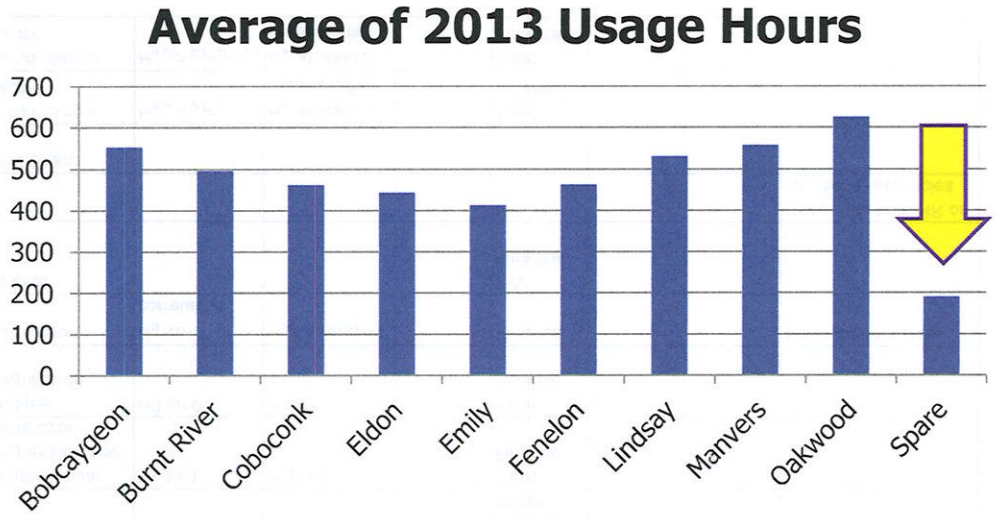
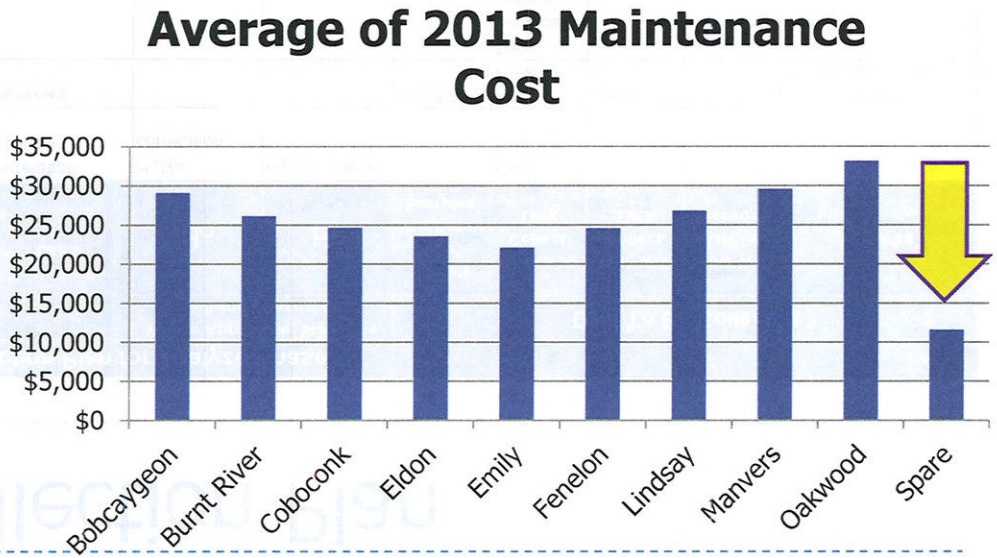
Step #14 - Utilization and maintenance by depot

Depot	% utilization	% maintenance
Fenelon	5.81%	5.80%
spares	5.98%	6.85%
Emily	7.78%	7.81%
Eldon	9.76%	9.72%
Lindsay	10.00%	9.49%
Burnt River	10.89%	10.78%
Coboconk	11.62%	11.64%
Bobcaygeon	12.15%	12.02%
Manvers	12.26%	12.20%
Oakwood	13.75%	13.69%

Although the spares have the lowest average usage and operating cost they account for almost 6% of total utilization and 6.85% of maintenance cost.





Step #17 - Is depot location a factor for maintenance cost?

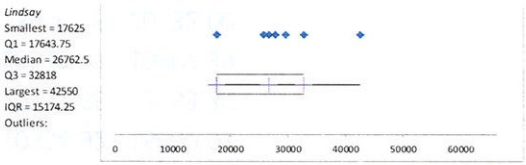
SUMMARY

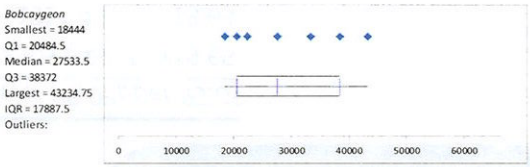
Groups	*Count*	*Sum*	*Average*	*Variance*
Coboconk	8	197329.78	24666.22	189463334.81
Fenelon	4	98222.25	24555.56	95129286.77
Oakwood	7	232113.50	33159.07	141838047.29
Eldon	7	164830.00	23547.14	67480105.39
Lindsay	6	160924.00	26820.67	85183752.67
Bobcaygeon	7	203757.25	29108.18	90011638.18
Burnt River	7	182808.11	26115.44	94587703.09
Emily	6	132469.50	22078.25	48017846.18
Manvers	7	207018.00	29574.00	271295326.75

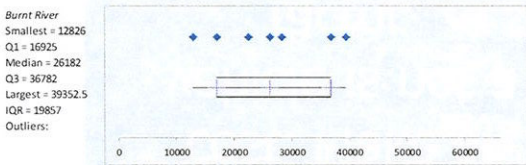
Depot location is not a factor for maintenance cost

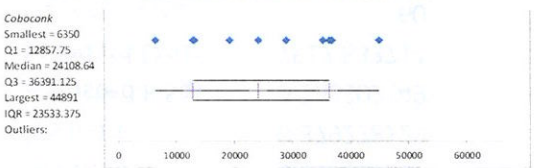
ANOVA

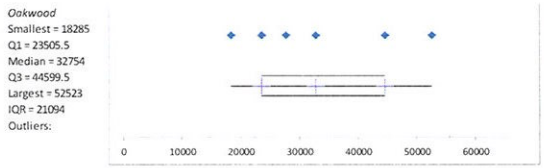
urce of Variati	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Grou	641867313.19	8.00	80233414.15	0.64	0.74	2.13
Within Groups	6268916122.39	50.00	125378322.45			
Total	6910783435.58	58.00				

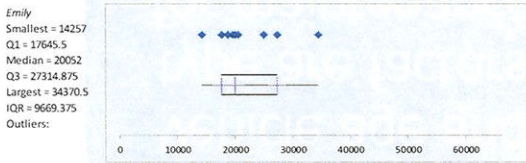


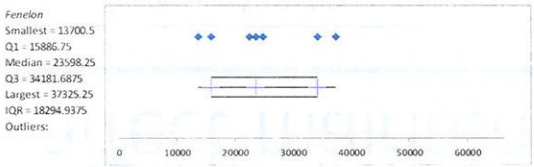


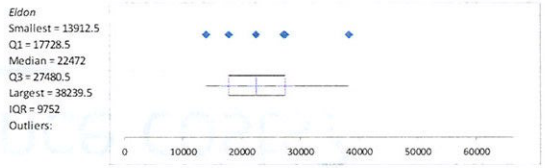


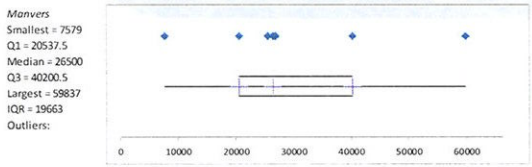












Fleet\maintenance by depot.xlsx

Step #17 - Does type, make, age of vehicle affect maintenance costs?

