Maintenance Cost Reduction Project:
Solving Problems with Labor and Maintenance Costs

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Executive Summary

ABC and its primary customer DCE have observed a "lack luster at best" industry wide business climate and pressure has been placed to reduce costs due to rising fuel expenses coupled with the soft economy. DCE's business volume in the (LTL) less-than-truckload division is down approximately 20% year over year in comparison sales and is seeking aggressive reductions in the amount they spend on equipment maintenance expenses as a percentage of their revenue. The focus of the project will be to reduce parts and labor expenses on tractor assets per mile driven. DCE currently runs approximately 2,500,000 miles per week on a tractor fleet of 1,525 tractor units. DCE has an average (non-tire) cost per mile driven on its tractor fleet of $0.102. The goal of this project will be to reduce this metric 20% to $0.080 per mile. Non-tire expenses include all parts and outside vendor repairs applied to tractor assets exclusive of any tire related expenses. Shop scheduling and productivity will be analyzed as well. Shop labor payroll is currently trending at $196,000 per week and we will be seeking a 20% reduction in this expense as well.

Based on the analyst's forecast for 2008 and therefore preparing for a slow freight cycle through the next two quarters it was imperative we examined and reacted to our findings rapidly. We understood to gain an immediate impact we would first start to analyze labor costs and then engage the more complex problems driving our tractor fleet's part consumption.

Following the Six Sigma strategy, we determined inconsistency in our shop scheduling and established staffing ratios amongst the twenty-three shop locations. Having limited productivity metrics in place we knew we had some low hanging fruit, so we began the process of setting up specifications for hours worked per asset type to gauge staffing needs by shop size.

Data was measured across the overall shop network using descriptive statistics. The between and within shop variation exposed several opportunities to adjust staffing levels, and/or hours per week reductions. From this information we brainstormed for standards for each asset type i.e. tractor, trailer, and forklift. Once the specifications were set we considered the following alternatives to address under performing shops:

1. Training and development of the shop personnel. This included communication of the newly established specification with measured accountability to standards, and identified internal specialists to assist with a performance improvement strategy. These solutions required limited resources and we could implement quickly.
2. Extensive specialized technical training to enhance knowledge to increase efficiency. This solution would be expensive and protract the measurable impact to gauge affect.
3. Reducing a non-working manager to a working lead-mechanic. This solution could be implemented quickly and at no expense. Administrative support and macro level management was required from the regional and corporate level.
4. Upgrade personnel or make the required cutbacks immediately. This solution required some shift rescheduling and reporting established to ensure quality was not compromised, but could be implemented with limited cost.

Beginning in May 2008 we began deploying solutions 1, 3, and 4 in varying degrees. Since this change we reduced over-time, as a percentage of total hours by 11% and mechanic headcount was reduced 21%. Total labor payroll was reduced 24%.

Labor payroll reductions gave us the shot in the arm we needed and provided us some time to dive deep into the more complex equipment problems that would yield an impact but over a longer period of time. We began to decompose our tractor fleet by make, model, and year built. The challenge was to reduce costs without outlaying capital to cycle underperforming tractors out and replace with newer models. In essence, we needed to make the best out of what we had currently.

The fleet is comprised primarily of 14 different tractor types. We encouraged all those with worthwhile suggestions to participate in a brainstorming exercise to discuss parts spending each week and ways to control consumption. Any idea that was determined to be practical, could be implemented fast, and was cost effective would be considered. From this we focused our efforts in these main areas:

1. Stratify tractor units by fleet type and determine our highest cost units, and further decompose spending by part component code. It was essential to understand where our money was going before we could advance a plan to control for it. Shop to shop comparisons were also used to target potential process issues. The data was grouped by preventative cost in nature (proactive) or a reaction to a breakdown (after the fact). This helped lead to a reduction in weekly tractor unit spending of 6%.
2. Analyze our miles data by unit seeking a relationship between tractor fleet type, maintenance cost per unit, and cost per mile driven. From this a positive relationship was determined to exist between age of the unit, fleet type, miles accumulated and maintenance costs. Something expected however using Pareto principles we were able to separate the vital few units from the many and focused on four main fleet types.
3. Tractor utilization. Once we established our higher cost lower performing tractor units from the lower cost higher performing units we began to educate the operations and equipment control departments to park and not use the tractor at all or place the tractor in a "best functionality" to mitigate maintenance costs and potential breakdown situations. This lowered the miles per unit per week 3,371 miles and reduced the cost per mile $0.15 on our higher cost tractor units. This approach assisted in a 15% reduction in road breakdown expenses over the period analyzed.

Executing a data driven philosophy over a 14-week period and 36,827,737 miles, overall tractor unit cost per mile was reduced 9.8%. A 16% decrease was achieved in our focus four highest cost tractor units.

1.0 Introduction

ABC and its primary customer DCE have observed a "lack luster at best" industry wide business climate and pressure has been placed to reduce costs due to rising fuel expenses coupled with the soft economy. DCE's business volume in the (LTL) less-than-truckload division is down approximately 20% year over year in comparison sales and is seeking aggressive reductions in the amount they spend on equipment maintenance expenses as a percentage of their revenue. DCE is seeking a 20% reduction in equipment maintenance expenses and labor payroll. The purpose of this report is to present the results of our problem-solving and cost reduction process and explain the solutions we embraced. The following analysis tools will be utilized: Brainstorming, cause and effect diagrams, process capability, control charts, process mapping, data stratification, and Pareto charts.

Labor

We began stratifying each shop into two groups based on size and hours of operation. Having limited productivity expectations or metrics in place we knew we had some low hanging fruit, so we began the process of setting up specifications for hours worked per asset type to gauge staffing needs by shop size. We concluded that we had inconsistency in our shop scheduling and established staffing ratios amongst the twenty-three shop locations. Engineering a model for each shop based on required hours per week per asset type we made adjustments that led to a 24% reduction in weekly mechanic payroll.

Assets

Tractor assets will be targeted because of their 73% contribution to total asset expenses. We further stratified and analyzed the data by shop location, tractor fleet types, and part component cost. Each tractor can be used in two main functions: Local pick up and delivery and longer haul runs from satellite locations to hub locations. The same unit is ideally utilized during the day in pick up and delivery functions and at night in the longer haul runs, 5 days per week. To understand our tractors we analyzed the type of usage and miles driven by unit, grouped by fleet type.

2.0 Improvement Opportunity: Define

Labor

Group 1-shop locations, are shops located at main larger hub locations. A hub is a large flow-though distribution center that typically operates on a twenty-four hour schedule five in half days per week. Group 2-shop locations, are smaller shops located at smaller hubs and/or satellite locations to the hub based on a geographic region. Satellite locations operate with slight variation but typically run two shifts over a 5:00am to 20:00 window, Monday through Friday. Each group separately was then further stratified by shop labor hours allocated to each asset type per week. The following table represents the actual performance versus the established new specification:

HRS/WK= hours per week per asset type

ASSET TYPE	ACTUAL HRS/WK	SPEC HRS/WK
TRACTOR	[illegible]	[illegible]
T[illegible]	[illegible]	[illegible]
F[illegible]	[illegible]	[illegible]

EXAMPLE MODEL

SHOP DETROIT	ASSET CNT	SPEC HRS/WK	ACTUAL HRS/WK
TRACTOR	[illegible]	[illegible]	[illegible]
T[illegible]	[illegible]	[illegible]	[illegible]
F[illegible]	[illegible]	[illegible]	[illegible]
T[illegible]	[illegible]	[illegible]	[illegible]

Specification hours per week divided by 45 hours (standard work week) this equaled the mechanic headcount propose at the Detroit Shop. For this example, 12 mechanics would be staffed versus 15, a reduction of 3 people.

Assets

When you slice up the total expense pie for an asset based transportation company, equipment maintenance i.e. tractors, trailers and forklifts make up the third largest piece behind labor and fuel. In order to decompose the tractor maintenance spending, it was important to stratify by fleet type. This was done in two methods:

