Cornell Local Roads Program

Town of Farmington

2014

TOWN OF
FARMINGTON

Report by Joshua Ren, Summer Intern

Cornell University 2015

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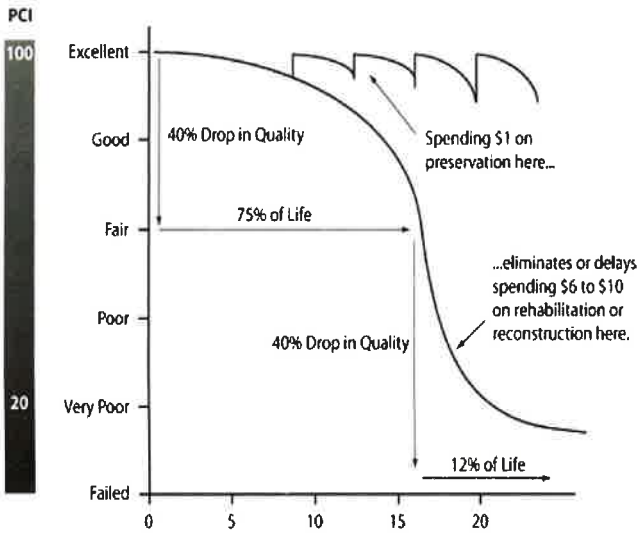
Executive Summary

The goals of the Cornell Local Roads program were to identify the condition of Farmington's roads and systematically decide the repairs that each road needs. A realistic 5 year budget can then be developed.

The main benefit to identifying distresses in roads is to save on repair costs over time. Although, a road may appear to be in good condition, if it is neglected for several years, it will deteriorate quickly and its repair cost will multiply. Spending more money on the maintenance of roads is an investment that will lower the costs of large capital projects in the future.



The strategy employed in creating this 5 year plan was prioritizing preventive measures and deferring repair of roads already in poor condition until there is enough money to spare for a large rehabilitation project.

For the first two years, priority is given to good roads that show some cracking. These roads need to be when their condition has not deteriorated to the point of needing more expensive repairs.

This 2014 survey evaluated Farmington's roads to have an average PCI of 85, meaning they are in good condition, but are starting to show signs of distress. These roads will need continued funding every year to keep them at their current standard.

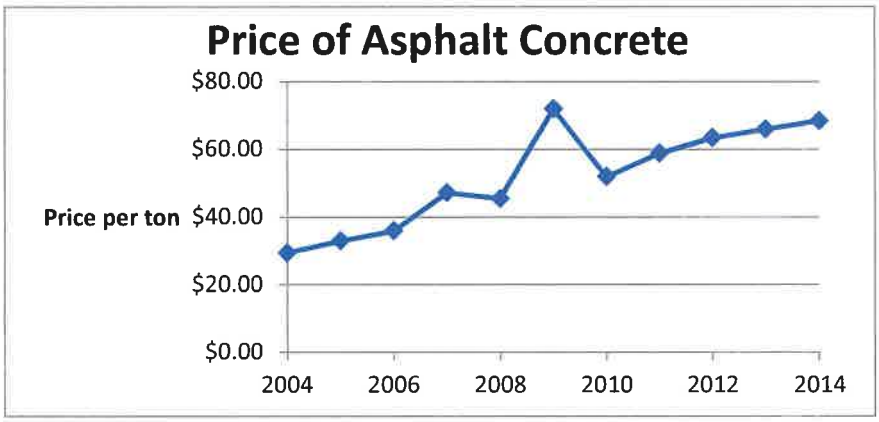
$331,000 will cover basic maintenance and repairs and prevent the rapid deterioration of roads. In other words, it will be enough to repair distresses at the rate they are formed on the "good" roads, but not enough to treat the roads in poorer condition.

Annual average maintenance...
14 miles of chip sealing at @ $18,200 per mile = $255,000
2000 gallons of crack sealing @ $13 per gallon = $26,000
120,000 square ft of slurry sealing @ $0.41 per square ft = $50,000

Continued maintenance of a good road will extend its lifespan, but not indefinitely. A portion of the budget must also be appropriated toward larger capital repair projects to rehabilitate failing roads. An additional $350,000 is needed to keep pace with the number of annual capital repairs, bringing the desired total road repair budget to $681,000. These capital repairs include mill and fills, overlays, recycling, and reconstructions.

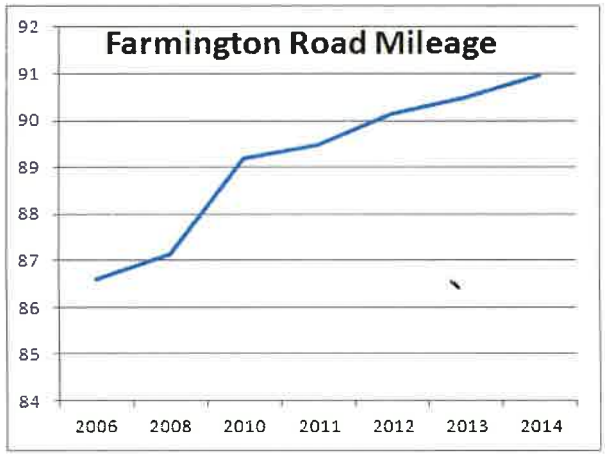
Rising Costs

A major concern that the Highway Department faces is the rising cost of repairs.

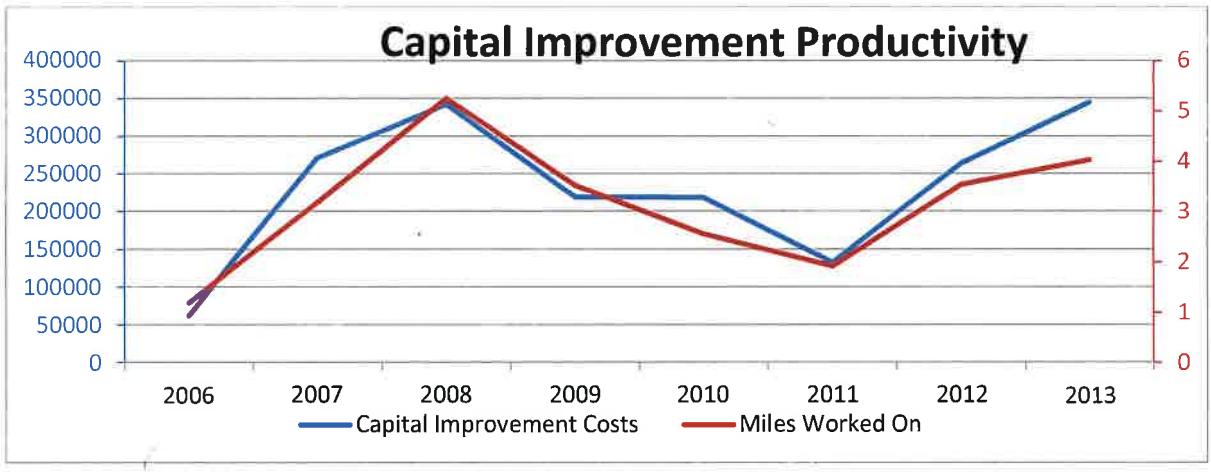


In the past 10 years, the price of hot mix asphalt has risen almost 300%, and it is likely to continue rising in price. Asphalt accounts for about 46% of the cost of a 2" overlay, a commonly done repair.

Another factor for rising costs is Farmington's increasing road mileage. Over the past 12 years, considerable construction has been done, adding over 5 miles of new subdivision roads. The new roads increase the total amount of area that needs to be maintained and drive up costs.



In 2014, the repair budget for the improvement of roads is about $600,000 (includes general repair budget, VLT and CHIPS money). This is an adequate amount of money to maintain roads at their current conditions, but it can be observed that costs are on the rise, and he budget needs to be increased to compensate. If the budget is increased further, forward progress can be made to increase the quality of Farmington's roads.

