Improve Trash Pick up Route 11

Project Start: 10/26/09
Project Revision: 11/18/09
Project Champion: Dan Brotton
Black/Green Belt: Drew Brown

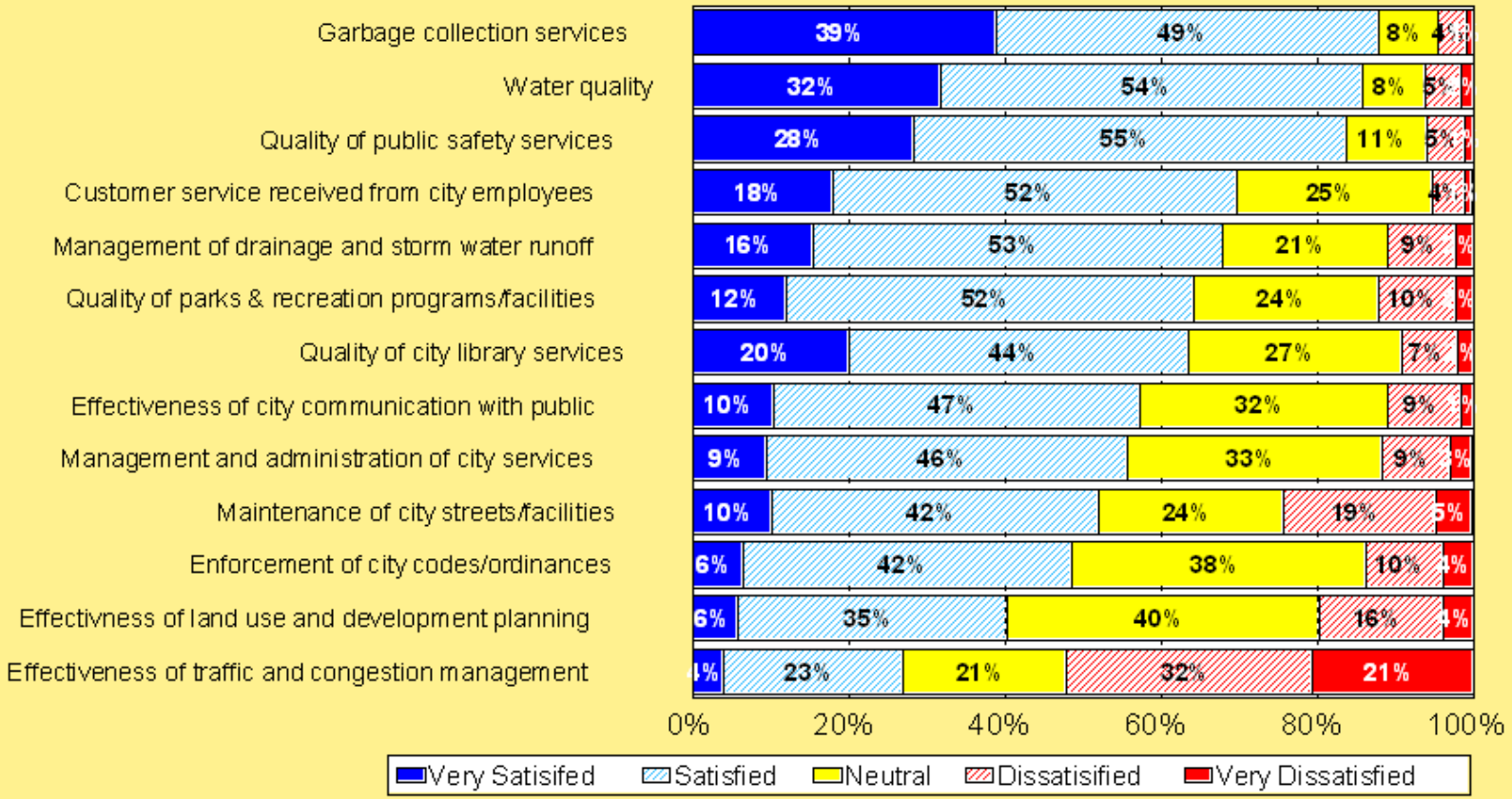
Tyler Solid Waste

- Through the Tyler 21 Comprehensive Planning Process, the citizens of Tyler responded to a survey that shows they are most satisfied with the Tyler Solid Waste garbage collection service as compared to other City services.

Solid Waste is #1

Q3. Level of Satisfication with Major City Services in the City of Tyler

by percentage of respondents (excluding "don't know" responses)

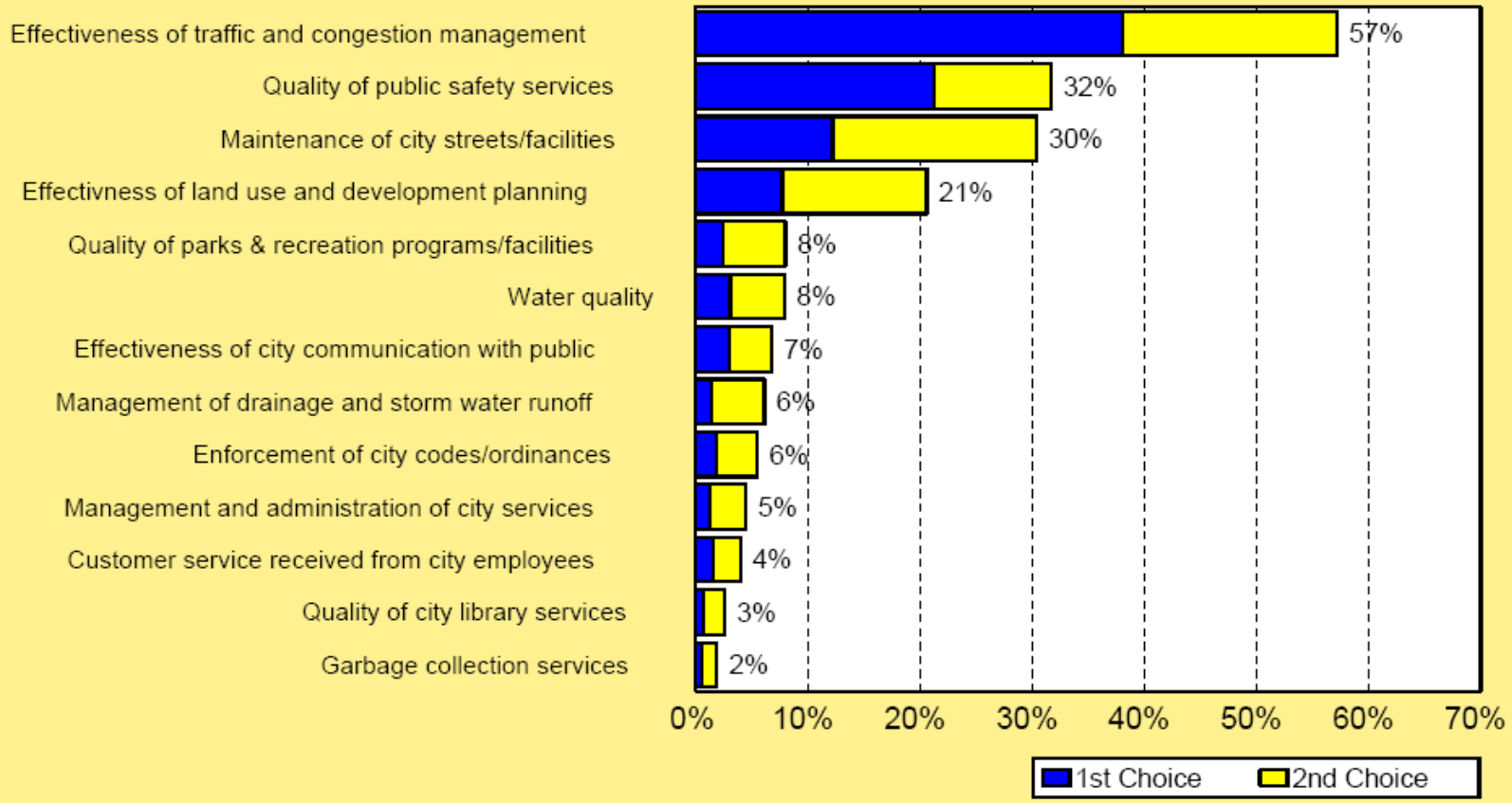


Source: ETC Institute (Tyler 2006)