Regression Statistics	
Multiple R	0.615855607
R Square	0.379278129
Adjusted R Squ	0.262302149
Standard Error	7517.833714
Observations	60

ANOVA

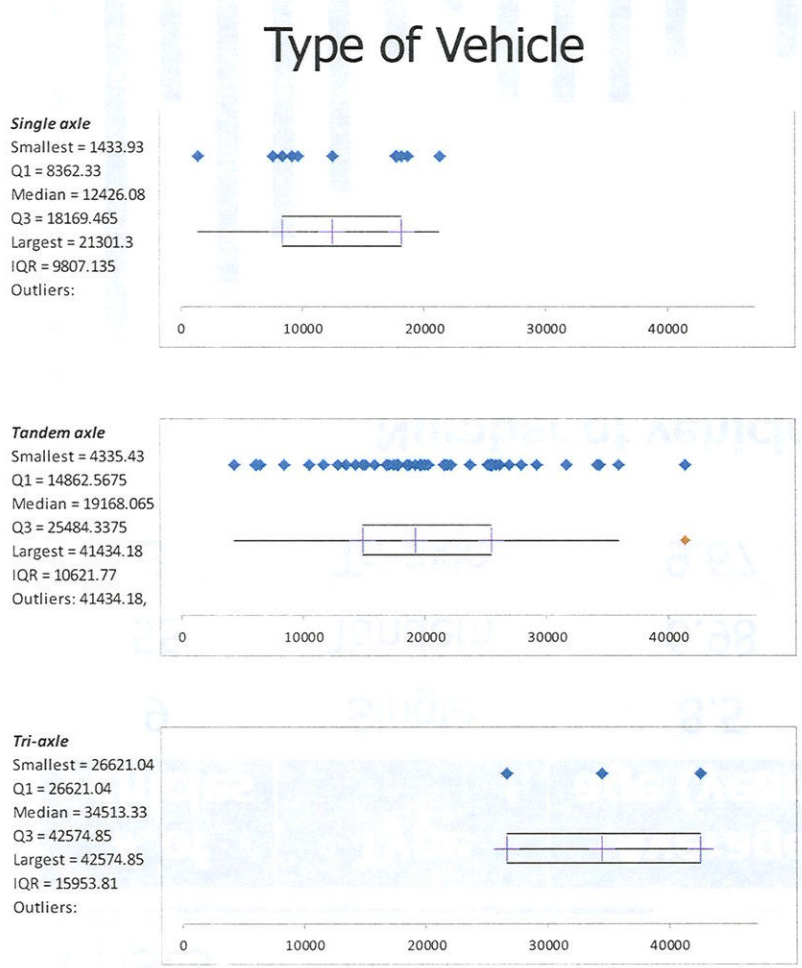
	df	*SS*	*MS*	*F*	*gnificance F*
Regression	9	1761231153.91	195692350.43	3.90	0.00
Residual	51	2882409011.11	56517823.75		
Total	60	4643640165.03			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	38589.55	6739.49	5.73	0.00	25059.45	52119.65	25059.45	52119.65
vehicle age	-516.56	248.03	-2.08	0.04	-1014.49	-18.63	-1014.49	-18.63
International	2507.92	6531.77	0.38	0.70	-10605.16	15621.01	-10605.16	15621.01
Volvo	2347.99	6317.50	0.37	0.71	-10334.92	15030.91	-10334.92	15030.91
Mack	-5909.68	7403.42	-0.80	0.43	-20772.66	8953.30	-20772.66	8953.30
Ford	-8754.79	9742.65	-0.90	0.37	-28313.97	10804.39	-28313.97	10804.39
Western Star	572.82	9742.65	0.06	0.95	-18986.36	20132.00	-18986.36	20132.00
Single	-22887.96	6908.71	-3.31	0.00	-36757.77	-9018.15	-36757.77	-9018.15
Tandem	-15998.27	6330.02	-2.53	0.01	-28706.32	-3290.23	-28706.32	-3290.23
Tri-axle	0.00	0.00	65535.00	#NUM!	0.00	0.00	0.00	0.00

Vehicle age and type are factors for maintenance cost. Make of vehicle is not a factor.

Fleet\regression data.xlsx

Step #17 - Vehicle type is a factor for maintenance costs

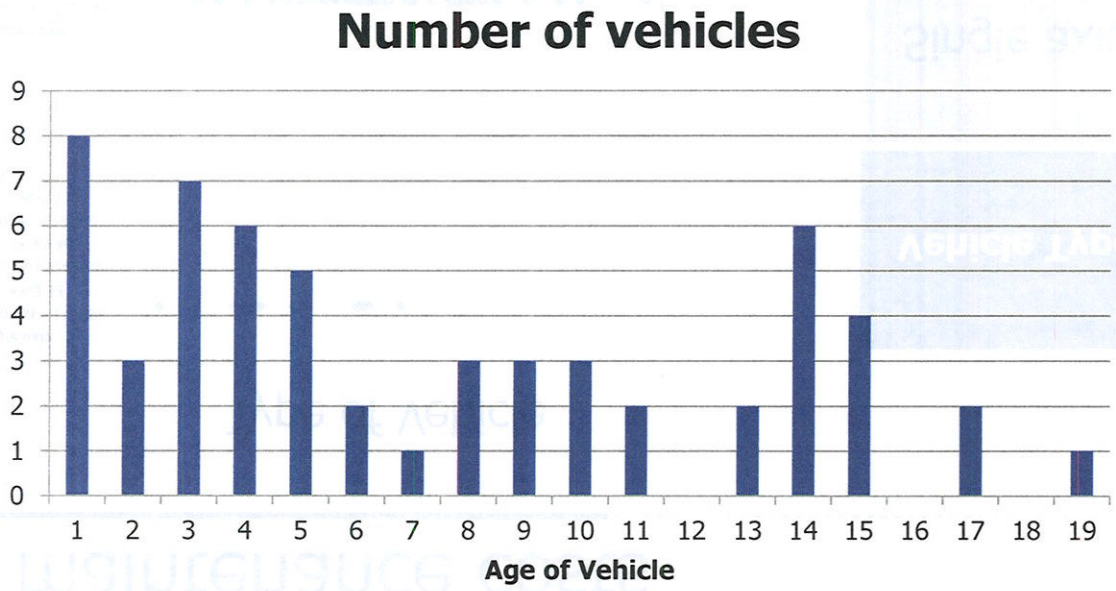


Vehicle Type	Average maintenance cost/hour	Median maintenance cost/year
Single axle	$27.38	$12,426
Tandem axle	$43.44	$19,168
Tri-axle	$67.59	$34,513

Fleet\maintenance by type.xlsx

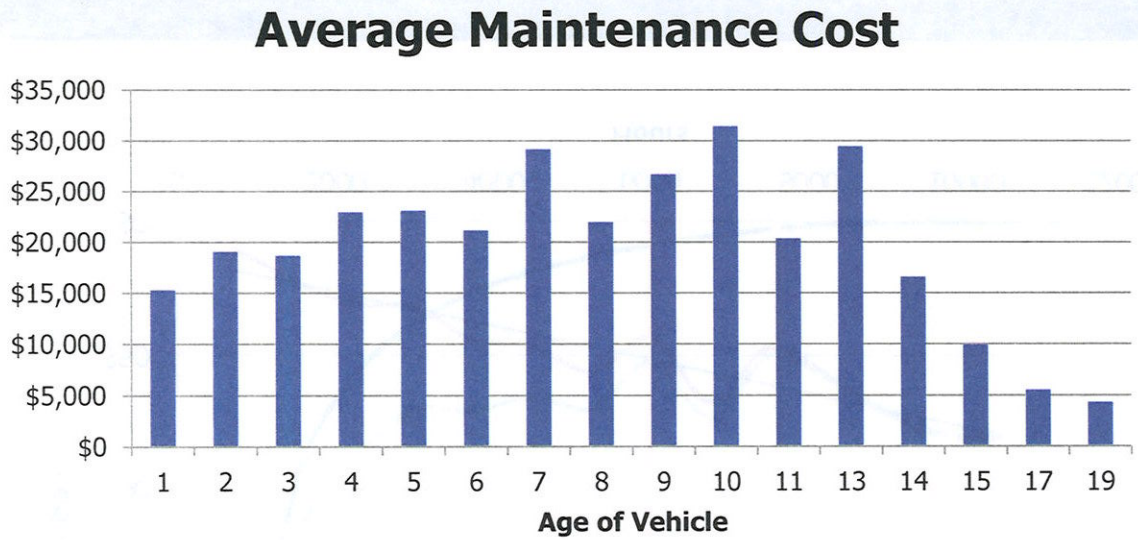
Step #17 - Vehicle age is a factor for maintenance costs

