Severity – Why it does not matter and what to do about it!

Tim Ronak – Senior Services Consultant AkzoNobel - email: timothy.ronak@akzonobel.com
Greg Griffith – Senior Services Consultant AkzoNobel - email: greg.griffith@akzonobel.com

Outline

- **Introduction**
- **Statistics 101** - 3 KEY things to understand about KPIs
  - Is the average (Arithmetic MEAN) useful?
  - What about variability … is it Quality data?
    - How far above or below is too far?
  - What other factors drive severity?
- **How do I use the results**
  - Understanding Statistics
  - What to do about it

Introduction

Question:

Have you ever been told …..

your SEVERITY is TOO HIGH?

… Compared to what?

Introduction

Headline June 2017:

Thatcham says OEMs must lower collision repair costs

- "The average repair bill has risen by 32% over the last three years," Thatcham CEO Peter Shaw said in a statement. "This has been driven by the repairability of parts such as headlamps, increasing complexity of vehicle materials and technology and the rising cost of spare parts, influenced to some extent by currency fluctuations. Vehicle manufacturers must bring these costs under control."
- Thatcham is the United Kingdom's version of the Insurance Institute for Highway Safety, but it also researches and develops repair procedures as well.

http://www.repairerdrivennews.com/2017/06/07/thatcham-oems-must-lower-collision-repair-costs/

Statistics 101

- Is an *"Average"* a meaningful KPI performance measurement?
- Measures of central tendency
  - **Mean:** An arithmetic average of all values
  - **Median:** The midpoint where half of the values are higher and half are lower
  - **Mode:** Most frequently occurring value

Statistics 101

Measures of central tendency

REAL ESTATE EXAMPLE

One way to create an example here would be to discuss house prices as it is the closest comparative to the variability of vehicle prices and subsequent repair costs I can think of.

Sale Price of House #1	$1,000,000
Sale Price of House #2	$350,000
Sale Price of House #3	$250,000
Sale Price of House #4	$200,000
Sale Price of House #5	$200,000
Total Home Sales	**$2,000,000**
Average Price (Mean)	**$400,000**
Median Price	**$250,000**
Mode Price	**$200,000**

Statistics 101

Some questions:

1. How many homes were sold at the average price?

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1. How many homes were sold at the average price?
2. If you had the average price in cash how many of the homes could you qualify to buy?

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Statistics 101

Some questions:

1. How many homes were sold at the average price?
2. If you had the average price in cash how many of the homes could you qualify to buy?
3. So … How meaningful or reliable is an average in this case?

REAL ESTATE EXAMPLE

One way to create an example [illegible] to discuss house prices as it is the closest comparative to the variability [illegible] vehicle prices and subsequent repair costs I can think of.

Sale Price of House #1	$1,0[illegible]00
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Sale Price of House #3	[illegible],000
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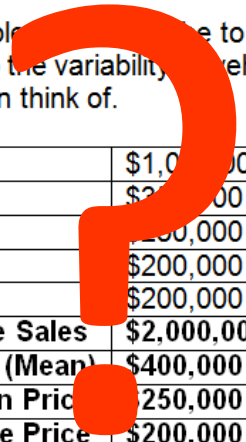


Statistics 101

In this Real Estate case the MEAN is NOT a reliable or meaningful measurement of the data for several reasons

1. The sample size is too small
2. The individual data points VARY too much
3. In a Normal Statistical Distribution something called a “Standard Deviation” is used to measure the ‘quality’ of a Mean.
4. In this case the Standard Deviation is **$340,954** and is 85% of the $400,000 MEAN *(In a Normal Distribution it is about 33.4% of the MEAN value)*
5. This implies that the random range of value for the **Majority** of houses in this market is from **$59,046** to **$740,954** !
6. This implies **SIGNIFICANT VARIABILITY** and as a result any assertion that the mean is meaningful measurement is FALSE

Statistics 101

So how do you know if the Data is meaningful?

Sample Size matters !

- Data analysis is dependent on the amount of data you have
- Smaller sample sizes (***n = # of individual values***) typically have WIDE variability
- For any arithmetic average to be meaningful samples sizes need to be larger than ***n ≥ 1000***
- For datasets where ***n ≤ 1000*** you need to 'test' the data to determine the reliability of the calculated average "MEAN"

Statistics 101

Testing KPI Data with a Standard Deviation

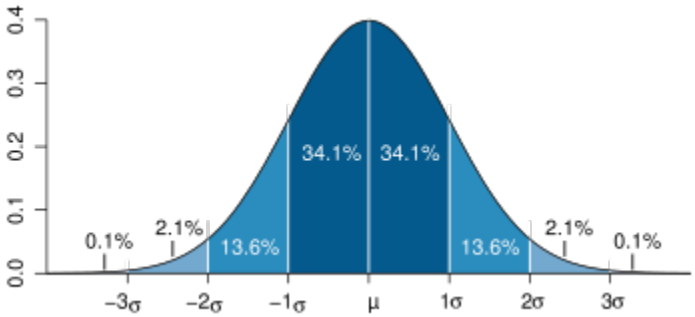
- In small sample sizes it is imperative for any meaningful discussion regarding a KPI value to include an assessment of variability.
- All random data varies around a central value “MEAN” and one test to assess the reliability of a particular KPI is a Standard Deviation calculation
- This Standard Deviation Measure determines how far a particular KPI can vary above and below a particular central value and still include the ‘Majority’ of a particular set of data (68%).
- It is important to note that a specific normally distributed data set will always randomly vary ABOVE and BELOW a particular central value.
- Only when data ranges outside of that normal variance can a difference be considered as being statistically significant and not simply a random variance.