Solid Waste needs the least attention

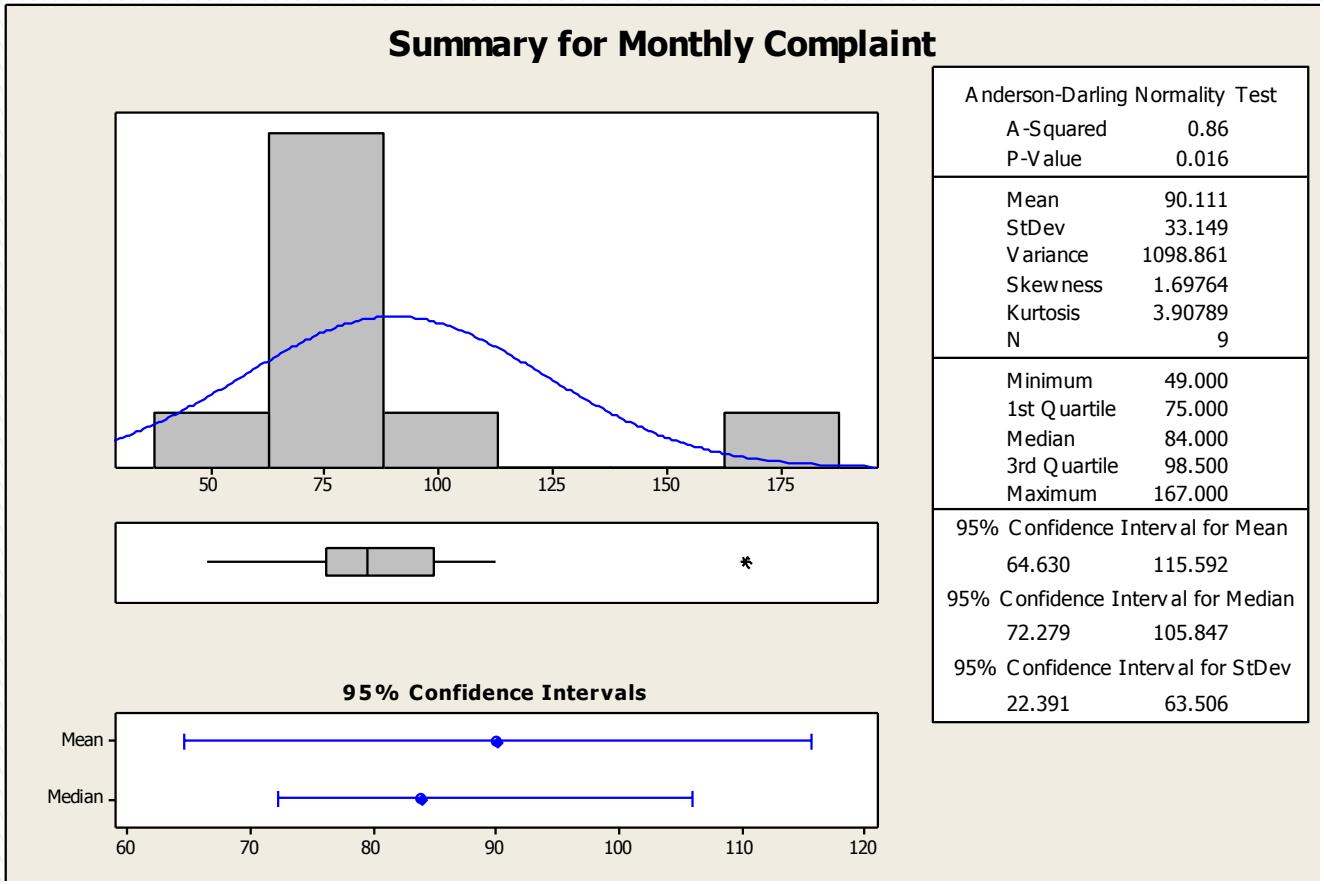
Q4. Items That Should Receive the Most Emphasis from City Leaders Over the Next THREE Years

by percentage of respondents who selected the item as one of their top two choices



Source: ETC Institute (Tyler 2006)

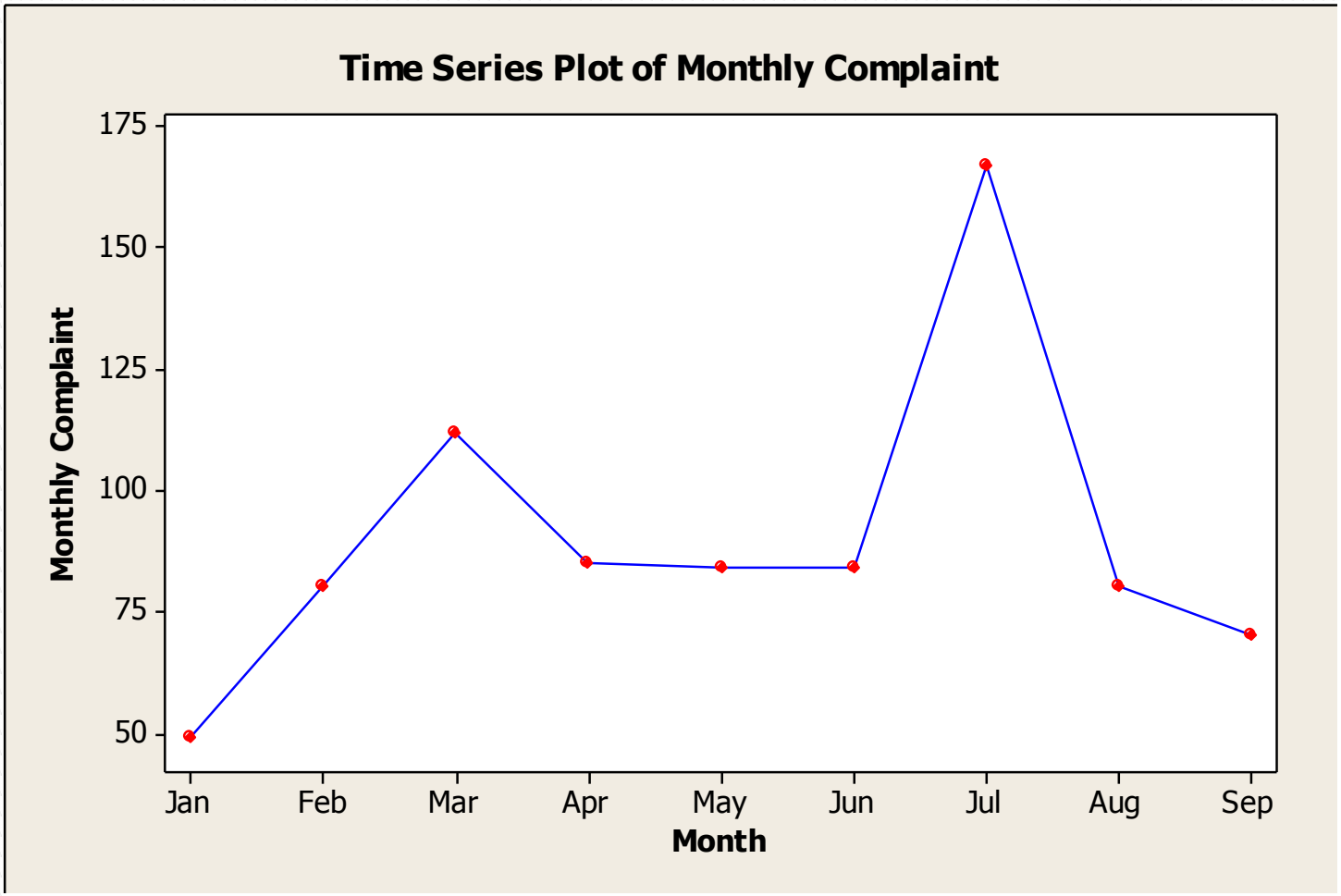
Monthly Call-ins for Jan 09 to Sept 09



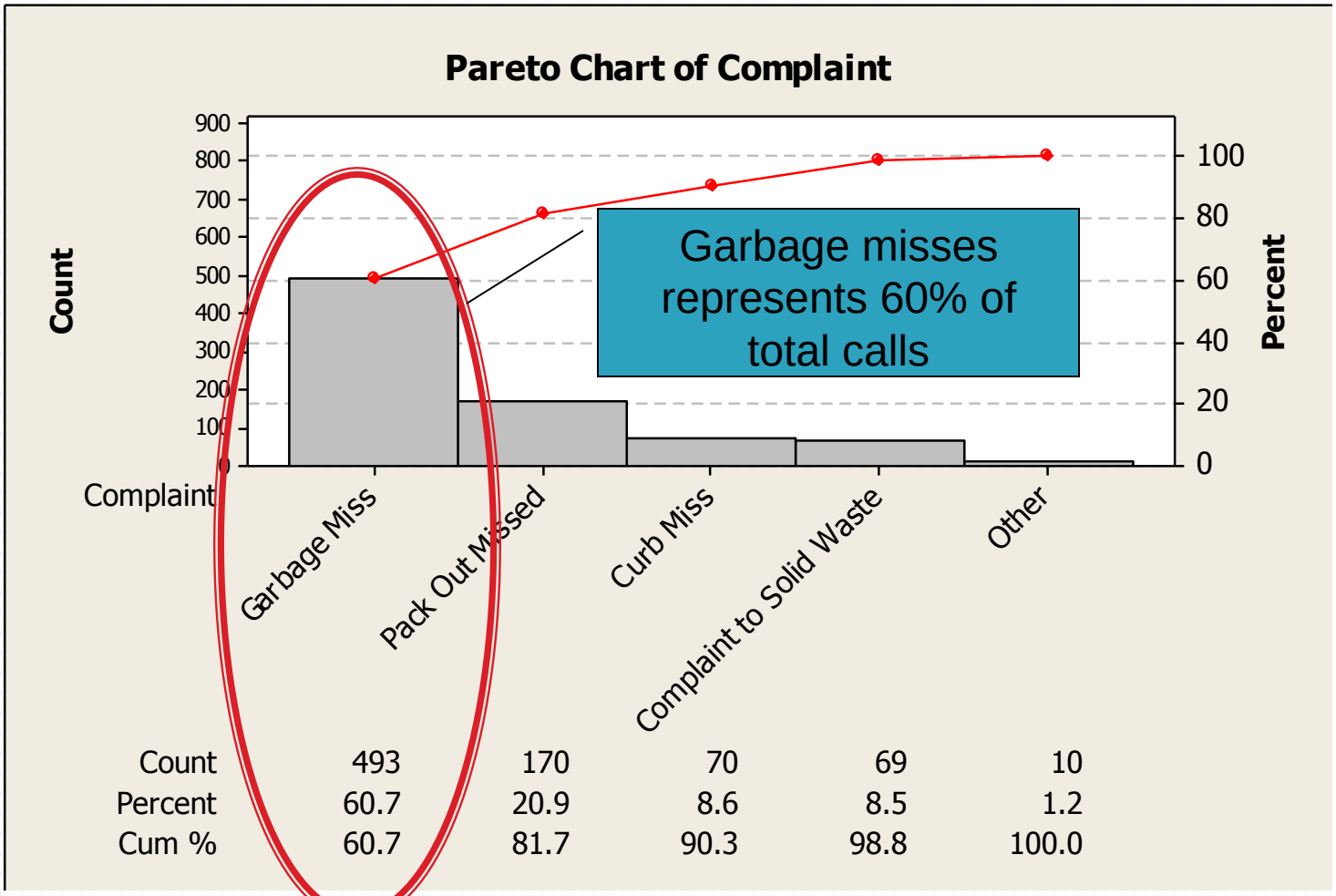
Anderson-Darling Normality Test	
A-Squared	0.86
P-Value	0.016
Mean	90.111
StDev	33.149
Variance	1098.861
Skewness	1.69764
Kurtosis	3.90789
N	9
Minimum	49.000
1st Quartile	75.000
Median	84.000
3rd Quartile	98.500
Maximum	167.000
95% Confidence Interval for Mean	
64.630	115.592
95% Confidence Interval for Median	
72.279	105.847
95% Confidence Interval for StDev	
22.391	63.506