# of vehicles	Type	Average age (years)	Median age (years)
9	Single	8.5	6
55	Tandem	6.98	5
3	Tri-axle	9.67	10



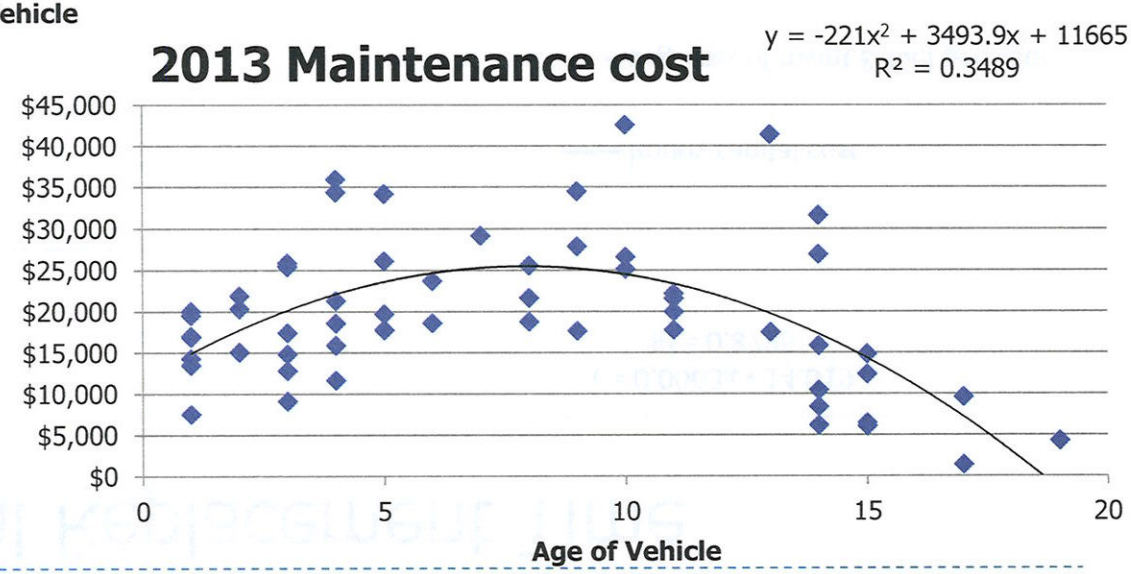
We currently have 15 vehicles that are over 12 years old.

Step #17 - Vehicle age is a factor for maintenance costs

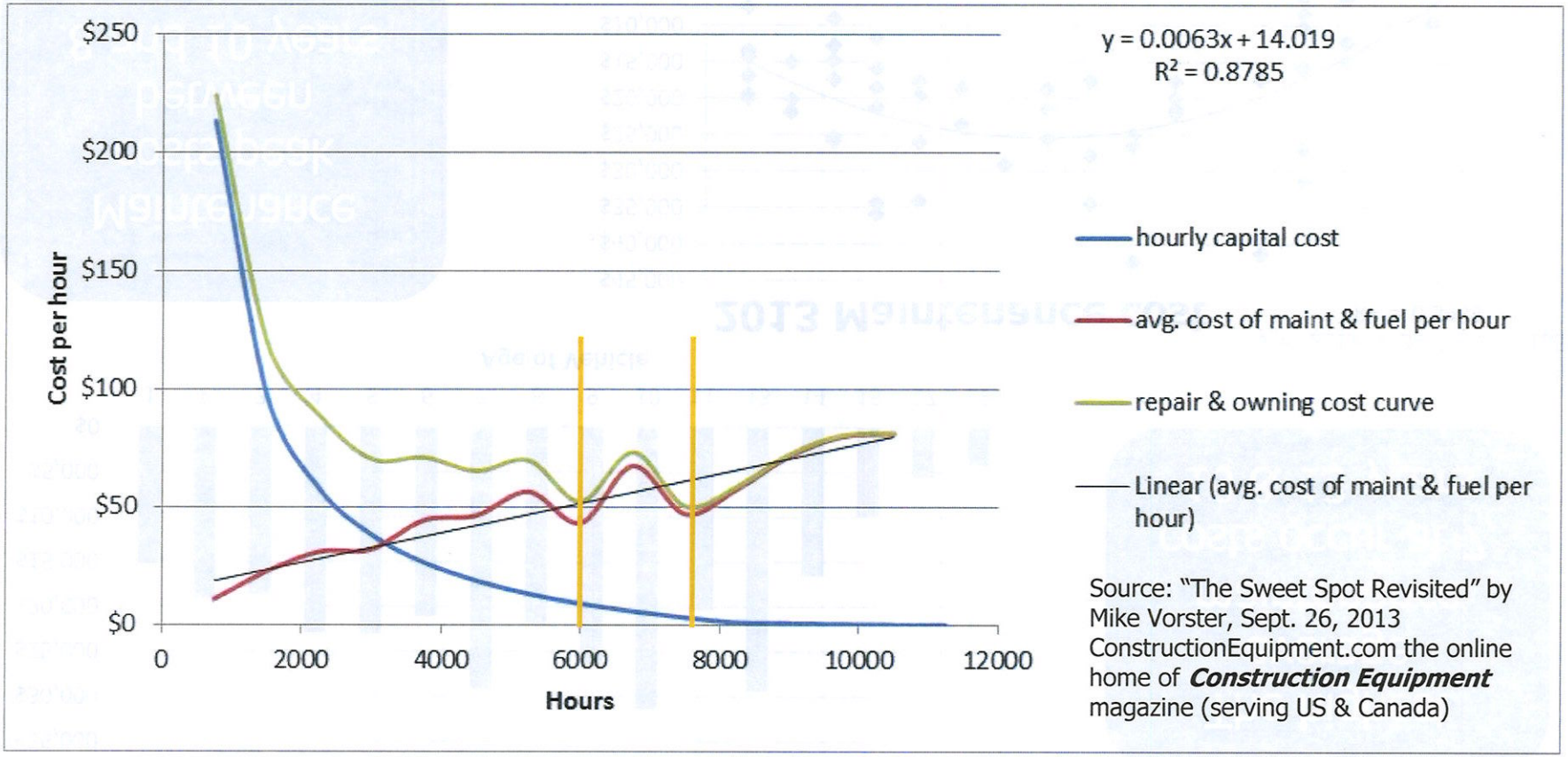


The highest average maintenance costs occur at 7, 10 & 13 years

Maintenance costs peak between 8 and 10 years



Step #17 - Optimal Replacement Time



Source: "The Sweet Spot Revisited" by Mike Vorster, Sept. 26, 2013 ConstructionEquipment.com the online home of ***Construction Equipment*** magazine (serving US & Canada)

The optimal time for truck replacement is 8 – 10 years

Step #17 - Does type, make, age of vehicle affect utilization?

Regression Statistics	
Multiple R	0.659358
R Square	0.434753
Adjusted R Square	0.326479
Standard Error	173.2215
Observations	60

ANOVA

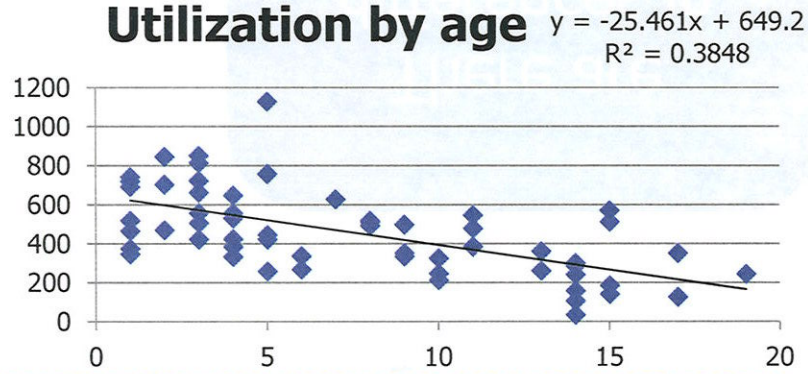
	df	SS	MS	F	gnificance F
Regression	9	1177006	130778.4333	4.90	0.00
Residual	51	1530291	30005.70149		
Total	60	2707297			

	Coefficients	tandard Err	t Stat	P-value	Lower 95%	Upper 95%	ower 95.0%	pper 95.0%
Intercept	451.63	155.29	2.91	0.01	139.87	763.38	139.87	763.38
vehicle age	-24.89	5.71	-4.36	0.00	-36.36	-13.42	-36.36	-13.42
International	169.20	150.50	1.12	0.27	-132.95	471.34	-132.95	471.34
Volvo	134.56	145.56	0.92	0.36	-157.67	426.80	-157.67	426.80
Mack	88.54	170.59	0.52	0.61	-253.92	431.01	-253.92	431.01
Ford	7.61	224.48	0.03	0.97	-443.06	458.28	-443.06	458.28
Western Star	108.89	224.48	0.49	0.63	-341.78	559.56	-341.78	559.56
Single	39.89	159.19	0.25	0.80	-279.69	359.47	-279.69	359.47
Tandem	57.13	145.85	0.39	0.70	-235.69	349.94	-235.69	349.94
Tri-axle	0	0	65535	#NUM!	0	0	0	0

Vehicle age is a factor for utilization – make and type are not factors.