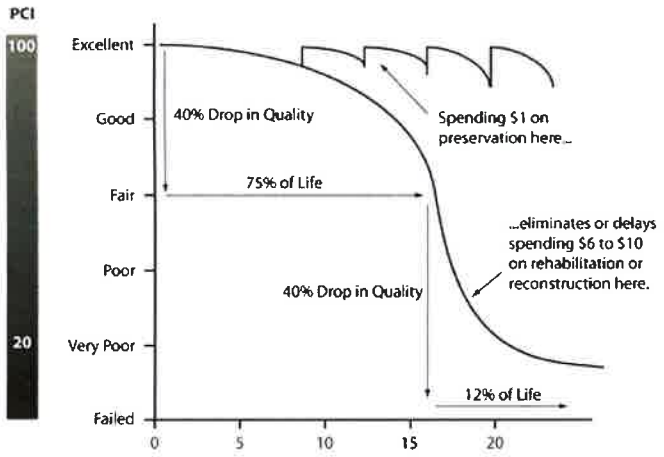


Detailed Description

Intern Joshua Ren was hired for the summer of 2014 to work with the Highway Department of Farmington to:

- Conduct an up-to-date a survey of road conditions
- Calculate average cost per square foot for each treatment Farmington uses on its roads
- Assign repairs to roads and estimate cost for repair
- Form a 5 year plan, targeting high priority roads first

Joshua Ren was hired through the Cornell Local Roads Program. Through this program, he and Highway Superintendent Ed McLaughlin, who would later act as Joshua Ren's supervisor, participated a three day training period. The Local Roads interns were instructed on the goals of the program, pavement repairs, pavement distresses, and using the CAMP-RS Software. The goal of the program is to reduce road repair costs for the municipalities over time by using the strategy, "Keep your good roads good." This strategy involves prioritizing surface treatments on roads that have started to show distresses, rather than targeting roads that have already fallen into serious disrepair. The logic behind this is that it is much cheaper to maintain a good road than to reconstruct a poor road. The dollar spent per year of lifespan extension ratio is more favorable when the road is still in fair condition. With this strategy, a 5 year plan is to be created to help the municipality appropriate its limited funds most efficiently.



First, a thorough survey of the road conditions in Farmington was conducted. This involved driving along all of Farmington's roads and inspecting for distresses. The distresses looked for are: drainage, roughness, longitudinal cracking, alligator cracking, edge cracking, potholes, rutting, and bleeding. (see **Sample Condition Survey** for full descriptions) The severity and extent of each were recorded and used to calculate the pavement condition index (PCI) of each road, which serves as a general indicator of how much repair the road needs. PCI ranges from 0 to 94, a road in perfect condition being a 94. Based on the severity, extent, and type of distresses a road has, a repair category for the road is selected. (see **Decision Trees** for more detail about how repair categories are picked) The repair categories are as listed in ascending order of expenses: Defer Maintenance, Crack Repairs, Patching, Surface Treatment, Overlay, Drainage Work, Rehab, and Reconstruction.

CAMP-RS Software

The CAMP-RS Software is a computer program that is to be used as a tool to help better address road repairs in a municipality. It was developed by the Cornell Local Roads Program for municipalities to integrate into their maintenance programs and was used to develop the 5 year budgeting plan found in this report.

After completing the road survey, the distress data was inputted into CAMP-RS and saved into its database. The software then calculates the PCI of each road which it will use later to determine each road's priority value.

The software abides by the stratagem of "keep your good roads good" and uses a formula to calculate a priority value for each road. This value is based on the volume of traffic, the suggested repair category, and PCI. Roads with drainage issues often will be prioritized first, as this often leads to a rapid deterioration of the road. Crack repairs are also highly prioritized because it is a very cheap repair that will extend the life of the road. Surface treatments and overlays have moderate priority so that several of them will be done a year. Rehabilitations and reconstructions have low priority because they are expensive and that money should be directed toward maintenance of good roads.

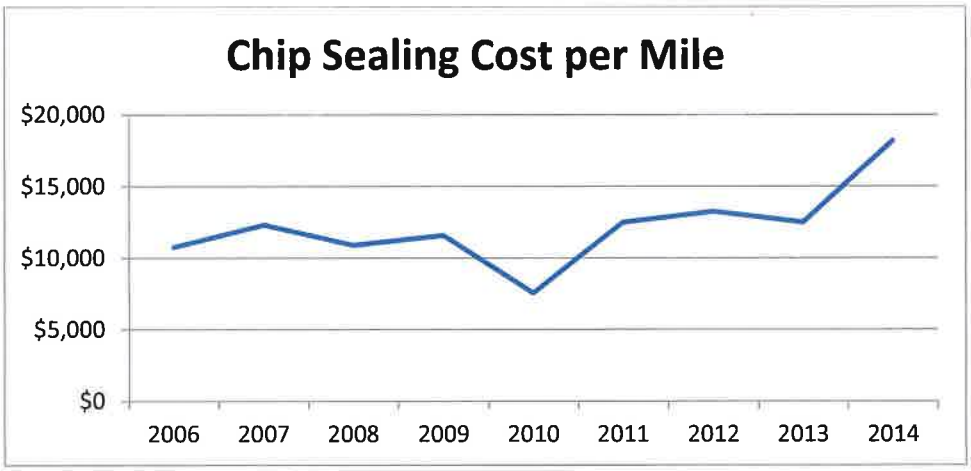
Next, the user must input values for the price per square foot of each repair. Since costs for labor and materials vary by municipality and by year, the price for each repair that Farmington uses needed to be calculated (for exact numbers for each repair see **Repair Alternatives)**. Farmington uses contractors for crack sealing, cape sealing, and central plant recycling. Estimated costs per square foot could be taken from past invoices for these repairs. Farmington does its own chip sealing, overlays, mill and fills, and edge repaving. In depth calculations had to be done to figure out cost per square footage for these (an example of this calculation is included in the **Appendix**).

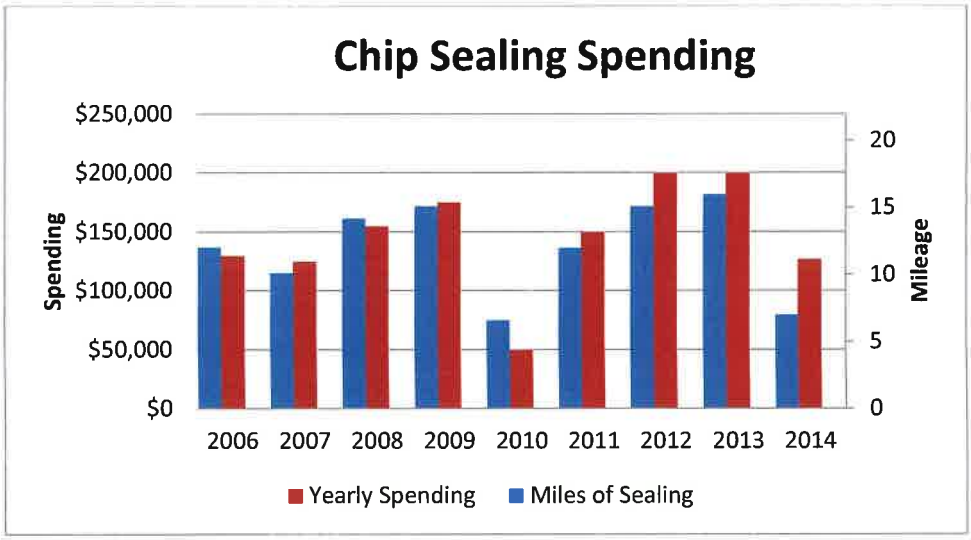
Given parameters for road width and length and cost per square footage of repair, the cost to repair each road section was calculated by CAMP-RS.

Overview of Repairs

Farmington uses a number of repairs for its roads. Two types of surface treatments are used primarily: chip seals for town roads and cape seals for subdivision roads, because it provides a smoother surface than a chip seal. For seriously damaged roads, 1.5" overlays, 2" overlays, and 2" mill and fills are used. For roads that have edges that are falling apart, an edge repaving is done, often followed by a surface treatment the next year. (see **Repair Alternatives** for detailed descriptions)

A certain amount of regular maintenance repairs, in the form of crack filling and surface treatments, must be done every year to keep roads from falling into disrepair. Using Section 284 documents from 2006-2014, the average yearly spending on crack filling and surface treatments is $200,000. However, this number has been increasing over time, and is estimated to be $326000 in 2014.





5 Year Budget

The CAMP-RS can create a rough draft budget when a yearly budget is inputted. $650,000 was inputted as the yearly budget. This number was based on the yearly spending on highway repairs from previous years. The software fit in as many high priority roads as the yearly budget will allow, creating the first draft of the budget.

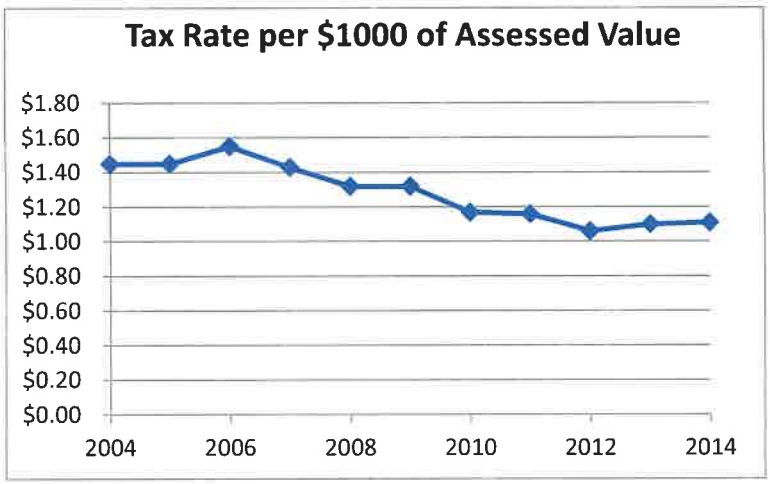
Highway Superintendent Ed McLaughlin was shown the draft, whereupon he made revisions. A significant amount of the 2014 repair budget was diverted toward the Mertensia Road Culvert Project which created setbacks for Superintendent McLaughlin's repair plan. Because of this, the yearly spending was reduced down to $450,000. This also provides ample leeway to account for a variety of factors: budget being reduced, losing VLT money, deterioration of roads that appear during the five year period, additional unexpected expenses. In order to meet this reduction in yearly spending, some planned overlays and mill and fills were substituted by less expensive repairs and maintenance was deferred for several expensive projects. The $650,000 figure was contingent upon the General Repair budget increasing from 2014 and onwards, and therefore, it would overestimate the amount of roads that could be repaired in a year if the budget does not increase.

