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Schedule and Cost Performance Analysis and Prediction in Louisiana DOTD

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Schedule and Cost Performance Analysis and Prediction in Louisiana DOTD

A Dissertation

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By

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To My Mother and Father, it was a long road, but I did it because that was what you wanted and because you always were in my heart.

Mahmoud Abdul Rahman Hamide, Ph.D., PE

May 13, 2017

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Abstract

Many construction projects in the United States are facing the risk of cost overrun and schedule delays. This is also happening here in the State of Louisiana. When these things happen, it causes cost overrun which can then be passed on to the tax payers and may also cause the state to take on less projects than they normal. Many researchers have studied the reasons behind both the cost overrun and the delays resulting in private firms, developing project management tools and best practices to prevent this risk. In this research, I aim to study the historical trend in 2912 publically funded projects in the State of Louisiana. The study will reveal the overall state level of accuracy of forecasting cost and schedule. A forecasting formula based on those historical projects will be developed to assist estimators at the Parish level in predicting cost and schedule performance.

Keywords: PERT, Scheduling analysis, Louisiana DOTD, Construction, Cost estimating, Schedule analysis, Statistics, Prediction model, Districts comparison, finish date forecast, Cost forecast.

Introduction

The State of Louisiana has so many projects that deal with the transportation system (roadway, bridges, drainage, traffic sign, traffic signal, lighting etc...)

This Dissertation will be a study and analysis of time and cost of the projects in LADOTD, whether the projects finish on time, before time or after time as well as the cost of the project that has been completed overrun or underrun or the exact amount that the bid amount was. With this study and analysis, it is intended to create time schedule and cost to be used to on reaching accuracy on finishing the project on time and the exact bid amount of the project (exclude whether condition, extra work, and some unexpected problems that may arise during the length of the project).

Louisiana Department of Transportation and Development (LADOTD) divided the State of Louisiana to 9 districts as shown in (Figure 1), that include 64 parishes as shown in (Figure 2), "**(www.dotd.la.gov)**"; the total number of the projects since 2005-2015 is 2912 projects and the total amount of these projects is $8,533,463,133.73.
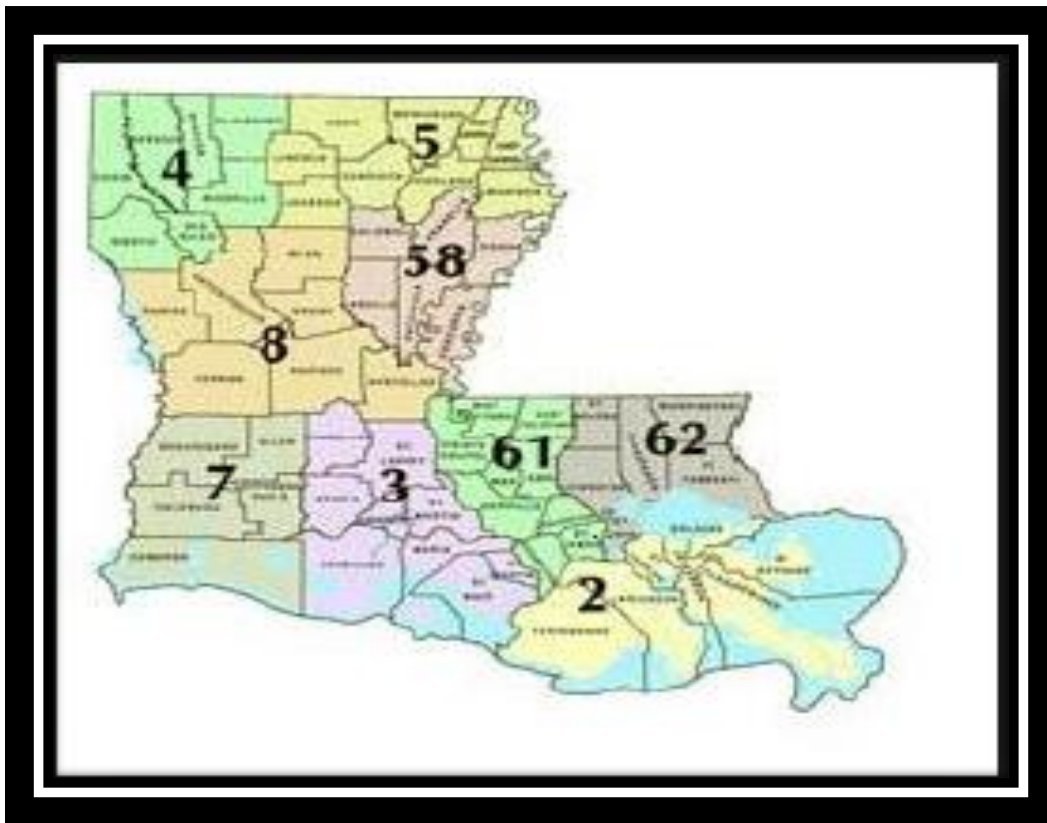
Figure 1-Louisiana's Congressional districts (Politics and government of Louisiana)
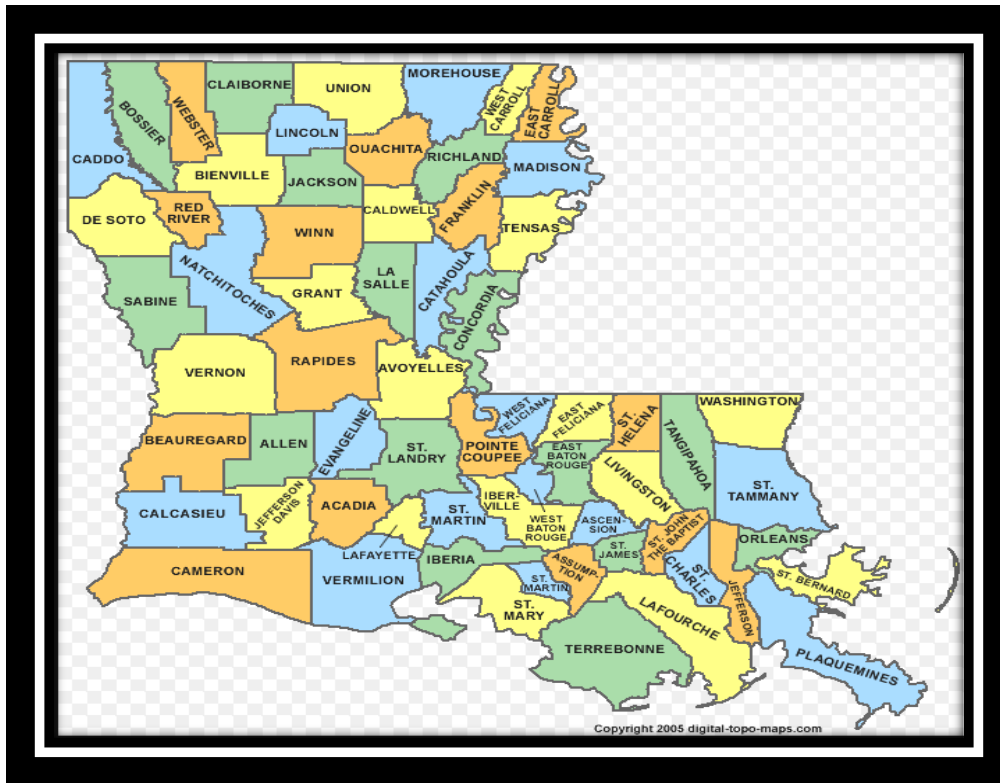
Figure 2-Louisiana's Congressional Parishes **(Politics and government of Louisiana)**

The following tables show some facts about every district in the State of Louisiana. I can use these facts to evaluate each parish to show the level of performance in completing the projects on time and within budget.

District 02

Total number of projects since 2005-2015 = 377
Total amount = $ 1,339,241,498.45
Total area (Land & Water) = 9,705 mi²

TABLE 1-DISTRICT 02 PARISHES

Parish	Area(Land & Water)	No. of Projects	Total Cost ($)
Terrebonne	2080 mi²	39	57,790,888.33
St. Charles	411 mi²	41	94,112,881.03
Jefferson	665 mi²	92	277,193,958.36
Orleans	350 mi²	96	344,675,832.20
St. Bernard	2158 mi²	22	30,474,855.59
Plaquemines	2567 mi²	30	50,492,696.20
Lafourche	1474 mi²	57	359,760,179.41

District 03

Total number of projects since 2005-2015 = 319
Total amount = $ 639,719,968.51
Total area (Land & Water) = 7,053 mi²

TABLE 2- DISTRICT 03 PARISHES

Parish	Area (Land & Water)	No. of Projects	Total Cost ($)
Lafayette	269 mi²	60	162,125,683.14
St. Martin	816 mi²	26	33,501,745.46
Iberia	1031 mi²	32	127,586,755.15
St. Mary	1119 mi²	20	28,674,454.53
St. Landry	939 mi²	54	110,759,642.81
Acadia	657 mi²	57	62,014,891.46
Evangeline	680 mi²	25	38,965,936.19
Vermilion	1542 mi²	45	74,579,722.13

District 04

Total number of projects since 2005-2015 = 461
Total amount = $ 975,856,869.07
Total area (Land & Water) = 5,305 mi²

TABLE 3- DISTRICT 04 PARISHES

Parish	Area(Land & Water)	No. of Projects	Total Cost ($)
Caddo	937 mi²	157	564,326,579.51
Bossier	867 mi²	94	137,990,883.19
Webster	615 mi²	53	56,302,920.18
Bienville	822 mi²	43	54,809,655.13
Red River	402 mi²	27	30,356,001.82
Desoto	895 mi²	54	76,079,114.16
Claiborne	767 mi²	33	55,991,715.08

District 05

Total number of projects since 2005-2015 = 383
Total amount = $ 636,576,992.16
Total area (Land & Water) = 5,684 mi²

TABLE 4-DiSTRICT 05 PARISHES

Parish	Area (Land& Water)	No. of Projects	Total Cost ($)
Ouachita	632 mi²	106	192,298,739.60
Richland	565 mi²	57	65,650,508.68
Lincoln	472 mi²	57	111,963,161.68
Madison	651 mi²	39	78,906,191.68
Morehouse	806 mi²	34	48,174,345.31
East Carroll	442 mi²	17	29,667,615.99
Jackson	580 mi²	30	88,857,244.07
West Carroll	361 mi²	20	22,271,687.15
Union	905 mi²	23	77,693,689.68

District 07

Total number of projects since 2005-2015= 256
Total amount = $ 603,007,614.38
Total area (Land& Water) = 5,622 mi²

TABLE 5-DISTRICT 07 PARISHES

Parish	Area (Land & Water)	No. of Projects	Total Cost ($)
Calcasieu	1094 mi²	106	290,767,843.90
Jefferson Davis	659 mi²	48	160,983,397.70
Beauregard	1166 mi²	36	72,070,520.08
Allen	766 mi²	40	40,253,853.24
Cameron	1937 mi²	26	38,931,999.46

District 08

Total number of projects since 2005-2015 = 247
Total amount = $ 422,236,452.35
Total area (Land & water) = 7,502 mi²

TRABLE 6-DISTRICT 08 PARISHES

Parish	Area(Land & Water)	No. of Projects	Total Cost ($)
Avoyelles	866 mi²	35	37,343,930.86
Rapides	1362 mi²	70	87,954,137.59
Grant	665 mi²	19	43,430,102.48
Natchitoches	1299 mi²	42	74,352,850.38
Winn	957 mi²	26	50,226,856.61
Vernon	1341 mi²	33	102,641,103.50
Sabine	1012 mi²	22	25,132,861.32

District 58

Total number of project since 2005-2015 = 170
Total amount = $ 1,238,197,844.65
Total area (Land & Water) = 3,965 mi²

TABLE 7-DISTRICT 58 PARISHES

Parish	Area (Land & Water)	No. of Projects	Total Cost ($)
La Salle	662 mi²	30	29,667,723.80
Caldwell	541 mi²	21	77,882,154.81
Concordia	747 mi²	28	967,746,388.94
Tensas	641 mi²	21	24,906,908.32
Catahoula	739 mi²	26	75,160,867.23
Franklin	635 mi²	44	62,833,801.55

District 61

Total number of projects since 2005-2015 = 280
Total amount = $ 853,131,977.39
Total area (Land & Water) = 3,726 mi²

TABLE 8- DISTRICT 61 PARISHES

Parish	Area (Land & Water)	No. of Projects	Total Cost ($)
Assumption	365 mi²	30	69,872,317.26
East Baton Rouge	470 mi²	107	443,864,803.08
West Baton Rouge	204 mi²	18	22,270,771.14
Point Coupee	591 mi²	20	45,491,846.64
West Feliciana	426 mi²	14	107,490,812.26
Ascension	303 mi²	44	66,877,967.37
Iberville	653 mi²	19	37,197,790.73
East Feliciana	456 mi²	18	41,153,447.30
St. James	258 mi²	10	18,912,221.61

District 62

Total number of projects since 2005-2015 = 419
Total amount = $ 958,115,888.04
Total Area (Land & Water) = 4,083   mi²

TABLE 9-DISTREICT 61 PARISHES

Parish	Area (Land & Water)	No. of Projects	Total Cost ($)
St. Tammany	1124 mi²	125	312,115,592.81
St. John	348 mi²	30	24,411,548.48
St. Helena	409 mi²	25	30,736,328.26
Livingston	703 mi²	89	230,284,130.71
Tangipahoa	823 mi²	110	285,869,406.85
Washington	676 mi²	40	74,698,880.93

Comparison between Districts (Number of Projects, Total Amount, Total Areas)

District 04 has the most total number of projects -see Figure 1A
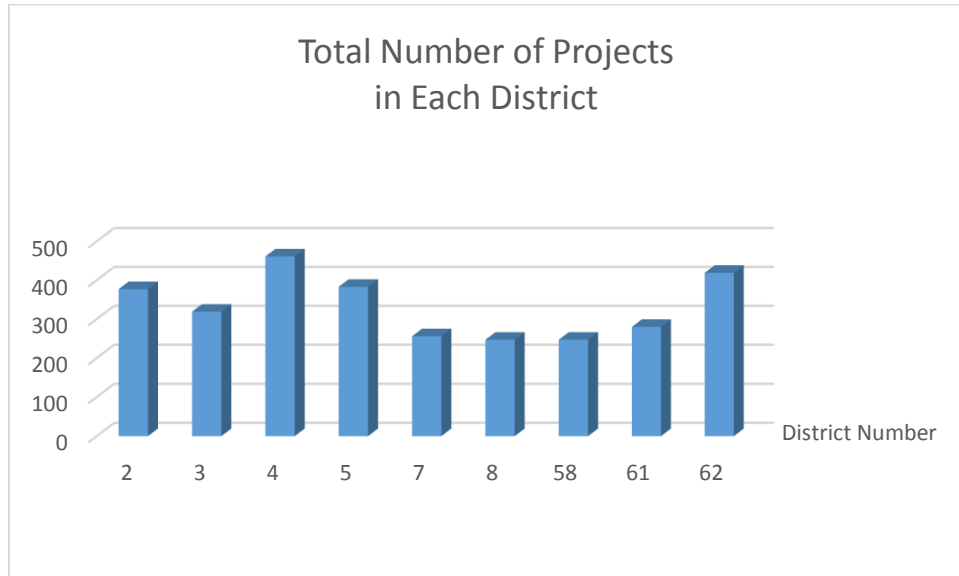
Figure 1A- Total Number of Projects in Each District

District 02 has the most total amount of projects- see Figure 1B
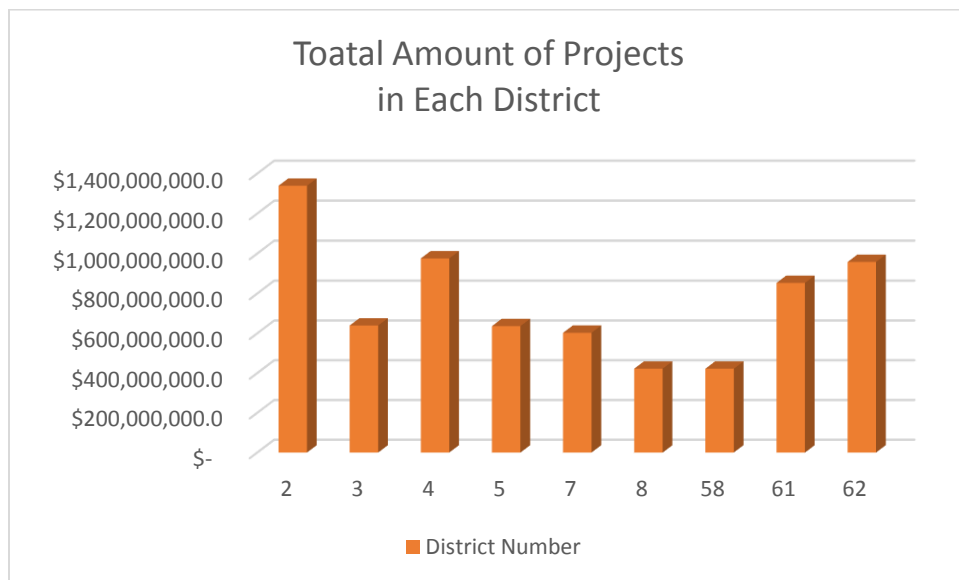
Figure 1B- Total Amount of Projects in Each District

District 02 has the most total area - see Figure 1C
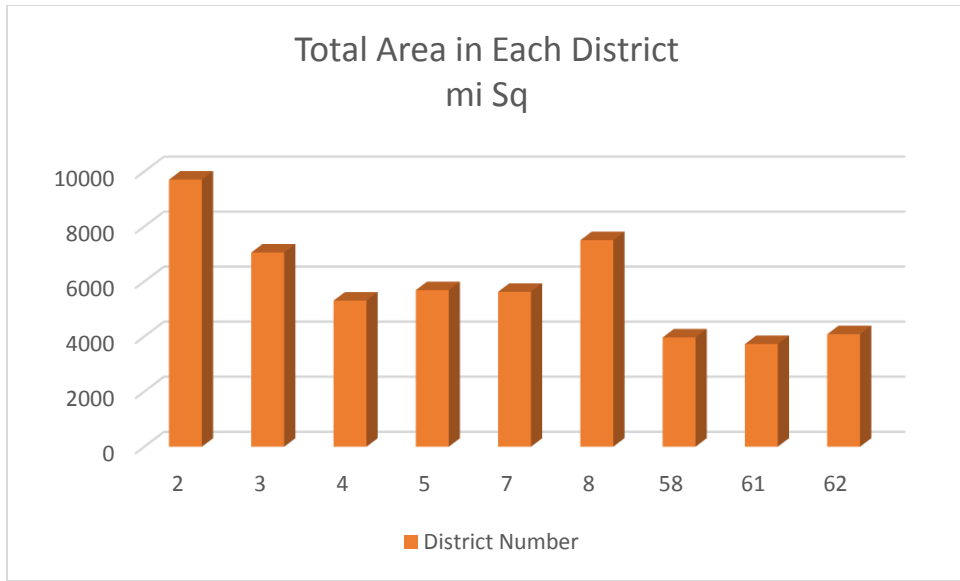
Figure 1C- Total Area in Each District

Objective

The objective is to find historical data of projects done in Louisiana and run statistical analysis methods to develop equations to predict future projects. (Time Finish and Final cost) so we can eliminate some of the PERT's weaknesses explained below:

1) The activity time estimates are somewhat subjective and depend on judgment. In cases where there is little experience in performing an activity, the numbers may be only a rough estimate.

2) Even if the activity times are well-estimated, PERT assumes a beta distribution for these time estimates, but the actual distribution may be different.

3) Even if the beta distribution assumption holds, PERT assumes that the probability distribution of the project completion time is the same as that of associated activities is delayed.

"(Origin, Methodology, Advantages and Limitations/www.businessmanagementideas.com/business/pert-origin…and-limitations/535)".

Also:

1) Study the accuracy of PERT method of scheduling, which is highly followed in Louisiana.
2) Compare parish and district level of schedule and cost performance.
3) Use historical data from 2005 through 2015 as a prediction model for future schedule and cost performance by parish**.**

Literature review

Network Scheduling Techniques

Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM)

Management is always seeking a new and better control networks and better methods for presenting technical and cost data to the owner. The most common networks are Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM). Both are network techniques used to manage and control a project. However, they are many similarities and differences between the two. First the similarities between PERT and CPM are both are to plan the scheduling, both follow the same procedure and use network diagram and both can be used to determine the earliest/latest start and finish times for each activity. On the other hand, they are two differences between PERT and CPM. First, in PERT three time estimates are used to calculate a weighted average of the expected activity time. In CPM only one-time estimate is used. Thus, PERT is considered to be a probabilistic tool, whereas CPM is considered to be a deterministic tool. Second, only CPM allows an explicit estimate of costs. Thus, while PERT allows control of time only, CPM allows control of both time and cost of project.

The Program Evaluation and Review Technique (PERT) is a widely used method for planning and coordinating projects. As Harold Kerzner explained in his book Project Management seven edition chapter 12. PERT was developed during the 1958 and 1959. The special projects office of the U.S. Navy, concerned with performance trends on large military development programs, introduced PERT on its Polaris Weapon System in 1958, after the technique had been developed with the aid of the management consulting firm of Booz, Allen, and Hamilton. Since that time, PERT has spread rapidly throughout the industries. At the same time the Navy was developing PERT, and they use PERT to coordinate the efforts of some 3,000 contractors involved with the project? Now all government contractors have been required to use PERT for all major government contracts. "Harold Kerzner. Project Management Seventh Edition chapter 12"

Throughout the dissertation, bid duration has been presented and it was developed using the Program Evaluation and Review Technique (PERT) as it is the most common scheduling technique in Louisiana, and it is relied on heavily in the Department of Transportation (LADOTD).

PERT is a project manager tool that helps schedule and manage complex projects. This section will explain the background of PERT technique and its limitations.

Project managers are responsible for numerous tasks that include, but not limited to planning, scheduling and controlling projects that are so large and complex that it would impossible for an individual to remember all the information that is needed to thoroughly plan a successful project. Using PERT took this uncertainty into account by allowing three times estimates to calculate a weighted average of the expected activity time which are:

A. Optimistic Time (t_o) Project completed before time of the contract (Duration under the most favorable conditions)
B. Pessimistic Time (t_p) Project Completed after time of the contract (Duration under the most unfavorable conditions)
C. Most Likely Time (t_m) Project completed on time of the contract (Value of Duration)

After estimating every Activity Time, Optimistic Time (t_o), Pessimistic Time (t_p) and Most Likely Time (t_m) then the Expected Time, t_e (Weighted Average), Standard Deviation, and Variance of Activity must be determined using the following formulas:

- **Expected Time (weighted average) (te) =** $\dfrac{to+4tm+tp}{6}$ (Equation 1)

- **Standard Deviation (σ)** $= \dfrac{tp-t0}{6}$ (Equation 2)

- **Variance (σ²)** $= (\dfrac{tp-to}{6})^2$ (Equation 3)

One of the limitations of PERT is the activity time and cost estimates are somewhat subjective and depend on judgment of the project manager or field team. Another limitation is that it depends on the level of effort the team puts into estimating pessimistic, optimistic and most likely cases, where lack of experience or variable site conditions will hurt the method." Clifford F. Gray and Erik W. Larson Project Management Second Edition Appendix 7.1"

Empirical Rule [68%-95%-99.7 % Rule]

Empirical Rules (68%-95%-99.7% rule**) (Figure 3)** provide an estimate of the spread of data in a normal distribution given the mean and the standard deviation. The Rules consist of the following:

68% of the observations fall within 1σ of the mean μ (mathematically, μ ± σ, where μ is the arithmetic mean). The empirical rule states that for roughly bell-shaped distribution about 68% of the data value will have z-scores between ±1 **(Figure 4)**
95% of the observations fall within 2σ of the mean μ (mathematically, (μ ± 2σ, where μ is the arithmetic mean). The empirical rule states that for roughly bell-shaped distribution about 95% of the data value will have z-scores between ±2 **(Figure 4)**
99.7 % of the observations fall within 3σ of the mean μ (mathematically, (μ ± 2σ, where μ is the arithmetic mean). The empirical rule states that for roughly bell-shaped distribution about 99.7% of the data value will have z-scores between ±3 **(Figure 4)**

Bell- shape (Normal Distribution Curve)

Normal distribution curve is symmetrical with a single central peak at the mean (average) of the data.
And because the curve is symmetric, the total area under the curve =1 and σ=0 and $\mu = 0$
"(Statistical Techniques in Business & Economics (Ninth Edition), Robert D. Mason. Douglas A. Lind)"
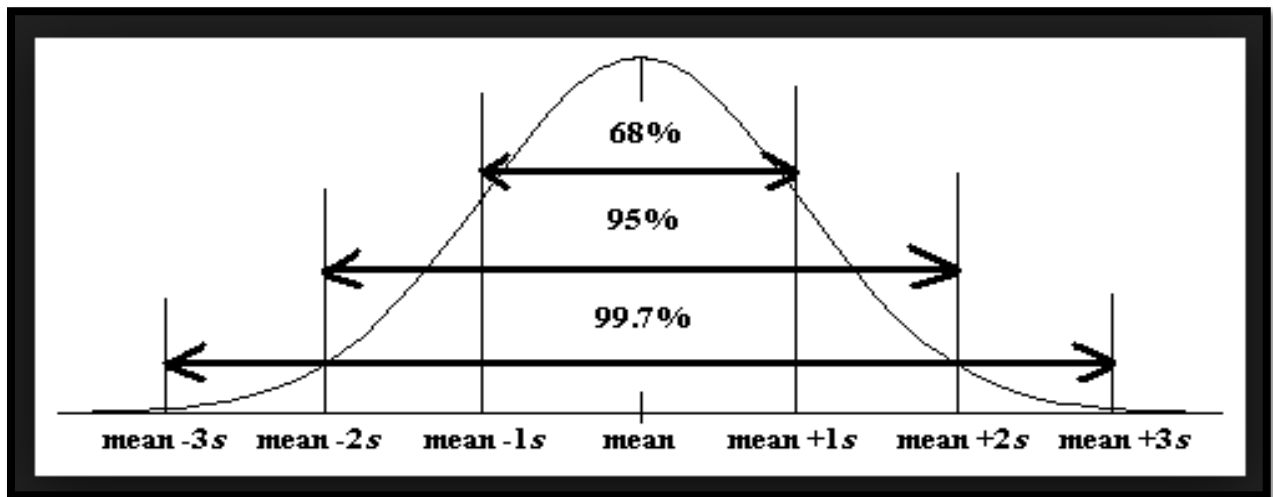
Figure 3-Normal Distribution Curve (Bell-Shape)
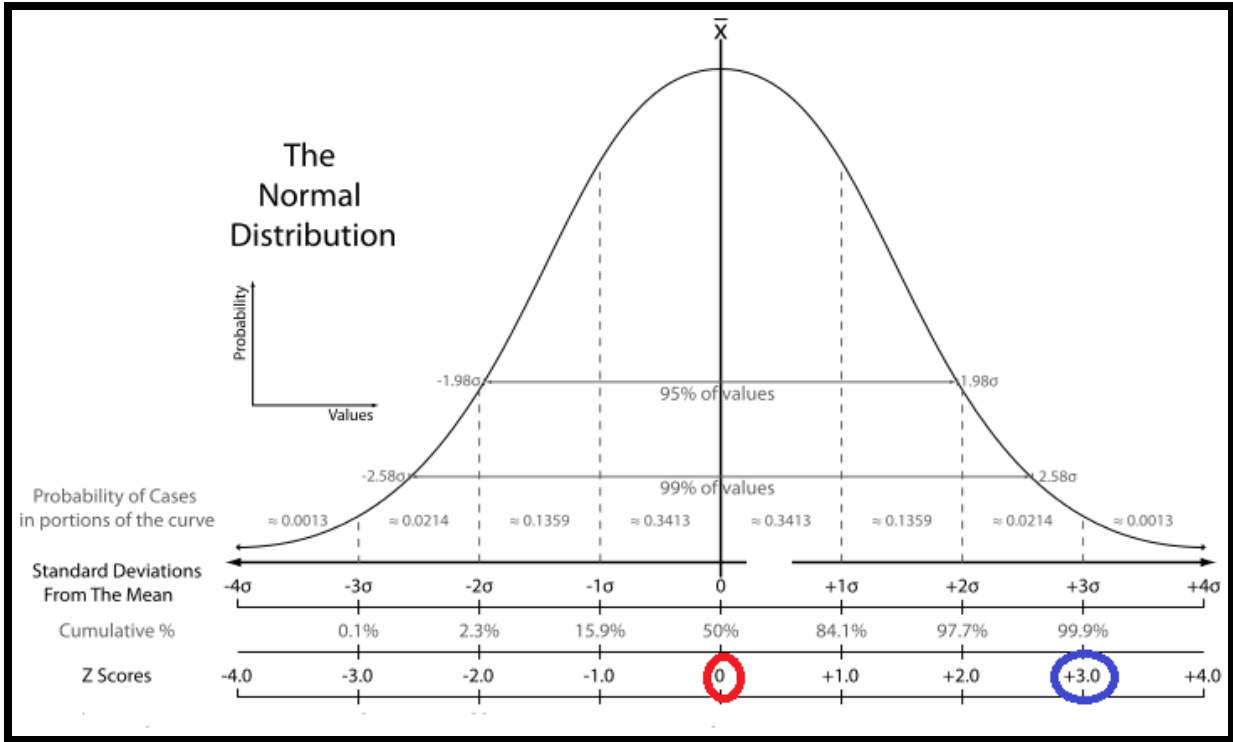
Figure 4- Normal Distribution, Z-Scores

Bell-shape shows how much variation or dispersion there is from the average (Mean). Small standard deviation indicates that data points tend to be very close to the mean, where a large standard deviation indicates that the data is spread out over a large range of values **(Figure 5)**

"(Davis, James B. Journal of Forestry, Volume 66, Number 5, 1 May 1968, pp. 405-408(4)Society of American Foresters)"
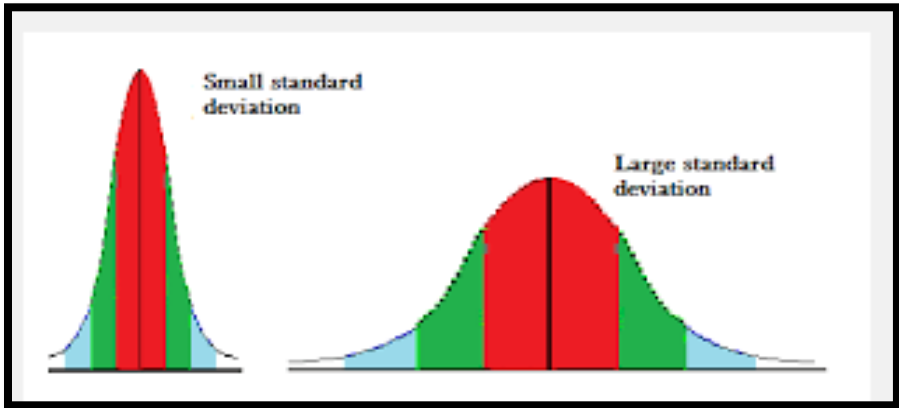
Figure 5 -Small and Large Standard Deviation

Z score Normal Distribution

Indicate how many standard deviations an element is from the mean

Z-Score can be positive (above the mean) and negative (below the mean)

Z-Score can be zero (equal to the mean)

Z-Score can be used for a special percentage.
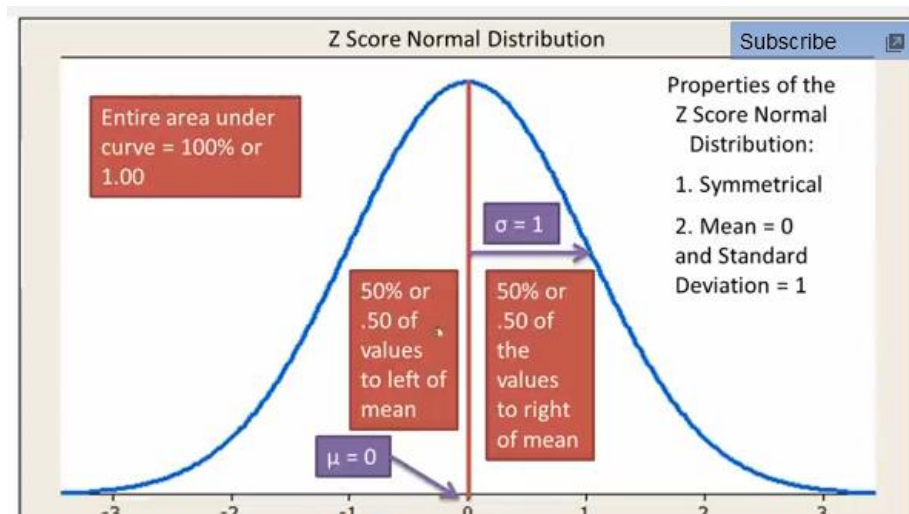
Figure 6- Z score Normal Distribution

To calculate the Z-Score use the following formula:

$$Z\text{-Score} = \frac{(X-\mu)}{\sigma} = \frac{X-\mu}{\sqrt{V}} \text{(Equation 4)}$$

Where:

X= Value of original score

μ = Population mean

σ = Population Standard deviation

V = Variance = σ^2

Two tables are used to find the values represent the area to the left of the Z-Score (Table10), Appendix B and to the right of the Z-Score (Table11), Appendix C

Example1

We have the following information regarding activities and their sequence for house construction

Activity	Description	Preceding Activities
A	Clear Lot	None
B	Excavate	A
C	Pour footing	A
D	Do plumbing rough-in	C
E	Lay block walls of cellar and house	A
F	Do electrical rough-in	C
G	Complete roof	D,B
H	Tile Walls	E
I	Clean and rough-grade lot	F,G
J	Install trim and inspection	I,H

The three times estimates are entered in the following table; the three time estimates are identical, indicating that the activity time is known with certainty.

Activity	(t_o)	(t_m)	(t_p)	(t_e)
A	10	30	50	30
B	10	30	110	40
C	30	40	50	40
D	10	20	30	20
E	30	30	90	40
F	20	50	140	60
G	20	30	40	30
H	10	10	10	10
I	120	120	120	120
J	10	20	30	20

(te) from above table is the expected time of an activity and can be used as weighted average and duration of an activity. As shown below:
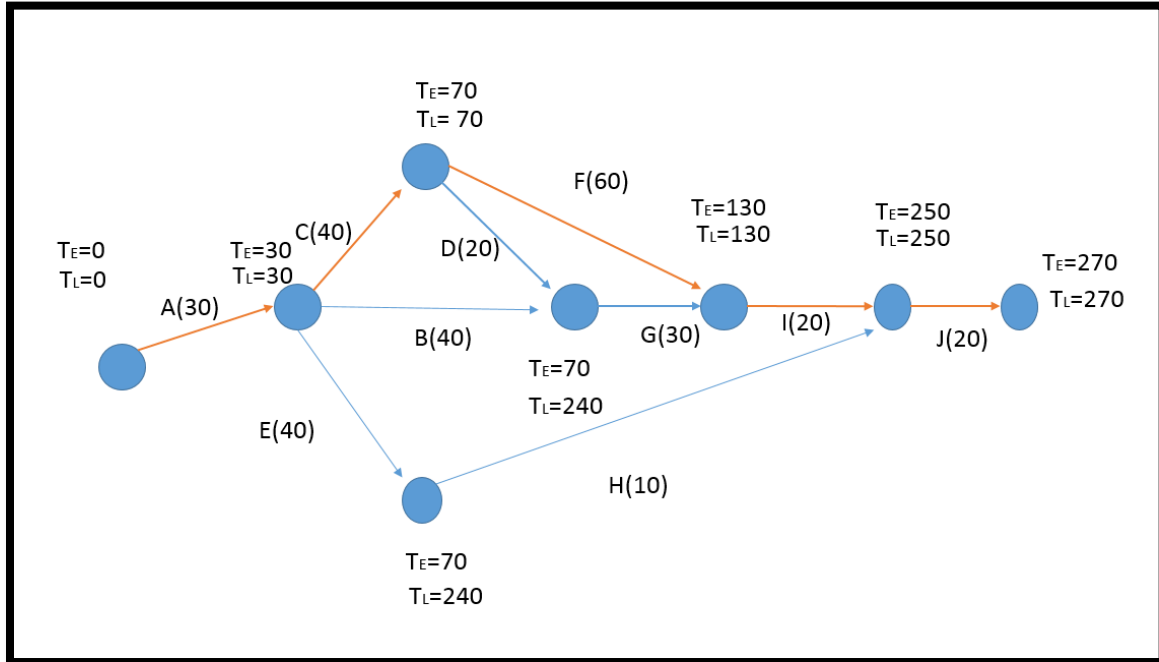
The project critical path is (A-C-F-I-J) and the total project is (30+40+60+20+20=170 days

1) All the activity that meet the following condition will be include in the critical path

   a) $T_E = T_L = 0$ for laid event
   b) $T_E = T_L = 30$ for head event
   c) $E_j - E_i = L_j - L_i = T_e$ 30-0 =30   30-0= 30 Te=30 (from table above)

From this method we also find that the critical path the same as method (a).
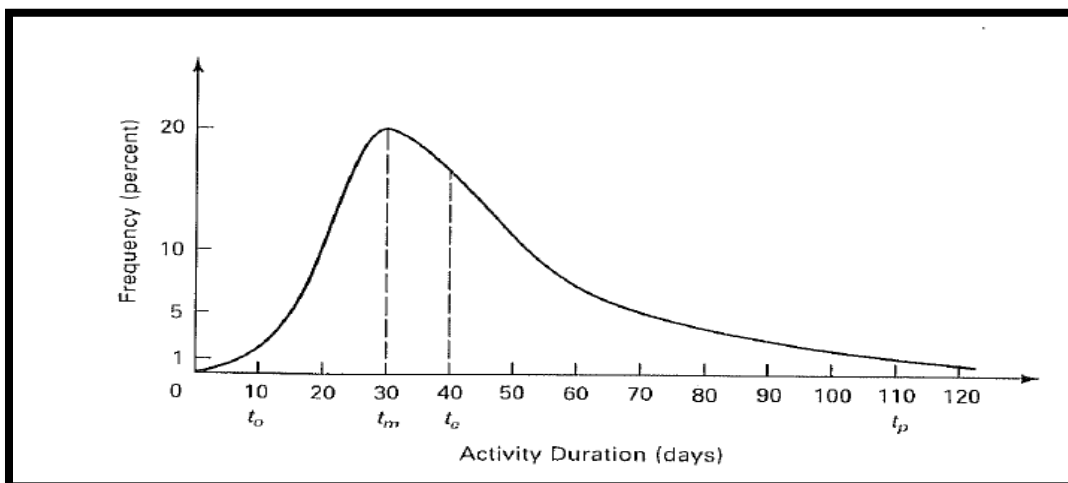
It has been determined for the normal distribution that there is a 50% chance that the entire project will be completed by its earliest expected time (270 days in our construction project). However, "50% chance" may not constitute sufficient information for management. Management may want to know the duration that has a large chance of completion (say 60%). Similarly, management may want to know the chance of completing the project in a given amount of time, (say 220 or 250 days). To answer such questions, an analysis involving the uncertainty associated with the duration times is presented.

Find the Z-Score for activity B the standard deviation is:

$$\sigma_B = \frac{110-10}{6} = 16.7 \text{ days}$$

And the Variance V is:

V= $\sigma^2 = (16.7)^2 = 278$ days

Table below show σ (Standard Deviation) and V (Variance) for other activities.

Activity	σ (Standard Deviation)	V (Variance)
A	3.3	11.1
B	16.7	278
C	3.3	11.1
D	3.3	11.1
E	10	100
F	20	400
G	3.3	11.1
H	0	0
I	0	0
J	3.3	11.1

From the table above for activity H and I the variance is zero, since $t_p = t_o$ for these activities. This means that no uncertainty is involved in their estimates. The larger the variance, the greater the degree of uncertainty involved in estimating the duration of the activity.

Assuming that the duration of the activities is independent on each other, the variance V of a group of activities can be computed by adding the variances of the activities in that group. The value of V is then expressed as

$$V = \sigma^2 1 + \sigma^2 2 + \cdots + \sigma^2 n$$

Where *n* is the number of activities in the group.

Of special interest are the activities that comprise the critical path. For example, in the construction project of Figure above, Critical Path is (A, C, F, I, J) the variance for the critical path is given as:

$$V = \sigma^2 A + \sigma^2 C + \sigma^2 F + \sigma^2 I + \sigma^2 J$$

V= 11 +11 +400 +0 +11 = 433

The value of the variance can be computed for any event by considering the group of critical activities that lead to that event. The chance of completing the project in certain desired time and the duration related to any desired probability of completion can now be calculated. Let:

S = scheduled project completion time = 270 days

D= the desired completion time = 300 days

$$Z = (D-S)/\sqrt{V}$$

Z = $(300-270)/\sqrt{433}$

Z = 30/20.8 = 1.44

The probability equivalent to Z = 1.44 can be found in Table (11)

Its value is 0.92507. There is a 92.51 % chance of completing the project in 300 days. One should remember that there is only a 50% chance of completing the construction project in 270 days.

"(Essentials of Production and Orations Management) by Ehud Menipaz) Page 146-150"

Example 2

We have the following information about activity A

μ= 30 days σ= 3.3 days

What is the probability that activity A would be completed in 29 days, 31 days and 26 days
Use the Z-Score method
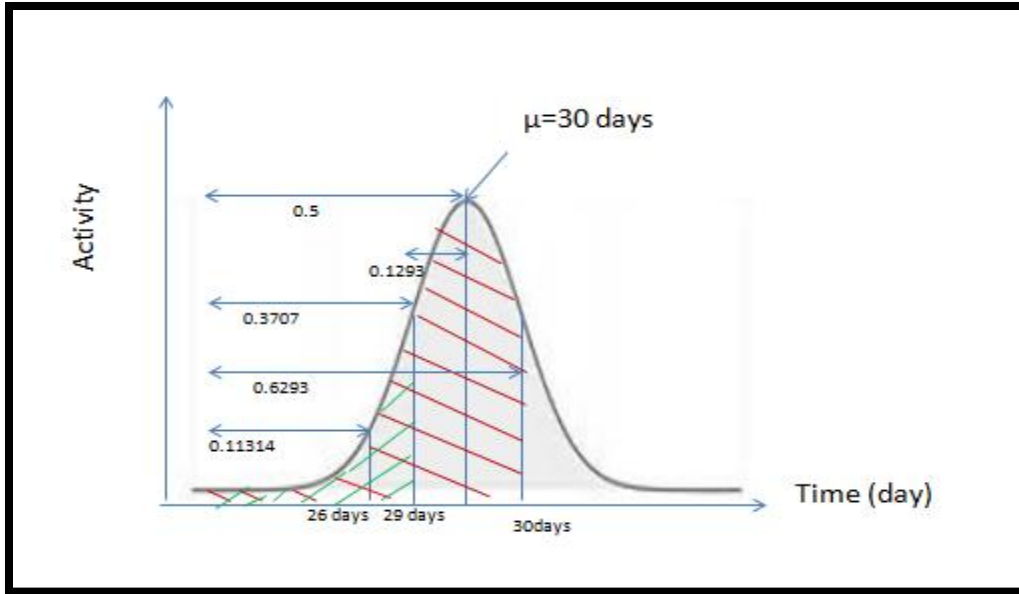
A) 29 days

$$Z = \frac{X - \mu}{\sigma} = \frac{29 - 30}{3.3} = \frac{-1}{3.3} = -0.303$$

From Table 10

Its value is 0.3707. There is a 37.07 % chance of completing the A activity in 29 days

B) 31 days

$$Z = \frac{X - \mu}{\sigma} = \frac{31 - 30}{3.3} = \frac{1}{3.3} = 0.303$$

From Table 11

Its value is 0.62930. There is a 62.9 % chance of completing the A activity in 31 days

C) 26 days

$$Z = \frac{X - \mu}{\sigma} = \frac{26 - 30}{3.3} = \frac{-4}{3.3} = -1.2121$$

From Table 10

Its value is 0.11314. There is a 11.3 % chance of completing the A activity in 26 days

Example 3

Use the Empirical Rule to find the probability of completing project A Given
μ= 30 and σ=3.3
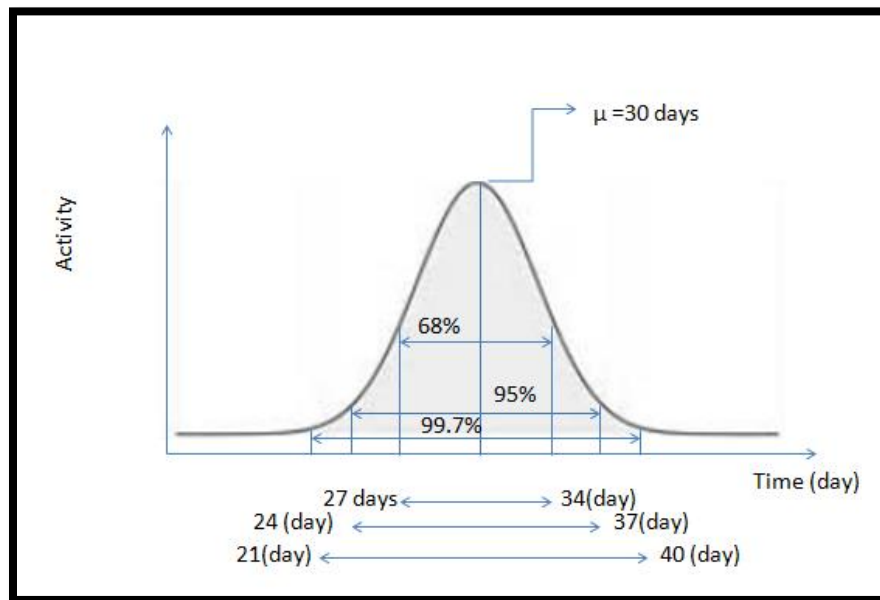
For 1 σ: μ ± σ
30 + 3.3 = 33.3 ≈ 34 days
 30 − 3.3 = 26.7 ≈ 27 days

 We are 68% confident that the project will finish 34 days ahead of schedule, and 27 days behind
schedule.

For 2 σ: μ ±2 σ
30 + 2(3.3) = 36.6 ≈ 37 days
30 − 2(3.3) = 23.4 ≈ 24 days
We are 95% confident that the project will finish 37 days ahead of schedule, and 24 days behind
schedule**.**

For 3 σ: μ ±3 σ

30 + 3(3.3) = 39.9 ≈ 40 days
30 − 3(3.3) = 20.1 ≈ 21 days
We are 99.7% confident that the project will finish 40 days ahead of schedule, and 21 days behind
schedule.

Methodology

The information obtained from LADOTD (Louisiana Department of Transportation and Development) for historical projects are divided by district and parish. Every project in the LADOTD has a Contract Report where all the information related to each project in the department will be included, such as the Project State Number, Location of the Project, Bid Days, Adjusted Days, Total Days, Charge Days, Bid Amount, Paid to Date, and Final Acceptance Date. The report also includes the approved Change Order Amount, Contract Date, Letting Date, Liquidation Damage Rate and other minor information about the individual project "**(Appendix A)".** This information has been used for my study.

The calculations are based on Average and Standard Deviation. Studying the contract reports for each project completed in the State of Louisiana, It had been observed multiple outlier that exists in few projects that will affect the average and the standard deviation that will be using throughout the studies and analysis.

Qualifying the data was done based on the following criteria:

1- Any project that has a percent overrun in days more than 100% was excluded from the research. The rationale behind this selection is that a project's duration that had more than doubled, had severe scope changes, acts of God, natural occurrences or complete work stop for undocumented reason that led to adding more duration.

2- Any project that had duration of 30 days was excluded from the research as the percent overrun would be very sensitive and would corrupt the data. Furthermore, according to LADOTD every project must have at least 30 days to be complete, even if the contractor's proposal calls for completion in less than 30 days; the contractor has to submit his bid with at least 30 days to complete the project.

3- Some projects that had a percent underrun in days less than 100% was excluded from the research. During my 27 years of experience in the construction field, some of these types of projects rarely happened.

4- Any project that had a cost overrun or underrun more than 150% percent was excluded from the research as it had a completely out of scope addition and would corrupt the data.

Outlier project cases that fell in any of the above categories made less than 1% of dataset, but keeping them in the dataset skewed the results in an un-proportional way. Some other projects become an outlier due to lack of design, utilities, contractor equipment shutdown, supplier closing down for specialty item, utility conflicts, Material damage during transport, Specifications being inadequate, subcontractors going out of business, a supplier providing and/or delivering non-compliant products to the job site, holidays and other events. Furthermore, some projects were completed before the bid days due to cancelation of the entire project because of lack of design or eliminating some items that we did not need to change or replace.

Also, a big change to the cost of a project will affect the average cost and the standard deviation of the cost. For example, at District 02, Jefferson Parish, job # 742-26-0066 the bid amount was $294,868.91, but the final amount was $2,467,123.72 and that extra amount was due to an extra work that has been

added to the job due to the utilities conflict that needed to be replaced, where the designer was not aware of the utilities at the time of design stage.

Analysis and Discussion

Empirical Rules (68%-95%-99.7%) will be used for analysis and study (Time and Cost).

Keeping in mind that a positive number indicates that the project was completed behind schedule and the negative number indicates that the project was completed ahead of schedule. Also positive amount means that the project was overrun when it was completed, and negative amount means that the project was underrun when it was completed.

District 02

All the projects in District 02 including Project Number, Project Location, Bid Day, Adjust Day, Total Day, Charge Day, Date Project Completed, Bid Amount and Paid Amount to date have been entered to Excel for analysis and the outcome shown in Table (Dist.02)

	Day Average		Cost (2005-2015)		Present value 2015	
Average	-11		$ 139,344.00		$ 205,669.00	
Standard Deviation	51.8		$ 537,652.00		$ 1,388,863.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-63	41	$ (398,308.00)	$ 676,997.00	$ (1,183,193.91)	$ 1,594,531.48
95%	-115	93	$ (935,960.00)	$ 1,214,649.00	$ (2,572,056.61)	$ 2,983,394.18
99.70%	-166	144	$ (1,473,612.00)	$ 1,752,301.01	$ (3,960,919.30)	$ 4,372,256.87
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	7%		3%		3%	
Standard Deviation	27%		17%		20%	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-20%	34%	-14%	20%	-17%	23%
95%	-47%	61%	-31%	37%	-37%	43%
99.70%	-74%	88%	-48%	54%	-57%	63%

TABLE (Dist. 02) Normal Distribution and Standard Deviation for District 02
Note: Present Value 2015 has been calculated for information only.

Schedule Analysis:

68% of the observations fall within 1σ of the average (mean) (mathematically, Average ± σ) so:

    a) **Average Day**

        Avg. - σ = -11 – 51.8 = - 62.8 ≈ - 63 days
        Avg. + σ = -11 + 51.8 = 41 days

    b) **% Average Day**

    Avg. - σ = (7%) – (27%) = -20%
    Avg. + σ = (7%) + (27%) = 34%

At District 02 we are 68% confident that a new project will finish 63 days ahead of schedule or 20% of the total project days, and 41 days behind schedule or 34% of the total project days.

95% of the observations fall within 2σ of the average (mean) (mathematically, Average ± 2σ)so:

    a) **Average Day**

    Avg. – 2 σ = -11– 2(51.8) = - 114.6 ≈ - 115days
        Avg. + 3 σ = -11 + 2(51.8) =   93 days

    b) **% Average Day**

    Avg. – 2 σ = (7%) - 2(27%) = - 47%
    Avg. + 3 σ = (7%) +2(27%) =   61%

At District 02 we are 95% confident that a new project will finish 115 days ahead of schedule or 47% of the total project days, and 93 days behind schedule or 61% of the total project days

99.7% of the observations fall within 3σ of the average (mean) (mathematically, Average ± 3σ) so:

    a) **Average Day**

    Avg. – 3 σ = -11 – 3 (51.8) = - 166.4 ≈ - 166 days
        Avg. + 3 σ = -11 + 3 (51.8) =   114 days

    b) **% Average Day**

        Avg. – 3 σ = (7%) – 3(27%) = -74%
        Avg. + 3 σ = (7%) + 3(27%) = 88%

At District 02 we are 99.7% confident that a new project will finish 166 days ahead of schedule or 74% of the total project days, and 114days behind schedule or 88% of the total project days.

Also see Chart (Dist.02A), Bell-Shape Distribution
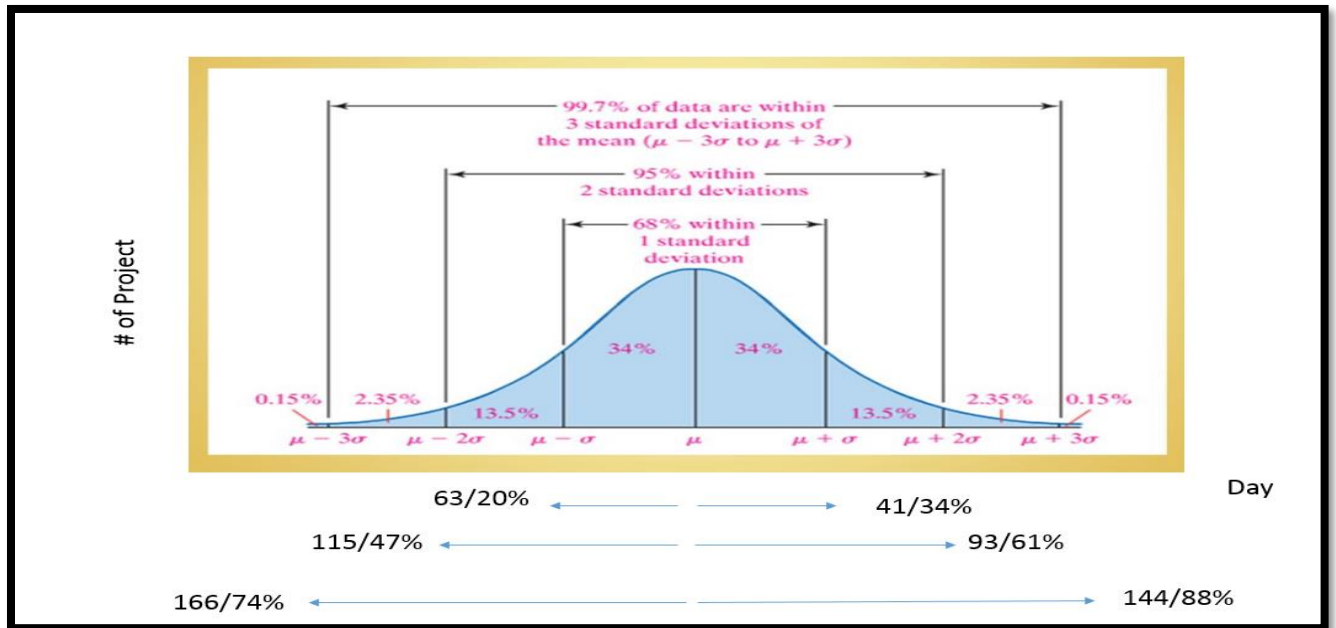
CHART (DIST. 02A) -PROJECT TIME RANGE/ % OF TOTAL PROJECT TIME RANGE FOR DISTRICT 02

COST ANALYSIS (2005-2015)

68% of the observations fall within 1σ of the average (mean) (mathematically, Average ± σ)so:

   a) **Average Cost**
      Avg. - σ = 139,344.00 – 537,652.00 = $ -398,308.00
      Avg. + σ = 139,344.00 + 537,652.00 = $ 676,996.00

   b) **% Average Cost**
      Avg. - σ = (3%) – (17%) = -14%
      Avg. + σ = (3%) + (17%) = 20%

At District 02 we are 68% confident that a new project cost will be underrun by $ 398,308.00 or 14% of the total amount of the project and overrun by $ 676,996.00 or 20% of the total amount of the project.

