article that the methods for distributing paving services appear to be politically driven.

According to DPW, the street paving selection system is based on an objective rating system with final street selection at the discretion of the department Director and the Mayor. Paving/resurfacing requests are directed to DPW's Street Services Division. This division consists of three employees: one Supervisor, one Inspector and one Lab Technician.

All requested streets are rated by the Inspector and a master list of the evaluated streets is presented to the Director of DPW prior to the beginning of each paving season. Street evaluations done in 2007 are for the following year paving season and range from 95 to 27. Streets with higher numbers are in the worse condition.

Street Evaluations and Street Selection

To determine if streets with the greatest need were selected for paving in 2008, the auditors compared the ratings of the streets on the paving lists with the street evaluation master lists for the respective Divisions.

**Finding:** Each Division's final paving list for 2008 contained streets that were not on the evaluation master list for that Division. Some of these 'additional' streets on the paving list had no rating listed.

**Finding:** Half of the streets on the final paving list were not part of the DPW original street evaluation list.

Table 8 shows the number and percent of streets on the 2008 paving schedule that were on the Master Evaluation list.

**TABLE 8**

**COMPARISON OF THE 2008 PAVING SCHEDULE TO THE STREET MASTER EVALUATION LIST**

| DIVISION | # of Streets Evaluated On Master List | Total # of Streets On 2008 Paving List | # Paving List Streets On Master List | % Paving List Streets on Master List | # Paving List Streets Not On Master List | % Paving List Streets Not On Master List |
|---|---|---|---|---|---|---|
| 1st | 155 | 19 | 8 | 42.10% | 11 | 57.8% |
| 2nd | 294 | 31 | 13 | 42.0% | 18 | 58.0% |
| 3rd | 380 | 57 | 25 | 43.8% | 32 | 56.2% |
| 4th | 361 | 83 | 49 | 59.0% | 34 | 41.0% |
| 5th | 170 | 69 | 33 | 47.8% | 36 | 52.2% |
| 6th | 38 | 14 | 8 | 57.1% | 6 | 42.9% |
| **TOTAL** | **1,398** | **273** | **136** | **49.8%** | **137** | **50.2%** |

**Finding:** The worse rated streets are not always selected for paving. However, many of the streets with less severe condition ratings selected for paving are primary roads. This seems to confirm DPW's commitment to keeping the City's primary roads in good condition.

Street ratings on the 2008 paving lists ranged from 100 to 32. The auditors used a rating of 75 or higher to identify streets with the greatest need for paving.

Table 9 shows the percent of streets on each division's paving list that were rated 75 or higher and less than 75.

**TABLE 9**

| BY DIVISION THE PERCENT (%) OF STREETS ON THE 2008 PAVING LISTS THAT WERE RATED 75 OR HIGHER AND LESS THAN 75 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **DIVISION** | **Total # of Streets On Paving List** | **# of Streets Rated >75** | **% Of Streets On Paving List** | **# of Streets Rated <75** | **% of Streets Paving List** | **# of Streets With No Rating** | **% of Streets With No Rating** |
| 1st | 19 | 13 | 68.4% | 3 | 15.7% | 3 | 15.7% |
| 2nd | 31 | 17 | 54.8% | 8 | 25.8% | 6 | 19.35% |
| 3rd | 57 | 28 | 49.1% | 19 | 33.33% | 10 | 17.5% |
| 4th | 83 | 39 | 46.9% | 39 | 46.9% | 5 | 6.0% |
| 5th | 69 | 25 | 36.2% | 32 | 46.3% | 12 | 17.39% |
| 6th | 14 | 11 | 78.5% | 2 | 14.2% | 1 | 7.1% |
| **TOTAL** | **273** | **133** | **48.72%** | **103** | **37.73%** | **37** | **13.55%** |

**Finding:** As of September 18, only 35.18 miles have been paved. Rising crude oil costs increased the cost of paving to $315,000 per mile.