Proposal

Ed McLaughlin worked with intern Joshua Ren to create a suggested plan for a rate of increase for the General Road Repair budget. The plan is to increase the General Road Repair budget by an amount equal to the maintenance bonds accrued that year. Maintenance bonds are a sum of money put aside by the contracting company that constructs a new road. The bond amount is equal to 10% of the cost to build. This bond is used to pay for the possible maintenance of the road if it shows distress and expires after two years. Since the responsibility of funding a newly built or rebuilt road shifts to the Highway Department after two years, the General Road repairs fund should be increased by the maintenance bond amount every year in preparation for when the bond expires.

On average over the past 12 years, $27,000 is accrued in maintenance bonds per year. From 2010 to 2014, the property tax levied through the Town of Farmington has increased by 4.3% per year, roughly equal to $24,000 per year. However, the tax rate per $1000 of assessed property value has gone down from $1.17 to $1.11 in the same time frame. This means that housing in Farmington has been being bought at a high enough rate to offset the decrease in taxation per capita.

In the long run, the roads are bound to suffer from an increase in traffic from the new housing if taxation rates continue at the current downwards rate.



The maximum allowable increase in property tax by the New York tax cap is 2% yearly, which roughly equates to a $12000 increase. Taking into account the rate of properties being sold, if the tax rate is increased by 2%, the maintenance bond amount can be matched every year, and there would be excess money to compensate for the rising cost of repairs.

Currently, the Highway Department spends about $600,000 yearly on road repairs and has $300,000 in General Road Repairs budget. This is made possible because the Highway Fund receives additional funds from VLT and CHIPS money.

If this plan is implemented and the General Roads Repair is increased by 36000 a year, in 10 years, the fund will increase to $660,000, enough to minimize the need for VLT and CHIPS money.

Conclusion

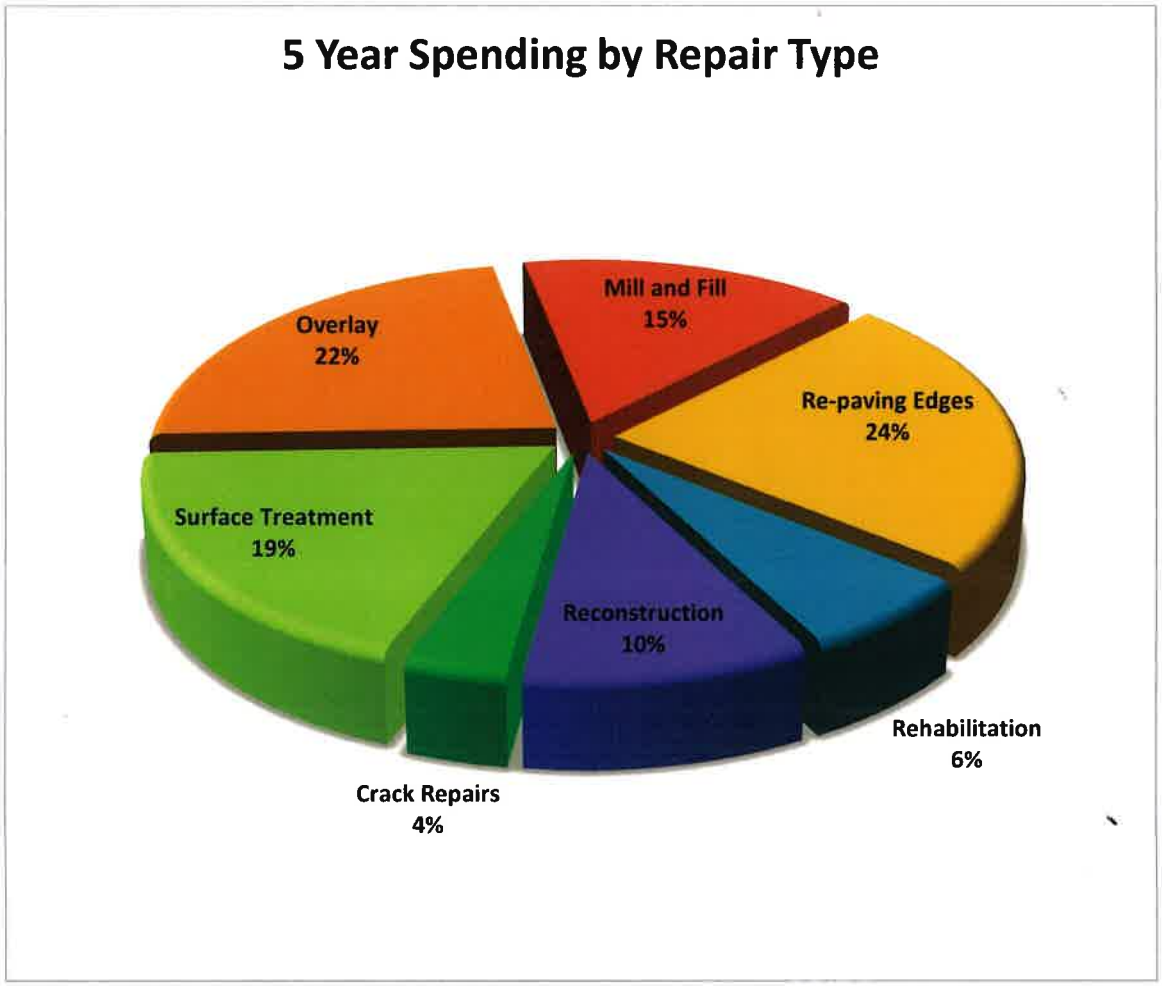
The summer of 2014 was the first time that the Highway Department took on an intern through the Cornell Local Road's Program. Superintendent Ed McLaughlin has considered the benefits of the CAMP-RS program and is willing to continue its usage in the future. A thorough survey of the road conditions has proven to be very useful in the development of an effective five year plan of road maintenance, and so it will likely continue to be done periodically. The five year plan will provide guidance on maintaining and preserving roads with a limited budget, but roads will not see significant overall improvement in quality unless funds are increased.

5 Year Capital Plan

Road Name	Repair Type		Year 1	Year 2	Year 3	Year 4	Year 5
15.3 Miles of Road	Crack Repairs		33600				
Green Rd	Crack fill and Chip Seal		25000				
Town Line Canadaigua - 4	2" Overlay		115000				
Martz Rd	2" Overlay		54000				
Collett Rd - 2	Chip Seal		27000				
Collett Rd West - 4	Chip Seal		17100				
Bittersweet Dr	Cape seal		17600				
Barkwood Ct	Cape Seal		5300				
Elder Dr	Cape Seal		16300				
Meadowbrook Lane - 2	Cape Seal		5700				
Meadowbrook Lane - 3	Cape Seal		9900				
Hathaway Drive	2" Mill and Fill		33700				
Coachlight Circle	2" Mill and Fill		31600				
Heritage Circle	2" Mill and Fill		23200				
13.7 Miles of Road	Crack Repairs			29200			
Corporate Drive	Chip Seal			6020			
Farmington Road	Chip Seal			4500			
State Street	Chip Seal			8200			
Bridal Path Lane	Cape Seal			3800			
Belmont Ln	Cape Seal			15300			
Commercial Dr North	Cape seal, fiber mat			11200			
Brownsville Rd	Re-pave Edges			36000			
Collett Rd West - 4	Re-pave Edges			46100			
Payne Rd - 1	Re-pave Edges			51300			
Shortsville Rd	Re-pave Edges			161000			
Amanda Pl	2" Mill and Reshape			6000			
Buckskin Dr	2" 50% Mill and Reshape			15000			
Red Fern Drive - 1	Cape Seal			8700			
1.2 Miles of Road	Crack Repair				2500		
Tomra Trail	Chip Seal				1800		
Yahn Road	Chip seal				13000		
Alfalfa Crescent	Cape Seal				1600		
Cornfield Circle	Cape Seal				8900		
Fairdale Glen	Cape Seal				13600		
Flaxen Drive	Cape Seal				14600		
Gannett Road	Cape Seal				28000		
Wheatstone Drive	Cape Seal				8900		
Willis Rd	Cape Seal				7800		
Mt. Payne Rd	Central Plant Recycle				56000		
Weigert Road - 2	1.5" Overlay				52900		
Weigert Road - 1	1.5" Overlay				56100		