Vehicle age and 2013 Usage Hours	
Pearson Coefficient of Correlation	-0.6203
t Stat	-6.0231
df	58
P(T<=t) one tail	0
t Critical one tail	1.6716
P(T<=t) two tail	0
t Critical two tail	2.0017

38% of the variance in usage hours is due to the age of the vehicle.



Fleet\regression data.xlsx

Step #17 – Does utilization vary throughout the year?

Anova: Single Factor

SUMMARY

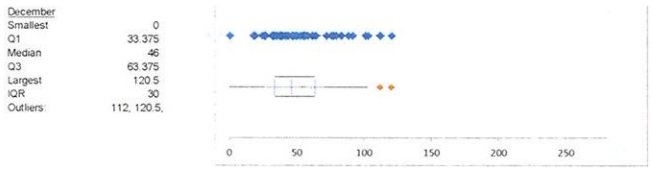
Groups	*Count*	*Sum*	*Average*	*Variance*
January	60	6073.17	101.2195	2280.563
February	60	6668	111.1333	2942.988
March	60	2826.5	47.10833	1009.069
April	60	1771.25	29.52083	542.6743
May	60	1927.5	32.125	1136.929
June	60	1538.5	25.64167	747.7042
July	60	1371.5	22.85833	850.7381
August	60	1199.5	19.99167	541.6991
September	60	848.5	14.14167	284.7804
October	60	833	13.88333	206.4607
November	60	969.75	16.1625	279.631

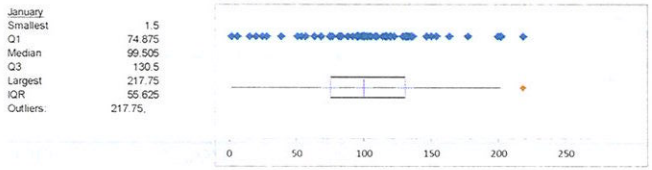
There are differences in utilization between months

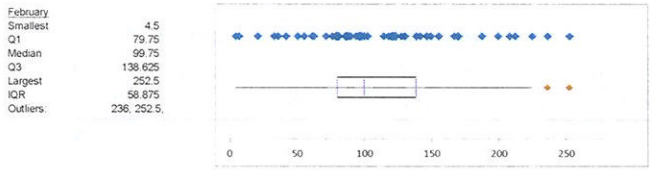
ANOVA

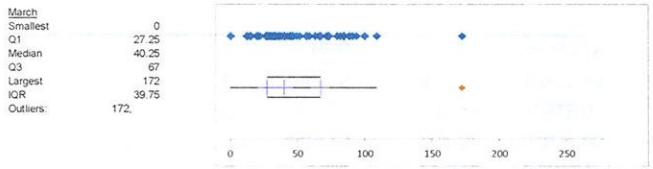
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	710755.02	10.00	71075.50	72.24	0.00	1.85
Within Groups	638570.94	649.00	983.93			
Total	1349325.96	659.00				

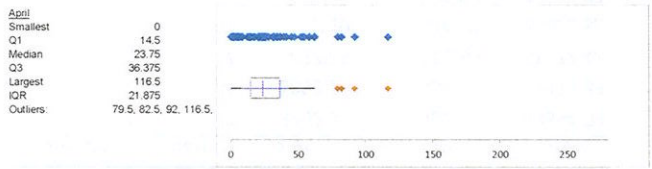
Step #17 – Does utilization vary throughout the year?

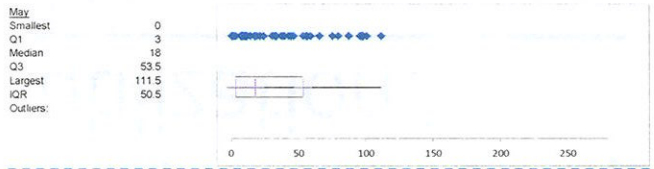


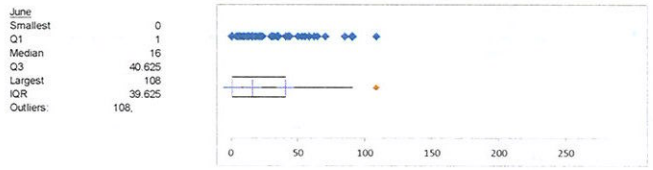


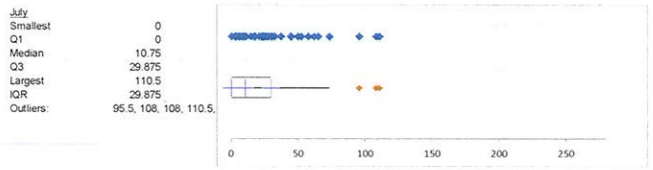


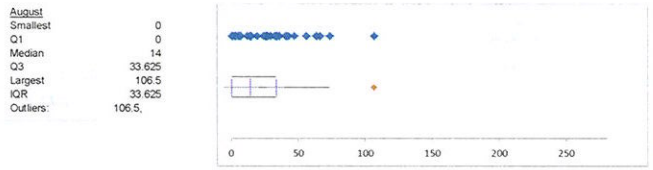


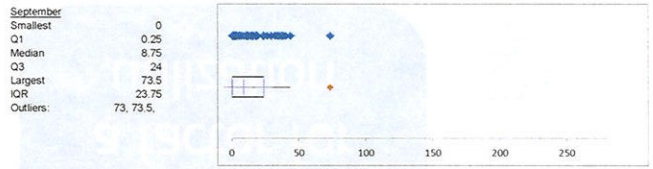


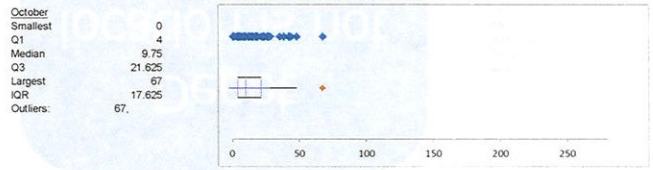


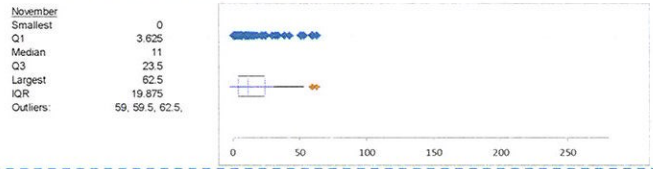












The trucks are used primarily for winter control

Step #17 Is depot location a factor for utilization?