95% of the observations fall within 2σ of the average (mean) (mathematically, Average ± 2σ) so:

   a) **Average Cost**
      Avg. – 2 σ = 139,344.00 – 2(537,652) = $ -935,960.00
      Avg. + 2 σ = 139,344.00 + 2(537,652) = $ 1,214,649.00

   b) **% Average Cost**
      Avg. – 2 σ = (3%) – 2(17%) = - 31%
      Avg. + 2 σ = (3%) + 2(17%) =   37%

At District 02 we are 95% confident that a new project cost will be underrun by $ 935,960.00 or 31% of the total amount of the project and overrun by $ 1,214,649.00 or 37% of the total amount of the project

99.7% of the observations fall within 3σ of the average (mean) (mathematically, Average ± 3σ) so:

a) **Average Cost**

Avg. – 3 σ = 139,344.00– 3 (537,652.00) = $- 1,473,612.00

Avg. + 3 σ = 139,344.00+ 3 (537,652.00) = $ 1,752,301.01

b) **% Average Cost**

Avg. – 3 σ = (3%) – 3 (17%) = - 48%

Avg. + 3 σ = (3%) + 3(17%) =   54%

At District 02 we are 99.7% confident that a new project cost will be underrun by $ 1,473,612.00 or 48 % of the total amount of the project and overrun by $ 1,752,301.01 or 54% of the total amount of the project.

Also see Chart (Dist.02B), Bell-Shape Distribution

Chart (Dist. 02B) Average Cost/% Average Cost (year 2005-2015) for District 02

See Appendix 1for normal distribution, standard deviation and Bell-Shape Distribution Curves (Time and Cost) for other districts (03, 04, 05, 07, 08, 58, 61, and 62) (Tables and Charts)

District 02 Parishes

District 02 has 7 different parishes including Terrebonne Parish, the tables below shows the normal Distribution and Standard Deviation for Terrebonne Parish and Empirical Rule (68%, 95%, 99.7%) results (Time and Cost).

Keep in mind that the negative sign means ahead of the time (Time) and Underrun (Cost) and plus sign means behind time (Time) and Overrun (Cost).

Terrebonne Parish (TE)

	Day Average		Cost (2005-2015)		Present value 2015	
Average	-24.9		$ 47,523.00		$ 42,497.00	
Standared Deviation	40.1		$ 331,518.00		$ 379,262.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-65	15	$ (283,996.00)	$ 379,041.00	$ (336,765.73)	$ 421,759.00
95%	-105	55	$ (615,514.00)	$ 710,559.00	$ (716,028.09)	$ 801,021.36
99.70%	-145	95	$ (947,032.00)	$ 1,042,078.00	$ (1,095,290.46)	$ 1,180,283.73
	% Day Average		% Cost Average		% Average at net present value	
Average	-22%		3%		3%	
Standared Deviation	26%		17%		19%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-48%	4%	-14%	20%	-16%	22%
95%	-74%	30%	-31%	37%	-35%	41%
99.70%	-100%	56%	-48%	54%	-54%	60%

TABLE (TE) Normal Distribution and Standard Deviation for Terrebonne Parish

Schedule Analysis:
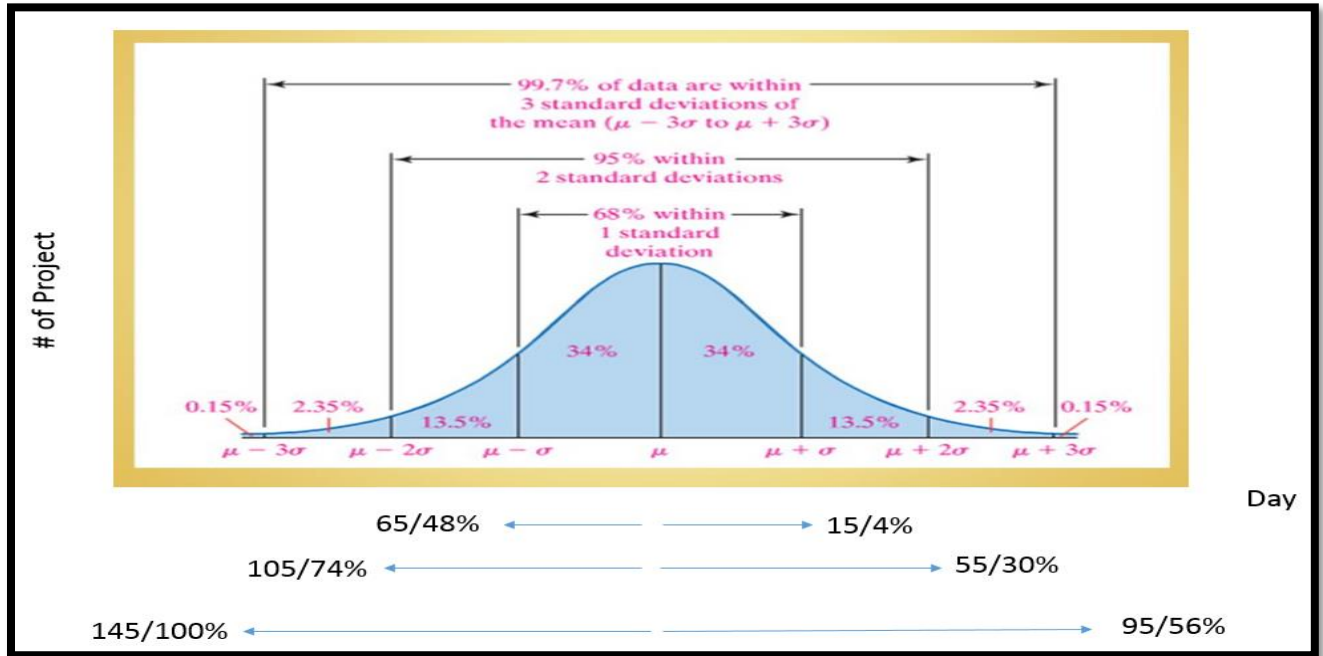
Chart (TE1) Average day/% Average day for Terrebonne Parish

At Terrebonne Parish we are:

68% confident that a new project will finish 65 days ahead of schedule or 48% of the total project days, and 15 days behind schedule or 4% of the total project days.
95% confident that a new project will finish 105 days ahead of schedule or 74% of the total project days, and 55 days behind schedule or 30% of the total project days.
99.7% confident that a new project will finish 145 days ahead of schedule or 100% of the total project days, and 95 days behind schedule or 56% of the total project days.
Chart (TE1)

COST ANALYSIS (2005-2015)

99.7% of data are within
3 standard deviations of
the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)

95% within
2 standard deviations

68% within
1 standard
deviation

34%   34%

0.15%   2.35%   13.5%   13.5%   2.35%   0.15%

$\mu - 3\sigma$ $\mu - 2\sigma$ $\mu - \sigma$ μ $\mu + \sigma$ $\mu + 2\sigma$ $\mu + 3\sigma$

\# of Project

Cost

283,996.00/14% ← → 379,041.00/20%

615,514.00/31% ← → 710,559.00/37%

947,032.00/48% ← → 1,042,078.00/54%
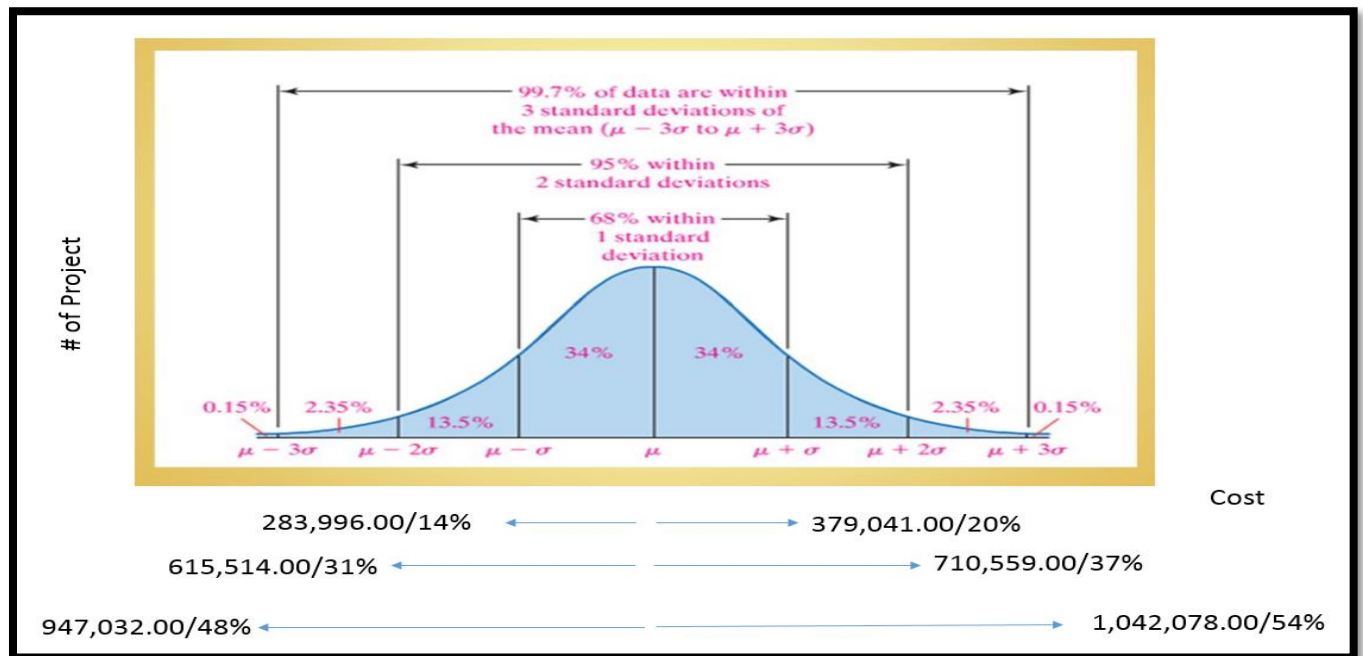
Chart (TE2) Average cost/% Average cost (2005-2015) for Terrebonne Parish

At Terrebonne Parish we are:

68% confident that a new project cost will be underrun by $ 293,996.00 or 14% of the total amount of the project and overrun by $ 379,041.00 or 20% of the total amount of the project.
95% confident that a new project cost will be underrun by $ 615,514.00 or 31% of the total amount of the project and overrun by $ 710,559.00 or 37% of the total amount of the project.
99.7% confident that a new project cost will be underrun by $ 947,032.00 or 48% of the total amount of the project and overrun by $ 1,042,078.00 or 54% of the total amount of the project.
Chart (TE2)

See Appendix E for other Districts 02 parishes

See Appendix F for District 03 Parishes

See Appendix I for District 04 Parishes

See Appendix J for District 05 Parishes

See Appendix K for District 07 Parishes

See Appendix L for District 08 Parishes

See Appendix M for District 58 Parishes

See Appendix N for District 61 Parishes

See Appendix O for District 62 Parishes

District Comparison, Analysis and Results

The purpose of this study is to know which district has more delay and more extra cost in their projects, and then study each individual parish. Based on that, we can learn from the good district and apply it in other district so we can improve all the district capability of handling the project from being in the design stage to construction stage.

Expert project managers say that the construction world is very competitive in saving money and completing the projects on time; which is every project manager's first priority next to safety.

Handling the project without delay and within the budget, one has to consider the following during the length of the project

1) Study the plan and become familiar with its various aspect
2) Be present during all stages of planning
3) Use current technologies
4) Have monthly meetings with all the team members involved in executing the project.

By comparing all the parishes in each district, by doing that it will show which parish completes the project on time within the budget.

During the comparison, it will be pointed out which parish is good in saving time and money in every district, so other researcher will come out with a plan that other parishes can follow.

The outcome of such comparison and analysis can present a plan that can result in better traffic system that is safer to the public and without any extra cost or delay.

District 02
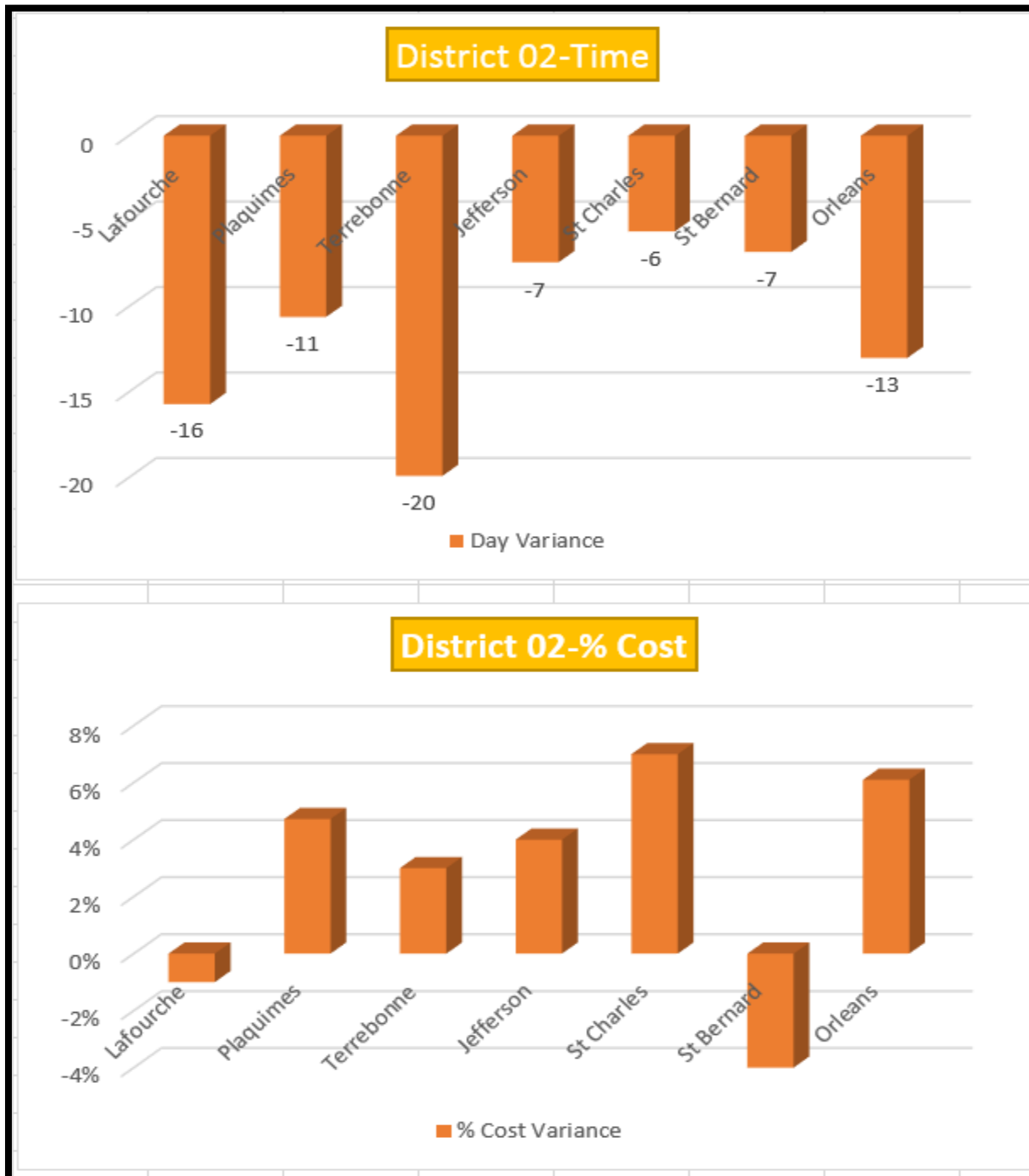
Figure 7- Comparing **Parishes Projects under District 02 (Time, % Cost)**

Figure (7) shows that Projects in Terrebonne Parish are the most probable to finish ahead of schedule in comparison to all other parishes. The results also show that St. Bernard has the least probability of finishing ahead of schedule. In fact, the average projects in District 02 finish on time.

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Also figure (7) clearly shows a problem in St. Charles parish as it has the highest % dollar overrun in comparison to all other parishes. Results also show that St. Bernard parish has a highest cost saving % in all parish. Results show that only St. Bernard and Lafourche have savings on average, while all other parishes have an overrun on average. Some projects that have cost saving does not mean is a good project manager or a good project Design, some saving is due to the elimination of some items that we do not need to contract the project, and that because the project design has poor field experience or unfamiliar to site.

Based on the total amount of liquidation damages, total amount of change order, number of project and the total amount of the projects in every parish in district 02 I realized that Lafourche parish has a good standing of running the projects is the most probable to finish ahead of schedule and no extra cost. This tells us that there is a very good communication among the team who are involved to execute the project.

District 03
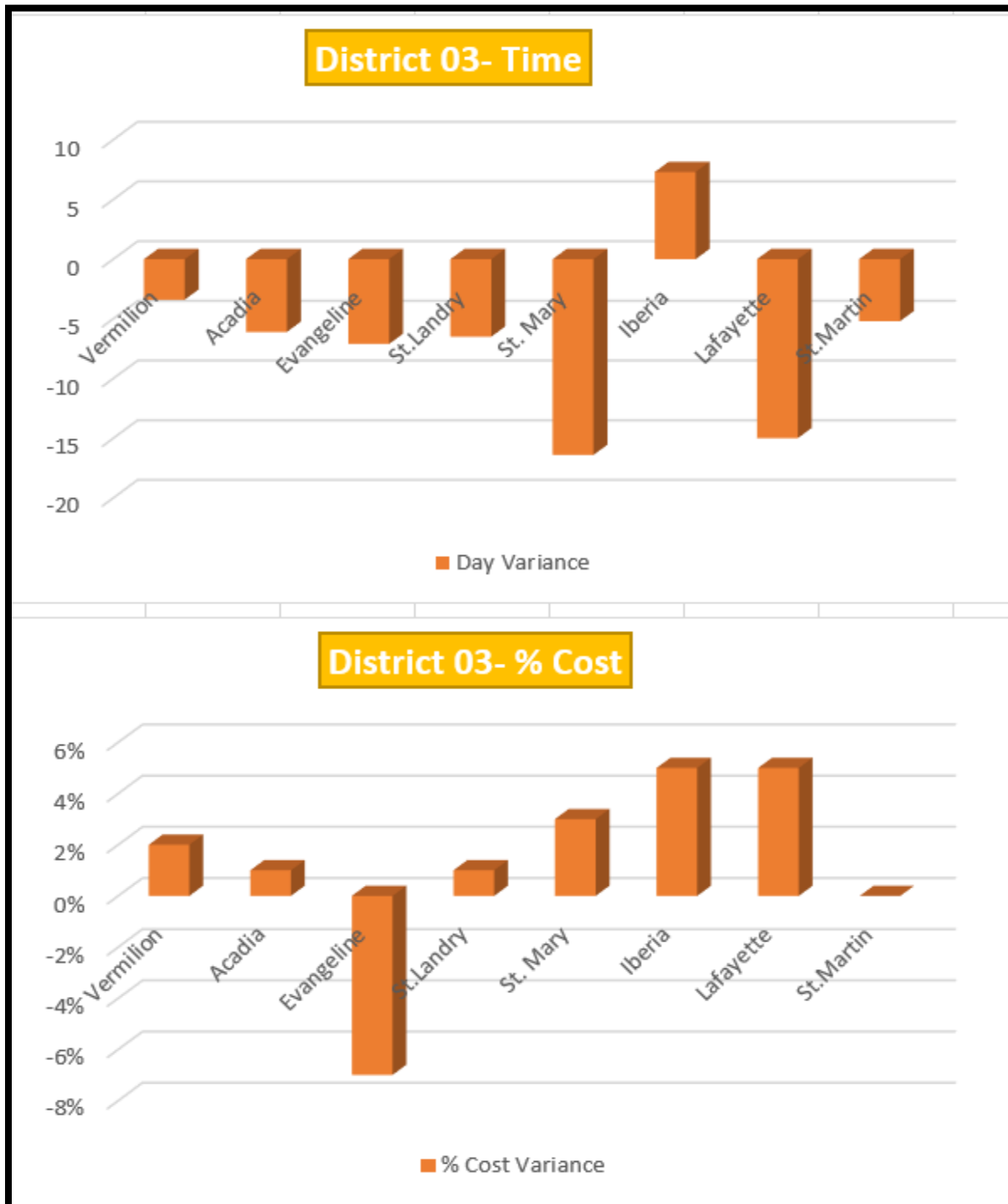
Figure 8- Comparing **Parishes Projects under District 03 (Time, % Cost)**

For District 03, the data shows the following:

The projects in St. Mary Parish are the most probable to finish ahead of schedule.

The projects in Vermillion Parish have the highest probably of finishing ahead of schedule.

The Projects in Iberia parish have the highest probably of finishing behind schedule.

The projects in Iberia Parish and Lafayette Parish have the highest percentage dollar overrun.

The projects in Evangeline Parish has the highest cost saving percentage

The projects in St. Martin Parish have the highest average to complete the project without overrun or underrun.

From the conclusion above, Evangeline Parish and St. Martine Parish have a good communication among the contractors, project engineer and design engineer.

Also Evangeline Parish and St. Martine Parish team have a good problem solving skills, team players and excellent technical knowledge.

District 4
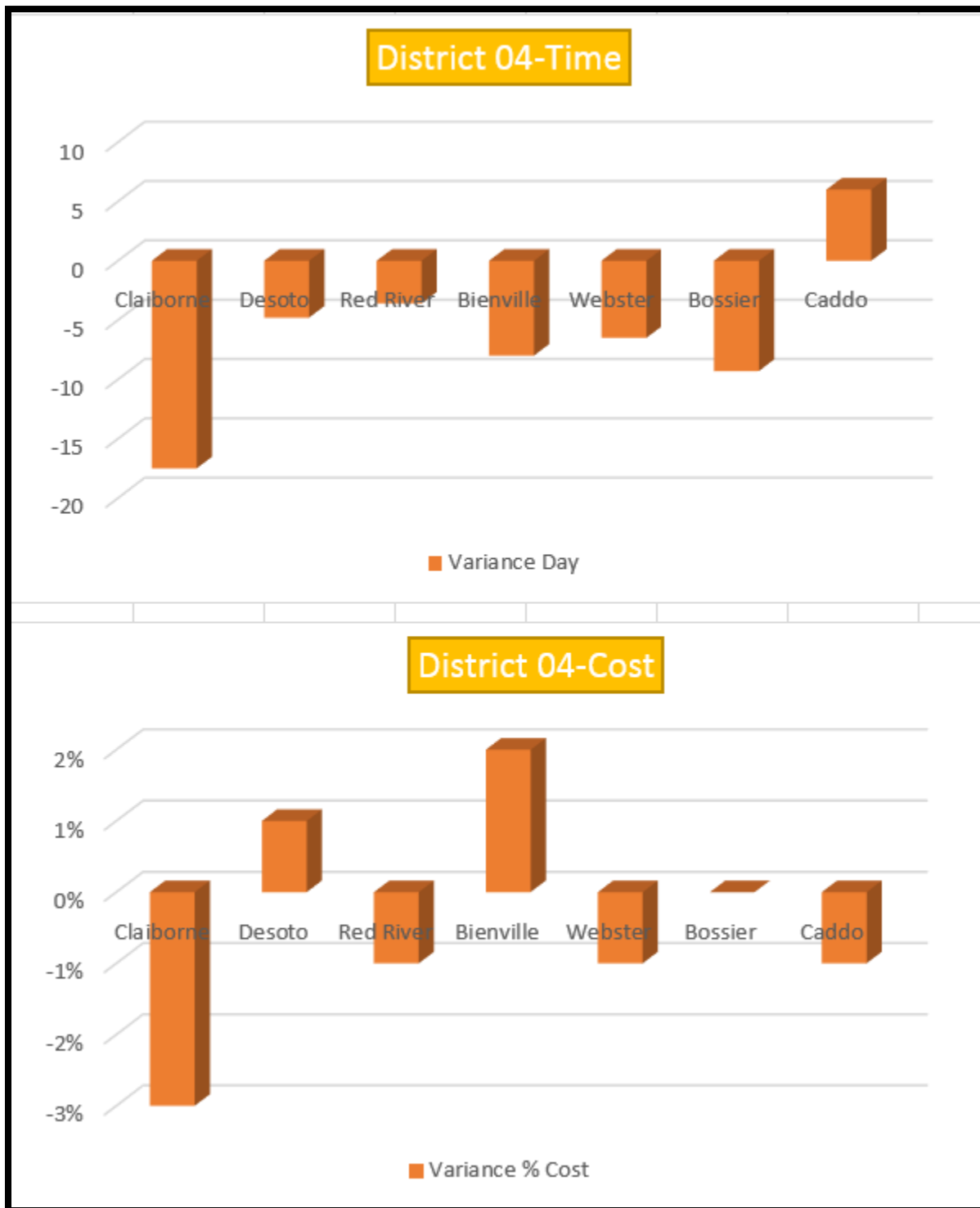
Figure 9- Comparing **Parishes Projects under District 04 (Time, % Cost)**

For District 04, the data shows the following:

The projects in Claiborne Parish are the most probable to finish ahead of schedule.

The projects in Red River Parish have the highest probably of finishing ahead of schedule.

The projects in Caddo parish have the highest probably of finishing behind schedule.

The projects in Bienville Parish have the highest percentage dollar overrun.

The projects in Claiborne Parish have the highest cost saving percentage.

The projects in Bossier Parish have the highest average to complete the project without overrun or underrun.

In Claiborne Parish and Caddo Parish, they've developed a communications plan to determine the best method for getting each type of information to the audiences. For example, everyone involved in the project needs a project status report, which could be distributed via email to the entire team. They also meet at least once a month, or as needed, to update and discus any possible conflict before it happens.

District 05
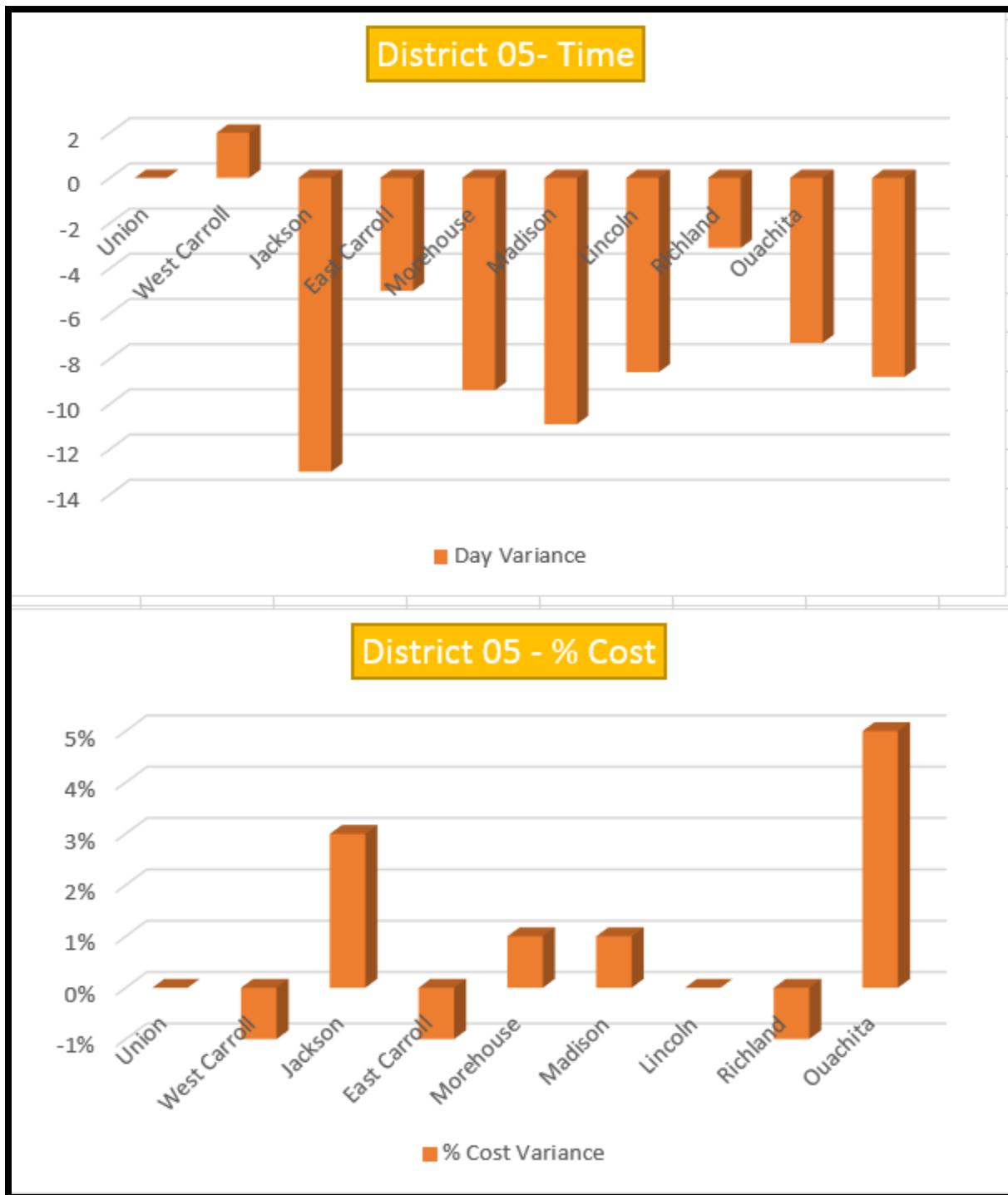
Figure 10- Comparing Parishes Projects under District 05 (Time, % Cost)

For District 05, the data shows the following:

The projects in Jackson Parish are the most probable to finish ahead of schedule.

The projects in Richland Parish have the highest probably of finishing ahead of schedule.

The Projects in West Carroll parish have the highest probably of finishing behind schedule.

The projects in Ouachita Parish have the highest percentage dollar overrun.

The projects in East Carroll Parish and West Carroll have the highest cost saving percentage

The projects in Union Parish and Lincoln Parish have the highest average to complete the project without overrun or underrun.

From the conclusion above, Richland Parish has good communications among the contractors, project engineer and design engineer.

Richland Parish believes in assigning roles and designating responsibilities accordingly. This is an important consideration to highlight at the beginning of any project so that everyone knows who's doing what. And that is why Richland Parish keeps a project on schedule, within budget, and within scope.

District 07
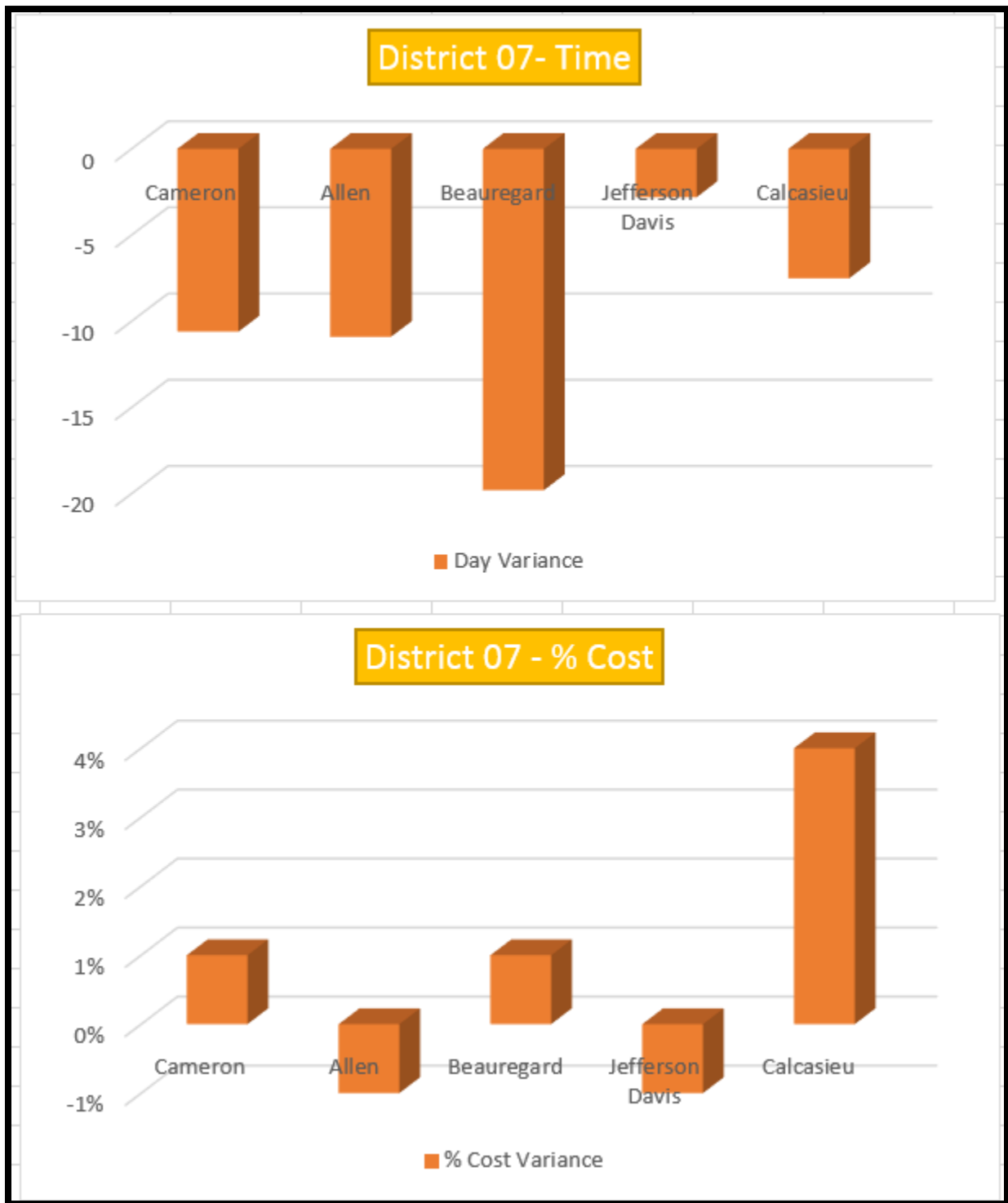
Figure 11- Comparing Parishes Projects under District 07 (Time, % Cost)

For District 07, the data shows the following:

The projects in Beauregard Parish are the most probable to finish ahead of schedule.

The projects in Jefferson Davis Parish have the highest probably of finishing ahead of schedule.

None of the projects completed behind schedule in District 07.

The projects in Calcasieu Parish have the highest percentage dollar overrun.

The projects in Allen Parish and Jefferson Davis parish have the highest cost saving percentage

Most of the parishes in district 07, and especially in Allen Parish and Jefferson Davis Parish, believe that communication is number one to success in completing project on schedule and within the budget, as well as training and taking extra training classes that enhance knowledge, skill and confidence which will empower you to maximize your performance and solve the challenge facing you projects to ensure personal and organizational success.

District 08
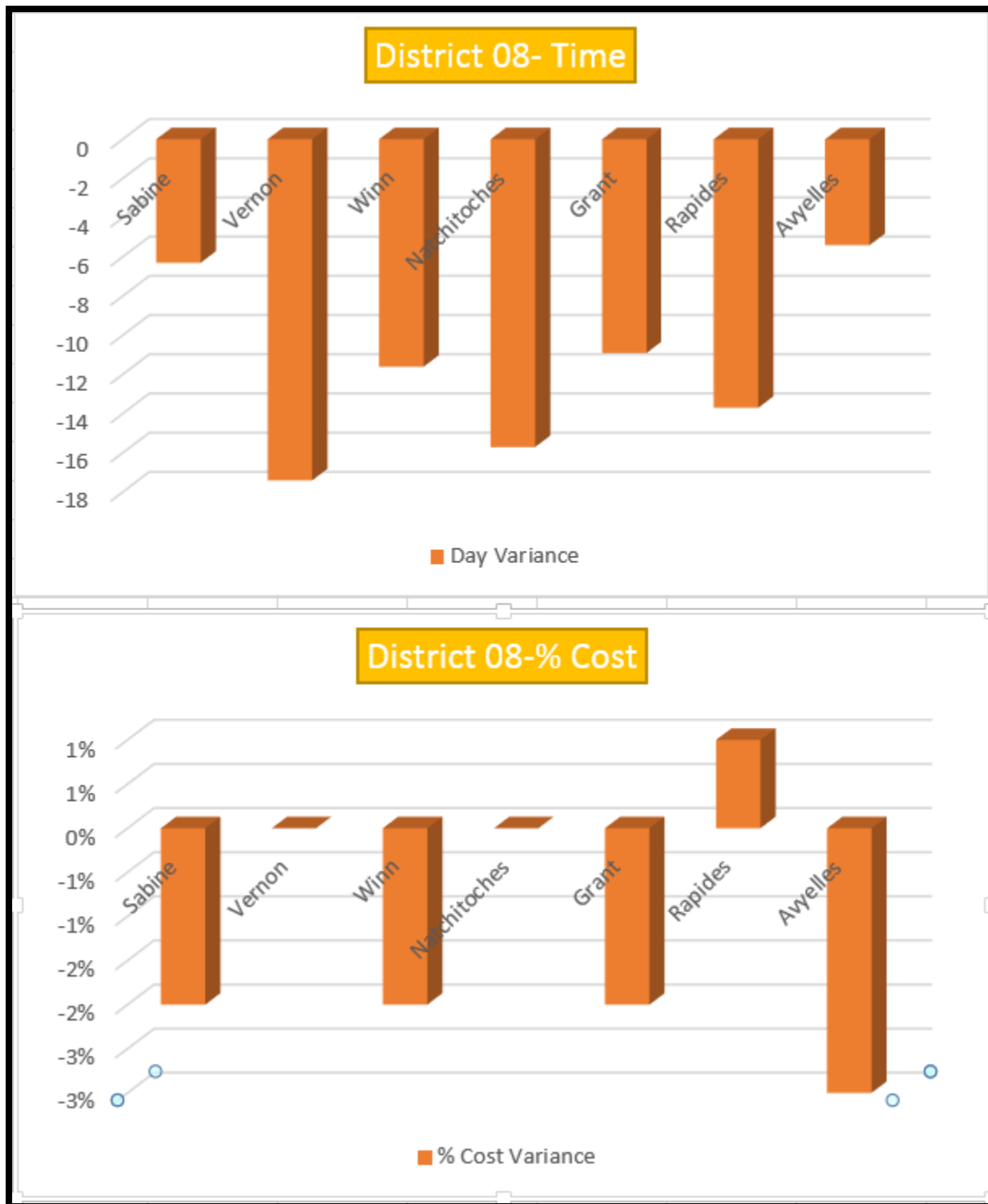
Figure 12- Comparing Parishes Projects under District 08 (Time, % Cost)

For District 08, the data shows the following:

Schedule

- The projects in Vernon Parish are the most probable to finish ahead of schedule.
- The projects in Avoyelles Parish have the highest probably of finishing ahead of schedule.
- None of the projects completed behind schedule in District 08.

Cost

- The projects in Rapides Parish and Lafayette Parish have the highest percentage dollar overrun.
- The projects in Avoyelles Parish have the highest cost saving percentage
- The projects in Vernon Parish and Natchitoches Parish have the highest average to complete the project without overrun or underrun.

Although Vernon and Natchitoches Parishes have a significant time saving in projects, cost tends to be exactly as forecasted. This is contrary to what we would expect. This may be due to poor cost reporting, or over estimating schedule duration to give contractors time contingency.

4) In Rapides Parish, the data shows time savings while there is a cost overrun, this could be due to expediting cost that the parish spends.

5) Avoyelles Parish, Vernon Parish and Natchitoches Parish have good communications among the contractors, project engineer and design engineer. Also project managers in these parishes believe that proper training and training classes that will improve skills and confidence among their team.

District 58
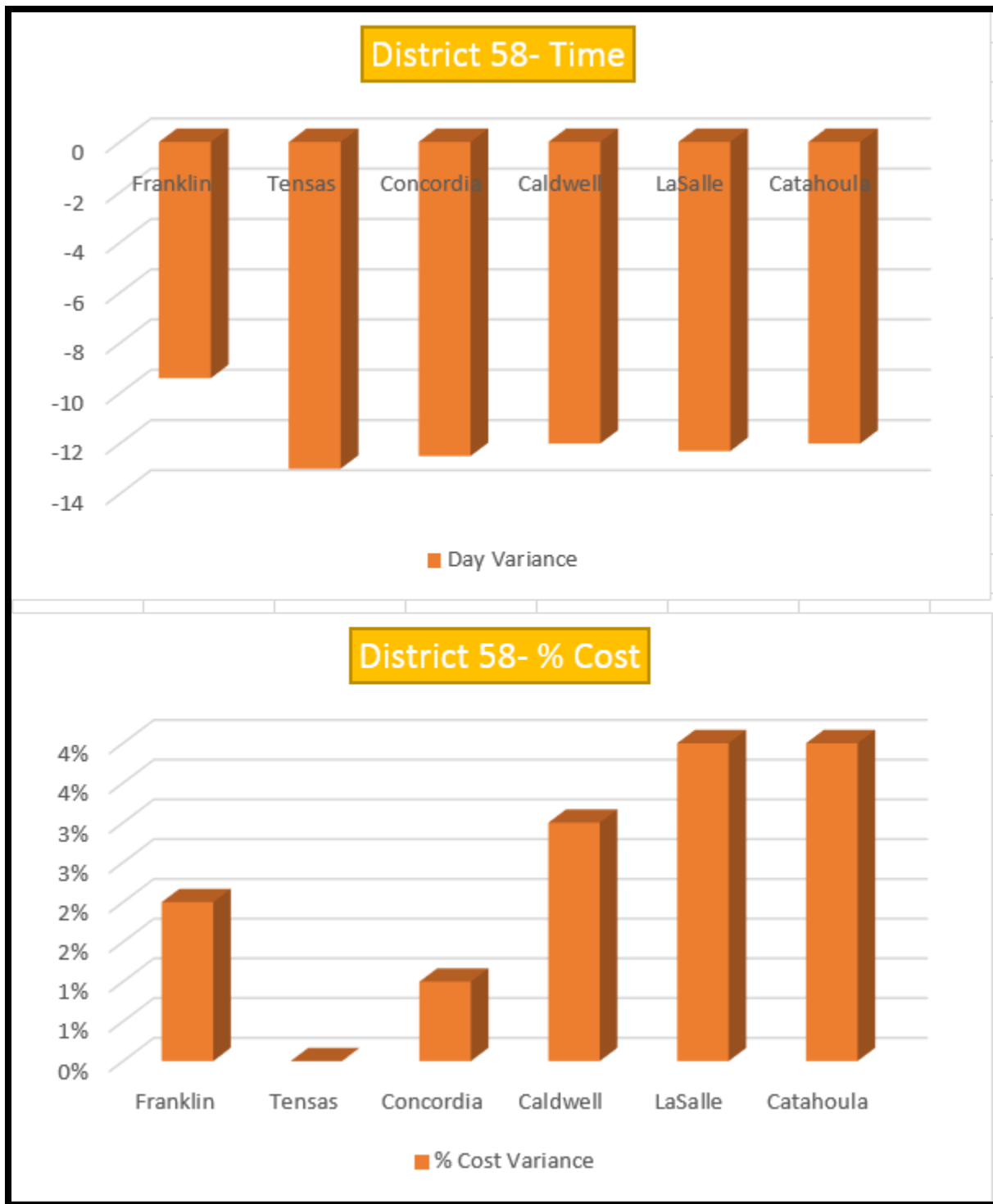
Figure 13-Comparing Parishes Projects under District 58 (Time, % Cost)

For District 58, the data shows the following:

The projects in Tensas Parish are the most probable to finish ahead of schedule.

The projects in Franklin Parish have the highest probably of finishing ahead of schedule.

None of the projects completed behind schedule in District 58.

The projects in LaSalle Parish and Catahoula Parish have the highest percentage dollar overrun.

The projects in Tensas Parish have the highest cost saving percentage

The projects in Tensas have the highest average to complete the project without overrun or underrun.

Tensas Parish has good communication reputation among the contractors, project engineer and design engineer. At Tensas Parish, successful project management is not only measured by experience, tools and techniques but also by proper teaching and how to influence others and resolve conflict.

District 61
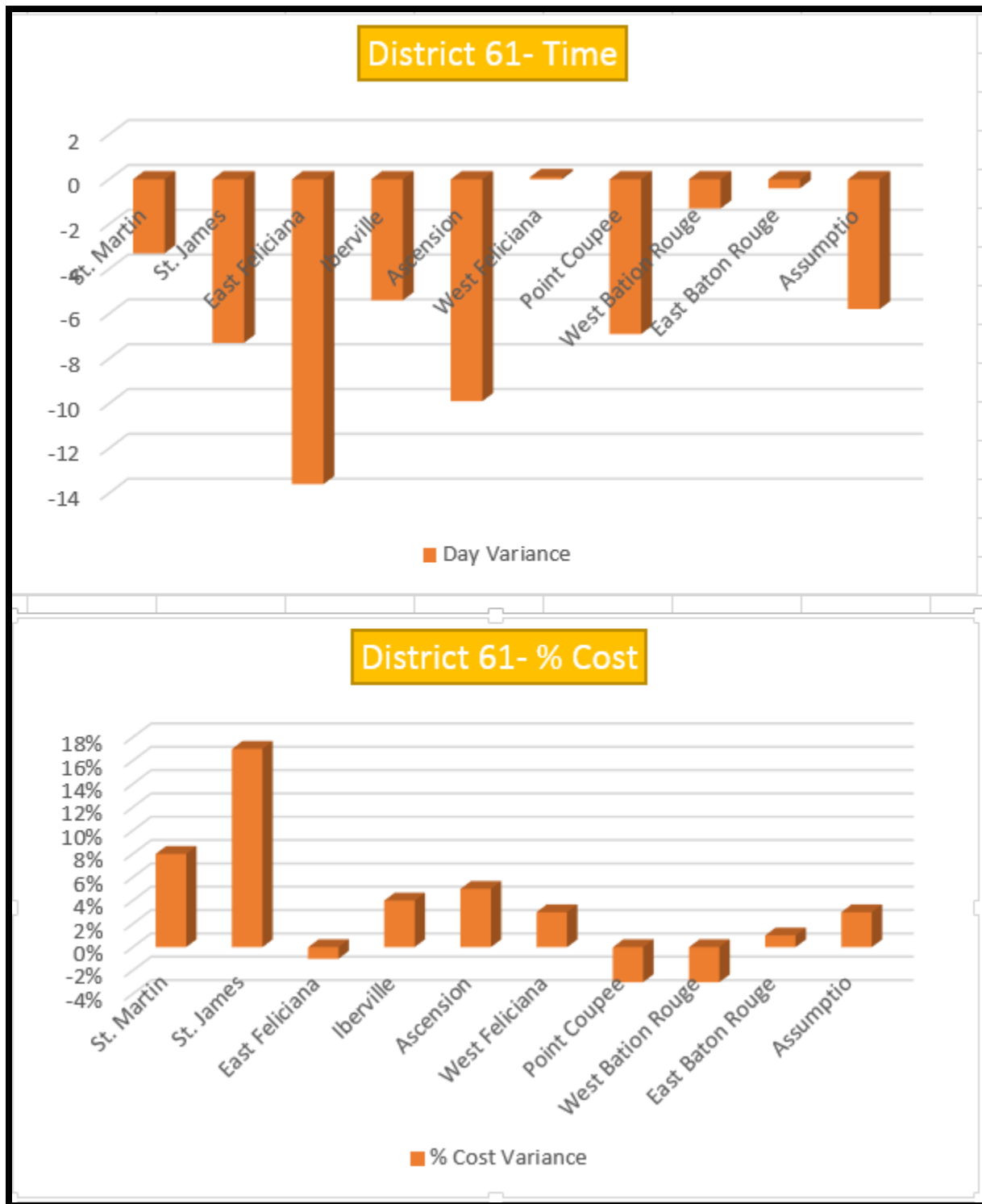
Figure 14- Comparing Parishes Projects under District 61 (Time, % Cost)

For District 61, the data shows the following:

The projects in East Feliciana Parish are the most probable to finish ahead of schedule.

The projects in West Baton Rouge Parish have the highest probably of finishing ahead of schedule.

The projects in St. James Parish have the highest percentage dollar overrun.

The projects in Point Coupee Parish and West Baton Rouge have the highest cost saving percentage

Most Parishes in District 61 are well managed because their project engineers implement good plans. It is the most important strategy to getting a project done, as well as a good flow of communications between project engineer, design engineer and the contractor.

The key to a successful plan is as follow:

1. Identify all the work items that are part of the project
2. Commit to being as organized as possible
3. Understand what is required

District 62
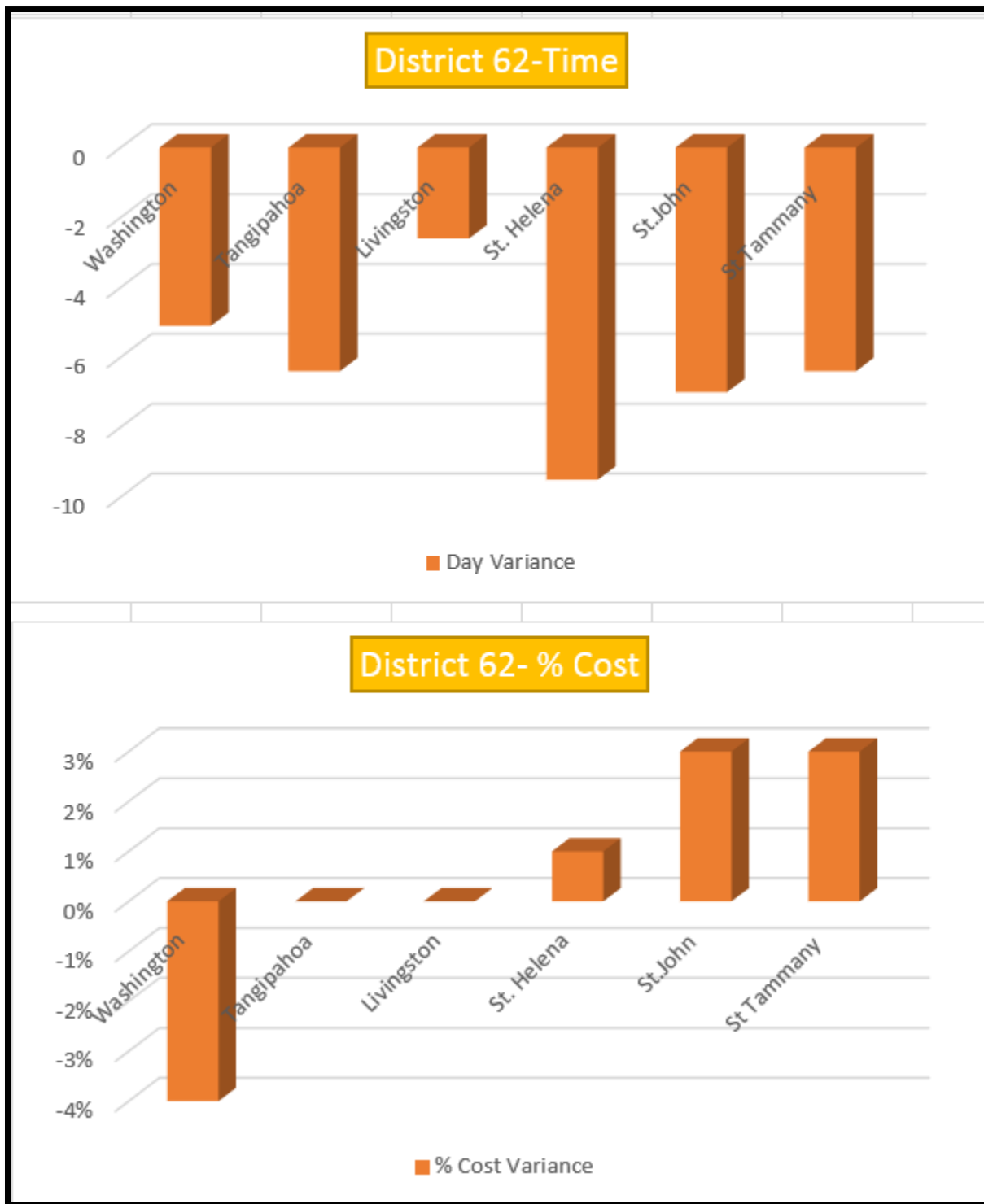
Figure 15- Comparing Parishes Projects under District 62 (Time, % Cost)

For District 62, the data shows the following:

The projects in St. Helena Parish are the most probable to finish ahead of schedule.

The projects in Livingston Parish have the highest probably of finishing ahead of schedule.

None of the projects completed behind schedule in District 62.

The projects in St. John Parish and St. Tammany Parish have the highest percentage dollar overrun.

The projects in Washington Parish have the highest cost saving percentage

The projects in Tangipahoa Parish and Livingston Parish have the highest average to complete the project without overrun or underrun.

All Districts
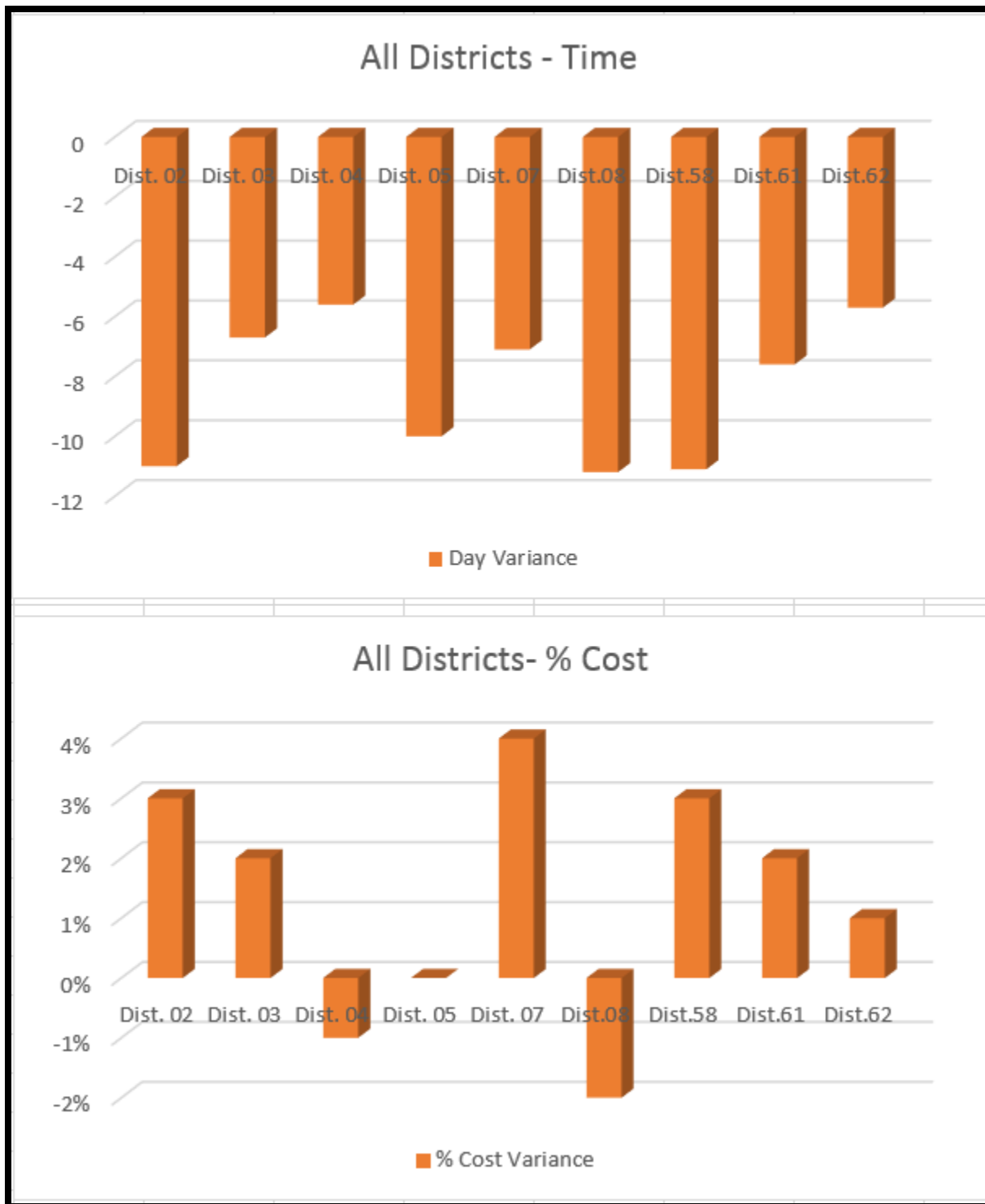
Figure 16- Comparing Projects at all District (Time, % Cost)

Figure (16) shows the comparison between districts in the State of Louisiana. I realized that all districts complete their projects behind time on average while most of the districts have extra cost.