**RECOMMENDATION NO. 11:**

As seen with the volatility of the oil prices this year, Council and the Mayor should encumber a certain amount of "oil inflation funds" to protect the paving schedule. This would allow streets to be paved on time and optimize use of the new software paving management system being purchased. (This system will be discussed later in this audit.)

**Finding:** DPW's paving selection system is subject to fluctuations and changes. Seventy seven percent (77 %) of the streets paved were from the original 2008 paving list and 23% of the streets were not on the original list.

Paving Management System

**Finding:** As described, DPW's new Paving Management System will use objective quantifiable criteria to select streets for paving. If used as indicated, this should eliminate undue influence in the City's paving program.

This will not be the Department's first use of a paving management system. In 1993, DPW contracted with a Canadian company to provide an on-line Pavement Management System. In the summer of 1994, the software was delivered, the system was up and running and data collection started. The software cost $250,000 and could only maintain data for three to four years. To keep information current, one quarter of the City had to be re-evaluated each year at a cost of $50,000. Because of budget constraints, updated evaluations did not occur and current data could not be obtained.

DPW has purchased new Paving Management System software that will use objective street condition criteria to select streets for paving/resurfacing. According to DPW, cost of the software is $35,000. The new software divides City streets into blocks and street segments. The software is designed to accept ongoing data about the street segments including information about the last time the street was paved, date(s) when utility cuts were restored and dates of pothole patching and other repairs.

How this street information data will be entered needs to be worked out. DPW is hoping to develop a mechanism to download some data from Division foremen reports into the Paving Management database.

**Finding:** Information from the foremen reports will not accurately report pothole repairs because repairs made "as needed" in the field are not recorded.

**RECOMMENDATION NO. 12:**

Divisions should track all pothole repairs, not just those referred by 311. The number of times a pothole is replaced should also be tracked. This will provide the Paving Management System more accurate street condition information.

Paving Process

For purposes of this audit, the terms 'paving' and 'resurfacing' are used interchangeably. The paving process consists of milling, applying binder and wearing asphalt layers and sealer.

Milling is the process of removing the old asphalt. It is used to strip/restore the road surface to a certain depth and expose the road base. While milling streets, crews may encounter soft spots where the road base needs to be repaired.

Depending on the severity of the soft spot, the area might need minimal repair or major overhaul. Repairing a soft spot requires digging up the road surface, sometimes up to 36 inches deep and then filling with slag or stones. According to a DPW crew member, slag is more suitable than stone for repairing a soft spot because the slag interlocks and forms a more secure base.

After the milling process and before the paving operation starts, a film of asphalt that serves as a prime and tact coat is sprayed on the road surface. After spraying the film, 1-1/2 to 2 inches of binder is laid by pavers and compacted by steel tired rollers. Binder is a hot asphalt mix that is usually of lower quality than the top coat wearing mix.

Wearing is the application of a layer of hot mix superpave asphalt. Superpave is an acronym for Superior Performing Asphalt Pavements, an asphalt mixture made according to specifications developed by the Strategic Highway Research Program. The wearing layer is placed over top of the binder and compacted by rollers. The street is then sealed with a polymer modified liquid to prevent water from seeping into the road base. This is the final layer in the asphalt process.

## CONTRACTS

Asphalt, Milling, Paving and Street Maintenance Contracts

As previously noted, the majority of street resurfacing/paving is done by outside contractors. The City has contracts for milling asphalt and concrete streets, paving, street maintenance (crack sealing and bituminous repairs) and asphalt purchase.

Asphalt Purchase Contract

The City contracts with Lindy Paving, Inc. for bituminous wearing and bituminous binder, cold patch and superpave binder. The contract, effective July 1, 2005 through December 31, 2008, sets a fixed annual dollar amount per ton for the wearing, binder and cold patch. The wearing and binder are made to City specifications; the superpave binder is made according PennDot specifications.

The 'fixed' prices listed in the contract are based on the Liquid Asphalt Price Index at the time of bid and may be "adjusted in accordance with the Price Adjustment clause utilized by the Pennsylvania Department of General Service…". In other words, the price per ton of the various asphalt mixes are affected by changes in the crude oil market. This clause is not part of the contract for bituminous mixtures but is included in a separate with the same vendor for purchase of the City Asphalt Plant.