Mean	90.11
STDEV	33.15

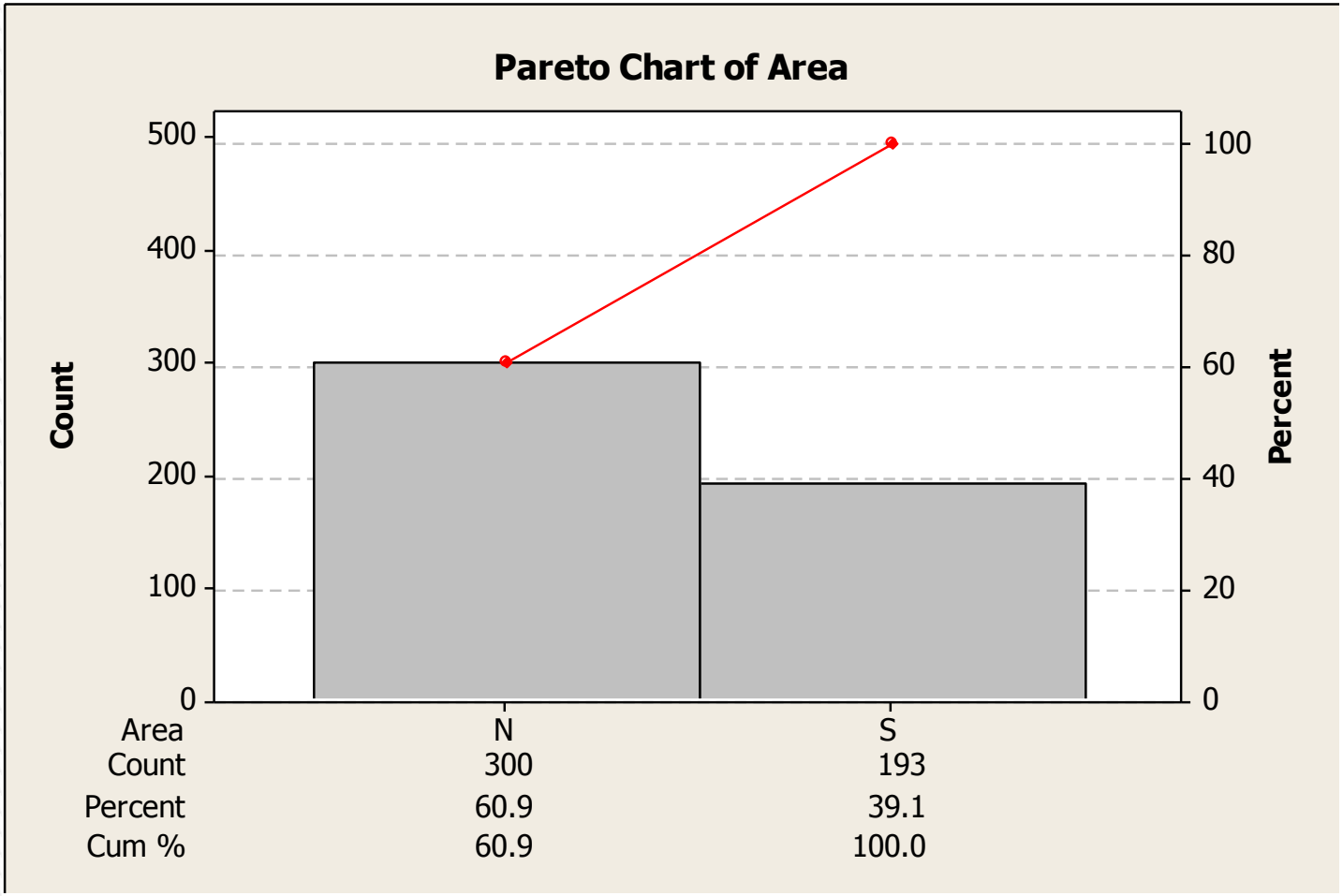
Time Series plot of call-ins over the course of year.



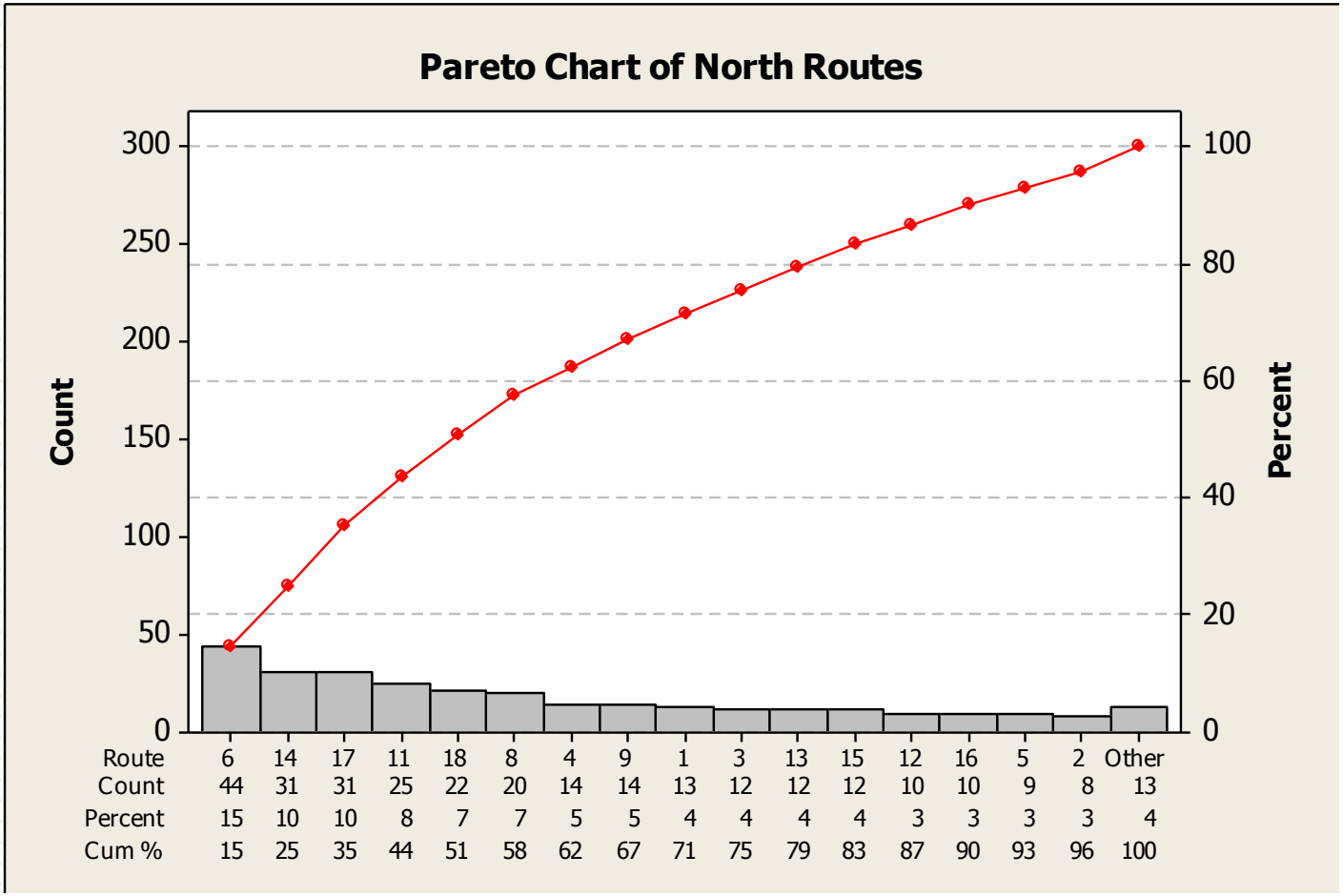
Time Series plot of call-ins over the course of year.