Statistics 101

Standard Deviation

- The **mean** is a good measure of central tendency for roughly symmetric distributions but can be misleading in skewed distributions since it can be greatly influenced by scores in the tail of the data distribution such as heavy hits, new cars or luxury cars perhaps.
- For normal distributions (Low variability), the **mean** is the most efficient measure to use and is the most reliable. However, when variability is introduced as can be observed in most repair shops individual work mix you move from a normally distributed dataset.
- This variability significantly affects the reliability of the **mean** and the result is that the **mean** may become highly unreliable as a meaningful measure of central tendency. Therefore, other statistical measures such as the **median** may be more informative for distributions such as collision repair costs or average home prices that are frequently highly skewed.
- The most significant point is that unless you consider the variability of the actual data analyzed a **mean** may not be telling the whole story and as a statistical fact may be highly suspect as a measure of a central tendency for a specific dataset from a performance benchmark perspective.

Dark blue is less than one standard deviation from the mean. For the normal distribution, this accounts for 68.27 % of the set; while two standard deviations from the mean (medium and dark blue) account for 95.45 %; and three standard deviations (light, medium, and dark blue) account for 99.73 %



In order to determine the 'quality' of the average or mean we need to consider the variability of the data values as measured by a **standard deviation**. Only then can a relatively meaningful 'TARGET RANGE' for Severity be determined.

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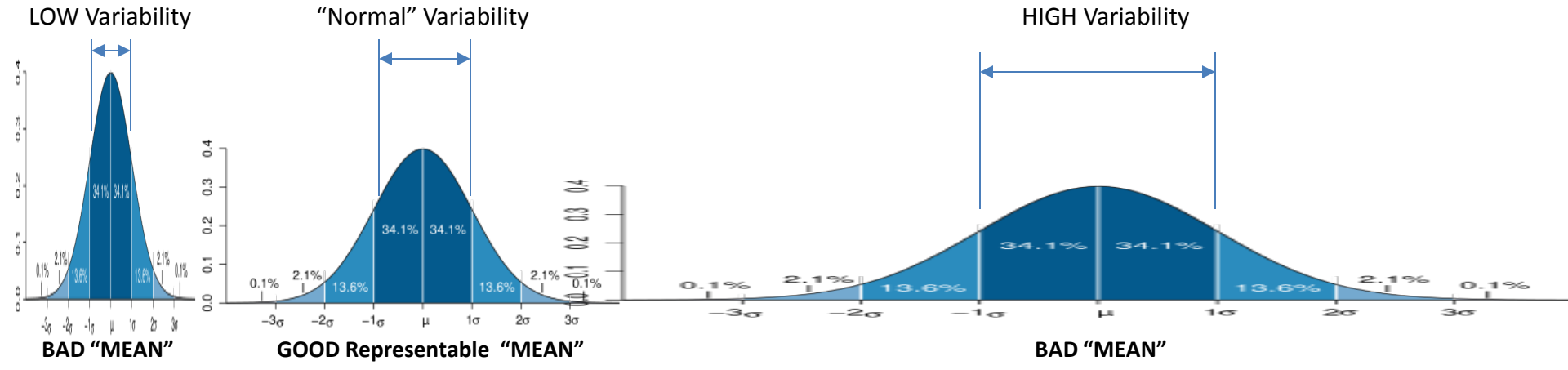
Statistics 101

How far above/below a KPI is too far

- Accidents are random events and when enough occur (n > 1000) they MAY begin to form a “Normal Distribution” where a central measure can be determined
- A normal Distribution will have the random majority within 68.3% of the individual data set
- Smaller sample sizes may create flatter distributions with larger variability and a wider numeric value range that will contain all of the data



Statistics 101

How far above/below a particular KPI is too far

- What should a target “range” for data be?
- Based on the idea that cumulated data will naturally vary around a central point it makes sense to consider where the MAJORITY (68.3%) of that data will fall.
- ‘+’ or ‘-’ one Standard Deviation will include the natural variance of data that will include 68.3% of the data (the natural random majority in a “normal” distribution)
- The Standard Deviation (SD) should be around 34% of the mean value
- ***The wider or larger the SD the less reliable the mean is as a measure or PREDICTER of central tendency !***