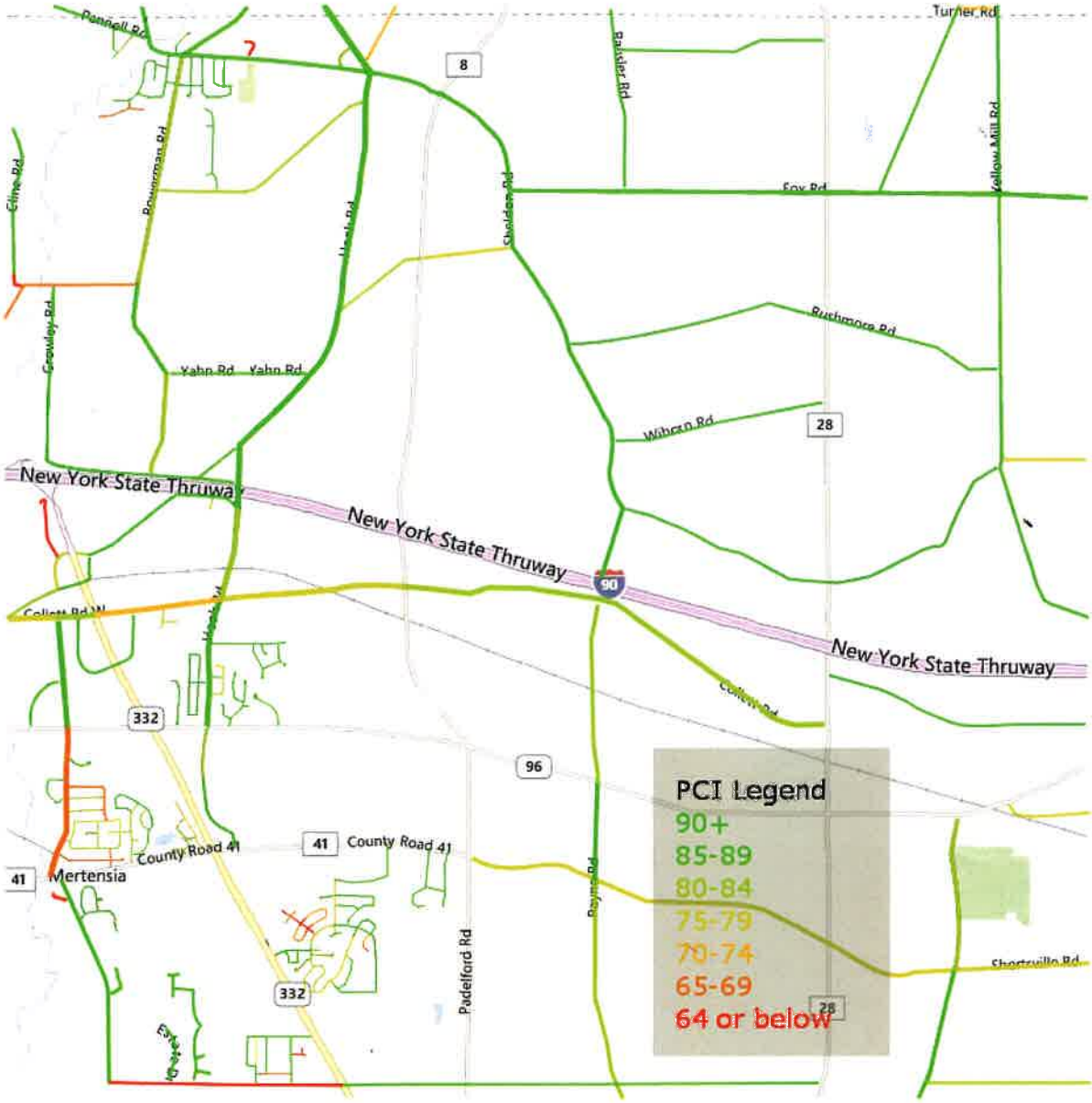
Road Name	Repair Type		Year 1	Year 2	Year 3	Year 4	Year 5
Weigert Road - 1	1.5" Overlay				56100		
Creek Pointe	Patch and Mill & Fill				23100		
Collett Road - 1	Re-pave Edges				63200		
Collett Road West - 2	Re-pave Edges				8800		
Estimated Crack repair and Surface treatments						150000	
Payne Road - 3	Chip Seal					16300	
Collett Road West - 2	Chip Seal					5900	
Farmington Road	Chip Seal					4500	
Doe Haven Drive	Cape Seal					20500	
Cline Road - 1	Reconstruct					47600	
Fallow Lane	Reconstruct					57000	
Walnut Drive - 1	Reconstruct					70000	
Walnut Drive - 2	2" Mill and Fill					5000	
Windingo Lane South	2" Mill and Fill					7000	
Windingo Lane North	2" Mill and Fill					8100	
Fawn Meadow	30% 2" Mill and Fill					25000	
Estimated Crack repair and Surface treatments							150000
Birchwood Drive	2" Mill and Fill						32500
Olde Park Square	2" Mill and Fill						18800
Collett Road West - 3	Re-pave Edges						46000
Sunset Drive	Central Plant Recycle						56000
Brownsville Rd	1.5" Overlay						60000
Marcus Way	2" Mill and Fill						39000
Total			**415000**	**402320**	**416900**	**416900**	**402300**

Deferred Roads							
Clover Meadow Lane	3/8 " Micro pave		32700				
Latting Road	Patch and Mill & Fill		56000				
Loomis Road - 2	1.5" Overlay		6500				
Sycamore Circle	All New Asphalt		37000				
Turner Road	1.5" Overlay		12800				
Beaver Creek Rd - 2	2" Mill and Fill		50600				
Church Ave	2" Overlay		16500				
Collett Road West - 1							
Cranberry Dr	Reconstruct		216000				
Curran Rd	1.5" Overlay		25000				
Holtz Rd	2" Overlay		61200				
Hook Rd - 2	2" Overlay		86600				
Hunts Park							
Marion way							
Mertensia Rd - 1							
Mulberry Dr							
Nettlecreek Lane							
Town Line Rd Canadaigua - 1	Rehab		755000				



Repair Type	Predicted Spending over 5 Years
Crack Repairs	$63,050
Surface Treatment	$327,020
Overlay	$394,100
Mill and Fill	$268,000
Re-paving Edges	$412,400
Rehabilitation	$112,000
Reconstruction	$174,600

Distress Map



CAMP-RS Asphalt Pavement Condition Survey

Street: _____	Distance: _____	Name: _____
Section #: _____	Start : _____	Date: _____
Start: _____	End : _____	Weather: _____
End: _____	Length: _____	Temp (F°/C°): _____

LONGITUDINAL/ TRANSVERSE CRACKING

SEVERITY	NO Defects	EXTENT Low	EXTENT Med	EXTENT High
Low		1	2	3
Med		4	5	6
High		7	8	9

ALLIGATOR CRACKING

SEVERITY	NO Defects	EXTENT Low	EXTENT Med	EXTENT High
Low		1	2	3
Med		4	5	6
High		7	8	9

EDGE CRACKING

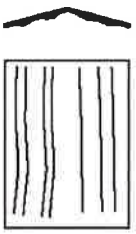
SEVERITY	NO Defects	EXTENT Low	EXTENT Med	EXTENT High
Low		1	2	3
Med		4	5	6
High		7	8	9

PATCHING / POTHOLES

NO Defects	EXTENT
	1 Low
	2 Medium
	3 High

Do not include good patches

RUTTING

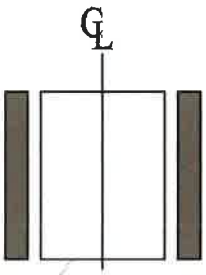


SEVERITY	NO Defects	EXTENT Low	EXTENT Med	EXTENT High
Low		1	2	3
Med		4	5	6
High		7	8	9

BLEEDING

SEVERITY	CONDITION
1	Good
4	Fair
7	Poor

DRAINAGE



SEVERITY	CONDITION
1	Good
4	Fair
7	Poor

ROUGHNESS

Check road for presence of the following:

- uneven surface
- sags
- humps
- frost heaves

SEVERITY	CONDITION
1	Good
4	Fair
7	Poor

Description of Distresses

Longitudinal/Transverse Cracking

Severity:

Low- Cracks are very thin, or they have been crack sealed already but starting to reform.
Medium- Cracks are 15 ft or longer and smaller cracks are forming off of main branches.
High- Cracks are wider than 1 cm and stretch across width of road or many cracks have formed off of a main crack, appearing almost like alligator cracking.

Extent:

Low- Cracks exist on less than 10% of road.
Medium- Cracks exist on roughly 10% to 40% of the road.
High- Cracks exist on more than 40% of the road.

Alligator Cracking

Severity:

Low- Cracks are thin; area of cracking is level with road.