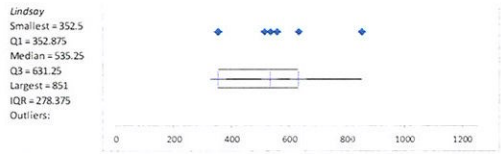
SUMMARY

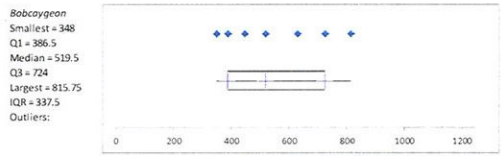
Groups	Count	Sum	Average	Variance
1	8	3702.26	462.78	68654.09
2	4	1853.25	463.31	33865.89
3	7	4279.5	611.36	61277.48
4	7	3110	444.29	24022.82
5	6	3185	530.83	33522.87
6	7	3869.75	552.82	31057.06
7	7	3468.37	495.48	32618.03
8	6	2477.5	412.92	17812.94
9	7	3906	558.00	96580.75

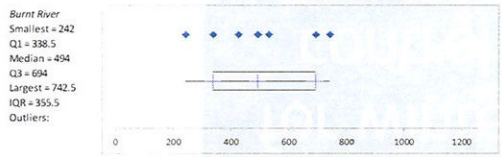
Depot location is not a factor for utilization

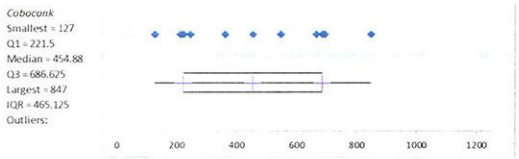
ANOVA

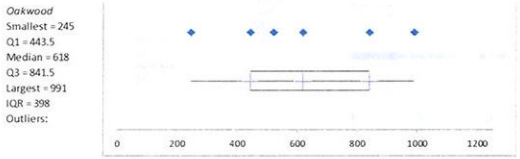
urce of Variati	SS	df	MS	F	P-value	F crit
Between Gro	217327.7	8	27165.96	0.59	0.78	2.13
Within Group	2312192	50	46243.84			
Total	2529520	58				

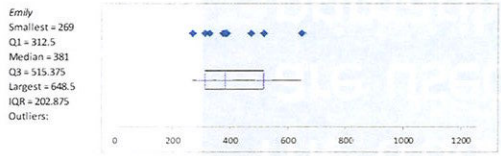


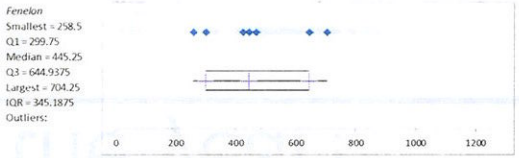


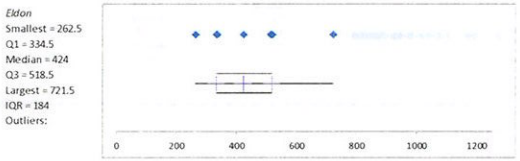


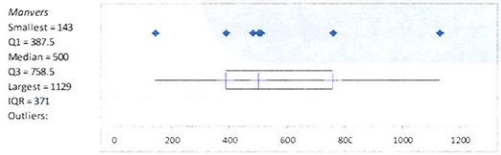






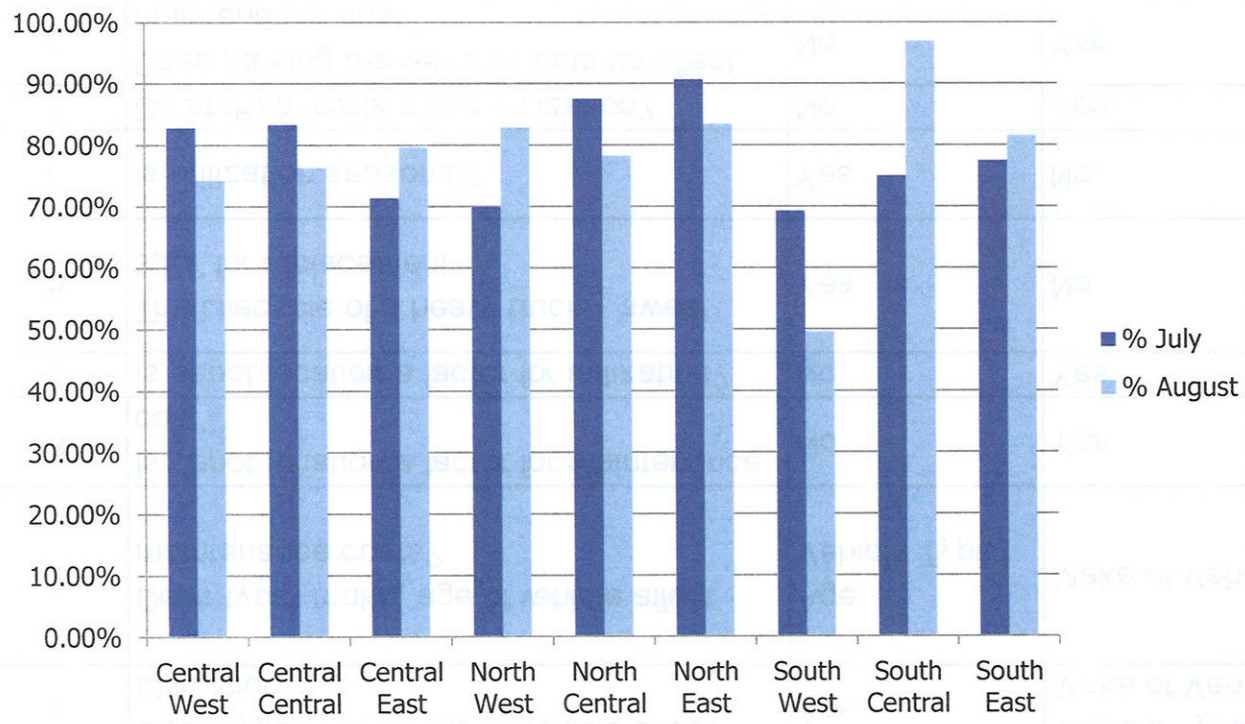






Fleet\utilization by depot.xlsx

Step #17 - Is staffing level a factor for utilization?



Vacation days are mostly taken between May and November with July and August being the most popular.

Decreased staffing levels may have an effect on utilization however a significant amount of the work during the summer doesn't require the use of a heavy truck.

Analyze Phase – Summary

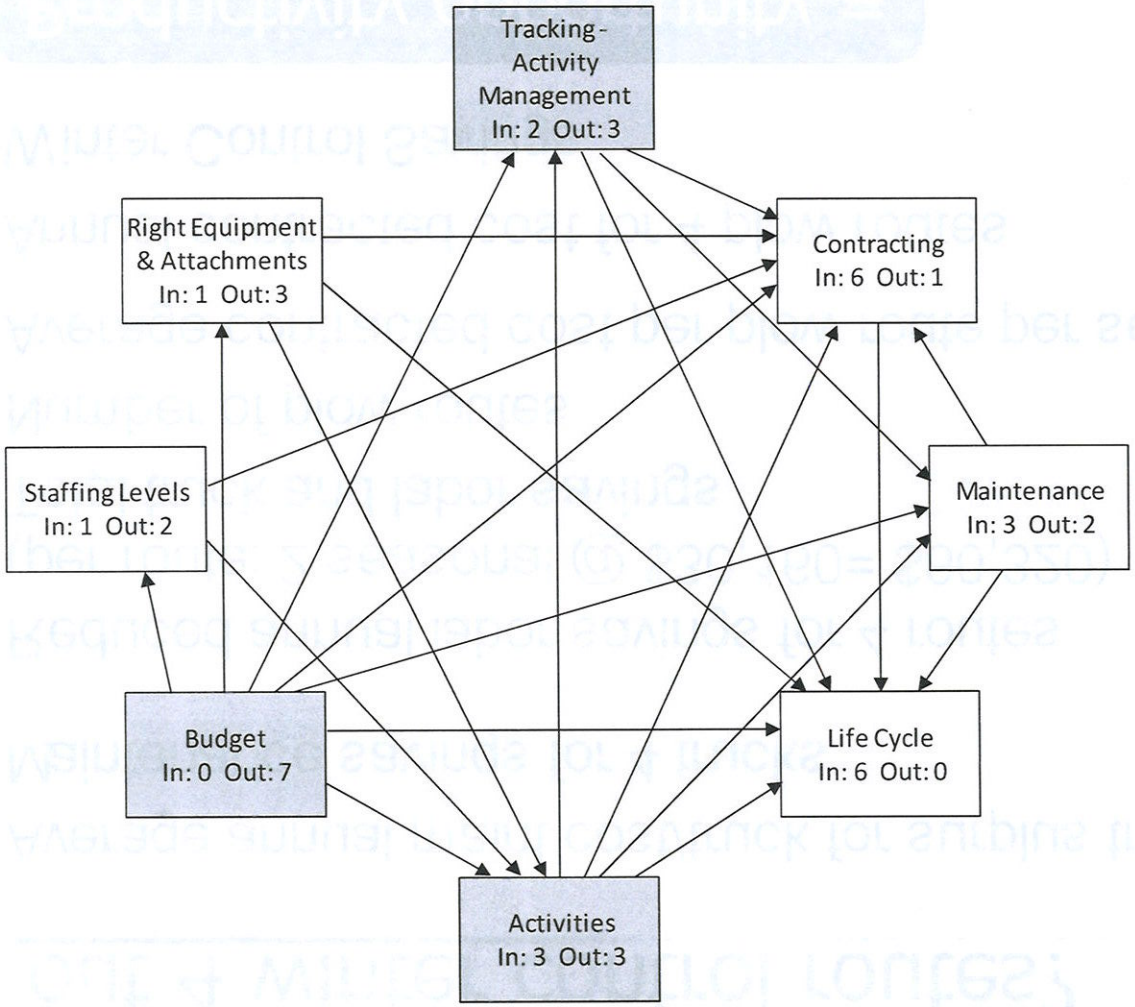
Test #	Potential vs. Identified X's	Critical X	Non Critical X	Comments
1	Does type, make, age of vehicle affect utilization?	Age	Vehicle Type Make of Vehicle	Utilization decreases as vehicles get older
2	Does type, make, age of vehicle affect maintenance costs?	Age Vehicle Type	Make of Vehicle	Maintenance costs increase as vehicles get older. Higher costs for tri-axles.
3	Is depot location a factor for maintenance cost?	No	Yes	
4	Is depot location a factor for utilization?	No	Yes	
5	The Lifecycle of a heavy truck - 'sweet spot' for replacement	Yes	No	Current replacement schedule is 12 - 15 years, optimal is 8 - 10
6	Is utilization seasonal?	Yes	No	Trucks are used mainly for winter control
7	Do staffing levels affect utilization?	No	Yes	
8	Does parking the vehicles outside affect maintenance cost?	No	Yes	Not enough data to infer it is a factor