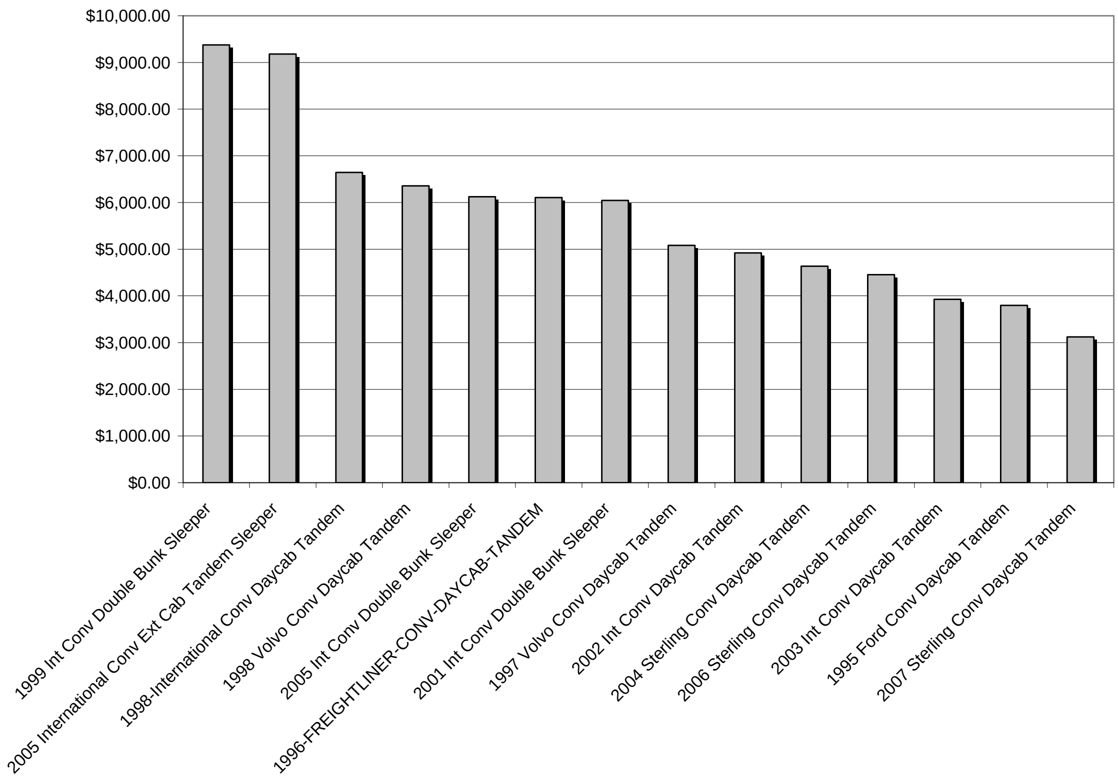
1. Maintenance cost per tractor (CPT)
2. Maintenance cost per mile driven (CPM).

Our reason for using this view of the data was due to the number of fleet types in the system and the variance in the fleet type size and miles driven as a percentage of the total tractor maintenance spending. The goal of the project was to reduce equipment maintenance costs overall by 20%. We targeted tractor assets due to its large proportion of the total expenses. The company's total maintenance part consumption includes trailers and forklifts; however, this will be a future project. The methods utilized in this project will provide a very good model for how we analyze the other asset types down the road.

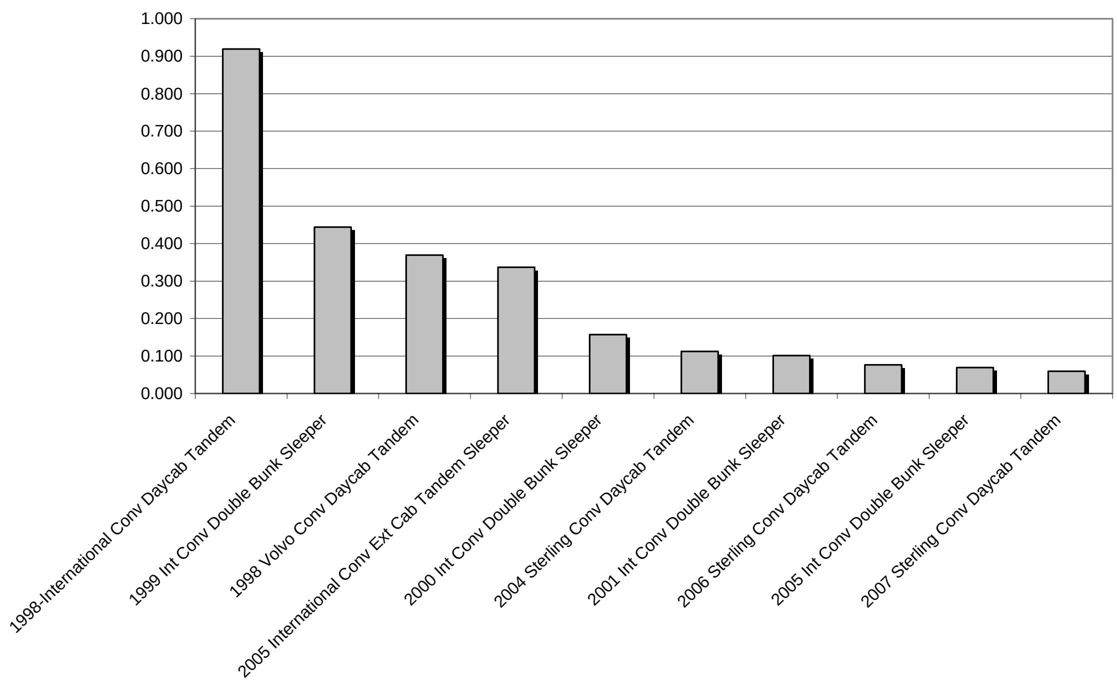
The following two Pareto Charts depict our focus four fleet types for the project:

- 1998 International Conversion Daycab Tandem
- 1998 Volvo Conversion Daycab Tandem
- 1999 International Conversion Double Bunk Sleeper
- 2005 International Conversion Ext Cab Tandem Sleeper

PARETO CHART- TRACTOR MAINTENANCE COST/UNIT



PARETO CHART- TRACTOR COST PER MILE DRIVEN



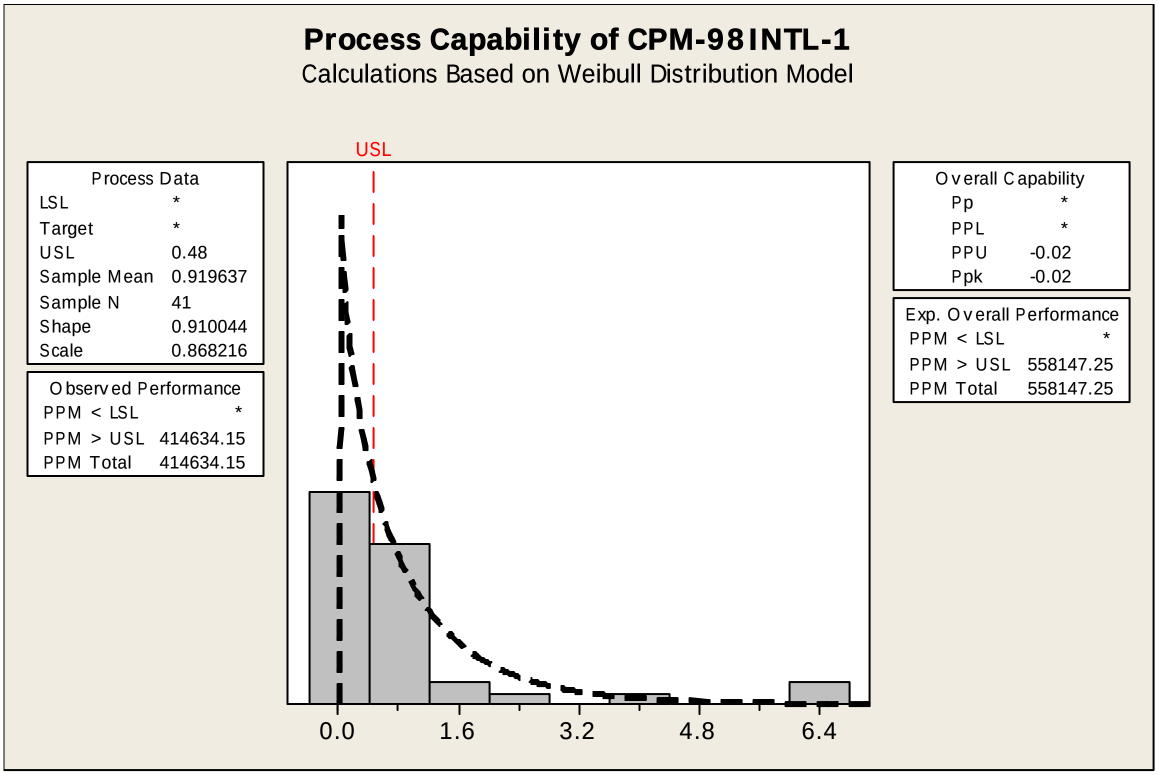
Although the focus four fleet types only comprise of 12% of the total fleet they contribute 23% to the fleet's maintenance costs.