Medium- Well defined cracking, with up to ⅛" in width. Pieces of pavement may be loose but have not broken away. Area of cracking may be depressed.

High- Cracks are wider than ⅛" and pieces have been broken away. Area of cracking is considerably warped and depressed.

Extent:

Low- One small patch every quarter mile.

Medium- A patches spanning a meter or more in diameter and take up 10% to 30% of road.

High- Cracks span more than 30% of the road.

Potholes/Patching

Extent:

Low- Fewer than or approximately equal to one pothole or patch per half mile.

Medium- Two to three potholes and patches per half mile.

High- Three or more potholes and patches per half mile.

Edge Cracking

Severity:

Low- Cracks are very thin, or they have been crack sealed already but starting to reform.

Medium- Well defined cracking, with up to ⅛" in width. Pieces of pavement may be loose but have not broken away.

High- Cracks are wider than ⅛" and pieces have been broken away.

Extent:

Low- Cracks exist on less than 10% of the section length.

Medium- Cracks exist on roughly 10% to 40% of the section length.

High- Cracks exist on more than 40% of the section length.

Drainage

Condition:

Good- No water accumulation on surface, road has good crown.

Fair- Road crown is in good condition, but pools of water form either in the shoulder or the road. There might be collected sediment on the road, evidence of suboptimal drainage.

Poor- There are large standing pools of water on pavement surface.

Roughness

Condition:

Good- Road surface is even and smooth.

Fair- Road has noticeable unevenness.

Poor- Road is bumpy to the point of being unsafe at the posted speed limit.

Rutting

Severity:

Low- Depth of rut is less than ½"

Medium- Depth of rut is between ½" and 1" deep

High- Ruts are greater than 1" deep and are holding water

Extent:

Low- Less than 10% of the road is covered by rutting.

Medium- Between 10% and 30% of the road is covered by rutting.

High- More than 30% of the road is covered by rutting.

Bleeding

Condition:

Good- No bleeding or only very isolated spots of bleeding are seen.

Fair- Bleeding covers 5% to 30% of road surface.

Poor- Bleeding covers more than 30% of road surface.

Overview of Repairs

Farmington's roads generally have been built on good foundations so distresses stemming from a poor base are uncommon. Crack filling, surface treatments, and overlays are used to treat the vast majority of the roads.

Crack filling is the cheapest repair available. It involves injecting sealant into the cracks in the road to prevent water from seeping through and weakening the foundation. Ideally, this would be used for newer or recently surface treated roads to keep it in good shape. However, it has also been used on roads that have fallen into more disrepair. This is done because there is not enough money in the budget for an overlay or mill and fill, and crack filling will keep the road watertight and buy some time.
Road Lifespan Extension: 2-3 years
Cost per Square foot: $.0176

Chip sealing is the cheapest surface treatment available. It is done by spraying a layer of tack coat on the road to seal all of the cracks. Then, a thin layer of gravel is spread on the tack coat to form the new road surface. Due to its affordability, it is the first choice for surface treatments on large town roads. The main disadvantage is that it creates a surface that is significantly rougher than asphalt. This makes it a less than ideal repair to use for subdivision roads.
Road Lifespan Extension: 3-4 years
Cost per Square foot: $.125

Cape Sealing is the second type of surface treatment used in Farmington. Cape sealing involves putting a chip seal on a road first. Then, a slurry seal is applied on top of the chip seal. The advantage of this method is that the road ends up with a smooth-textured and resilient surface, making it the preferable surface treatment to use on subdivision roads.
Road Lifespan Extension: 3-4 years
Cost per Square foot: $.41

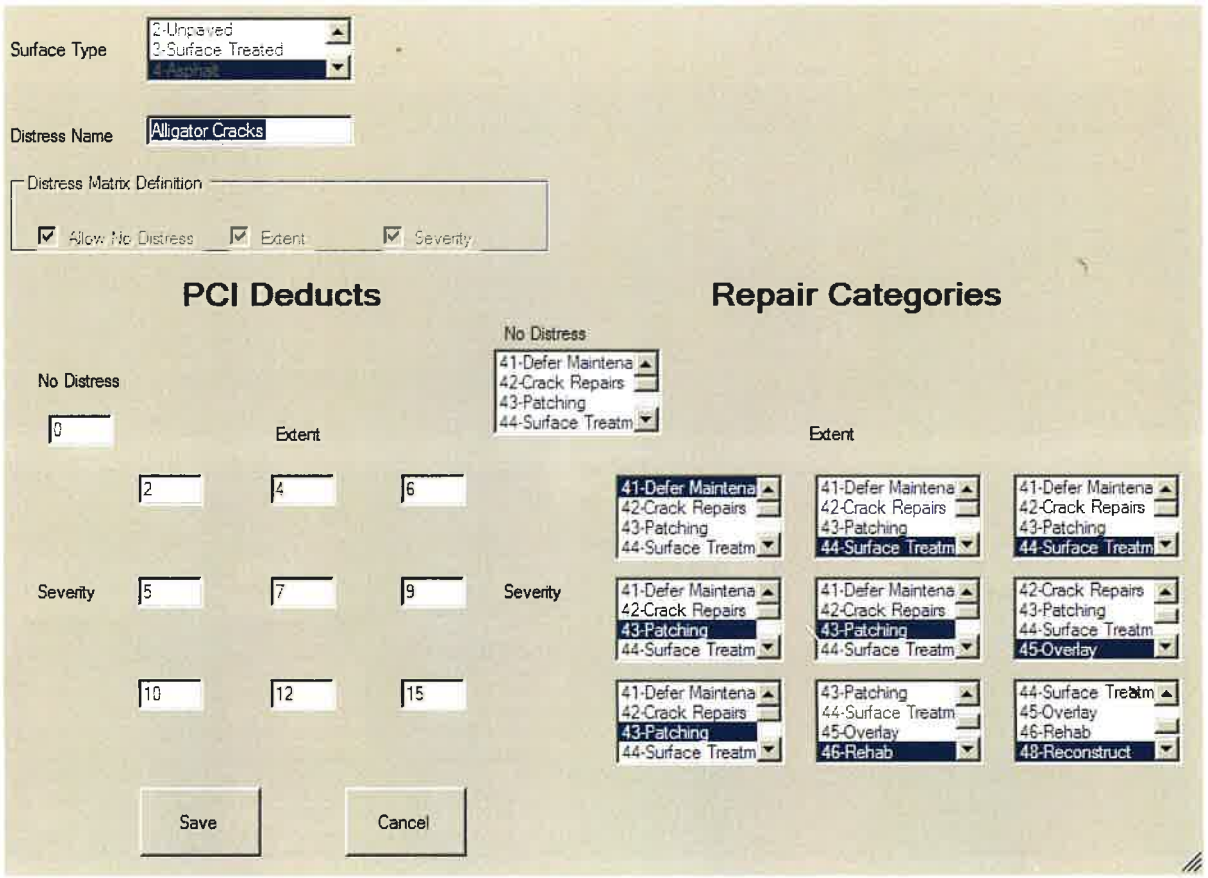
Overlays are an expensive repair used to treat serious distresses in roads. Low to medium severity cracking can usually be fixed with crack filling or a surface treatment. However, if a road's cracking is severe and extensive an overlay might be required. Also, if a road develops, roughness, potholes, or rutting, a thick 2" overlay will be required to fill in the depressions in the road and re-level it, since a surface treatment will not be enough to fix those distresses. A thinner 1.5" overlay would be used on a road with extensive cracking, but a relatively even surface.
Road Lifespan Extension: 6-7 years
1.5" Cost per Square foot: $.61
2" Cost per Square foot: $.81

Mill and Fills are used to treat serious distresses in roads. 2 inches of the top surface is milled out and replaced with new asphalt. Although this is an expensive repair and overlays are a cheaper alternative, it is necessary to use on roads with gutters. Whereas an overlay will increase the height of the road, mill and fills will keep the road at level with the gutter.
Road Lifespan Extension: 6-7 years
Cost per Square foot: $.95

Central Plant Recycling/Cold-in-Place Recycling is a rehabilitation treatment used for roads that have fallen into disrepair. First, inches of the road is first milled out. Central plant recycling involves transporting the resulting aggregate to a central plant. There, oil emulsion is added to create asphalt concrete. This mixture is sent back to the road where it is placed down as a new road surface. For cold-in-place recycling, the aggregate is mixed with the oil emulsion at location instead of being brought to a plant. Otherwise, he process is the same. Both types of recycling will require a surface treatment or overlay done on the road soon after to protect and strengthen the road.
Road Lifespan Extension: 7-8 years
Cost per Square foot: $.70

Reconstruction is the most expensive repair possible and involves digging up the road and its base entirely and rebuilding it with all new stone. It is done infrequently and used as a last resort for roads that have fallen into severe disrepair and compromised the integrity of the base. Reconstruction projects will vary in price due to a variety of factors and will require engineers to properly assess and plan out.
Road Lifespan Extension: ~10 years
Cost per Square foot: ~$6.00