The City is able to "piggyback off" the Commonwealth's contract with Lindy and obtain superpave and other hot asphalt at a reduced cost. Asphalt prices in the State contract are also subject to the price of crude oil. A significant rise in crude oil prices will lead to a resulting rise in the cost of asphalt off both City and State contracts.

Because so much money is budgeted each year for paving, a significant increase in asphalt costs will result in reduced paving unless additional funding is allocated. As noted previously, increased asphalt costs reduce paving from an anticipated 50 miles to 35.18 miles. As of September 2008, an additional $2 million allocated will allow DPW to pave 6 to 8 more miles.

DPW purchases the bulk of its asphalt off the Commonwealth contract. According to DPW, the City contract with Lindy is used primarily for cold patch.

In 2007, DPW spent $2,644,797.16 on asphalt from the State contract and $65,595.27 on asphalt through the City asphalt contract.

Milling Contracts

The City has two milling contracts with Swank Associated for calendar years 2006, 2007 and 2008. One contract is for Community Development Block Grant (CDBG) eligible areas and the other is for non-CDBG areas. The price differential for the contracts is due to the requirement that the contractor must pay prevailing wage rates to his employees if he is paid with CDBG monies. As noted in the audit introduction, CDBG monies are a major source of funds for street paving.

**Finding:** Bid sheet totals for the two contracts indicate a savings to the City of $167,115.00 at the non CDBG rate over the three year contract term. The bid for CDBG area milling is approximately 6% higher than non CDBG areas.

Table 10 shows the difference between the same contractor's bids for milling in CDBG and non CDBG areas:

**TABLE 10**

| LINDY'S MILLING BIDS FOR CDBG AND NON-CDBG AREAS BY YEAR | | | |
|---|---|---|---|
| **YEAR** | **CDBG AREA BID PRICE** | **NON CDBG AREA BID PRICE** | **DIFFERENCE** |
| 2006 | $ 928,315.00 | $ 878,400.00 | +$49,915.00 |
| 2007 | $1,001,785.00 | $ 947,460.00 | +$54,325.00 |
| 2008 | $1,123,435.00 | $1,060,560.00 | +$62,875.00 |
| **TOTAL** | **$3,053,535.00** | **$2,886,420.00** | **+$167,115.00** |

2008 Paving Schedule

**Finding:** The majority of streets (184 streets or 61%) on DPW's 2008 paving schedule are not in CDBG areas. One hundred and eight (108) streets in CDBG areas comprise 36% of the paving schedule; one street was listed as both CDBG and non CDBG and 16 streets had no designation.

**Finding:** Milling and paving costs for each street depends on the total square yards of the street to be resurfaced. When the square yardage of CDBG and non CDBG streets is compared, the amount of CDBG and non CDBG milling and paving is almost equal: CDBG streets 49.3% and 50.6% non CDBG.

Table 11 is a divisional breakdown by paving square yardage and CDBG designation:

**TABLE 11**

| 2008 DIVISIONAL PAVING SCHEDULE BY CDBG DESIGNATION AND SQUARE YARDAGE | | | | |
|---|---|---|---|---|
| **DIVISION** | **CDBG SQUARE YARDS** | **NON CDBG SQUARE YARDS** | **MISSING DESIGNATION YARDAGE** | **BOTH CD/NON-CD** |
| 1st | 103,238.6 | 18,488 | | |
| 2nd | 69,580.9 | 51,301.35 | 16,101 | |
| 3rd | 71,214 | 139,742 | | |
| 4th | 123,075.75 | 123,186.5 | | |
| 5th | 38,557.3 | 114,598 | 28,618 | 1748 |
| 6th | 40,324 | 10,040 | | |
| **TOTAL** | **445,990.55** | **457,355.85** | **44,719** | **1748** |

Paving Contract

The City has one contract for paving and this contract was bid for CDBG areas only. This rate will apply to all paving, in CDBG and non CDBG areas. The contract was awarded to Russell Standard Corporation for years 2007 and 2008.