3.0 Performance: Measure

Current process capability on each fleet's CPM is as follows:

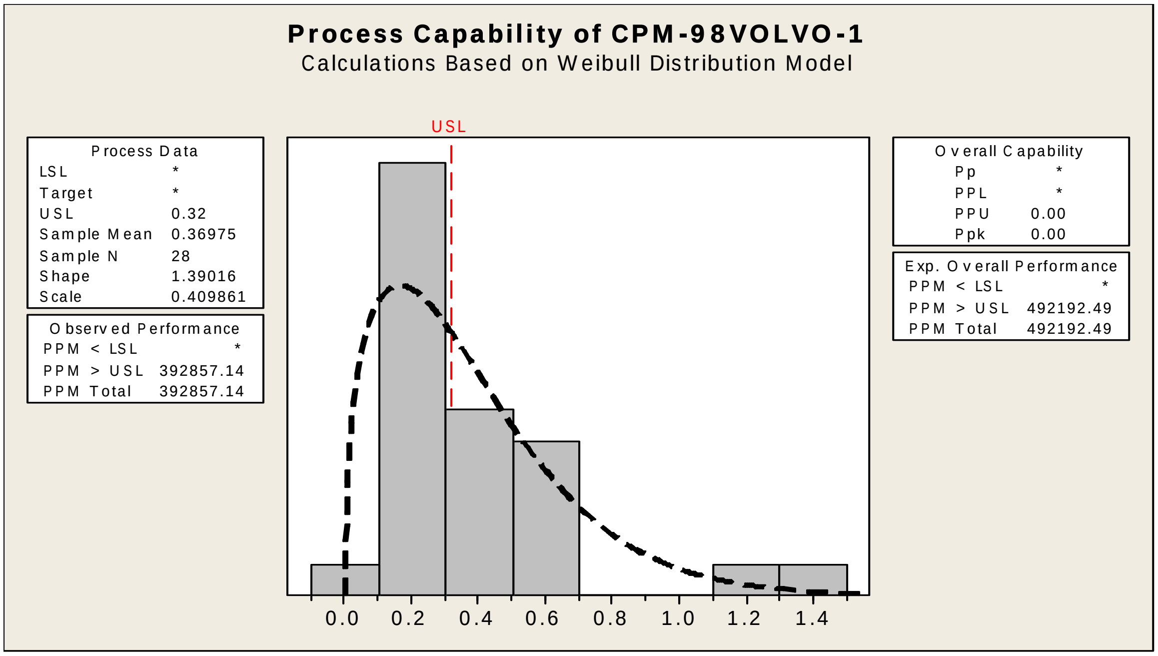
Descriptive Statistics: CPM-1998 INT'L-1

Variable	Mean	StDev	Minimum	Median	Maximum
CPM-98INTL-1	0.920	1.362	0.131	0.412	6.140



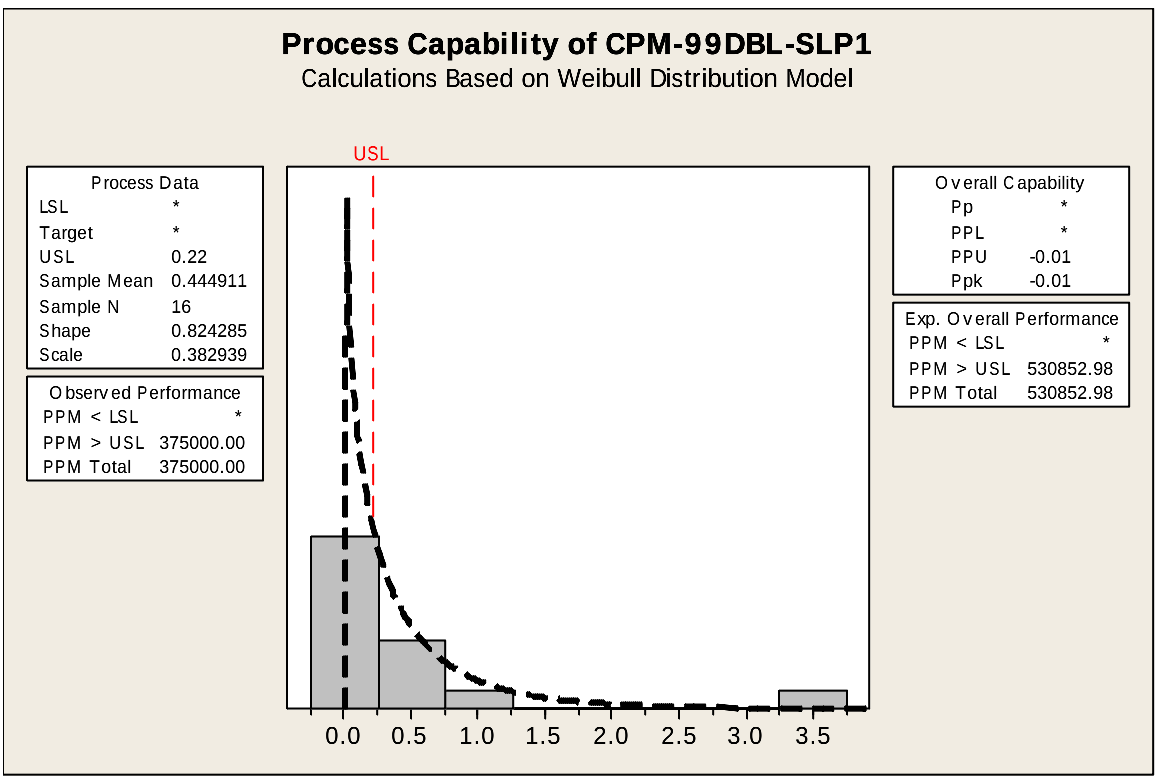
Descriptive Statistics: CPM-1998 VOLVO-1

Variable	Mean	StDev	Minimum	Median	Maximum
CPM-98VOLVO-1	0.3698	0.3094	0.0827	0.2424	1.3270



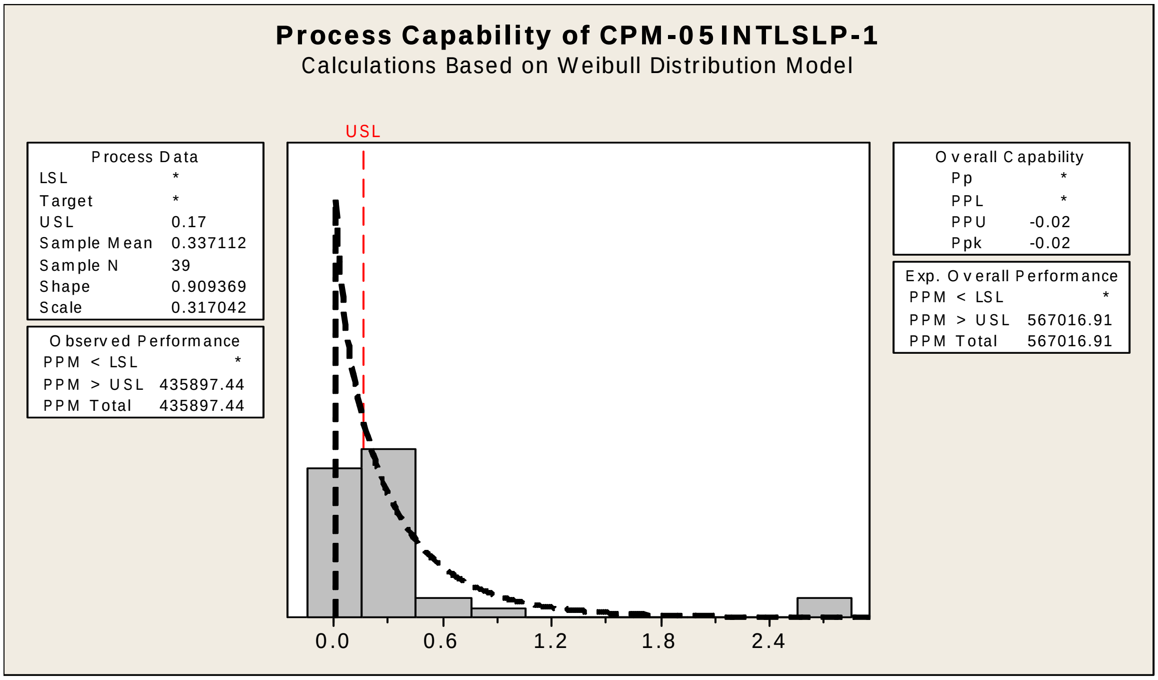
Descriptive Statistics: CPM-1999 DOUBLE-SLEEPER-1

Variable	Mean	StDev	Minimum	Median	Maximum
CPM-99DBL-SLP1	0.445	0.863	0.064	0.188	3.586



Descriptive Statistics: CPM-2005 INT'L SLEEPER-1

Variable	Mean	StDev	Minimum	Median	Maximum
CPM-05INTLSLP-1	0.3371	0.5626	0.0227	0.1568	2.6907