Majority of calls from North customers

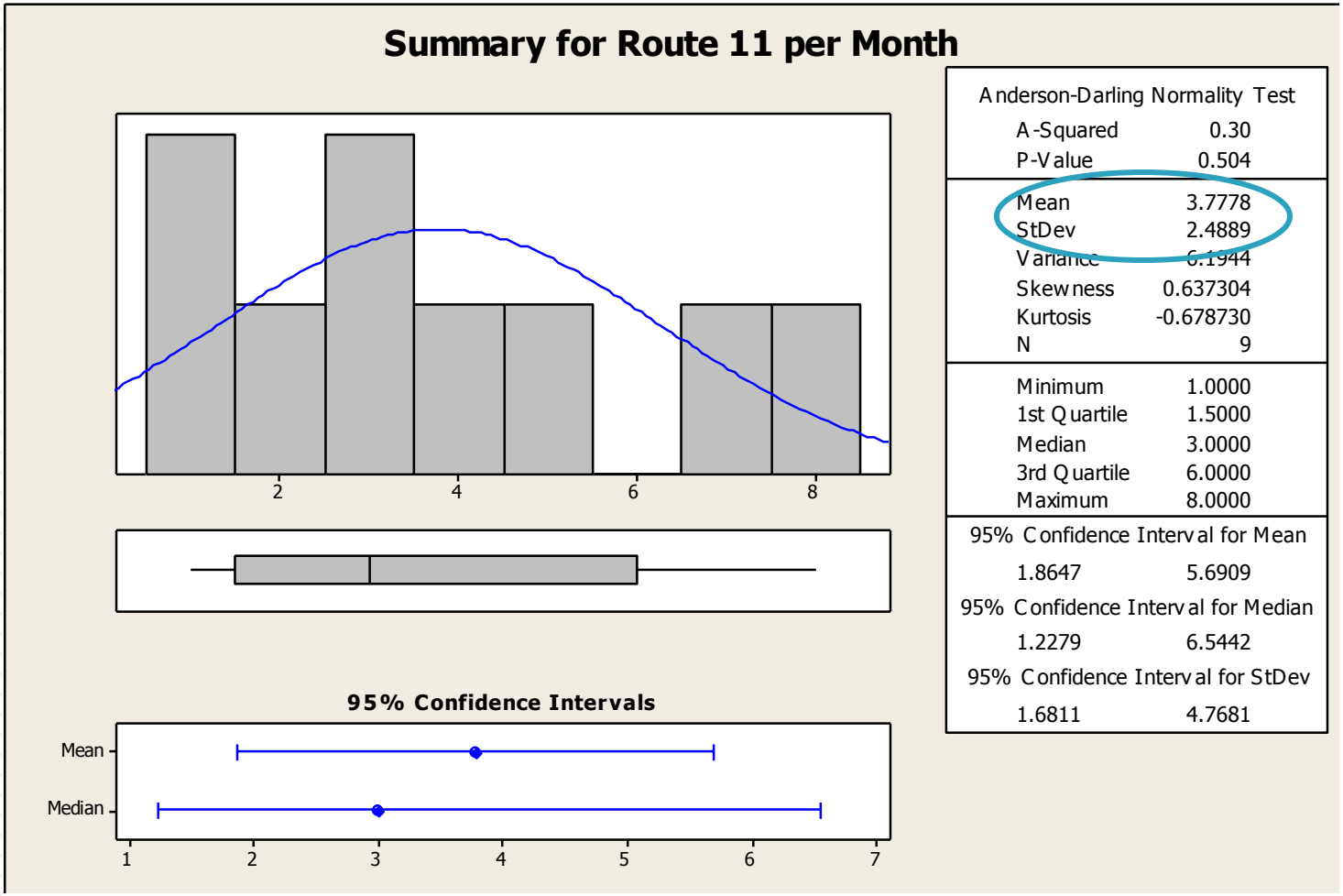


Route ranking for most call-ins.



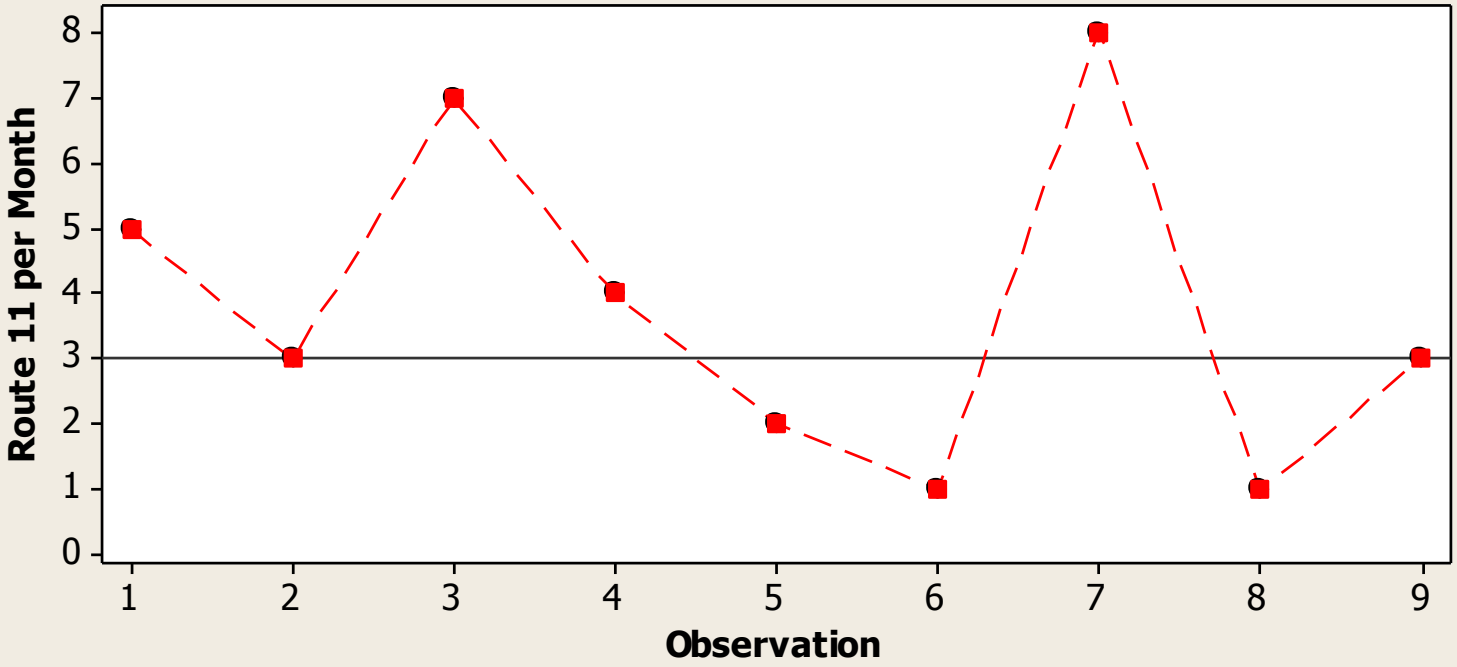
Define Phase
1. Select Output Characteristic

Summary for Call-in for Route 11



Anderson-Darling Normality Test	
A-Squared	0.30
P-Value	0.504
Mean	3.7778
StDev	2.4889
Variance	6.1944
Skewness	0.637304
Kurtosis	-0.678730
N	9
Minimum	1.0000
1st Quartile	1.5000
Median	3.0000
3rd Quartile	6.0000
Maximum	8.0000
95% Confidence Interval for Mean	
1.8647	5.6909
95% Confidence Interval for Median	
1.2279	6.5442
95% Confidence Interval for StDev	
1.6811	4.7681

Run Chart for Route 11



Number of runs about median:	6
Expected number of runs:	5.4
Longest run about median:	2
Approx P-Value for Clustering:	0.656
Approx P-Value for Mixtures:	0.344

Number of runs up or down:	6
Expected number of runs:	5.7
Longest run up or down:	3
Approx P-Value for Trends:	0.616
Approx P-Value for Oscillation:	0.384

Project Charter

Project Charter

Project Authorization

Organization:	Champion:	Process Owner:
Solid Waste	Kristi Boyett	Dan Brotton
Project:		**Project #:**
Improve trash pick up		

Problem Statement:
As of Janurary 2009, there have been 812 customer complaints. Of those complaints 493 were for Garbage Miss. The North route has represented the majority of the complaints with 300 for garbage miss. Route 11 has averaged 3.8 complaints with a standard deviation of 2.5 complaints.

Project Objective:
Reduce the number of complaints, to average of .98 complaints with a minimal standard deviation

Estimated Defect Level:	Initial Goal:	Estimated Benefits:
3.8	75% improve	
Approval Date:	**Champion Signature:**	**Process Owner Signature:**
10/26/2009		
Estimated Completion Date:	**Project Leader:**	**Financial Analyst:**
1/29/2010	Drew Brown	

Project Team

Name	Role	Comments	Phone

Project Definition and Scoping

Metrics (unit of measure):
Quality Complaints from Customers, Route time, Land fill weight, Sigma score

Critical to Satisfaction (linkage to customer):
Trash picked up

Defect Definition (include opportunity):
Customer complaint for garbage missed

Scope of Project:
North 11 route

Problem Statement:

As of January 2009, there have been 812 customer call-ins. Of those call-ins 493 were for Garbage Miss. The North route has represented the majority of the call-ins with 300 for garbage miss. Route 11 has averaged 3.8 call-ins with a standard deviation of 2.5 call-ins.