District 07 has the highest percentage dollar overrun.

District 08 has the highest cost saving percentage. Also District 04 has some cost saving percentage.

The rest of the districts have high percentage dollar overrun

The next researcher needs to do more investigation as to why districts are facing overrun/underrun and how to improve these districts so they can complete their projects on time and within the budgets

Linear Equation Prediction Model

 Based on the linear equation as shown on the charts below, using the variance days and % cost variance we will forecast schedule performance and predict the cost performance.

To use this data a prediction method, we will use the linear equation prediction model. We will use the "Bid days" and "number of days' variance" to forecast schedule performance and we will use the "bid amount" and "cost variance" to predict the cost performance.

District 02

Plaquemines Parish

Plaquemines Parish - Time

y = -0.2094x + 4.6859

- Day Variance
- Linear (Day Variance)

Plaquemines Parish-% Cost

y = 3E-08x + 0.005

- % Cost Variance overrun/underrun
- Linear (% Cost Variance overrun/underrun)

Exhibit 2/02

53
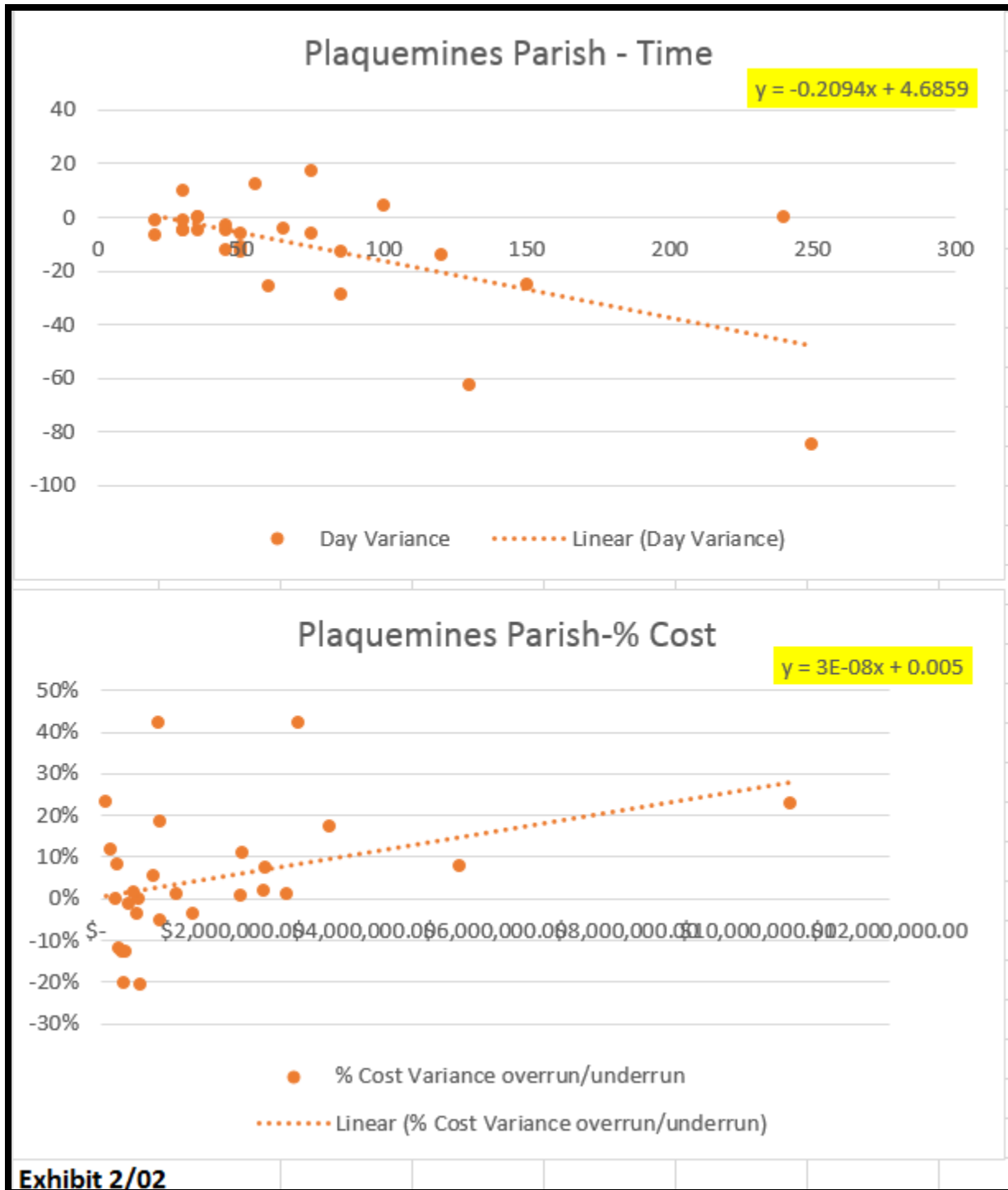
Example

Plaquemines Parish, from exhibit 2/02 we have:

Schedule Performance "days variance" = -0.2094* "bid Days" + 4.6859

Cost Performance "% Overrun/underrun" = 3E-08* "bid amount" +.005

 Project A has Bid Day is 150 days and the Bid amount is $ 3,856,000.00.

What is the possibility to complete the Project on schedule, and within the budget?

Solution

From exhibit (2/02) we have:

Schedule Performance

$$\text{Days variance} = -0.2094* \text{"bid Days"} + 4.6859$$

$$= -0.2094 *(150) -12.76 =-26.724 \approx -27 \text{ days}$$

So there is a possibility that project A will be completed 27 days behind schedule.

Based on Chart (PQ1) we are 68% confident that Project A will be completed 27 days behind schedule.

Cost Performance

$$\text{\% Overrun/underrun} = 3E\text{-}08* \text{"bid amount"} +.005$$

$$= 3E\text{-}08 *(3,856,000) + .005 =0.12068 \approx 12.1\%$$

So there is a Possibility that Project A will overrun about 12.1% of the bid amount.

Based on Chart (PQ2) we are 68% confident that Project A will be completed with 12.1% Overrun

Linear equations for other districts 02 parishes see Appendix P
Linear equations for Districts 03 parishes see Appendix P
Linear equations for Districts 04 parishes see Appendix P
Linear equations for Districts 05 parishes see Appendix Q
Linear equations for Districts 07 parishes see Appendix R
Linear equations for Districts 08 parishes see Appendix S
Linear equations for Districts 58 Parishes see Appendix X
Linear equations for Districts 61 parishes see Appendix Y
Linear equations for Districts 62 Parishes see Appendix Z

Breaking the projects by dollar value, does it make a different result?

The Study and Analysis includes all the projects that have been completed in the State of Louisiana, regardless of the final amount. Some projects have been eliminated due to the qualification data. This section will break the projects by dollar value to improve; it will not effect if I keep all the projects together and will not affect my result more that 1%.

Projects that were completed (2005 to 2014) will be used to find the linear equations; projects that have completed in 2015 will be used to evaluate the linear equation and to find out if breaking the projects by dollar value will make a difference.

Taking Jefferson Parish projects as an example

 Part A) All Values are included (NO break by dollar value)
Table below show the normal distribution and the standard deviation for the year 2005-2014

	Time		Cost (2005-2014)		
Average	-2.2		$ 250,037.00		
Standarea	18.2		$ 1,291,520.00		
	AVERAGE TIME		**AVERAGE COST 2005-2014**		
	Ahead of Time	Behind Time	Underrun		Overrun
68%	-20	16	$ (1,041,483.00)	$	1,541,557.00
95%	-39	34	$ (2,333,003.00)	$	2,833,076.00
99.70%	-57	53	$ (3,624,523.00)	$	4,124,596.00
	% Day Average		% Cost Average		
Average	-6%		4%		
Standarea	23%		13%		
	Ahead of Time	Behind Time	Underrun		Overrun
68%	-29%	17%	-9%		17%
95%	-52%	40%	-22%		30%
99.70%	-75%	63%	-35%		43%

Table (2005-2014)

Figure below show the bell-shape for 2005-2014 (Time)
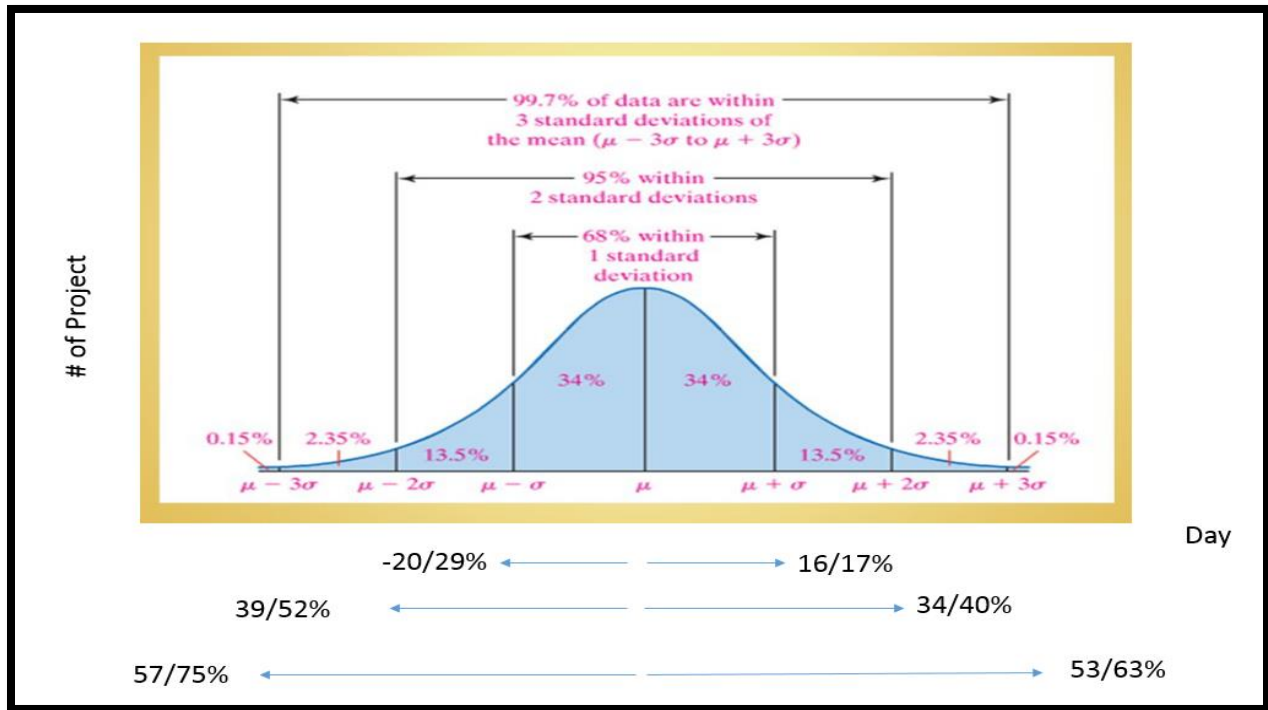
Chart (2005-2014 Time)

Figure below show the bell-shape for 2005-2014 (Cost)
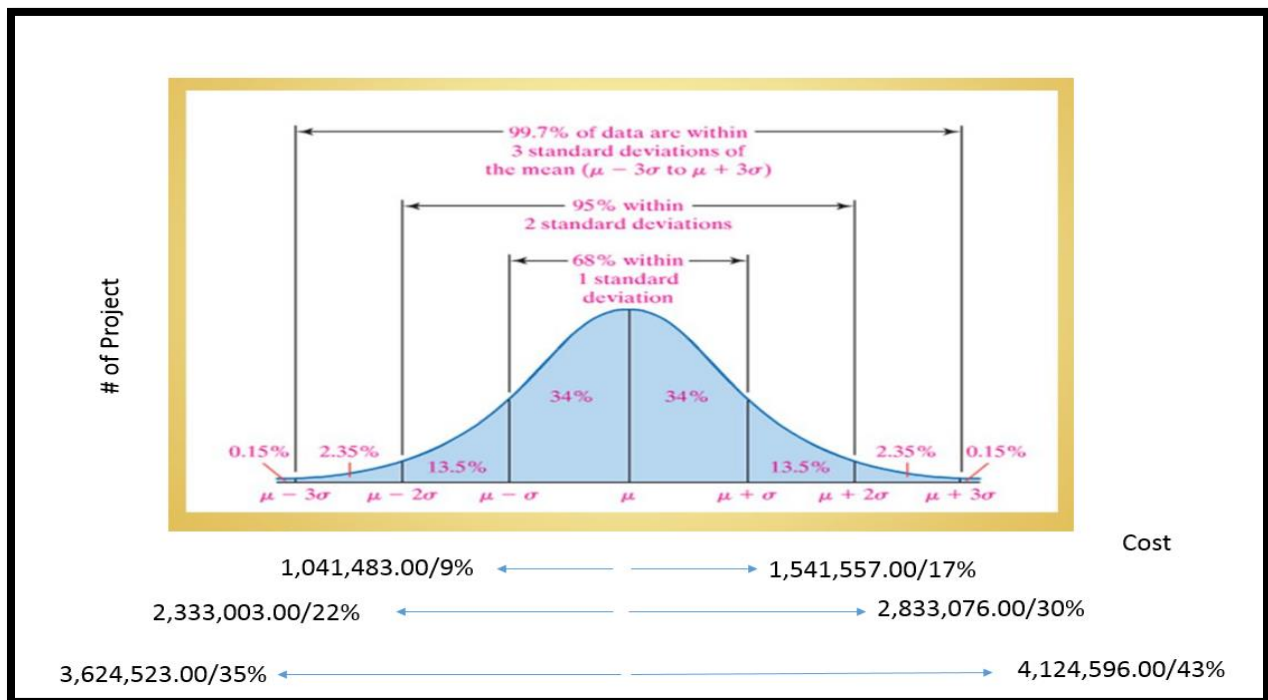
Chart (2005-2014 Cost)

The chart below shows the linear equations for the year 2005-2014

Jefferson Parish -Time

$y = 0.0102x - 8.2997$

Legend: ● Days Variance · · · · · · · Linear (Days Variance)

Jefferson Parish -Cost

$y = 9E-10x + 0.039$

Legend: ● % Cost Variance overrun/underrun
· · · · · · · Linear (% Cost Variance overrun/underrun)
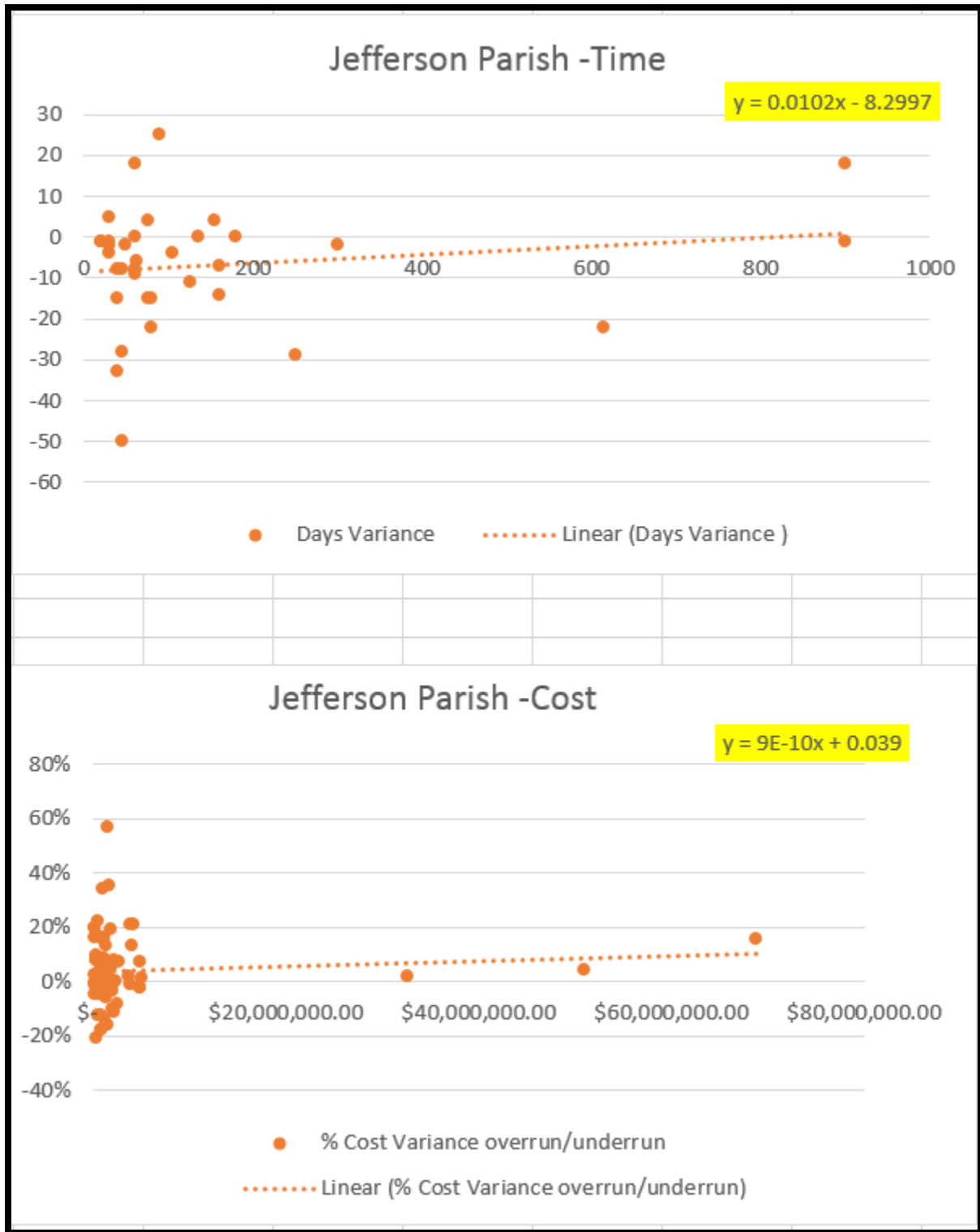
Exhibit (2005-2014)

Now we can apply the above linear equation using projects that have been completed in 2015

1) Project H.006138

Bid day = 75 days

Project completed = 73 days

Bid Amount = $ 707,778.97

Total Amount Paid = $ 746,168.31

Schedule Performance

Days variance = 0.0102* "bid Days"-8.2997

= 0.0102 * (75) – 8.2997 = -8 days

The actual number of days that the project completed is 73 days, which is 2 days behind schedule. If we use the linear equation from Exhibit (2005-2014) we will predict that the job will be completed 8 days behind schedule. According to chart (2005-2014 Time) we are 68% confident that a new project will finish 20 days behind schedule and 16 days ahead of schedule, the actual days and the predicated days are within the 68% range. Although the completing days and the predicated days are not matched, both show that the project will be completed ahead of schedule.

Cost Performance

% Overrun/underrun = 9E-10* "bid amount" + 0.039

= 9E-10* (707,778.97) + 0.039 = 4% Overrun

The actual paid amount was 5% overrun

The predicted paid amount is 4% overrun

Based on Chart (2005-2014 cost) we are 68% confident that a new project cost will be 9% underrun and

17% overrun

Then applied the linear equation from Exhibit (2005-2014) to the other projects that have been

completed in 2015, we have the following table:

Time

2015 Project #	Bid Day	Complete Day	Behind Schedule (−) Ahead of Schedule (+)	Predicting Day	Range -20 days To 16 days
H.009066	50	53	3	-8	yes
H.009088	270	242	-28	-6	NO
H.009272	20	11	-9	-9	yes
H.009565	40	30	-8	-8	yes
H.009645	120	119	-1	-8	yes
H.010399	50	43	-7	-8	yes

From Above Table we can say that:

83% of projects that completed in 2015 were behind schedule, so the predicted day.

100% was within the range and so the predicted day.

67% of the project that completed in 2015 was the same total day as the predicted day.

Using the linear equations from Exhibit (2005-2014) will predict the closet possibility of completing the project. Also, we can change some activity accordingly to avoid liquidation damage for the contractor and to give LADOTD an idea when the project will be completed so they will know when the other project should start without any conflict if both projects are at the same location.

Cost

2015 Project #	Bid Amount $	% Paid $	%Overrun (+) %Underrun(-)	Predicting % $	Range -9% +17%
H.009066	352,518.81	345,726.76	-2%	4%	Yes
H.009088	656,463.25	647,869.47	-1%	4%	Yes
H.009272	112,140.25	121,144.25	8%	4%	Yes
H.009565	688,451.00	677,673.24	-2%	4%	yes
H.009645	2,541,777.98	2,392,997.54	-6%	4.2%	Yes
H.010399	1,390,777.00	1,263,190.12	-9%	4%	Yes

The table above shows that 68% of project cost will be within the range (-9%/+17%). The linear equation still gives us an idea how far we are from completing the project on bid amount. See Recommendation section in this dissertation.

Part B) Breaking the project at Jefferson Parish (District 02) by dollar value:

1) $100,000.00 – $1,000,000

Table below show the normal distribution and the standard deviation for the year 2005-2014

	Time		Cost (2005-2014)		
Average	-2		$ 10,524.00		
Standared Deviation	15.2		$ 85,205.00		
	AVERAGE TIME		AVERAGE COST 2005-2014		
	Ahead of Time	Behind Time	Underrun		Overrun
68%	-17	13	$ (74,681.00)	$	95,728.00
95%	-32	28	$ (159,886.00)	$	180,933.00
99.70%	-47	43	$ (245,090.00)	$	266,137.00
	% Day Average		% Cost Average		
Average	-7%		3%		
Standared Deviation	29%		12%		
	Ahead of Time	Behind Time	Underrun		Overrun
68%	-36%	22%	-9%		15%
95%	-65%	51%	-21%		27%
99.70%	-94%	80%	-33%		39%

Figure below show the bell-shape for 2005-2014 (Time)
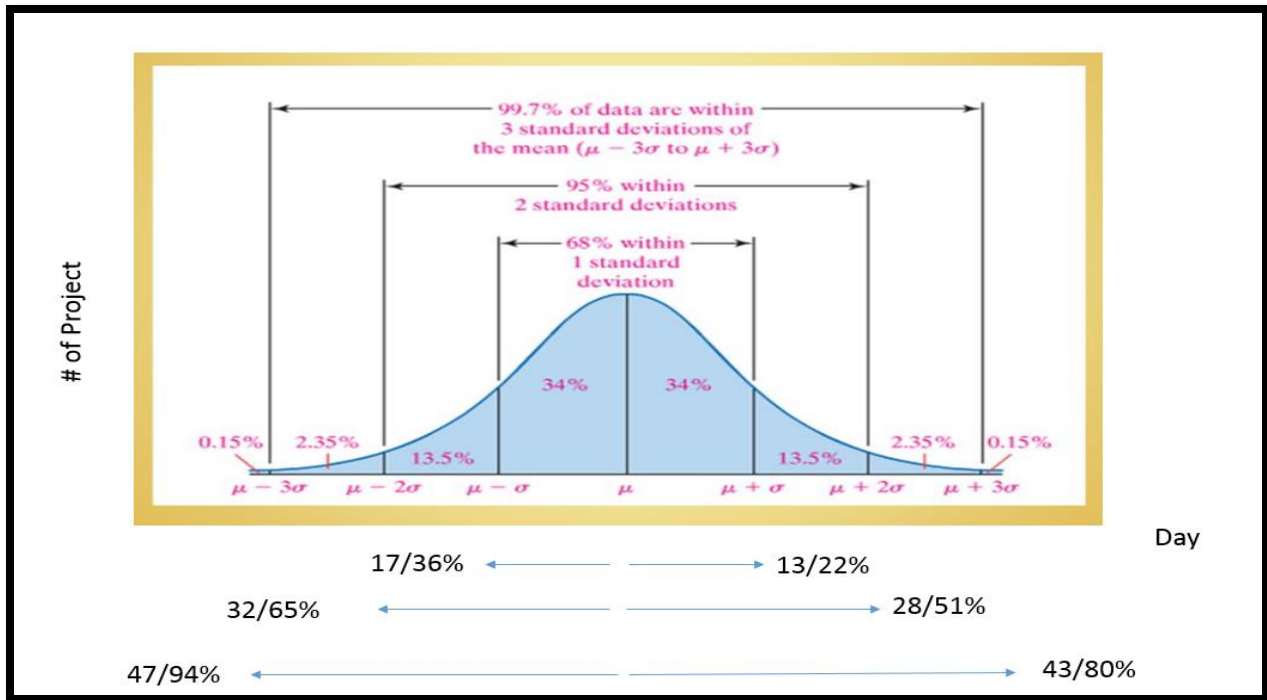
Chart (2005-2014) (A)

Figure below show the bell-shape for 2005-2014 (Cost)

Chart (2005-2014) (A)

Jefferson Parish- Time

$y = 0.1263x - 7.2834$

Day Variance ⋯⋯ Linear (Day Variance)

Jefferson Parish -Cost

$y = -4E-08x + 0.0474$

% Cost Variance overrun/underun

⋯⋯ Linear (% Cost Variance overrun/underun)
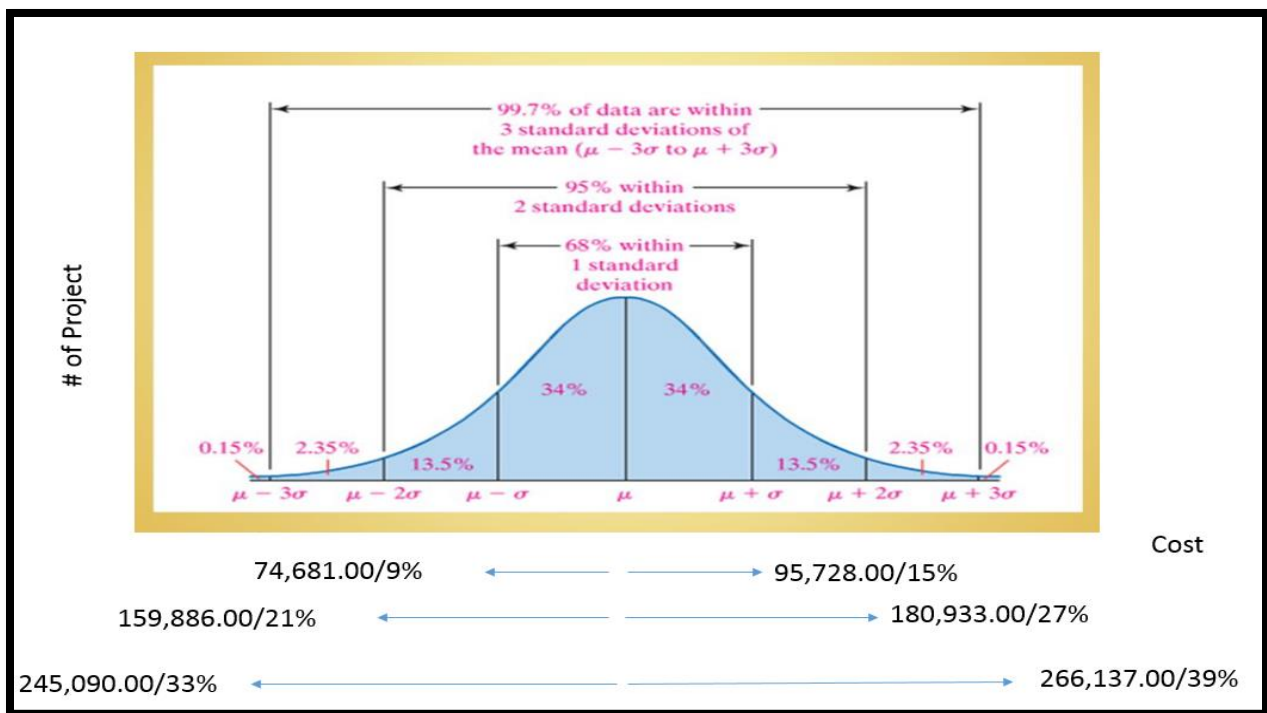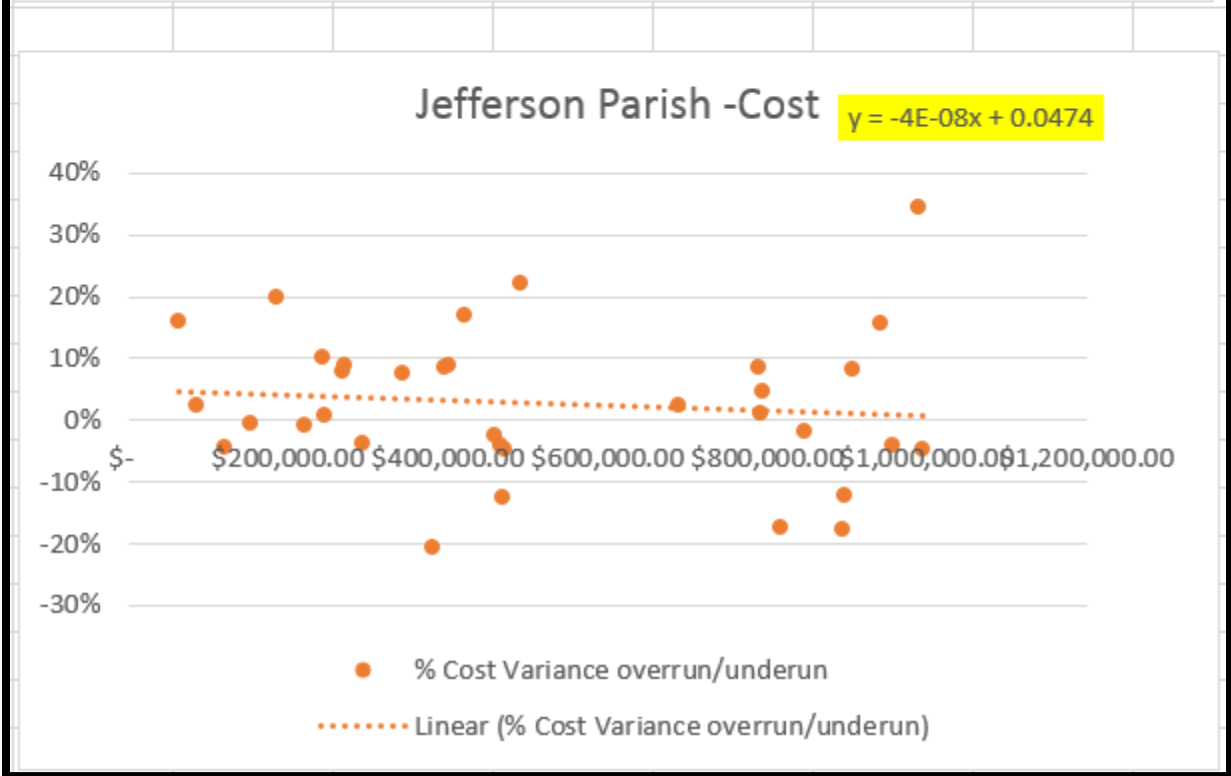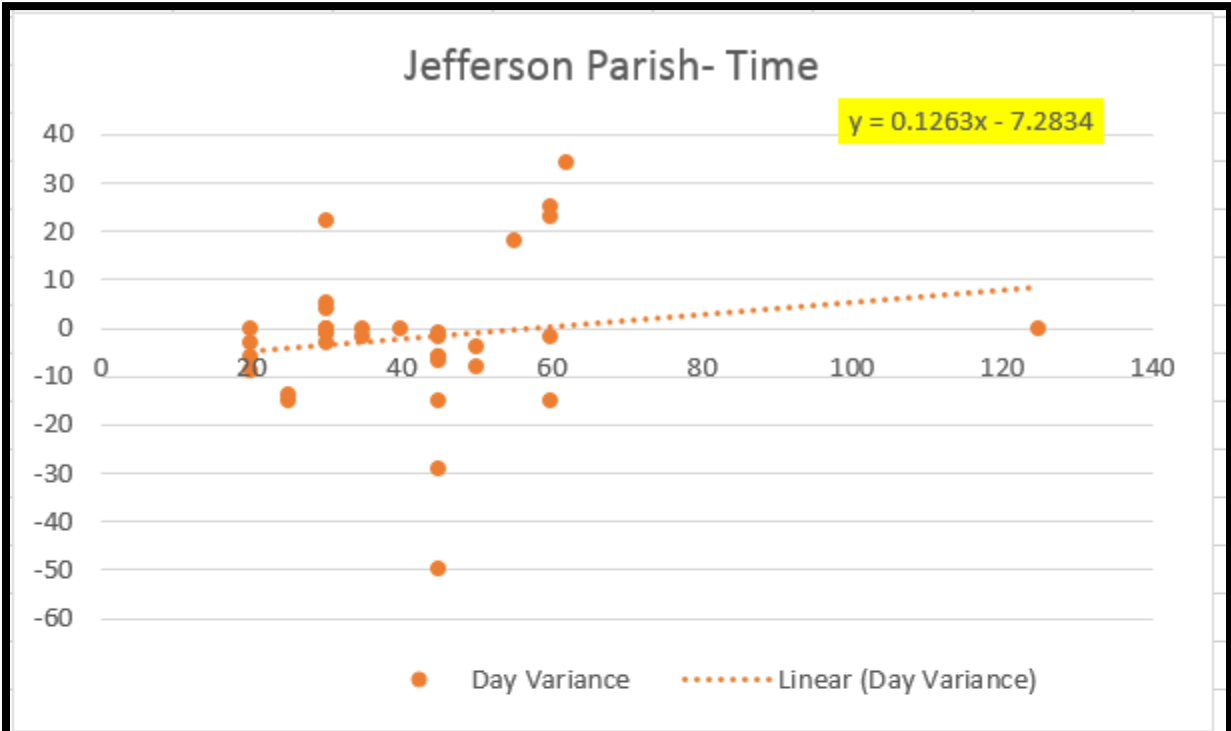
Exhibit (2005-2014) (A)

Now we can apply the above linear equation using projects that have been completed in 2015

Project H.006138

Bid day = 75 days

Project completed = 73 days

Bid Amount = $ 707,778.97

Total Amount Paid = $ 746,168.31

Schedule Performance

Days variance = 0.1263* "bid Days"-7.2834

= 0.1263* (75) − 7.2834 = 3 days

The actual number of days that the project completed is 73 days which is 2 days behind schedule. If we use the linear equation from Exhibit (2005-2014) (A) we will predict that the job will be completed 3 days ahead of schedule. According to chart (2005-2014 Time) (A) we are 68% confident that a new project will finish 17 days behind schedule and 13 days ahead of schedule, the actual days and the predicated days are within the 68% range.

Cost Performance

 % Overrun/underrun = -4E-08* "bid amount" + 0.0474

 = -4E-08* (707,778.97) + 0.0474 = 2% Overrun

The actual paid amount was 5% overrun

The predicted paid amount is 2% overrun

 Based on Chart (2005-2014 cost) (A) we are 68% confident that a new project cost will be 9% underrun

and 15% overrun.

Then applied the linear equation from Exhibit (2005-2014) (A) to the other projects that have been

completed in 2015, we have the same conclusion as a part A of this section.

2) $ 1,000,0001 To 5,000,000

Table below shows the normal distribution and the standard deviation for the year 2005-2014

	Time		Cost (2005-2014)		
Average	-0.2		$ 120,133.00		
Standared Deviation	19.8		$ 294,418.00		
	AVERAGE TIME		AVERAGE COST 2005-2014		
	Ahead of Time	Behind Time	Underrun		Overrun
68%	-20	20	$ (174,286.00)	$	414,551.00
95%	-40	39	$ (468,704.00)	$	708,970.00
99.70%	-60	59	$ (763,123.00)	$	1,003,388.00
	% Day Average		% Cost Average		
Average	-5%		6%		
Standared Deviation	17%		15%		
	Ahead of Time	Behind Time	Underrun		Overrun
68%	-22%	12%	-9%		21%
95%	-39%	29%	-24%		36%
99.70%	-56%	46%	-39%		51%

99.7% of data are within 3 standard deviations of the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)

95% within 2 standard deviations

68% within 1 standard deviation

34% 34%

0.15% 2.35% 13.5% 13.5% 2.35% 0.15%

$\mu - 3\sigma$ $\mu - 2\sigma$ $\mu - \sigma$ μ $\mu + \sigma$ $\mu + 2\sigma$ $\mu + 3\sigma$

# of Project

Day

20/22% ← → 20/12%

40/39% ← → 39/29%

60/56% ← → 59/46%

Chart (2005-2014) (B)

99.7% of data are within 3 standard deviations of the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)

95% within 2 standard deviations

68% within 1 standard deviation

34% 34%

0.15% 2.35% 13.5% 13.5% 2.35% 0.15%

$\mu - 3\sigma$ $\mu - 2\sigma$ $\mu - \sigma$ μ $\mu + \sigma$ $\mu + 2\sigma$ $\mu + 3\sigma$

# of Project

Cost

174,286.00/9% ← → 414,551.00/21%

468,704.00/24% ← → 708,970.00/36%

763,123.00/39% ← → 1,003,388.00/51%

Chart (2005-2014) (B)

66

Jefferson Parish- Time

$y = 0.135x - 13.877$

Jefferson Parish- Cost

$y = -1E\text{-}08x + 0.0886$

Exhibit (2005-2014)

Project H.006138

Bid day = 120 days

Project completed = 119 days

Bid Amount = $ 2,541,777.98

Total Amount Paid = $ 2,392,997.54

Schedule Performance

Days variance = 0.135* "bid Days"-13.877

= 0.135* (119) – 13.877 = -2 days

The actual number of days that the project completed is 73 days which is 2 days behind schedule. If we use the linear equation from Exhibit (2005-2014) (B) we will have predicted that the job will be completed 2 days behind schedule. According to chart (2005-2014 Time) (B) we are 68% Confident that a new project will finish 20 days behind schedule and 20 days ahead of schedule, the actual days and the predicated days are within the 68% range. And both actual day and predicted day are behind schedule.

Cost Performance

 % Overrun/underrun = -1E-08* "bid amount" +0.0886

= -1E-08* (2541777.98) +0.0886 = 11% Overrun

The actual paid amount was 5% overrun

The predicted paid amount is 11% overrun

 Based on Chart (2005-2014 cost) (B) we are 68% confident that a new project cost will be 9% underrun and 21% overrun.

Then applied the linear equation from Exhibit (2005-2014) (B) to the other projects that have been completed in 2015, we have the same conclusion as a part A of this section.

In conclusion we do not have to break the project by value because our result still with the range and also the actual value is close to the predict value in time and cost.

Compare PERT Technique and Dissertation Technique

PERT Technique

We have the following information regarding activities and their sequence for State Project # H.000314.6 Jefferson Parish/District 02

Find the expected Time for activity A (Equation 1)

Expected Time (weighted average) (te) for activity A $= \frac{to+4tm+tp}{6}$

$= \frac{18+4*21+32}{6} = 22.33$

Table below show expected time for all activities

ACTIVITY	DESCRIPTION	(t$_o$) OPTIMISTIC TIME	(t$_m$) MOST LIKELY TIME	(t$_p$) PESSIMISTIC TIME	(te) EXPECTED TIME
A	Pavement Patching	18	21	32	22
B	Cold planning	27	30	49	33
C	Adjust Manhole and Catch Basin	15	15	15	40
D	Handicap Ramps	9	9	9	9
E	Concrete Curbs	9	9	9	9
F	Asphaltic Concrete	40	45	53	46
G	Saw & Seal Joints	25	27	35	28
H	Guardrails	10	12	23	14
I	Pavement Stripe	15	15	21	16
J	Clean Up	18	18	18	20

Standard Deviation (σ) for Activity A $= \dfrac{tp - t0}{6}$

$= \dfrac{32 - 18}{6} = 2.33$

Variance (σ²) for Activity A $= (\dfrac{tp - to}{6})^2$

$= (\dfrac{32 - 18}{6})^2 = 5.43$

Table below show σ (Standard Deviation) and V (Variance) for all activities

ACTIVITY	σ STANDARD DEVIATION	V VARIANCE
A	2.33	5.43
B	3.67	13.44
C	0	0
D	0	0
E	0	0
F	2.17	4.69
G	1.67	2.78
H	2.17	4.69
I	1	1
J	0	0

It has been determined for the normal distribution that there is a 50% chance that the entire project will be completed by its earliest expected time (125 days in our construction project).

Assuming that the duration of the activities are independent of each other, the variance V of a group of activities can be computed by adding the variances of the activities in that group. The value of V is then expressed as

$$V = \sigma^2 1 + \sigma^2 2 + \cdots + \sigma^2 n$$

Where *n* is the number of activities in the group.

Critical Path is (A, B, F, G, H, I, J) the variance for the critical path is given as:

$$V = \sigma^2 A + \sigma^2 B + \sigma^2 F + \sigma^2 G + \sigma^2 H + \sigma^2 I + \sigma^2 J$$

V= 5.43+ 13.44+ 4.69+ 2.78+ 4.67+ 1 = 32.05

The value of the variance can be computed for any event by considering the group of critical activities that lead to that event. The chance of completing the project in certain desired time and the duration related to any desired probability of completion can now be calculated. Let:

S = scheduled project completion time = 125 days

D= the desired completion time = 129 days

$$Z = (D-S)/\sqrt{V}$$

$$Z = (129-125)/\sqrt{32.05}$$

$$Z = 4/5.66 = 0.71$$

The probability equivalent to Z = 0.71 can be found in Table (11)

Its value is 076115. There is a 76.12% chance of completing the project in 129 days. One should remember that there is only a 50% chance of completing the construction project in 125 days.

Dissertation Technique

From LADOTD Site Manager Contractor Reports
State Project H.000314.6
Bid Days = 125
Complete Days = 129

From Exhibit 7/02 (Jefferson Parish/District 02)

Y= Days variance = -0.0761" Bid Days" +1.3796
            = -0.0761 (125) + 1.3796 = - 8.13 ≈- 8 days

S = scheduled project completion time = 125 days

D= the desired completion time = 125-8 = 117 days

$$Z = (D-S)/\sqrt{V}$$

Z = (117-125)/$\sqrt{32.05}$

Z = -8/5.66 = -1.41

The probability equivalent to Z = -1.41 can be found in Table (11) appendix C

Its value is 0.07927 there is a 79.27% chance of completing the project in 117 days. One should remember that there is only a 50% chance of completing the construction project in 125 days.

 Run the same project using the two techniques, this dissertation has a proved that the dissertation technique has better result than PERT. In general, and after testing the dissertation technique, both techniques have close percentage to the actual complete day and cost.

Recommendations

Analysis of the results shows outcome can be refined further using multiple methods. The first is obtaining a larger set of data points from ongoing/completed project. The larger the population set, the more representative it is. Secondly, it is recommended to utilize computer simulation models to simulate a cost loaded schedule versus actual completion; this will provide another prediction equation and provide a platform to test its accuracy. Thirdly, it is recommend that the LADOTD itself can establish an ongoing research program in collaboration with contractors that automatically adds new projects to each district's data points to refine the prediction model. Finally, applying this model nationwide to other DOTDs as a federally funded endeavor.

Summary and conclusion:

Reasons behind delay in schedule and cost overrun:

Construction projects in Louisiana face multiple factors that contribute to the cost and schedule overrun. Some of these factors are due to the weather. Louisiana is prone to hurricanes, high winds and heavy rainfall that is scattered and very high to predict. Since most highway projects involve a form of civil work, even the lightest rain of < 0.5 inches would have a schedule delay that will result in a cost overrun. Also lightening alerts have made it very dangerous to work as a lot of companies dictate that work must be stopped if a lightening occurs 7 to 15 miles from the work scope.

Louisiana is also a region that has multiple oil, gas and chemical plants. With their demanding turnaround and capacity expansions, it applies heavy influence on the labor and material market that raises the prices and makes it more competitive to retain and incentivize the working force. This factor also affects the 3rd party equipment rental prices and the engineering design availability and commitment to deadlines.

Some of these parishes' project engineers were contacted to get an answer to some questions such as: Why most of the projects were done behind time or on time and no extra cost to the LADOTD. Various answers were given, but the most important one pointed to communications. Experience is also a significant factor to have a good and complete project on time, behind time and no extra cost to LADOTD. On the other hand, other parishes that had a lot of delay to complete the project and overrun were questioned. They mostly blamed the delay to lack of communications between Design Engineers and Projects Engineers.

This dissertation has generated a lot of information that will be very helpful to the Industry of Construction and Design in determining time and cost for future projects. The outcome of this dissertation shall:

1) Benefit the contractors by applying the equations that have been developed so that they are able to predict the number of days the project will be completed by, or if the predicted number of days is ahead or behind the estimated day of completion of the project, knowing that contractors can go back and rearrange the scheduling by changing some activity duration ;
2) Enable the contractors in predicting the total cost of the project or if it is underrun or overrun from the proposed cost; and
3) Allow LADOTD to use the equations to predict the total cost of the project so they are able to fund the project with the amount closest to the actual amount.

 Communication is the key that holds a project team together, and complete the project on time or behind schedule and no extra cost. Communication is not just talking; it is also listening. Poor communication will render an already challenging situation nearly impossible to control. The goal of project communications Management is to ensure timely and within the budget completion of the project.

An effective Project Manager spends most of her/his time communicating with other team members. According to the "**PMBOKGuide**", a project manager spends 70-90% of her/his time in communication during a project. Communication needs to be planned at the first meeting between all who are involved with the project. Project Manager must have some skills so projects will be completed on time within the budget, some of these skills are:

1) Communication. Did you know that 90 percent of a project manager's time is spent communicating? ...
2) Leadership. ...
3) Team management. ...
4) Negotiation. ...
5) Personal organization. ...
6) Risk management.*https://www.liquidplanner.com/blog/6-essential-**skills**-for-**project**-manage*

This dissertation will benefit the LADOTD as well as contractor in adjusting the completion time of a project as well as predicting the budget.

Appendix

Appendix A

(LADOTD Site Manager Contractor Reports)

Project #: 450-15-0100   Funding: NH-10-5(362)229

Contractor: JAMES CONSTRUCTION GROUP LLC

PE: Skoien, Richard   District: 02   Gang: 232

Description: CAUSEWAY BOULEVARD INTERCHANGE (PHASE I)

Description: I- 10 -LOC ON RT I-10 / CAUSEWAY BOULEVARD INTERCHANGE

Description:

Route: I- 10

Parish: Jefferson

Bid Days: 615

Adjusted Days : 153

Total Days : 768

Charged Days: 755

Percent Time Used: 98.31

Liq Damage Rate: 5,000.00

Spec Year: 2006

Bid Amount: 32,555,213.36

Approved Change Order Amount: 759,755.23

Pending Change Order Amount: 0.00

Approved Amount: 33,314,968.59

Paid to Date: 33,233,683.47

Percent Complete: 99.7560102157071

Contract Date: 10/29/2008

Letting Date: 08/28/2008

Final Inspection Date: 02/21/2013

Final Acceptance Date: 04/08/2013

Final Estimate Received Date: 08/25/2014

Final Released Date: 04/08/2015

Notice to Proceed: 12/02/2008

Fed Oversight Needed: Y

Fuel/Asphalt Adjustments: Yes

DBE Goal %: 10

Calendar Day Job

Subcontractor: Marshland Construction, LLC   DBE Type: NA   Approved Date: 10/23/2009

Subcontractor: J. Star Enterprises   DBE Type: MWBE   Approved Date: 10/26/2009

Subcontractor: C.E.C., Inc.   DBE Type: NA   Approved Date: 07/27/2009

Subcontractor: Gilley Construction, Inc.   DBE Type: NA   Approved Date: 03/12/2009

Subcontractor: BARRIERE CONSTRUCTION CO., LLC.   DBE Type: NA   Approved Date: 06/15/2009

Subcontractor: Traffic Solutions, Inc.   DBE Type: WWBE   Approved Date: 04/06/2009

Subcontractor: Creek Services LLC   DBE Type: MWBE   Approved Date: 04/08/2009

Subcontractor: Jack B. Harper Contractor, LLC   DBE Type: NA   Approved Date: 01/22/2009

Subcontractor: Lamay Group, Llc   DBE Type: NA   Approved Date: 01/22/2009

Appendix B

Table 10

STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.										
Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
-3.8	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
-3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
-3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
-3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
-3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
-3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
-3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
-3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
-3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
-2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
-2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
-2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
-2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
-2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
-2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
-2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
-2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
-2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
-2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
-1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
-1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
-1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
-1.6	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
-1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
-1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
-1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08691	.08534	.08379	.08226
-1.2	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
-1.1	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
-1.0	.15866	.15625	.15386	.15151	.14917	.14686	.14457	.14231	.14007	.13786
-0.9	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
-0.8	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
-0.7	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
-0.6	.27425	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
-0.5	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
-0.4	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
-0.3	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
-0.2	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
-0.1	.46017	.45620	.45224	.44828	.44433	.44038	.43644	.43251	.42858	.42465
-0.0	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414

Cumulative Probabilities for the Normal Probability Distribution (Negative Value)

Appendix C

Table 11

STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997

Cumulative Probabilities for the Normal Probability Distribution (Positive Value)

Appendex D
District 03

The tables and the Bell-shape distribution curves below show the accuracy of a new project being completed ahead of time or behind time, where the negative sign means ahead of the time and plus sign means behind time. Also the tables and Bell-shape distribution curves show the confident that a new project cost will be underrun or overrun where the negative sign means underrun and positive sign mean overrun.