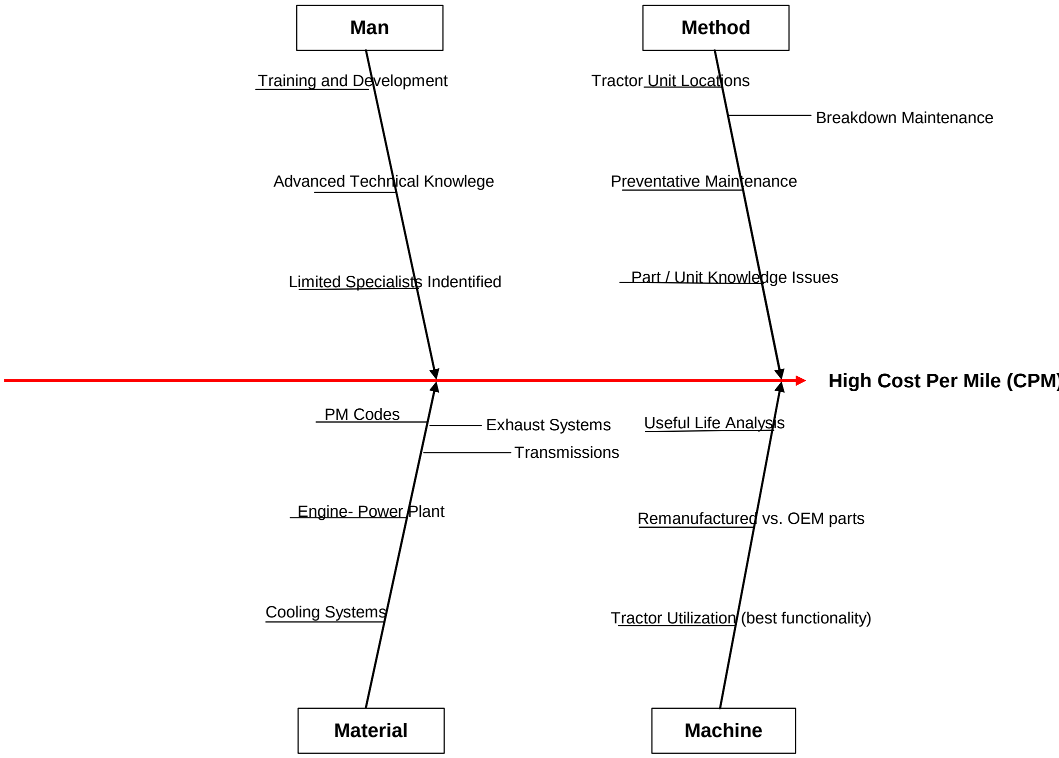
Target performance improvements were set for each of the focus four fleet types accordingly:

- 1998 International Conversion Daycab Tandem was targeted at $0.480
- 1998 Volvo Conversion Daycab Tandem was targeted at $0.320
- 1999 International Conversion Double Bunk Sleeper was targeted at $0.220
- 2005 International Conversion Ext Cab Tandem Sleeper $0.170

4.0 Data Analysis and Interpretation with Recommendations: Analyze and Improve

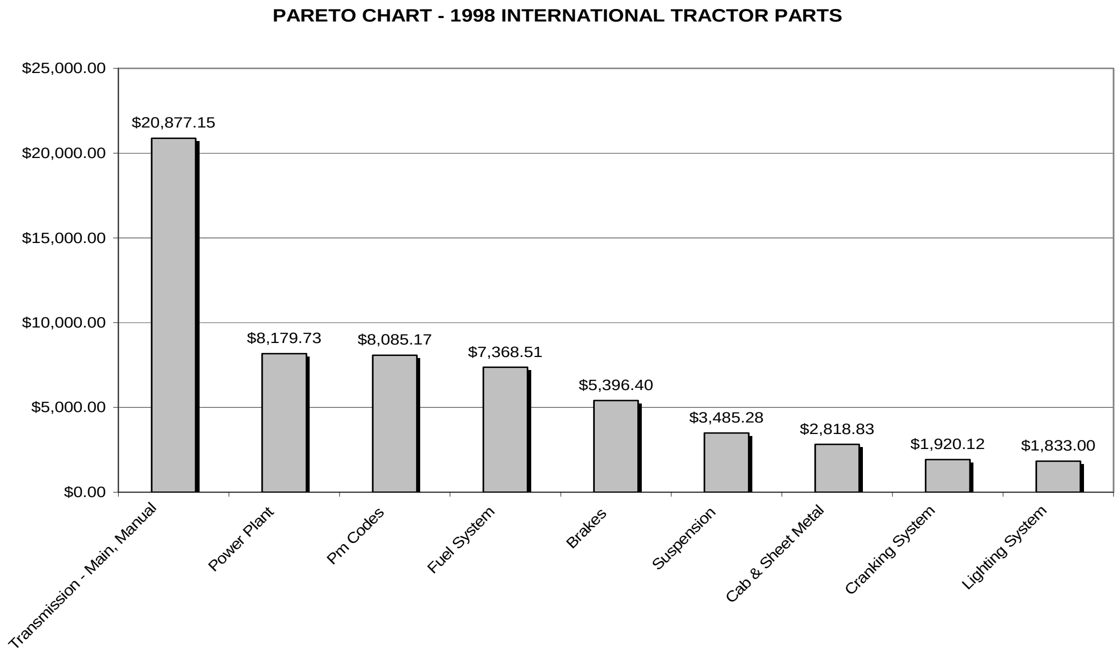
The following cause and effect diagram depicts identified potential causes to our focus four fleet's high CPM yield:

Focus Four Highest Cost Per Mile Tractor Units



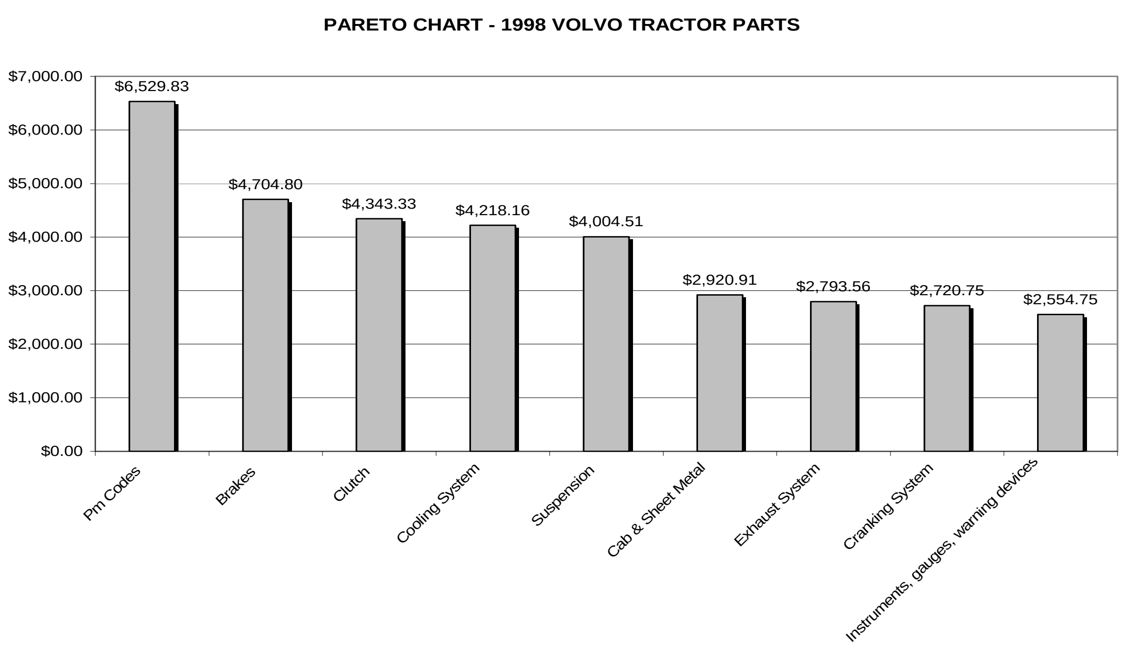
It was determined that the 1998 International's primary cause for maintenance cost and repair stemmed from transmission and power plant (engine) failures. The average odometer reading on this model was 625,421 miles. An action plan was deployed to mitigate utilization and/or "park" some units that have run their useful life. With this approach, we reduced weekly miles for the fleet type by 1,333 per week or 4.79%. Placing applicable units in a "park" status to not be used entirely or placing the unit in its proper functionality accomplished this. We performed an observational study to isolate where we had them and educated our operations personnel on the best functionality of the unit while minimizing disruption to the company's service product.

The following Pareto Chart details the components generating the highest cost for this model:



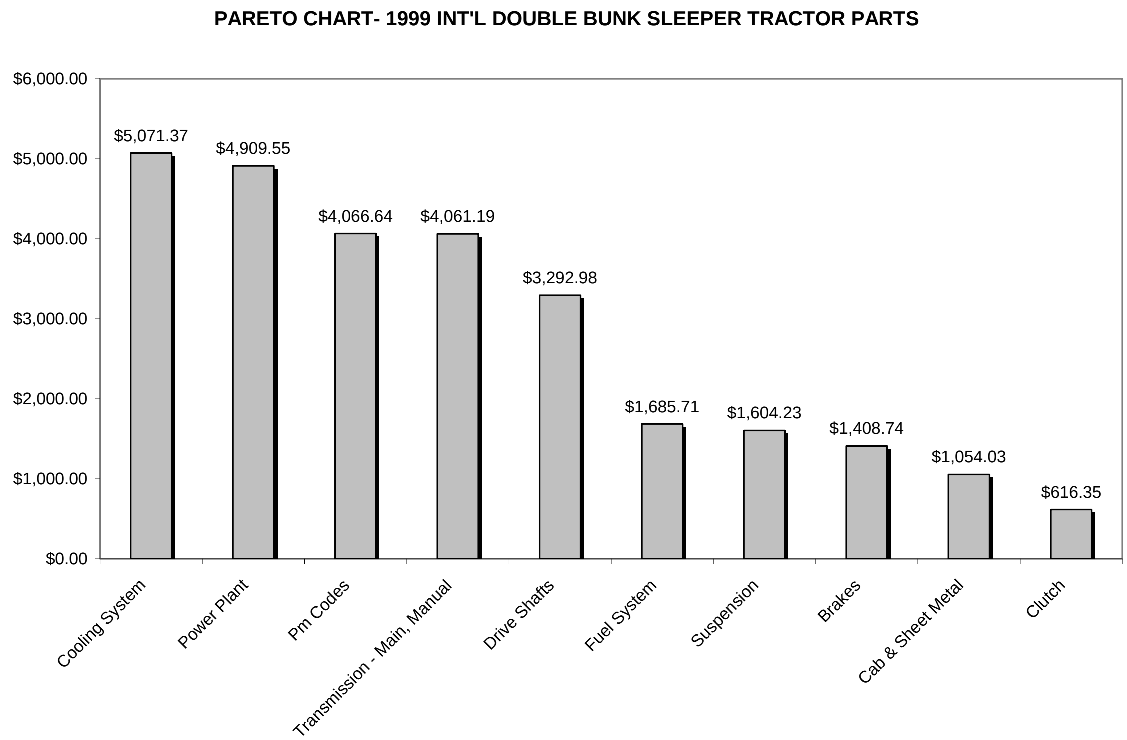
The analysis of the 1998 Volvo model led to a system-wide analysis of the (PM Code) preventative maintenance process. Current process was to PM a tractor every 90 days or 30,000 miles. The analysis yielded that PM Codes were being performed on average at every 18,190 miles due to the system's indicator for a PM Code being triggered on days first then miles second. The average cost for a PM Code ran at $225.00 per work order performed. We implemented a process change to PM Code tractors at 30,000 miles or no longer than 120 days between cycles.

The following Pareto Chart details the highest component costs for this model:



A study was performed on cooling system failures on the 1999 Int'l Double Bunk Sleepers. The likelihood of a breakdown occurred as models approached 1,000,000 miles. Corrective action was put in place to flag units in the system as they approached 750,000 miles. At the unit's next service, they will have the radiators switched out to prevent road breakdowns. Again for this model due to high costs for power plant and transmission failures and an average odometer of 851,267 a proper utilization strategy was deployed analogous to the 1998 International process. Although miles per week driven increased 1,602 miles or 4.74%, CPM was reduced $0.28 due to placing the units in a best functionality position to perform at higher levels.

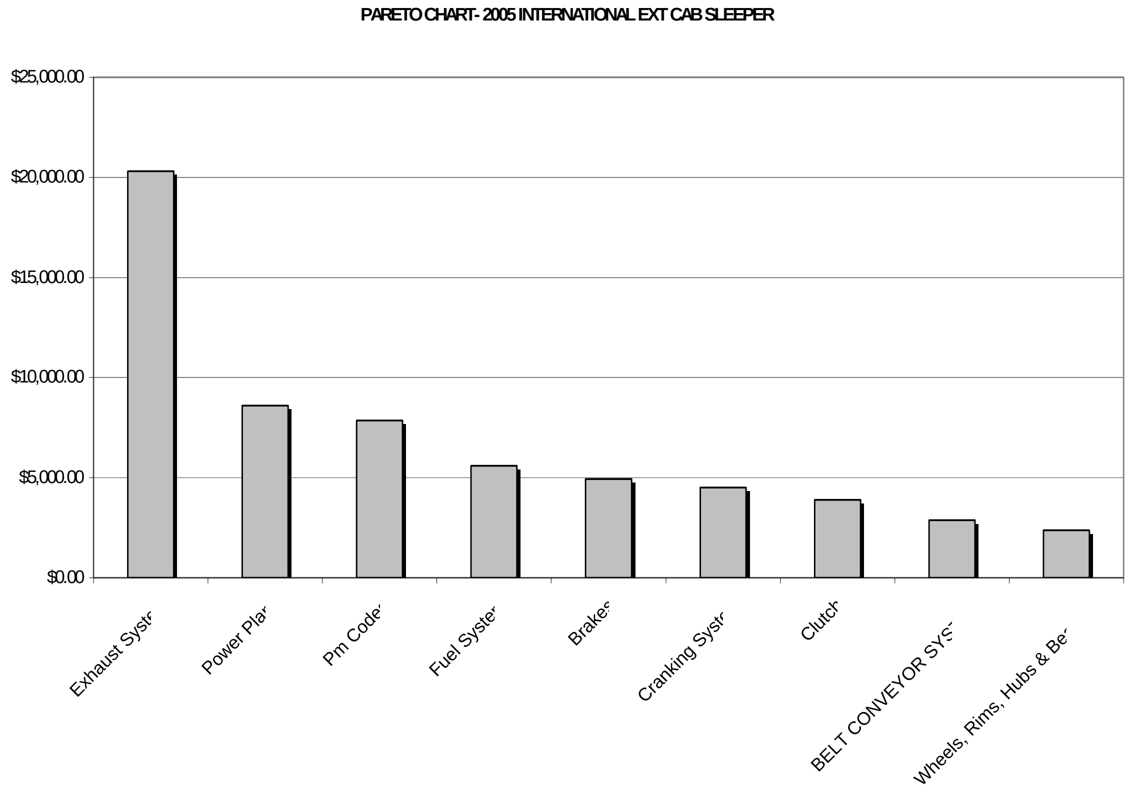
The following Pareto Chart details the highest component cost for this model:



The analysis of the 2005 International Ext Cab Tandem Sleeper model revealed an exhaust manifold bracketing issue. The piping system was not supported adequately. Therefore, a solution was implemented to properly secure and mitigate the issue.

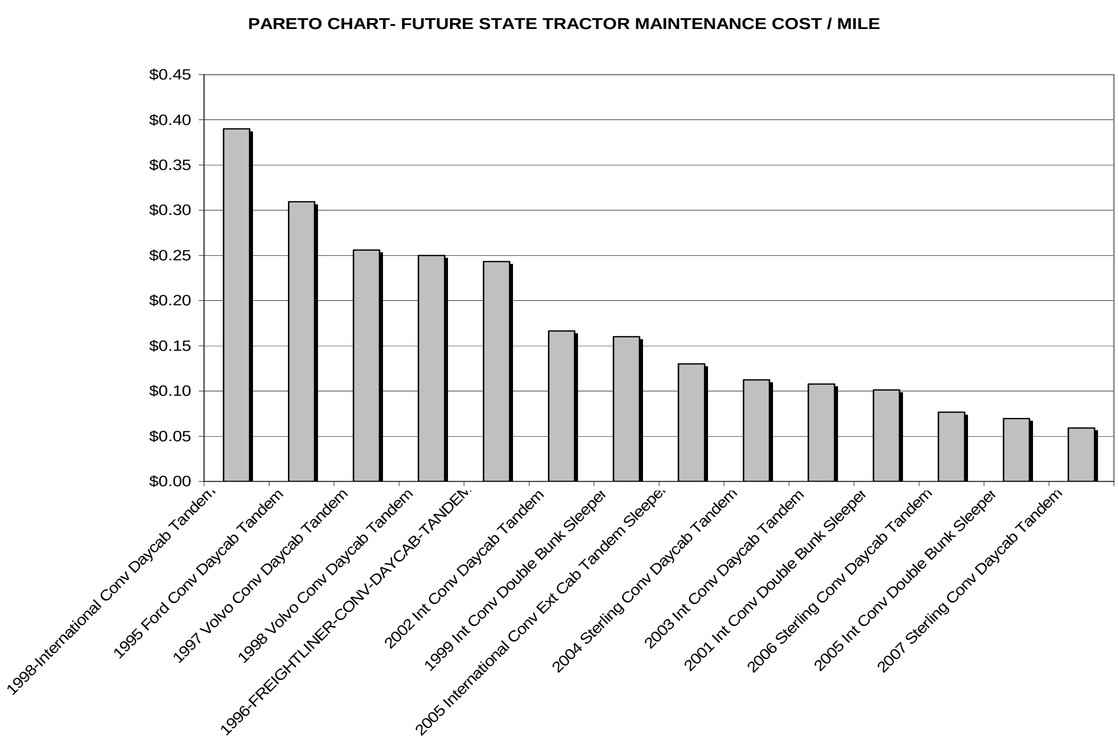
For this model as well, an action plan to mitigate utilization was deployed reducing miles per week driven by 4,338 or 4.64%.

