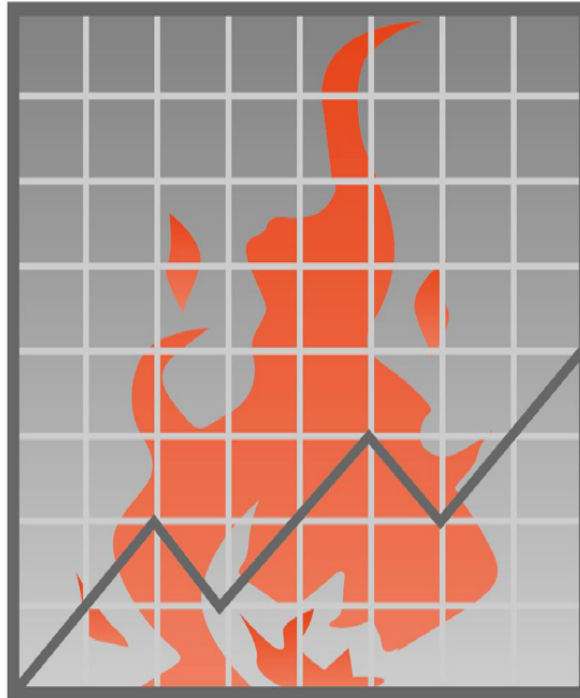


# FireStats



**DATA ANALYSIS FOR  
THE FIRE SERVICE**

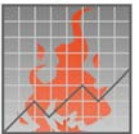
# CalChiefs 2005

## Statistics for Fire Chiefs

Presented by Paul Rottenberg

paul@FireStats.com

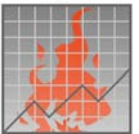
**FireStats**



DATA ANALYSIS FOR  
THE FIRE SERVICE

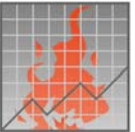
# Different Measures

- Baseline measures
- Objectives
- Standards
- Performance measures



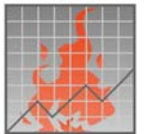
# Objectives

- The things that we want to be doing or get accomplished at the point when we decide to establish “objectives.”
- Often used interchangeably with standards, but incorrectly so.