**Finding:** It appears that the City has not bid separate contracts for paving for some time. It is noted in Russell Standards' paving contract for years 2001, 2002 and 2003 that this contract is "to include CD Areas".

After the City was placed under Act 47 receivership in 2004, the bulk of funds available for capital improvements were CDBG monies. Consequently, most paving and other capital improvements were done in CDBG areas.

**RECOMMENDATION NO. 13:**

DPW should consider bidding separate paving contracts for CDBG and non-CDBG areas, especially if the amount of paving in non CD areas will increase. Using the price differential in the milling contracts as a basis, the City could save approximately 6% of paving costs in non-CDBG areas with separate paving contracts.

Paving Quality Guarantee

Section 1.14 of the paving contract contains a Guarantee clause which states that "the Contractor shall, at his cost, replace any work, materials or equipment furnished and installed by him …which develops defects, except from vandalism or unusual wear and tear within one (1) year from the date of the Final Acceptance of the work for each project". In addition, "Additional warranties of specific materials and systems may be required of the Contractor on a per project basis and will be so noted in the Director's request (RPF) letter".

According to DPW personnel and the Controller's Engineer, all paving has a two year warranty or guarantee. This appears to be an additional warranty as provided for in the contract.

A two year warranty or guarantee appears reasonable given that most of the paving and resurfacing is not performed over optimal bases. According to DPW, paving done on a brand new base should last 20-22 years but is cost prohibitive. A new base would involve removing all underlying cobblestone, brick, trolley tracks and applying a new base of slag or crushed stone.

Warranty Inspection Process

The purpose of DPW's pavement inspection program is to ensure that all remedial work is completed by the contractor within the warranty period. According to the Asphalt Manager, warranty inspection is performed by inspectors from the Asphalt Division at six month intervals post paving. The Asphalt Manager provided a list of streets that were paved in 2004 and inspected before the warranty period expired in 2006.

Of the 54 street sections inspected, 51 had cracking that 'needs sealed', three had 'substantial cracking', 1 area 'needs profiled at bus stop' and 1 had a 'small failure at a RR (Rail Road) tressel'.

**Finding:** The list was organized by Division and community but contained no paving completion date, warranty start date, DPW inspection date or evidence of multiple inspections.

**RECOMMENDATION NO. 14:**

Warranty inspection reports should include basic information such as the date when the warranty begins to run ('the date of Final Acceptance of the work') and date or dates the street was inspected. This would ensure that periodic inspections are occurring and would provide a more accurate record of the warranty inspection program.

In 2008, inspectors from the Controller's Office started to spot check streets whose warranty is close to expiring. According to the Controller's Engineer, a few minor cracks have been observed close to the warranty expiration.

**UTILITY CUT PERMITS AND WARRANTIES**

All utility companies and private contractors must obtain proper permits from the DPW permit office prior to the starting work that requires street cuts and other obstruction. Fees vary by type of obstruction. All applications for permits must include a contact person and phone number and must be certified and signed by the applicants. An emergency contact number also must be provided. In case of emergency contractors may start the work; however a permit must be obtained no later than 24 hours after the work is started. All permits have expiration dates, if the work does not begin before the expiration date, a new permit must be obtained.

Failure to obtain all applicable permits prior to the start of a job will result in a written citation and fine up to $300.00 a day per offence. A copy of the valid permit must be kept at the job site at all times.

In addition to the permit, a copy of the City standards for street opening and restoration are provided. These standards include excavation or opening procedures, time lines for street restoration and acceptable restoration materials use.

DPW has 6 inspectors, one in each Division. If the job finished by the permit holder or its contractor/subcontractor is not satisfactory, DPW inspectors will contact the permit holder for needed corrections. The permit holder is the primary responsible party for the work performed. All restoration work is warranted for two years. Any repairs during the warranty period are at the expense of the contractor.

Degradation Fees

**Finding:** In addition to the permit fee, some cities charge a non-refundable degradation fee. This fee help covers the City's cost of the degradation to the life of the pavement. Degradation fees are based on a set amount per square yard of the "area of influence". The dimensions of the area of influence are usually the dimensions of the excavated opening plus 2.5 feet on each side.