Project Objective:

Reduce the number of call-ins, to average of .98 call-ins with a minimal standard deviation.

Cost of a Garbage Miss

The cost of a Garbage Miss is **$39.50** to the Department to correct this defect.

	Cost	Savings	
		75%	90%
Soft Dollars	$1,068.96	$801.72	$962.06
Hard Dollars	$827.04	$620.28	$744.34
Total Dollars	**$1,896**	**$1,422**	**$1,706.40**

Lean Sigma TYLER

Capability Analysis

Attribute Capability

Confidence -->	0.95
Units -->	785
Opportunities -->	80
TOP's -->	62,800
Defects -->	34

Sample data is:
- ○ Short Term
- ◉ Long Term

Confidence Interval is:
- ○ One-sided
- ◉ Two-sided

Long Term Capability

	p(d)	Percent	ppm	Ppk	Z		Defects	
Upper Limit on Failure Rate	0.0008	0.1%	756	1.06	3.17	<= "worst case" =>	48	95%
Nominal Value	0.0005	0.1%	541	1.09	3.27	<= "best estimate"	↕	Confidence
Lower Limit on Failure Rate	0.0004	0.0%	375	1.12	3.37	<= "best case"=>	24	Interval

Estimated Short Term Capability (shifted by 1.5 sigma)

	p(d)	Percent	ppm	Cpk	Z
Nominal Value	0.0000	0.0%	1	1.59	4.77

Lean Sigma TYLER

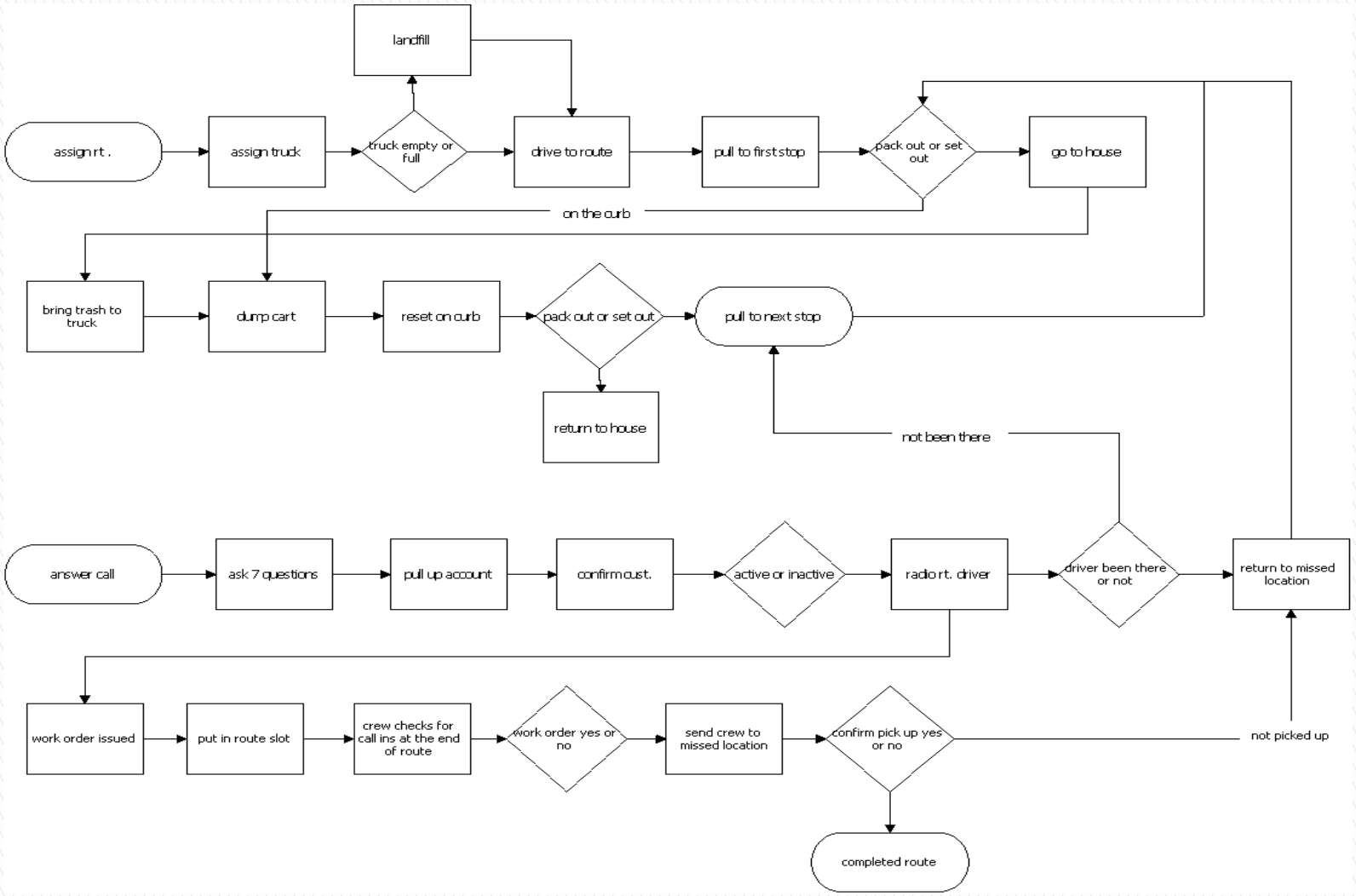
Measure Phase
5. Define Performance Objective

Defect Levels/Goals:

	Date	DPMO(LT)	Zbench(ST)	Cpk
Baseline	12/10/2009	541	3.27	1.09
Goal	2/26/2010	135	5.14	1.71
Stretch Goal	2/26/2010	54	5.40	1.80

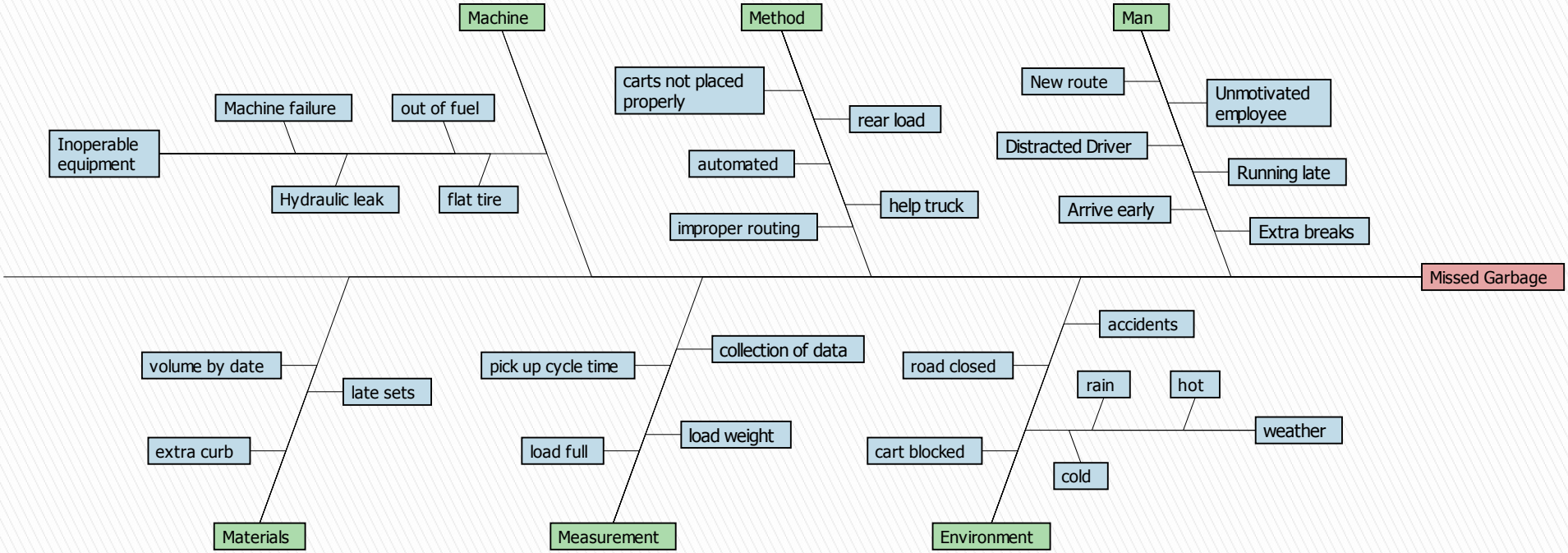
Measure Phase
6. Identify Variation Sources

Process flow map for trash pick up and call in process



Measure Phase
6. Identify Variation Sources

Fishbone Diagram



YX Diagram

YX Diagram Summary

Process:	
Date:	

Output Variables	
Description	Weight
Decrease the # of callins	9

Input Variables	
Description	Ranking
Carts not placed properly	81
Cart blocked	81
Collection of Data	81
Help Truck	81
Late Sets	81
Volume by Date	81
Distracted Driver	63
Extra Curb	63
Improper Routing	63
Arrive Early	63
Unmotivated Employee	63
Weather--hot/cold/raining/muddy at LF	63
Rearload for curbtrash	45
Inoperable Equipment	45
Running Late	45
New Route	45
Load Full-go to LF	45
Automated Service	27
Machine Failure	27
Accidents	9
Extra breaks	9
Flat Tire	9
Hydraulic Leak	9
Load Weight	9
Out of Fuel	9
Pickup Cycle Time	9
Road Closed	9

