



## CITY OF KIRKLAND

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### MEMORANDUM

**To:** Kurt Triplett, City Manager

**From:** Kathy Brown, Public Works Director  
Julie Elsom, Sr. Operations and Financial Analyst  
George Minassian, Project Engineer  
Ray Steiger, P.E., Operations Manager

**Date:** March 3, 2016

**Subject:** ASPHALT MILLING MACHINE PURCHASE

### **RECOMMENDATION:**

Staff recommends that the City Council authorize the purchase of an Asphalt Milling Machine in 2016 for an amount not to exceed \$600,000, including sales tax. Purchase of the Milling Machine will increase productivity, reduce cost, and allow better maintenance of arterials and neighborhoods streets, thereby increasing the City's overall Pavement Condition Index (PCI) sooner than the current rate of production.

### **BACKGROUND DISCUSSION:**

The proposed purchase was presented to the City Council's Public Works, Parks and Human Services Committee on February 3<sup>rd</sup> and to the Finance Committee February 23<sup>rd</sup>. The Milling Machine's primary purpose is to aid in improving the City's overall roadway condition and will be used to supplement the City's Annual Asphalt Preservation Program.

#### *Components of Preservation Program*

The Preservation Program is broken down into three components:

1. Slurry Seal Program: The main purpose of the slurry seal program is to extend the life of low volume roadways. This is done by coating the roadway with a mixture of emulsified liquid asphalt, an oil-like substance mixed with tiny pieces of gravel. When it dries, it acts as a sealant and protects the roadway from weather-related damage.
2. (City) Crew Maintenance and Preservation: This includes all of the ongoing work the City maintenance crews do throughout the year to keep the roadway network in good condition. This component includes, but is not limited to: pothole repairs, structural repairs/patching, and minor roadway overlay projects.

3. Overlay Program: Overlay is a process in which the life of the street is extended by structurally repairing the roadway in select locations and then resurfacing the entire road with a new 2 to 3-inch thick asphalt surface. To prepare a street for an overlay, the old deteriorated areas of pavement must be removed, and the roadway is then repaired; this repair is often referred to as structural patching. Removal of deteriorated asphalt is customarily done by two methods:

- a. Saw-cutting and excavation (or "dig-out"): a labor-intensive process that requires saw cutting the defective pavement area and removal of all material down to a stable base. Broken material is loaded into dump trucks by a backhoe (see photo to right).
- b. Milling/planing: a milling machine uses a large rotating drum with "teeth" to grind up (plane) and remove a given thickness of defective pavement. The removed pavement is ground up into small particles (referred to as 'millings') which are directly loaded into a dump truck via an attached conveyor and then hauled away (see photo to right) to be recycled.



#### *Structural Patching: Saw Cutting & Excavation vs. Milling*

In advance of preservation (by slurry seal or overlay method), surface cracking and deteriorated asphalt areas are sampled at different locations using a coring machine to determine the depth and nature of the distresses. These distressed areas must be structurally repaired in advance of the preservation so that distresses do not continue to impact the new pavement. If the saw-cut/dig-out method is to be used for preparation, the entire depth of the asphalt must be removed, regardless of the extent of cracking or distress. If the milling method is used, the distressed pavement surface can be milled just to the extent of the cracks without the need for a full depth pavement replacement.

The saw-cut/dig-out method removes asphalt pavement in large chunks that often contain pieces of sub-surface soils. Because of this, excavated material using this method cannot be readily reused or recycled without further processing, and consequently the material is usually hauled away to a landfill for disposal.

#### *Benefits of Milling Machine*

The milling method is more environmentally sustainable and efficient; two factors highlight this:

- Environmental: Millings can be directly reused as a base material in alleys, paths, trails, parking lots, and other City projects. They can also be directly recycled and reused as aggregate in new pavement. This ability to recycle materials not only diverts waste from the landfill, but it also preserves energy and raw materials that go into creating aggregate which is needed to make asphalt. Overall, the ability to reuse millings reduces the impact that resurfacing Kirkland's roadway network has on the environment and may lower greenhouse gas emissions.