Note: Present Value 2015 has been calculated for information only

	Day Average		Cost (2005-2015)		Present value 2015	
Average	-6.7		$ 27,533.00		$ 31,857.00	
Standared Deviation	34.4		$ 494,314.00		$ 580,807.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-41	28	$ (466,781.00)	$ 521,848.00	$ (548,950.56)	$ 612,664.43
95%	-76	62	$ (961,095.00)	$ 1,016,162.00	$ (1,129,758.05)	$ 1,193,471.93
99.70%	-110	97	$ (1,455,409.00)	$ 1,510,476.00	$ (1,710,565.55)	$ 1,774,279.42
	% Day Average		% Cost Average		% Average at net present value	
Average	-8%		2%		2%	
Standared Deviation	27%		16%		19%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-35%	19%	-14%	18%	-17%	21%
95%	-62%	46%	-30%	34%	-36%	40%
99.70%	-89%	73%	-46%	50%	-55%	59%

TABLE (Dist. 03) Normal Distribution and Standard Deviation for District 03
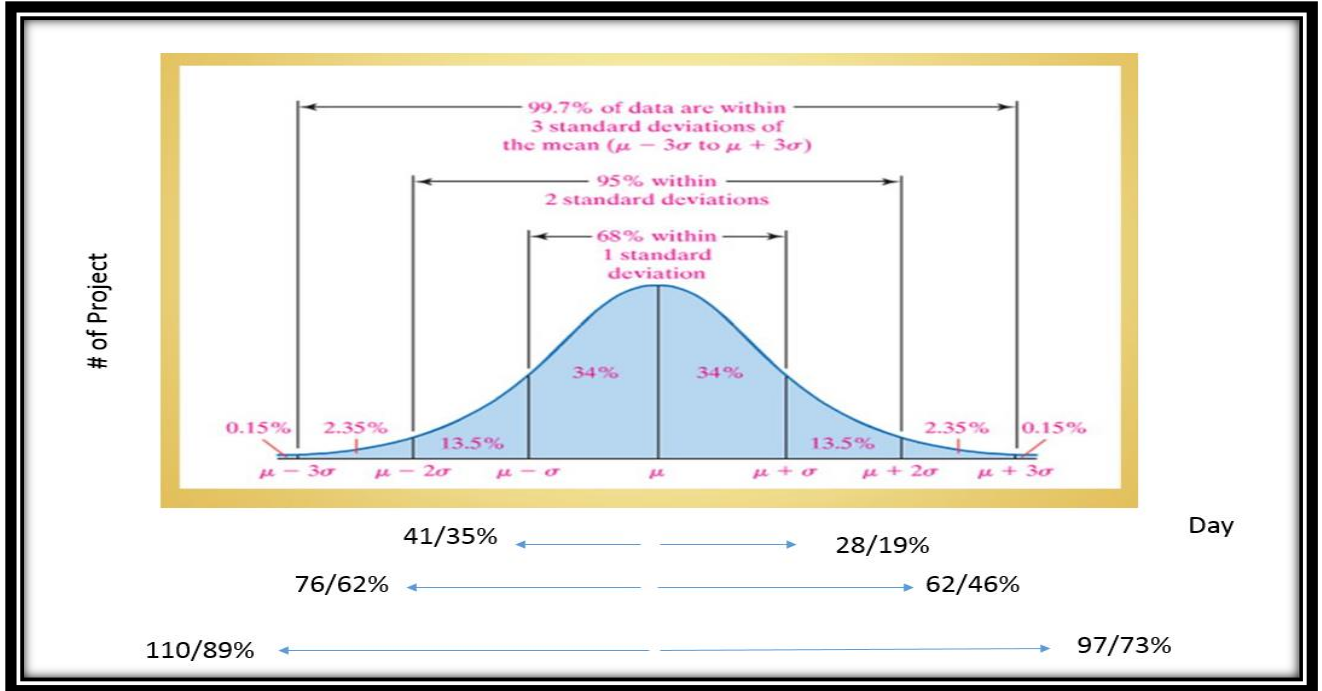
Chart (Dist. 03a) Average day/ % Average day for District 03
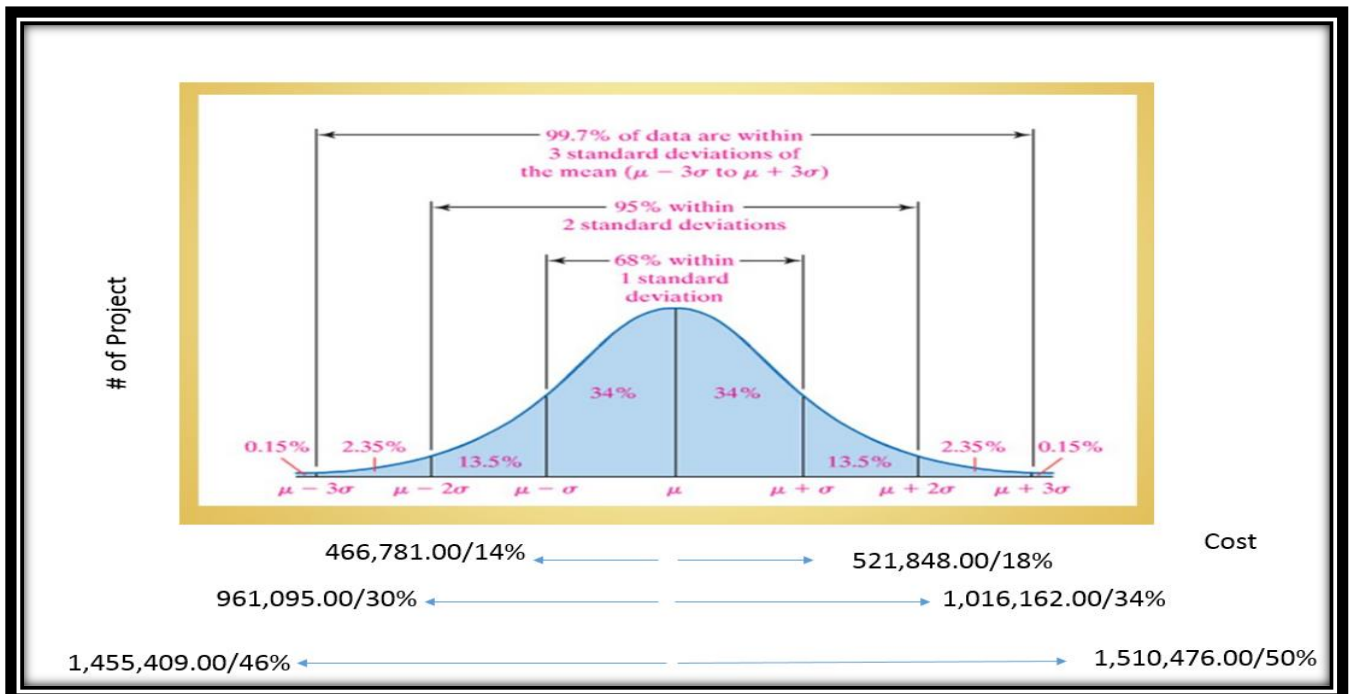
Chart (Dist. 03b) Average Cost/% Average Cost (year 2005-2015) for District 03

District 04

	Time		Cost (2005-2015)		Present value 2015	
Average	-5.6		$ 15,826.00		$ 16,697.00	
Standared Deviation	33.6		$ 417,006.00		$ 457,291.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-39	28	$ (401,180.00)	$ 432,832.00	$ (440,595.64)	$ 473,987.90
95%	-73	62	$ (818,186.00)	$ 849,838.00	$ (897,885.91)	$ 931,987.17
99.70%	-106	95	$ (1,235,192.00)	$ 1,266,844.00	$ (1,355,177.18)	$ 1,388,570.44
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-16%		-1%		-1%	
Standared Deviation	27%		14%		16%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-43%	11%	-15%	13%	-17%	15%
95%	-70%	38%	-29%	27%	-33%	31%
99.70%	-97%	65%	-43%	41%	-49%	47%

TABLE (Dist. 04) Normal Distribution and Standard Deviation for District 04
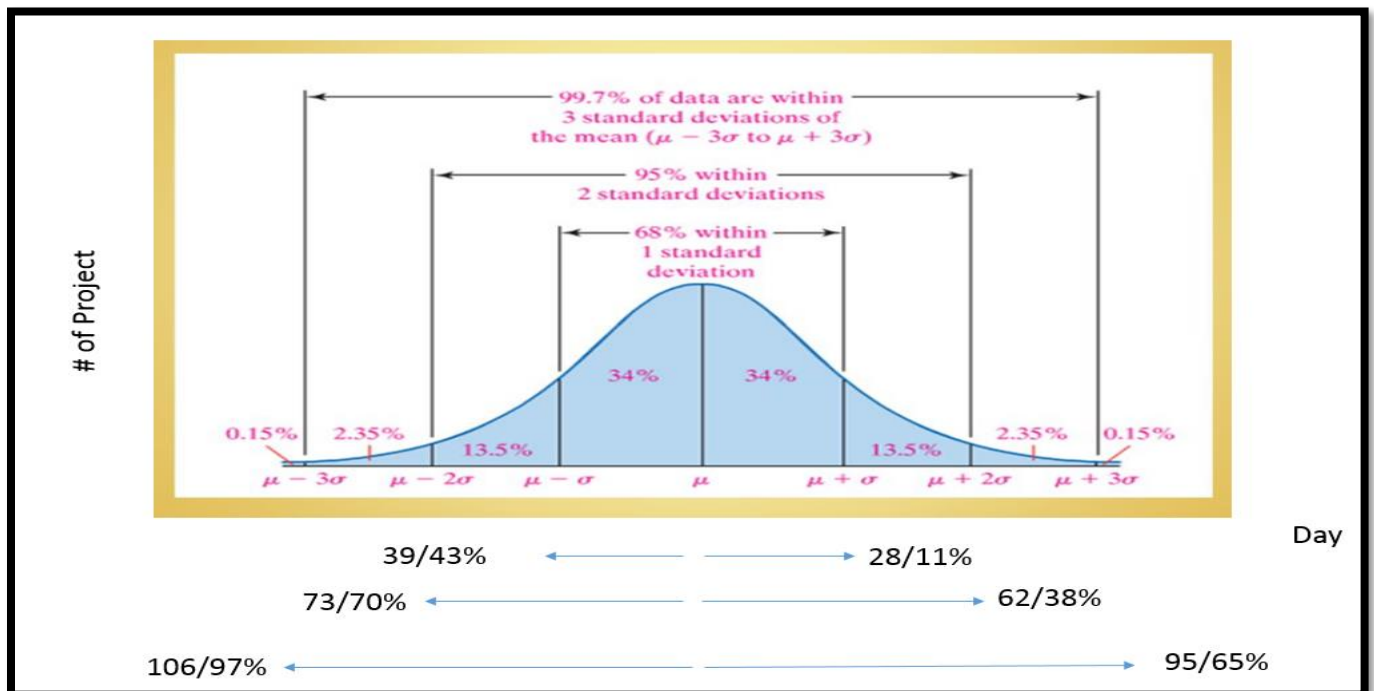
Chart (Dist. 04a) Average day/ % Average day for District 04
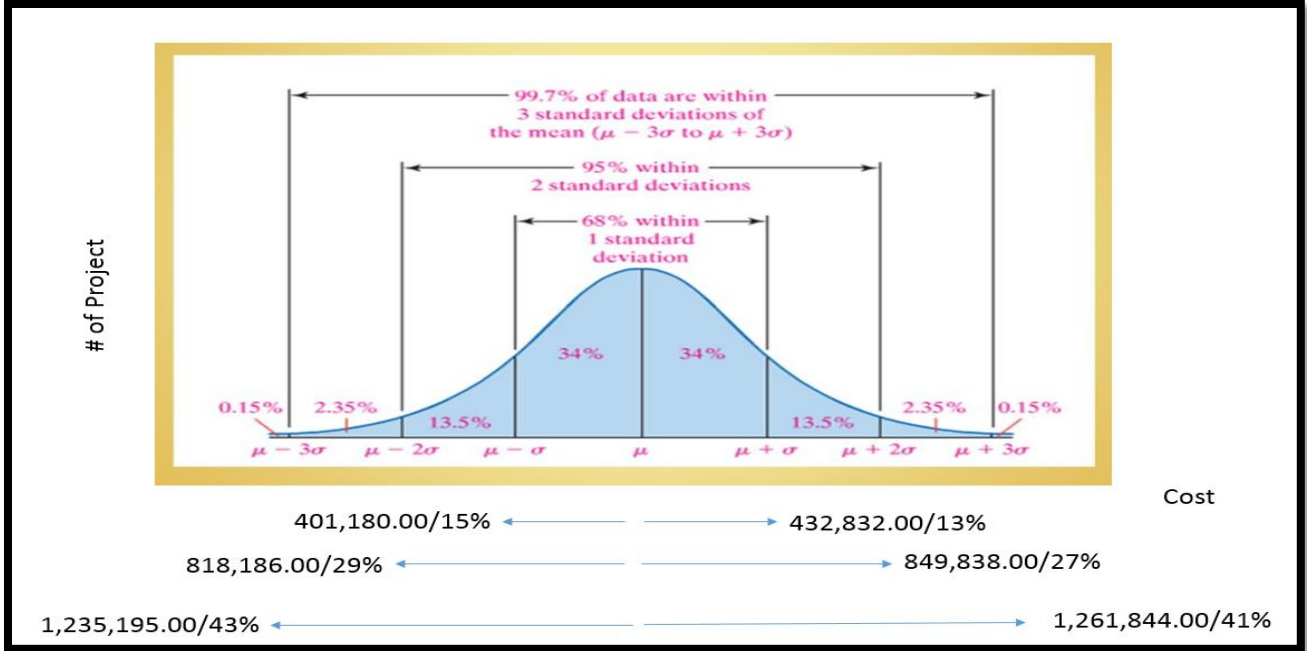
Chart (Dist. 04b) Average Cost/% Average Cost (year 2005-2015) for District 04

District 05

	Time		Cost (2005-2015)			Present value 2015		
Average	-10.4		$ 107,926.00			$ 130,387.00		
Standared Deviation	34		$ 932,753.00			$ 1,176,064.00		
	AVERAGE TIME		**AVERAGE COST 2005-2015**			**AVERAGE COST 2015**		
	Ahead of Time	*Behind Time*	*Underrun*		*Overrun*	*Underrun*		*Overrun*
68%	-44	24	$ (239,345.00)	$	305,960.00	$ (288,178.93)	$	359,815.62
95%	-78	58	$ (511,998.00)	$	578,613.00	$ (612,176.20)	$	683,812.90
99.70%	-112	92	$ (784,651.00)	$	851,266.00	$ (936,173.48)	$	1,007,810.17
	% Day Average		**% Cost Average**			**% Average at net present value**		
Average	-17%		0%			0%		
Standared Deviation	25%		9%			11%		
	Ahead of Time	*Behind Time*	*Underrun*		*Overrun*	*Underrun*		*Overrun*
68%	-42%	8%	-9%		9%	-11%		11%
95%	-67%	33%	-18%		18%	-22%		22%
99.70%	-92%	58%	-27%		27%	-33%		33%

TABLE (Dist. 05) Normal Distribution and Standard Deviation for District 05
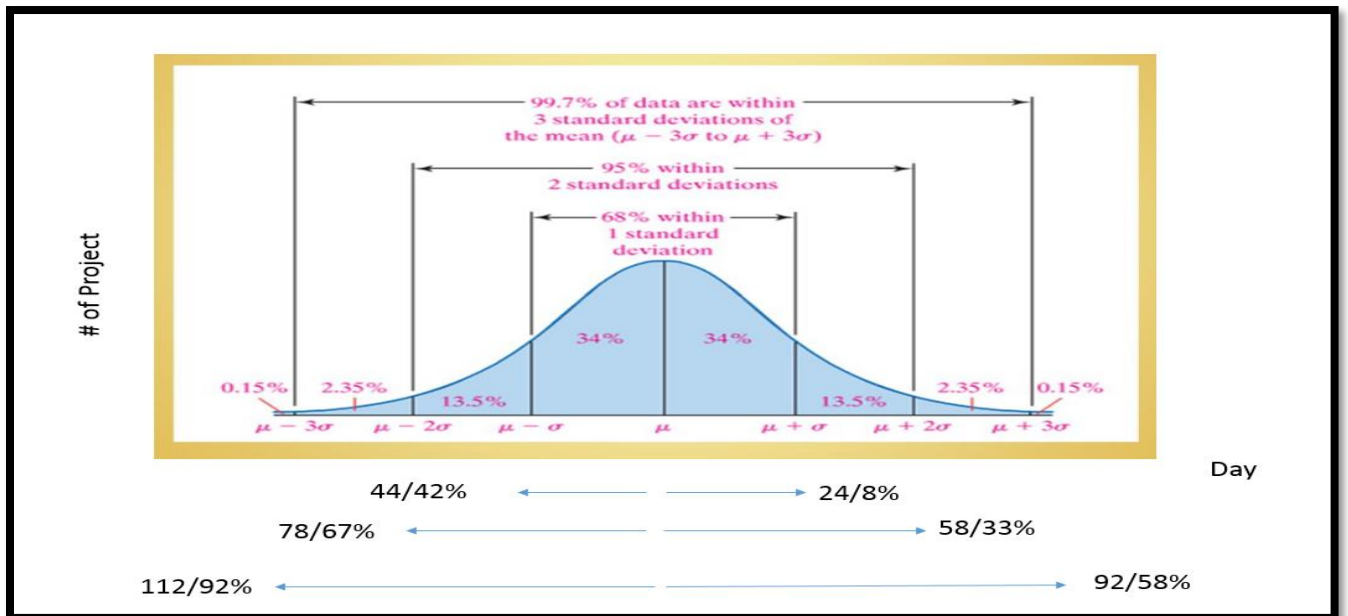
Chart (Dist.05a) Average day/ % Average day for District 05

99.7% of data are within
3 standard deviations of
the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)

95% within
2 standard deviations

68% within
1 standard
deviation

34%   34%

0.15%   2.35%   13.5%   13.5%   2.35%   0.15%

$\mu - 3\sigma$ $\mu - 2\sigma$ $\mu - \sigma$ μ $\mu + \sigma$ $\mu + 2\sigma$ $\mu + 3\sigma$

Cost

239,345.00/9%   ⟵   ⟶   305,960.00/9%

511,998.00/18%   ⟵   ⟶   578,613.00/18%

784,651.00/27%   ⟵   ⟶   851,266.00/27%
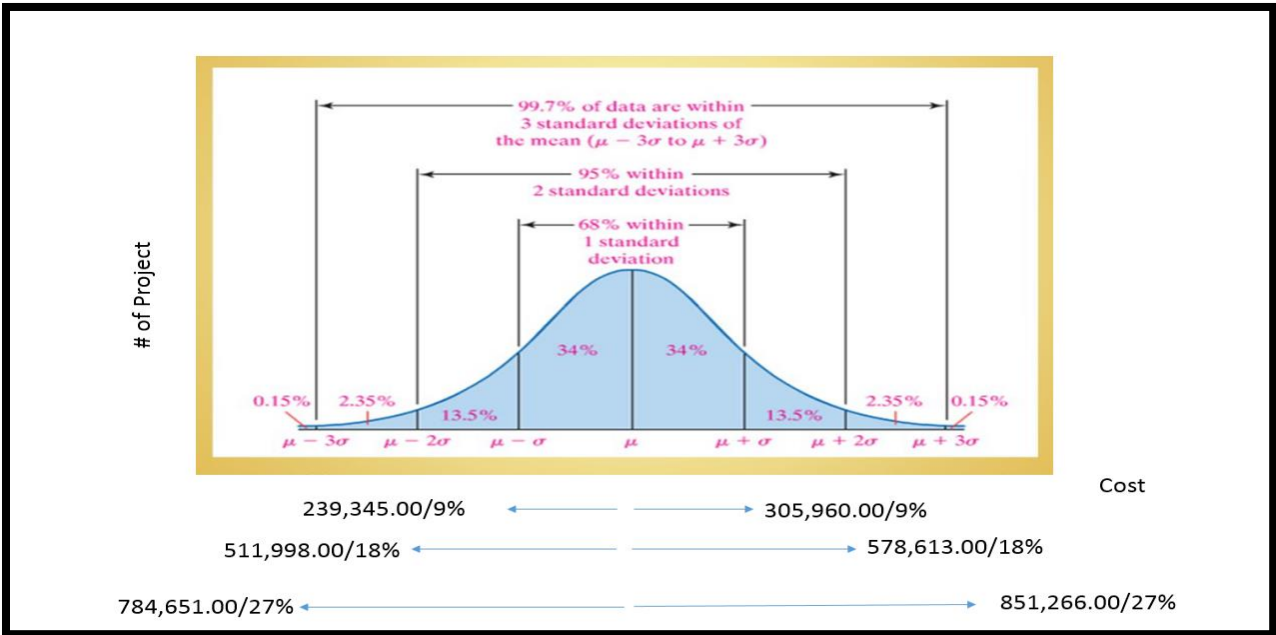
Chart (Dist. 05b) Average Cost/% Average Cost (year 2005-2015) for District 05

District 07

	Time		Cost (2005-2015)			Present value 2015	
Average	-7.1		$ 1,667.00			$ 708.00	
Standared Deviation	11		$ 101,032.00			$ 114,139.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**		
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*	
68%	-18	4	$ (99,365.00)	$ 102,698.00	$ (113,430.35)	$ 114,847.11	
95%	-29	15	$ (200,396.00)	$ 203,730.00	$ (227,569.08)	$ 228,985.85	
99.70%	-40	26	$ 301,428.00	$ 304,762.00	$ (341,707.81)	$ 343,124.58	
	% Day Average		**% Cost Average**		**% Average at net present value**		
Average	-13%		4%		4%		
Standared Deviation	16%		14%		15%		
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*	
68%	-29%	3%	-10%	18%	-11%	19%	
95%	-45%	19%	-24%	32%	-26%	34%	
99.70%	-61%	35%	-38%	46%	-41%	49%	

TABLE (Dist. 07) Normal Distribution and Standard Deviation for District 07
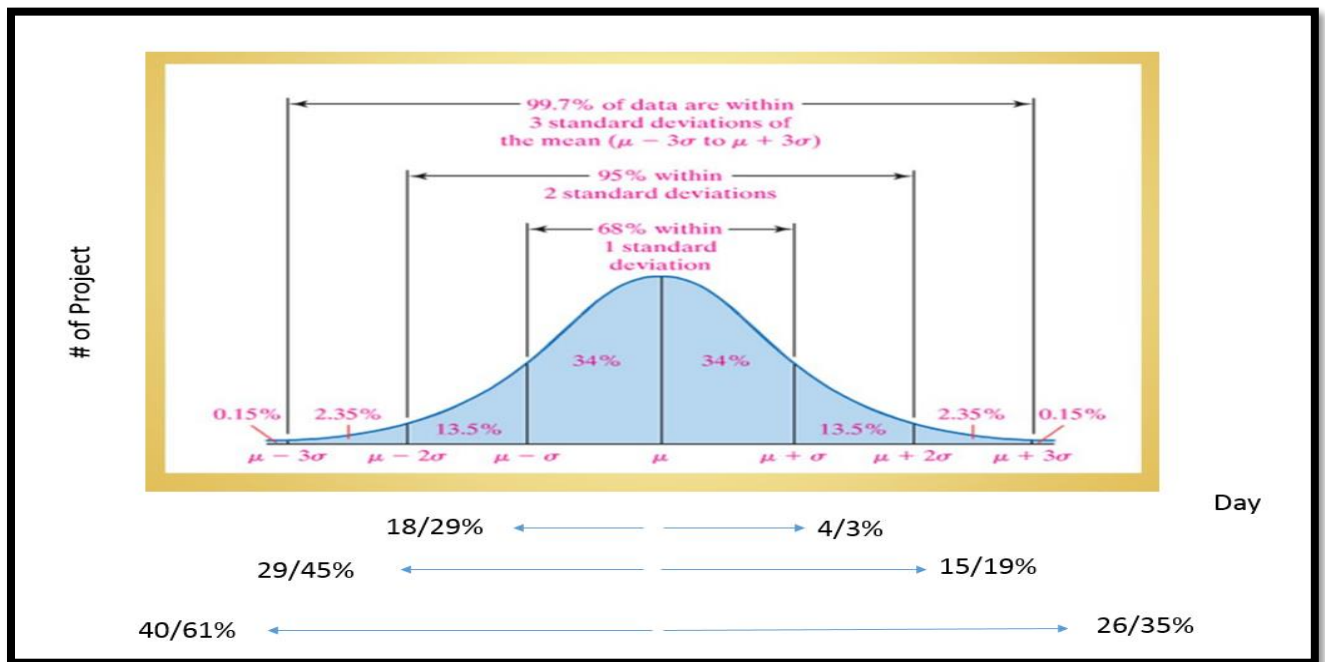
Chart (Dist.07a) Average day/ % Average day for District 07
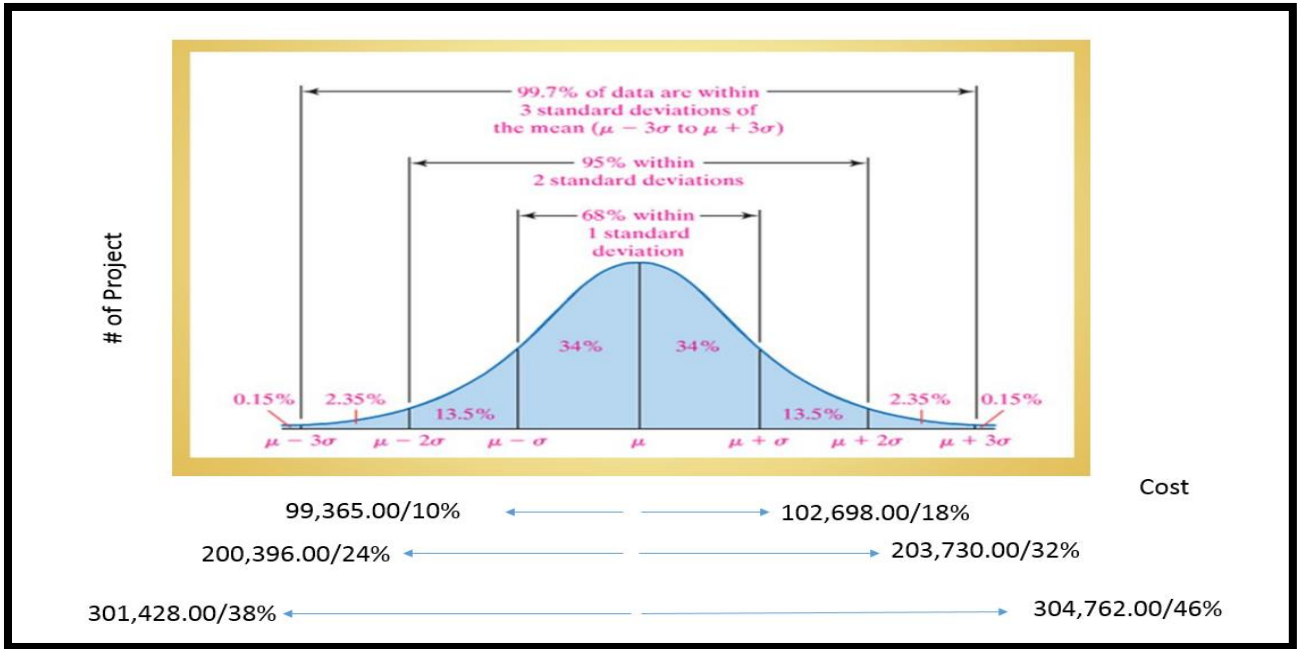
Chart (Dist. 07b) Average Cost/% Average Cost (year 2005-2015) for District 07

District 08

	Time		Cost (2005-2015)			Present value 2015	
Average	-11.2		$ 38,202.00			$ (45,112.00)	
Standared Deviation	14.9		$ 97,724.00			$ 116,139.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**			**AVERAGE COST 2015**	
	Ahead of Time	*Behind Time*	*Underrun*		*Overrun*	*Underrun*	*Overrun*
68%	-26	4	$ (135,927.00)	$	59,522.00	$ (161,251.00)	$ 71,026.23
95%	-41	19	$ (233,651.00)	$	157,247.00	$ (277,389.62)	$ 187,164.84
99.70%	-56	34	$ (331,376.00)	$	254,971.00	$ (393,528.23)	$ 303,303.45
	% Day Average		**% Cost Average**			**% Average at net present value**	
Average	-21%		-2%			-2%	
Standared Deviation	25%		6%			7%	
	Ahead of Time	*Behind Time*	*Underrun*		*Overrun*	*Underrun*	*Overrun*
68%	-46%	4%	-8%		4%	-9%	5%
95%	-71%	29%	-14%		10%	-16%	12%
99.70%	-96%	54%	-20%		16%	-23%	19%

TABLE (Dist. 08) Normal Distribution and Standard Deviation for District 08
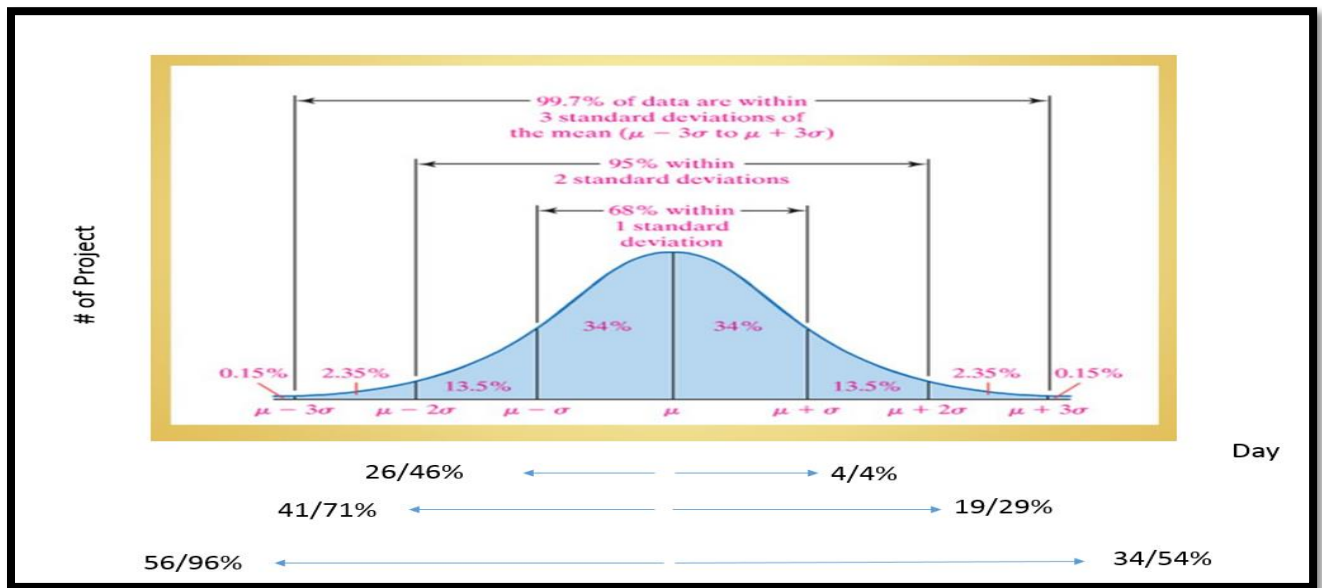
Chart (Dist.08 a) Average day/ % Average day for District 08

Chart values below the bell curve:

135,927.00/8% ← → 59,522.00/4%

233,651.00/14% ← → 157,247.00/10%

331,376.00/20% ← → 254,971.00/16%
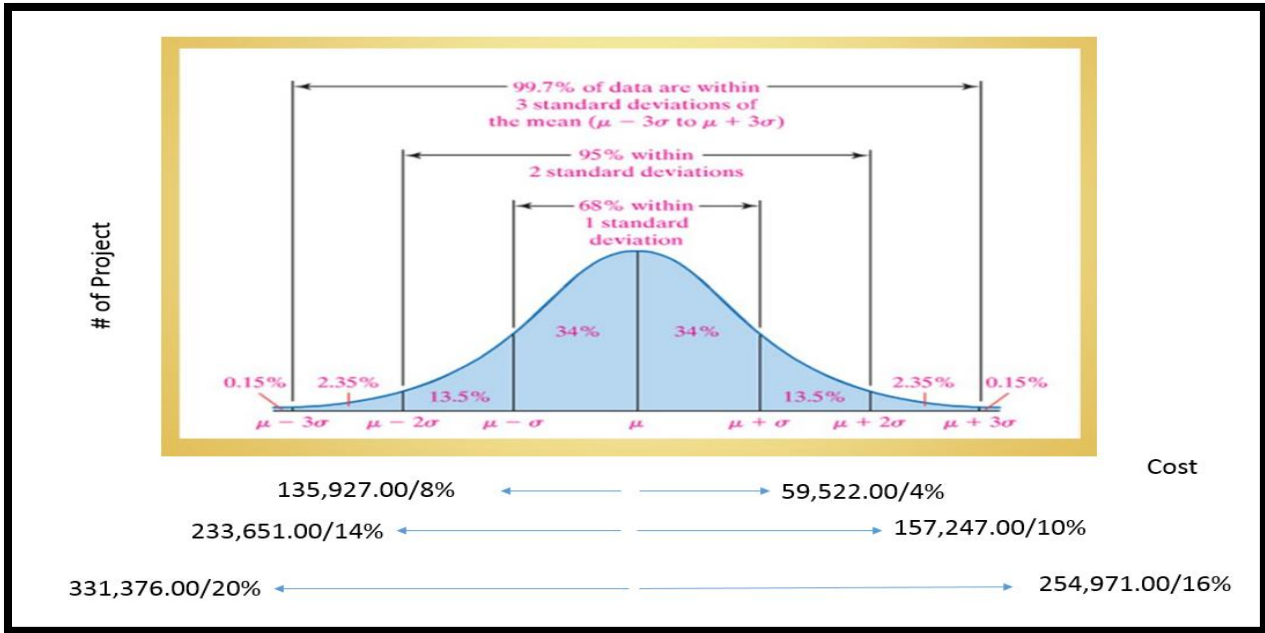
Cost

Chart (Dist. 08b) Average Cost/% Average Cost (year 2005-2015) for District 08

District 58

	Time		Cost (2005-2015)		Present value 2015	
Average	-11		$ 105,440.00		$ 119,951.00	
Standered Deviation	17.3		$ 637,457.00		$ 737,602.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-28	6	$ (532,017.00)	$ 742,897.00	$ (617,650.40)	$ 857,552.81
95%	-46	23	$ (1,169,474.00)	$ 1,380,354.00	$ (1,355,252.00)	$ 1,595,154.42
99.70%	-63	41	$ (1,806,931.00)	$ 2,017,811.00	$ (2,092,853.61)	$ 2,332,756.02
	% Day Average		% Cost Average		% Average at net present value	
Average	-19%		3%		3%	
Standard Deviation	23%		8%		10%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-42%	4%	-5%	11%	-7%	13%
95%	-65%	27%	-13%	19%	-17%	23%
99.70%	-88%	50%	-21%	27%	-27%	33%

TABLE (Dist.58) Normal Distribution and Standard Deviation for District 58
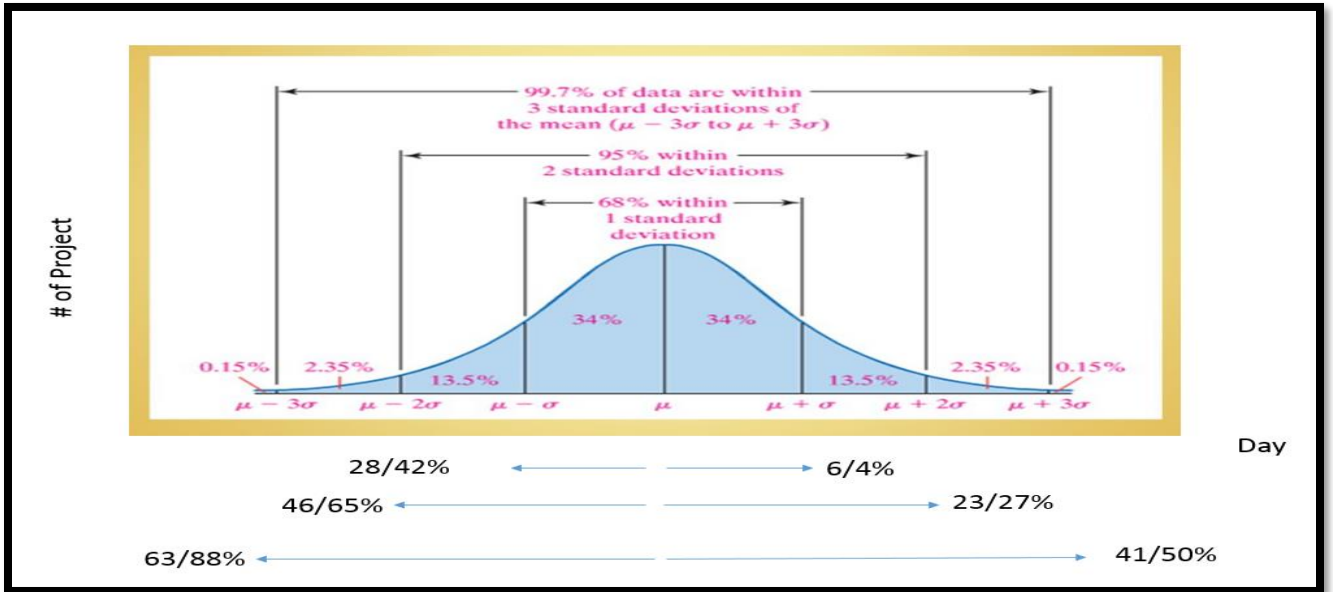
Chart (Dist.58a) Average day/ % Average day for District 58
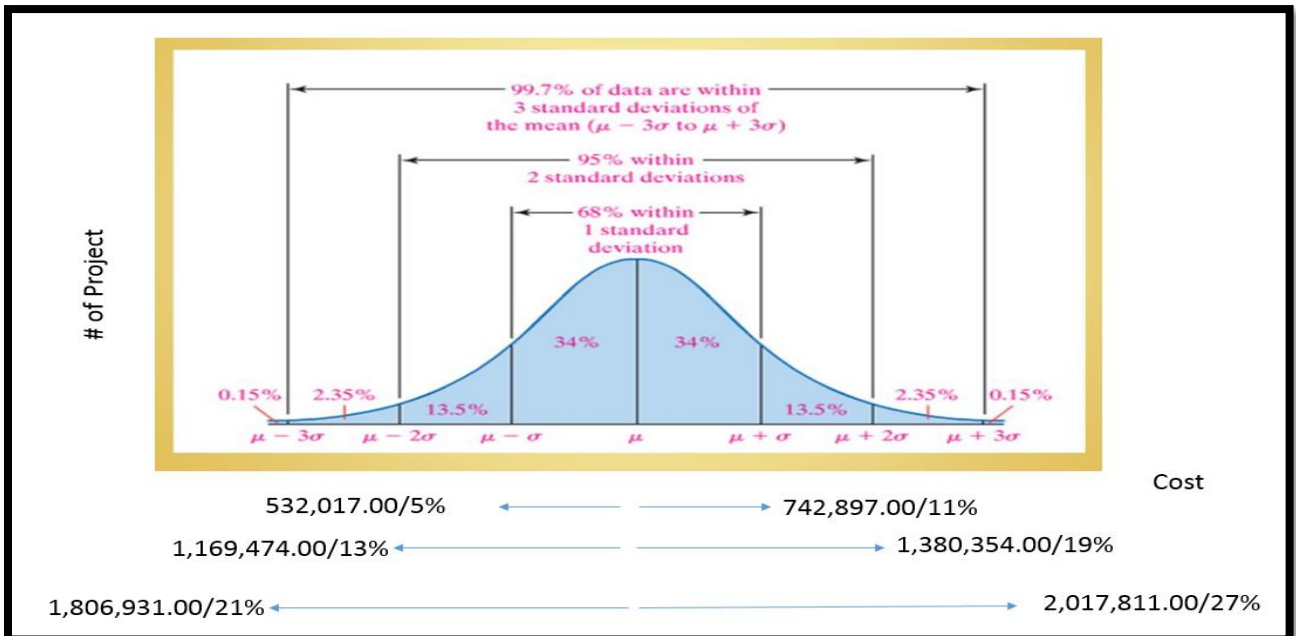
Chart (Dist. 58b) Average Cost/% Average Cost (year 2005-2015) for District 58

District 61

	Time		Cost (2005-2015)			Present value 2015		
Average	-5.4		$ 40,403.00			$ 35,357.00		
Standared Deviation	8.4		$ 288,310.00			$ 332,541.00		
	AVERAGE TIME		AVERAGE COST 2005-2015			AVERAGE COST 2015		
	Ahead of Time	Behind Time	Underrun		Overrun	Underrun		Overrun
68%	-14	3	$ (247,906.00)	$	328,713.00	$ (297,183.43)	$	367,897.62
95%	-22	12	$ (536,216.00)	$	617,023.00	$ (629,723.95)	$	700,438.15
99.70%	-31	20	$ (824,526.00)	$	905,333.00	$ (962,264.48)	$	1,032,978.67
	% Day Average		% Cost Average			% Average at net present value		
Average	-8%		4%			4%		
Standared Deviation	12%		12%			13%		
	Ahead of Time	Behind Time	Underrun		Overrun	Underrun		Overrun
68%	-20%	4%	-8%		16%	-9%		17%
95%	-32%	16%	-20%		28%	-22%		30%
99.70%	-44%	28%	-32%		40%	-35%		43%

TABLE (Dist. 61) Normal Distribution and Standard Deviation for District 61
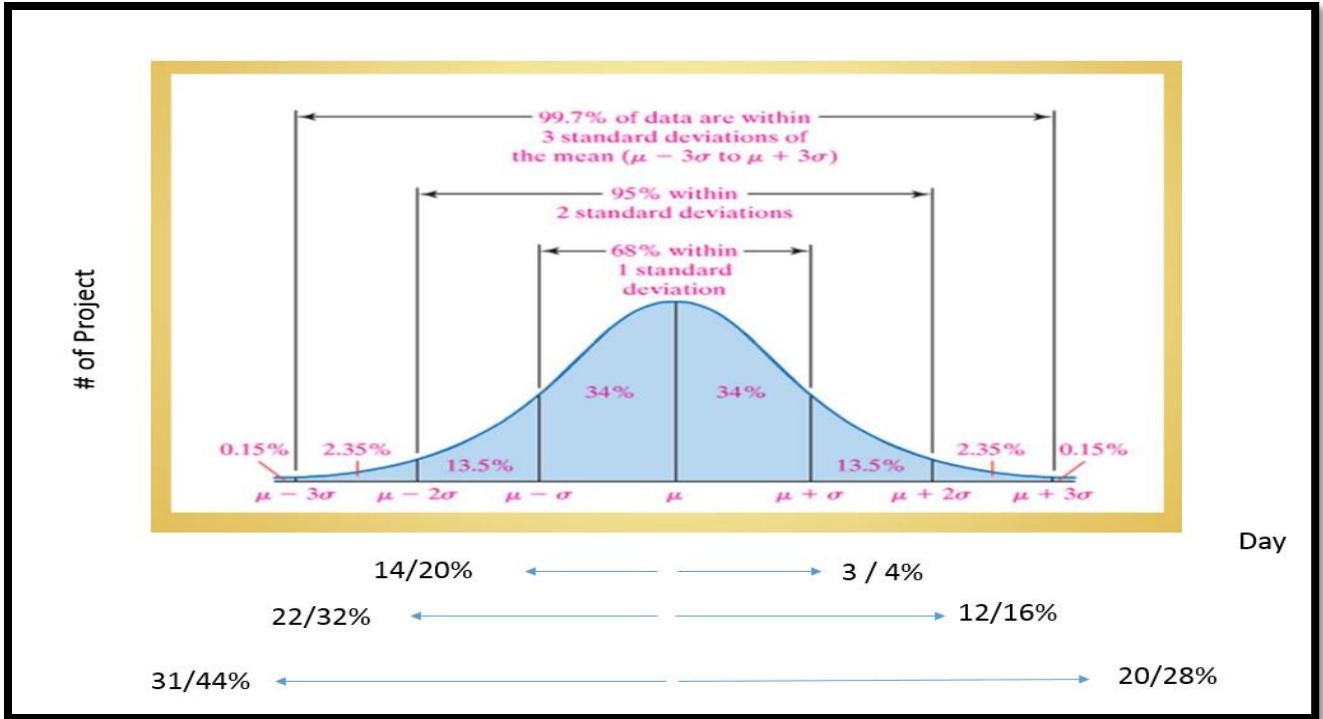
Chart (Dist.61a) Average day/ % Average day for District 61
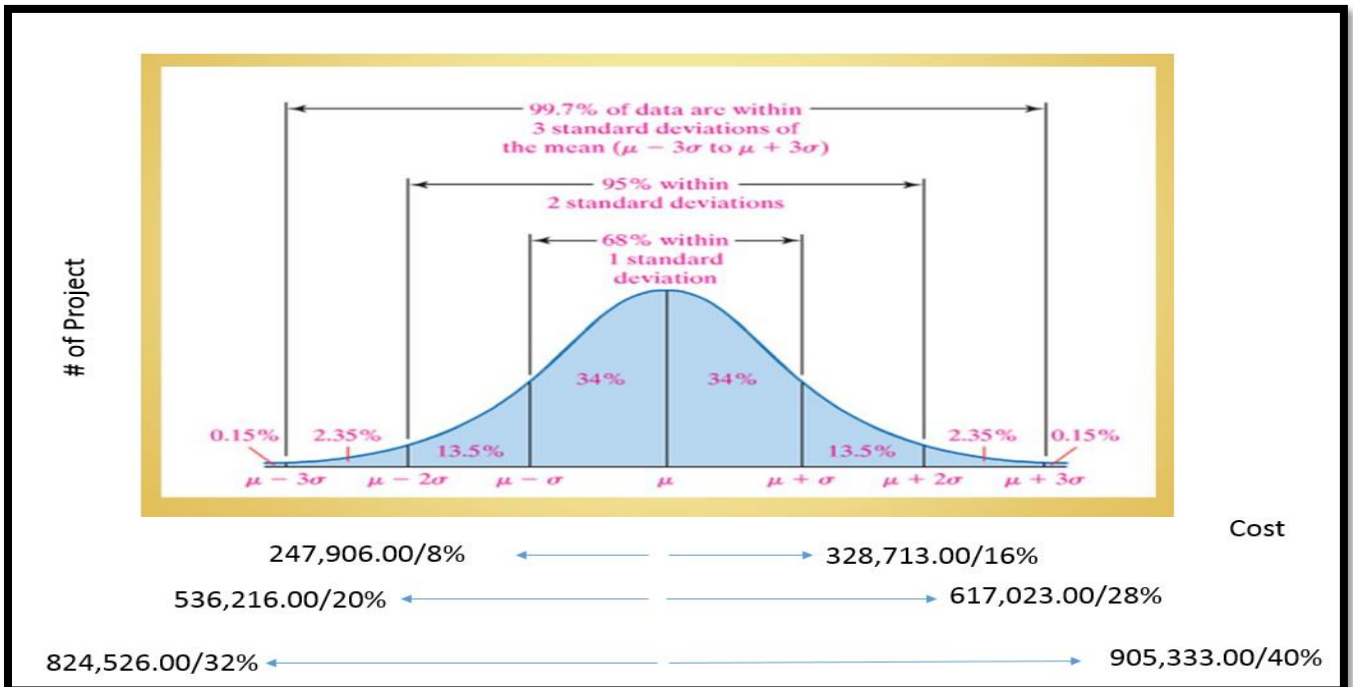
Chart (Dist. 61b) Average Cost/% Average Cost (year 2005-2015) for District 61

District 62

	Time		Cost (2005-2015)		Present value 2015	
Average	-5.7		$ 24,390.00		$ 27,711.00	
Standared Deviation	21.5		$ 722,048.00		$ 758,075.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	*Behind Time*	Underrun	*Overrun*	Underrun	*Overrun*
68%	-27	16	$ (697,658.00)	$ 746,438.00	$ (730,363.96)	$ 784,786.47
95%	-49	37	$ (1,419,706.00)	$ 1,468,486.00	$ (1,488,439.17)	$ 1,543,861.68
99.70%	-70	59	$ (2,141,755.00)	$ 2,190,534.00	$ (2,246,514.38)	$ 2,301,936.89
	% Day Average		*% Cost Average*		*% Average at net present value*	
Average	-10%		1%		1%	
Standared Deviation	25%		19%		21%	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-35%	15%	-18%	20%	-20%	22%
95%	-60%	40%	-37%	39%	-41%	43%
99.70%	-85%	65%	-56%	58%	-62%	64%

TABLE (Dist. 62) Normal Distribution and Standard Deviation for District 62
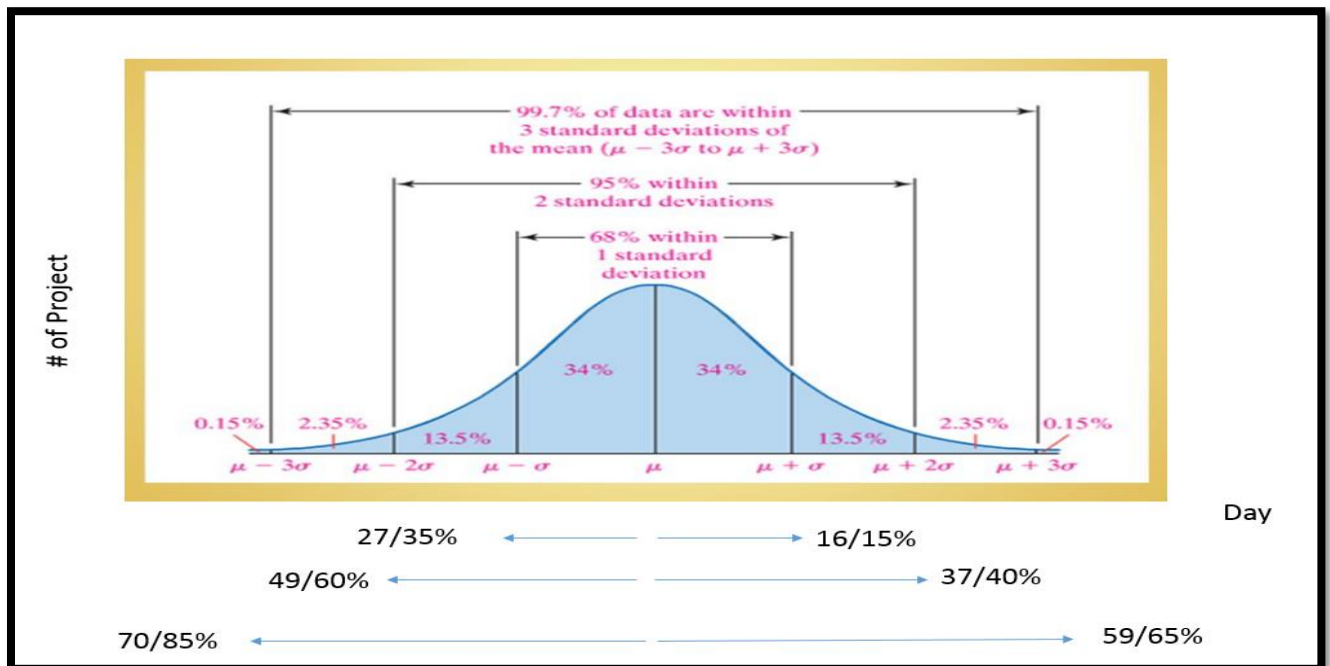
Chart (Dist.62a) Average day/ % Average day for District 62
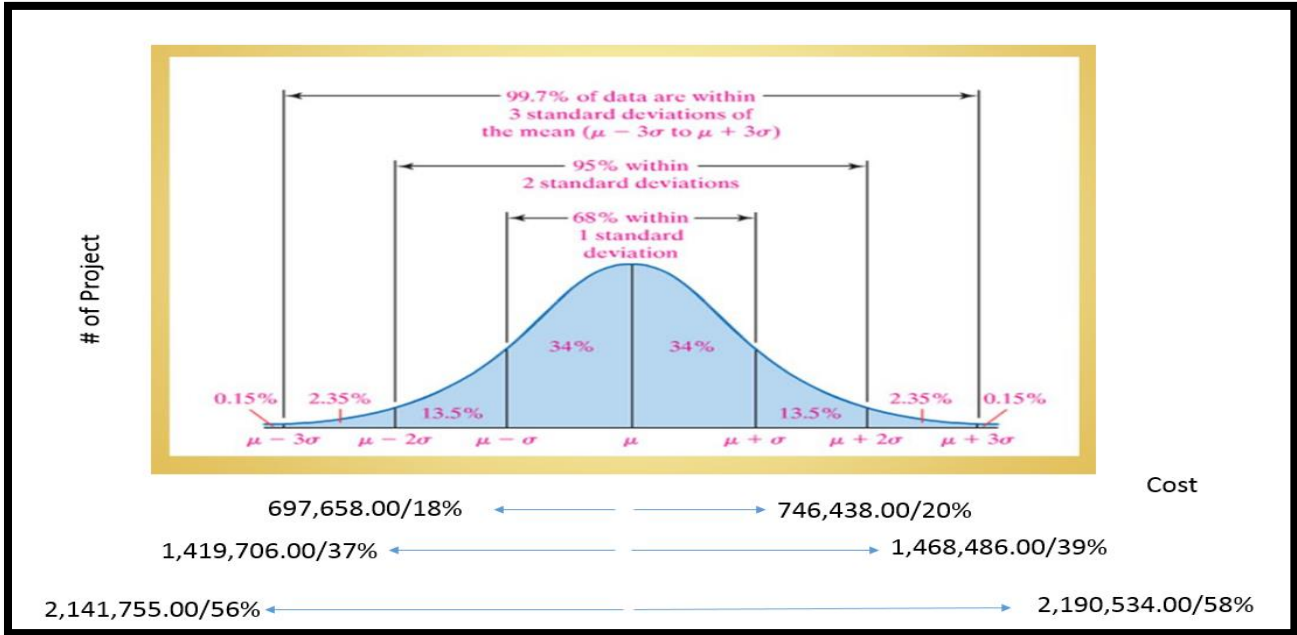
Chart (Dist. 62b) Average Cost/% Average Cost (year 2005-2015) for District 62

Appendix E

District 02 Parishes

St. Charles Parish (CH)

	Time		Cost (2005-2015)		Present value 2015	
Average	-5.6		$ 575,849.00		$ 583,324.00	
Standared Deviation	17.6		$ 3,114,156.00		$ 3,113,866.00	
	AVERAGE TIME		*AVERAGE COST 2005-2015*		*AVERAGE COST 2015*	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-23	12	$ (2,538,307.00)	$ 3,690,005.00	$ (2,530,541.78)	$ 3,698,189.98
95%	-41	30	$ (5,652,463.00)	$ 6,804,162.00	$ (5,644,407.67)	$ 6,844,055.87
99.70%	-58	47	$ (8,766,619.00)	$ 9,918,318.00	$ (8,758,273.55)	$ 9,924,921.75
	% Day Average		*% Cost Average*		*% Average at net present value*	
Average	-10%		7%		8%	
Standared Deviation	29%		21%		24%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-39%	19%	-14%	28%	-16%	32%
95%	-68%	48%	-35%	49%	-40%	56%
99.70%	-97%	77%	-56%	70%	-64%	80%

TABLE (CH) Normal Distribution and Standard Deviation for St. Charles Parish
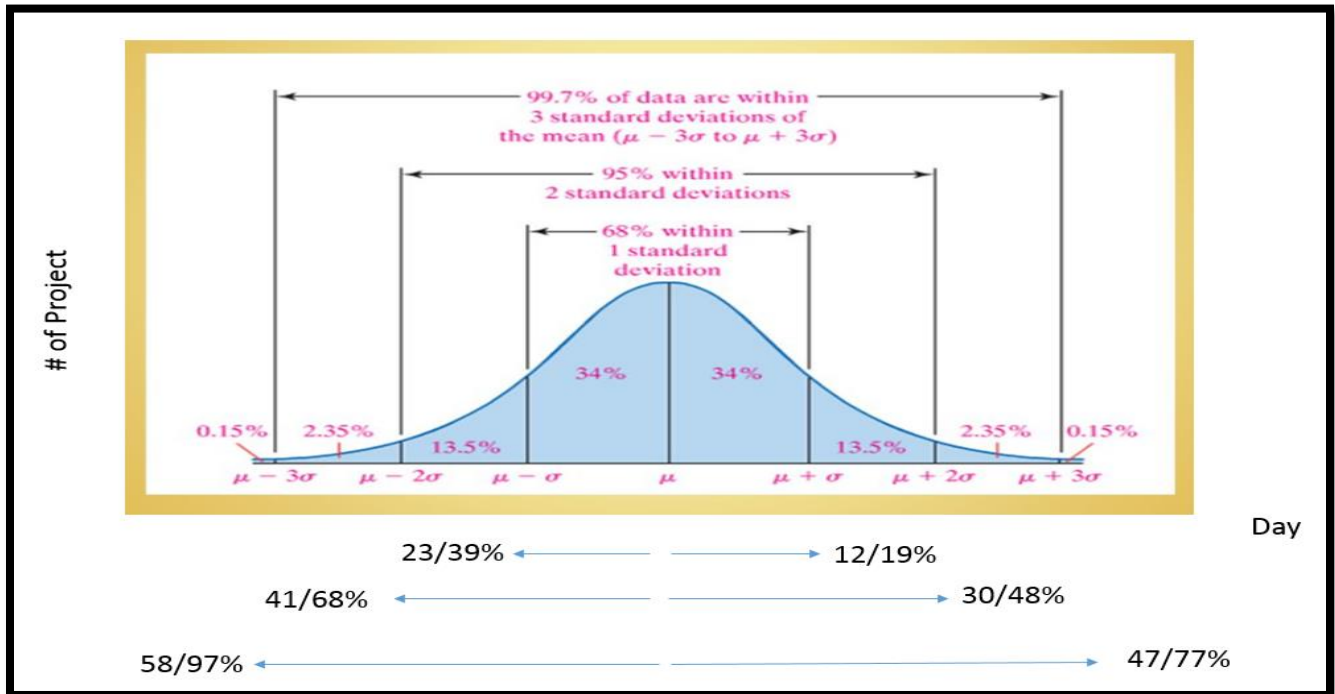
Chart (CH1) Average day/% Average day for St. Charles ParisChart (CH2) Average cost/% A
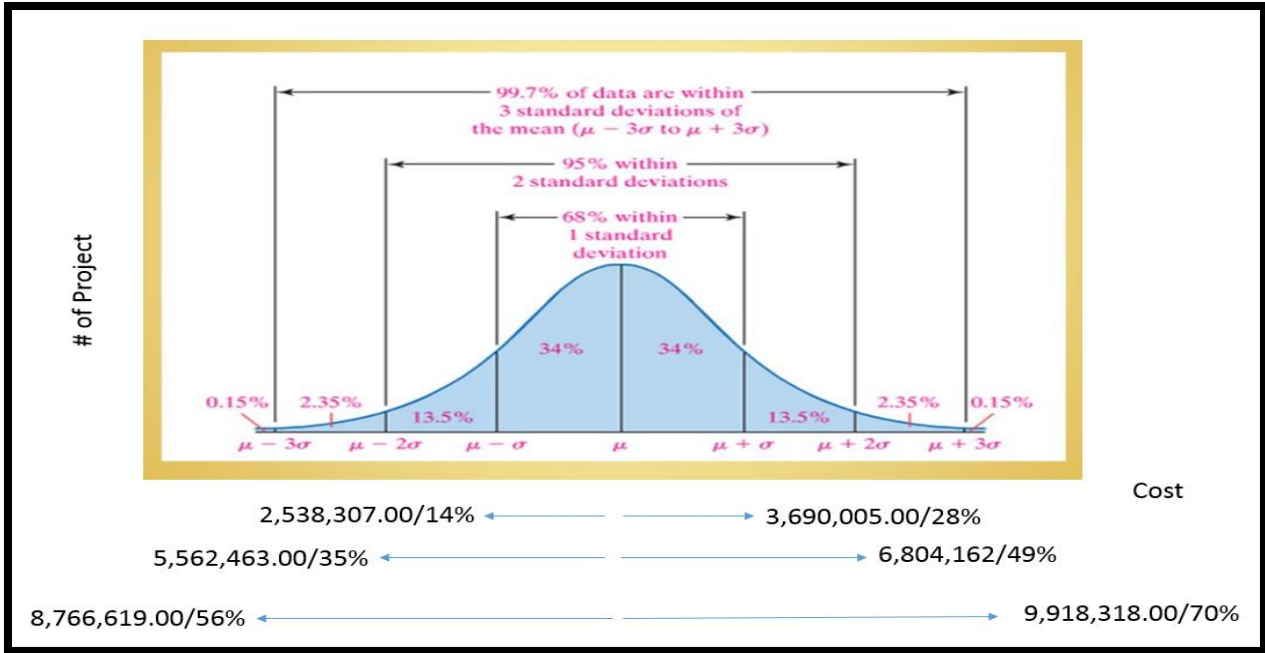
average cost (2005-2015) for St. Charles Parish