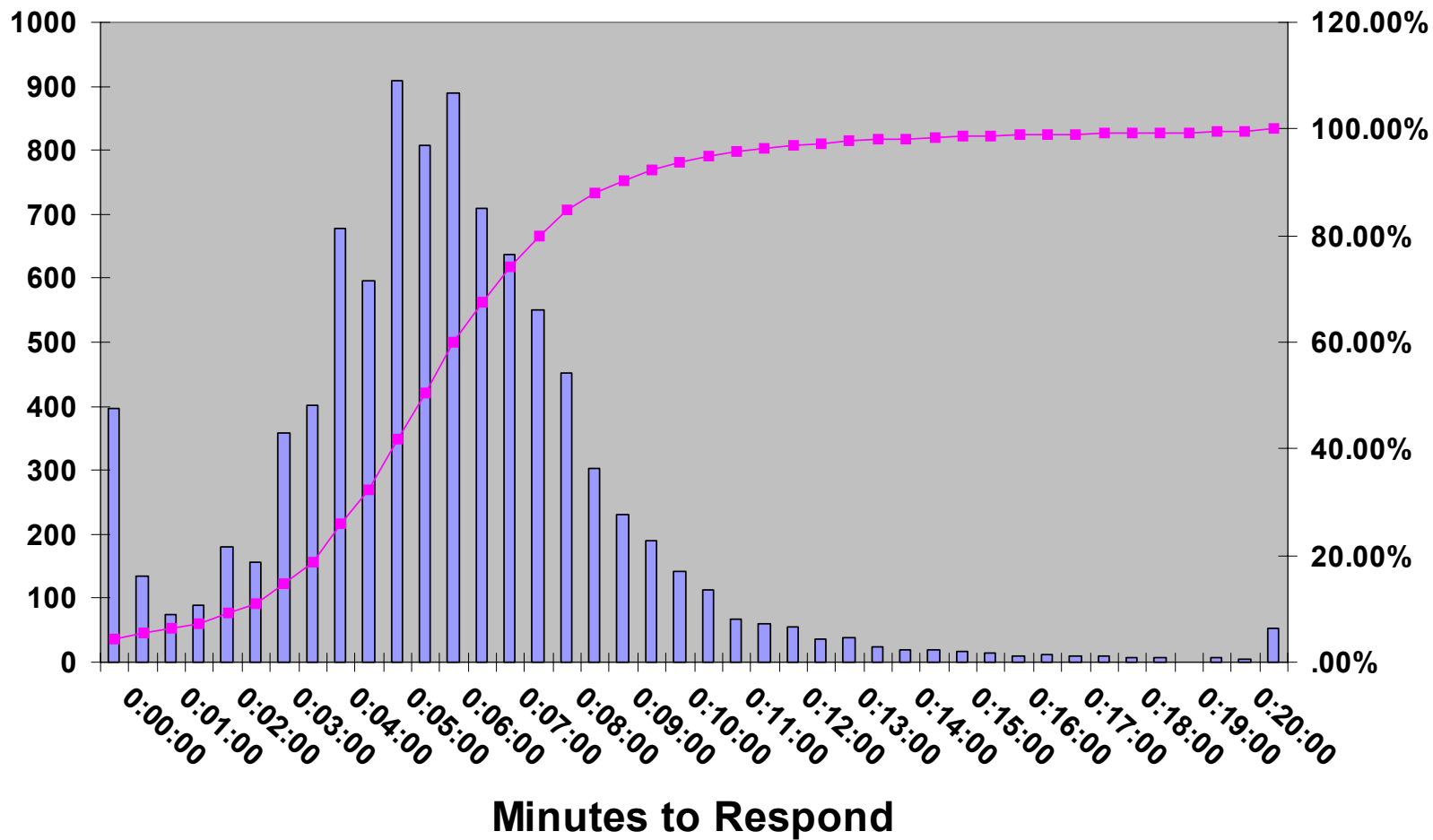


# Baseline Measures

- The first set of valid measurements that you take.
- Unlike triage, you don't have to start where you stand.
- Go back as far as you want and start there.

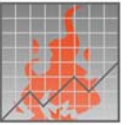


## Response Times (2004) with Cumulative Frequency



# Standards

- What we are supposed to be achieving as decided by us and other stakeholders.

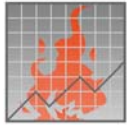


# Performance Measures

- The measurements of what we are doing now.

# Five Major Questions

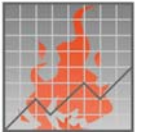
- **What are statistics?**
- **Who is the audience -- who are the stakeholders?**
- **What do we want to measure?**
- **Why do we want to measure it?**
- **What are the different types of measures available?**
  
- **Bonus Question: Why do so many people fear or hate statistics?**



# ***What are statistics?***

***statistics - a branch of applied mathematics concerned with the collection and interpretation of quantitative data and the use of probability theory to estimate population parameters.***

**FireStats**

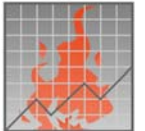


**DATA ANALYSIS FOR  
THE FIRE SERVICE**

# Why Do People Fear and/or Hate Statistics?

- Esoteric nomenclature
- Used more often to advocate than explain
- Statistics teachers are usually lousy

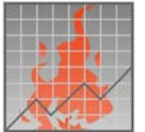
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DATA ANALYSIS FOR  
THE FIRE SERVICE

# ***Who is the audience or who are the stakeholders?***

- ***Jane Citizen***
- ***City Manager***
- ***CalChiefs***
- ***Labor***



# *What do we want to measure?*

## *Operational*

- *Response Time*
- *Turnout Time*
- *Total Reflex Time*
- *Committed Time*
- *Number of runs*
- *Types of runs*

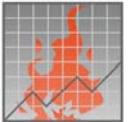
# ***What do we want to measure?***

## ***Budget-related***

***Budget per assessed dollar value***

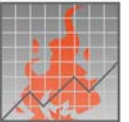
***Budget per sworn personnel***

***Cost per run by type (accounting)***



# ***Why do we want to measure it?***

- ***Because someone asked us to?***
- ***Because to do so allows us to understand what we are currently doing and therefore to make improvements?***



# Three Most Desirable Characteristics of Statistics

1. Understandable
2. Duplicable
3. Relevant

# ***What are the different types of measures available?***

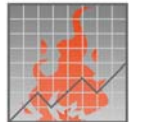
***Numeric – actual numbers that represent something like the relationship between data points***