Regarding the recycling of materials and of note, in 2015, the Washington State Legislature passed legislation (HB 1695) requiring the use of recycled materials in all transportation projects for jurisdictions over 100,000 in population and encouraging other agencies to follow suit. In part, the bill outlines these requirements and the trend:

Beginning in the year 2016, all Washington roadway, street, highway, and transportation infrastructure projects undertaken by the DOT or a local government with more than 100,000 residents must use at least 25-percent construction aggregate and recycled concrete materials each year cumulatively across all projects if adequate amounts of materials are available. Each year after 2016, that percentage must be increased by at least 5 percent through the year 2020. During this time period, the DOT and its implementation partners must also report to the Legislature annually on the progress being made to reach the established recycling goals. Local governments with less than 100,000 residents must review their capacity for recycling and reusing construction materials, establish strategies for meeting that capacity, and begin implementing those strategies.

Also beginning in the year 2016, any local government with less than 100,000 residents, or any local government with jurisdiction over a public works transportation or infrastructure

House Bill Report

- 2 -

HB 1695

Kirkland will be well suited to meet these objectives in advance if it becomes a requirement in the future for cities with populations of less than 100,000.

- **Efficiency:** When comparing various “in-house” projects from the last few years between when a rented milling machine was used and when the saw-cut and dig-out method was used, the City maintenance crew was approximately 40% more productive when a milling machine was used. The milling machine has the ability to remove the old deteriorated asphalt to a specified depth at a production rate greater than can be achieved utilizing the saw-cut/dig-out method. Use of a milling machine will result in an increase in production, allowing the crew to prepare more lane miles of roadway for the labor that is allocated to this annual activity.

#### *Current Preservation Program Funding*

Excluding project management, design, and inspection (soft costs), approximately \$4.3 Million is allocated annually for the City’s Preservation Program. Of this amount, approximately \$3.5 M is work that is contracted out and funded through the Capital Improvement Program (CIP). In addition, on average, the City maintenance crew spends approximately \$812,000 per year to keep the roadway in good working condition. These operating costs include \$200,000 per year for structural patching in support of the contracted slurry seal program. A funding breakdown is summarized as follows:

Expenses				Preservation Program Total
		Capital	Operating	
1. SLURRY SEAL		550,000	200,000	
2. CREW MAINT & PRESERVATION			612,000	
3. OVERLAY				
<i>CONSTRUCTION EXCLUDING STRUCTURAL REPAIR</i>		2,720,000		
<i>STRUCTURAL REPAIR</i>		252,000		
<b>Total Expenses:</b>		<b>\$ 3,522,000</b>	<b>\$ 812,000</b>	<b>\$ 4,334,000</b>

Based on 2014 Actuals, does not include soft costs

Table 1 – Preservation Program (current)

Street operating expenses in support of the preservation program can be further broken down into four main categories as follows:

	2014 Actual \$	% of total
Salaries/Wages	242,000	30%
Supplies & Other Charges	250,000	30%
Rock/Aggregate/Hot Mix Asphalt	282,000	35%
Hauling/Dumping	38,000	5%
<b>Total</b>	<b>\$812,000</b>	

Table 2 – Street Operating Expenses

### *Key Cost Assumptions*

The following assumptions were used in the financial analysis of the milling machine purchase recommendation:

- Reuse/Recycling: As outlined in Table 2, the Street operating fund spends approximately \$282,000 per year on rock, aggregate, sand, gravel, crushed rock, and hot mix asphalt for the Preservation Program. Of this amount, \$52,000 is for the purchase of crushed rock. Millings produced by the milling machine can be reused in place of crushed rock in many Public Works operations. It was estimated that nearly 88% of the crushed rock purchased annually by the Streets Division could be replaced by reused millings, however, to be conservative, only a 50% (\$26,000) reduction was used in the analysis.
- Hauling/Dumping: It was assumed that the \$38,000 per year for hauling and disposing of roadway materials would be reduced in proportion to the amount of millings being reused; this amounts to an expenditure reduction of \$15,000 per year. In addition to this direct cost savings, there are several local asphalt companies that will take the millings for reuse as an aggregate in their hot mix asphalt, and they do not charge for dumping of the material.
- Life expectancy: For analysis purposes, a conservatively short 12-year useful life was used for the milling machine in evaluation of the \$600,000 purchase price (based on

research with other agencies and a private contractor, it would be reasonable to expect a longer service life based on what they are experiencing with similar machines).