Improve Phase

Step #18 - Affinity Diagram

Tracking - Activity Management	Attachments	Budget	Staffing Levels	Activities	Maintenance	Contracting
Time cards	Additional trays for patching	More $$$ to use trucks	Spread vacation year round	Weekly work plan (post it)	Ready vehicles for winter (wax)	Contract management
Tracking of activities	Hot box for asphalt patch	One pot of $	Seasonal summer staff	Ditching program	Preventative Maintenance	True cost of contracting
SOP - time tracking & cost	Attachments - one person units for brushing, sweeping	Reactive vs Proactive	Eliminate contracting	Find more uses for trucks ie. Landfill use (cover)		
Change time cards	Trailers to increase trucking volumes		Training	Gravel trucking		
Better tracking of use	tri-axles vs tandems			Other department using trucks		
True cost of contracting				Sharing equipment		
				Level of Service - too high?		

Step #18 - Interrelationship Digraph



Drivers are:

Tracking (Activity Management) **Budget Activities**

Step #17 - Model - What if we contracted out 4 winter control routes?

Average annual maint cost/truck for surplus trucks	$	12,918.00
Maintenance savings for 4 trucks	**$**	**51,672.00**
Reduced annual labor savings for 4 routes (per route: 2 seasonal @ $30,160= $60,320)		$241,280.00
Total truck and labor savings		**$292,952.00**
Number of plow routes		4
Average contracted cost per plow route per season	$	63,775.00
Annual contracted cost for 4 plow routes	**$**	**255,100.00**
Winter Control Savings		**$37,852.00**

Productivity opportunity = $32,000 in savings

Fleet\Copy of CKL Trucks DL V1-1.xls

Implementation Schedule

#	Quick Hit	Potential X's	Activity	Deliverable	Assigned Date	Responsibility	Due Date
1)	X		Create SOP for recording truck usage	Standard Operating Procedure	10-Dec-13	Todd Bryant	01-May-14
2)	X		Billing	Change to annual charge	10-Dec-13	Todd Bryant	01-May-14
3)	X		SOP for cleaning vehicles	Standard Operating Procedure	10-Dec-13	Todd Bryant/Pat Russell	17-Jan-14
4)		X	Fleet Policy updates	Report and updated policy to Council	10-Dec-13	Todd Bryant	01-May-14
5)		X	Contract out 4 routes	Tender issued for contract	10-Dec-13	Michelle Hendry	31-Mar-14

Life Cycle Replacement

Current Fleet Policy has life cycle replacement between 12 – 15 years. Recommendation: 8 – 10 years

2014 capital approval for 5 replacement trucks:

Truck #	2011 cost	2012 cost	2013 cost	3 year cost
S32	$13,068.34	$13,377.31	$12,426.08	$38,871.73
T44	$34,138.58	$35,666.20	$23,099.33	$92,904.11
T45	$23,520.57	$19,559.05	$17,752.17	$60,831.79
T46	$26,149.65	$28,664.63	$30,094.38	$84,908.66
T47	$28,091.91	$19,631.04	$22,139.37	$69,862.32
Total	**$124,969.05**	**$116,898.23**	**$105,511.33**	**$347,378.61**

Life Cycle Replacement

- Reduce the fleet age to an 8 – 10 year replacement by 2018 budget
- Maintain current replacement cycle as detailed in the 2014 proposed capital Budget

- 2015 – 4 tandem, 1 tri-axle
- 2016 – 4 tandem, 1 tri-axle
- 2017 – 3 tandem, 1 tri-axle
- 2018 – 3 tandem, 1 single-axle

Standard Operating Procedures

Standard Operating Procedures have been created for:

- Cleaning of Vehicles
- Recording Truck Utilization

Step #19 - Determine Optimum Operating Windows of KPIVs – Updated FMEA

Process Step/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Severity	Potential Cause(s) / Mechanism(s) of Failure	Occurrence	Current Process Controls Prevention	Current Process Controls Detection	Detection	Risk Priority Number	Recommended Action(s)	Responsibility & Target Completion Date	Actions Taken & Completion Date	Severity	Occurrence	Detection	RPN
Buying the truck	**Not delivered on time**	We can't use it Have to maintain older vehicle	5	Delay in process Vendor has issues (staff loss)	10	bi-weekly updates with salesperson	bi-weekly updates with salesperson	3	**150**	Maintain bi-weekly meetings	Fleet - ongoing					0
	Not the right truck (not within specs)	We can't use it Have to maintain older vehicle	7	Delay in process, specs not clear	10	bi-weekly updates with salesperson	bi-weekly updates with salesperson	3	**210**	Maintain bi-weekly meetings	Fleet - ongoing					0
Using the truck	**Out of Service in winter**	Can't do the work (plowing snow)	8	Mechanical	8	Spare vehicles, graders, on-call mechanics, mobile units	Maintenance records	1	**64**							0
	Out of service in summer	Can't do the work	3	Mechanical Annual Inspection Lack of staff	7	Need fewer trucks in summer, flexibility in scheduling	Scheduling	1	**21**							0
Billing for use of the truck	**Inconsistent Reporting**	Lack of revenue for fleet Lack of good data for future plans Poor justification for council decision making	10	No SOP for data collection Time cards not reviewed properly	7	None	None	10	**700**	Create SOP for data recording Annual charge to replace hourly rate	Finance & fleet - May 2014	Utilization hours tracked by Fleet	10	2	2	40

Step #21 - Cost savings

After analysis, 4 trucks have been declared surplus.

Truck #	2013 Maintenance Cost	Decommissioning	Average sale price	Total savings
T27	$26,941.03	Spring 2014	$3,500.00	$30,441.03
T29	$8,445.56	Spring 2014	$3,500.00	$11,945.56
T30	$15,852.99	Spring 2014	$3,500.00	$19,352.99
T39	$10,486.32	Spring 2014	$3,500.00	$13,986.32
				$75,725.90

Savings in maintenance + average sale price

Step #21 - Cost savings

Based on analysis 4 winter control routes will be contracted out and an additional 4 trucks will be decommissioned.