Analyze Phase
6. Identify Variation Sources

Cycle time for route 11

Process Measurement Sheet		Process																Date:				Demand per Shift		785
		Available Production Time Per Shift (Sec)													27000			Area:				Takt Time:		68.8
#	Element	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Avg Time	Capability	Operators
1	Set out	20.53	151.8	10.65	13.16	12.5	14.79	17.78	13.75	8.44	147.4	13.57	11.28	20.19	72.91	12.37	13.82	10.5	12.53	12.81	14.85	30.28	892	0.44
2	Pack out	81.69	45.44	26.94	31.84	25.25	18.72	41.56	47.69	36.06	27.75	58.53	40.91	54.56	44.28	43.51	56.4					42.57	634	0.62
3																								
4																								
5																								
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11																								
12																								
13																								
14																								
15																								
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19																								
20																								
																				Totals		72.85	371	1.06

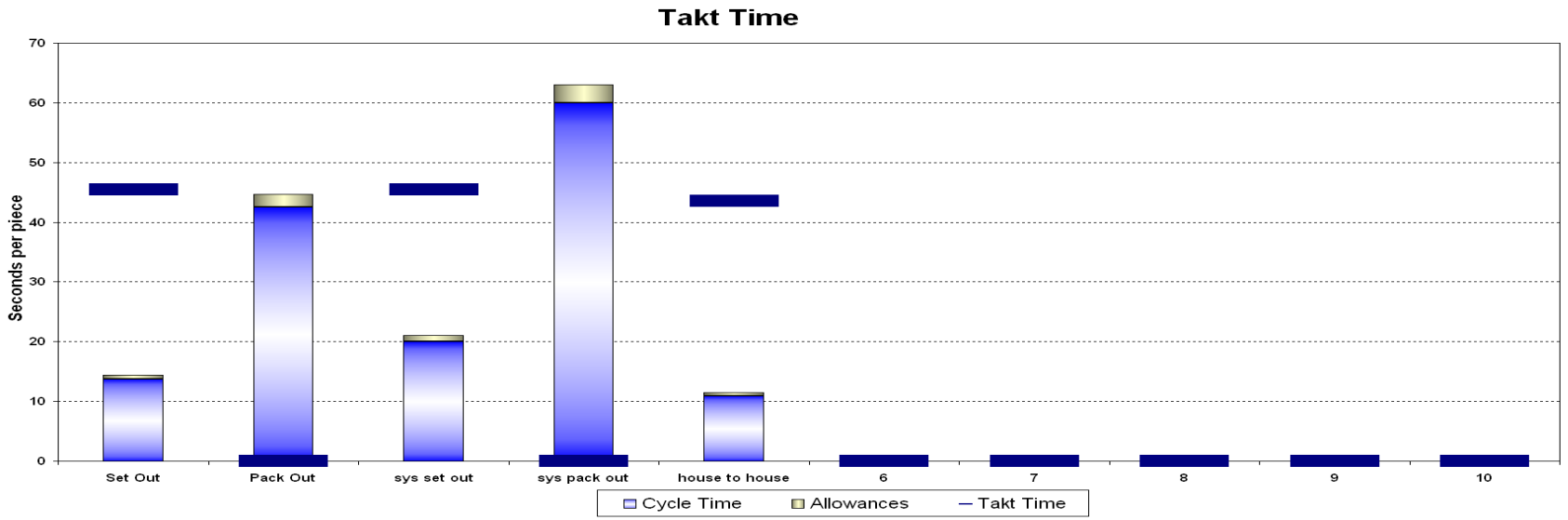
Based on cycle times only 1 truck is needed.

Analyze Phase
6. Identify Variation Sources

Variable: Cycle time and Takt time for route 11

STANDARD WORK TO TAKT TIME

Operation		Date	



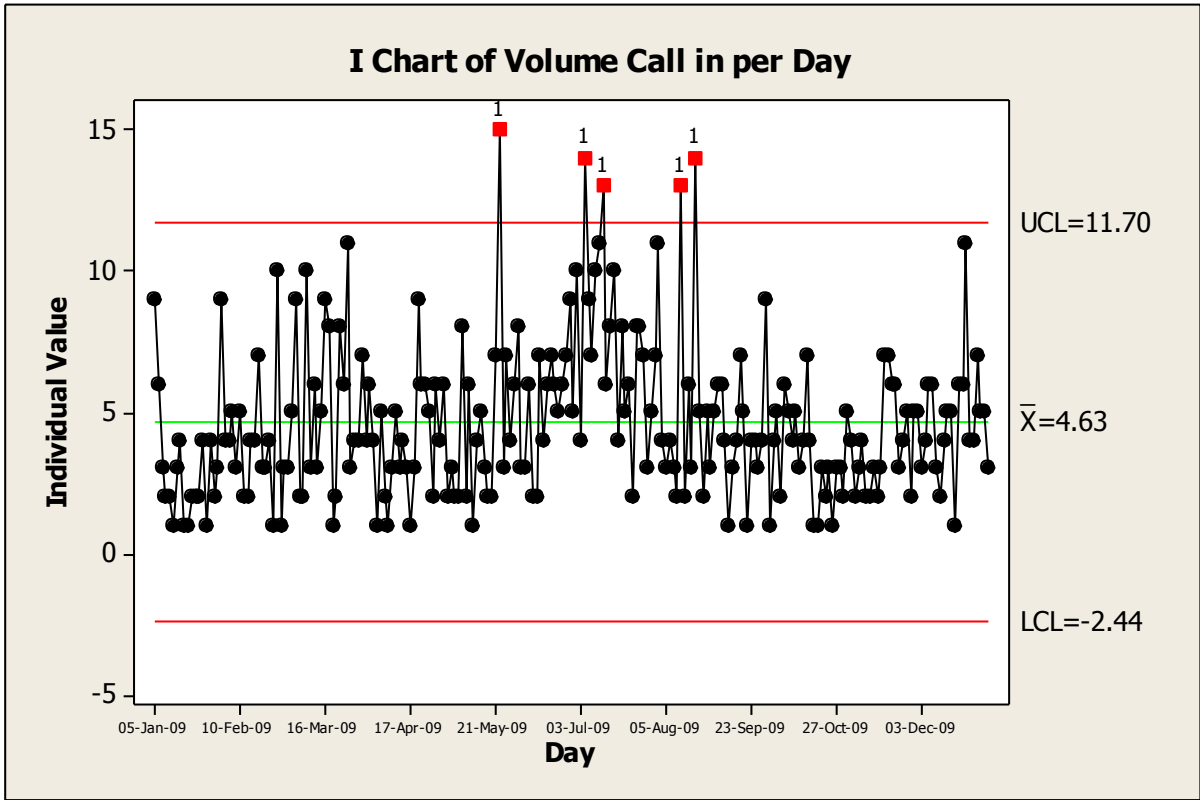
Operation/Operator	Set Out	Pack Out	sys set out	sys pack out	house to house	6	7	8	9	10
Cycle Time	13.7	42.6	20.0	60.0	10.9					
Average demand per day:	753	32	753	32	785					
Number of shifts per day	1	1	1	1	1					
Total Time Available per shift (seconds)	34200		34200		34200					
Takt Time	45.42	0.0	45.4	0.0	43.6	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Allowances	0.7	2.1	1.0	3.0	0.5	0.0	0.0	0.0	0.0	0.0

work time (sec)	10316.10	1362.24	15060.00	1920.00	8556.50					
Work time (hr)	2.87	0.38	4.18	0.53	2.38					
Total work time (hrs)	5.62		4.72							
land fill and lunch	1.90		2.50							
Total hours	7.52		7.22							
Total time	7:31									

7:31 total time to complete route

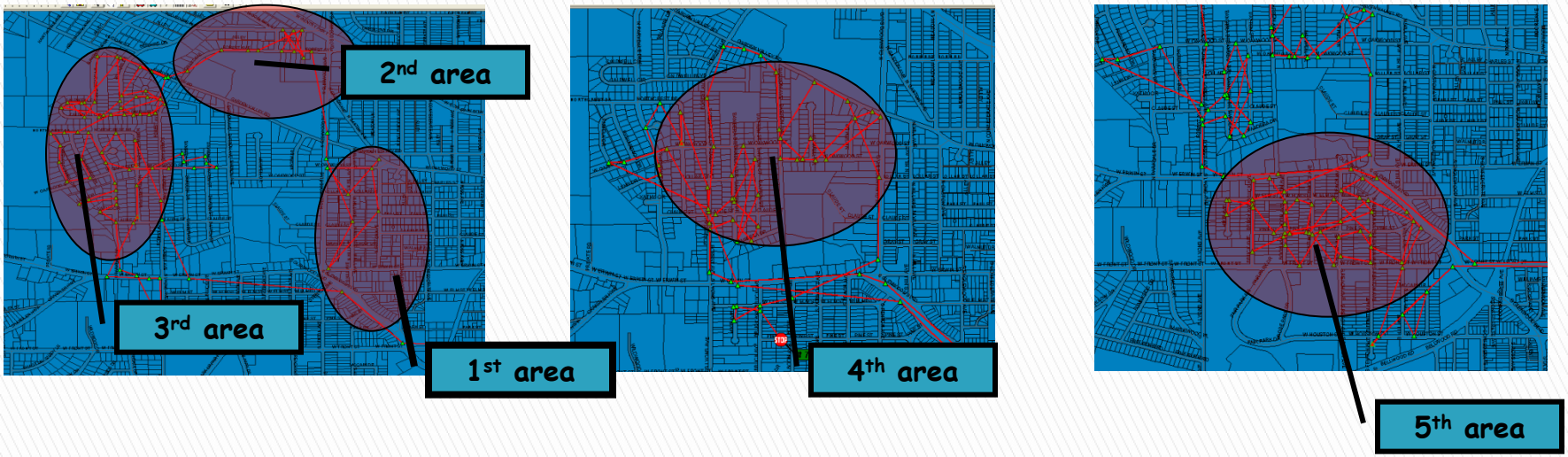
Analyze Phase
6. Identify Variation Sources

Variable: Holiday pick up volume



Analyze Phase
6. Identify Variation Sources

Variable: Routing



In following Rt.11 and upon reviewing Air Track tracking report we noticed the route seemed to run sporadic leaving one section and going to another only to have to back track to the previous area.