***Pictures – tell a similar story, but graphically***

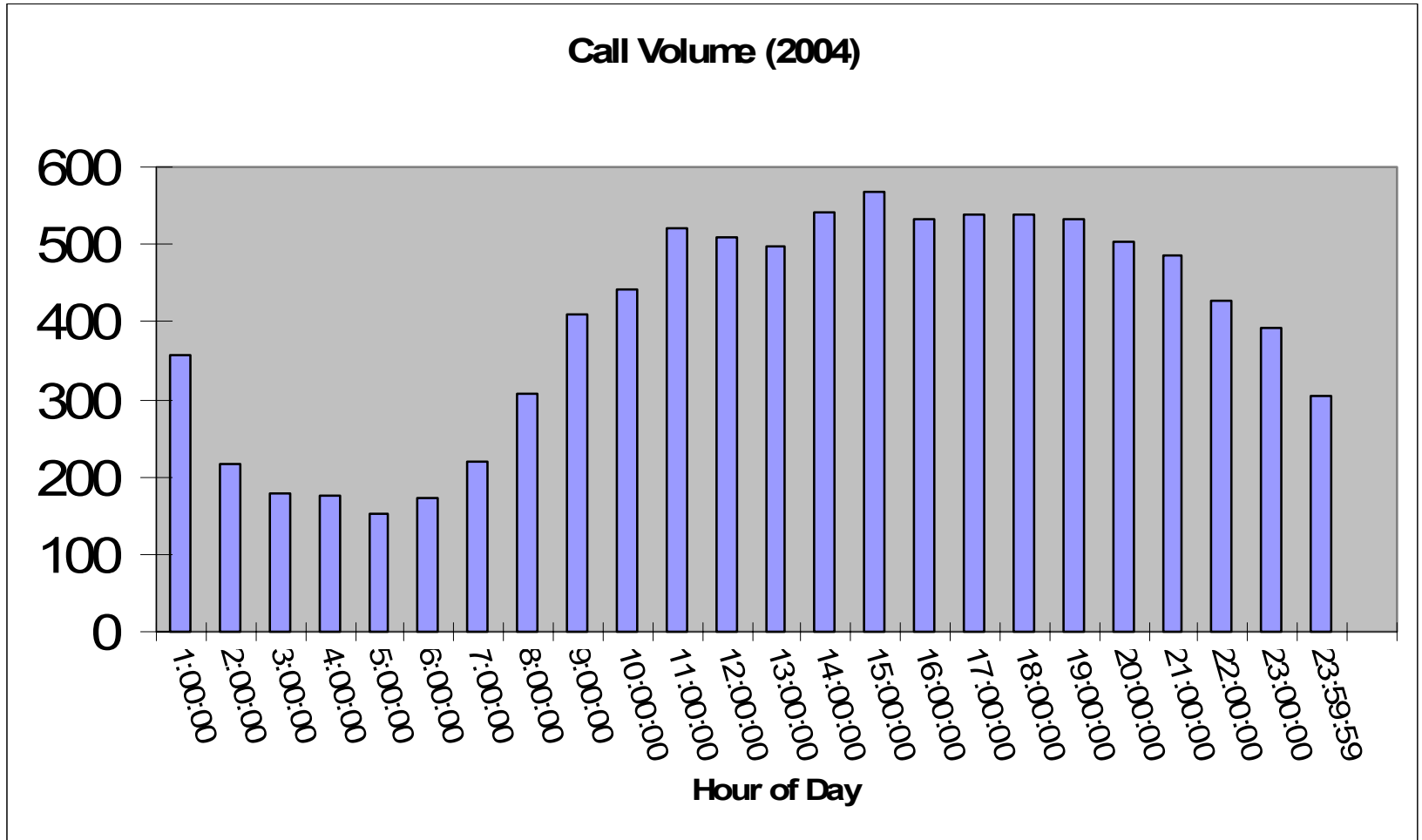
***Tables – kind of a hybrid of the two.***

# NUMBER

- There were 27 calls today.
- The chief seems 10 feet tall.
- The ratio of firefighters to apparatus is 1:1.
- 98% of all statistics are poorly presented.
- 6 people are already asleep.