Truck #	2013 Maintenance Cost	Decommissioning	Average sale price	Total savings
T24	$6,088.08	Spring 2014	$3,500.00	$9,588.08
T31	$31,633.81	Spring 2014	$3,500.00	$35,133.81
T34	$41,434.18	Spring 2014	$3,500.00	$44,934.18
T35	$17,489.01	Spring 2014	$3,500.00	$20,989.01
				$110,645.08

Savings in maintenance + average sale price

Step #21 - Cost savings

2014 Savings	Projected Savings
4 surplus trucks	$75,725.90
4 trucks surplus due to new contracts	$110,645.08
Savings due to contracts	$37,852.00
Improved productivity – maintenance	$32,000
	$256,222.98

Future Cost Avoidance	Projected Savings
One time savings – less replacement cost for 8 trucks	$1,800,000.00
TOTAL	**$2,056,222.98**

Improve Phase – Summary and Conclusions

- Utilization benchmark set at 500 hours per year
- Tracking of utilization addressed, SOP to be finalized after new process implemented
- Annual charge to be implemented after pilot project in Finance complete
- Changes to fleet policy to be recommended to Council
- Contracted out 2 routes in winter 2013, another 2 to be contracted in fall 2014
- 8 trucks have been decommissioned and will not be replaced

Control Phase

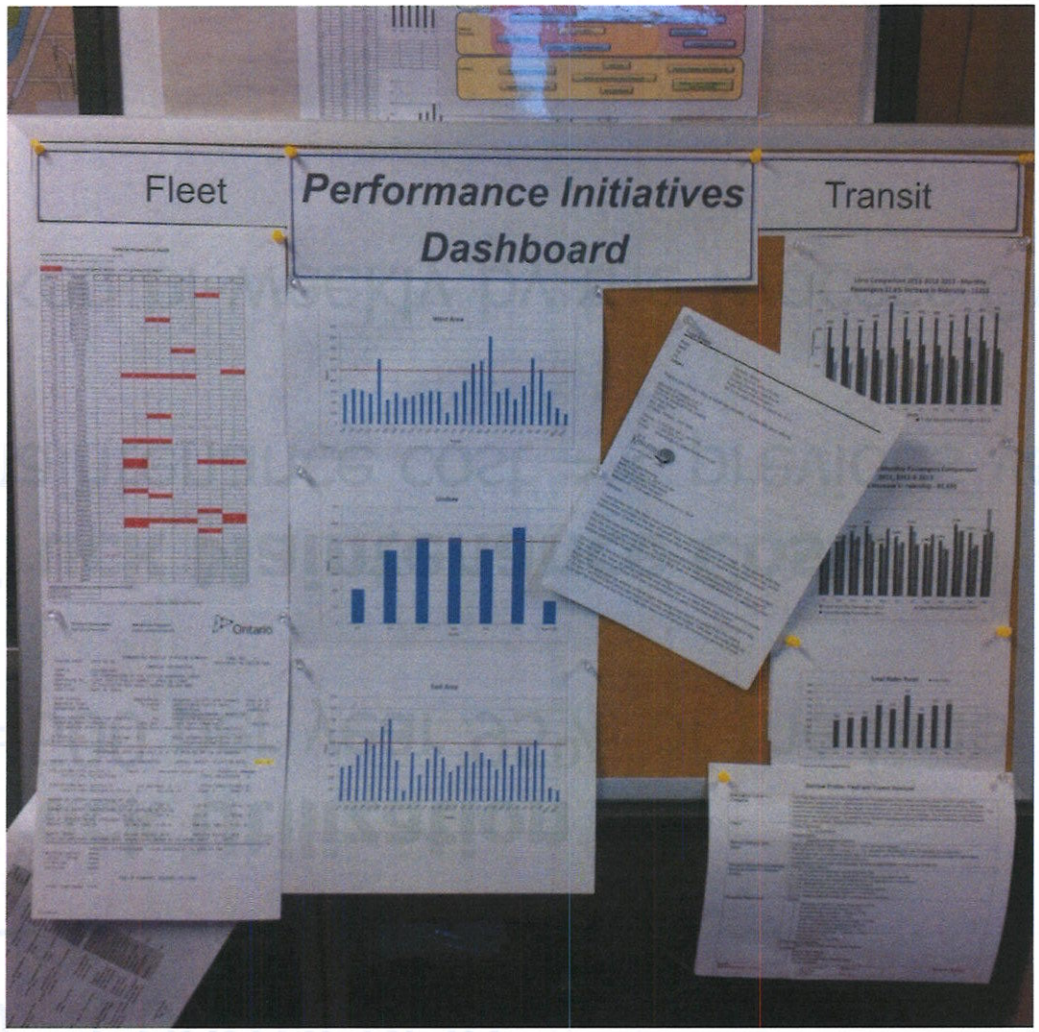
Step #20 - Control Plan

Heavy Truck Utilization
Hours >=500 per year 95% of the time

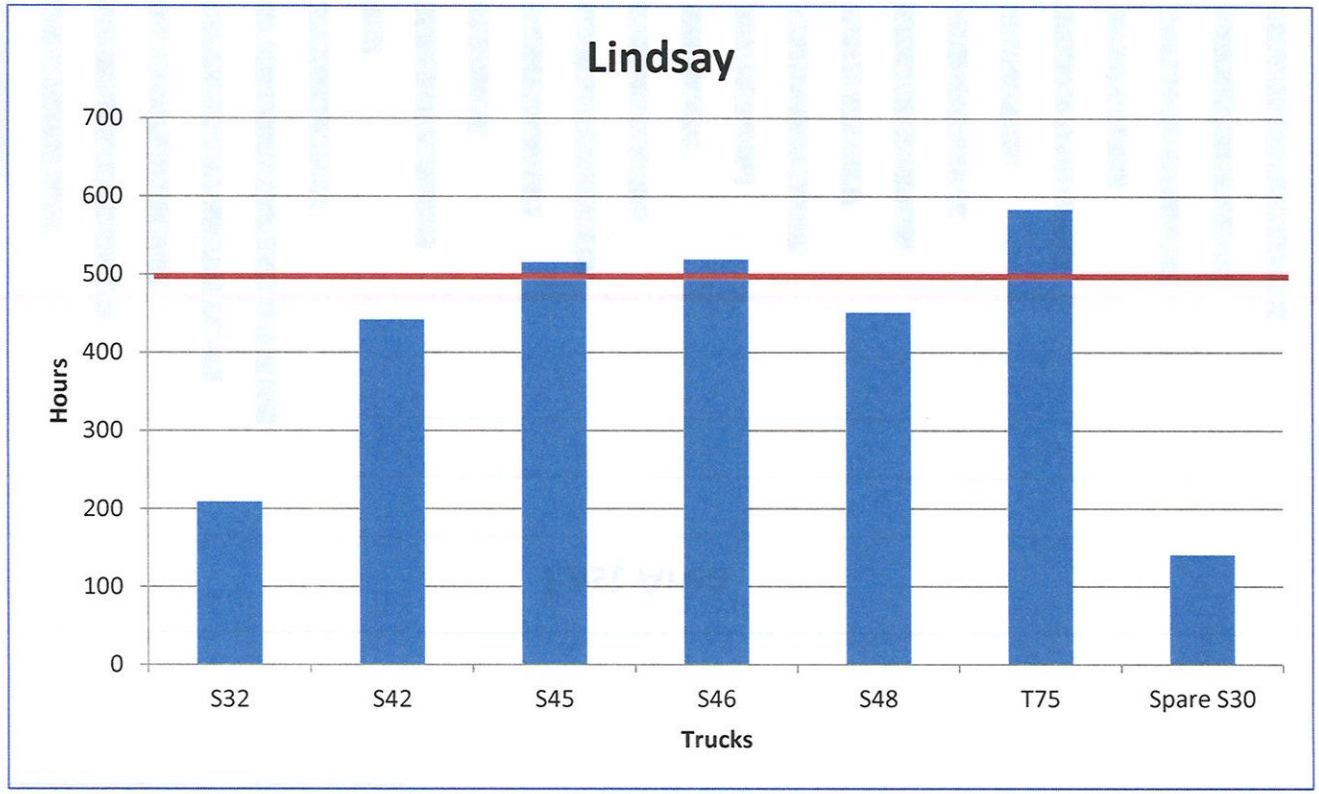
Heavy Truck Maintenance Costs
Overall maintenance cost =< previous year