**RECOMMENDATION NO. 15:**

DPW should consider charging a degradation fee in addition to street opening permit fees. A degradation fee would help cover the City's cost of repair work after the two year warranty has expired.

Pavement Maintenance Contract

Like its paving contract, the City's contract for pavement maintenance sealing is bid for CDBG areas only but is used City wide. Pavement maintenance includes cleaning and sealing joints and cracks in existing pavement surface and sawing and sealing bituminous overlays. Matcon Diamond, Inc. was awarded the current contract for a two year term effective April 1, 2008 through March 31, 2010. The previous three year contract was awarded to Swank, the City's current milling contractor.

Sawing and sealing bituminous overlays is done when asphalt is applied over a concrete base. The underlying concrete joints (places where the concrete is scored or where two sections abut) are marked on the asphalt by the paving contractor with orange paint. The paving maintenance contractor then saws out a section of asphalt over the joint and applies a sealer over the joint. This process theoretically prevents cracking in the asphalt from the underlying joint. Crack sealing is described in the contract as cleaning and sealing longitudinal and transverse joints and cracks in existing pavement surface.

**Finding:** According to DPW's asphalt division manager "crack sealing has not been recently used because we have been putting all our funding into repaving. We plan to start crack sealing next year as a maintenance item". DPW inspectors will identify cracks for sealing.

Sealing cracks in the asphalt pavement restricts water penetration into the underlying base and sub base layers. This prevents premature pavement failures, deterioration and potholes. Flexible rubberized asphalt sealers move with the pavement and prevent water intrusion, extending pavement life by three to five years. The City of Peoria utilizes its pavement management program to assist in prioritizing roadways for crack seal.

**RECOMMENDATION NO. 16:**

City Administration should invest in a comprehensive crack seal program. This cost effective preventive maintenance program would extend the life of City streets and reduce DPW's pothole repair costs. DPW should consider using its own crews to reduce the cost of a comprehensive crack sealing program.

# APPENDIX

Fourth Division Multiple Snow Complaint Days

Neighborhood Area Key:

| | |
|---|---|
| ALNTWN | Allentown |
| ARLNGTN | Arlington |
| BLTZ | Beltzhoover |
| BNR | Bon Air |
| BRKLN | Brookline |
| CRRK | Carrick |
| KNXVL | Knoxville |
| MTW | Mt. Washington |
| OVRBK | Overbrook |
| SSF | South Side Flats |
| SSLPS | South Side Slopes |

Snow Route Designation Key:

| | |
|---|---|
| P | Primary Route |
| S | Secondary Route |
| PSR | Pick-up Salt Route |
| P/S | Primary or Secondary Route |
| Blank Space | Not Found on DPW Snow Routes |