Jefferson Parish (JE)

	Time		Cost (2005-2015)		Present value 2015	
Average	-7.4		$ 252,995.00		$ 273,285.00	
Standared Deviation	29		$ 1,227,935.00		$ 1,305,015.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-36	22	$ (974,940.00)	$ 1,480,929.00	$ (1,031,729.95)	$ 1,578,300.84
95%	-66	51	$ (2,202,875.00)	$ 2,708,864.00	$ (2,336,745.35)	$ 2,883,316.24
99.70%	-95	80	$ (3,430,809.00)	$ 3,936,798.00	$ (3,641,760.74)	$ 4,188,331.63
	% Day Average		% Cost Average		% Average at net present value	
Average	-7%		4%		4%	
Standared Deviation	23%		12%		14%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-30%	16%	-8%	16%	-10%	18%
95%	-53%	39%	-20%	28%	-24%	32%
99.70%	-76%	62%	-32%	40%	-38%	46%

TABLE (JE) Normal Distribution and Standard Deviation for Jefferson Parish
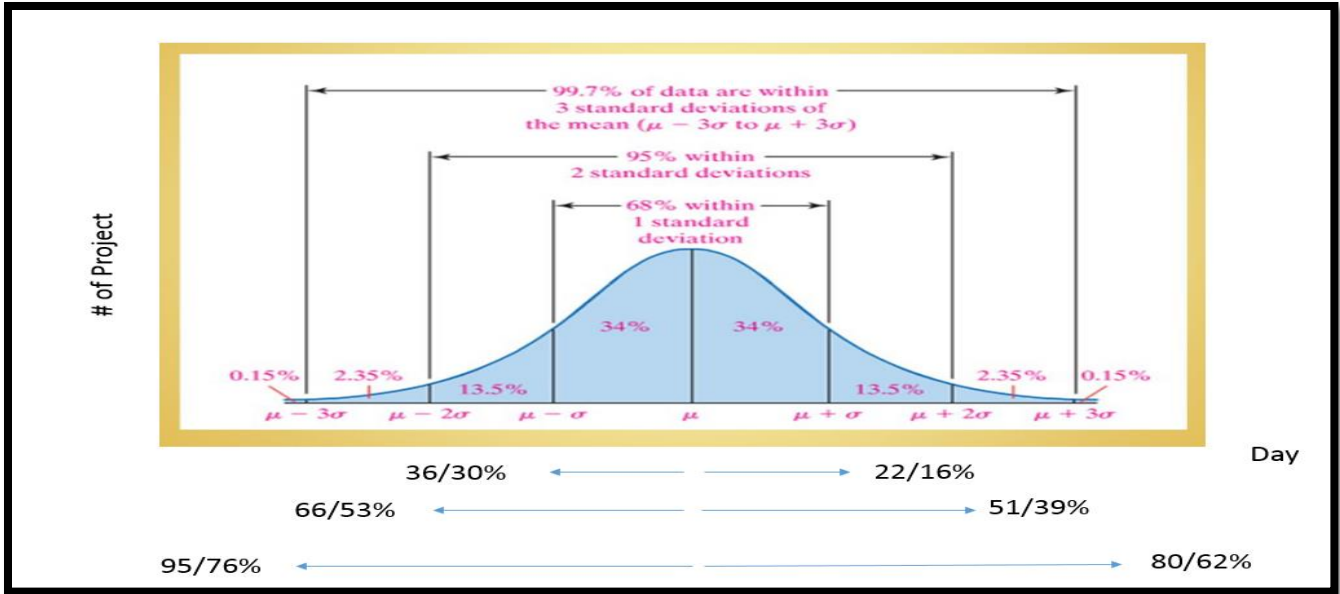
Chart (JE1) Average day/% Average day for Jefferson Parish
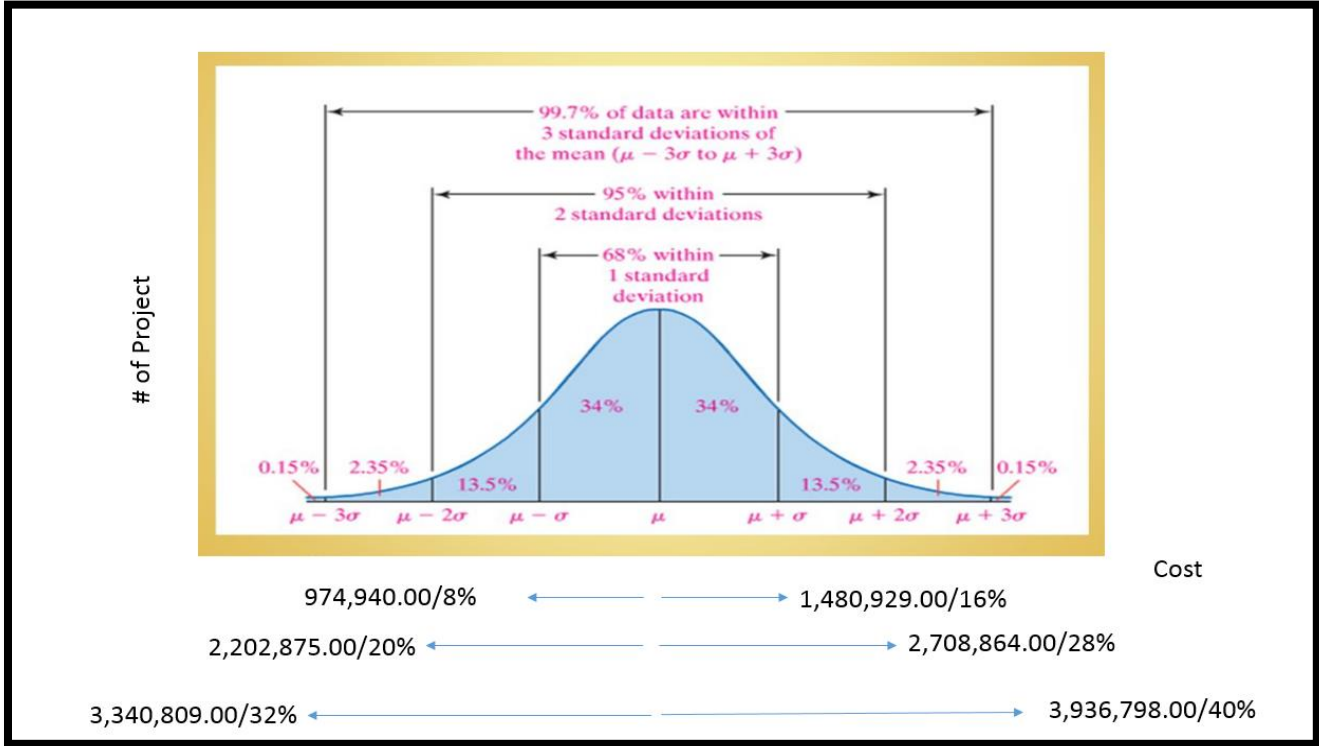
Chart (JE2) Average cost /% Average cost (2005-2015) for Jefferson Parish

Orleans Parish

	Time	Cost (2005-2015)		Present value 2015	
Average	-12.5	$ 94,244.00		$ 117,165.00	
Standared Deviation	66.3	$ 1,035,914.00		$ 1,231,555.00	
	AVERAGE TIME		AVERAGE COST 2005-2015	AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-79	54	$ (941,670.00)	$ 1,130,158.00	$ (1,114,390.16)	$ 1,348,719.22
95%	-145	120	$ (1,977,583.00)	$ 2,166,072.00	$ (2,345,944.85)	$ 2,580,273.91
99.70%	-211	186	$ (3,013,497.00)	$ 3,201,985.00	$ (3,577,499.54)	$ 3,811,828.60
	% Day Average		% Cost Average		% Average at net present value	
Average	-7%		6%		7%	
Standared Deviation	22%		21%		25%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-29%	15%	-15%	27%	-18%	32%
95%	-51%	37%	-36%	48%	-43%	57%
99.70%	-73%	59%	-57%	69%	-68%	82%

TABLE (OR) Normal Distribution and Standard Deviation for Orleans Parish
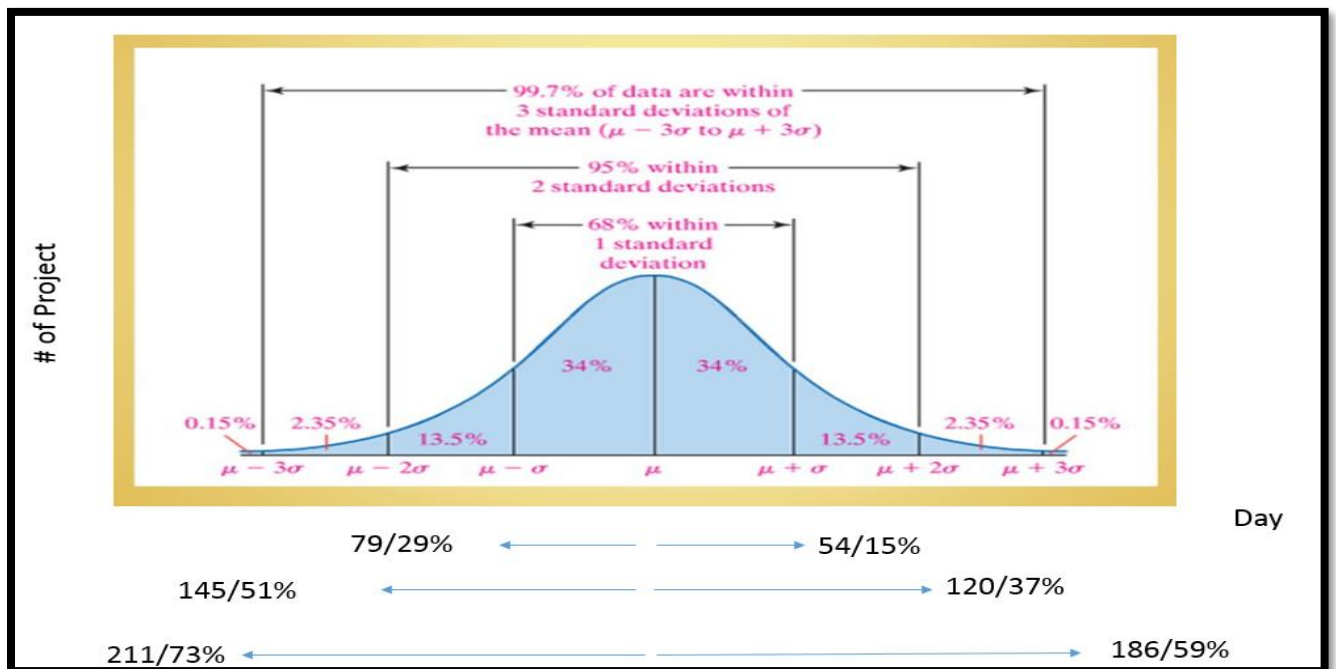
Chart (OR1) Average day/% Average day for Orleans Parish

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941,670.00/15% ←——————→ 1,130,158.00/27%

1,977,583.00/36% ←——————→ 2,166,072.00/48%

3,013,497.00/57% ←——————→ 3,201,985.00/69%
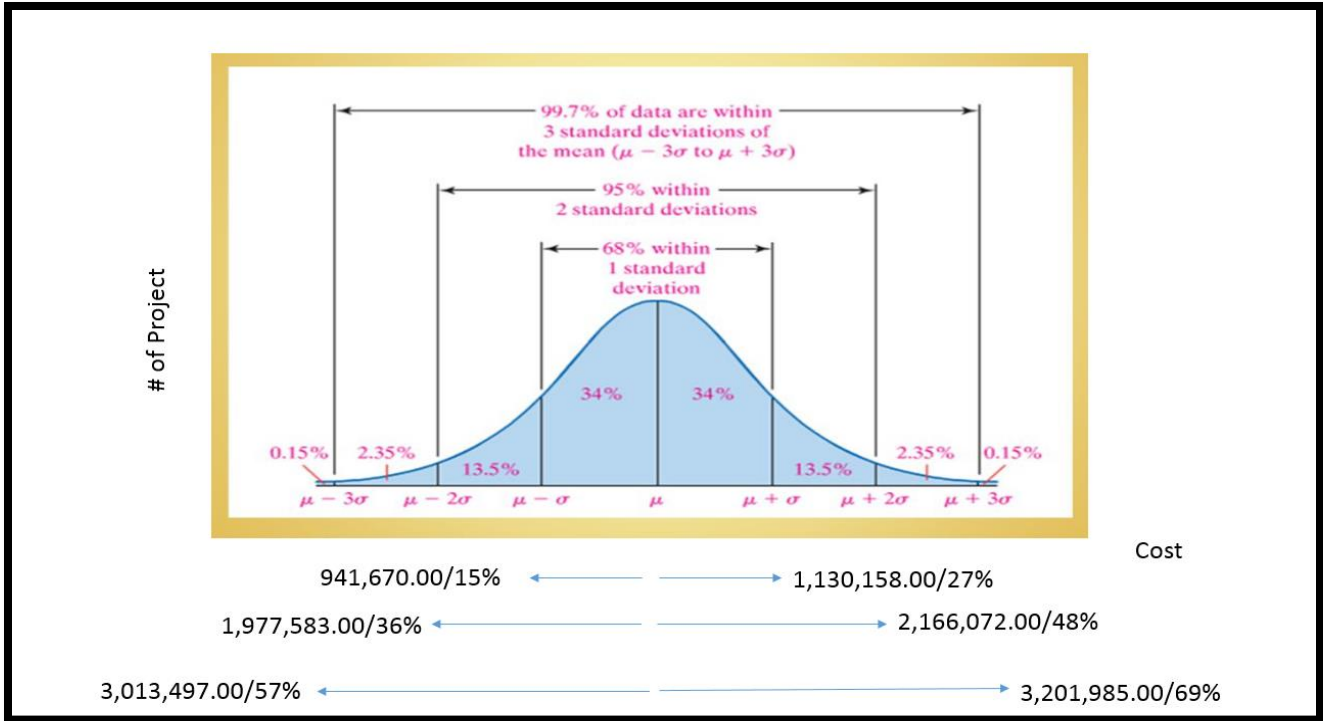
Chart (OR2) Average cost /% Average cost (2005-2015) for Orleans Parish

St. Bernard Parish (BD)

	Time		*Cost (2005-2015)*		*Present value 2015*	
Average	-6.8		$ 14,027.00		$ 18,342.00	
Standared Deviation	15.7		$ 303,890.00		$ 349,801.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-23	9	$ (289,863.00)	$ 317,917.00	$ (331,458.49)	$ 368,143.07
95%	-38	25	$ (593,753.00)	$ 621,807.00	$ (681,259.27)	$ 717,943.85
99.70%	-54	40	$ (897,643.00)	$ 925,697.00	$ (1,031,060.05)	$ 1,067,744.63
	% Day Average		*% Cost Average*		*% Average at net present value*	
Average	-4%		-4%		-5%	
Standared Deviation	32%		16%		19%	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-36%	28%	-20%	12%	-24%	14%
95%	-68%	60%	-36%	28%	-43%	33%
99.70%	-100%	92%	-52%	44%	-62%	52%

TABLE (BD) Normal Distribution and Standard Deviation for St. Bernard Parish
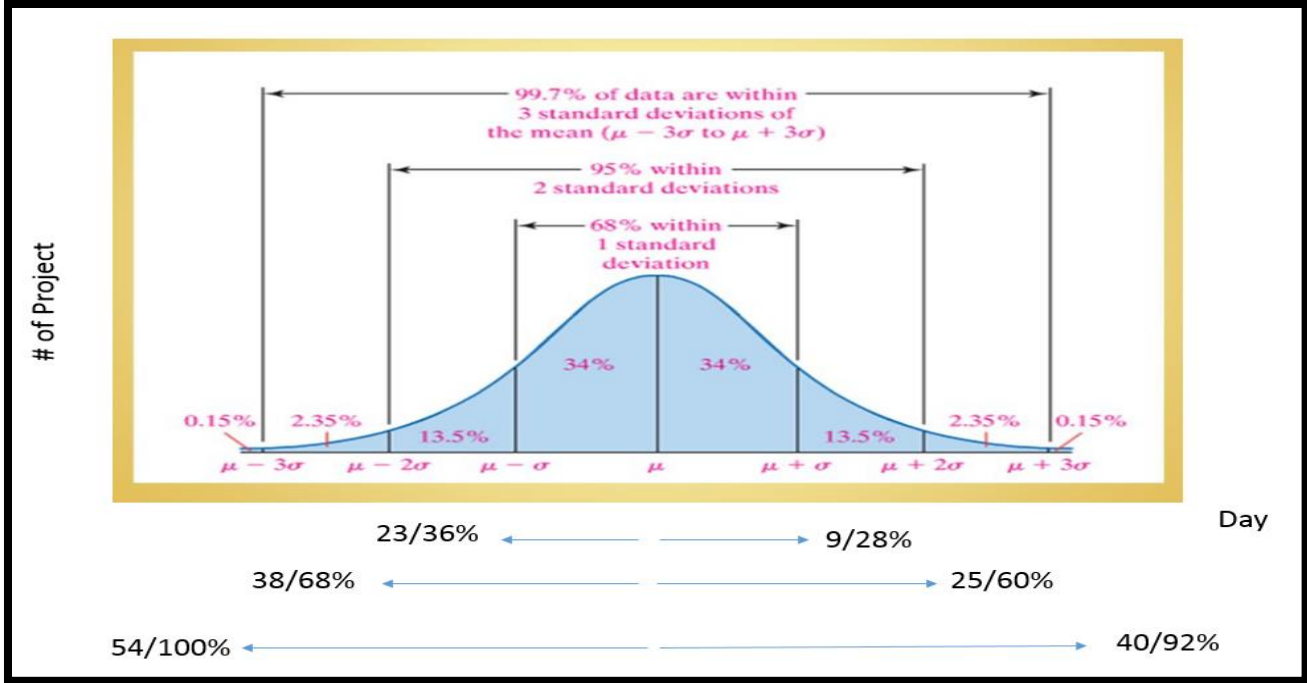
Chart (BD1) Average day/ % Average day for St. Bernard Parish
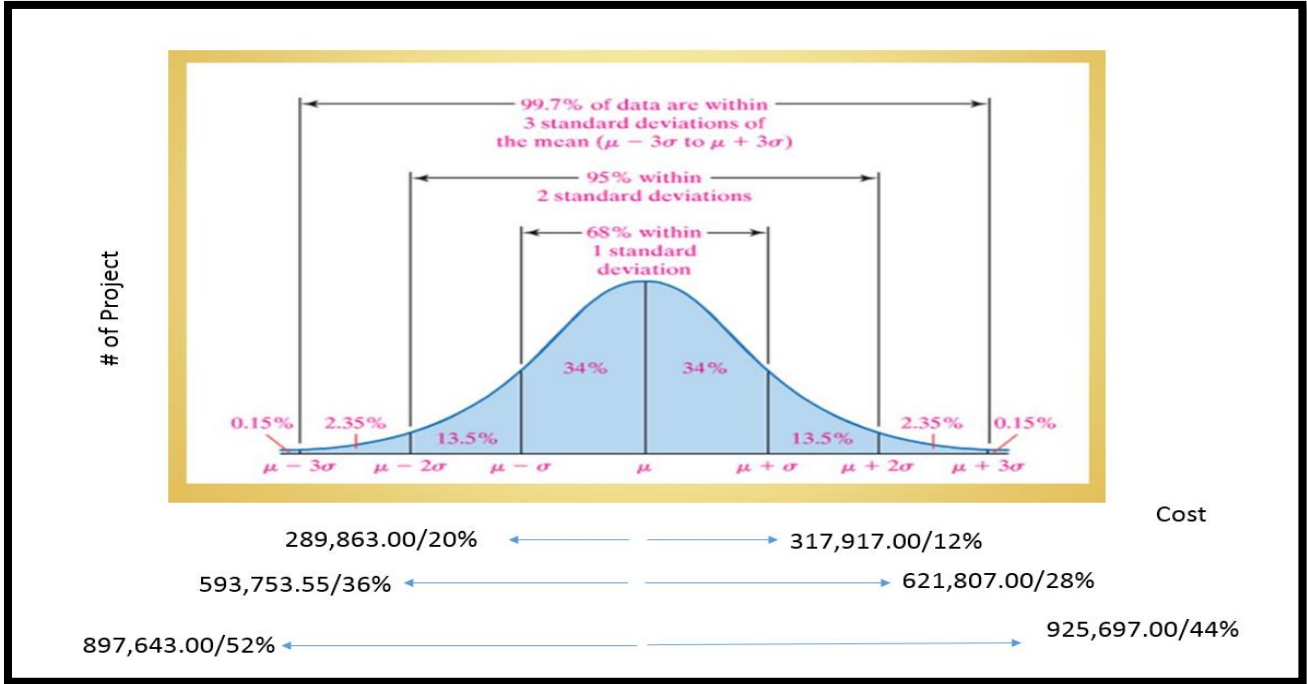
Chart (BD2) Average cost /% Average cost (2005-2015) for St. Bernard Parish

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Plaquemines Parish (PQ)

	Time		Cost (2005-2015)			Present value 2015		
Average	-10.6		$	194,523.00		$	210,722.00	
Standared Deviation	20.9		$	516,947.00		$	547,048.00	
	AVERAGE TIME		AVERAGE COST 2005-2015			AVERAGE COST 2015		
	Ahead of Time	Behind Time	Underrun		Overrun	Underrun		Overrun
68%	-31	10	$ (322,424.00)	$	711,470.00	$ (336,326.55)	$	757,770.02
95%	-52	31	$ (839,371.00)	$	1,228,418.00	$ (883,374.84)	$	1,304,818.31
99.70%	-73	52	$ (1,356,319.00)	$	1,745,365.00	$ (1,430,423.13)	$	1,851,866.60
	% Day Average		% Cost Average			% Average at net present value		
Average	3%		5%			5%		
Standared Deviation	19%		16%			17%		
	Ahead of Time	Behind Time	Underrun		Overrun	Underrun		Overrun
68%	-16%	22%	-11%		21%	-12%		22%
95%	-35%	41%	-27%		37%	-29%		39%
99.70%	-54%	60%	-43%		53%	-46%		56%

TABLE (PQ1) Normal Distribution and Standard Deviation for Plaquemines Parish
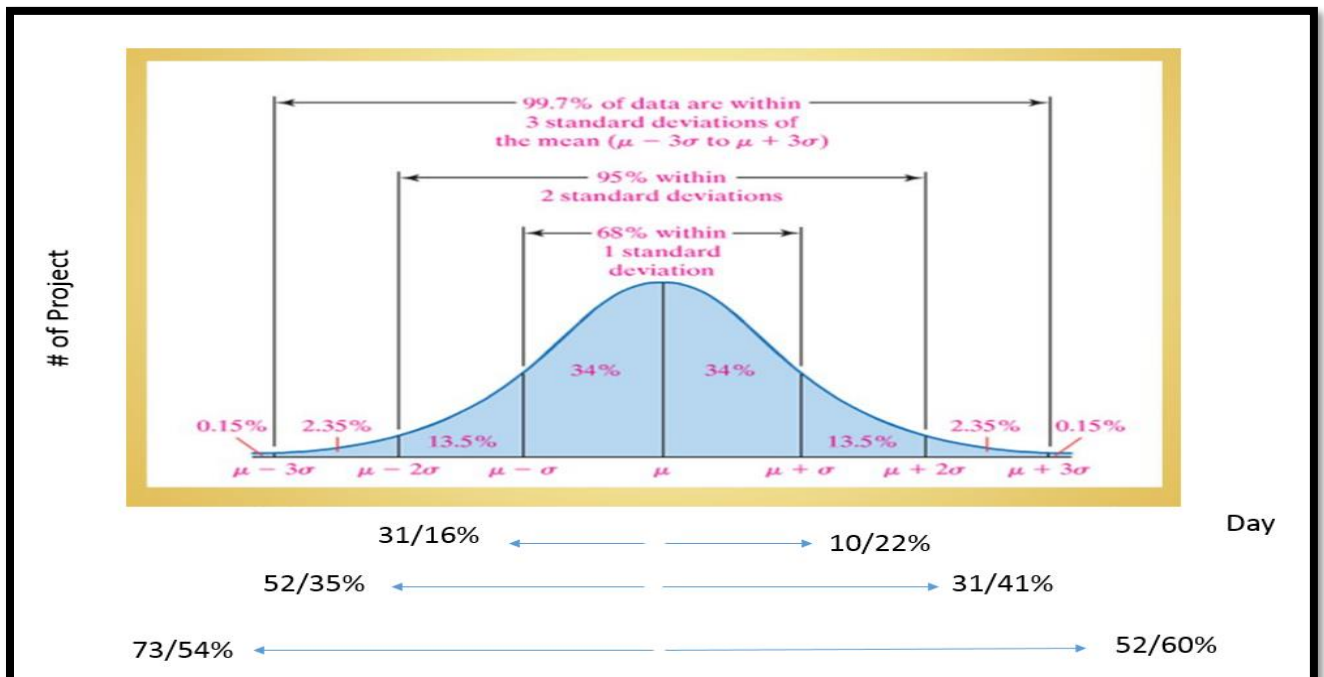
Chart (PQ1) Average day/ % Average day for Plaquemines Parish

99.7% of data are within
3 standard deviations of
the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)

95% within
2 standard deviations

68% within
1 standard
deviation

34%   34%

0.15%   2.35%
13.5%   13.5%   2.35%   0.15%

$\mu - 3\sigma$ $\mu - 2\sigma$ $\mu - \sigma$ μ $\mu + \sigma$ $\mu + 2\sigma$ $\mu + 3\sigma$

# of Project

Cost

322,424.00/11% ←———→ 711,470.00/21%

839,371.00/27% ←———————→ 1,228,418.00/37%

1,356,319.00/43% ←———————→ 1,745,365.00/53%
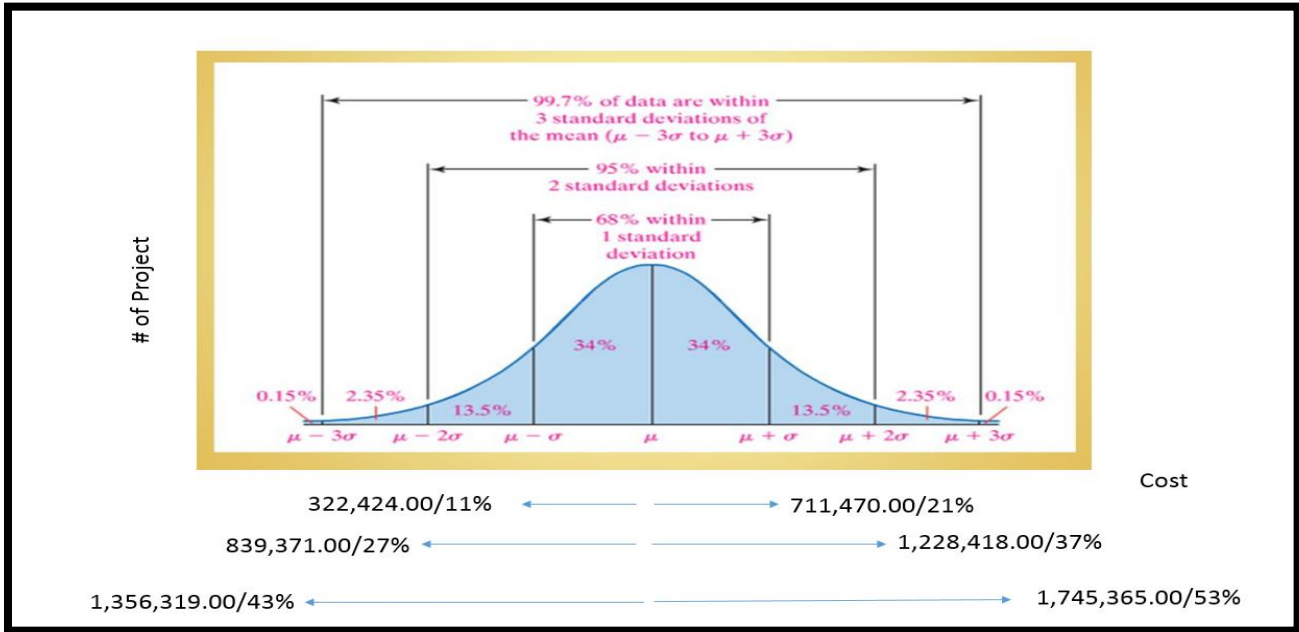
Chart (PQ2) Average cost /% Average cost (2005-2015) for Plaquemines Parish

Lafourche Parish (LA)

	Time		Cost (2005-2015)		Present value 2015	
Average	-15.7		$ 80,438.00		$ 891,190.00	
Standared Deviation	22.3		$ 441,413.00		$ 512,277.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-38	7	$ (360,976.00)	$ 521,851.00	$ (423,087.63)	$ 601,466.90
95%	-60	29	$ (802,389.00)	$ 963,265.00	$ (935,364.90)	$ 1,113,744.16
99.70%	-82	51	$ (1,243,803.00)	$ 1,404,678.00	$ (1,447,642.17)	$ 1,626,021.43
	% Day Average		% Cost Average		% Average at net present value	
Average	-21%		-1%		-2%	
Standared Deviation	26%		14%		17%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-47%	5%	-15%	13%	-19%	15%
95%	-73%	31%	-29%	27%	-36%	32%
99.70%	-99%	57%	-43%	41%	-53%	49%

TABLE (LA) Normal Distribution and Standard Deviation for Lafourche Parish

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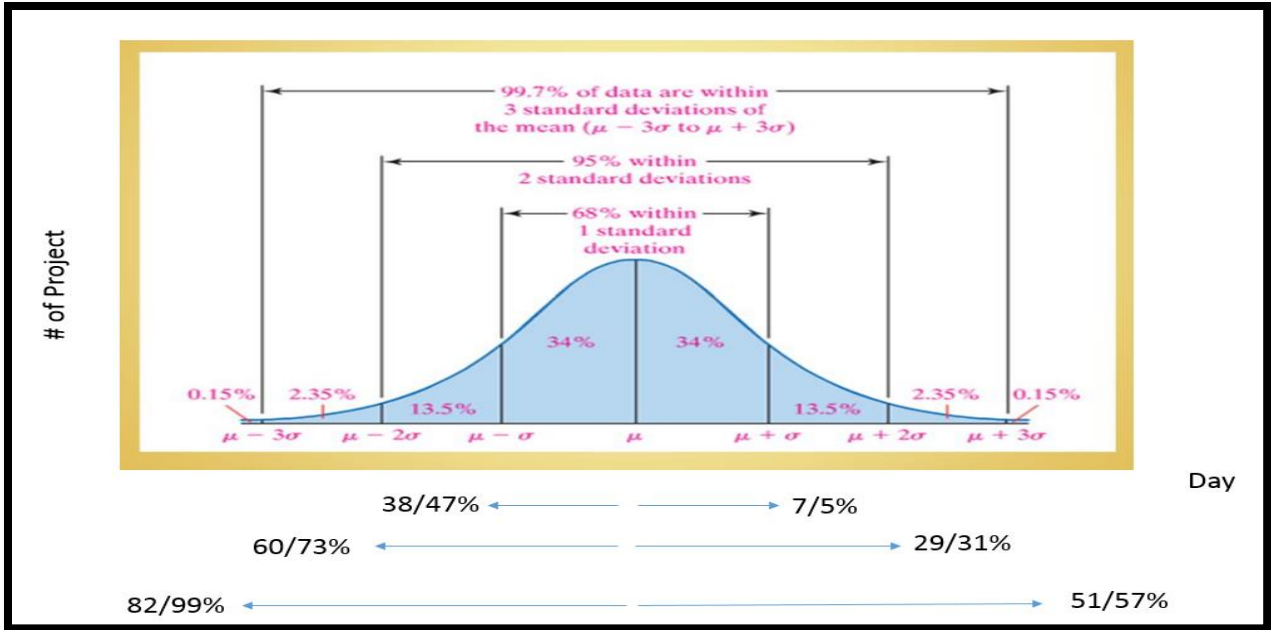
Chart (LA1) Average day/ % Average day for Lafourche Parish
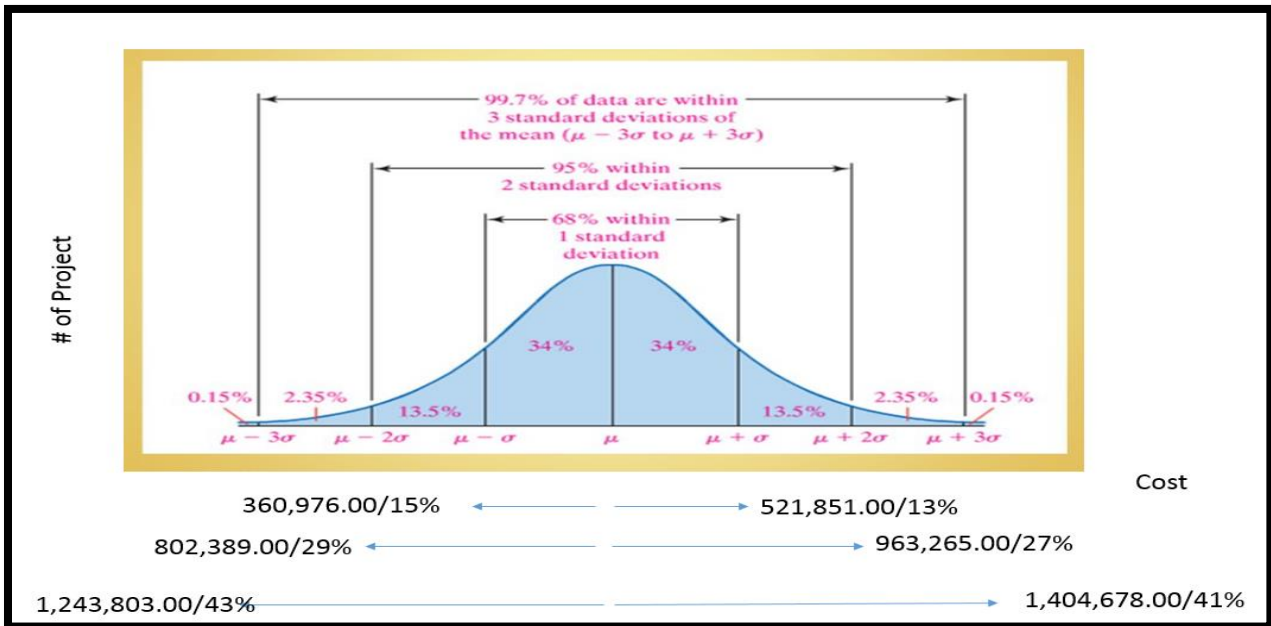
Chart (LA2) Average cost /% Average cost (2005-2015) for Lafourche Parish

Appendix F

District 03 Parishes

Vermilion Parish (VN)

	Time		Cost (2005-2015)		Present value 2015	
Average	-3.4		$ 65,495.00		$ 79,354.00	
Standared Deviation	20.4		$ 488,140.00		$ 576,904.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-24	17	$ (422,645.00)	$ 553,635.00	$ (497,549.81)	$ 656,257.37
95%	-44	37	$ (910,786.00)	$ 1,041,776.00	$ (1,074,453.40)	$ 1,233,160.96
99.70%	-65	58	$ (1,398,926.00)	$ 1,529,916.00	$ (1,651,356.99)	$ 1,810,064.55
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-6%		2%		2%	
Standared Deviation	24%		16%		19%	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-30%	18%	-14%	18%	-17%	21%
95%	-54%	42%	-30%	34%	-36%	40%
99.70%	-78%	66%	-46%	50%	-55%	59%

TABLE (VN) Normal Distribution and Standard Deviation for Vermilion Parish
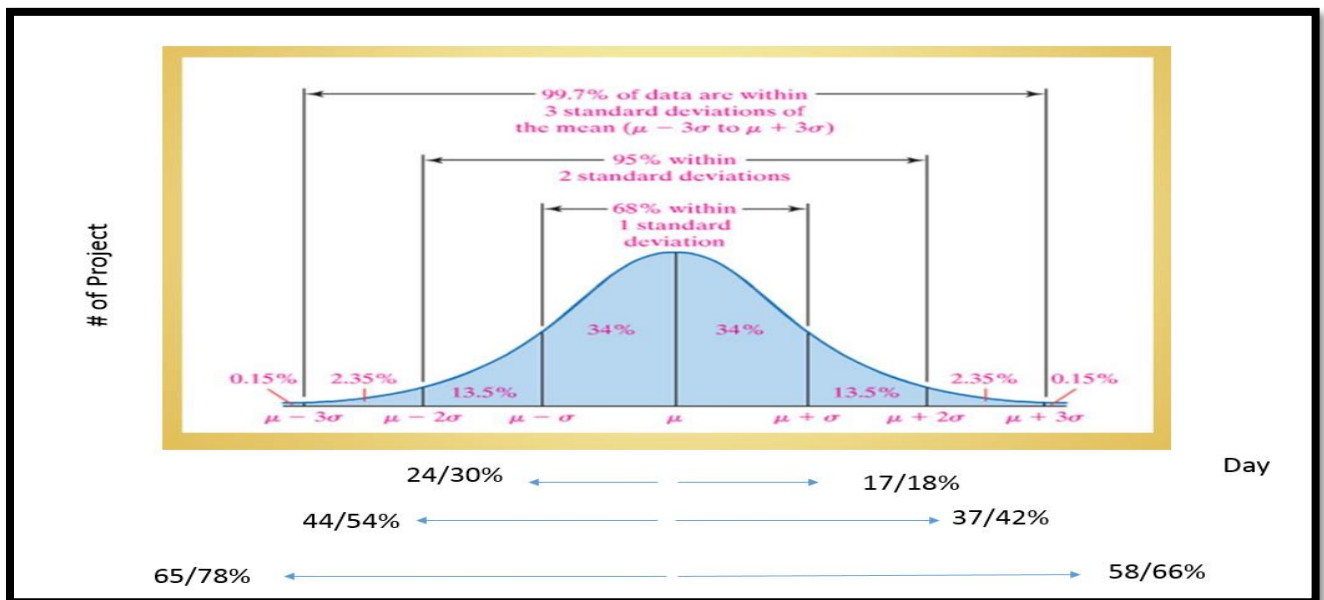
Chart (VN1) Average day/ % Average day for Vermilion Parish

99.7% of data are within
3 standard deviations of
the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)

95% within
2 standard deviations

68% within
1 standard
deviation

# of Project

34%   34%

0.15%   2.35%   13.5%   13.5%   2.35%   0.15%

$\mu - 3\sigma$ $\mu - 2\sigma$ $\mu - \sigma$ μ $\mu + \sigma$ $\mu + 2\sigma$ $\mu + 3\sigma$

Cost

422,645.00/14% ← → 553,635.00/18%

910,786.00/30% ← → 1,041,776.00/34%

1,398,926.00/46% ← → 1,529,916.00/50%
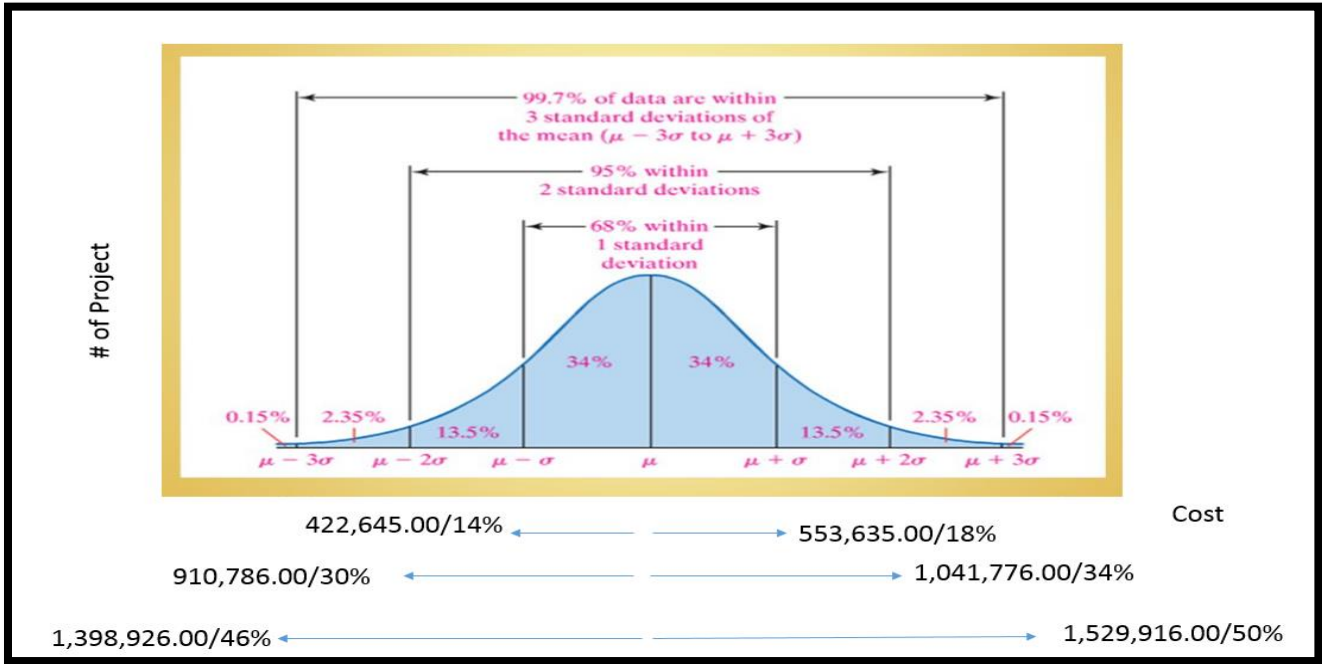
Chart (VN2) Average cost /% Average cost (2005-2015) for Vermilion Parish

Acadia Parish (AC)

Using the Empirical Rule (68%-95%-99.7%) we have **TABLE (AC)**

	Time		Cost (2005-2015)		Present value 2015	
Average	-6.1		$ (119,227.00)		$ 45,108.00	
Standared Deviation	19.6		$ 925,734.00		$ 128,929.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-26	14	$ (1,044,960.00)	$ 806,507.00	$ (83,821.23)	$ 174,037.23
95%	-45	33	$ (1,970,694.00)	$ 1,732,240.00	$ (212,750.46)	$ 302,966.46
99.70%	-65	53	$ (2,896,427.00)	$ 2,657,974.00	$ (341,679.69)	$ 431,895.69
	% Day Average		% Cost Average		% Average at net present value	
Average	7%		1%		1%	
Standared Deviation	27%		18%		21%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-20%	34%	-17%	19%	-20%	22%
95%	-47%	61%	-35%	37%	-41%	43%
99.70%	-74%	88%	-53%	55%	-62%	64%

TABLE (AC) Normal Distribution and Standard Deviation for Acadia Parish
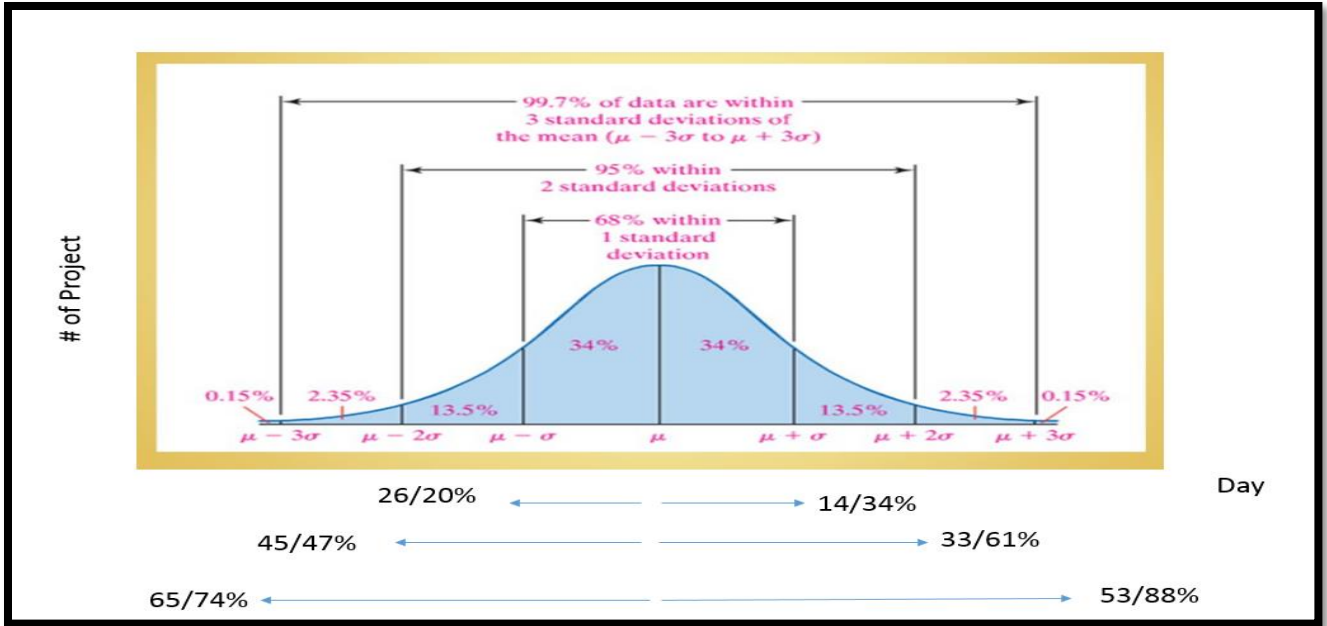
Chart (AC1) Average day/ % Average day for Acadia Parish
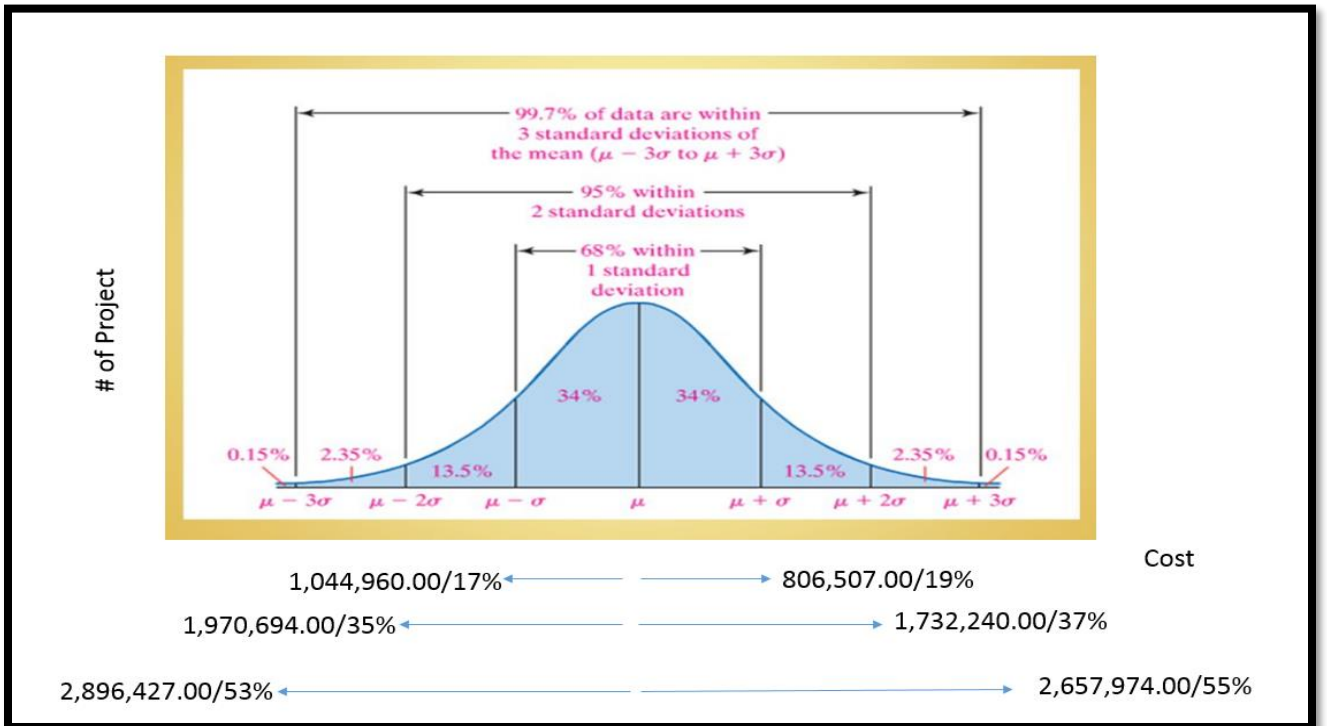
Chart (AC2) Average cost /% Average cost (2005-2015) for Acadia Parish

Evangeline Parish (EV)

	Time		Cost (2005-2015)		Present value 2015	
Average	-7.1		$ (9,507.00)		$ (12,599.00)	
Standared Deviation	8		$ 185,694.00		$ 227,266.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-15	1	$ (195,201.00)	$ 176,187.00	$ (239,865.09)	$ 214,667.59
95%	-23	9	$ (380,894.00)	$ 361,880.00	$ (467,131.44)	$ 441,933.94
99.70%	-31	17	$ (566,588.00)	$ 547,574.00	$ (694,397.78)	$ 669,200.28
	% Day Average		% Cost Average		% Average at net present value	
Average	-6%		-7%		-9%	
Standared Deviation	29%		23%		28%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-35%	23%	-30%	16%	-37%	19%
95%	-64%	52%	-53%	39%	-65%	47%
99.70%	-93%	81%	-76%	62%	-93%	75%

TABLE (EV) Normal Distribution and Standard Deviation for Evangeline Parish
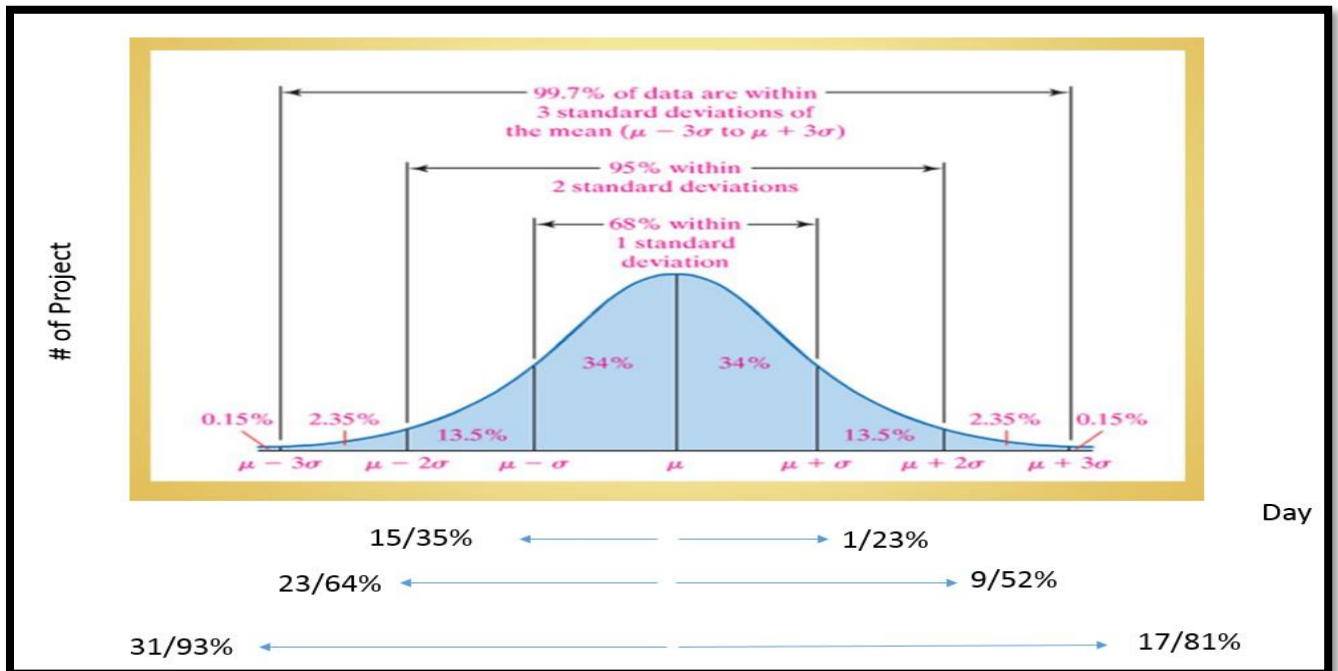
Chart (EV1) Average day/ % Average day for Evangeline Parish
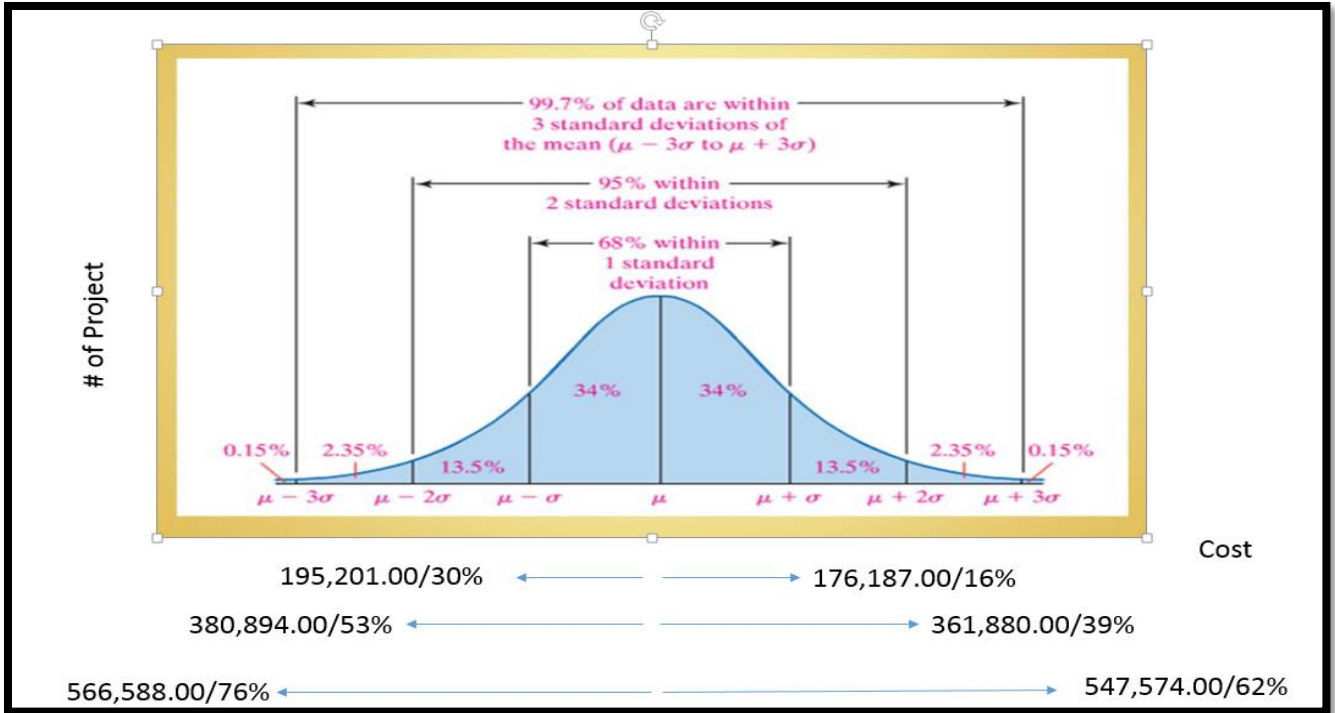
Chart (EV2) Average cost /% Average cost (2005-2015) for Evangeline Parish