The following Pareto Chart details the highest component cost for this model:



5.0 Improve: Future State

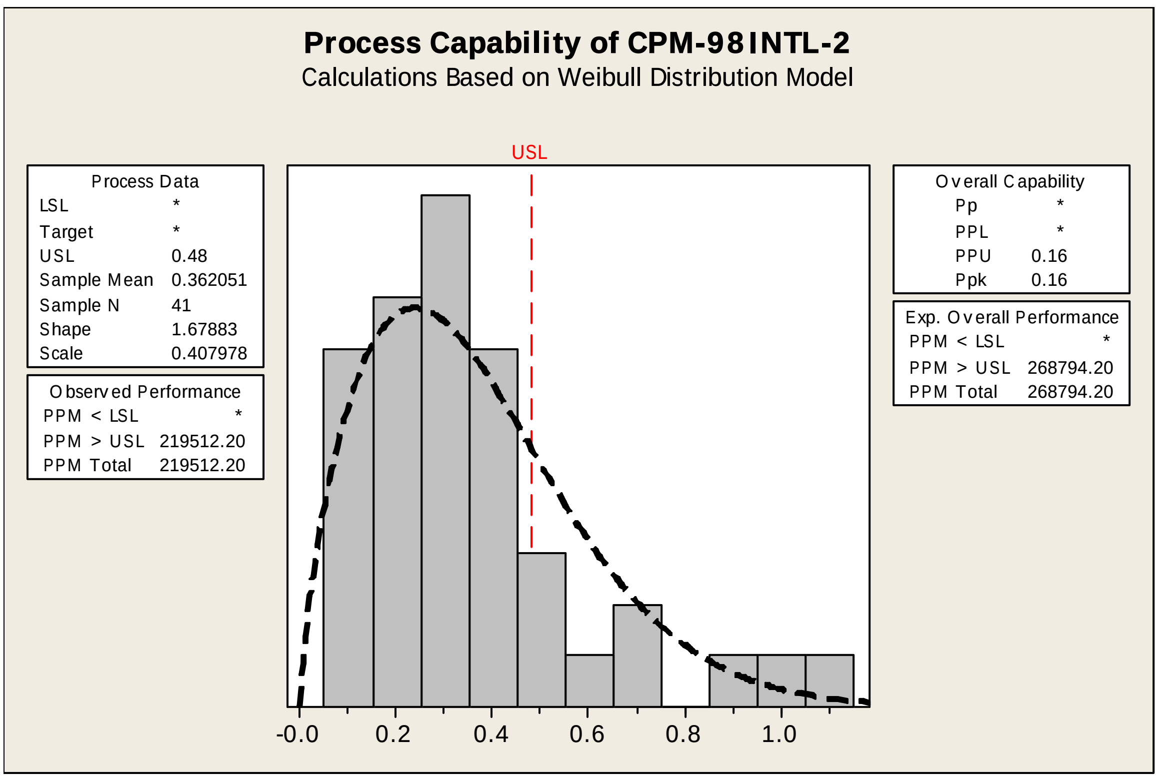
Future state process capability:



	MILES PER WEEK			COST PER MILE			
DESCRIPTION	CURRENT	FUTURE	DIFF MPW	CURRENT	FUTURE	CPM DIFF	$WK DIFF
1998-International Conv Daycab Tandem	27,792.58	26,459.48	-1,333.10	$0.91	$0.39	($0.52)	$ 13,699.21
1998 Volvo Conv Daycab Tandem	23,802.52	22,838.69	-963.83	$0.36	$0.25	($0.11)	$ 2,512.26
1999 Int Conv Double Bunk Sleeper	32,152.25	33,754.38	1,602.13	$0.44	$0.16	($0.28)	$ 9,451.23
2005 International Conv Ext Cab Tandem Sleeper	93,461.01	89,122.17	-4,338.84	$0.17	$0.13	($0.04)	$ 3,154.92
						WK	$ 28,817.61
						ANNUAL	$ 1,498,515.83

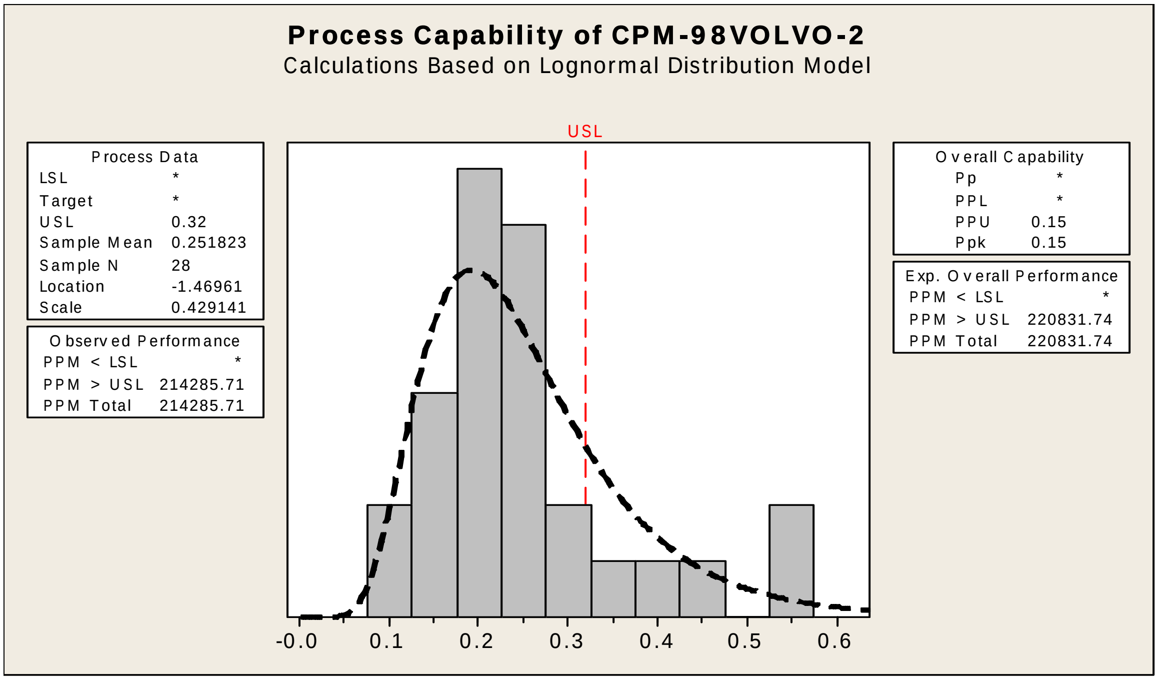
Descriptive Statistics: CPM-1998 INT'L-2

Variable	Mean	StDev	Minimum	Median	Maximum
CPM-98INTL-2	0.3621	0.2354	0.0571	0.2892	1.1304



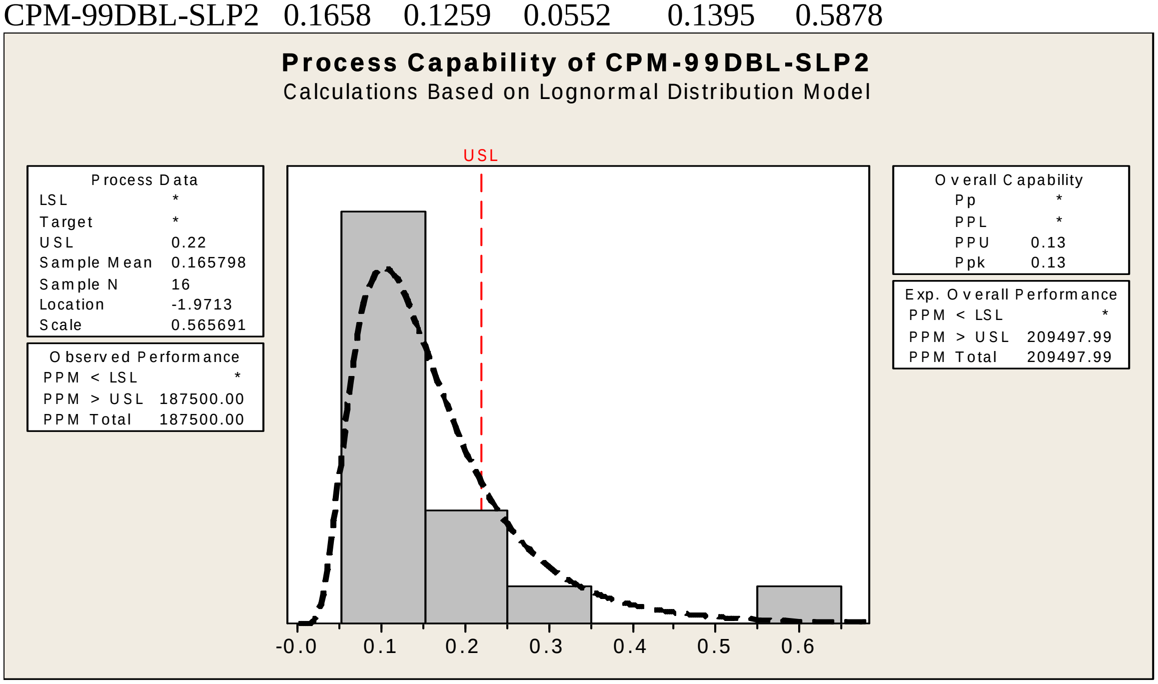
Descriptive Statistics: CPM-1998 VOLVO-2

Variable	Mean	StDev	Minimum	Median	Maximum
CPM-98VOLVO-2	0.2518	0.1156	0.0878	0.2286	0.5613