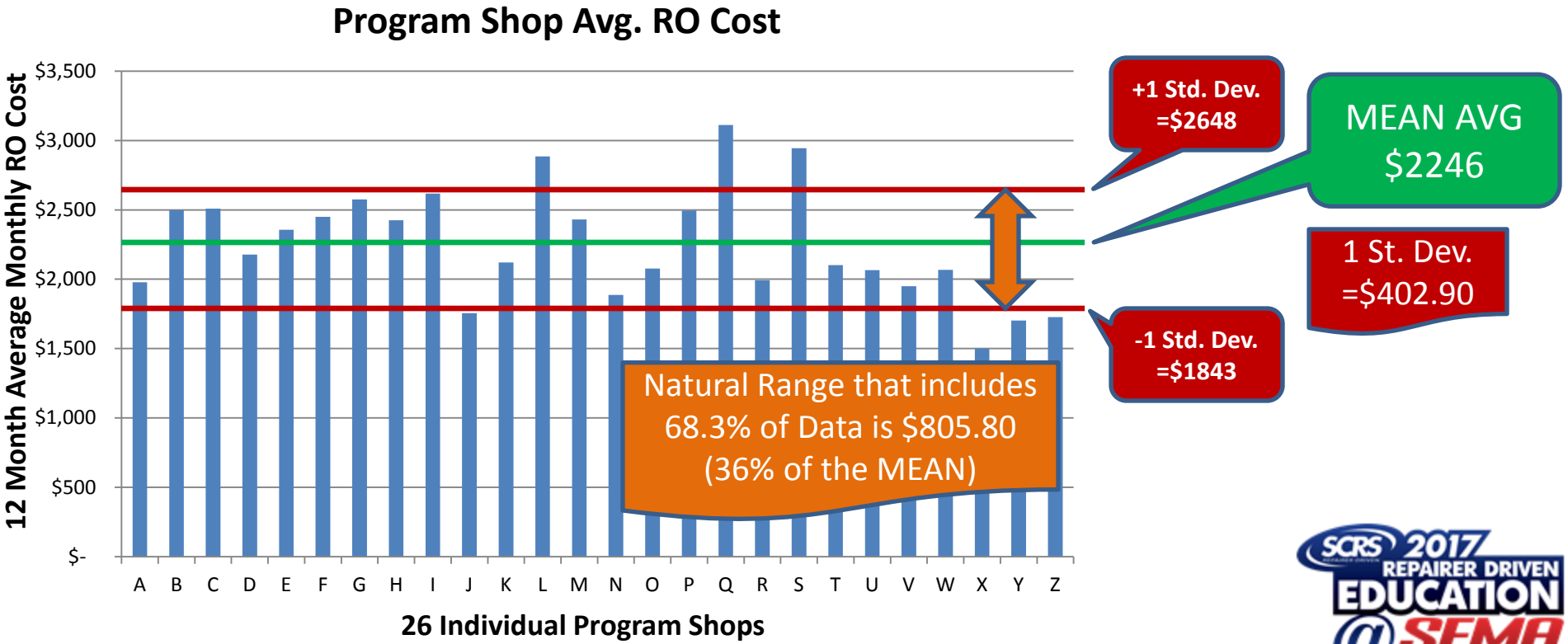
Statistics 101

How far above/below a particular KPI is too far

- We use a Standard Deviation to determine the ‘range’ around the central value that INCLUDES this MAJORITY of 68.3% of the random data points.
- It is important to note that this ‘variance’ discussion applies to ALL KPI data including:
  - Cycle time
  - Parts type used
  - Repair versus replace decisions
  - And ANY other KPI used to evaluate your business activity

Statistics 101

What should that look like in the real world?



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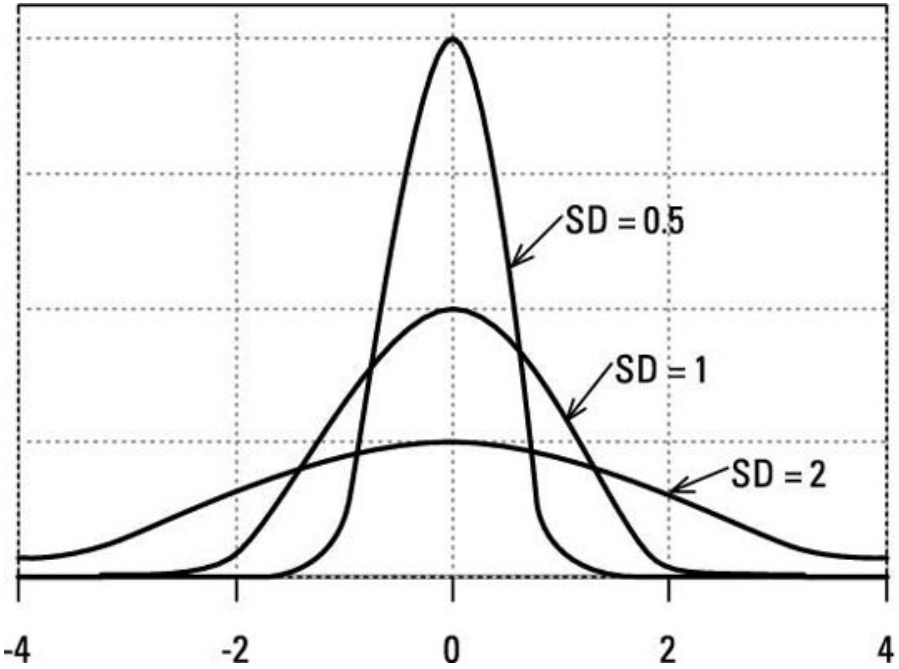
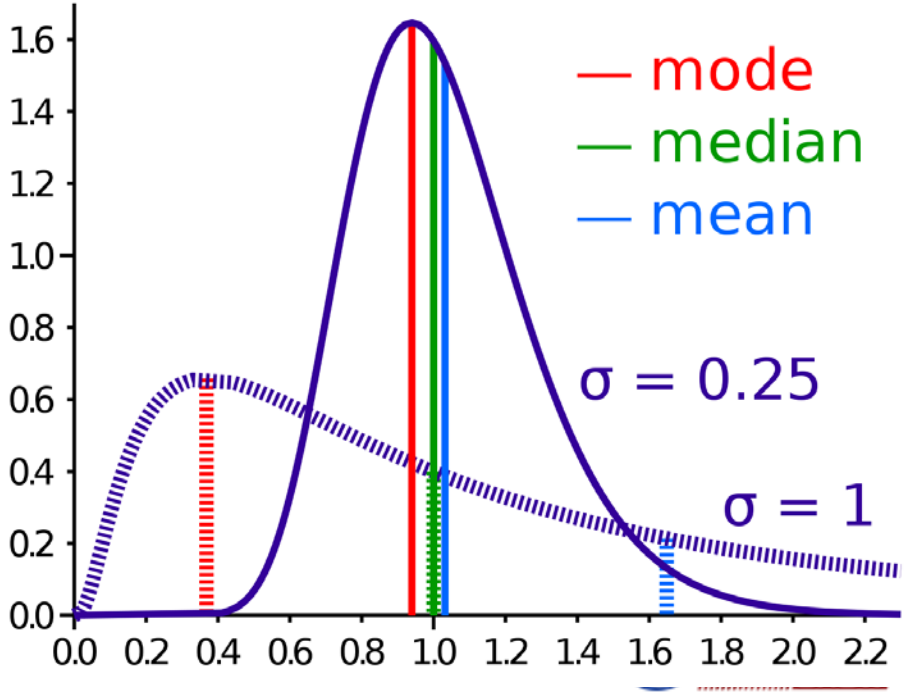
Statistics 101