St. Landry Parish (LY)

	Time		Cost (2005-2015)		Present value 2015	
Average	-6.5		$ 38,115.00		$ 46,244.00	
Standared Deviation	23.18		$ 338,928.00		$ 380,162.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-30	17	$ (300,813.00)	$ 377,043.00	$ (33,917.82)	$ 426,405.45
95%	-53	40	$ (639,741.00)	$ 715,972.00	$ (714,079.46)	$ 806,567.08
99.70%	-76	63	$ (978,670.00)	$ 1,054,900.00	$ (1,094,241.09)	$ 1,186,728.72
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-12%		1%		2%	
Standared Deviation	17%		10%		10%	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-29%	5%	-9%	11%	-8%	12%
95%	-46%	22%	-19%	21%	-18%	22%
99.70%	-63%	39%	-29%	31%	-28%	32%

TABLE (LY) Normal Distribution and Standard Deviation for St. Landry Parish
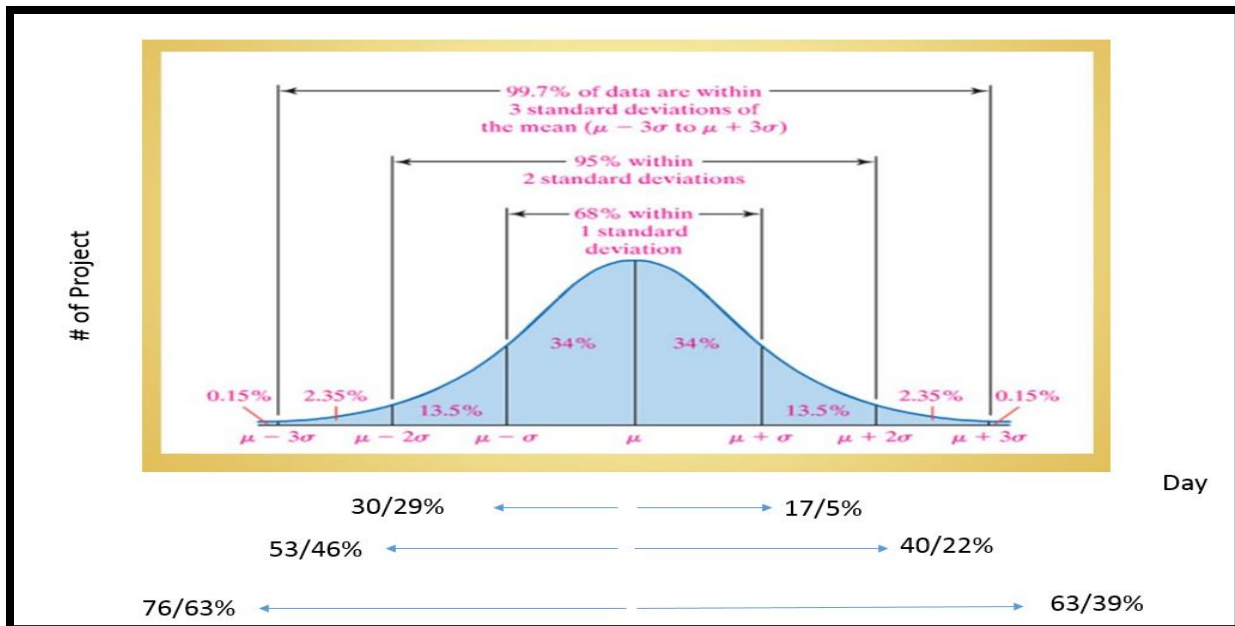
Chart (LY1) Average day/ % Average day for St. Landry Parish
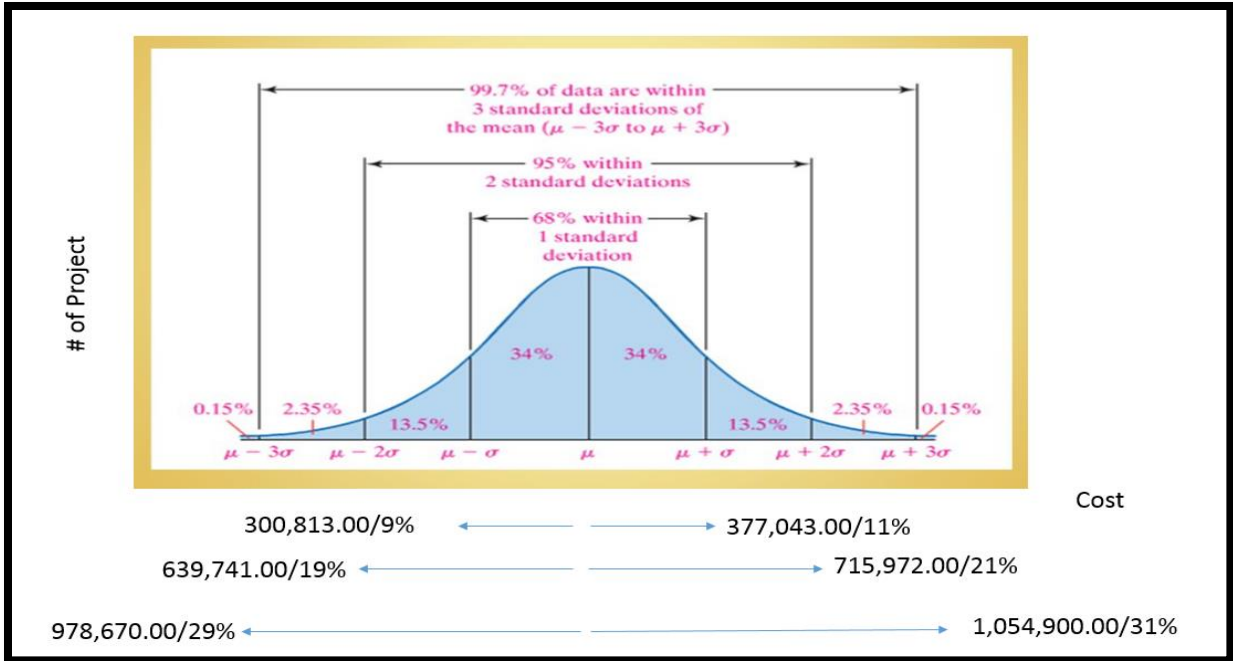
Chart (LY2) Average cost /% Average cost (2005-2015) for St. Landry Parish

St. Mary Parish (MR)

	Time		Cost (2005-2015)		Present value 2015	
Average	-16.4		$ (13,776.00)		$ (13,743.00)	
Standard Deviation	31.7		$ 162,907.00		$ 167,651.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-48	15	$ (176,683.00)	$ 149,131.00	$ (181,393.96)	$ 153,907.67
95%	-80	47	$ (339,590.00)	$ 312,039.00	$ (349,044.77)	$ 321,558.48
99.70%	-111	79	$ (502,498.00)	$ 474,946.00	$ 516,695.59	$ 489,209.29
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-11%		3%		3%	
Standard Deviation	17%		24%		25%	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-28%	6%	-21%	27%	-22%	28%
95%	-45%	23%	-45%	51%	-47%	53%
99.70%	-62%	40%	-69%	75%	-72%	78%

TABLE (MR) Normal Distribution and Standard Deviation for St. Mary Parish
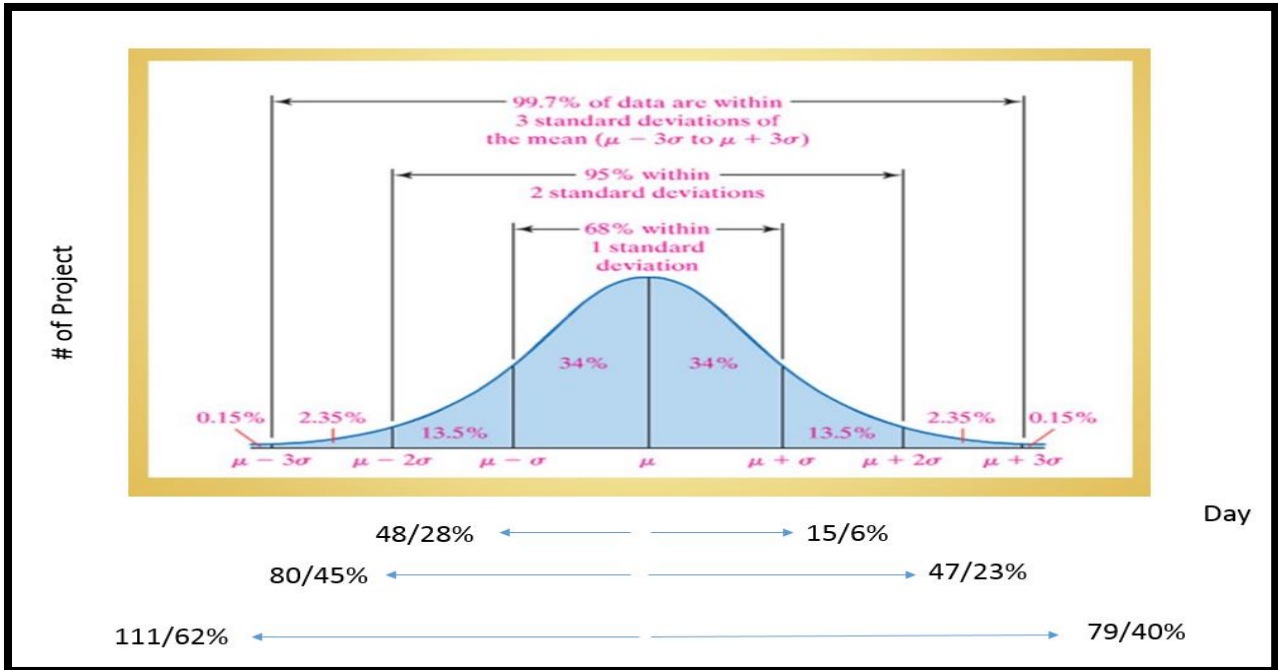
Chart (MR1) Average day/ % Average day for St. Mary Parish
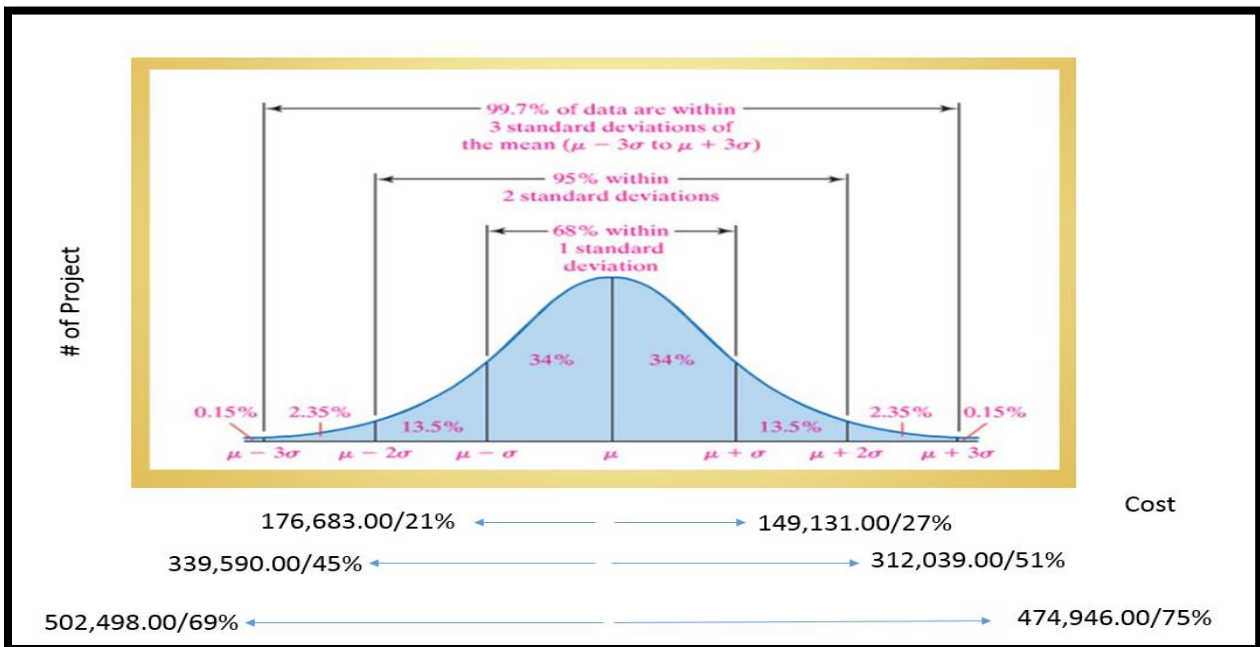
Chart (MR2) Average cost /% Average cost (2005-2015) for St. Mary Parish

Iberia Parish (IB)

	Time		Cost (2005-2015)		Present value 2015	
Average	7.3		$ 41,555.00		$ 44,430.00	
Standared Deviation	29.3		$ 300,118.00		$ 327,718.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-22	37	$ (258,563.00)	$ 341,674.00	$ (283,288.47)	$ 372,147.82
95%	-51	66	$ (558,681.00)	$ 641,792.00	$ (611,006.61)	$ 699,865.96
99.70%	-81	95	$ (858,800.00)	$ 941,910.00	$ (938,724.76)	$ 1,027,584.11
	% Day Average		% Cost Average		% Average at net present value	
Average	0%		5%		5%	
Standared Deviation	15%		20%		23%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-15%	15%	-15%	25%	-18%	28%
95%	-30%	30%	-35%	45%	-41%	51%
99.70%	-45%	45%	-55%	65%	-64%	74%

TABLE (IB) Normal Distribution and Standard Deviation for Iberia Parish
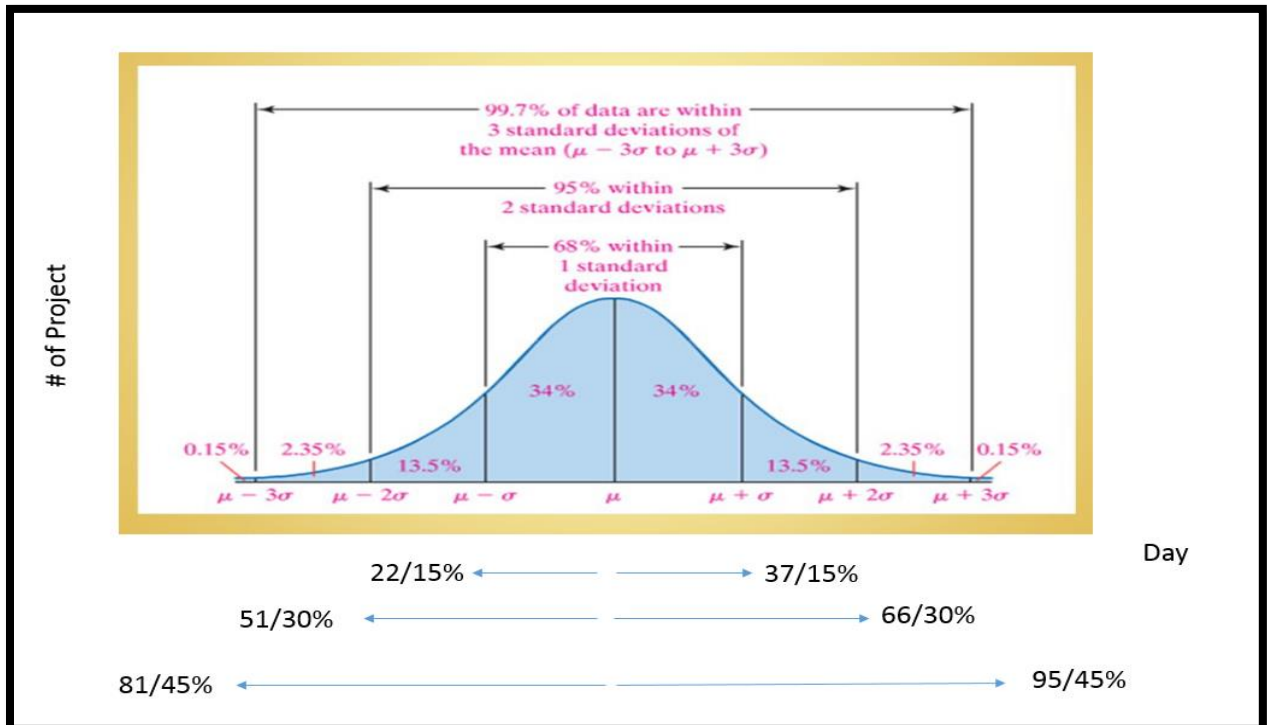
Chart (IB1) Average day/ % Average day for Iberia Parish

99.7% of data are within
3 standard deviations of
the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)

95% within
2 standard deviations

68% within
1 standard
deviation

34%   34%

0.15%   2.35%   13.5%   13.5%   2.35%   0.15%

$\mu - 3\sigma$ $\mu - 2\sigma$ $\mu - \sigma$ μ $\mu + \sigma$ $\mu + 2\sigma$ $\mu + 3\sigma$

# of Project

Cost

258,563.00/15% ←——————→ 341,674.00/25%

558,681.00/35% ←——————→ 641,792.00/45%

858,800.00/55% ←——————→ 941,910.00/65%

Chart (IB2) Average cost /% Average cost (2005-2015) for Iberia Parish

Lafayette Parish (LF)

	Time		Cost (2005-2015)		Present value 2015	
Average	-15		$ 152,805.00		$ 176,665.00	
Standared Deviation	62.4		$ 438,557.00		$ 503,582.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-77	47	$ (285,752.00)	$ 591,363.00	$ (326,917.04)	$ 680,246.52
95%	-140	110	$ (724,309.00)	$ 1,029,920.00	$ (830,498.82)	$ 1,183,828.03
99.70%	-202	172	$ (1,162,866.00)	$ 1,468,477.00	$ (1,334,080.59)	$ 1,687,410.07
	% Day Average		% Cost Average		% Average at net present value	
Average	-10%		5%		6%	
Standared Deviation	27%		14%		17%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-37%	17%	-9%	19%	-11%	23%
95%	-64%	44%	-23%	33%	-28%	40%
99.70%	-91%	71%	-37%	47%	-45%	57%

**TABLE (LF1) Normal Distribution and Standard Deviation for Lafayette Parish**
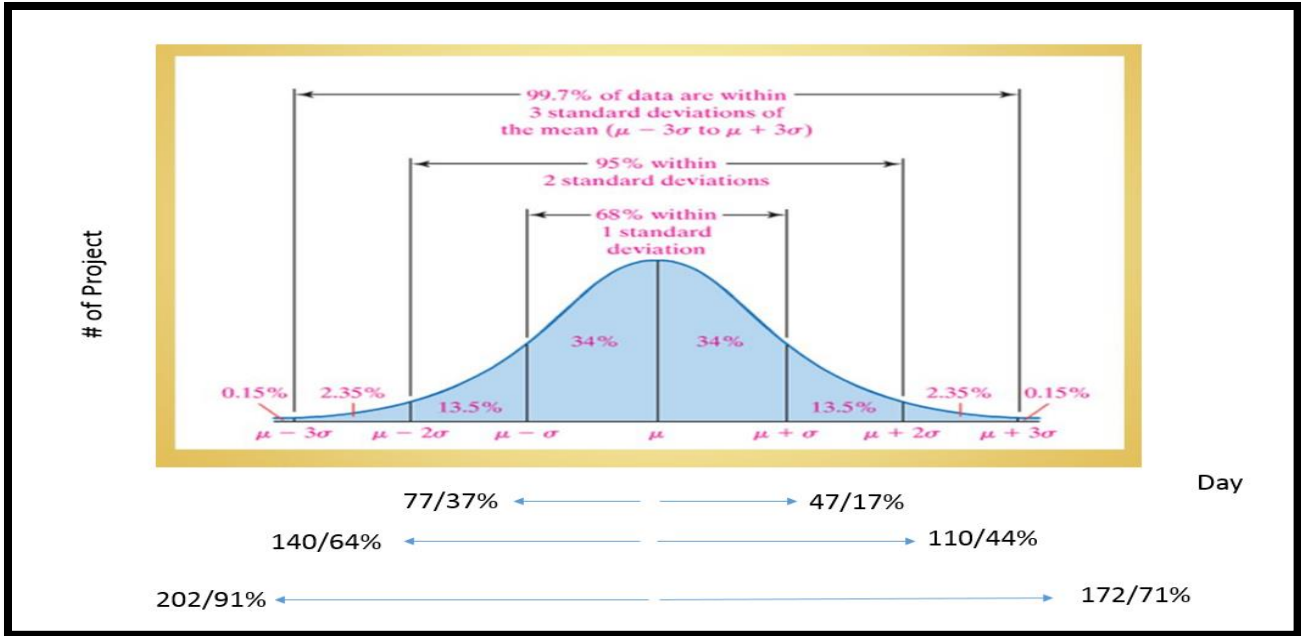
Chart (LF1) Average day/ % Average day for Lafayette Parish

The chart shows a normal distribution with the following annotations:

- 99.7% of data are within 3 standard deviations of the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)
- 95% within 2 standard deviations
- 68% within 1 standard deviation
- 0.15%, 2.35%, 13.5%, 34%, 34%, 13.5%, 2.35%, 0.15%
- $\mu - 3\sigma$, $\mu - 2\sigma$, $\mu - \sigma$, μ, $\mu + \sigma$, $\mu + 2\sigma$, $\mu + 3\sigma$
- Day

77/37% ← → 47/17%
140/64% ← → 110/44%
202/91% ← → 172/71%
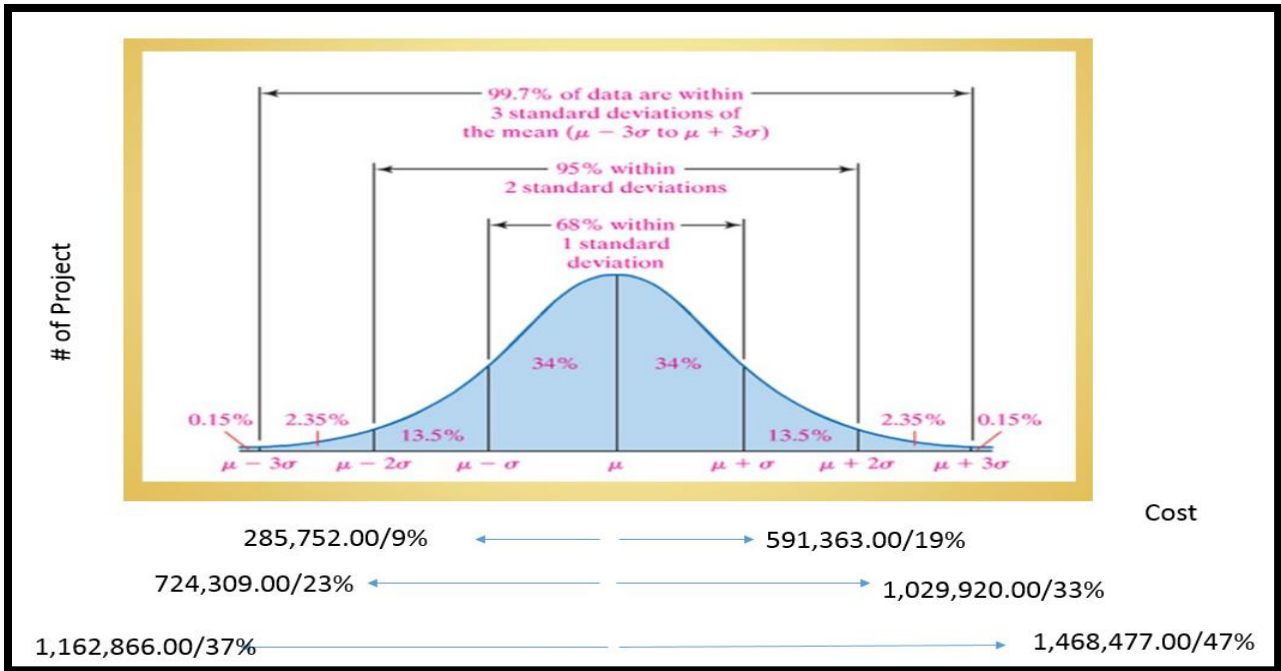
Chart (LF2) Average cost /% Average cost (2005-2015) for Lafayette Parish

The chart shows a normal distribution with the following annotations:

- 99.7% of data are within 3 standard deviations of the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)
- 95% within 2 standard deviations
- 68% within 1 standard deviation
- 0.15%, 2.35%, 13.5%, 34%, 34%, 13.5%, 2.35%, 0.15%
- $\mu - 3\sigma$, $\mu - 2\sigma$, $\mu - \sigma$, μ, $\mu + \sigma$, $\mu + 2\sigma$, $\mu + 3\sigma$
- Cost

285,752.00/9% ← → 591,363.00/19%
724,309.00/23% ← → 1,029,920.00/33%
1,162,866.00/37% ← → 1,468,477.00/47%

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St. Martin Parish (MN)

	Time		Cost (2005-2015)			Present value 2015	
Average	-5.2		$ (845.00)			$ 782.00	
Standered Deviation	15.8		$ 132,513.00			$ 152,131.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**			**AVERAGE COST 2015**	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*		*Underrun*	*Overrun*
68%	-21	11	$ (133,358.00)	$ 131,668.00		$ (151,348.81)	$ 152,912.52
95%	-37	26	$ (265,871.00)	$ 264,180.00		$ (303,479.48)	$ 305,043.18
99.70%	-53	42	$ (398,384.00)	$ 396,693.00		$ (455,610.14)	$ 457,173.84
	% Day Average		**% Cost Average**			**% Average at net present value**	
Average	-13%		0%			0%	
Standered Deviation	25%		10%			12%	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*		*Underrun*	*Overrun*
68%	-38%	12%	-10%	10%		-12%	12%
95%	-63%	37%	-20%	20%		-24%	24%
99.70%	-88%	62%	-30%	30%		-36%	36%

TABLE (MN1) Normal Distribution and Standard Deviation for St. Martin Parish
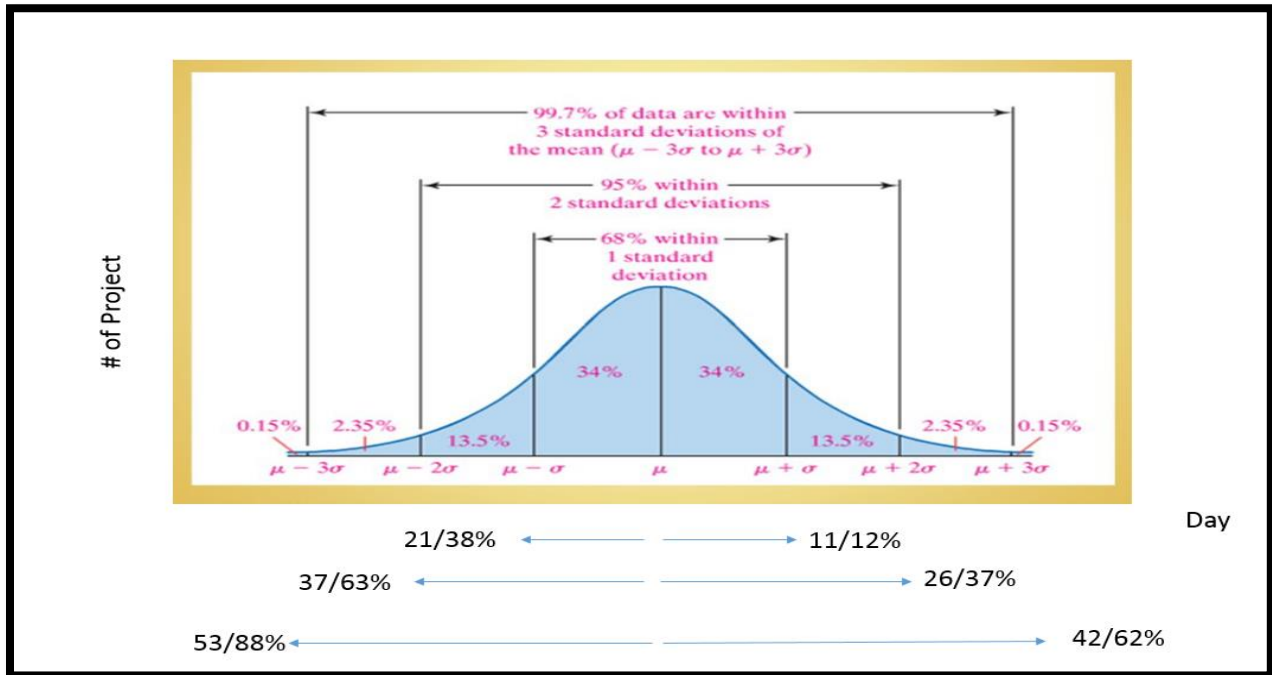
Chart (MN1) Average day/ % Average day for St. Martin Parish
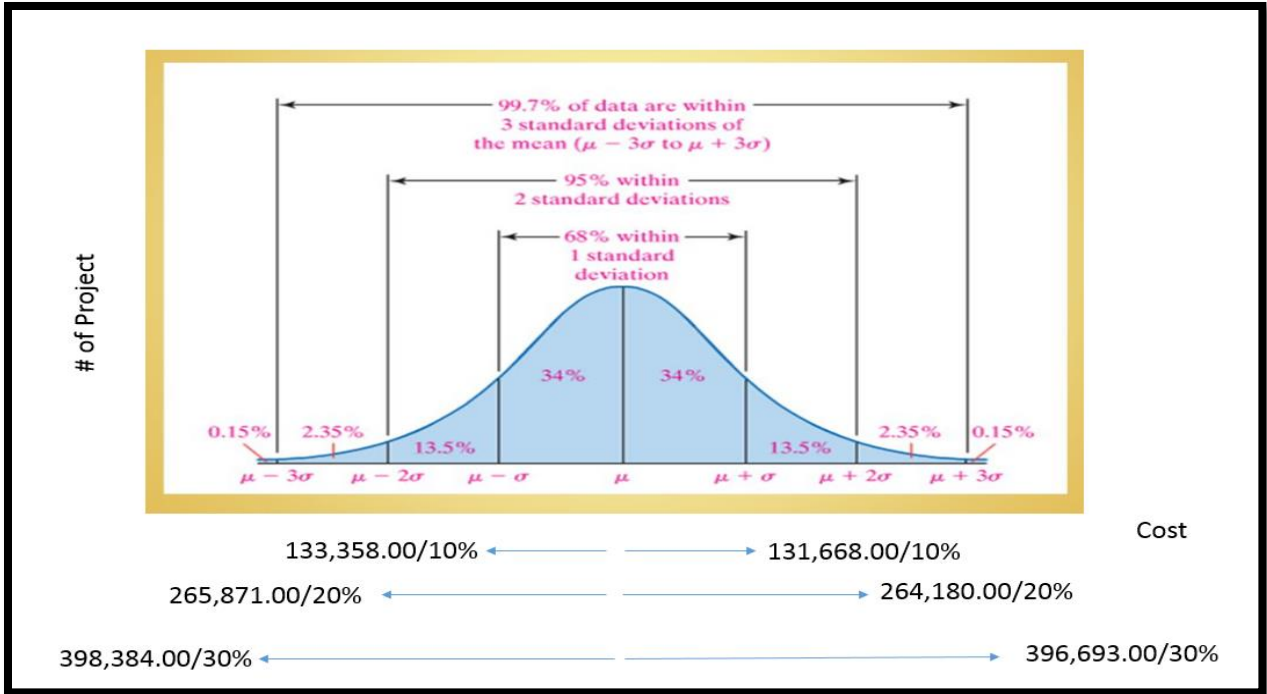
Chart (MN2) Average cost /% Average cost (2005-2015) for St. Martin Parish

Appendix I

District 04 Parishes

District 04 has 7 different parishes the tables below show the confident that the new project will be completed ahead of the time or behind the time, where the negative sign means ahead of the time and plus sign means behind time. Also Tables will show the confident that a new project cost will be underrun or overrun where the negative sign means underrun and positive sign mean overrun

Claiborne Parish (CL)

	Time		Cost (2005-2015)		Present value 2015	
Average	-22.6		$ (23,834.00)		$ (27,638.00)	
Standard Deviation	35.2		$ 54,999.00		$ 64,831.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-39	4	$ (78,833.00)	$ 31,165.00	$ (92,469.43)	$ 37,192.79
95%	-60	25	$ (133,832.00)	$ 86,165.00	$ (157,300.54)	$ 102,023.90
99.70%	-82	47	$ (188,831.00)	$ 141,164.00	$ 222,131.66	$ 166,855.01
	% Day Average		% Cost Average		% Average at net present value	
Average	-21%		-3%		-4%	
Standard Deviation	21%		7%		8%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-42%	0%	-10%	4%	-12%	4%
95%	-63%	21%	-17%	11%	-20%	12%
99.70%	-84%	42%	-24%	18%	-28%	20%

TABLE (CL) Normal Distribution and Standard Deviation for Claiborne Parish
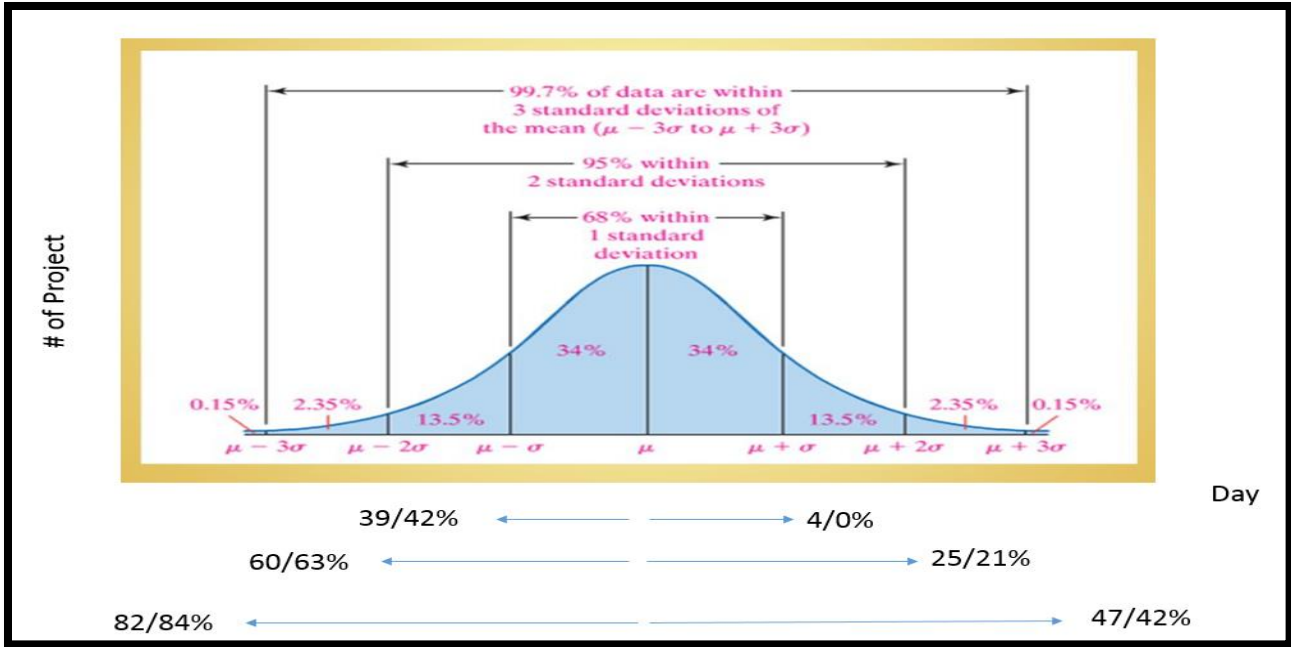
Chart (CL1) Average day/ % Average day for Claiborne Parish
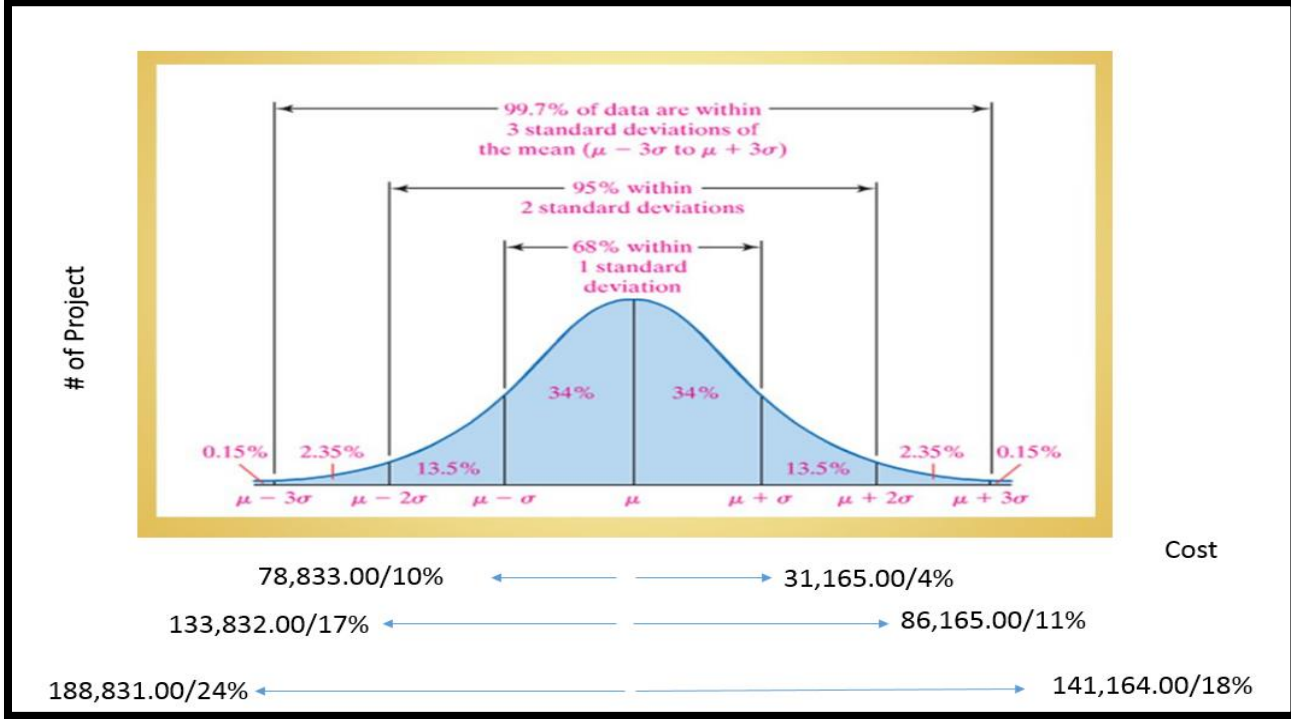
Chart (CL2) Average cost /t% Average cost (2005-2015) for Claiborne Parish

Desoto Parish (DS)

	Time		Cost (2005-2015)		Present value 2015	
Average	-4.8		$ 28,903.00		$ 28,020.00	
Standard Deviation	8.8		$ 132,186.00		$ 142,298.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-14	4	$ (103,283.00)	$ 161,088.00	$ (114,278.35)	$ 170,318.50
95%	-22	13	$ (235,469.00)	$ 293,274.00	$ (256,576.77)	$ 312,616.92
99.70%	-31	22	$ (367,655.00)	$ 425,460.00	$ (398,875.20)	$ 454,915.34
	% Day Average		% Cost Average		% Average at net present value	
Average	-19%		1%		1%	
Standard Deviation	22%		6%		7%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-41%	3%	-5%	7%	-6%	8%
95%	-63%	25%	-11%	13%	-13%	15%
99.70%	-85%	47%	-17%	19%	-20%	22%

TABLE (DS1) Normal Distribution and Standard Deviation for Desoto Parish
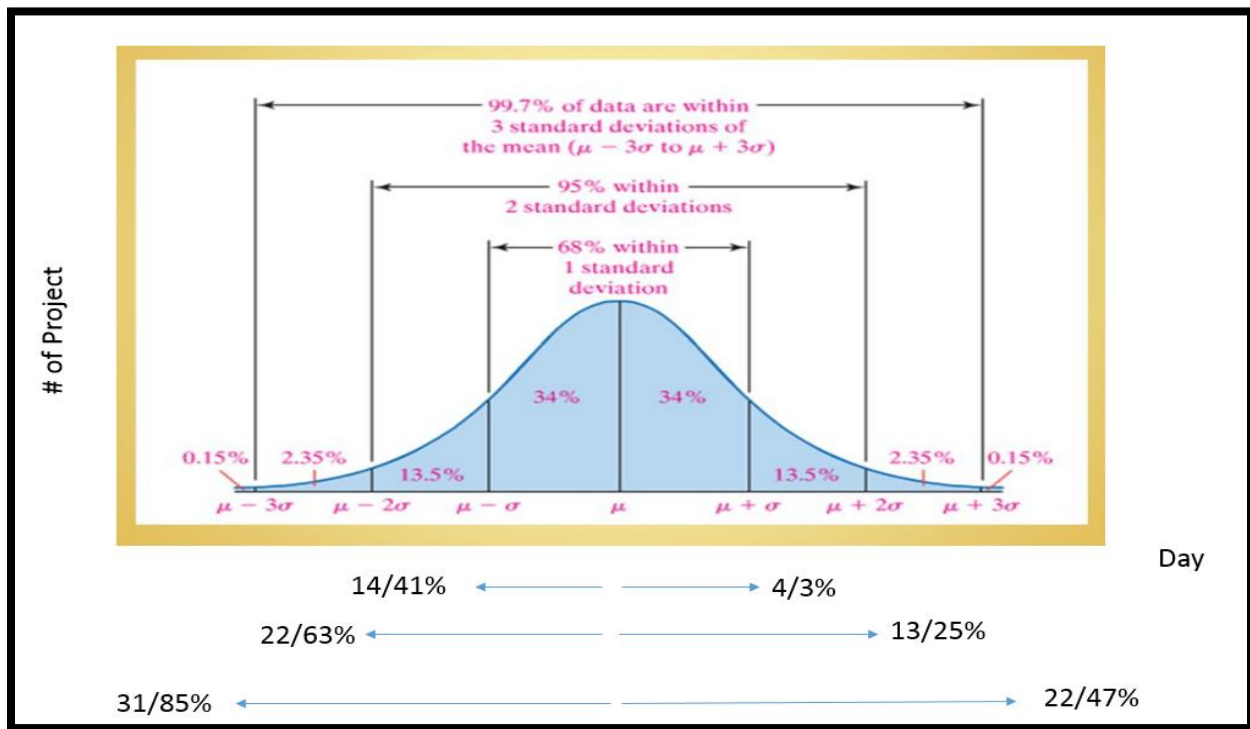
Chart (DS1) Average day/ % Average day for Desoto Parish
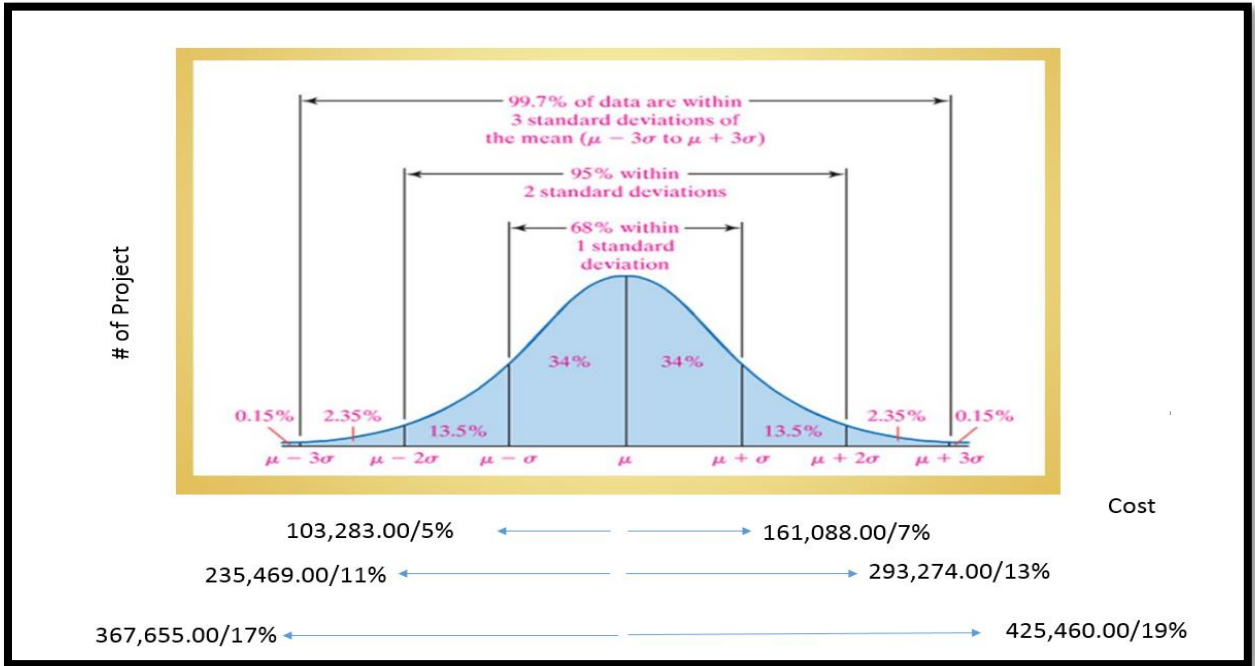
Chart (DS2) Average cost /% Average cost (2005-2015) for Desoto Parish

Red River Parish (RR)

	Time		Cost (2005-2015)		Present value 2015	
Average	-3.6		$ (10,851.00)		$ (10,281.00)	
Standared Deviation	9.1		$ 33,635.00		$ 37,618.00	
	AVERAGE TIME		*AVERAGE COST 2005-2015*		*AVERAGE COST 2015*	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-13	6	$ (44,486.00)	$ 22,784.00	$ (47,898.88)	$ 27,337.16
95%	-22	15	$ (78,121.00)	$ 56,420.00	$ (85,516.90)	$ 64,955.18
99.70%	-31	24	$ (111,757.00)	$ 90,055.00	$ (123,134.91)	$ 102,573.20
	% Day Average		*% Cost Average*		*% Average at net present value*	
Average	-14%		-1%		-1%	
Standared Deviation	24%		5%		6%	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-38%	10%	-6%	4%	-7%	5%
95%	-62%	34%	-11%	9%	-13%	11%
99.70%	-86%	58%	-16%	14%	-19%	17%

TABLE (RR) Normal Distribution and Standard Deviation for Red River Parish

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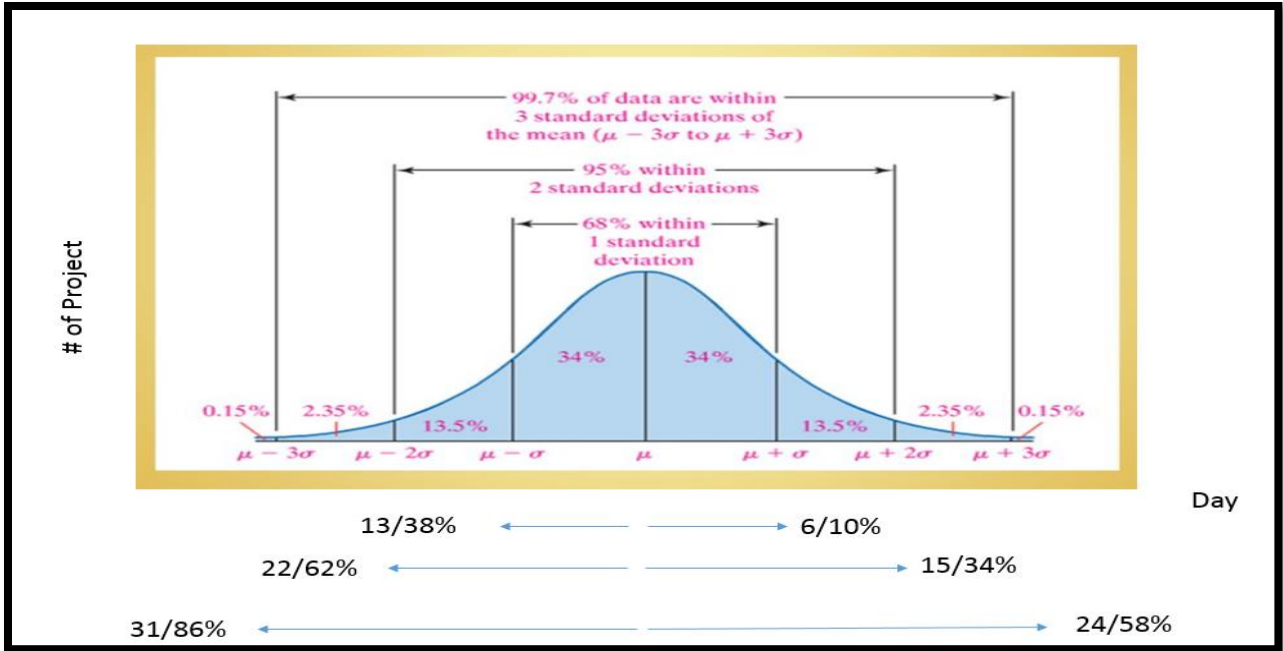
Chart (RR1) Average day/ % Average day for Red River Parish
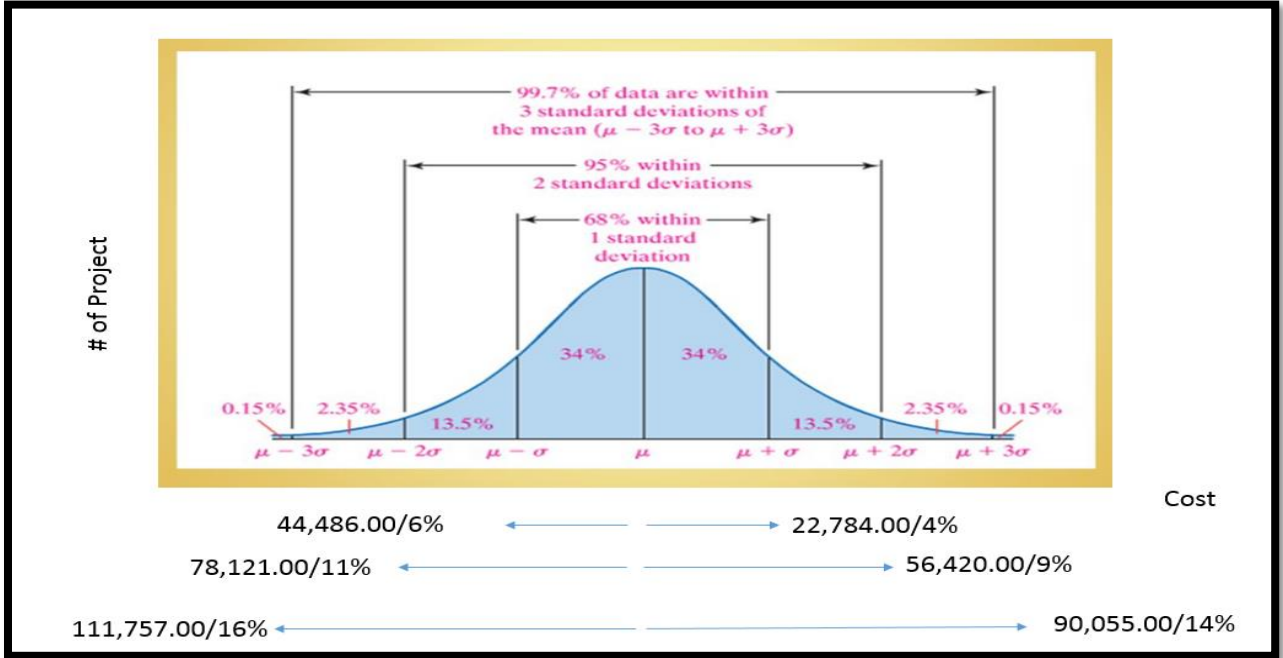
Chart (RR2) Average cost /% Average cost (2005-2015) for Red River Parish

Bienville Parish (BV)

	Time		Cost (2005-2015)		Present value 2015	
Average	-8		$ 24,955.00		$ 32,940.00	
Standared Deviation	25.4		$ 198,064.00		$ 232,777.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-33	17	$ (173,109.00)	$ 223,020.00	$ (199,836.77)	$ 265,717.41
95%	-59	43	$ (371,174.00)	$ 421,084.00	$ (432,613.85)	$ 498,494.50
99.70%	-84	68	$ (569,238.00)	$ 619,148.00	$ (665,390.94)	$ 731,271.59
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-20%		2%		2%	
Standard Deviation	24%		19%		21%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-44%	4%	-17%	21%	-19%	23%
95%	-68%	28%	-36%	40%	-40%	44%
99.70%	-92%	52%	-55%	59%	-61%	65%