- **Structural Patching:** The annual overlay program consists of private contractors overlaying approximately 80,000 square yards of asphalt. Structural repairs are done by the contractor in advance of this overlay work and usually require up to 14 days of advanced work. For this recommendation, it was assumed that at least 15-20% of the necessary structural repairs will be completed by the City maintenance crew prior to the overlay contract. This will result in a shift in funding from capital to operating, a proposal will be brought forward in the 2017-2018 budget to address this change. With this approach, the private contractor can commence overlay work immediately upon award of the contract.
- **Staffing:** Finally, it is projected that an estimated 900 labor-hours will be required to complete the additional 15-20% structural patching under the staff recommendation. Efficiencies shown through past City project performance indicates up to a 40% increase in production when a milling machine is used (production increased from 1.0 tons to 1.4 tons of asphalt per labor-hour). This ability to work more efficiently will allow the crew to accomplish more repair work in the same amount of time; therefore, it was determined that no additional staffing is needed to accomplish this additional work.

#### *Summary of Financial Analysis*

Using the above assumptions and considering all other costs associated with owning, operating, and maintaining a milling machine, it is projected to take between 6-8 years for the purchase to pay for itself. This range is highly sensitive to the percentage of structural repair the City maintenance crew is able to complete in preparation of the capital component of the overlay program. The more structural repair work that the crew completes, the shorter the payback period. The analysis has been conservative where possible, and the payback period is dependent on actual reuse of materials and the percentage of structural repair necessary in a given year. Both of these factors will vary from year to year. The sensitivity of the analysis indicates that for every additional \$12,000 in savings (materials, labor, etc.), it will take one less year to pay off the purchase.

To demonstrate the variation of the potential annual savings, Table 4 compares the cost over 12 years using the current 'status quo' program with the cost if a milling machine is purchased. In all three scenarios, the cost is less utilizing a purchased milling machine. The highest savings are realized if the crew completes 20% of the structural repair work every year for twelve years.

<b>% of Structural Repair</b>	<b>Status Quo (\$ in Millions)</b>	<b>Milling Machine (\$ in Millions)</b>	<b>'Savings' (\$ in Millions)</b>
15%	2.9	2.6	.3
17.5%	3.4	2.8	.6
20%	3.9	3.0	.9

Table 4 – Projected 12-year savings based on City repair

### *Reinvesting Savings*

Projected cost savings realized from the proposed program changes will be reinvested into the capital Preservation Program. This will result in the ability to leverage funding in order to accomplish more preservation now. The ability to address the pavement while it is still in good condition will mitigate the need for costly rehabilitation and reconstruction of the roadway in the future.

### *Consider Renting*

The ability to rent a milling machine for short periods over the last several years has provided both the opportunity to provide staff training on this specialized equipment, and it has also allowed staff the opportunity to study the method for pavement repair. However, scheduling the machine for rental during the season that is most advantageous to street preservation work has become increasingly more challenging. In 2015, no rental equipment was available during the paving season. In the past, when the City has rented a milling machine, it cost on average \$7,200 per week, thus in order to retain the machine for the entire pavement repair season (in advance of the overlay program from May-July), it would cost nearly \$86,400 per year. After only seven years of renting, the City will have spent as much as it costs to purchase a milling machine.

### *Long Term*

For best results, paving operations require temperatures between 40-70 degrees with little to no rain; therefore there is a limited window for paving. Paving is best done in the summer through early fall when temperatures tend to be mild, and the weather is drier than during other seasons. The City maintenance crew, however, has the ability to complete structural patching throughout the year as weather permits. Thus, by completing structural patching in advance of the contracted (slurry seal and overlay) work, a longer 'construction season' will be realized. Given that these additional days can be dedicated to contractor paving, it is estimated that every seven years will allow the City to accomplish the equivalent of one full year of additional paving. This will result in an increase in Pavement Condition Index (PCI), a decrease in the deferred maintenance, and will help to stabilize and/or increase the overall pavement quality for less cost than the current programs.