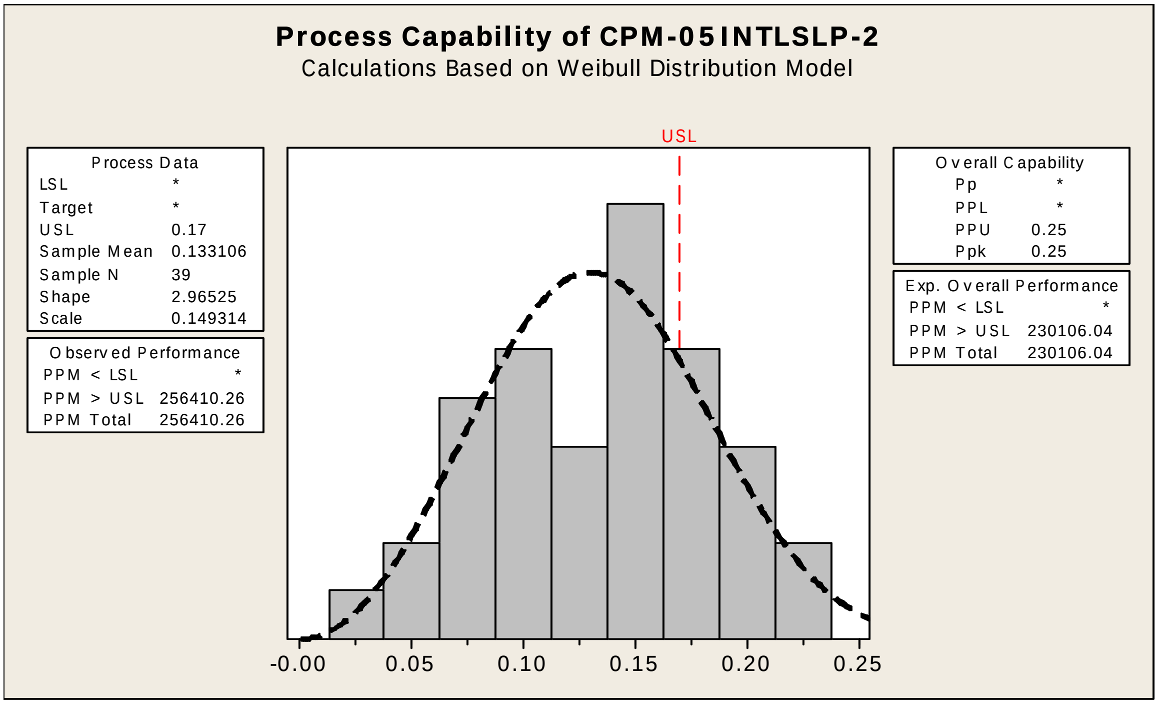
Descriptive Statistics: CPM-1999DOUBLE-SLEEPER-2

Variable	Mean	StDev	Minimum	Median	Maximum
CPM-99DBL-SLP2	0.1658	0.1259	0.0552	0.1395	0.5878



Descriptive Statistics: CPM-2005 INT'L SLEEPER-2

Variable	Mean	StDev	Minimum	Median	Maximum
CPM-05INTLSLP-2	0.13311	0.05048	0.03007	0.13951	0.23276