TABLE (BV) Normal Distribution and Standard Deviation for Bienville Parish
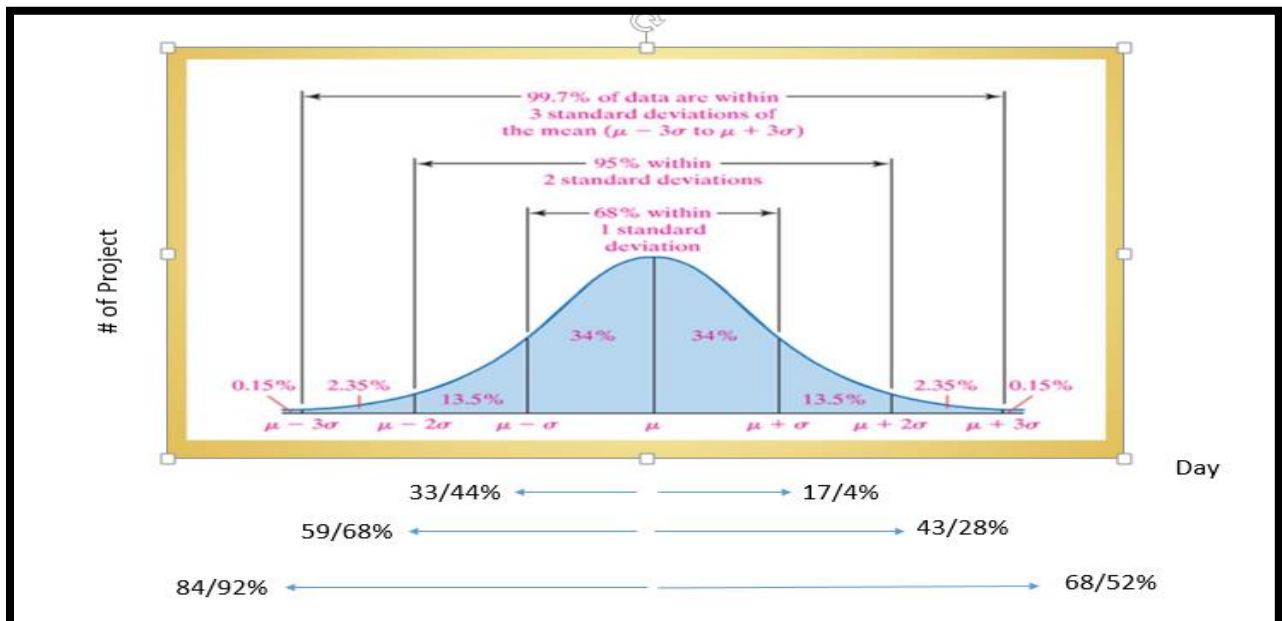
Chart (BV1) Average day/ % Average day for Bienville Parish
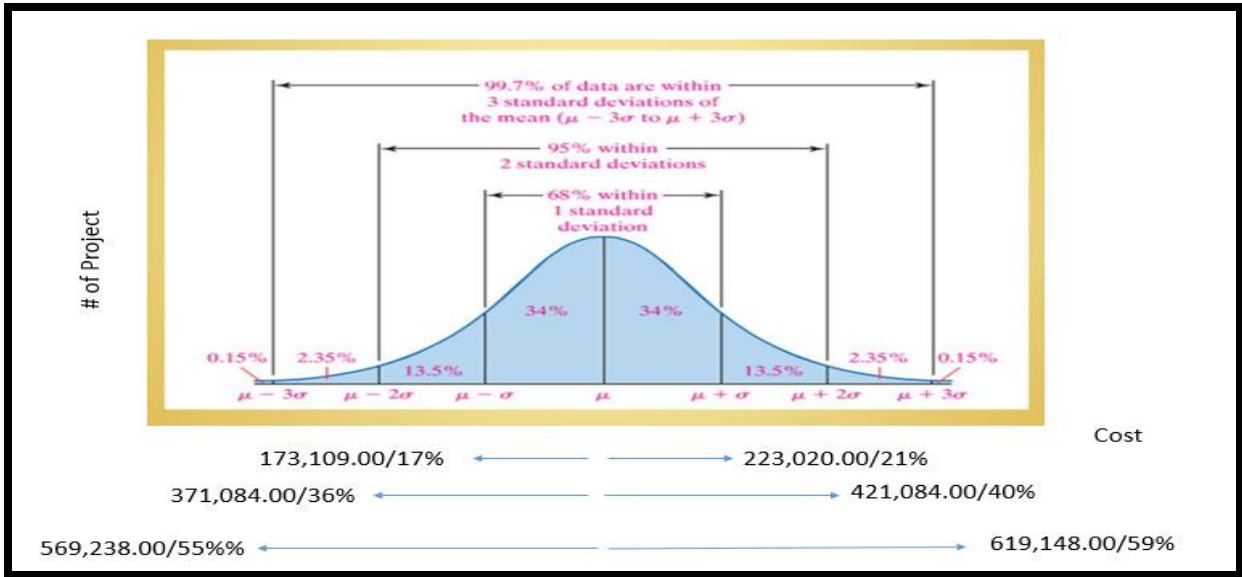
Chart (BV2) Average cost /% Average cost (2005-2015) for Bienville Parish

Webster Parish (WE)

	Time		Cost (2005-2015)		Present value 2015	
Average	-6.5		$ 7,877.00		$ 8,452.00	
Standared Deviation	6.9		$ 58,937.00		$ 69,575.00	
	AVERAGE TIME		*AVERAGE COST 2005-2015*		*AVERAGE COST 2015*	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-13	0	$ (51,059.00)	$ 66,814.00	$ (61,123.14)	$ 78,026.22
95%	-20	7	$ (109,996.00)	$ 125,751.00	$ (130,697.82)	$ 147,600.89
99.70%	-27	14	$ (168,933.00)	$ 184,688.00	$ (200,272.50)	$ 217,175.57
	% Day Average		*% Cost Average*		*% Average at net present value*	
Average	-16%		-1%		-1%	
Standared Deviation	27%		10%		12%	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-43%	11%	-11%	9%	-13%	11%
95%	-70%	38%	-21%	19%	-25%	23%
99.70%	-97%	65%	-31%	29%	-37%	35%

TABLE (WE1) Normal Distribution and Standard Deviation for Webster Parish

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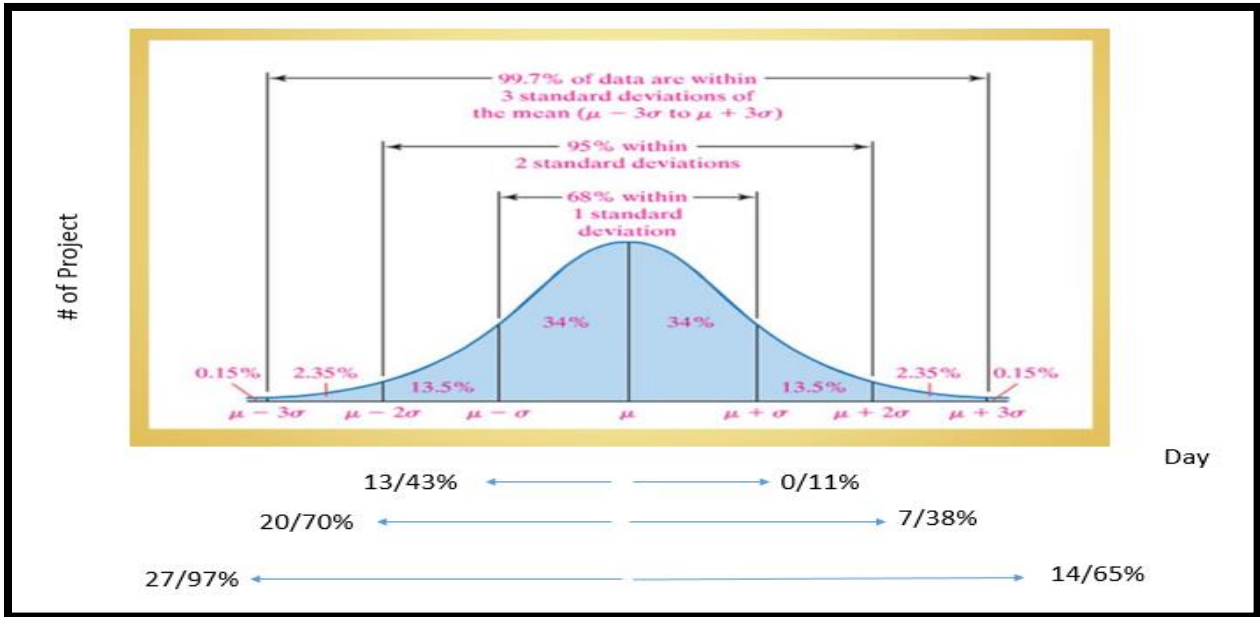
Chart (WE1) Average day/ % Average day for Webster Parish
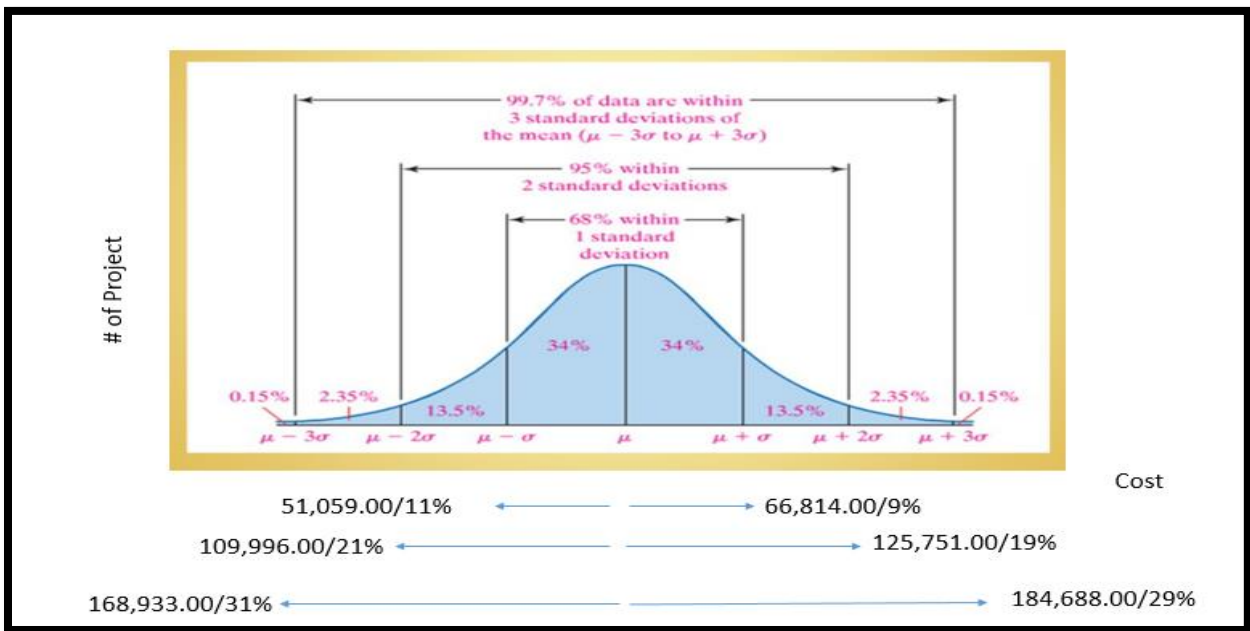
Chart (WE2) Average cost /% Average cost (2005-2015) for Webster Parish

Bossier Parish (BO)

	Time		Cost (2005-2015)		Present value 2015	
Average	-9.3		$ 14,039.00		$ 17,232.00	
Standard Deviation	21.3		$ 186,334.00		$ 231,174.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-31	12	$ (172,296.00)	$ 200,373.00	$ (213,941.32)	$ 248,405.93
95%	-52	34	$ (358,630.00)	$ 386,707.00	$ (445,114.94)	$ 479,579.55
99.70%	-74	55	$ (544,964.00)	$ 573,042.00	$ (676,288.56)	$ 710,753.17
	% Day Average		% Cost Average		% Average at net present value	
Average	-15%		0%		-1%	
Standard Deviation	23%		13%		16%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-38%	8%	-13%	13%	-17%	15%
95%	-61%	31%	-26%	26%	-33%	31%
99.70%	-84%	54%	-39%	39%	-49%	47%

TABLE (BO) Normal Distribution and Standard Deviation for Bossier Parish
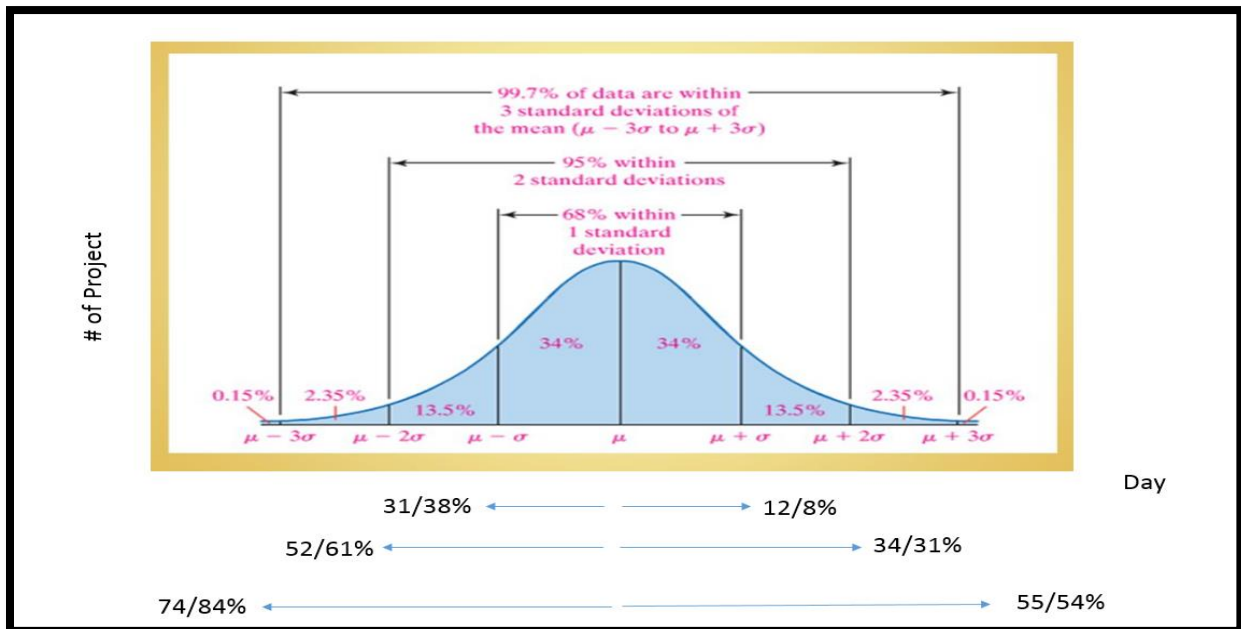
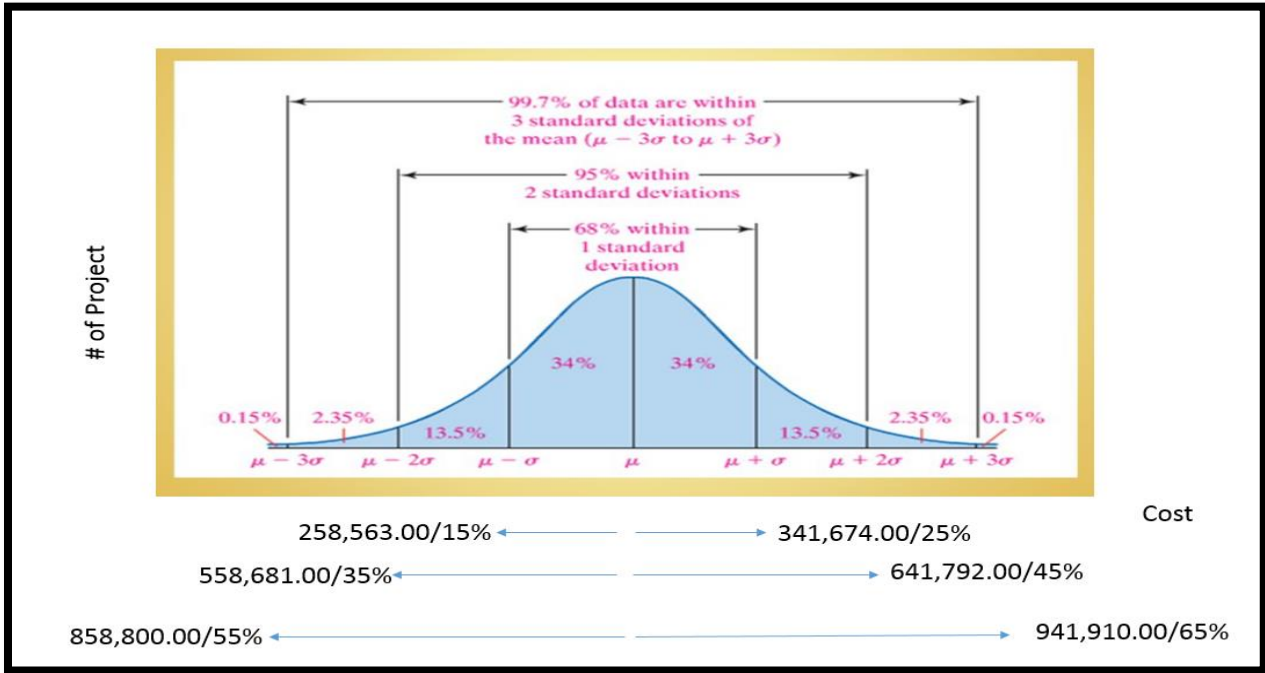

Chart (BO1) Average day/ % Average day for Bossier Parish

172,296.00/13% ← → 200,373.00/13%

358,630.00/26% ← → 386,707.00/26%

544,964.00/39% ← → 573,042.00/39%
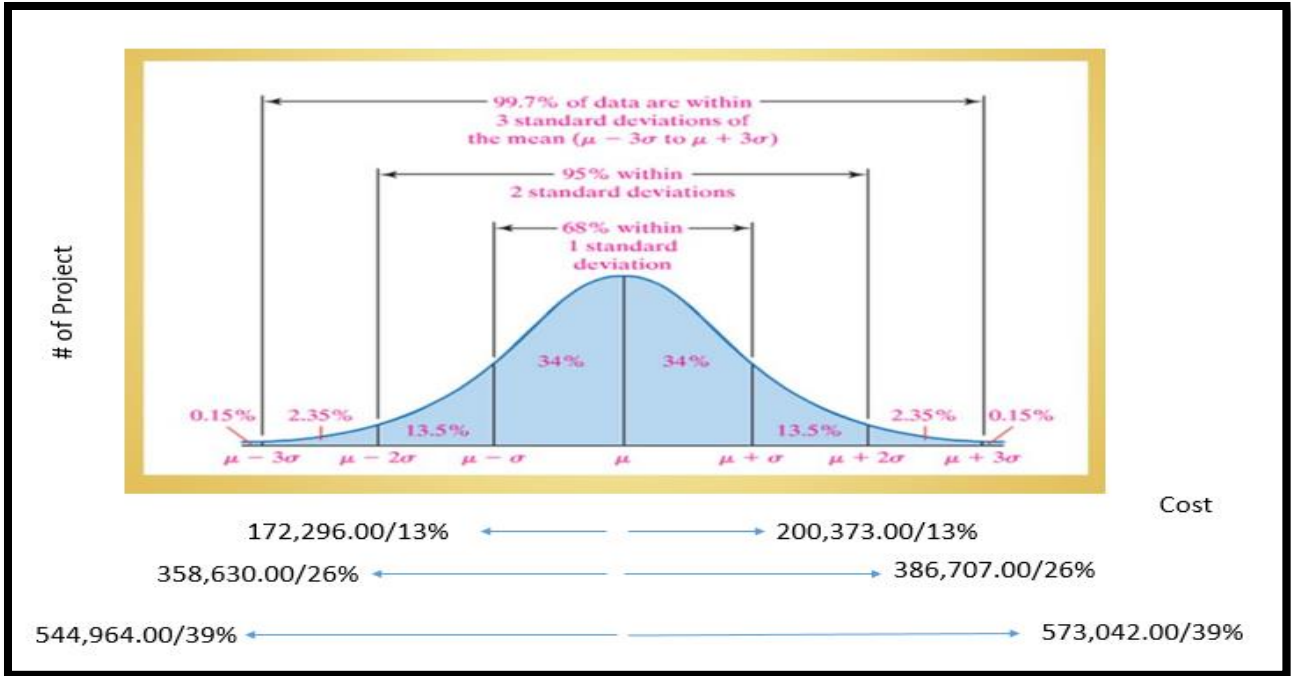
Chart (BO2) Average cost /% Average cost (2005-2015) for Bossier Parish

Caddo Parish (CD)

	Time		Cost (2005-2015)		Present value 2015	
Average	6		$ 32,927.00		$ 34,702.00	
Standard Deviation	44.6		$ 670,366.00		$ 726,592.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-39	51	$ (637,438.00)	$ 703,438.00	$ (691,889.98)	$ 761,293.58
95%	-83	95	$ (1,307,804.00)	$ 1,373,659.00	$ (1,418,481.76)	$ 1,487,885.35
99.70%	-128	140	$ (1,978,168.00)	$ 2,044,024.00	$ (2,145,073.54)	$ 2,214,477.13
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-11%		-1%		-1%	
Standard Deviation	29%		15%		17%	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-40%	18%	-16%	14%	-18%	16%
95%	-69%	47%	-31%	29%	-35%	33%
99.70%	-98%	76%	-46%	44%	-52%	50%

TABLE (CD) Normal Distribution and Standard Deviation for Caddo Parish
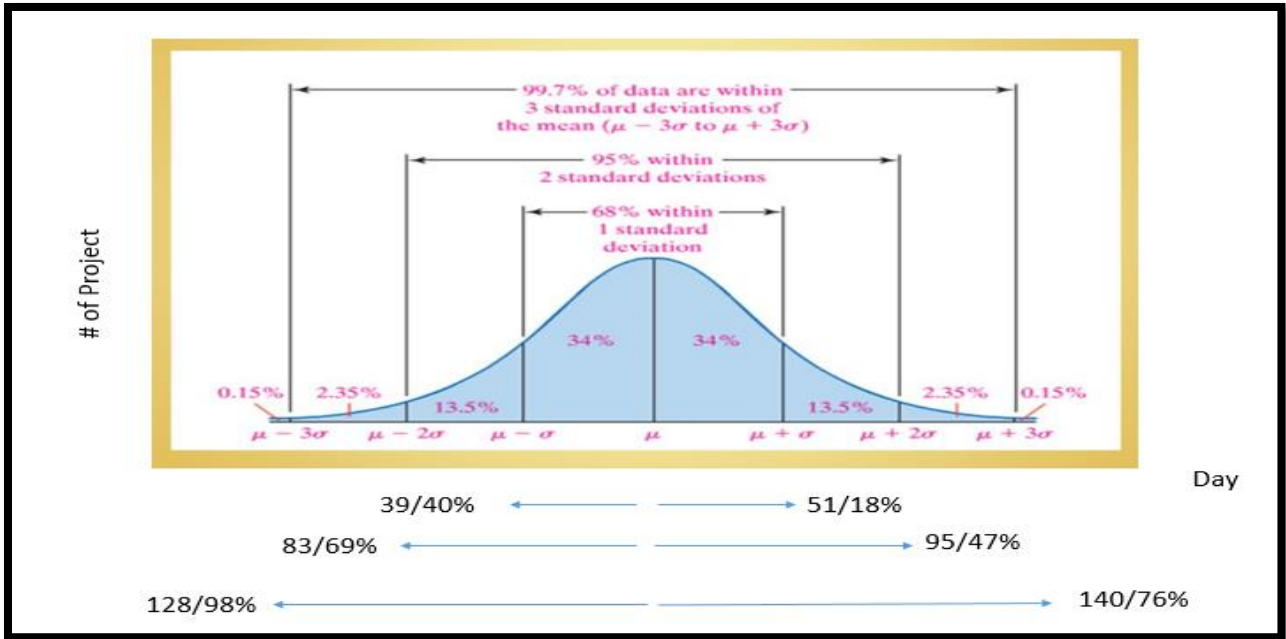
Chart (CD1) Average day/ % Average day for Caddo Parish
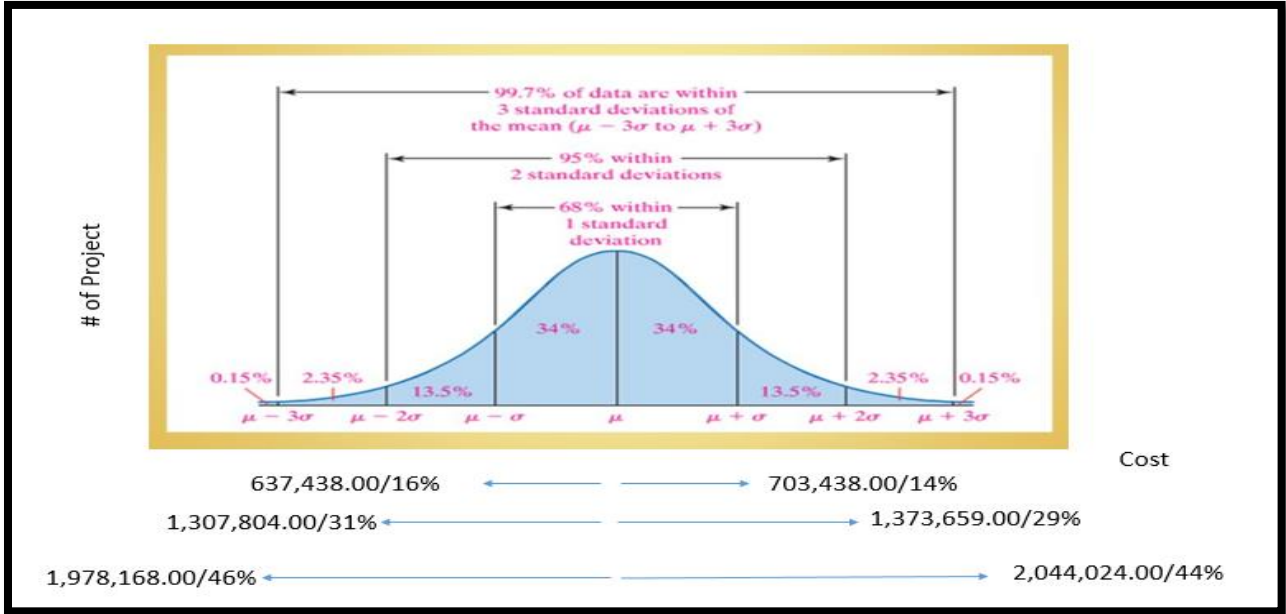
Chart (CD2) Average cost /% Average cost (2005-2015) for Caddo Parish

Appendix J
District 05 Parishes

Union Parish (UN)

	Time		Cost (2005-2015)			Present value 2015	
Average	2		$ 19,996.00			$ 24,713.00	
Standared Deviation	49.1		$ 94,802.00			$ 112,342.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015		
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun		Overrun
68%	-47	51	$ (74,806.00)	$ 114,798.00	$ (87,629.39)	$	137,055.26
95%	-96	100	$ (169,609.00)	$ 169,609.00	$ (199,971.71)	$	249,397.59
99.70%	-145	149	$ (264,411.00)	$ 264,411.00	$ (312,314.03)	$	361,739.39
	% Day Average		% Cost Average		% Average at net present value		
Average	-11%		0%		0%		
Standared Deviation	17%		7%		8%		
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun		Overrun
68%	-28%	6%	-7%	7%	-8%		8%
95%	-45%	23%	-14%	14%	-16%		16%
99.70%	-62%	40%	-21%	21%	-24%		24%

TABLE (UN) Normal Distribution and Standard Deviation for Union Parish

Chart (UN1) Average day/ % Average day for Union Parish

74,806.00/7% → ← → 114,798.00/7%

169,609.00/14% ← → 169,609.00/14%

264,411.00/21% ← → 264,411.00/21%
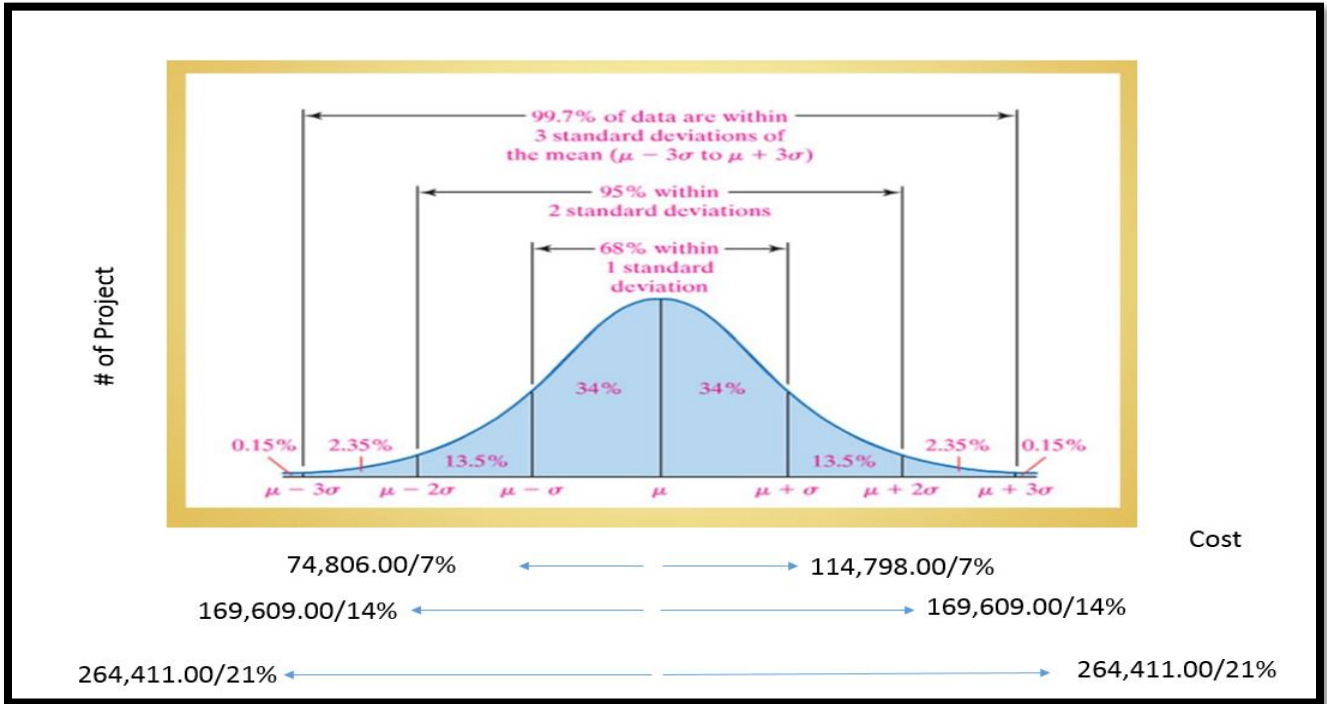
Chart (UN2) Average cost /% Average cost (2005-2015) for Union Parish

West Carroll Parish (WC)

	Time		Cost (2005-2015)		Present value 2015	
Average	-13		$ (69,885.00)		$ 93,953.00	
Standared Deviation	26.6		$ 426,331.00		$ 569,017.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-40	14	$ (496,216.00)	$ 356,445.00	$ (662,969.88)	$ 475,064.16
95%	-66	40	$ (922,546.00)	$ 782,776.00	$ (1,231,986.90)	$ 1,044,081.18
99.70%	-93	67	$ (1,348,877.00)	$ 1,209,107.00	$ (1,801,003.92)	$ 1,613,098.20
	% Day Average		% Cost Average		% Average at net present value	
Average	-18%		-1%		-1%	
Standared Deviation	21%		15%		20%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-39%	3%	-16%	14%	-21%	19%
95%	-60%	24%	-31%	29%	-41%	39%
99.70%	-81%	45%	-46%	44%	-61%	59%

**TABLE (WC) Normal Distribution and Standard Deviation for West Carroll Parish**
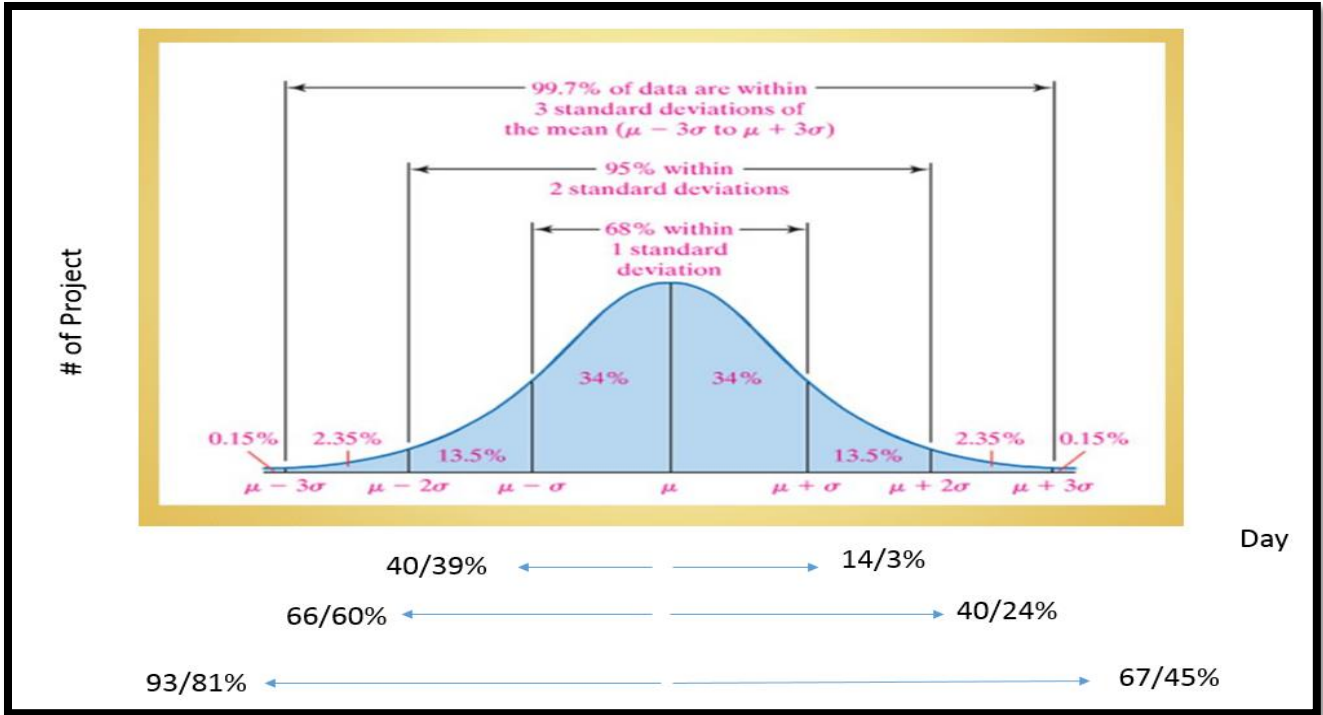
Chart (WC1) Average day/ % Average day for West Carroll Parish
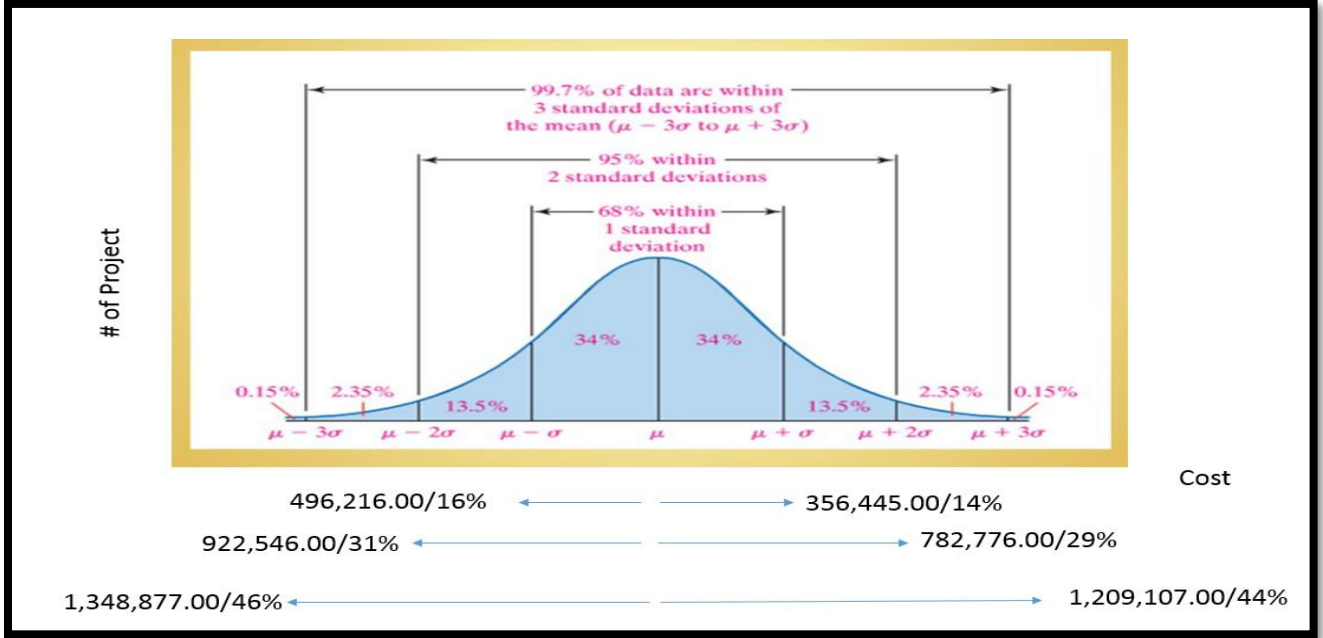
Chart (WC2) Average cost /% Average cost (2005-2015) for West Carroll Parish

Jackson Parish (JK)

	Time		Cost (2005-2015)		Present value 2015	
Average	-5		$ 90,970.00		$ 106,941.00	
Standard Deviation	34.7		$ 294,859.00		$ 332,704.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-40	30	$ (203,888.00)	$ 385,829.00	$ (225,763.45)	$ 439,645.54
95%	-74	64	$ (498,747.00)	$ 680,688.00	$ (558,467.95)	$ 772,350.03
99.70%	-109	99	$ (793,606.00)	$ 975,547.00	$ (891,172.44)	$ 1,105,054.52
	% Day Average		% Cost Average		% Average at net present value	
Average	-13%		3%		3%	
Standard Deviation	25%		6%		7%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-38%	12%	-3%	9%	-4%	10%
95%	-63%	37%	-9%	15%	-11%	17%
99.70%	-88%	62%	-15%	21%	-18%	24%

TABLE (JK) Normal Distribution and Standard Deviation for Jackson Parish
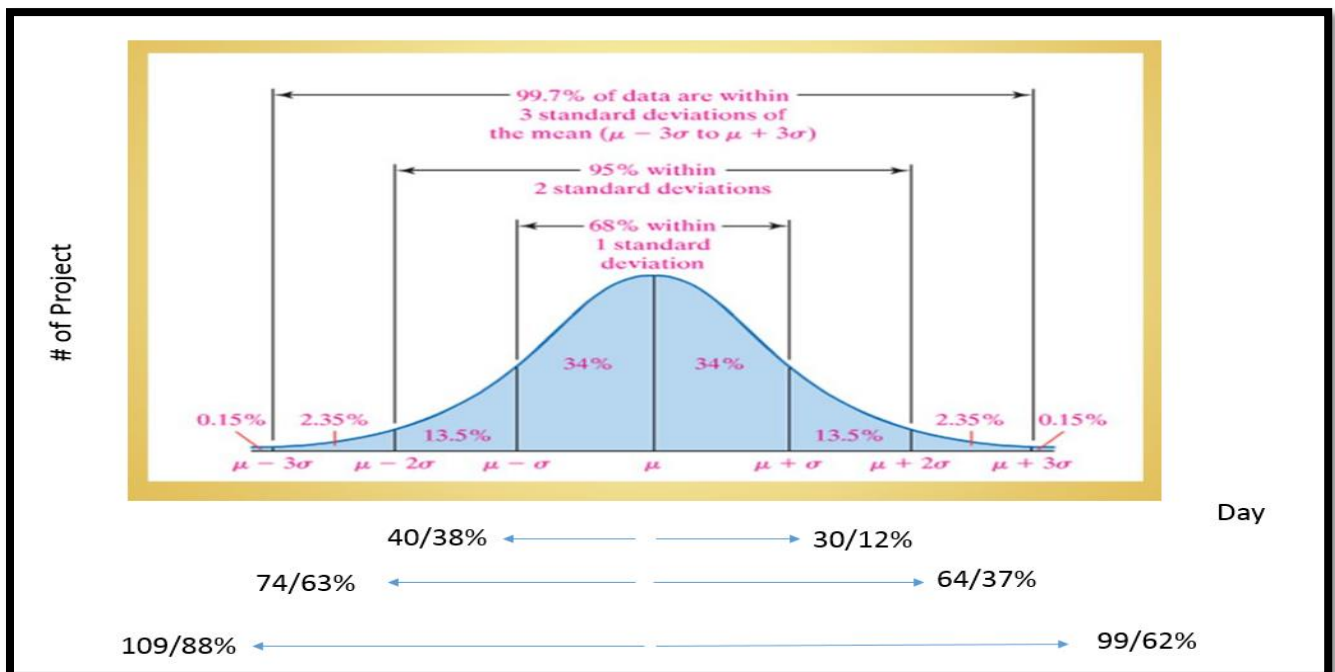
Chart (JK1) Average day/ % Average day for Jackson Parish
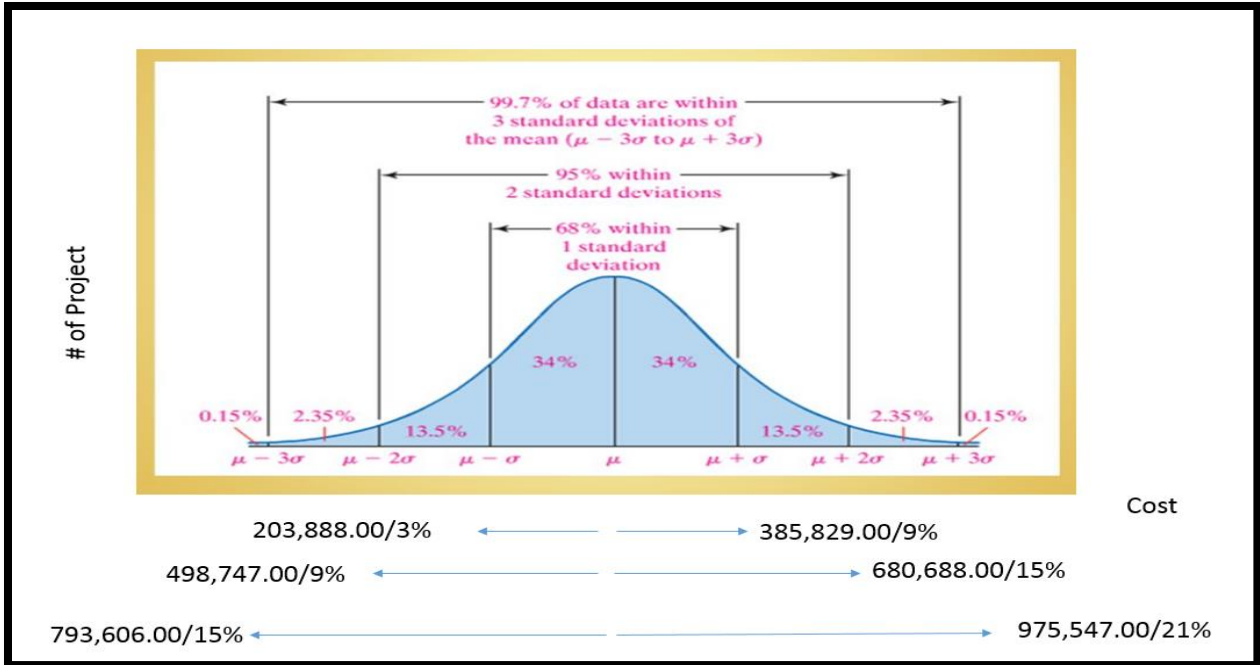
Chart (JK2) Average cost /% Average cost (2005-2015) for Jackson Parish

East Carroll Parish (EC)

	Time		Cost (2005-2015)		Present value 2015	
Average	-9.4		$ 22,089.00		$ (26,806.00)	
Standared Deviation	15.3		$ 86,017.00		$ 106,376.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-25	6	$ (108,106.00)	$ 63,928.00	$ (133,182.09)	$ 79,570.59
95%	-40	21	$ (194,123.00)	$ 149,945.00	$ (239,558.43)	$ 185,946.93
99.70%	-55	36	$ (280,140.00)	$ 235,962.00	$ (345,934.77)	$ 292,323.27
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-19%		-1%		-2%	
Standared Deviation	19%		4%		4%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-38%	0%	-5%	3%	-6%	2%
95%	-57%	19%	-9%	7%	-10%	6%
99.70%	-76%	38%	-13%	11%	-14%	10%

TABLE (EC) Normal Distribution and Standard Deviation for East Carroll Parish
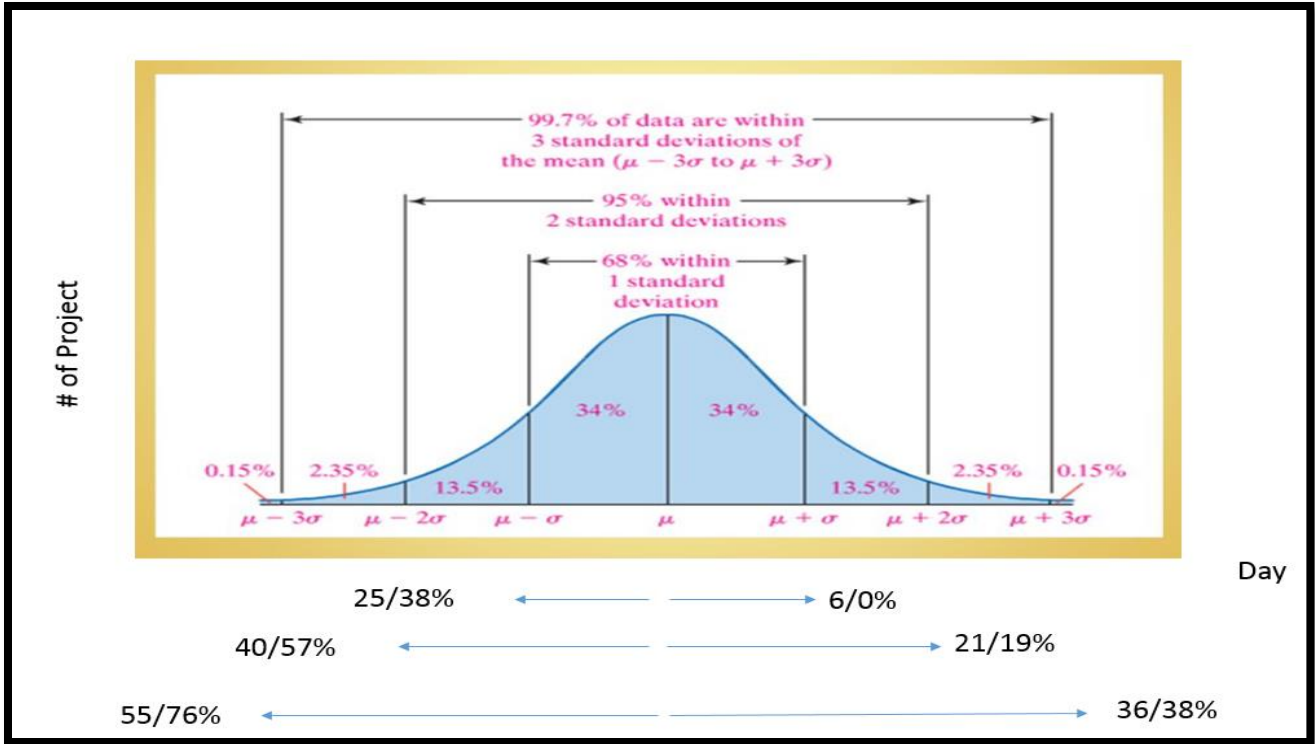
Chart (EC1) Average day/ % Average day for East Carroll Parish

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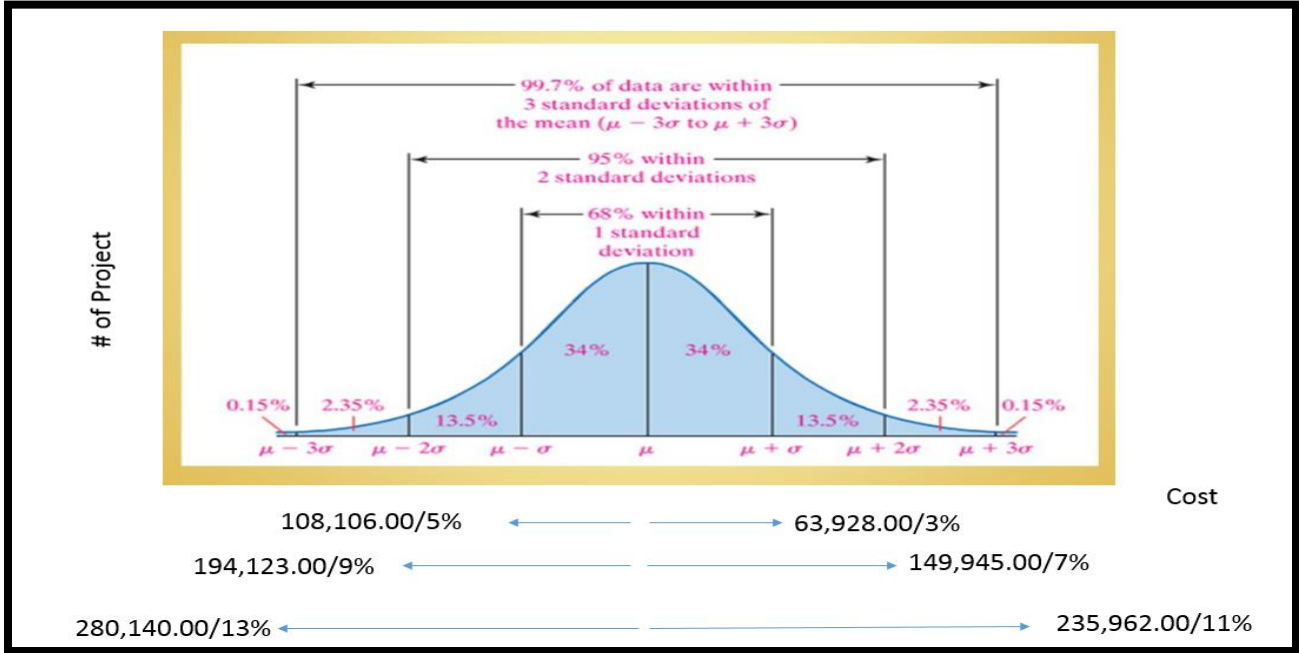
Chart (EC2) Average cost /% Average cost (2005-2015) for East Carroll Parish

Morehouse Parish (MH)

	Time		Cost (2005-2015)		Present value 2015	
Average	-10.9		$ 19,180.00		$ 23,839.00	
Standared Deviation	23.2		$ 623,051.00		$ 107,666.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-34	12	$ (603,870.00)	$ 642,231.00	$ (83,826.75)	$ 131,505.34
95%	-57	35	$ (1,226,921.00)	$ 1,265,282.00	$ (191,492.79)	$ 239,171.38
99.70%	-80	59	$ (1,849,972.00)	$ 1,888,332.00	$ (299,158.83)	$ 346,837.42
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-20%		1%		1%	
Standared Deviation	20%		7%		8%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-40%	0%	-6%	8%	-7%	9%
95%	-60%	20%	-13%	15%	-15%	17%
99.70%	-80%	40%	-20%	22%	-23%	25%

TABLE (MH1) Normal Distribution and Standard Deviation for Morehouse Parish
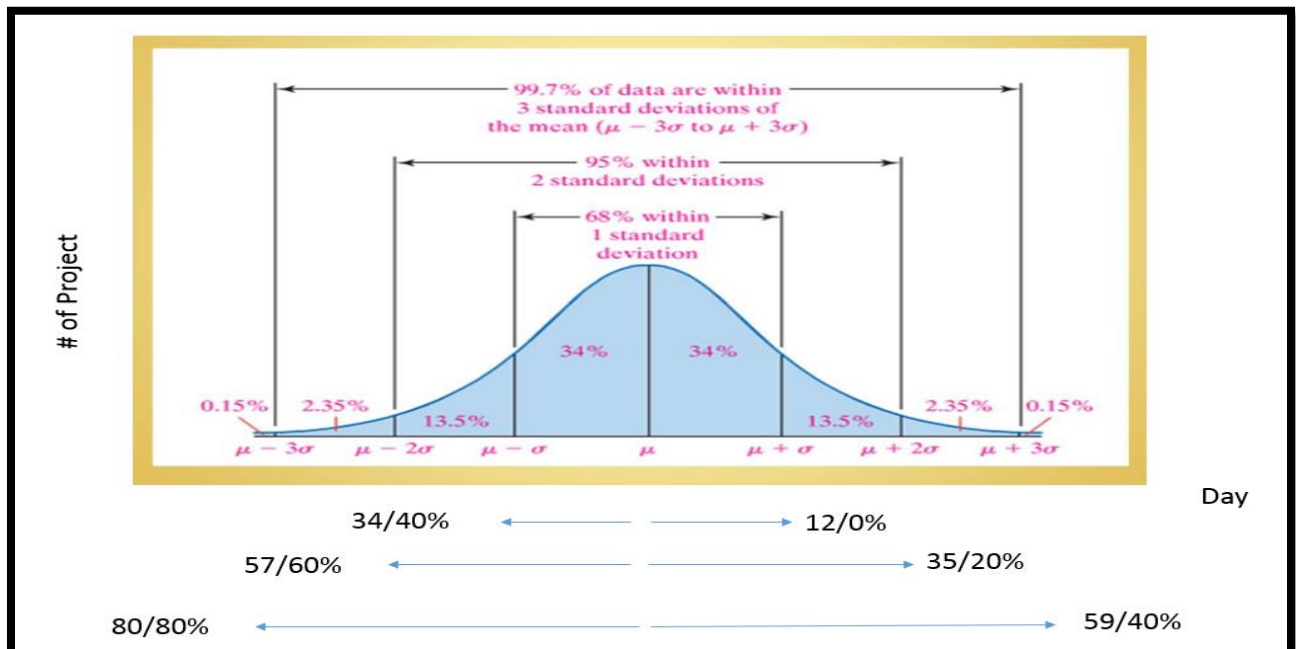
Chart (MH1) Average day/ % Average day for Morehouse Parish
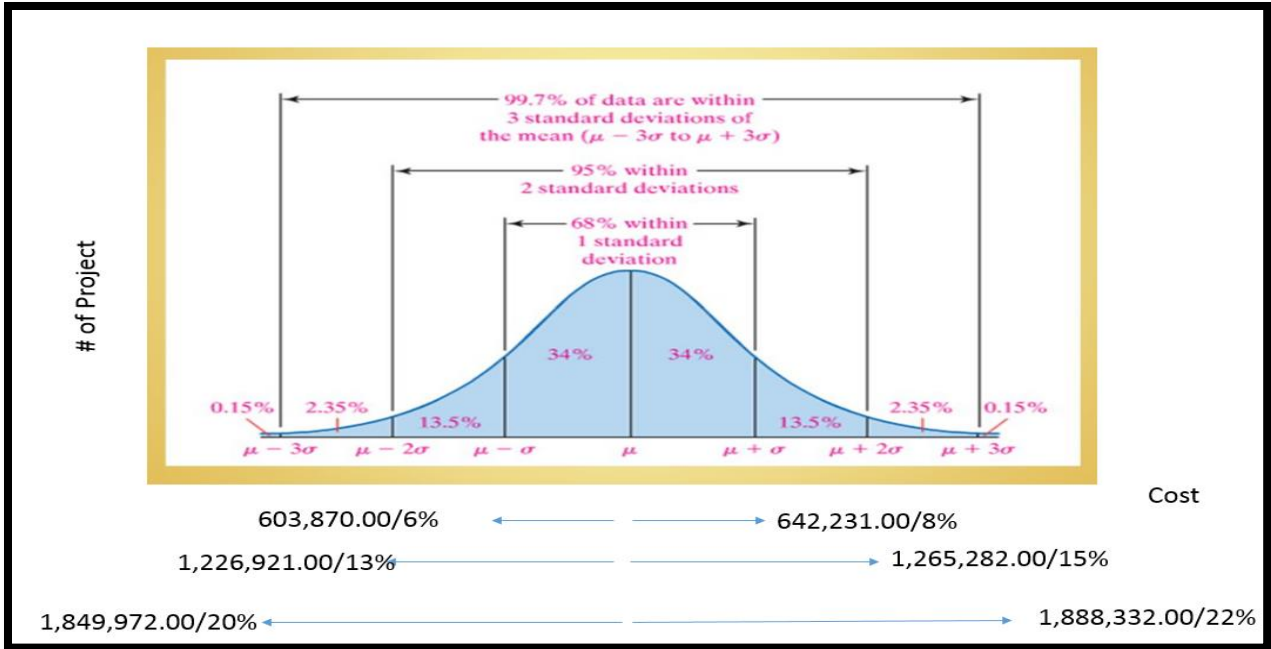
Chart (MH2) Average cost /% Average cost (2005-2015) for Morehouse Parish

Madison Parish (MA)