### *Timeline*

A six month lead time is anticipated between the procurement (purchase) and the delivery of a milling machine. Thus, if the City were to wait for the upcoming 2017/2018 budget process to consider purchasing a milling machine, the equipment would not be available in time for the 2017 paving season. Staff is beginning to seek a rental unit in preparation of the 2016 paving season, however to be ready for the 2017 paving season, staff is requesting authorization to proceed with the procurement and purchase of a milling machine in 2016.

### *Funding*

Because of the limited number of paving days each year, the Street Preservation Program usually ends with a fund balances that are then carried over to the next year. (This is one of the problems the additional productivity of the Milling Machine is intended to address.) The City

programs these for more street preservation. For example, the Council authorized staff to use these balances from 2013 and 2014 to do additional overlay on the 85<sup>th</sup> Street project, which came in under the revised budget. Therefore the recommendation is for the \$600,000 purchase to be paid for using a combination of unspent 2015 fund balance and 2016 Street Preservation Program funding and the remaining balance of the Street Improvement reserve. The amounts are proposed to be allocated as follows:

- \$194,000 unspent fund balance from the 2015 Street Preservation Program.
- \$140,000 from the NE 85<sup>th</sup> Street Overlay Project, which came in below budget.
- \$170,042 from the 2016 Street Preservation Program. The overall 2016 Program would be reduced by this amount, but the \$170,000 would likely have been unspent fund balance anyway at the end of 2016 based on current rates of production.
- \$95,958 from utilizing the balance of the street improvement reserve. This reserve is made up mostly of unspent gas tax revenue allocated to previous transportation capital projects. Because funding is restricted and must be used for maintaining and improving streets, a separate reserve was set up for tracking purposes. The bulk of the reserve (\$900,000) has been allocated for the Arterial Street LED Conversion Project in 2016, and the recommended use is the remaining balance. The City has changed its practice and all gas tax revenue is now programmed in the CIP. Therefore the reserve is not needed for future transactions.

If Council concurs with the recommendation, staff is seeking a motion to authorize the funding and purchase of the Milling Machine.

**FISCAL NOTE**

CITY OF KIRKLAND

Source of Request							
Kathy Brown, Public Works Director							
Description of Request							
Funding totalling \$600,000 to purchase an asphalt milling machine. Funding sources include 1) \$194,000 from the 2015 Street Preservation project, 2) \$140,000 from the NE 85th Street Overlay project, 3) \$170,042 from the 2016 Street Preservation project and 4) \$95,958 from the Street Improvement Reserve.							
Legality/City Policy Basis							
Fiscal Impact							
<b>One-time use of project balances of \$194,000 from the 2015 Annual Street Preservation Program ST 1506 and \$140,000 from the NE 85th Street Overlay project ST 0006 002.</b> These projects are expected to have unspent balances available to fund this request. <b>One-time use of \$170,042 from the 2016 Annual Street Preservation Program ST 1606.</b> The upcoming 2016 program will be reduced by this amount. <b>One-time use of \$95,958 from the Street Improvement Reserve.</b> This reserve is fully able to fund this request; however this request will exhaust the remaining balance. It has been the intent to close this reserve as it doesn't have a current funding source or purpose.							
Recommended Funding Source(s)							
<i>Reserve</i>	Description	2016 Est End Balance	Prior Auth. 2015-16 Uses	Prior Auth. 2015-16 Additions	Amount This Request	Revised 2016 End Balance	2016 Target
	Street Improvement Reserve	95,958	0		95,958	0	N/A
	Funding of \$900,000 from the Street Improvement Reserve is allocated to the Arterial Streetlight LED Conversion ST 0088 in 2016.						
<i>Revenue/Exp Savings</i>							
<i>Other Source</i>							
Other Information							
Prepared By	Neil Kruse, Senior Financial Analyst				Date	March 2, 2016	