Analyze Phase
6. Identify Variation Sources

Variable: Corner Houses

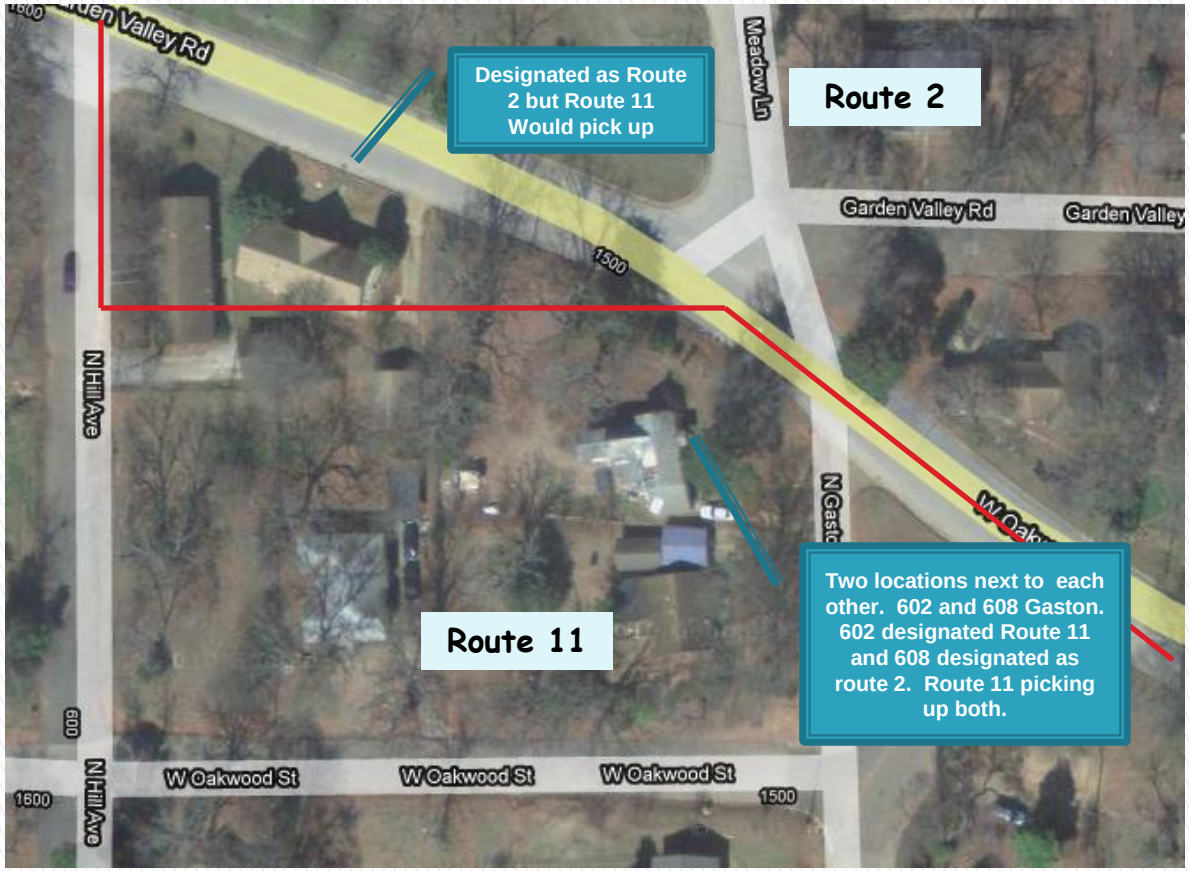
Route Smart initial location indicates cart placement in front of location.

The red dot indicates the actual location of where the cart is actual placed.

The system will place the cart location at the address location. Houses on the corner need to be manually adjusted in the system in order for RouteSmart to route the truck to pick up the cart at the correct location. If this is not done then the potential for the cart not to be picked up will exist.

Analyze Phase
6. Identify Variation Sources

Variable: Route Border



The system can have locations that are clearly in a routes path and have them designated as being picked up by another route. When RouteSmart does this it routes the houses in a direction that does not pick up the carts.

Analyze Phase
6. Identify Variation Sources

Variable: Non-existent and Dead Ends

Gaston dead ends at this location and restarts as it crosses Oakwood. The system is not updated and has the route path going through an area that does not have a street.

Lollar does not flow through as indicated. Route smart sending the truck through an area that is non-existent

Analyze Phase
6. Identify Variation Sources

Variable: Safety Issues

Improve Phase
9. Implement Improvements

COUNTERMEASURES					
X	Verified Causes	Countermeasure	Impact on Metric	Validation Tool	Date Complete
X1	Process flow	Improve the process flow of handling call in from customer			
X2	Collection of Data	Add a non-chargeable column and improve document classification			
X3	Improper Routing	Improve route to be more efficient			
X4	Pick up cycle time	Adjust service times according to cycle times			
X5					
X6					

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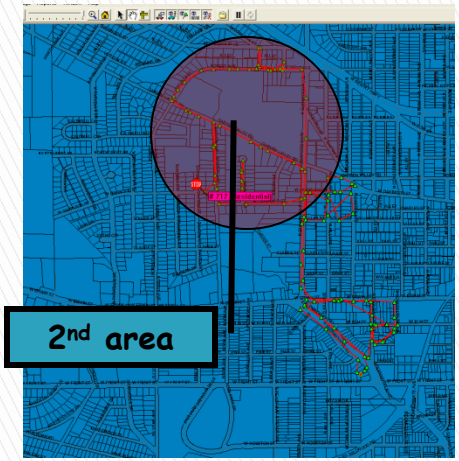
Improve Phase
9. Implement Improvements



We utilized the Route Smart system to help identify an optimized route that would prevent or minimize the sporadic routing. In addition it provides an estimated route completion. In running the route we identified additional opportunities for improvement of the route.

Improve Phase
9. Implement Improvements

Variable: Corner Houses

Route Smart initial location indicates cart placement in front of location.

Relocated the designated trash pick for the houses and RouteSmart is able to re-route to pick up those carts in the appropriate areas. It is necessary to identify all corner houses to make the needed changes.

Improve Phase
9. Implement Improvements

Variable: Route Border

Adjust boundaries as needed in order to reduce or eliminate the over crossing of routes. It will be necessary to ensure that all border areas be addressed on a case by case issue.

Improve Phase
9. Implement Improvements

Variable: Non-existent and Dead Ends

Gaston dead ends at this location and restarts as it crosses Oakwood. The system not updated and has the route path going through an area that does not have a street.

Lollar does not flow through as indicated. Route smart sending the truck through an area that is non-existent

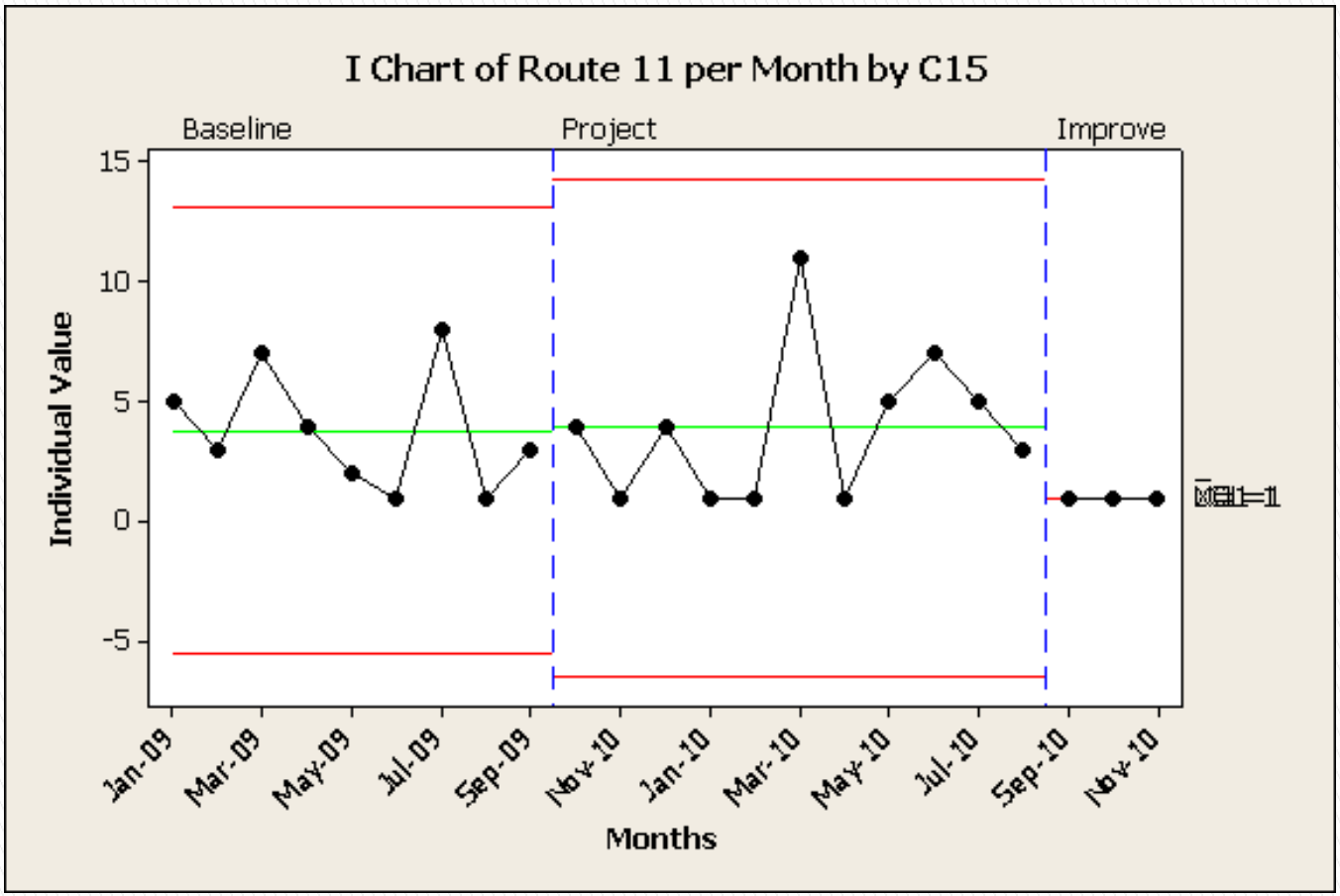
It is of vital importance for the driver and management to identify all roads that are non-existent or end in dead ends. The GIS group will then be able to make the appropriate adjustments and RouteSmart will account for the errors and bypass or adjust the route as needed.