| 4th Division | 2006-2007 | # Complaints | Ranking | Area | | 2007-2008 | #Complaints | Ranking | Area |
|---|---|---|---|---|---|---|---|---|---|
| | Allen | 2 | S | ALNTWN | | Cedarhurst | 4 | | ALNTWN |
| | Loyal | 3 | | ALNTWN | | Ceres | 2 | | ALNTWN |
| | Proctor | 2 | | ALNTWN | | Lillian | 5 | S | ALNTWN |
| | Warrington | 2 | P | ALNTWN | | Loyal | 2 | | ALNTWN |
| | Brent | 2 | | ARLNGTN | | Warrington | 3 | P | ALNTWN |
| | Eccles | 4 | PSR | ARLNGTN | | Abel | 3 | | ARLNGTN |
| | Parkwood | 4 | P/S | ARLNGTN | | Devlin | 2 | | ARLNGTN |
| | Salisbury | 4 | P/S | ARLNGTN | | Dippel | 2 | | ARLNGTN |
| | Sterling | 2 | PSR | ARLNGTN | | Eccles | 8 | PSR | ARLNGTN |
| | Walde | 2 | S | ARLNGTN | | Elsie | 3 | S | ARLNGTN |
| | Will | 5 | S | ARLNGTN | | Goldbach | 5 | S | ARLNGTN |
| | Cathedral | 2 | S | ARLNGTN | | Parkwood | 10 | P/S | ARLNGTN |
| | Ormsby | 2 | P/S | ARLNGTN | | Patterson | 2 | PSR | ARLNGTN |
| | Althea | 2 | | BLTZ | | Rinne | 7 | S | ARLNGTN |
| | Ashdale | 3 | | BLTZ | | Salisbury | 2 | P/S | ARLNGTN |
| | Bigger | 4 | | BLTZ | | Schuler | 3 | S | ARLNGTN |
| | Cedarhurst | 5 | | BLTZ | | Sumner | 4 | PSR | ARLNGTN |
| | Climax | 3 | S | BLTZ | | Topeka | 2 | | ARLNGTN |
| | Freeland | 5 | S | BLTZ | | Weise | 3 | S | ARLNGTN |
| | Industry | 2 | S | BLTZ | | Walde | 5 | S | ARLNGTN |
| | Loyal | 3 | | BLTZ | | Cathedral | 3 | S | ARLNGTN |
| | Georgia | 3 | | BNR | | Althea | 4 | | BLTZ |
| | Institute | 2 | P | BNR | | Climax | 4 | S | BLTZ |
| | Ballinger | 5 | S | BRKLN | | Industry | 5 | S | BLTZ |
| | Bayridge | 2 | P | BRKLN | | Loyal | 8 | | BLTZ |
| | Bellaire | 3 | P | BRKLN | | Camfield | 4 | S | BNAR |
| | Brookline | 2 | P | BRKLN | | Drycove | 3 | S | BNAR |
| | Capital | 2 | P | BRKLN | | Duart | 2 | | BNAR |
| | Creedmoor | 4 | P/S | BRKLN | | Altaview | 2 | S | BRKLN |
| | Dahlia | 2 | | BRKLN | | Amman | 3 | P/S | BRKLN |
| | Elmbank | 2 | | BRKLN | | Bayridge | 2 | P | BRKLN |
| | Fernhill | 4 | P | BRKLN | | Bellaire | 3 | P | BRKLN |
| | Fitch | 2 | | BRKLN | | Berkshire | 2 | S | BRKLN |
| | Greencrest | 2 | | BRKLN | | Blaine | 2 | S | BRKLN |
| | Jillson | 4 | S | BRKLN | | Bodkin | 2 | S | BRKLN |
| | LaMarido | 2 | S | BRKLN | | Capital | 6 | P | BRKLN |
| | Milan | 2 | P | BRKLN | | Creedmoor | 3 | P/S | BRKLN |
| | Oakridge | 3 | P/S | BRKLN | | Dillon | 2 | | BRKLN |
| | Pioneer | 2 | P | BRKLN | | Fair | 3 | | BRKLN |
| | Roseville | 2 | | BRKLN | | Fernhill | 6 | P | BRKLN |
| | Rossmore | 2 | S | BRKLN | | Fitch | 6 | | BRKLN |
| | Sageman | 2 | | BRKLN | | Glenarm | 2 | P | BRKLN |
| | Stetson | 4 | P/S | BRKLN | | Greencrest | 2 | | BRKLN |
| | Timberland | 3 | P | BRKLN | | Herber | 2 | | BRKLN |
| | Wareman | 2 | S | BRKLN | | Hobson | 2 | S | BRKLN |
| | Westfield | 2 | | BRKLN | | LaMarido | 6 | S | BRKLN |
| | Whited | 3 | P | BRKLN | | Stapleton | 2 | P | BRKLN |
| | Winterhill | 3 | S | BRKLN | | Templeton | 2 | | BRKLN |
| | Woodbourne | 2 | P/S | BRKLN | | Timberland | 4 | P | BRKLN |
| | Woodward | 5 | P | BRKLN | | Wareman | 2 | S | BRKLN |
| | Zimmerman | 4 | | BRKLN | | Whited | 6 | P | BRKLN |