# Chart

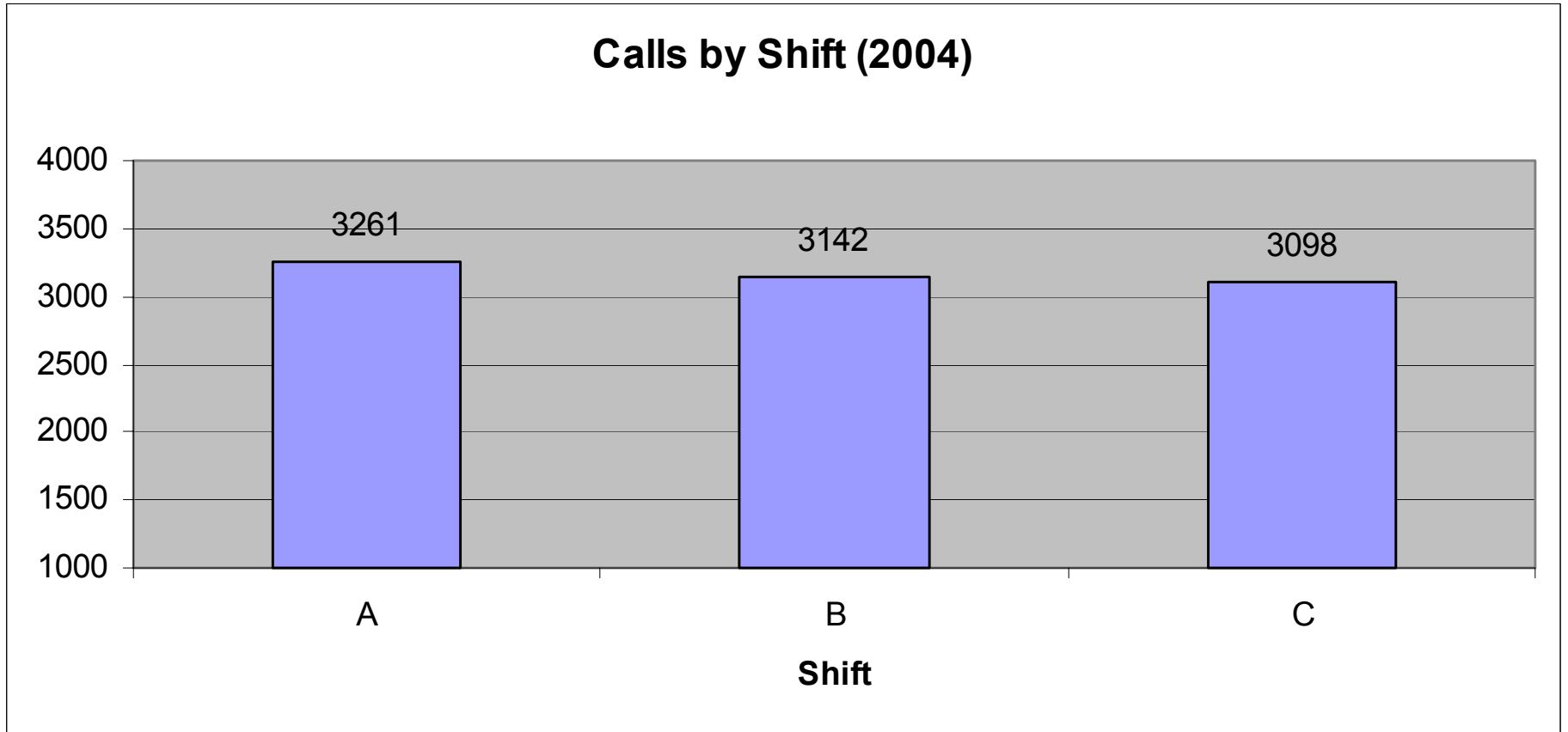


# Table

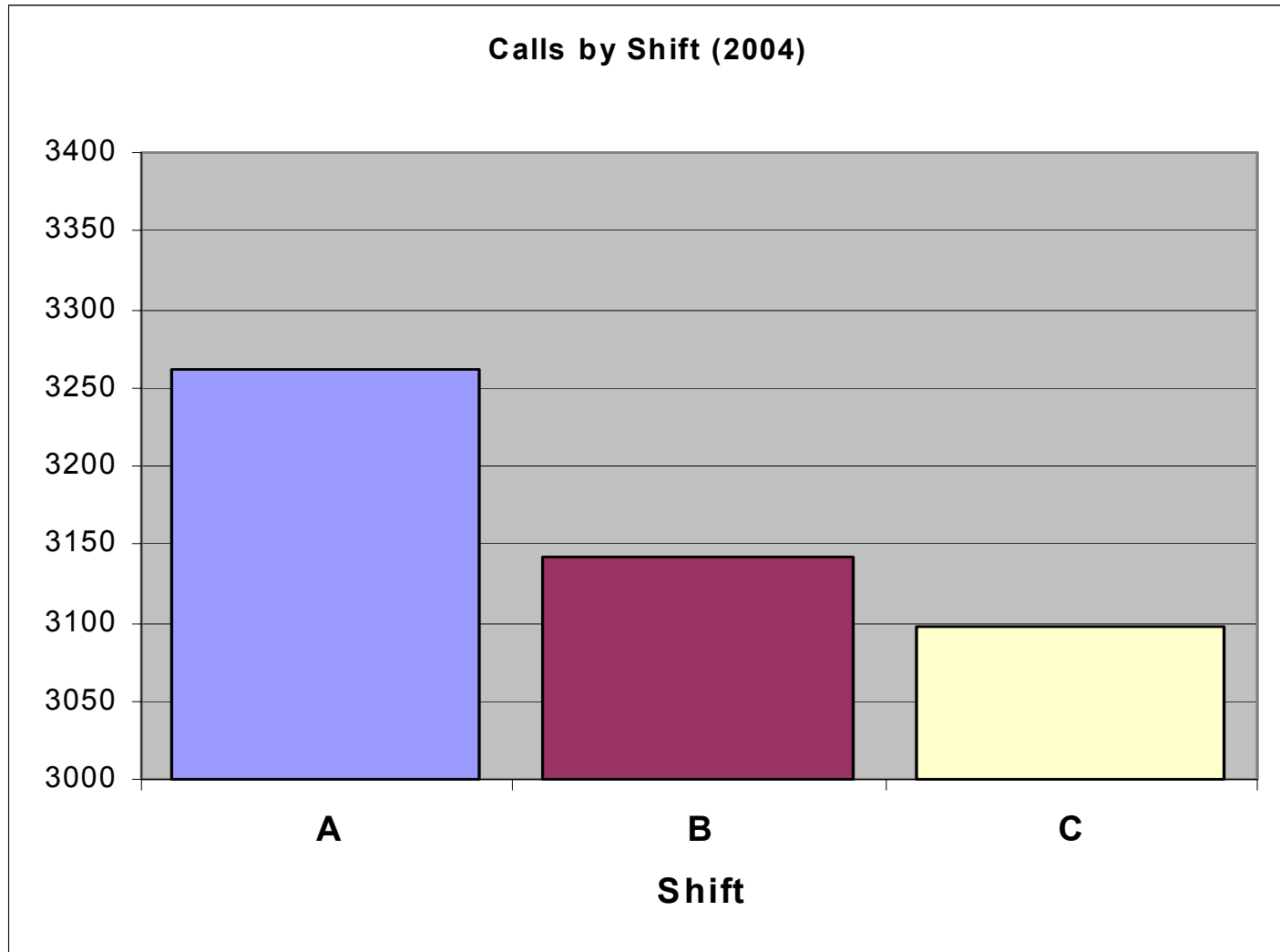
## C Shift Response Times by Station

	<b>Sta. 90</b>	<b>Sta. 91</b>	<b>Sta. 92</b>	<b>Sta. 93</b>	<b>Sta. 94</b>
Mean	0:05:19	0:06:12	0:06:16	0:06:43	0:05:59
Standard Error	0:00:04	0:00:09	0:00:08	0:00:11	0:00:08
Median	0:05:08	0:06:01	0:06:17	0:06:29	0:05:43
Mode	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00
Standard Deviation	0:02:34	0:03:07	0:02:58	0:03:29	0:03:04
Sample Variance	0:00:00	0:00:00	0:00:00	0:00:01	0:00:00
Kurtosis	5:22:23	11:03:33	1:52:07	12:49:16	22:22:12
Skewness	0:33:54	6:11:36	8:06:37	14:15:36	20:56:30
Range	0:21:29	0:23:02	0:16:57	0:20:50	0:18:48
Minimum	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00
Maximum	0:21:29	0:23:02	0:16:57	0:20:50	0:18:48
Sum	9:16:40	1:00:14	5:50:52	13:48:59	3:58:31
Count	<b>1189</b>	<b>474</b>	<b>516</b>	<b>338</b>	<b>521</b>

