

Statistical Concepts



Statistical Concepts Overview

- What are Statistics?
- Statistical Terms
 - Random Samples, Average
 - Standard Deviation, Control Charts
- Formulas
- Applications in the Aggregate Industry

What are Statistics?

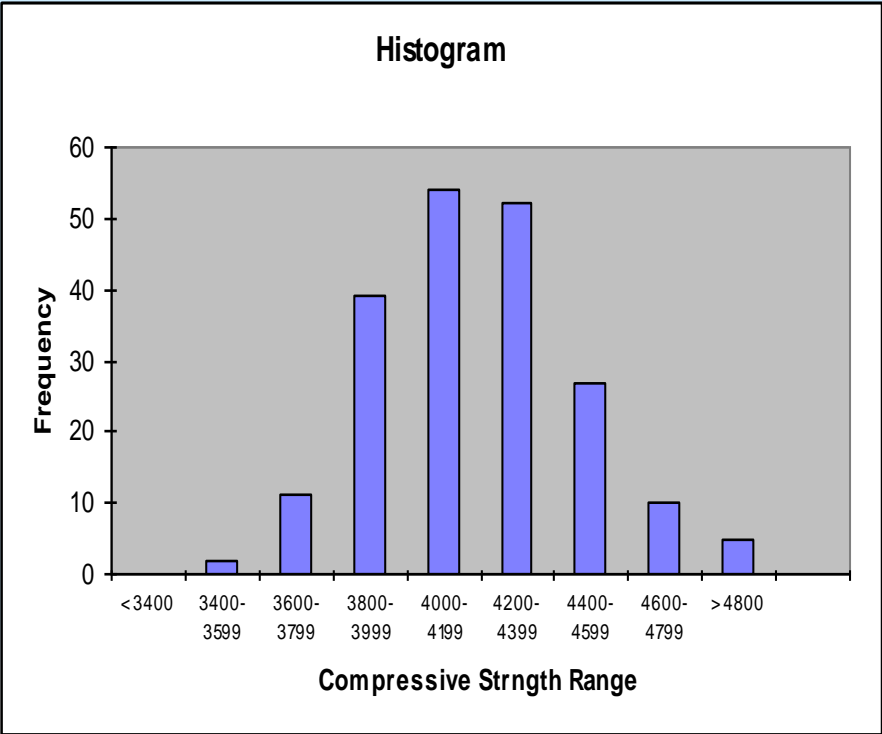
- Statistics has been described as “the science of making decisions based on uncertainties.”
- In other words...
 - “Making the best decisions based on incomplete information”
 - Making decisions based on test samples

Statistics Are All Around Us

- What type of corn gives the highest yield?
- Which feed mixture causes chickens to gain the most weight?
- How effective is a new drug?
- What is the average compressive strength for concrete cylinders?
- What is the average gradation for a No. 57 aggregate?

Common Statistical Terms

- Random sample
- Frequency
- Control chart
- Average
- Standard deviation



Random Sample

- Selection of sample where each possible sample has an equal chance of being selected
- Selection of one sample does not affect the selection of any other sample

Frequency

- The number of actual occurrences of a value or range of values
 - The number of times 40% - 45% passes the $\frac{1}{2}$ " screen in a series of gradation tests (see example on next slide)

Average

- Value that is calculated by adding each of the sample values and dividing by the number of observations
 - i.e. -- 10, 11, 16, 12, 19, 21, 13, 14
 - Sum of numbers = $10+11+16+12+19+21+13+14=116$
 - n = Number of observations = 8

$$\text{Average} = \bar{x} = \frac{\sum x}{n} = \frac{116}{8} = 14.5$$

Common Statistical Terms

- Standard Deviation
 - Measure of Variation & Consistency
 - Describes how data are distributed or scattered
 - Defines how the data are spread apart
 - “Average” deviation that each data point is from the mean
 - **Lower standard deviation means more consistency**
 - **Higher standard deviation means higher variability**

$$\text{Std Deviation} = s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

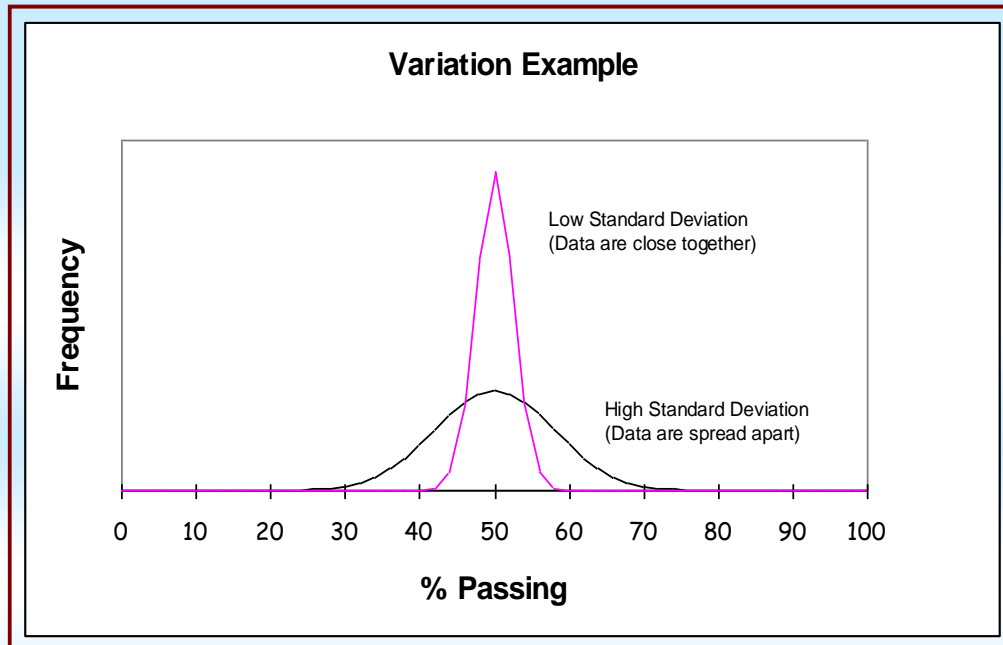
Standard Deviation

Observation	x	Average	(x-Avg)	(x-Avg) ²
1	10	14.5	-4.5	20.25
2	11	14.5	-3.5	12.25
3	16	14.5	1.5	2.25
4	12	14.5	-2.5	6.25
5	19	14.5	4.5	20.25
6	21	14.5	6.5	42.25
7	13	14.5	-1.5	2.25
8	14	14.5	-0.5	0.25
Sum	116			106
Average	14.5			

$$\text{Std Deviation} = s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} = \sqrt{\frac{106}{7}} = 3.9$$

Statistical Relationships

Average = 50% Passing



Summary

- Statistics is about making decisions (predictions) based on test samples
- Common statistical terms
 - Random Samples
 - Frequency
 - Control charts
 - Average
 - Standard Deviation

Summary

- Average (Arithmetic Mean)
 - Value that is calculated by adding each of the sample values and dividing by the number of observations

$$\text{Average} = \bar{x} = \frac{\sum x}{n}$$