Many types of distributions

VARIANCE

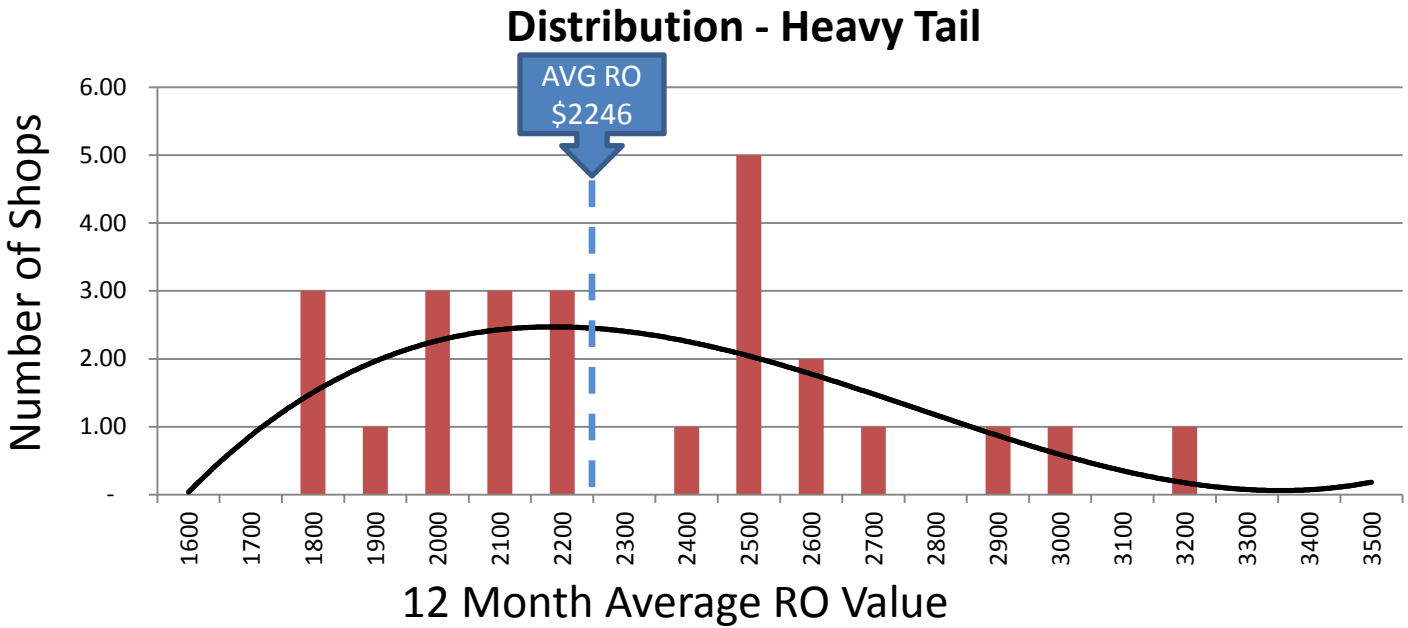


SKEWNESS



Statistics 101

- This sample of 26 shops shows that the distribution of 12 month Average RO values is not a symmetrical “normal” distribution
- A Heavily SKEWED statistical tail to the right exists



Statistics 101

Let us look at some real data from different individual shops?

Individual Shop RO Distribution Analysis

SHOP	Median	MEAN Avg	StdDev	Low Limit	High Limit	Records
MLO 3	$ 1,891	$ 2,791	$ 3,148	$ (356.43)	$ 5,939.32	518
MLO 2	$ 1,355	$ 2,592	$ 3,326	$ (734.70)	$ 5,917.91	351
MLO 1	$ 1,980	$ 2,814	$ 2,819	$ (4.88)	$ 5,633.23	501
ALL MLO	$ 1,830	$ 2,749	$ 3,075	$ (325.81)	$ 5,823.77	1370
MID WST	$ 1,642	$ 2,502	$ 2,575	$ (73.15)	$ 5,076.96	722
WST CST	$ 2,528	$ 3,208	$ 2,795	$ 413.26	$ 6,002.66	497
ALL SHOP	**$ 1,919**	**$ 2,768**	**$ 2,899**	**$ (130.52)**	**$ 5,666.57**	**2589**

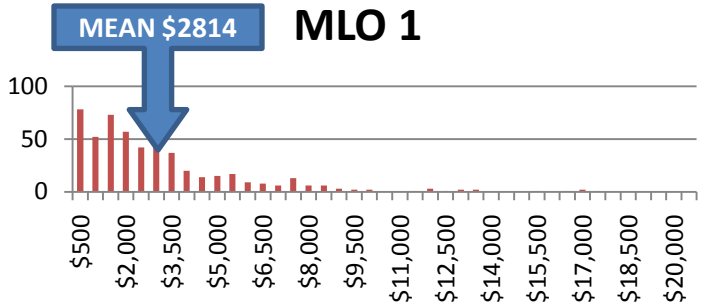
Shop Data Sourced: July 2017 – September 2017