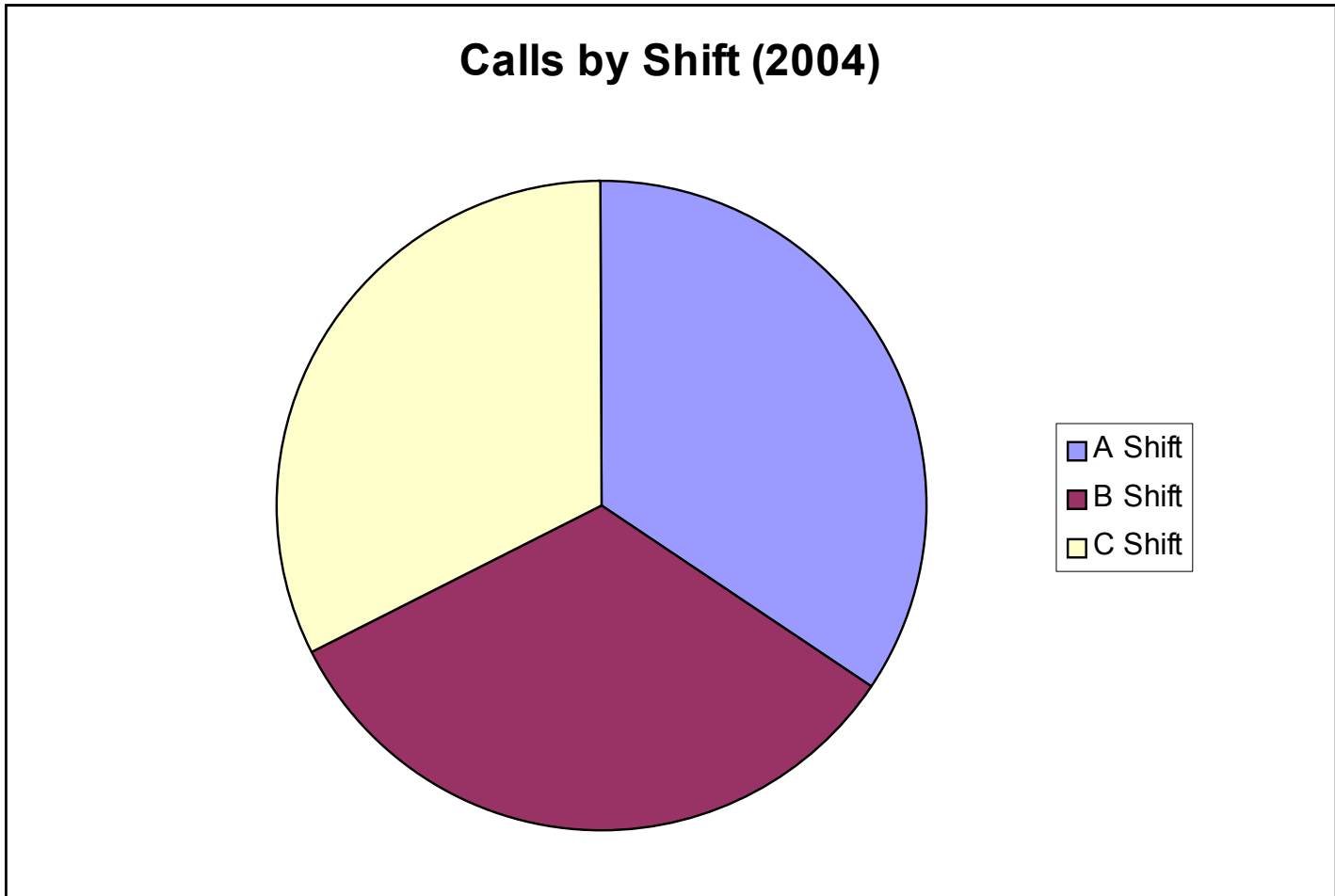
# Objective Chart



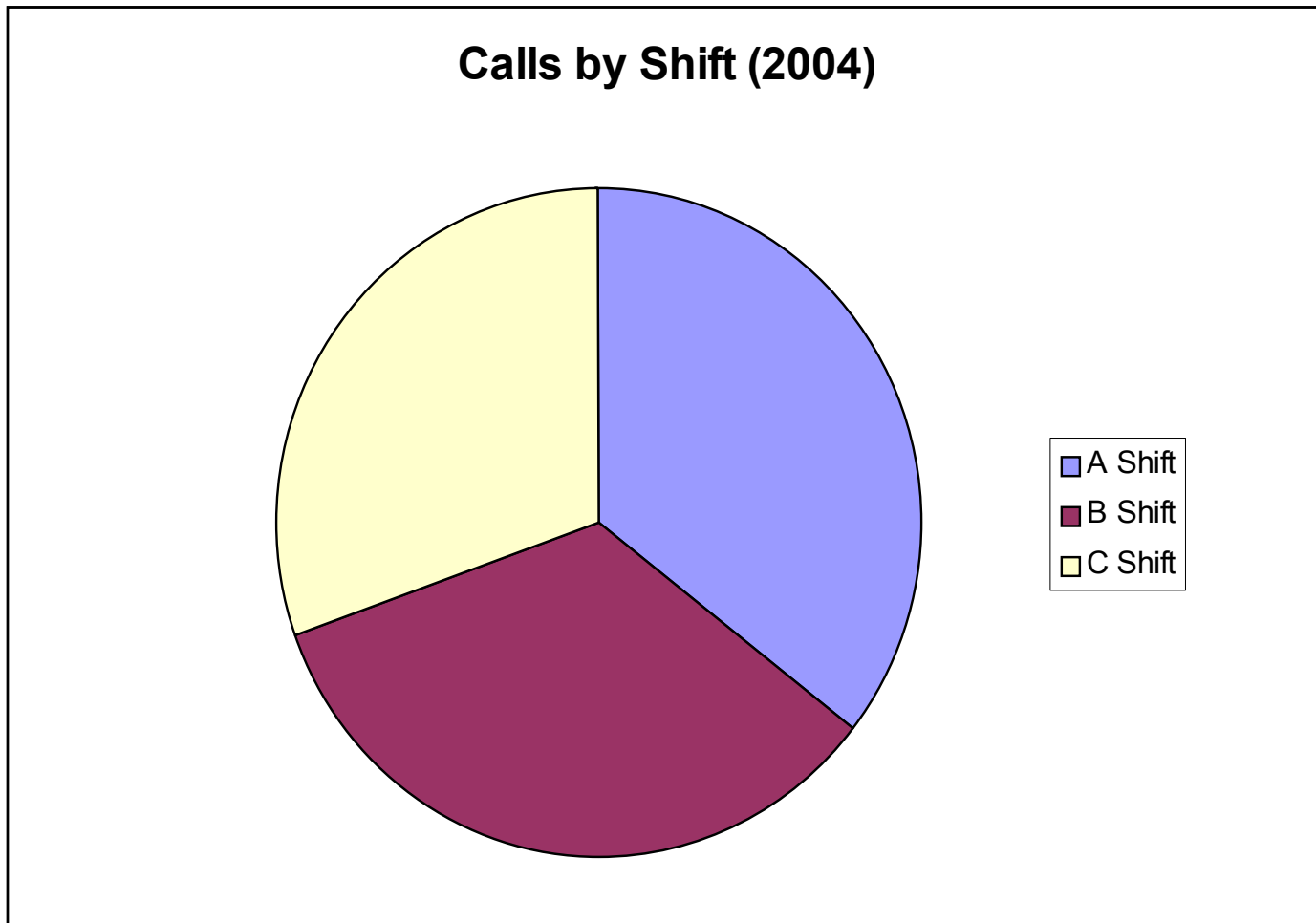
# Misleading Chart



# Deficient Chart



# Deficient Chart Changed



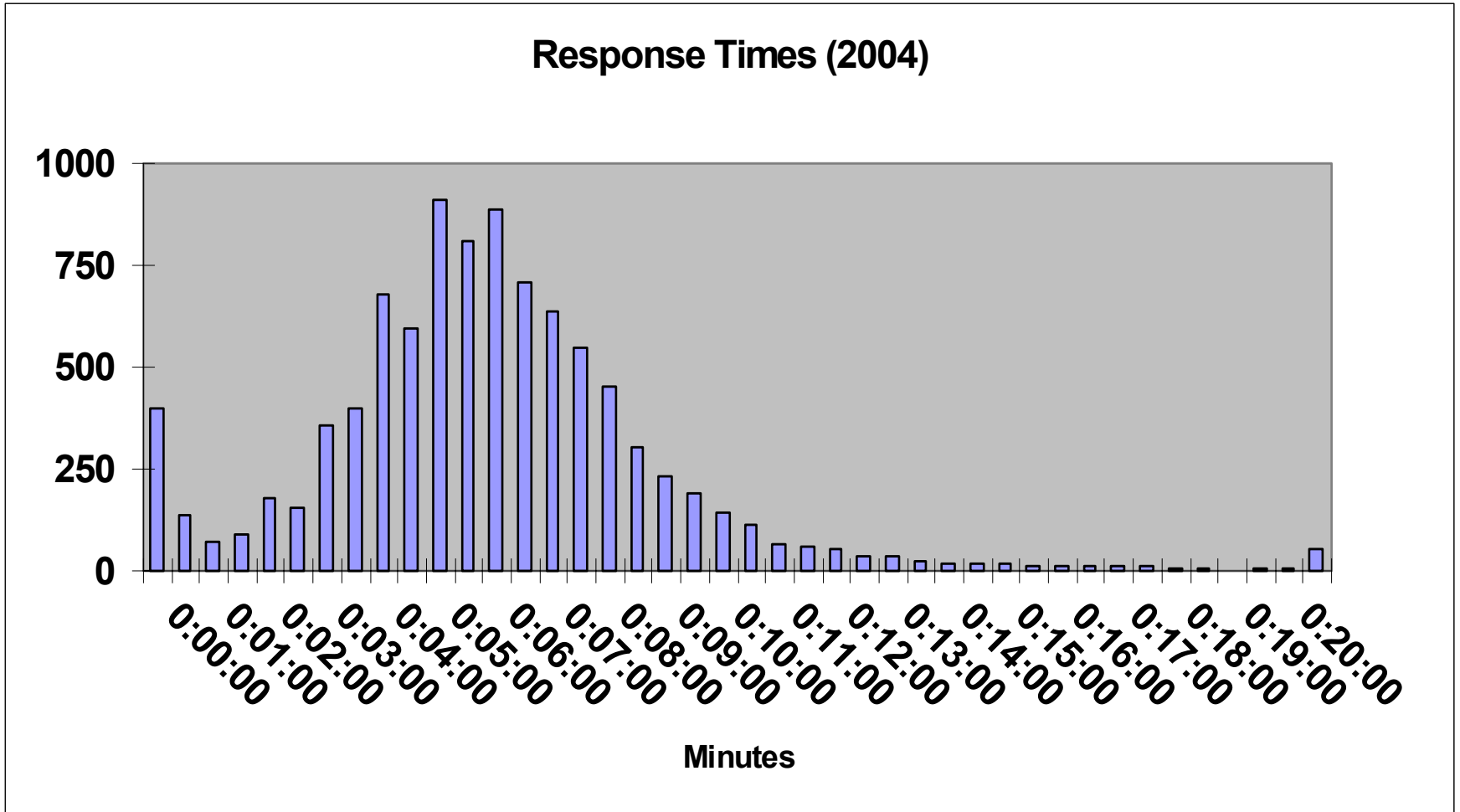
# Response Time Statistics

- **Response time for code 3 calls**
- **Response time for code 2 calls**
- **Response time for calls in first due area**
- **Response time for calls outside of first due area**
- **Response time for calls with multiple engine companies and times for each arriving company until the incident is fully staffed per the initial dispatch protocols**
- **Response times by station**
- **Response times by district, quadrant or other geographic measure**
- **Response times by hour of day**
- **Response times by day of week**
- **Response times by month of year**
- **Response times for surface streets versus others (e.g. freeway, wildland, recreational, water, etc...)**