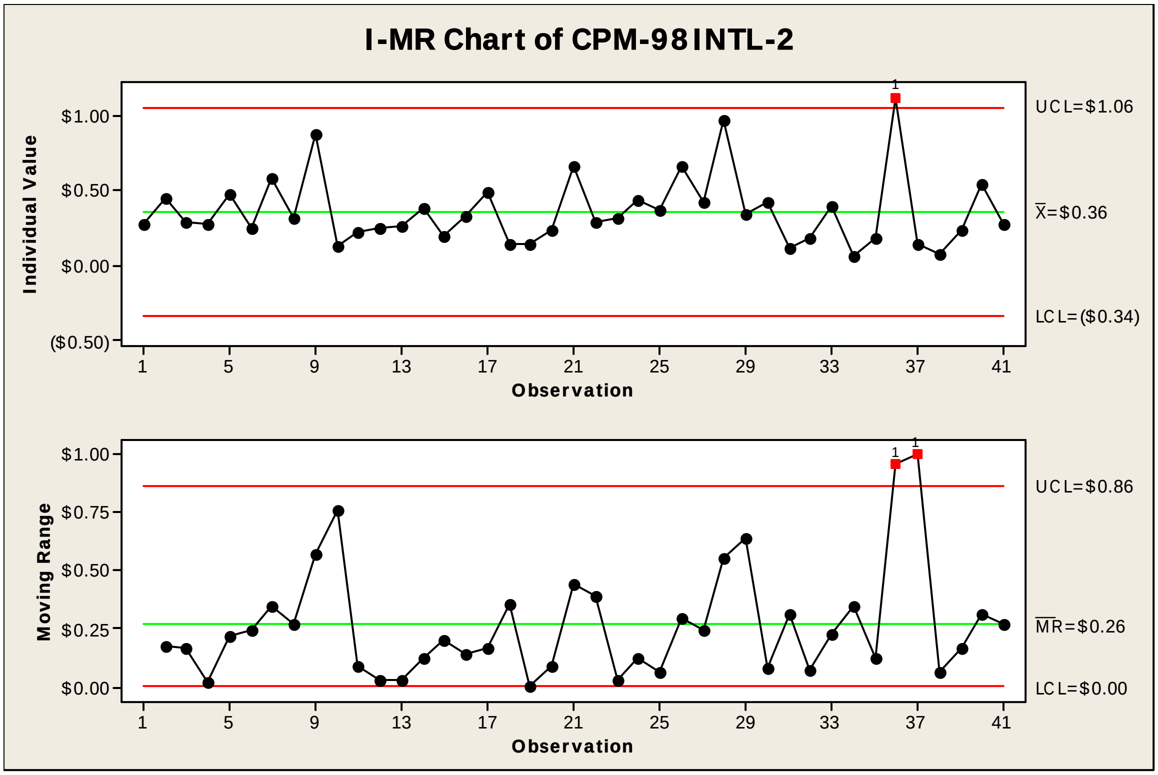


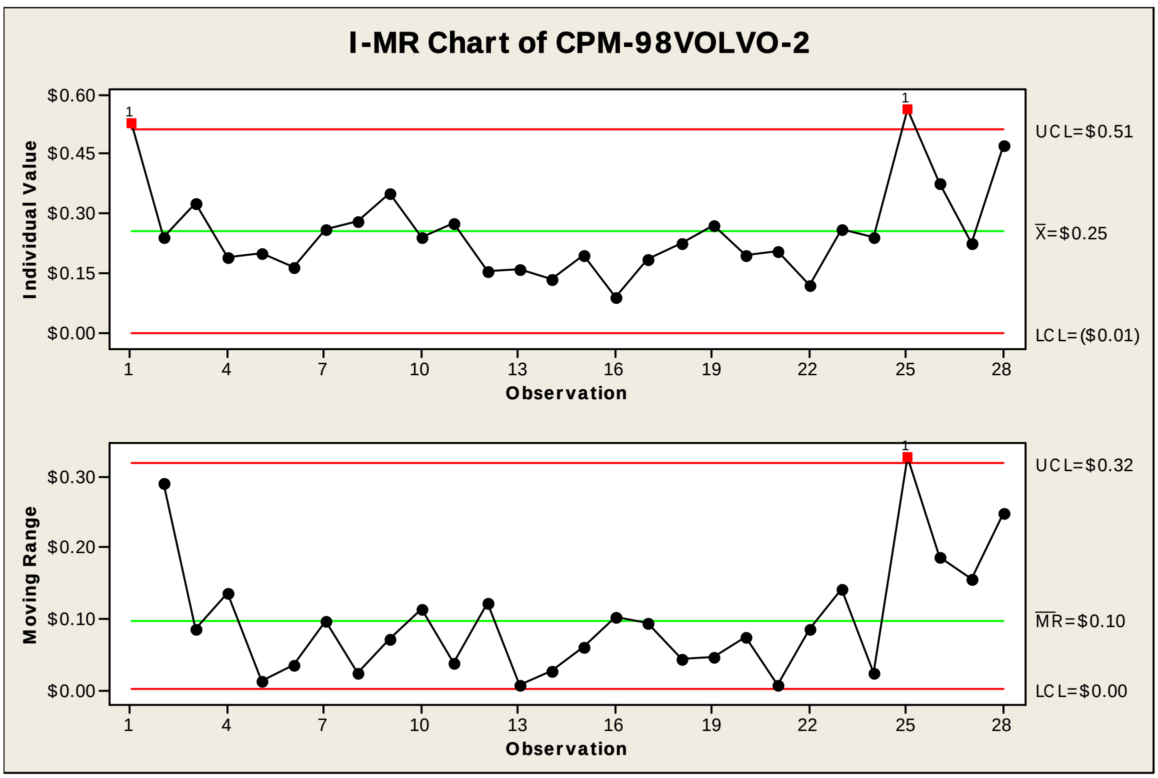
6.0 Control

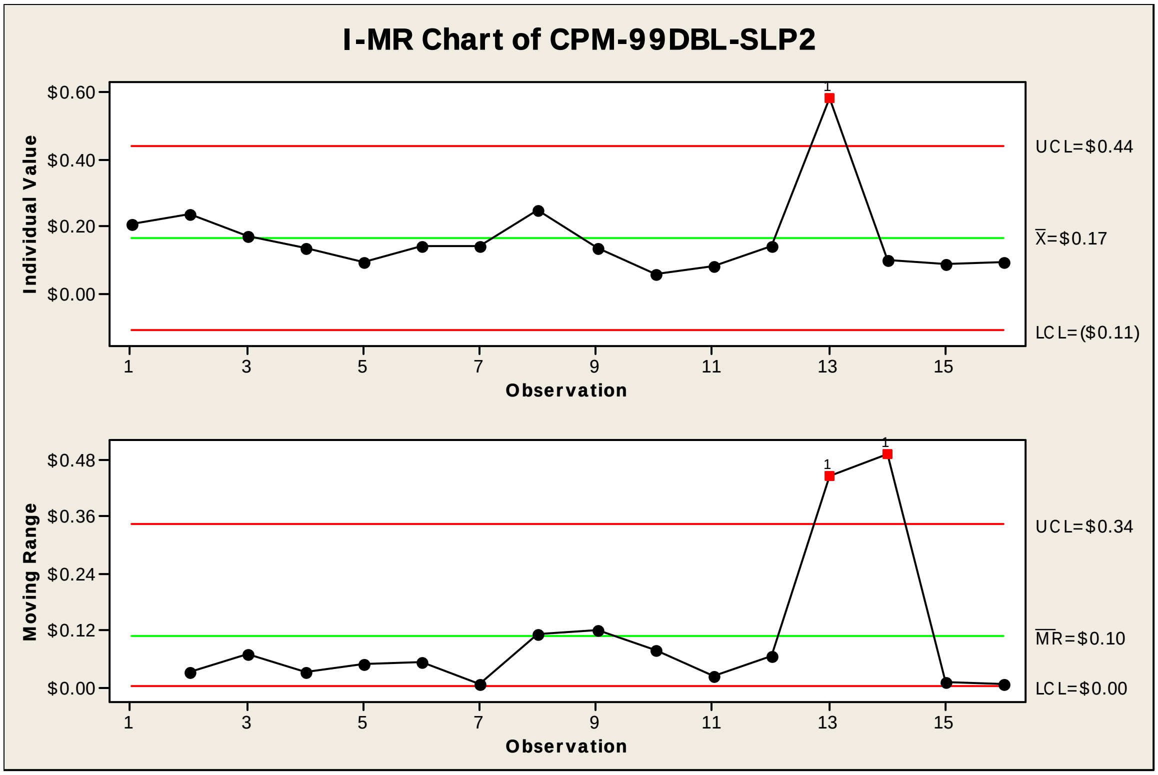
To control what we have implemented we will use the following tools:

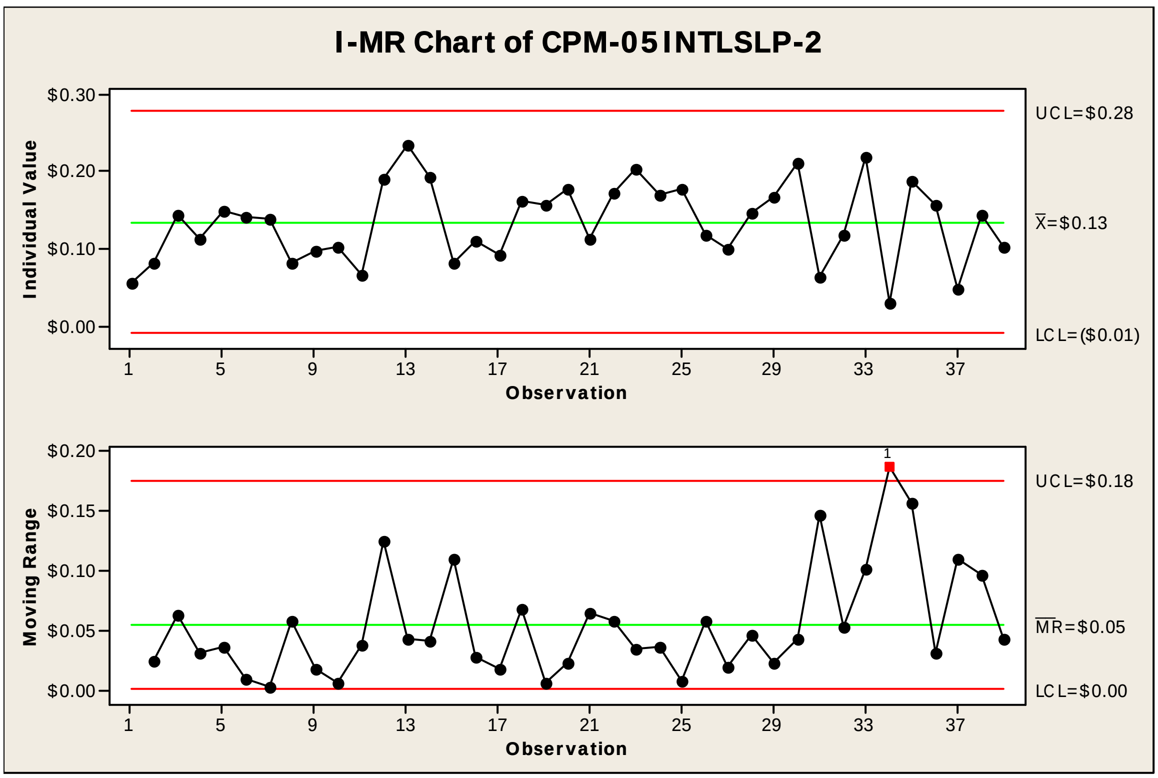
- Standardized work
- Data collection and reporting
- Control charts (I-MR and X-bar)
- Run charts and Pareto charts for trending

The newly created staffing model for each shop location will provide process consistency as to how we establish headcount and labor hours based on asset counts. Standardized performance metrics coupled with a data collection, analysis, and a reporting plan will be designed to identify under performing shops and individuals. Training through our identified specialists will limit variation and ensure proper efficient training application throughout the shops. An example of the I-MR control charts has been included for the focus four fleet's cost per mile analyzed in this project. We will continue and expand this level of analysis to all fleets and asset type i.e. tractor, trailer, and forklift in the future. Data will be collected, analyzed, and a reporting plan established to measure asset costs by component code, miles utilized, unit odometer reading, CPM, and breakdowns. We will use Pareto and run charts to visually trend this data over time.


I-MR Chart of CPM-98INTL-2
Individual Value
$1.00
$0.50
$0.00
($0.50)
UCL=$1.06
X̄=$0.36
LCL=($0.34)
1
5
9
13
17
21
25
29
33
37
41
Observation
Moving Range
$1.00
$0.75
$0.50
$0.25
$0.00
UCL=$0.86
M̄R̄=$0.26
LCL=$0.00
Observation


I-MR Chart of CPM-98VOLVO-2
Individual Value
$0.60
$0.45
$0.30
$0.15
$0.00
UCL=$0.51
X̄=$0.25
LCL=($0.01)
1
4
7
10
13
16
19
22
25
28
Observation
Moving Range
$0.30
$0.20
$0.10
$0.00
UCL=$0.32
M̄R̄=$0.10
LCL=$0.00
Observation


I-MR Chart of CPM-99DBL-SLP2
Individual Value
$0.60
$0.40
$0.20
$0.00
UCL=$0.44
X̄=$0.17
LCL=($0.11)
Observation
Moving Range
$0.48
$0.36
$0.24
$0.12
$0.00
UCL=$0.34
MR̄=$0.10
LCL=$0.00
Observation


I-MR Chart of CPM-05INTLSLP-2
Individual Value
$0.30
$0.20
$0.10
$0.00
UCL=$0.28
X̄=$0.13
LCL=($0.01)
Observation
Moving Range
$0.20
$0.15
$0.10
$0.05
$0.00
UCL=$0.18
MR̄=$0.05
LCL=$0.00
Observation

7.0 Conclusion

With rising fuel costs and a slow freight cycle, our primary service provider, DCE, has challenged us to reduce costs in parts and labor expenses as a percentage of their revenue. We understood to gain an immediate impact we would first start to analyze labor costs and second engage the more complex problems driving our tractor fleet's part consumption.

Following a Six Sigma strategy, inconsistencies were determined to exist in the shop's scheduling and staffing requirements. We also had limited productivity metrics in place to assess performance. We engineered the shop-staffing model, built in standards and accountability to reduce labor payroll costs by 24%.

Executing a data driven philosophy, we stratified our tractor units by fleet type to determine our highest cost units. From there we dug deeper to understand what was driving the high costs in four primary fleet types. The focus four fleets included the 1998 International Conversion Daycab Tandem, 1998 Volvo Conversion Daycab Tandem, 1999 International Double Bunk Sleeper, and 2005 International Conversion Ext Cab Tandem Sleeper. These units were decomposed to root cause issues by component code, miles driven, and utilization by our operations group. This approach led to an overall tractor unit CPM reduction of 9.8%. A 16% reduction was achieved on our focus four highest cost tractor fleets.