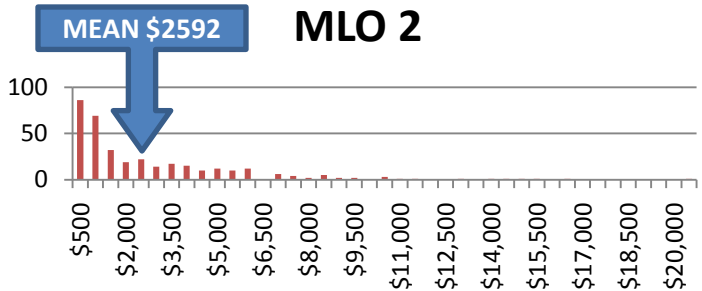
Total of 2589 individual records with Totals, Detail and Individual 'Part/No-Labor' sale RO's removed

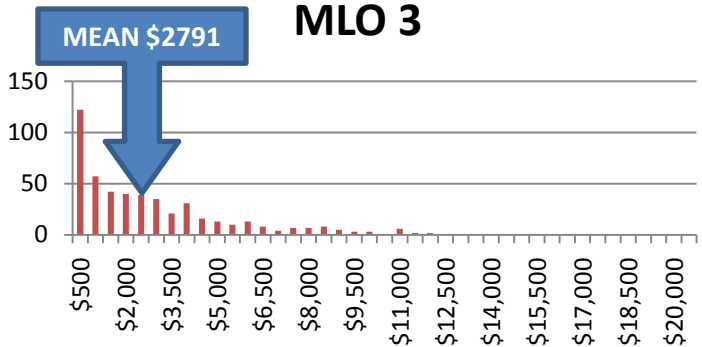
Individual Shop RO Distribution Analysis

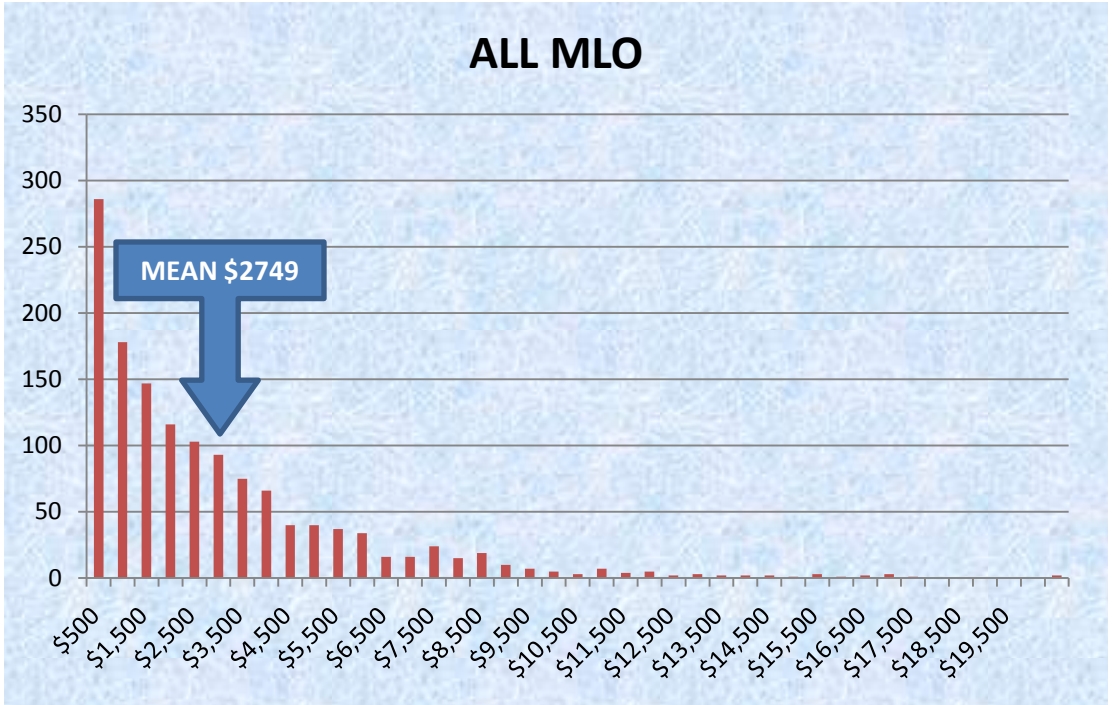
Range	Break	MLO 1	MLO 2	MLO 3	ALL MLO	MID WST	WST CST	ALL SHOPS
$ -	$ 500	78	86	122	286	142	42	470
$ 501	$ 1,000	52	69	57	178	107	50	335
$ 1,001	$ 1,500	73	32	42	147	92	59	298
$ 1,501	$ 2,000	57	19	40	116	58	53	227
$ 2,001	$ 2,500	42	22	39	103	61	42	206
$ 2,501	$ 3,000	44	14	35	93	52	40	185
$ 3,001	$ 3,500	37	17	21	75	23	38	136
$ 3,501	$ 4,000	20	15	31	66	30	32	128
$ 4,001	$ 4,500	14	10	16	40	23	22	85
$ 4,501	$ 5,000	15	12	13	40	31	28	99
$ 5,001	$ 5,500	17	10	10	37	21	12	70
$ 5,501	$ 6,000	9	12	13	34	16	15	65
$ 6,001	$ 6,500	8	0	8	16	9	16	41
$ 6,501	$ 7,000	6	6	4	16	17	6	39
$ 7,001	$ 7,500	13	4	7	24	9	11	44
$ 7,501	$ 8,000	6	2	7	15	2	2	19
$ 8,001	$ 8,500	6	5	8	19	5	5	29
$ 8,501	$ 9,000	3	2	5	10	2	2	14
$ 9,001	$ 9,500	2	2	3	7	4	2	13
$ 9,501	$ 10,000	2	0	3	5	3	3	11
$ 10,001	$ 10,500	0	3	0	3	1	5	9
$ 10,501	$ 11,000	0	1	6	7	1	2	10
$ 11,001	$ 11,500	1	1	2	4	3	3	10
$ 11,501	$ 12,000	3	0	2	5	1	1	7
$ 12,001	$ 12,500	1	0	1	2	3	0	5
$ 12,501	$ 13,000	2	1	0	3	2	0	5
$ 13,001	$ 13,500	2	0	0	2	1	0	3
$ 13,501	$ 14,000	0	1	1	2	1	0	3
$ 14,001	$ 14,500	0	1	1	2	0	3	5
$ 14,501	$ 15,000	0	1	0	1	0	0	1
$ 15,001	$ 15,500	1	1	1	3	0	0	3
$ 15,501	$ 16,000	0	0	1	1	0	0	1
$ 16,001	$ 16,500	1	1	0	2	0	0	2
$ 16,501	$ 17,000	2	0	1	3	1	0	4
$ 17,001	$ 17,500	1	0	0	1	0	0	1
$ 17,501	$ 18,000	0	0	0	0	0	0	0
$ 18,001	$ 18,500	0	0	0	0	1	1	2
$ 18,501	$ 19,000	0	0	0	0	0	1	1
$ 19,001	$ 19,500	0	0	0	0	0	0	0
$ 19,501	$ 20,000	0	0	0	0	0	0	0
$ 20,000		0	1	1	2	0	1	3
		518	**351**	**501**	**1370**	**722**	**497**	**2589**