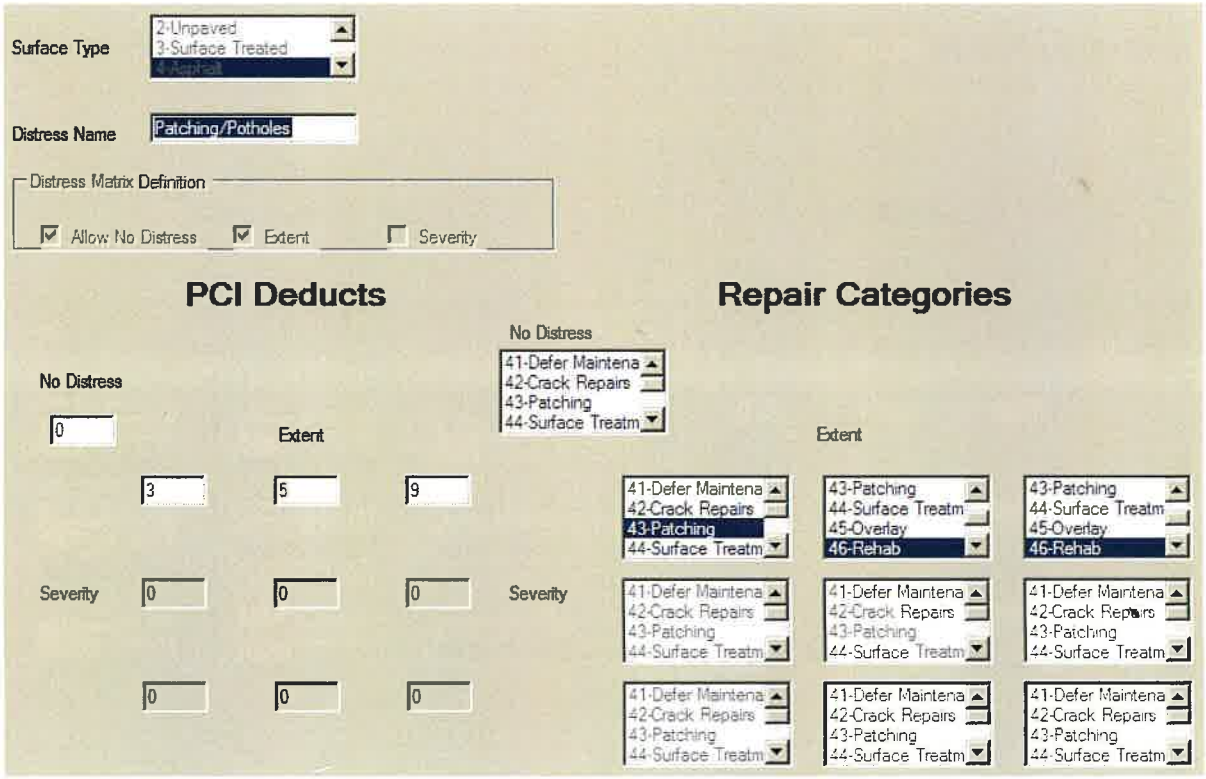
Decision Trees Explained



The CAMP-RS Software uses a decision tree to decide the recommended repair category and PCI deduction for each possible distress. On the 3 x 3 matrices, extent is on the horizontal axis and severity on the vertical. A low extent, low severity distress corresponds to the top left entry, a high extent, high severity distress corresponds to the bottom right entry and so on. The PCI deductions are commutative among all of the distresses observed for a road. The road is assigned the repair category with the highest repair category index number, listed next to the name of the repair category.

Example: A road has moderate severity, high extent alligator cracking and low extent, low severity longitudinal cracking. The alligator cracking results in a PCI deduction of 9 and the longitudinal cracking results in 2. This gives a total PCI of 94-2-9 = 83. For repair categories, the longitudinal cracking will select 42-Crack Repairs and the alligator cracking will select 45-Overlay. Since Overlay has the higher index, it will be recommended for the road.

The Decision Tree shown on the previous page is for Alligator cracking. Each distress does not necessarily have the same Decision tree. The tree for Patching/Potholes shown below has a 1x3 matrix and only takes extent into account. It is difficult to judge the severity of certain distresses, so they are judged only on extent.



References

Wright, William C., P.E., and John E. Berry, P.E. Ontario County Material Bids 2004-2014. Ontario County Public Works, Canandaigua, NY.

"U.S. Energy Information Administration." *Gasoline and Diesel Fuel Update*. Web. 20 July 2014.

New York State DOT Local Roads Listing. 10 Sept. 2013. Farmington, NY.

McLaughlin, Ed. Agreement for the Expenditure of Highway Monies Section 284 of the Highway Law. 2006-2014. Farmington, NY

Cornell Asset Management Program – Roads & Streets (CAMP-RS). Ithaca, NY: New York LTAP Center, 2014. Print.

Galehouse, Larry, James S. Moulthrop, and R. Gary Hicks. "Principles of Pavement Preservation." *Principles of Pavement Preservation - Pavement Preservation Compendium II*. Federal Highway Administration. Web. 22 July 2014.

Road Inventory

Name	From	To	Length	Width	PCI	Priority
Hook Road - 1	State Route 96	Collett Road West	0.76	22	87	114
Hook Road - 3	Curran Road	Allen-Padgham Road	2.43	22	92	114
Mertensia Road - 2	State Route 96	Elizabeth Way	0.266	24	88	114
Mertensia Road - 3	Elizabeth Way	Collette Road	0.372	24	92	114
Beaver Creek Road - 1	County Road 41	Race Track Enterance	0.5	22	88	102
Cline Road - 2	Gillis Rd	Victor Town Line	0.95	22	90	102
Herendeen Road - 1	County Road 28	Yellow Mills Rd	1.298	28	88	102
Herendeen Road - 2	Sheldon Road	County Road 28	1.342	28	92	102
Loomis Road - 1	Hook Road	Plastermill Road	1.012	22	90	102
Meadowbrook Lane - 1	Bonnie Brae Cr	Clovermeadow La	0.51	24	92	102
Payne Road - 2	Shortsville Rd	State Route 96	0.56	22	92	102
Running Brook Rd	Red Fern Drive	Wood Drive	0.32	24	92	102
Sheldon Road - 1	County Road 8	Fox Road	0.752	28	92	102
Sheldon Road - 2	Fox Road	Holtz Road	0.338	28	92	102
Sheldon Road - 3	Holtz Road	Rushmore Road	0.659	28	92	102
Sheldon Road - 4	Rushmore Road	Wisborn Road	0.624	28	92	102
Sheldon Road - 5	Wisborn Road	Herendeen Road	0.297	28	92	102
Wood Drive	Running Brook Rd	County Road 41	0.22	24	92	102
Yellow Mill Road - 1	Stafford Road	Herendeen Road	1.12	25	90	102
Yellow Mill Road - 2	Herendeen Road	Rushmore Road	0.6	25	90	102
Yellow Mill Road - 3	Rushmore Road	Fox Road	1.05	25	88	102
Yellow Mill Road - 4	Fox Road	Turner Road	1.1	25	92	102
Allen-Padgham Road - 2	Bowerman Road	Hook Road	1.106	30	92	96
Allen-Padgham Road - 3	Hook Road	County Road 8	0.435	30	92	96
T/L Road Canadaigua - 2	State Route 332	County Road 8	0.7	22	92	96
Collett Road - 2	Payne Road	County Road 28	1.57	26	82	95
Green Road	Bowerman Road	Hook Road	1.43	22	83	95
Martz Road	Hook Rd	County Rd 8	0.571	22	81	95
T/L Road Canadaigua - 4	Payne Road	County Road 28	1.22	22	87	95
Commercial Drive North	Dead End	Collett Road	0.13	24	78	92
Belmont Lane	Hook Road	Cul de Sac	0.32	22	77	90
Bowerman Road - 2	Allen Padgham Rd	Wayne County Line	0.41	28	88	90
Commercial Drive South	State Route 96	Hammerhead	0.3	22	88	90
Creekside Drive	Cul de Sac	Pannell Rd	0.21	20	83	90
Crowley Road	Hook Rd	Brownsville Rd	2.18	22	92	90
Elizabeth Way	State Route 96	Mertensia Road	0.39	22	90	90
Estate Drive	Canandaigua T/L	Clovertrail Drive	0.37	22	92	90
Farmbrook Drive - 1	State Route 332	Carridge Court	0.08	40	92	90
Farmbrook Drive - 2	Carridge Court	Meadowbrook Lane	0.18	24	92	90
Fox Road - 1	Sheldon Road	Rausler Road	0.6	22	86	90
Fox Road - 2	Rausler Road	County Road 28	1.185	22	92	90
Fox Road - 3	County Road 28	Ellsworth Road	0.312	22	92	90