| 4th Division | 2006-2007 | # Complaints | Ranking | Area | | 2007-2008 | #Complaints | Ranking | Area |
|---|---|---|---|---|---|---|---|---|---|
| | Appian | 4 | S | CRRK | | Woodward | 9 | P | BRKLN |
| | Ariston | 3 | | CRRK | | Appian | 4 | S | CRRK |
| | Askal | 2 | | CRRK | | Brinwood | 2 | S | CRRK |
| | Brinwood | 2 | S | CRRK | | Brook | 4 | S | CRRK |
| | Calhoun | 3 | S | CRRK | | Brownsville | 4 | P | CRRK |
| | Carrick | 4 | S | CRRK | | Calhoun | 2 | S | CRRK |
| | Cherryhill E. | 2 | S | CRRK | | Cherryhill E. | 5 | S | CRRK |
| | Concordia | 2 | S | CRRK | | Claus | 2 | S | CRRK |
| | Copperfield | 2 | S | CRRK | | Concordia | 2 | S | CRRK |
| | Denise | 2 | | CRRK | | Custer | 2 | S | CRRK |
| | Dickman | 4 | | CRRK | | Dellrose | 3 | S | CRRK |
| | Fairland | 2 | S | CRRK | | Dickman | 7 | | CRRK |
| | Gilboa | 3 | | CRRK | | Diehl | 2 | S | CRRK |
| | Hornaday | 2 | S | CRRK | | Earlton | 2 | | CRRK |
| | Leolyn | 2 | S | CRRK | | Eiler | 2 | | CRRK |
| | Linnview | 4 | S | CRRK | | Ellendale | 3 | S | CRRK |
| | Merritt | 4 | S | CRRK | | Gilboa | 2 | | CRRK |
| | Meyers W. | 3 | S | CRRK | | Glade | 3 | S | CRRK |
| | Nice | 2 | | CRRK | | Glenroy | 5 | S | CRRK |
| | Parallel | 2 | S | CRRK | | Highnote | 3 | | CRRK |
| | Poplargrove | 4 | | CRRK | | Hornaday | 3 | S | CRRK |
| | Redrose | 4 | | CRRK | | Lacona | 5 | S | CRRK |
| | Vida | 2 | | CRRK | | Linnview | 5 | S | CRRK |
| | Westmont | 3 | S | CRRK | | Loleta | 6 | | CRRK |
| | Woodford | 6 | S | CRRK | | Lunar | 4 | | CRRK |
| | Dove | 3 | | KNXVL | | Maytide | 3 | S | CRRK |
| | Moore | 2 | S | KNXVL | | Merritt | 5 | S | CRRK |
| | Reifert | 2 | S | KNXVL | | Minooka | 2 | S | CRRK |
| | Rochelle | 2 | S | KNXVL | | Mosgrove | 2 | S | CRRK |
| | Wilbur | 5 | S | KNXVL | | Mt. Joseph | 3 | S | CRRK |
| | Kambach | 2 | | MTW | | Nice | 4 | | CRRK |
| | Kenova | 2 | | MTW | | Nobles Steps | 2 | | CRRK |
| | Briggs | 3 | S | OVRBK | | Nome | 2 | | CRRK |
| | Groveland | 2 | S | OVRBK | | Parkfield | 2 | P/S | CRRK |
| | Horning | 2 | S | OVRBK | | Plummet | 2 | | CRRK |
| | Jacob | 4 | S | OVRBK | | Poplargrove | 2 | | CRRK |
| | Kingwood | 2 | P/S | OVRBK | | Ruralton | 3 | S | CRRK |
| | Meter | 2 | | OVRBK | | Sankey Ct. | 2 | | CRRK |
| | Olivet | 5 | S | OVRBK | | Sprucewood | 4 | S | CRRK |
| | Spinneweber | 2 | S | OVRBK | | Steiner | 5 | S | CRRK |
| | Vineland | 2 | S | OVRBK | | Stewart | 4 | S | CRRK |
| | Walna | 3 | | OVRBK | | Transverse | 2 | S | CRRK |
| | Wychelm | 3 | | OVRBK | | Triana | 2 | S | CRRK |
| | E. Carson | 4 | P | SSF | | Vida | 2 | | CRRK |
| | Harcum | 2 | S | SSF | | Woodford | 6 | S | CRRK |
| | Larkins | 2 | S | SSF | | Reifert | 3 | S | KNXVL |
| | Mary | 3 | P | SSF | | Moore | 3 | S | KNXVL |
| | Wrights | 2 | S | SSF | | Parklow | 4 | | KNXVL |
| | Arlington | 3 | PSR | SSLPS | | Suncrest | 2 | S | KNXVL |
| | Greeley | 2 | PSR | SSLPS | | Wilbur | 3 | S | KNXVL |
| | Gregory | 2 | | SSLPS | | Zara | 3 | S | KNXVL |