Statistics 101









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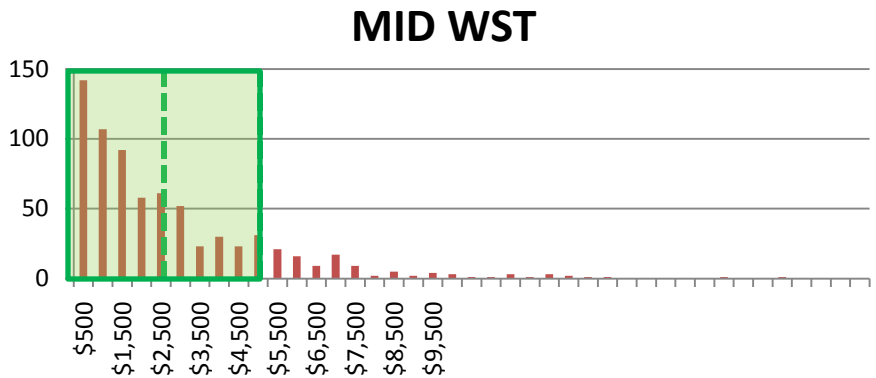
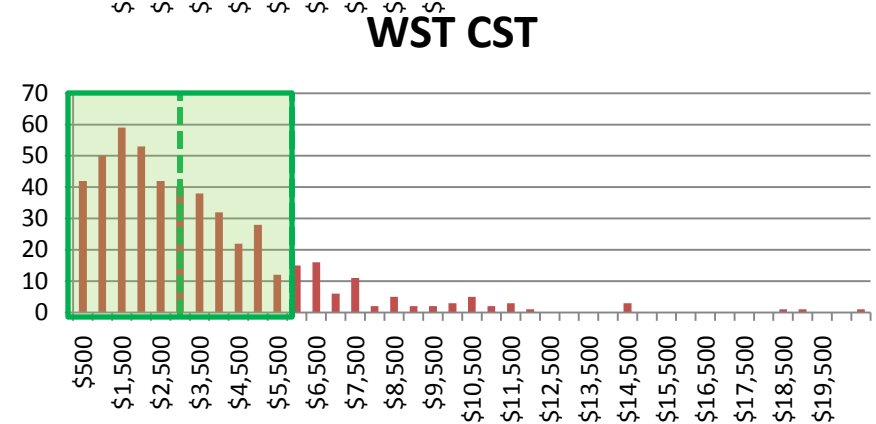
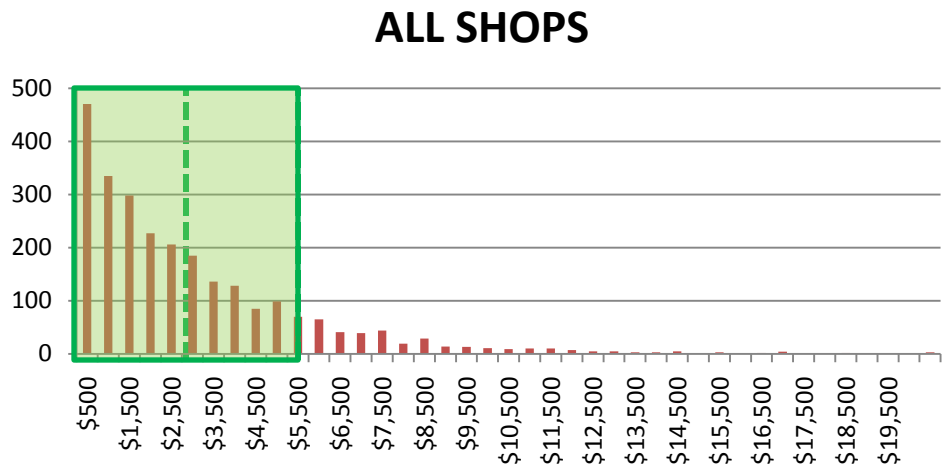
Statistics 101

Every dataset reviewed shows signs of significant skewed variability that implies Severity is a POOR measure of central value!