Name	From	To	Length	Width	PCI	Priority
Fox Road - 4	Ellsworth Road	Yellow Mills Road	0.701	22	92	90
Fox Road - 5	Yellow Mills Road	Manchester T/L	0.525	22	92	90
Glen Carlyn Drive	State Road 96	Cul de Sac	0.28	24	90	90
Heather Lane	Bittersweet Drive	Allen Padgham Road	0.29	26	92	90
King Hill Drive	Hook Road	Cul de Sac	0.5	24	92	90
Kyte Road	County Road 28	Manchester T/L	1.62	30	86	90
Rausler Road	Fox Road	Macedon Town Line	1.09	20	92	90
Rushmore Road - 1	Sheldon Rd	County Road 28	1.54	22	88	90
Rushmore Road - 2	County Road 28	Yellow Mills Road	1.11	22	92	90
Sand Hill Road - 1	Latting Road	Shortsville Road	0.68	22	88	90
Tudor Way	County Road 41	Hanover Road	0.37	22	90	90
West Corporate Drive	State Route 332	Collett Road West	0.47	24	86	90
Wiborn Road	Sheldon Road	County Road 28	1.29	24	92	90
Spartan Drive	Canadaigua T/L	Opal Dr	0.36	22	90	90
Meadowbrook Lane - 2	Clovermeadow La	Bean Pole Cr	0.11	24	86	85
Meadowbrook Lane - 3	Bean Pole Cr	Hammerhead	0.19	24	88	85
Payne Road - 1	Canandaigua T/L	Shortsville Rd	1.2	22	86	85
Bowerman Road - 1	Brownsville Rd	Allen Padgham Rd	1.37	32	83	84
Sand Hill Road - 2	Shortsville Road	State Route 96	0.92	22	84	84
Plaster Mill Road - 2	Gateway Drive	Victor Town Line	0.29	22	83	84
Chipmunk Circle	Stonefield lane	Cul de Sac	0.05	22	89	80
Church Ave	Aleen Padgham Road	Hook Road	0.19	20	81	80
Elder Drive	Holly Lane	Allen-Padgham Road	0.25	30	89	80
Hawthorne Circle	Cul de Sac	Mulberry Drive	0.17	30	89	80
Huckleberry Road	Cul de Sac	Allen Padgham Rd	0.31	20	89	80
Stuart Circle	Tudor Way	Cul de Sac	0.09	20	89	80
Suede Circle	Cul de Sac	Whitetail La	0.12	24	87	80
Antlers Drive - 2	Doe Haven Dr	Doe Haven Dr	0.05	20	90	78
Barberry Lane	Elder Dr	Heather Lane	0.21	30	92	78
Bean Pole Circle	Meadowbrook Lane	Meadowbrook Lane	0.31	24	90	78
Beechwood Drive	Mt Ash Drive	Walnut Drive	0.2	21	92	78
Bridal Path Lane	Hook Road	Belmont Lane	0.08	22	92	78
Calm Lake Drive	County Road 41	Calm Lake Drive	0.42	24	92	78
Carriage Court	Farmbrook Drive	Farmbrook Drive	0.2	21	92	78
Colonie Drive	King Hill Drive	Dead End	0.25	24	90	78
Coral Drive	Amber Drive	Amber Drive	0.37	22	92	78
Creek View Trail	Mertensia Rd	Cul de Sac	0.19	24	92	78
Dalton Drive	Cul de Sac	Meadowbrook La	0.63	20	90	78
Deerfield Drive	Mertensia Rd	Doe Haven Dr	0.23	22	90	78
Elmwood Circle	Birchwood Drive	Mt Ash Dr	0.14	20	92	78
Emma Lane - 1	County Road 41	Kris Crossing	0.26	22	90	78
Emma Lane - 2	Kris Crossing	Cul de Sac	0.09	22	92	78
Fraser Way - 1	County Road 41	Hammerhead	0.32	22	92	78
Fraser Way - 2	Hammerhead	Cul de Sac	0.13	22	90	78
Galvin Court	Allen-Padgham Rd	Cul de Sac	0.16	24	90	78
Hanover Road	Creek Point	Tudor Way	0.33	20	92	78

Name	From	To	Length	Width	PCI	Priority
Hayride Drive	Oatfield Drive	Clover Meadow Lane	0.24	24	92	78
Holland Drive	Glen Carlyn Dr	Cul de Sac	0.21	22	88	78
Holly Lane	Mulberry Dr	Barberry La	0.16	20	92	78
Honeysuckle Lane	Heather Lane	Allen-Padgham Road	0.16	20	92	78
Jensbrook Court	Spartan Drive	Cul de Sac	0.06	22	90	78
Jensen Court	King Hill Dr	Cul de Sac	0.2	22	88	78
Kris Crossing	Emma Lane	Fraser Way	0.12	22	90	78
Lake Run	Calm Lake Dr	Hathaway Dr	0.06	24	92	78
Lilly Brook Court	New Michigan Rd	Cul de Sac	0.21	22	88	78
Limestone Lane	Cul de Sac	Cul de Sac	0.19	24	88	78
Maplewood Drive	Canandaigua T/L	Mt Ash Dr	0.27	24	92	78
Mecier Boulevard	State Route 332	Cul de Sac	0.23	22	90	78
Mt Ash Drive	Elmwood Dr	State Route 332	0.43	20	90	78
Oatfield Drive	Meadowbrook La	Clovermeadow La	0.3	24	92	78
Old Mill Road	Pannell Rd	Creekside Dr	0.15	20	92	78
Opal Drive	Spartan Dr	End	0.35	22	92	78
Pine Hill Lane	Glen Carlyn Dr	Cul de Sac	0.15	18	90	78
Raymond Avenue	Jensen Ct	Colonie Dr	0.11	22	88	78
Scottsdale Drive	Glen Carlyn Dr	Hammerhead	0.04	22	92	78
Squire Drive	King Hill Dr	Cul de Sac	0.09	22	92	78
Stonefield Lane	Green Rd	Cul de Sac	0.55	22	92	78
White Tail Lane	Hunters Drive	Buckskin Drive	0.16	24	90	78
Windsor Circle	Hanover Road	Cul de Sac	0.09	20	88	78
Wishing Well Lane	Red Fern Drive	Dalton Drive	0.14	20	90	78
Woodside Circle	Stonefield Lane	Cul de Sac	0.02	22	90	78
Red Fern Drive - 2	Meadowbrook Ln	Limestone Ln	0.05	20	90	78
Beaver Creek Road - 2	Race Track Enterance	State Road 96	0.28	36	80	76
Collett Road West - 4	Hook Road	County Road 8	1.079	24	81	76
Town Line Road Canadaigua	County Road 8	Payne Road	0.88	22	87	76
Shortsville Road - 1	County Rd 8	Payne Rd	0.775	25	79	76
Shortsville Road - 2	Payne Rd	County Rd 28	1.425	25	78	76
Shortsville Road - 3	County Rd 28	Shortsville V/L	1.55	25	80	76
Amanda Place	Mulberry Drive	Marcus Way	0.05	22	81	75
Bonnie Brae Circle	Meadowbrook Lane	Cul de Sac	0.17	24	80	75
Buckskin Drive - 1	Deer Run	Barkwood Ct	0.31	20	76	75
Corporate Drive	State Route 332	Collett Road	0.38	24	88	75
New Michigan Road	Canandaigua T/L	County Road 41	1.27	30	86	75
Plaster Mill Road - 1	Loomis Road	Gateway Drive	0.328	22	86	75
Curran Road	Crowley Rd	Hook Rd	0.35	22	87	72
Ellsworth Road	Fox Rd	Turner Rd	1.14	22	89	72
Hook Road - 2	Collett Road West	Curran Road	0.92	22	81	72
Mt Payne Road	Yellow Mills Rd	Stafford Rd	0.45	25	78	72
Yahn Road	Weigert Road	Hook Road	0.89	22	86	72
Amber Drive	New Michigan Rd	Clovertrail Dr	0.82	22	84	70
Clover Meadow Lane	State Route 332	Meadowbrook La	0.63	24	77	70
Latting Road	Sand Hill Rd	Manchester T/L	1	22	84	70