Improve Phase
9. Implement Improvements

Variable: Safety Issues

As RouteSmart does not account major intersections it is vital that an in depth analysis be made to identify all potential safety issues. Once identified, RouteSmart can be updated and re-route as necessary.

Improve Phase
9. Implement Improvements



Reduced variation and defect count down.

Improve Phase
9. Implement Improvements

Attribute Capability

Confidence -->	0.95
Units -->	785
Opportunities -->	80
TOP's -->	62,800
Defects -->	34

Sample data is: ○ Short Term ◉ Long Term

Confidence Interval is: ○ One-sided ◉ Two-sided

Page 1

Long Term Capability

	p(d)	Percent	ppm	Ppk	Z		Defects	
Upper Limit on Failure Rate	0.0008	0.1%	756	1.06	3.17	<= "worst case" =>	48	95%
Nominal Value	0.0005	0.1%	541	1.09	3.27	<= "best estimate"		Confidence
Lower Limit on Failure Rate	0.0004	0.0%	375	1.12	3.37	<= "best case"=>	24	Interval

Estimated Short Term Capability (shifted by 1.5 sigma)

	p(d)	Percent	ppm	Cpk	Z
Nominal Value	0.0000	0.0%	1	1.59	4.77

Process improvement is shown from the baseline to the improved process

Attribute Capability

Confidence -->	0.95
Units -->	785
Opportunities -->	26
TOP's -->	20,410
Defects -->	3

Sample data is: ○ Short Term ◉ Long Term

Confidence Interval is: ○ One-sided ◉ Two-sided

Page 1

Long Term Capability

	p(d)	Percent	ppm	Ppk	Z		Defects	
Upper Limit on Failure Rate	0.0004	0.0%	429	1.11	3.33	<= "worst case" =>	9	95%
Nominal Value	0.0001	0.0%	147	1.21	3.62	<= "best estimate"		Confidence
Lower Limit on Failure Rate	0.0000	0.0%	30	1.34	4.01	<= "best case"=>	1	Interval

Estimated Short Term Capability (shifted by 1.5 sigma)

	p(d)	Percent	ppm	Cpk	Z
Nominal Value	0.0000	0.0%	0	1.71	5.12

Control Phase
12. Implement Process Controls

Street by Street Directions - Summary

Solution Name: <active scenario>
Solution Label:
Report Date: 6/4/2010
Report Time: 9:07 AM

Disclaimer: The directions provided below are computer-generated and may not reflect actual traffic conditions. You are required to obey all traffic rules and regulations at all times. Such traffic rules and regulations shall take precedence over the computer-generated directions.

Route 11

Directions Address Miles Time

- **Start route Office** 7:00 AM

Right out of facility (0.20 miles) N BOIS D ARC AVE **0.20** 7:00 AM
Turn right onto (0.62 miles) W ERWIN ST **0.72** 7:02 AM
Stay straight on (0.21 miles) W ERWIN ST **1.09** 7:03 AM
Turn right onto N HILL AVE **1.15** 7:05 AM
Stay straight on N HILL AVE **1.17** 7:06 AM
Turn right onto GRAY ST **1.24** 7:06 AM
Turn right onto N GASTON AVE **1.32** 7:07 AM
Turn right onto W ERWIN ST **1.39** 7:07 AM
Turn right onto (0.14 miles) N HILL AVE **1.53** 7:07 AM
Turn right onto CLAUDE ST **1.60** 7:07 AM
Turn left onto (0.12 miles) N GASTON AVE **1.72** 7:09 AM
Turn right onto LOLLAR ST **1.79** 7:09 AM
Stay straight on LOLLAR ST **1.85** 7:11 AM
Turn right onto (0.08 miles) N CONFEDERATE AVE **1.93** 7:12 AM
Turn right onto PAUL ST **2.06** 7:13 AM
Turn right onto N GASTON AVE **2.14** 7:13 AM
Turn left onto LOLLAR ST **2.21** 7:13 AM
Stay straight on LOLLAR ST **2.28** 7:15 AM
Turn left onto N GLENWOOD BLVD **2.39** 7:15 AM
Stay straight on N GLENWOOD BLVD **2.54** 7:17 AM
Turn left onto W ERWIN ST **2.61** 7:17 AM

Route Smart enables the supervisor to verify where the operator is at and to check if the route is being run in the appropriate manner. The turn by turn directions can be utilized to audit where the truck is on the route. The directions provide the time in with the truck should be at.

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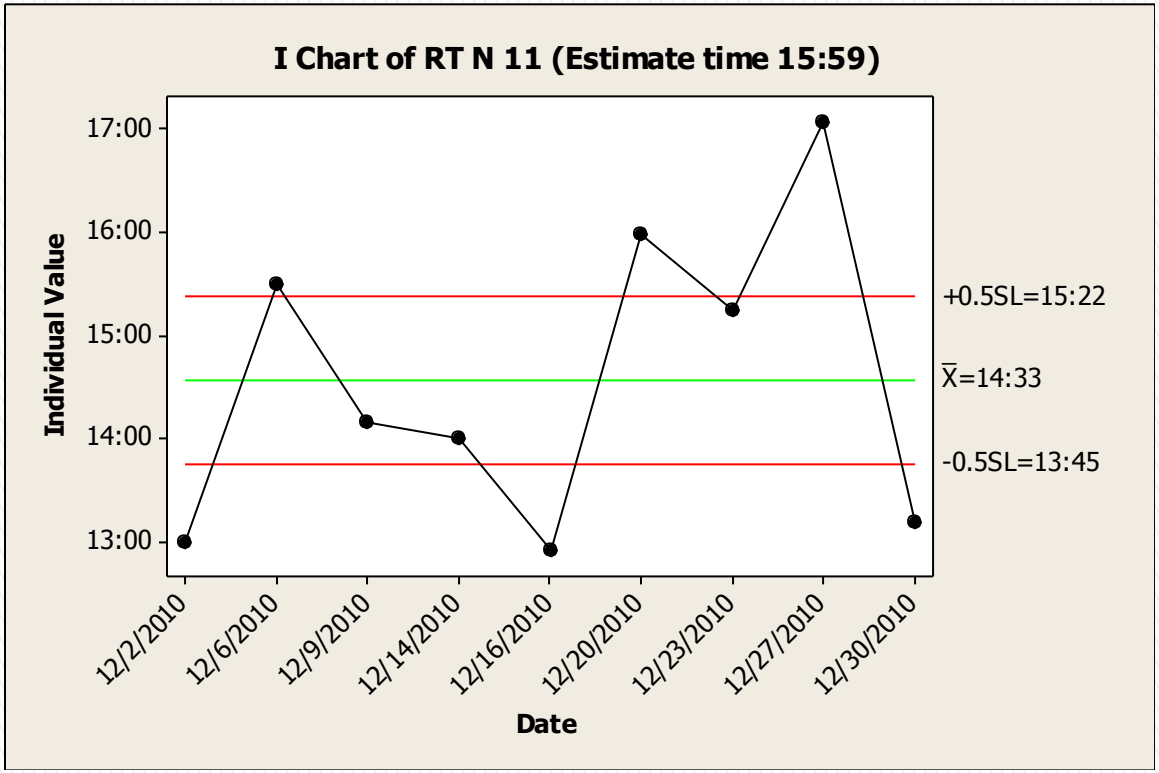
Control Phase
12. Implement Process Controls

Visual Management Board created in order to communicate to the operators the basic information that they need to know about their performance.

Control Phase
12. Implement Process Controls



The control chart is used to monitor performance in completing the overall route in a timely manner.

Lessons Learned

Next Steps:

- **Leveraged lessons learned to other routes;**