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How Do I Use the Results?

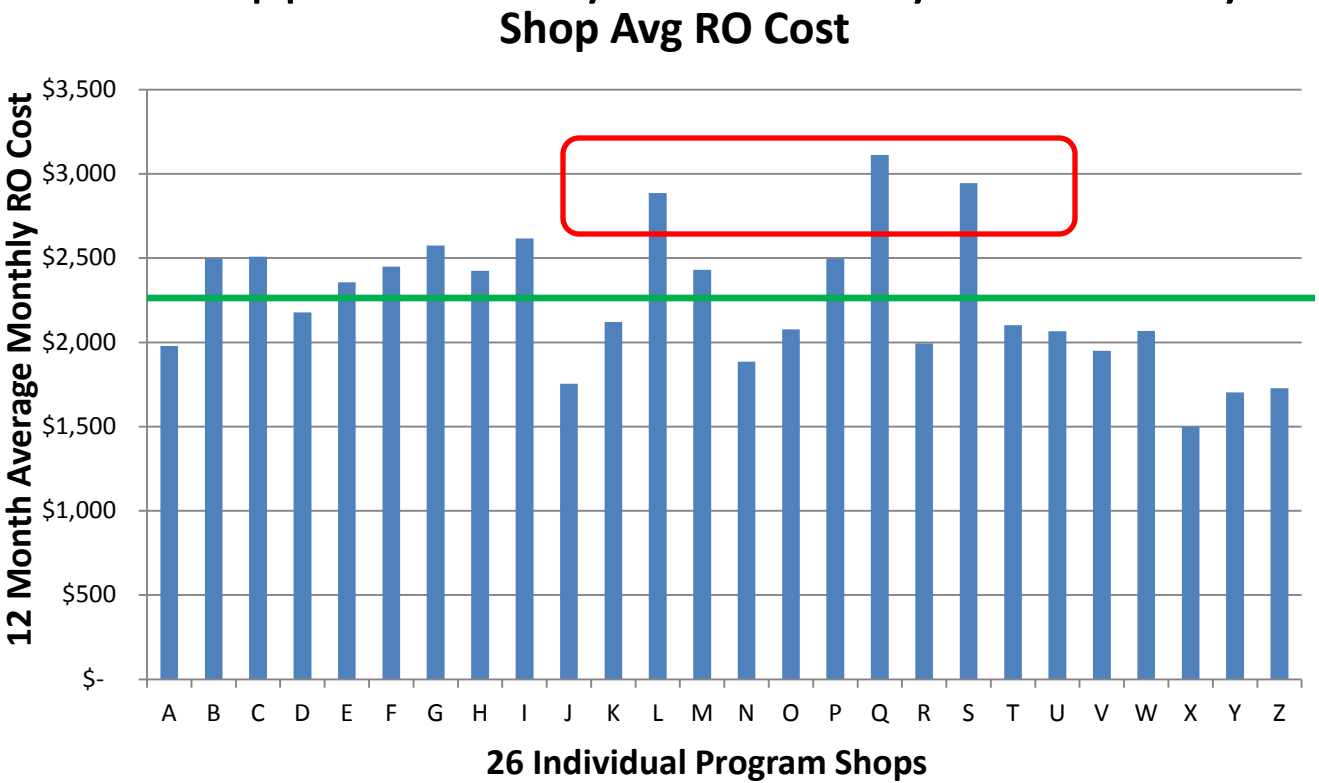
KPI Management

- Does your DRP feel like playing Whack-A-Mole?
- You are told your severity is STILL too high!
- What do you do when logic does not matter?
- How do you deflect an unjustified demand?

Statistics 101

Establishing a Ceiling

What Happens when you are told your Severity is Too High?



Statistics 101

Establishing a Ceiling

What Happens when you are told your Severity is Too High?

MEAN AVG $2246

AVERAGE IS REDUCED !

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How Do I Use the Results?

- Like it or not KPI's are being used to make decisions about your business performance whether the KPI are valid or not !
- Being able to discuss those variables in an intelligent way is CRUCIAL for you to be able to deflect a NEGATIVE CRITIQUE … especially when it is beyond your control !

How Do I Use the Results?

Step 1 – Variance Explanation

- Suggest that the number of cars repaired is insufficient to create any kind of comparable benchmark due to variability
- Discuss how variability makes using the Average value a useless performance measure unless you also include the value range that the majority (68%) of the data will fall into
- This is a range that is +/- 1 Standard Deviation (SD)
- This implies you would need to know the Standard Deviation value for both the DRP data as well as your own
- **When assessing highly variable data without a Standard Deviation range around a MEAN any performance comparison is NOT really meaningful at all !**

How Do I Use the Results?

Step 2 – OEM Model Comparison

- If the Sample size and Variance deflection is unsuccessful use available insurance company data as is available from the insurance funded IIHS & HLDI
  - IIHS = Insurance Institute for Highway Safety
  - HLDI = Highway Loss Data Institute
- Comparative Insurance data is tabulated from closed claims from all of the insurers for most OEM vehicle models.
- Guess What ! – The type of car repaired matters !
- Lets take a look !

How Do I Use the Results?

Determine the Severity Weighted value of YOUR work mix !