Name	From	To	Length	Width	PCI	Priority
State Street	State Route 96	Manchester T/L	0.56	22	79	70
Willis Road	Gannett Road	Hook Road	0.09	40	84	70
Gateway Drive	Plastermill Rd	State Road 332	0.27	22	79	68
Holtz Road	County Road 8	Sheldon Road	0.55	26	78	68
Weigert Road - 2	Yahn Road	Brownsville Road	0.586	28	87	68
Bittersweet Drive	Allen Padgham Rd	Barberry La	0.29	28	89	65
Cornfield Circle	Flaxen Drive	Cul de Sac	0.17	24	86	65
Creek Pointe	Tudor Way	Hanover Rd	0.38	24	84	65
Deer Run	Mertensia Rd	Hunters Dr	0.04	20	88	65
Ebony Court	Coral Drive	Cul de Sac	0.05	22	86	65
Fairdale Glen	State Route 96	Cul de Sac	0.27	22	88	65
Gannett Road	Willis Rd	Willis Rd	0.65	20	88	65
Hunters Drive	Deer Run	Barkwood Court	0.23	24	88	65
Pheasant Crossing	Mertensia Rd	Mertensia Rd	0.31	22	88	65
Red Fern Drive - 1	Meadowbrook La	Running Brook Rd	0.2	20	72	65
Tomra Trail	Dead End	Loomis Road	0.12	22	84	65
Wheatstone Drive	Clover Meadow Lane	Flaxen Drive	0.17	24	86	65
Collett Road - 1	County Road 8	Payne Road	1.48	26	82	64
Collett Road West - 2	Mertensia Road	State Route 332	0.206	43	81	64
Doe Haven Drive	Mertensia Road	Buckskin Drive	0.43	22	66	64
Loomis Road - 2	Plastermill Road	State Route 332	0.092	22	84	64
Nettle Creek Lane	New Michigan Rd	End	0.09	21	62	64
Payne Road - 3	State Route 96	Collett Road	1.12	22	83	64
Weigert Road - 1	Crowley Road	Yahn Road	0.622	28	84	64
Marion Way	Onyx Dr	Spartan Dr	1	22	89	64
Alfalfa Crescent	Meadowbrook Lane	Meadowbrook Lane	0.03	24	77	60
Flaxen Drive	Clover Meadow Lane	Bonnie Brae Circle	0.28	24	83	60
Perez Drive	Hathaway Dr	State Route 332	0.06	24	84	60
Walnut Drive - 2	Beechwood Dr	Birchwood Dr	0.05	20	81	60
Sheldon Road - 6	Herendeen Rd	Dead End	0.05	26	76	60
Hook Road - 4	Allen-Padgham Road	Macedon Town Line	0.4	22	94	57
Birchwood Drive	Mt Ash Drive	Canandaigua T/L	0.27	24	73	56
Fawn Meadow	Mertensia Rd	Cul de Sac	0.5	24	67	56
Stafford Road	Yellow Mills Road	Manchester T/L	0.3	20	79	56
Windingo Lane North	Cranberry Drive	Cul de Sac	0.08	20	68	56
Windingo Lane South	Cranberry Drive	Cul de Sac	0.07	20	68	56
Mulberry Drive	Cul de Sac	Elder Dr	0.5	28	86	52
Turner Road	Macedon Town Line	Yellow Mills Road	0.18	22	74	52
Allen-Padgham Road - 1	Wayne County Line	Bowerman Road	0.393	30	94	48
Collett Road West - 1	Victor Town Line	Mertensia Road	0.24	24	76	48
Clovertrail Drive	Prop Tanner Trail	Amber Drive	0.14	24	94	45
Maxwell Road	Rausler Road	County Road 28	1.26	22	94	45
Pannell Road	Wayne County Line	Allen Padgham Road	0.42	20	94	45
Hathaway Drive	County Road 41	Cul de Sac	0.28	24	72	44
Heritage Circle	Cranberry Drive	Cranberry Drive	0.22	21	74	44
Mertensia Road - 1	County Road 41	State Route 96	0.9	24	69	40

Name	From	To	Length	Width	PCI	Priority
Chelsea Place	Estate Dr	Cul de Sac	0.07	22	94	39
Omega Drive	Spartan Dr	Hammerhead	0.04	24	94	39
Onyx Drive	Opal Dr	Clovertrail Dr	0.13	24	94	39
Hunts Park Road	Gateway Drive	Cul de Sac	0.43	20	47	36
Cline Road - 1	Brownsville Road	Gillis Road	0.09	20	60	34
Fallow Lane	County Road 41	Hunters Drive	0.09	24	66	34
Farmington Road	Hook Road	Wayne County Line	0.27	22	72	32
Collett Road West - 3	State Route 332	Hook Road	0.738	24	74	30
Town Line Road Canadaigua	New Michigan Road	State Route 332	1.3	22	53	30
Marcus Way	Cul de Sac	Cul de Sac	0.35	22	66	28
Brownsville Road	Vctor Town Line	Weigert Road	0.84	22	68	26
Sunset Drive	Allen-Padgham Rd	Cul de Sac	0.19	22	61	26
Sycamore Circle	Maplewood Drive	East to Stoneway	0.07	20	62	26
Walnut Drive - 1	Beechwood Drive	Maplewood Drive	0.16	28	62	26
Barkwood Court	Tudor Way	Cul de Sac	0.11	22	76	24
Olde Park Square	Creek Pointe	Hanover Rd	0.17	22	76	24
Coachlight Circle	Cranberry Drive	Cranberry Drive	0.3	21	74	22
Cranberry Drive	Cul de Sac	Meadowbrook Lane	0.37	21	63	16

Municipality: Farmington
Project Name: Chip Seal Calculation

Date: June 18, 2014
By: Joshua Ren

Production

(•) per Day ( ) per Hour
Day length: 10.0 hours

( ) Area (•) Linear ( ) Each

		Units
length	32,600	feet
	26.0	feet
	32,600	feet
Percentage covered (%)	100%	

PRODUCTION	COSTS	%
Materials	$ 100,000	94%
Invoices	$ -	0%
Labor	$ 4,050	4%
Equipment	$ 2,000	2%
TOTAL	$ 106,050	

Project Scope

Contingency (%)			
length		feet	
		feet	
	-	feet	
Percentage covered (%)	100%		
Actual area to be worked on during project	-	feet	

PROJECT	COSTS	%
Materials	$ -	
Invoices	$ -	
Labor	$ -	
Equipment	$ -	
TOTAL	$ -	

Unit cost calculation	Percentage covered (%)	100%	$ 3.253	/feet

Abbreviations & Conversions

Length

		Conversion factors	
in	inch	63360	12
ft	foot	5280	1
yd	yard	1760	0.33
mi	mile	1	0.000189

Weight

lbs	pound	2000	1
ton	ton	1	0.00050

Area

		Conversion factors	
sf	square foot	9	1
sy	square yard	1	0.11

Volume

cf	cubic feet	27	1.000
cy	cubic yard	1	0.037
gal	gallons	202	7.48

Power

hp	horsepower

Town Name: Farmington
Project Name: Chip Seal Calculation
Date: June 18, 2014
By: Joshua Ren

Production: Linear per Day
Day length: 10.0

length	32,600	feet
	26	feet
	32,600	feet

www.nysdot.gov/divisions/operating/oom/ transportation-maintenance/repository/ EqRates2009.pdf

LABOR				Labor Cost	EQUIPMENT				Equipment Cost
Benefit rate (%)	50%			$ 4,050.00	Overhead (%)	0%			$ 2,000.00
Position	Wages $/hour	Total $/hour	Quantity	per Day	Type	Rate $/hour	Total $/hour	Quantity	per Day
Truck Drivers	$ 15.00	$ 22.50	13	$ 2,925.00	Self Propelled Aggrega	$ 200.00	$ 200.00	1	$ 2,000.00
Flaggers	$10	$ 15.00	3	$ 450.00	Roller	$ -	$ -	1	$ -
Loader Operator	$ 20.00	$ 30.00	1	$ 300.00	Trucks	$ -	$ -	13	$ -
Foreman	$ 25.00	$ 37.50	1	$ 375.00					

Town Name: Farmington
Project Name: Chip Seal Calculation

Date: June 18, 2014
By: Joshua Ren

Production Linear
per Day

Day length: 10.0

length	32,600	feet
	26	feet
	32,600	feet

MATERIALS				Material Cost	INVOICES				Invoice Cost
				$ 100,000.00					$ -
Item	Price $/unit	Unit	Quantity	per Day	Item	Price $/unit	Unit	Quantity	per Day
CRS-2P	$ 2.48	Gal	28300	$ 70,099.10					
Crushed Stone	$ 11.50	ton	2610	$ 30,015.00					

Maintenance Bond Records 2002-2014

2002		2003		2004	
$31,106	Autumn Grove Senior Housing	$7,900	Belmont Estates	$13,000	Stonewood 1
$16,600	Pheasants Crossing				
$47,706		$7,900		$13,000	

2005		2006		2007	
		$11,400	Philips Landing 1	$22,600	Philips Landing 2
		$7,600	Stonewood 2	$6,400	Stonewood 3
$0		$19,000		$29,000	

2008		2009		2010	
$10,800	Philips Landing 3			$18,991	Auburn Meadows 1
$10,800		$0		$18,991	

2011		2012		2013	
$19,000	Beaver Creek 1	$19,500	Auburn Meadows 2	$52,000	Auburn Meadows 4
		$13,600	Auburn Meadows 3	$19,500	Beaver Creek 2
$19,000		$33,100		$71,500	

2014	
$36,600	Auburn Meadows 5
$13,600	Beaver Creek 3
$50,200	

Grand Total Maintenance Bond	**$319,200**
Accrued per Year:	**$26,600**