# Descriptive Stats for 10,000 Responses

<i>Response Times Descriptive Statistics</i>	
Mean	0:05:49
Standard Error	0:00:05
Median	0:05:28
Mode	0:00:00
Standard Deviation	0:07:22
Sample Variance	0:00:02
Kurtosis	4:30:39
Skewness	14:53:45
Range	10:05:04
Minimum	0:00:00
Maximum	10:05:04
Sum	5:33:19
Count	9466

# Histogram



# Response Time Raw Data

<b>Response Time</b>	<b>Frequency</b>	<b>Response Time</b>	<b>Frequency</b>
0:00:00	396	0:10:30	113
0:00:30	134	0:11:00	68
0:01:00	74	0:11:30	60
0:01:30	88	0:12:00	56
0:02:00	180	0:12:30	35
0:02:30	157	0:13:00	38
0:03:00	357	0:13:30	23
0:03:30	401	0:14:00	20
0:04:00	679	0:14:30	20
0:04:30	597	0:15:00	16
0:05:00	909	0:15:30	14
0:05:30	807	0:16:00	9
0:06:00	889	0:16:30	11
0:06:30	708	0:17:00	10
0:07:00	638	0:17:30	9
0:07:30	550	0:18:00	8
0:08:00	453	0:18:30	8
0:08:30	302	0:19:00	1
0:09:00	231	0:19:30	7
0:09:30	189	0:20:00	5
0:10:00	143	More	53

# Structure Fire Response

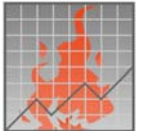
<b>Statistic</b>	<b>Second-in</b>	<b>Third-in</b>
<b>Mean</b>	0:07:14	0:08:46
<b>Standard Error</b>	0:00:17	0:00:28
<b>Median</b>	0:06:51	0:08:15
<b>Mode</b>	0:05:21	0:05:50
<b>Standard Deviation</b>	0:02:23	0:03:33
<b>Sample Variance</b>	0:00:00	0:00:01
<b>Kurtosis</b>	49:28:22	215:33:22
<b>Skewness</b>	21:41:38	53:39:23
<b>Range</b>	0:12:32	0:22:20
<b>Minimum</b>	0:02:21	0:03:57
<b>Maximum</b>	0:14:53	0:26:17
<b>Sum</b>	8:55:28	8:45:55
<b>Count</b>	74	60

# Conclusion

For each analysis you wish to perform:

- Make sure that you are analyzing the right thing articulated down to the most easily defensible level
- Write it down so it makes sense to you and your audience because you will have to document it
- Run descriptive statistics
- Create a histogram
- Generate your summary of raw data
- Interpret your findings, revise as necessary

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DATA ANALYSIS FOR  
THE FIRE SERVICE