Highway Loss Data Institute

Collision Damage with other lines included

By Make and Model 2013-2015 Models

Sourced Date: Oct 2017

http://www.iihs.org/iihs/topics/insurance-loss-information

NOTE: "Enable Macros" to use the Filter buttons in Row 7

Insurance Institute for Highway Safety
Highway Loss Data Institute

Legend
- Substantially better
- Better than average
- Average
- Worse than average
- Substantially worse
- Insufficient data available

Size	Model	Vehicle Model	Collision	Property damage	Compre-hensive	Personal injury	Medical paymen	Bodily injury	OEM
MICRO	2 DOOR CARS	Scion iQ	77	81	75				SCION
MICRO	2 DOOR CARS	Smart ForTwo	59	76	42	106	124	88	SMART
MICRO	2 DOOR CARS	Smart ForTwo convertible	59		72				SMART
MICRO	2 DOOR CARS	Smart ForTwo electric	54		42				SMART
MICRO	**2 DOOR CARS**	**SEGMENT AVERAGE**	**62**	**79**	**58**	**106**	**124**	**88**	**SUB TOTAL**
MICRO	4 DOOR CARS	Mitsubishi Mirage	135	108	119	215	242	159	MITSUBISHI
MICRO	**4 DOOR CARS**	**SEGMENT AVERAGE**	**135**	**108**	**119**	**215**	**242**	**159**	**SUB TOTAL**
MINI	2 DOOR CARS	Fiat 500	72	76	66	96	89	84	FIAT
MINI	2 DOOR CARS	Fiat 500 convertible	76	79	60	85			FIAT
MINI	2 DOOR CARS	Fiat 500 electric	73	59	76			60	FIAT
MINI	2 DOOR CARS	Mini Cooper	92	72	114	74	74	85	MINI
MINI	2 DOOR CARS	Mini Cooper convertible	80	72	100	57			MINI
MINI	2 DOOR CARS	Mini Cooper Coupe	72	60					MINI
MINI	2 DOOR CARS	Mini Cooper Roadster convertible	57	50	78				MINI
MINI	2 DOOR CARS	Toyota Yaris	94	88	92				TOYOTA
MINI	**2 DOOR CARS**	**SEGMENT AVERAGE**	**77**	**70**	**84**	**78**	**82**	**76**	**SUB TOTAL**
MINI	4 DOOR CARS	Chevrolet Spark	104	113	81	158	185	137	CHEVROLET
MINI	4 DOOR CARS	Chevrolet Spark electric	78		38				CHEVROLET
MINI	4 DOOR CARS	Ford Fiesta	106	113	79	145	160	138	FORD

How Do I Use the Results?

1. Use the HLDI Sortable sheet to determine the “Base 100” value for the OEM Brand you seek
2. Source your work mix percent by vehicle brand from your management system
3. Complete the table as it is on the right
4. Use the supplied severity value from your DRP and ‘adjust it’ to your specific work mix
5. The weighted value represents where the provided severity value should be adjusted to based on the type of work mix you have using the insurance provided data

Shop Weighted Work Mix Worksheet

OEM Brand Example	% of Work mix		HLDI Info		Contribution
Chevrolet	23.0%	X	103.0%	=	0.2369

Weighted Severity Calculator

Shop Primary Brands	Work Mix		HLDI 100		
Chevrolet	31.0%	X	93.6%	=	0.29016
Audi	13.0%	X	194.7%	=	0.25311
Dodge	35.0%	X	106.7%	=	0.37345
BMW	9.0%	X	184.2%	=	0.16578
Volkswagon	12.0%	X	110.9%	=	0.13308
Blank	0.0%	X		=	0
Blank	0.0%	X		=	0
Blank	0.0%	X		=	0
Blank	0.0%	X		=	0
Blank	0.0%	X		=	0
Blank	0.0%	X		=	0
Total Should = 100%	**100.0%**		**Weighted Severity =**		**1.22**

	DRP Severity		Weighted Severity		Adjusted Severity
Work Mix Adjusted Market Severity Calculation	$ 2,895	X	1.22	=	**$3,519**

How Do I Use the Results?

Action Plan

Typically Severity is too variable to actually be used to meaningfully measure performance

Step 1

- When pressed to use it as a performance statistic work to determine the “quality” of the data by requesting the Standard Deviation of the dataset being used to evaluate you
- Use this value to assess variability of the original data and define a Range that 68% of the data falls into
- If that is not forthcoming calculate your own Standard Deviation and demonstrate that the sample is too small and too variable to be a meaningful measure

How Do I Use the Results?

Action Plan

Typically Severity is too variable to actually be used to meaningfully measure performance

Step 2

- If the debate continues elevate the analysis of the KPI to include the actual provided data from the insurance industry regarding the paid out claim Severity data by OEM in the HLDI report
- Use this data to ‘weight’ the DRP provided average Severity value to reflect the actual work mix completed by your facility
- This is the new starting point if further debate is required imply that there still needs to be a “range” around this ‘work mix’ adjusted severity value higher and lower due to variability.

Conclusion

Summary

While this discussion was focused on Severity … ANY KPI used to evaluate you has the same inherent variability trait.

With smaller sample sizes, higher variability reduces the validity of the data as a meaningful performance measure.

We hope you are now able to have a more convincing conversation about your performance and avoid being the ***"Mole"*** in a real world **KPI *"Whack-A-Mole"*** performance review!

Thank You !

Greg Griffith – greg.griffith@akzonobel.com
Tim Ronak – timothy.ronak@akzonobel.com

Questions ?

Contact Tim for the presentation or spreadsheet

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