Both tracked bi-weekly by the Process Owner

Step #20 - Fleet dashboard



Step #20 - 90 day results - utilization



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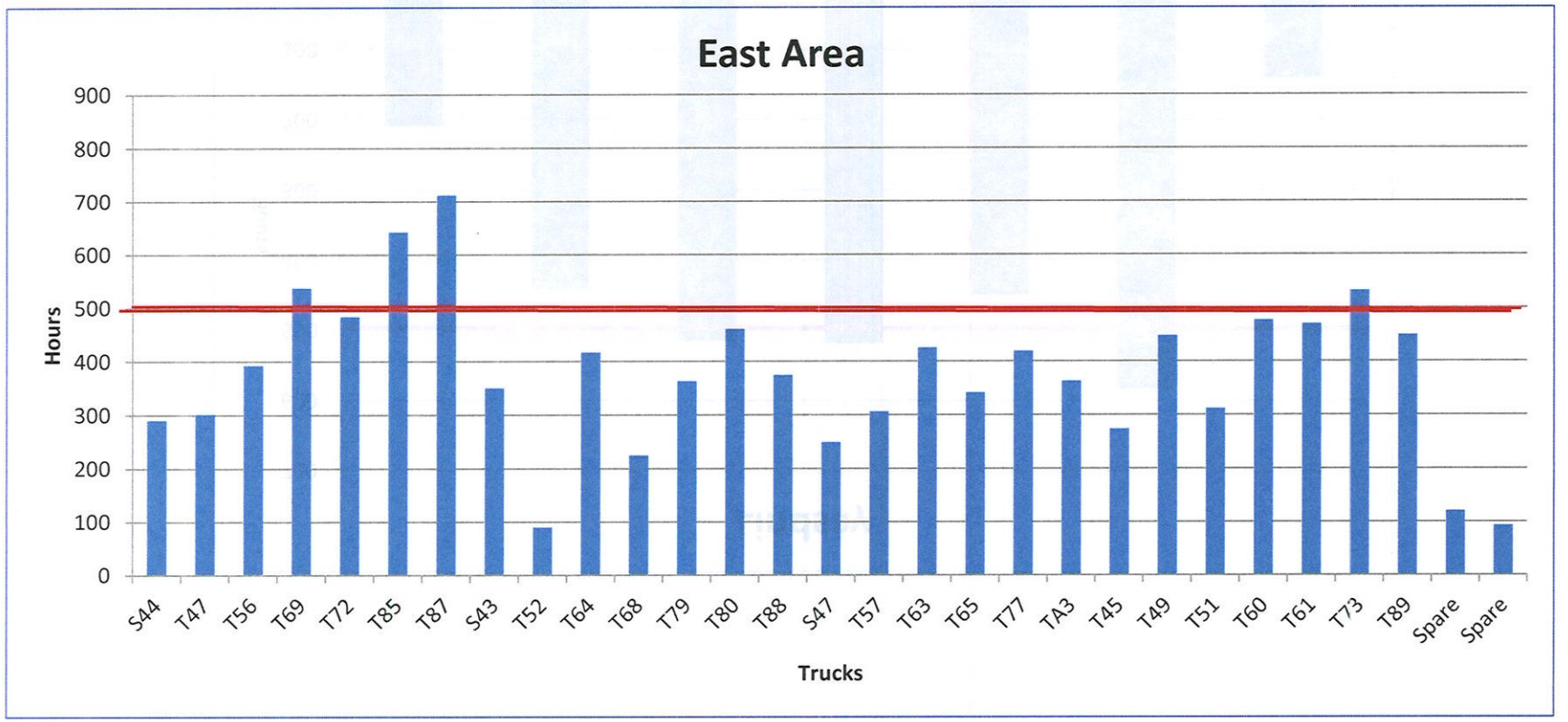

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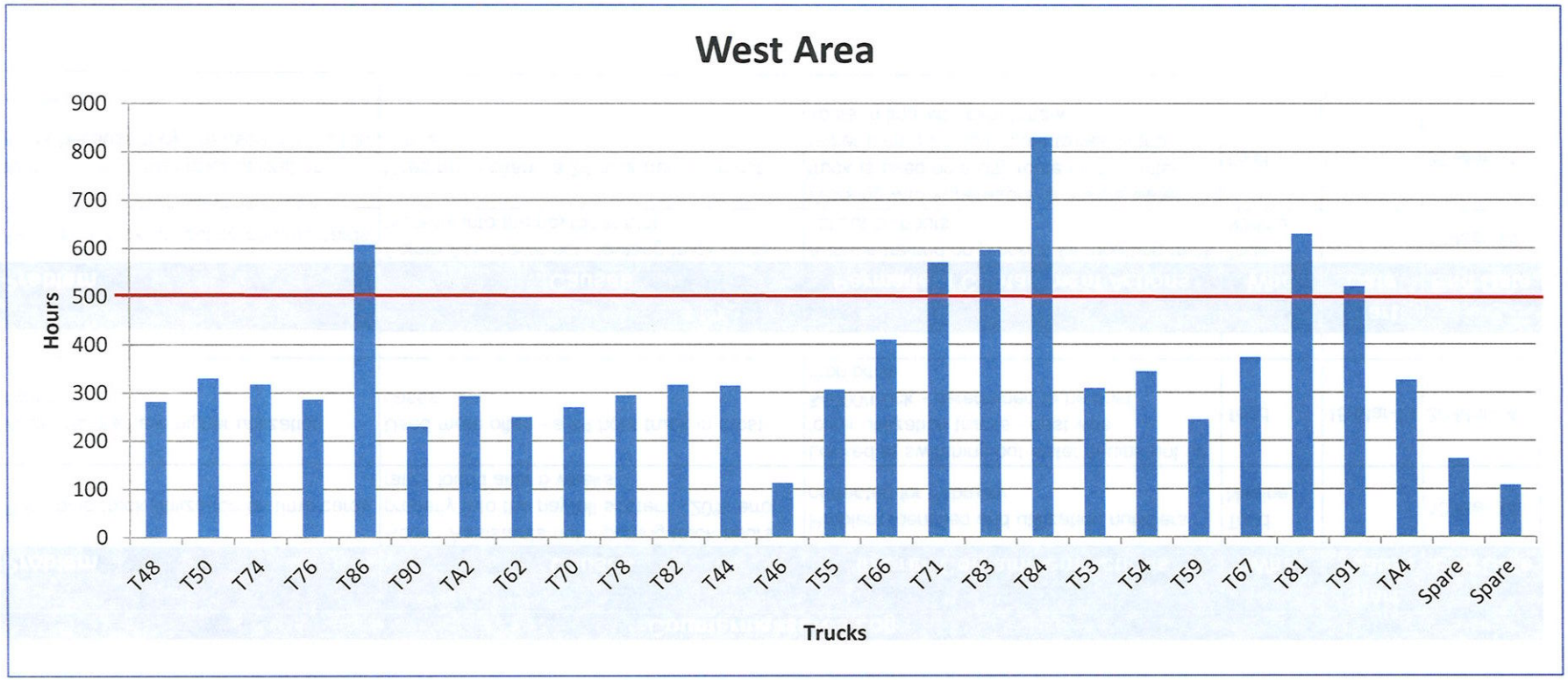

Step #20 - Error-proof KPIVs

Countermeasures Log					
Problem	**Causes**	**Interim Containment Actions**	**Who**	**Start Date**	**End Date**
Recording truck utilization on time cards	Admin Assistants not inputting truck hours properly into the payroll system - 20% error rate - found after 6 weeks	Problem identified and utilization numbers corrected for February	Todd, Nadine		10-Mar-14
Water trucks have higher utilization hours	Used more often - a 24 hour truck in most cases	Looked at switching out water equipment to lower utilization trucks - cost was $4000/truck - determined to be cost prohibitive	Todd	15-Mar-14	30-Mar-14
Problem	**Causes**	**Permanent Containment Actions**	**Who**	**Start Date**	**End Date**
Recording truck utilization on time cards	Admin Assistants not inputting truck hours properly into the payroll system	Admins trained on process for inputting truck utilization hours	Todd, Nadine		17-Mar-14
Water trucks have higher utilization hours because they are used more often	Used more often - a 24 hour truck in most cases	Working with supervisors to ensure water truck is used on a day route in the winter rather than a 24 hour route to help keep hours in line with benchmark	Todd		30-Mar-14

Lessons Learned

- Watch out for 'bunny trails' that can take you away from your core issues
- Communication is key – before, during and after