| 4th Division | 2006-2007 | # Complaints | Ranking | Area | | 2007-2008 | #Complaints | Ranking | Area |
|---|---|---|---|---|---|---|---|---|---|
| | Marcus | 2 | | SSLPS | | Eureka | 3 | P | MTW |
| | Nusser | 2 | S | SSLPS | | Judicial | 2 | | MTW |
| | Oakley | 3 | PSR | SSLPS | | Kenova | 2 | | MTW |
| | S. 18th | 2 | P/S | SSLPS | | William | 3 | P | MTW |
| | Sharon | 2 | | SSLPS | | Olivet | 6 | S | OVRBK |
| | St. Martin | 2 | | SSLPS | | Horning | 2 | S | OVRBK |
| | Stella | 2 | S | SSLPS | | Ariston | 6 | S | OVRBK |
| | | | | | | Ballinger | 5 | S | OVRBK |
| | | | | | | Cortina | 6 | S | OVRBK |
| | | | | | | Elwyn | 3 | S | OVRBK |
| | | | | | | Fernland | 2 | S | OVRBK |
| | | | | | | Hillview | 4 | S | OVRBK |
| | | | | | | Homehurst | 4 | S | OVRBK |
| | | | | | | Horning | 3 | S | OVRBK |
| | | | | | | Jacob | 2 | S | OVRBK |
| | | | | | | Kingwood | 2 | S | OVRBK |
| | | | | | | Odette | 3 | S | OVRBK |
| | | | | | | Parklyn | 3 | P/S | OVRBK |
| | | | | | | Seaton | 2 | P | OVRBK |
| | | | | | | Seldon | 4 | P/S | OVRBK |
| | | | | | | Vineland | 5 | S | OVRBK |
| | | | | | | 5th | 2 | S | SSF |
| | | | | | | Carey | 3 | | SSF |
| | | | | | | Edwards | 3 | S | SSF |
| | | | | | | Fox | 2 | S | SSF |
| | | | | | | Hot Metal Br | 3 | | SSF |
| | | | | | | Larkins | 2 | | SSF |
| | | | | | | S. 12th | 3 | P/S | SSF |
| | | | | | | S. 16th | 3 | | SSF |
| | | | | | | Wharton | 2 | S | SSF |
| | | | | | | Arlington Ct | 4 | | SSLPS |
| | | | | | | Delta | 2 | | SSLPS |
| | | | | | | Gregory | 2 | | SSLPS |
| | | | | | | Hackstown | 2 | | SSLPS |
| | | | | | | Hartford | 5 | S | SSLPS |
| | | | | | | Magdalena | 2 | | SSLPS |
| | | | | | | McCord | 2 | PSR | SSLPS |
| | | | | | | Mission | 2 | PSR | SSLPS |
| | | | | | | Monastery | 2 | | SSLPS |
| | | | | | | Newton | 2 | | SSLPS |
| | | | | | | Oakley | 5 | PSR | SSLPS |
| | | | | | | Quarry | 2 | | SSLPS |
| | | | | | | St. Joseph | 3 | | SSLPS |
| | | | | | | Stella | 2 | PSR | SSLPS |
| | | | | | | Wellington | 3 | PSR | SSLPS |