	Time		Cost (2005-2015)		Present value 2015	
Average	-8.6		$ 94,173.00		$ 104,390.00	
Standared Deviation	23.6		$ 329,021.00		$ 353,635.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-32	15	$ (234,848.00)	$ 423,193.00	$ (249,244.10)	$ 458,025.06
95%	-56	39	$ (563,868.00)	$ 752,214.00	$ (602,878.69)	$ 811,659.64
99.70%	-79	62	$ (892,889.00)	$ 1,081,235.00	$ (956,513.27)	$ 1,165,294.22
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-13%		1%		1%	
Standared Deviation	24%		8%		9%	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-37%	11%	-7%	9%	-8%	10%
95%	-61%	35%	-15%	17%	-17%	19%
99.70%	-85%	59%	-23%	25%	-26%	28%

TABLE (MA) Normal Distribution and Standard Deviation for Madison Parish

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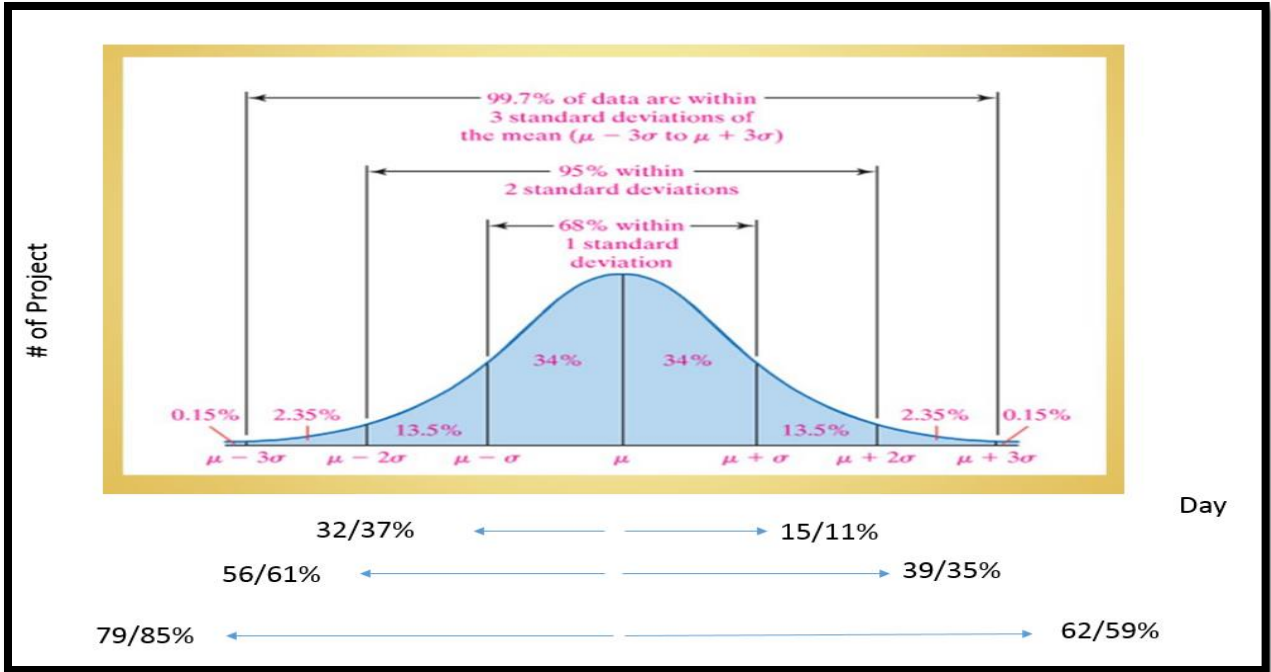
Chart (MA1) Average day/ % Average day for Madison Parish
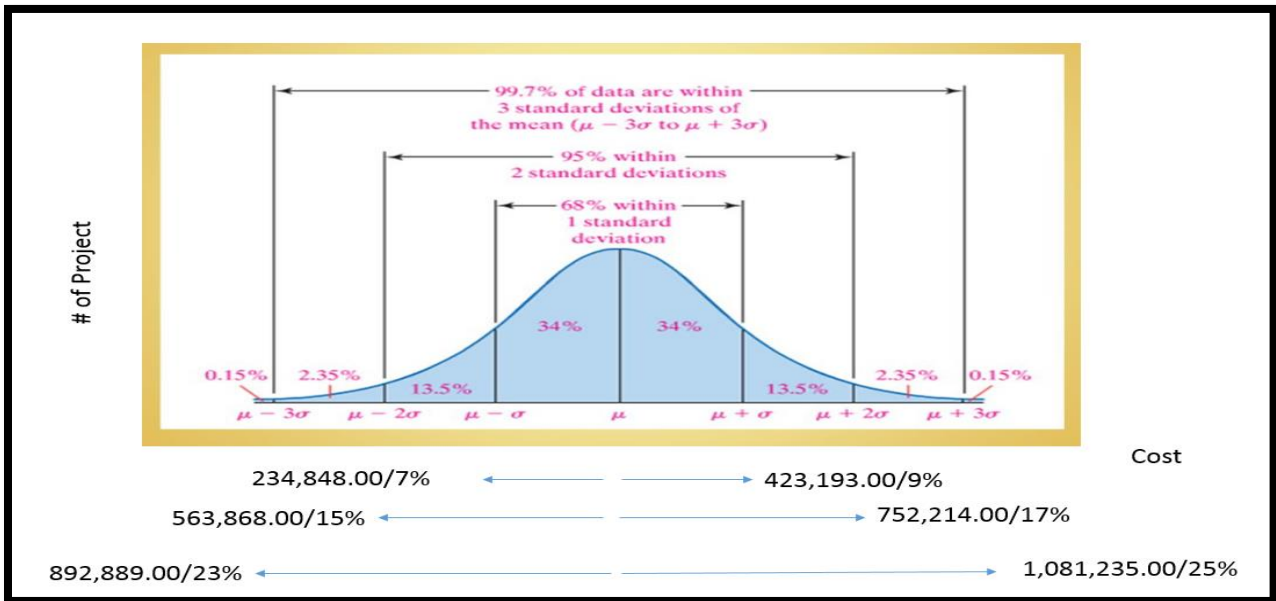
Chart (MA2) Average cost /% Average cost (2005-2015) for Madison Paris

Lincoln Parish (LN)

	Time		Cost (2005-2015)		Present value 2015	
Average	-3.1		$ 30,810.00		$ 37,542.00	
Standared Deviation	25		$ 182,906.00		$ 212,480.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-28	22	$ (152,097.00)	$ 213,716.00	$ (174,938.01)	$ 250,022.42
95%	-53	47	$ (335,003.00)	$ 396,622.00	$ (387,418.23)	$ 462,502.64
99.70%	-78	72	$ (517,909.00)	$ 579,529.00	$ (599,898.45)	$ 674,982.85
	% Day Average		% Cost Average		% Average at net present value	
Average	-14%		0%		1%	
Standared Deviation	25%		8%		9%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-39%	11%	-8%	8%	-8%	10%
95%	-64%	36%	-16%	16%	-17%	19%
99.70%	-89%	61%	-24%	24%	-26%	28%

TABLE (LN) Normal Distribution and Standard Deviation for Lincoln Parish
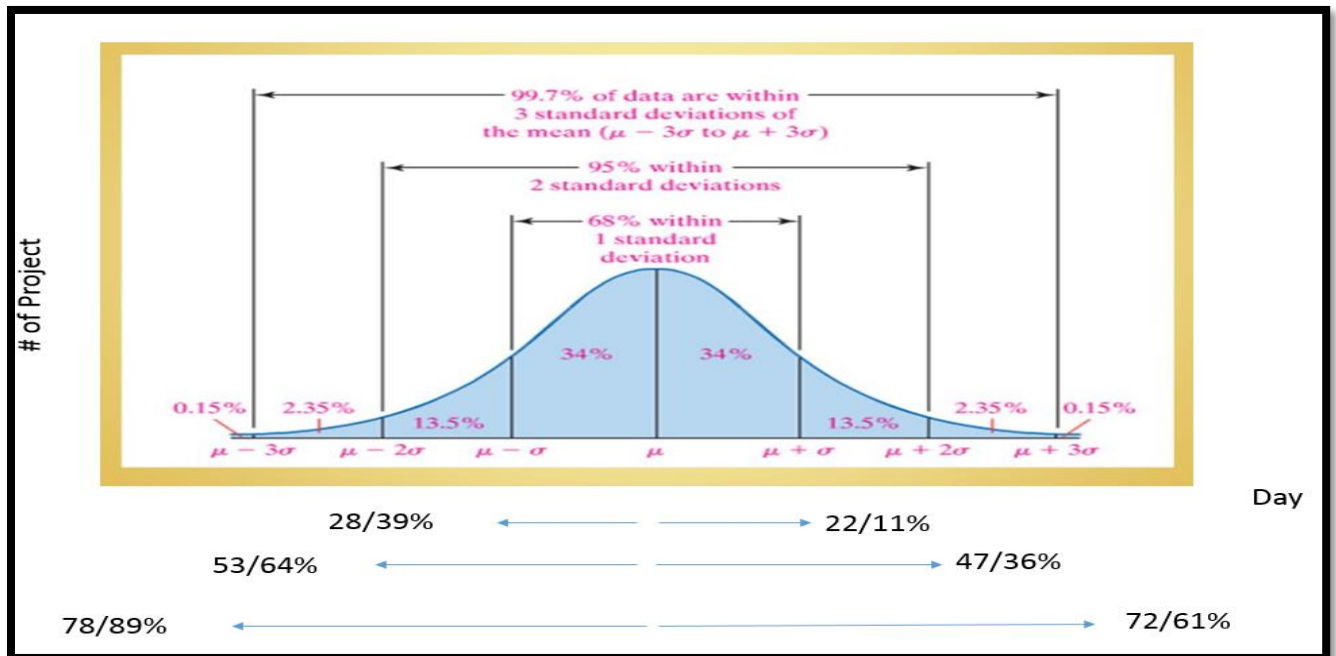
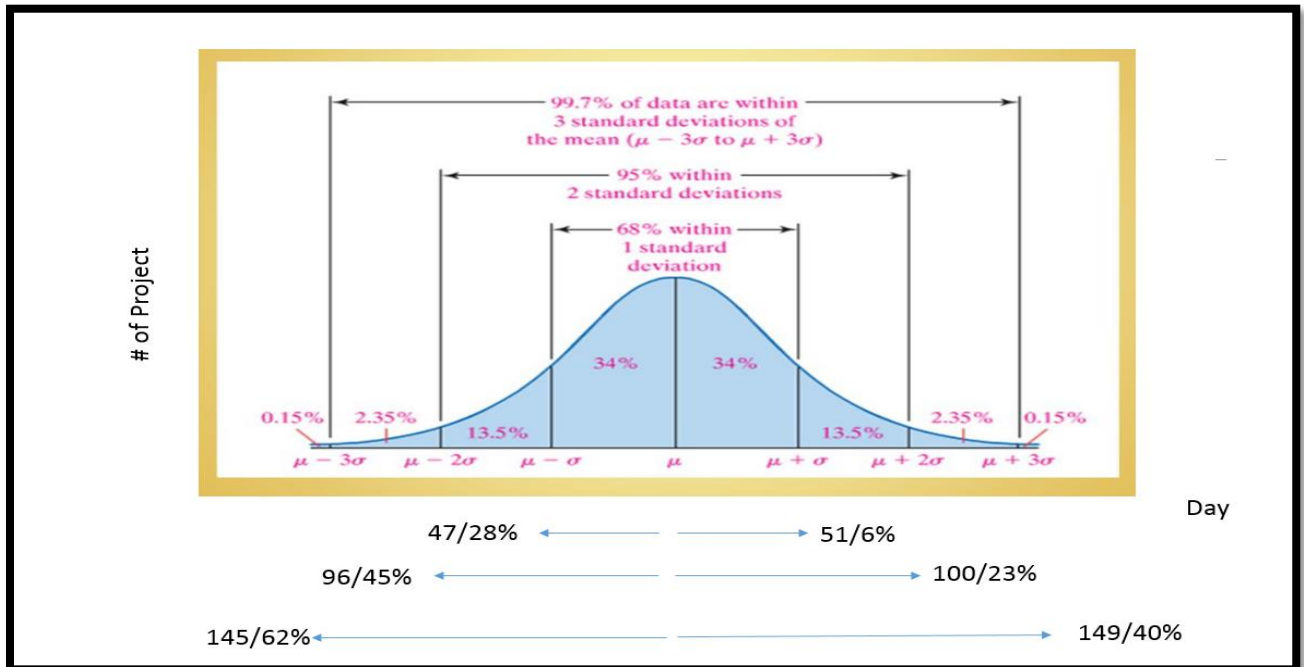

Chart (LN1) Average day/ % Average day for Lincoln Parish
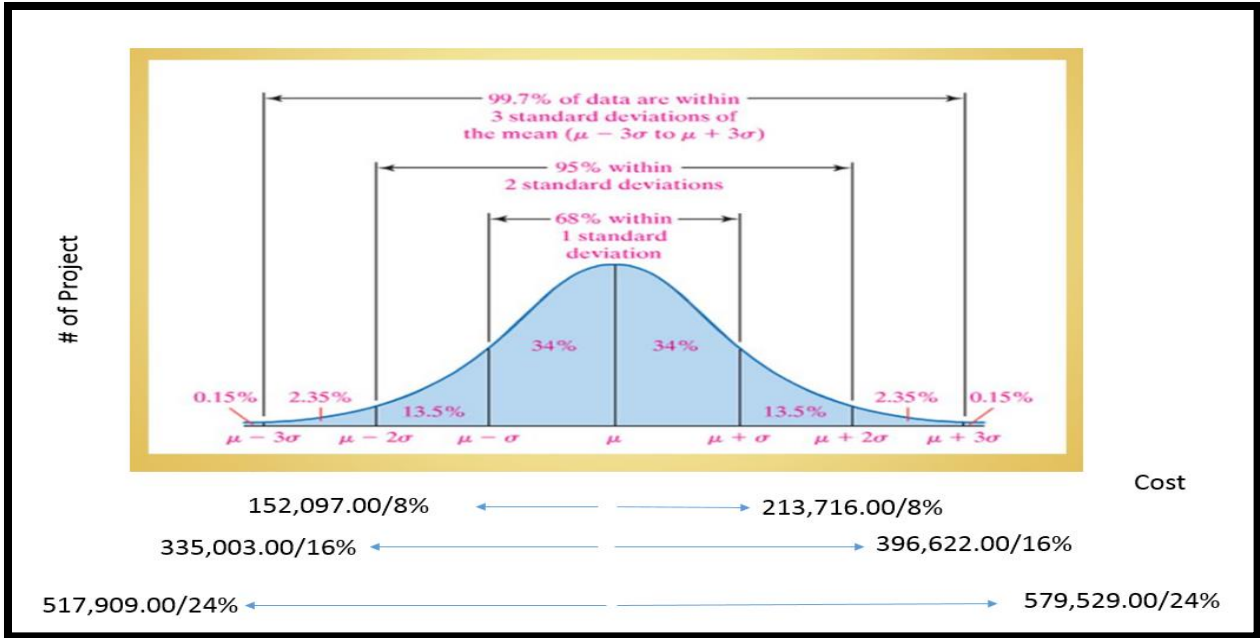
Chart (LN2) Average cost /% Average cost (2005-2015) for Lincoln Parish

Richland Parish (RH)

	Time		Cost (2005-2015)		Present value 2015	
Average	-7.3		$ (32,468.00)		$ 33,761.00	
Standard Deviation	14.1		$ 656,435.00		$ 209,352.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-21	7	$ (688,903.00)	$ 623,967.00	$ (789,103.66)	$ 729,307.99
95%	-35	21	$ (1,345,339.00)	$ 1,280,403.00	$ (1,548,309.48)	$ 1,488,513.81
99.70%	-50	35	$ 2,001,774.00	$ 1,936,838.00	$ (2,307,515.31)	$ 2,247,719.63
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-10%		-1%		-1%	
Standard Deviation	20%		15%		18%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-30%	10%	-16%	14%	-19%	17%
95%	-50%	30%	-31%	29%	-37%	35%
99.70%	-70%	50%	-46%	44%	-55%	53%

TABLE (RH) Normal Distribution and Standard Deviation for Richland Parish

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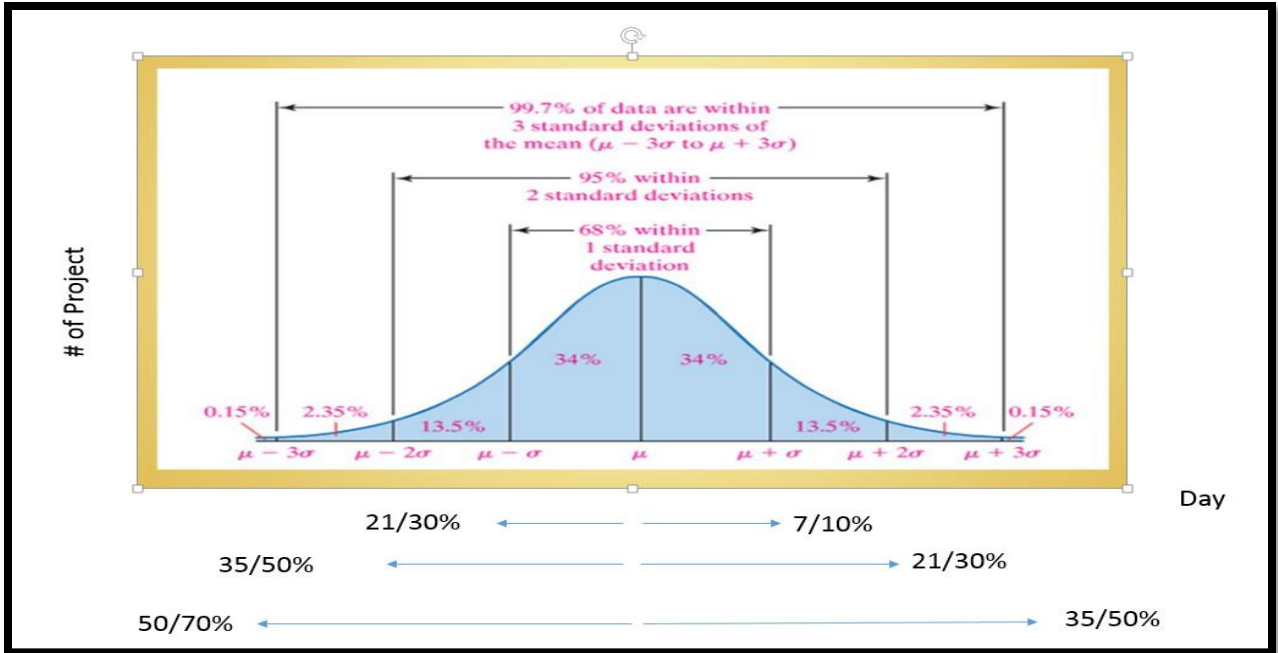
Chart (RH1) Average day/ % Average day for Richland Parish
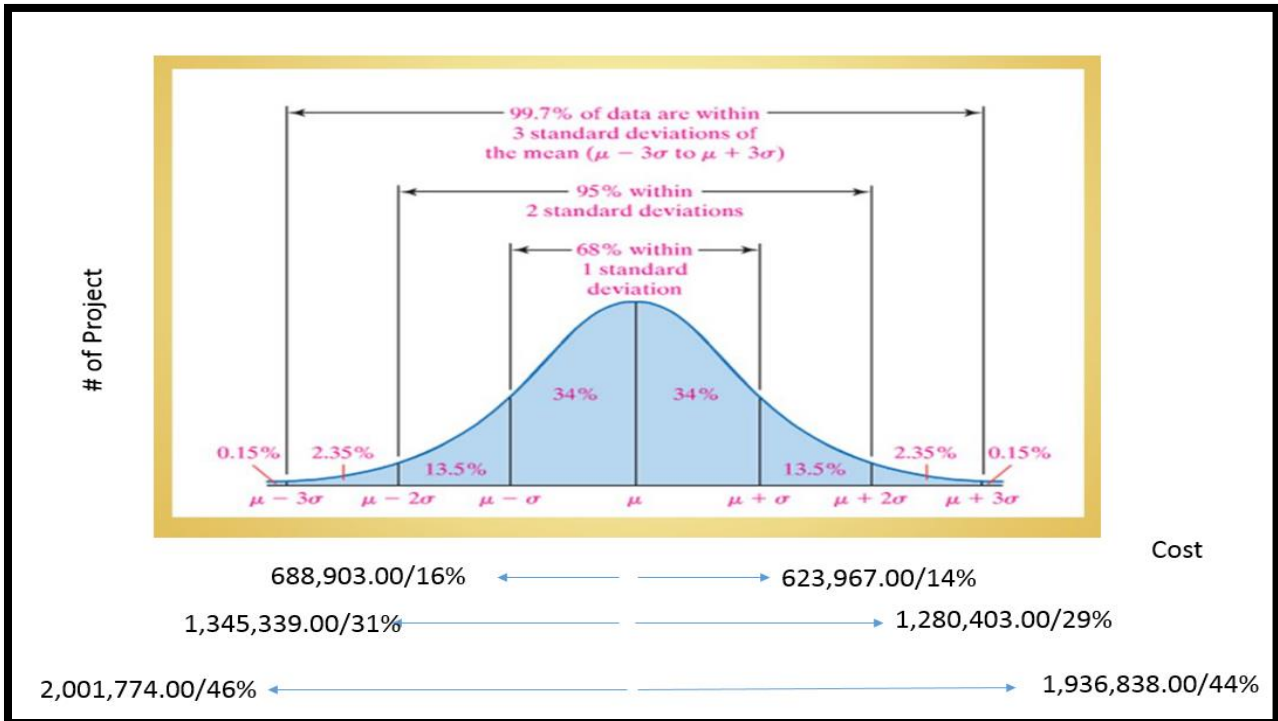
Chart (RH2) Average cost /% Average cost (2005-2015) for Richland Parish

Ouachita Parish (OU)

	Time		Cost (2005-2015)		Present value 2015	
Average	-8.8		$ 152,530.00		$ 166,264.00	
Standared Deviation	15.6		$ 872,879.00		$ 968,751.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-24	7	$ (720,349.00)	$ 994,920.00	$ (802,487.01)	$ 1,135,015.17
95%	-40	22	$ (1,593,227.00)	$ 1,846,306.00	$ (1,771,238.10)	$ 2,103,766.26
99.70%	-56	38	$ (2,466,106.00)	$ 2,697,691.00	$ (2,739,989.20)	$ 3,072,517.35
	% Day Average		*% Cost Average*		*% Average at net present value*	
Average	-15%		5%		5%	
Standared Deviation	23%		13%		15%	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-38%	8%	-8%	18%	-10%	20%
95%	-61%	31%	-21%	31%	-25%	35%
99.70%	-84%	54%	-34%	44%	-40%	50%

TABLE (OU) Normal Distribution and Standard Deviation for Ouachita Parish
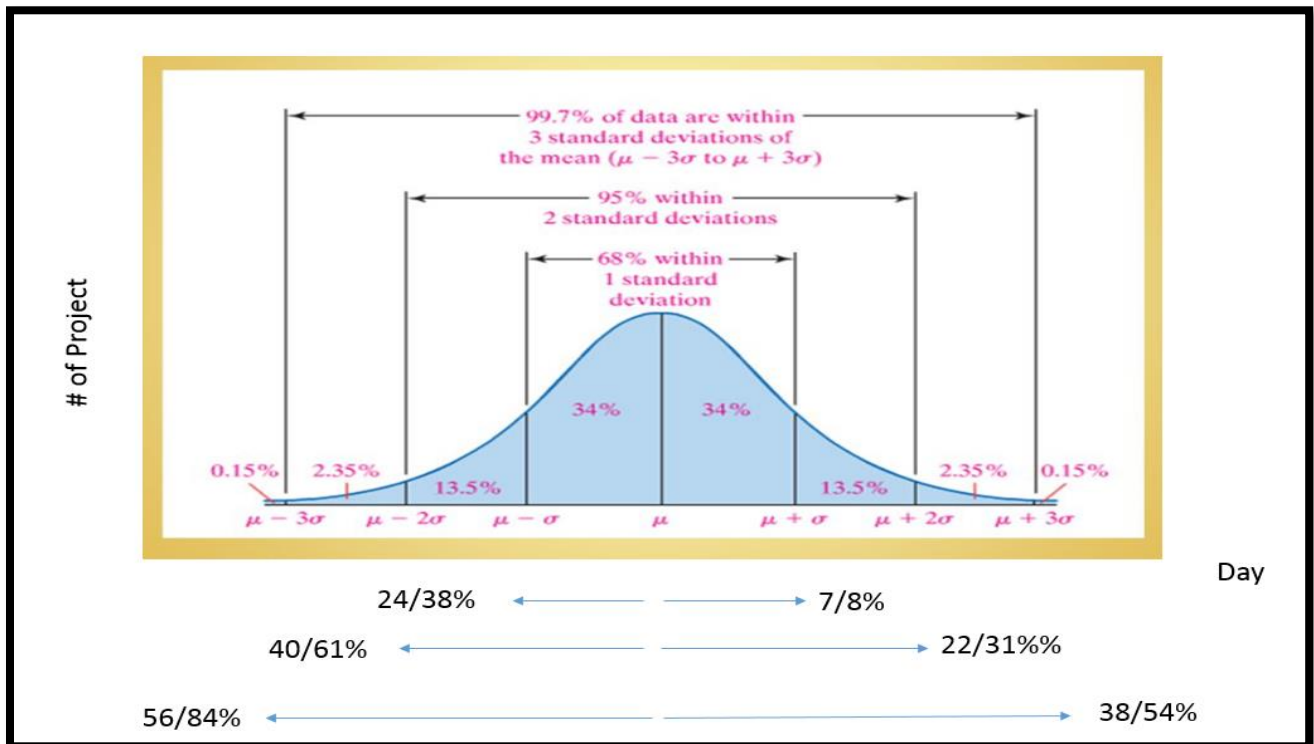
Chart (OU1) Average day/ % Average day for Ouachita Parish

99.7% of data are within 3 standard deviations of the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)

95% within 2 standard deviations

68% within 1 standard deviation

34%   34%

0.15%   2.35%   13.5%   13.5%   2.35%   0.15%

$\mu - 3\sigma$ $\mu - 2\sigma$ $\mu - \sigma$ μ $\mu + \sigma$ $\mu + 2\sigma$ $\mu + 3\sigma$

# of Project

Cost

720,349.00/8%   994,920.00/18%

1,593,227.00/21%%   1,846,306.00/31%

2,466,106.00/34%   2,697,691.00/44%
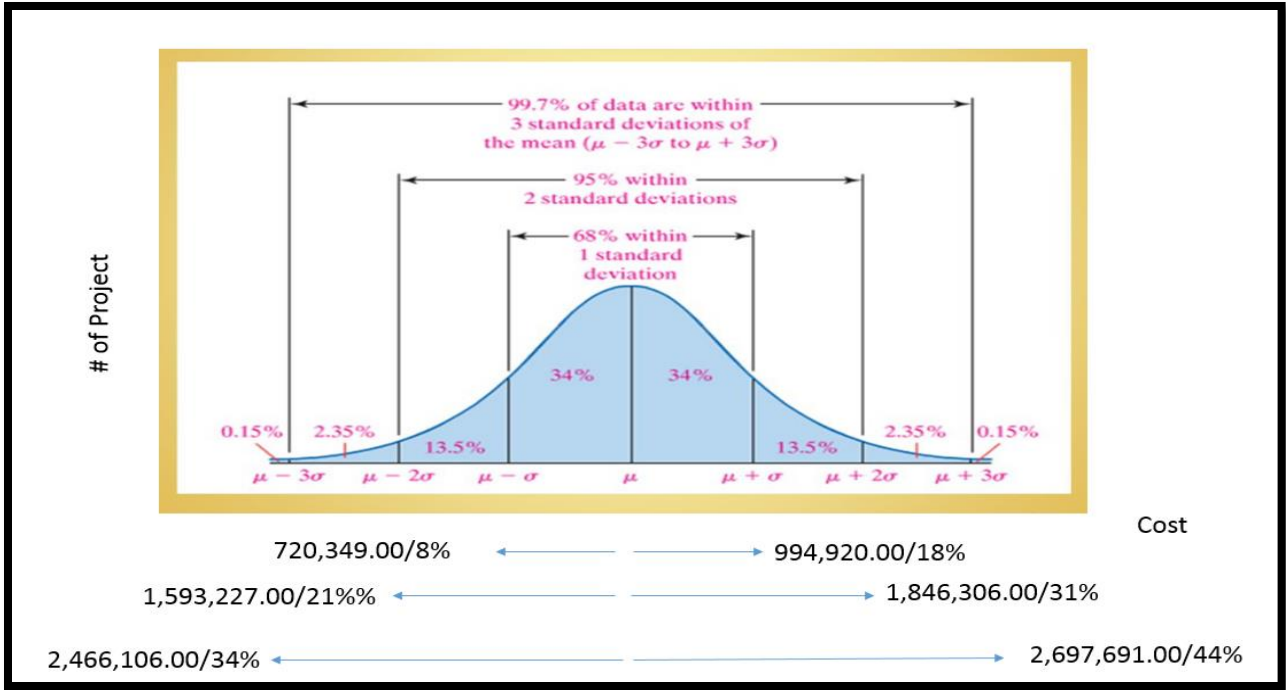
Chart (OU2) Average cost /% Average cost (2005-2015) for Ouachita Parish

Appendix K

Cameron Parish (CM)

	Time		Cost (2005-2015)			Present value 2015	
Average	-10.6		$ (1,459,845.00)			$ 1,742,139.00	
Standared Deviation	15		$ 7,510,439.00			$ 8,968,360.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015		
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun	
68%	-26	5	$ (8,970,283.00)	$ 6,050,594.00	$ (10,710,499.10)	$ 7,226,221.14	
95%	-41	20	$ (16,480,722.00)	$ 13,561,033.00	$ (19,678,859.22)	$ 16,194,581.25	
99.70%	-56	35	$ (23,991,161.00)	$ 21,071,472.00	$ (28,647,219.34)	$ 25,162,941.37	
	% Day Average		% Cost Average		% Average at net present value		
Average	-15%		1%		1%		
Standared Deviation	21%		24%		29%		
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun	
68%	-36%	6%	-23%	25%	-28%	30%	
95%	-57%	27%	-47%	49%	-57%	59%	
99.70%	-78%	48%	-71%	73%	-86%	88%	

TABLE (CM1) Normal Distribution and Standard Deviation for Cameron Parish
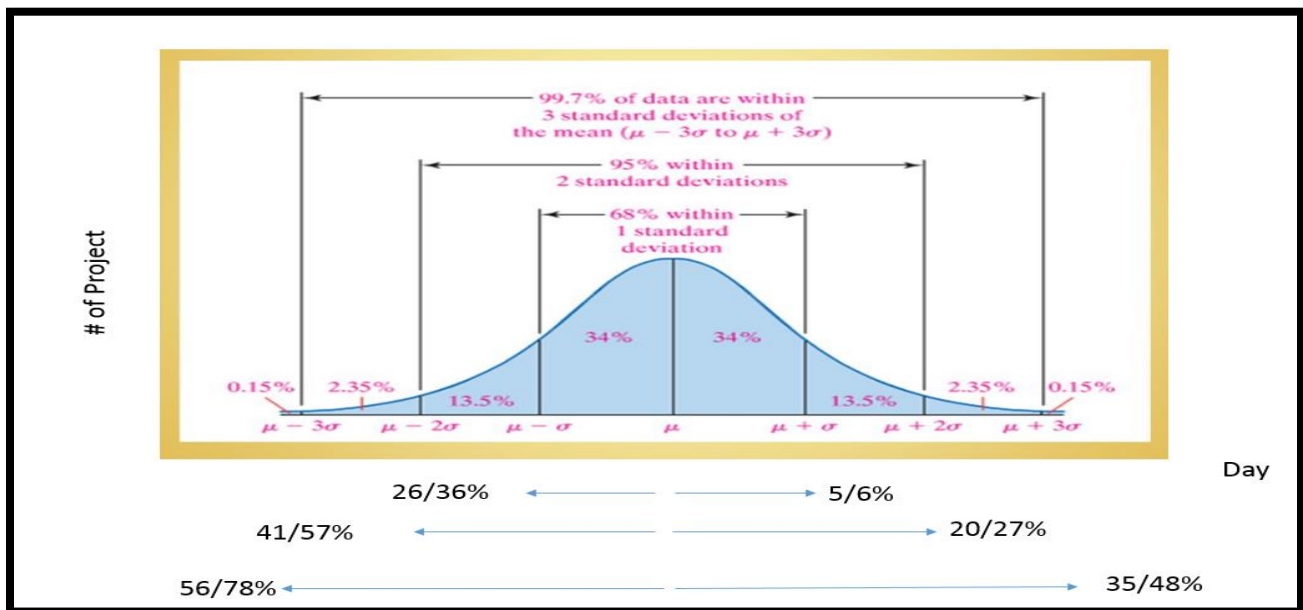
**Chart (CM1) Average day/ % Average day for Cameron Parish**

Chart (CM2) Average cost /% Average cost (2005-2015) for Cameron

Chart (CM3) Average cost / % Average cost (Present Value 2015) for Cameron Parish

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Allen Parish (AL)

	Time		Cost (2005-2015)		Present value 2015	
Average	-10.9		$ (2,026.00)		$ (1,012.00)	
Standared Deviation	22.1		$ 87,118.00		$ 97,125.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-33	11	$ (89,144.00)	$ 85,092.00	$ (98,137.61)	$ 96,113.11
95%	-55	33	$ (176,262.00)	$ 172,210.00	$ (195,262.97)	$ 193,238.47
99.70%	-77	55	$ (263,381.00)	$ 259,328.00	$ (292,388.33)	$ 290,363.83
	% Day Average		% Cost Average		% Average at net present value	
Average	-14%		-1%		-1%	
Standared Deviation	19%		7%		8%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-33%	5%	-8%	6%	-9%	7%
95%	-52%	24%	-15%	13%	-17%	15%
99.70%	-71%	43%	-22%	20%	-25%	23%

TABLE (AL) Normal Distribution and Standard Deviation for Allen Parish
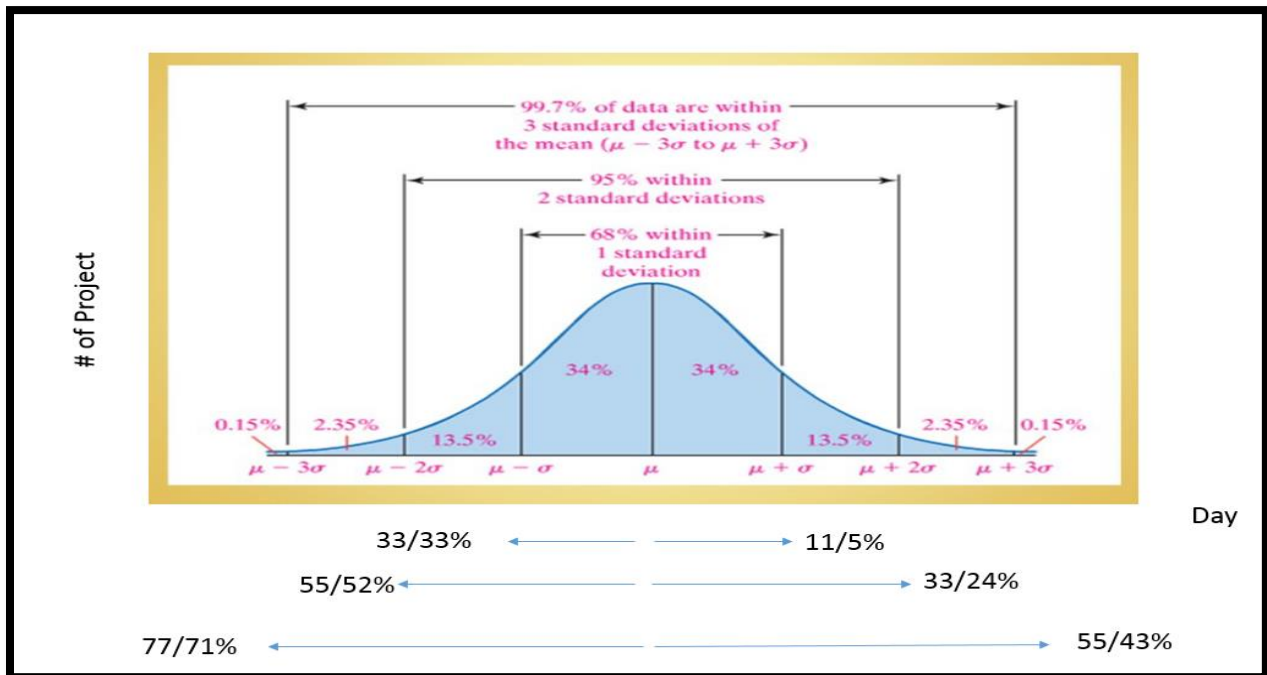

Chart (AL1) Average day/ % Average day for Allen Parish

89,144.00/8% ← → 85,092.00/6%

176,262.00/15% ← → 172,210.00/13%

263,381.00/22% ← → 259,328.00/20%
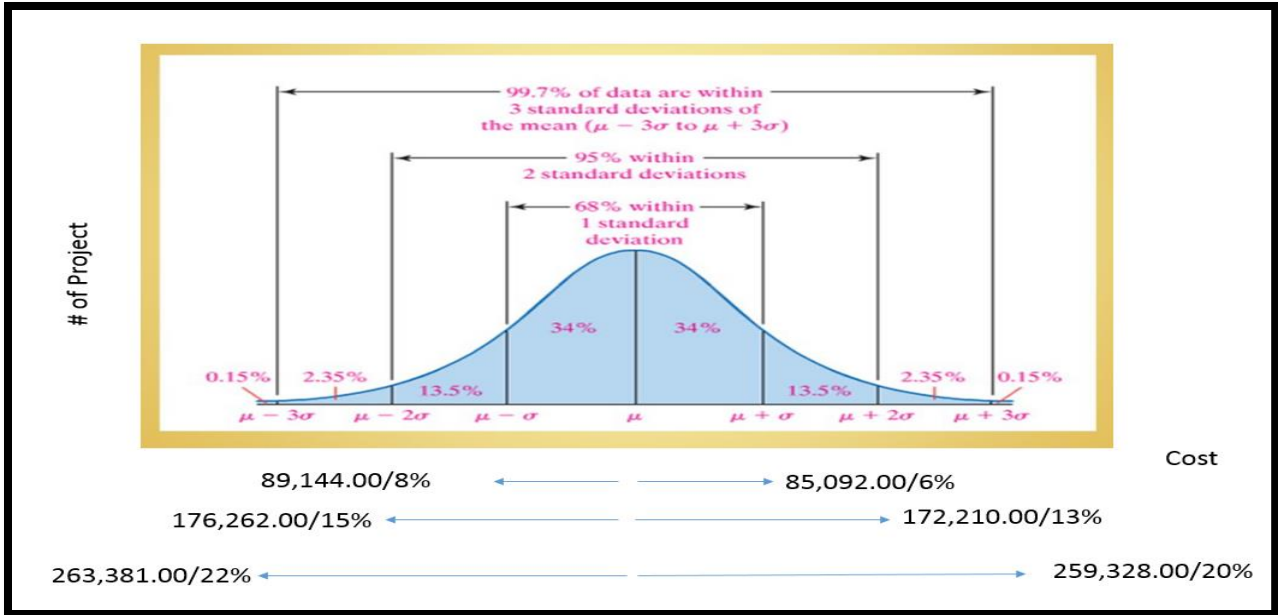
Chart (AL2) Average cost /% Average cost (2005-2015) for Allen Parish

Beauregard Parish (BE)

	Time		Cost (2005-2015)		Present value 2015	
Average	-19.8		$ 70,291.00		$ 85,892.00	
Standared Deviation	22.9		$ 274,087.00		$ 313,941.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-43	3	$ (203,797.00)	$ 344,378.00	$ (228,049.79)	$ 399,832.90
95%	-66	26	$ (477,884.00)	$ 618,465.00	$ (541,991.14)	$ 713,774.25
99.70%	-88	49	$ (751,971.00)	$ 892,552.00	$ (855,932.49)	$ 1,027,715.59
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-28%		1%		1%	
Standared Deviation	22%		10%		11%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-50%	-6%	-9%	11%	-10%	12%
95%	-72%	16%	-19%	21%	-21%	23%
99.70%	-94%	38%	-29%	31%	-32%	34%

**TABLE (BE) Normal Distribution and Standard Deviation for Beauregard Parish**
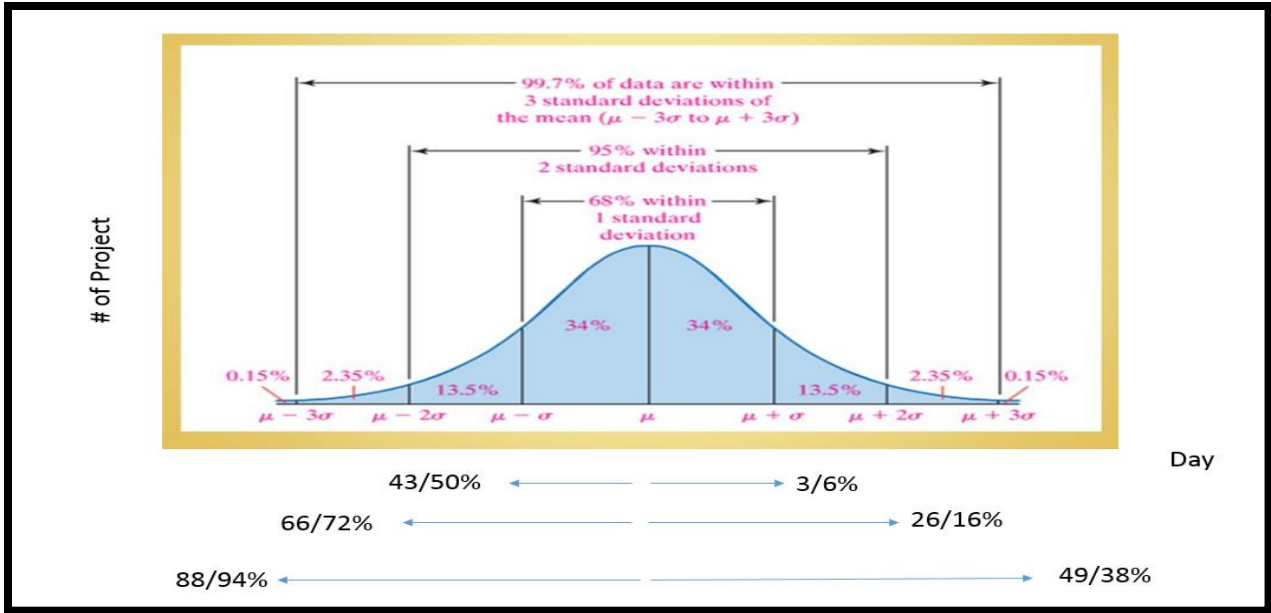
Chart (BE1) Average day/ % Average day for Beauregard Parish
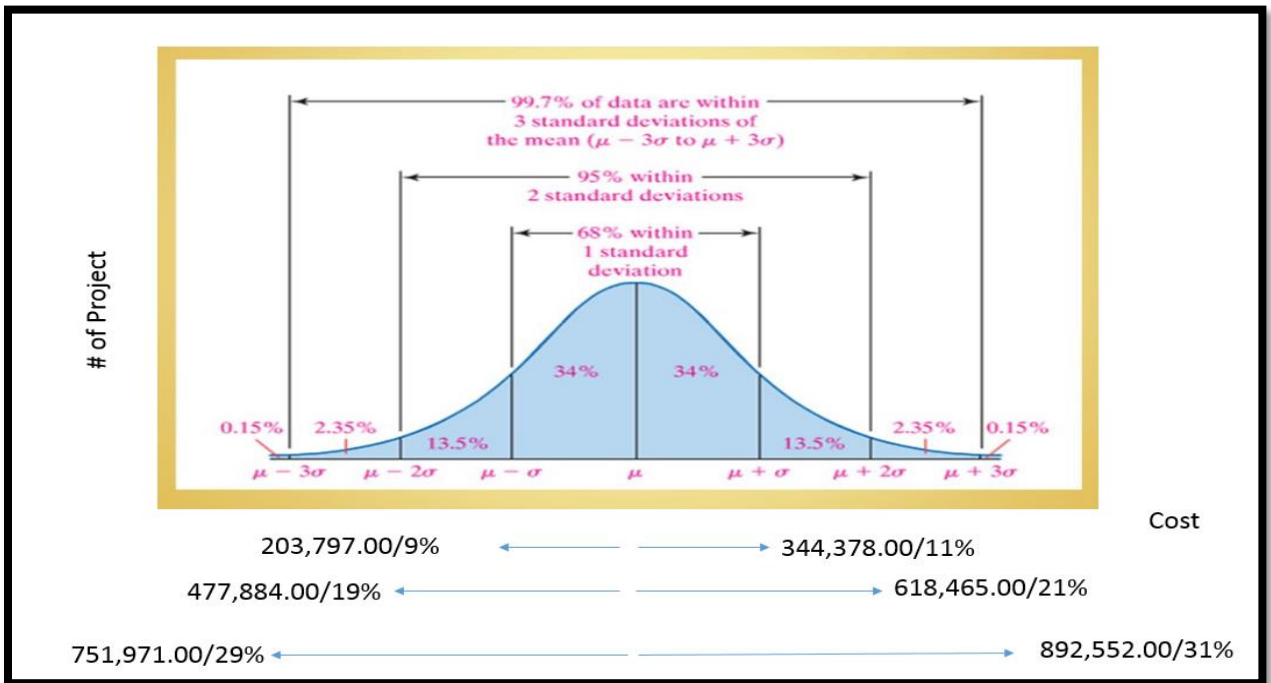
Chart (BE2) Average cost /% Average cost (2005-2015) for Beauregard Parish

Jefferson Davis Parish (JD)

	Time		Cost (2005-2015)		Present value 2015	
Average	-2.8		$ 28,048.00		$ 27,597.00	
Standared Deviation	8.5		$ 293,120.00		$ 305,167.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-11	6	$ (265,072.00)	$ 321,168.00	$ (277,570.79)	$ 332,763.94
95%	-20	14	$ (558,191.00)	$ 614,287.00	$ (582,738.16)	$ 637,931.31
99.70%	-28	23	$ (851,311.00)	$ 907,407.00	$ (887,905.53)	$ 943,098.68
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-6%		-1%		-3%	
Standared Deviation	31%		12%		11%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-37%	25%	-13%	11%	-14%	8%
95%	-68%	56%	-25%	23%	-25%	19%
99.70%	-99%	87%	-37%	35%	-36%	30%

TABLE (JD) Normal Distribution and Standard Deviation for Jefferson Davis Parish
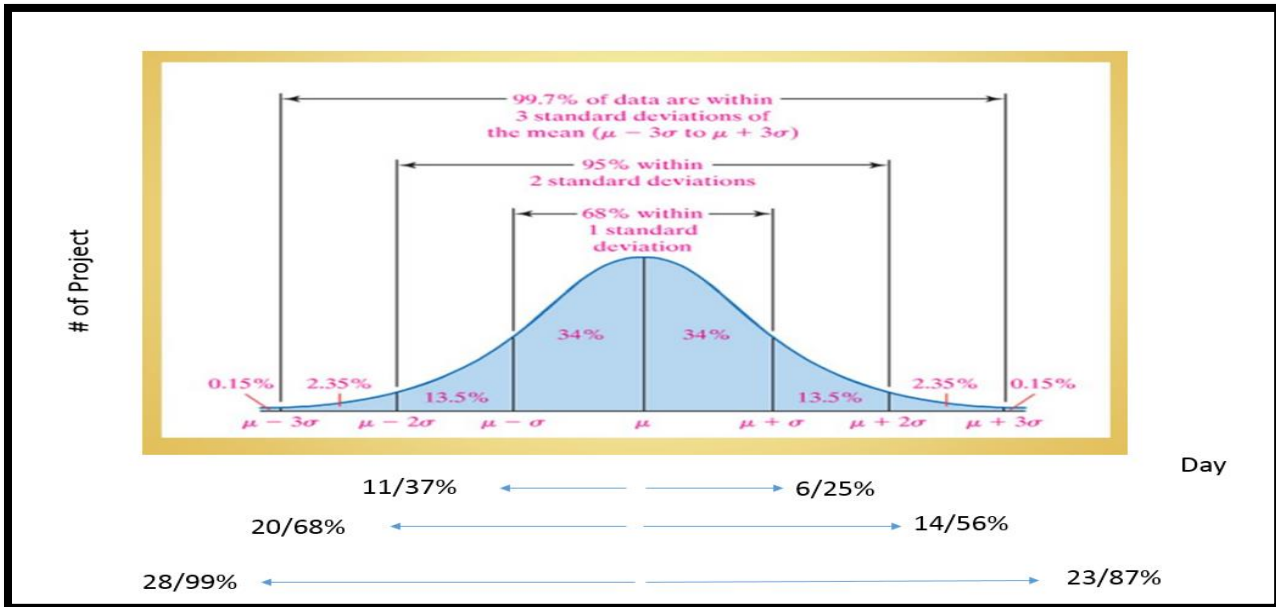
Chart (JD1) Average day/ % Average day for Jefferson Davis Parish
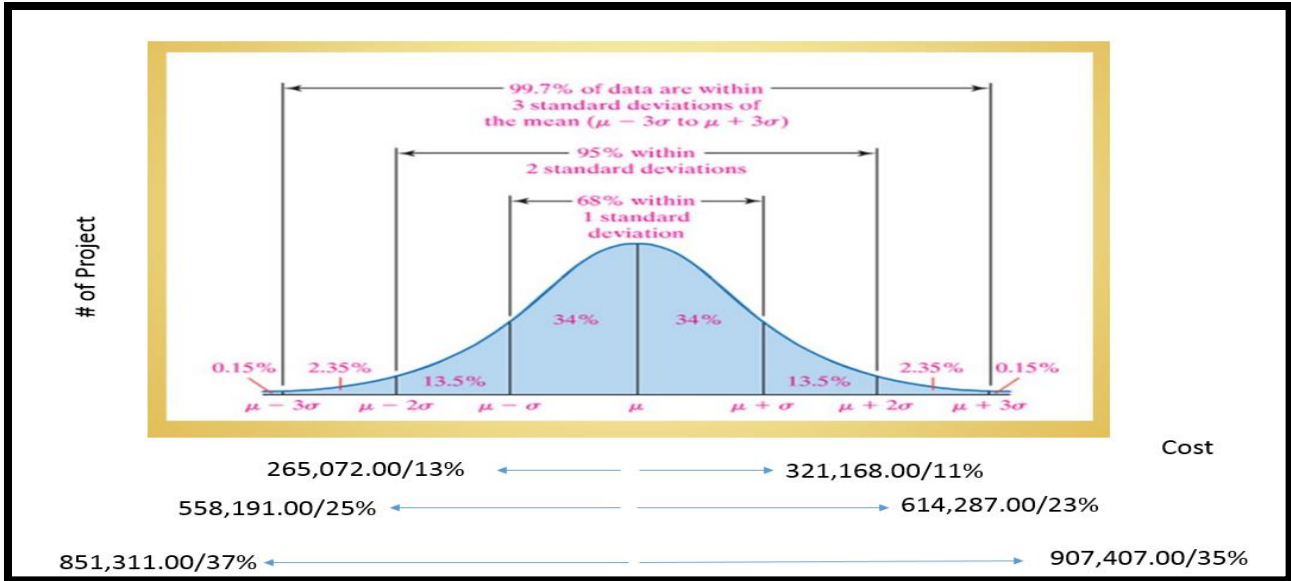
Chart (JD2) Average cost /% Average cost (2005-2015) for Jefferson Davis Parish

Calcasieu Parish (CA)

	Time		Cost (2005-2015)		Present value 2015		
Average	-7.5		$ 253,355.00		$ 300,393.00		
Standared Deviation	18.3		$ 1,122,171.00		$ 1,393,258.00		
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015		
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun		Overrun
68%	-26	11	$ (880,187.00)	$ 1,408,372.00	$ (1,107,688.20)	$	1,733,991.15
95%	-44	29	$ (2,024,466.00)	$ 2,552,652.00	$ (2,528,527.87)	$	3,154,830.83
99.70%	-62	47	$ (3,168,746.00)	$ 3,696,931.00	$ (3,949,367.55)	$	4,575,670.50
	% Day Average		% Cost Average		% Average at net present value		
Average	-15%		4%		4%		
Standared Deviation	26%		12%		14%		
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun	
68%	-41%	11%	-8%	16%	-10%		18%
95%	-67%	37%	-20%	28%	-24%		32%
99.70%	-93%	63%	-32%	40%	-38%		46%

TABLE (CA) Normal Distribution and Standard Deviation for Calcasieu Parish
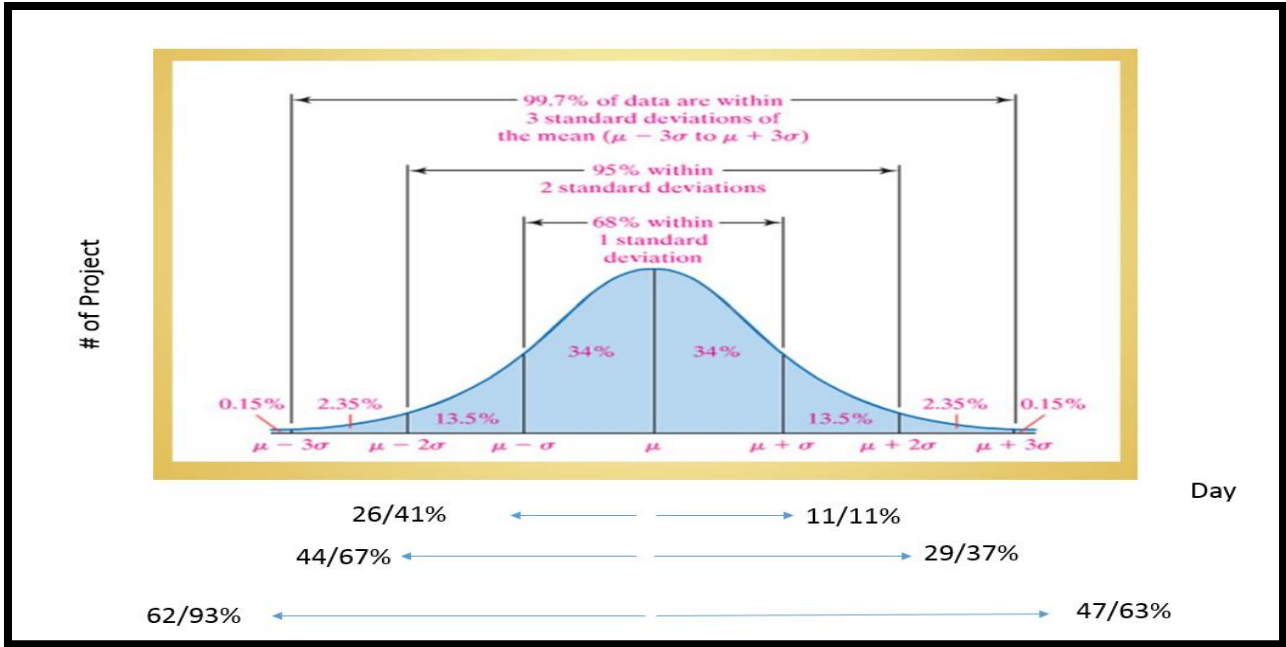
Chart (CA1) Average day/ % Average day for Jefferson Calcasieu Parish
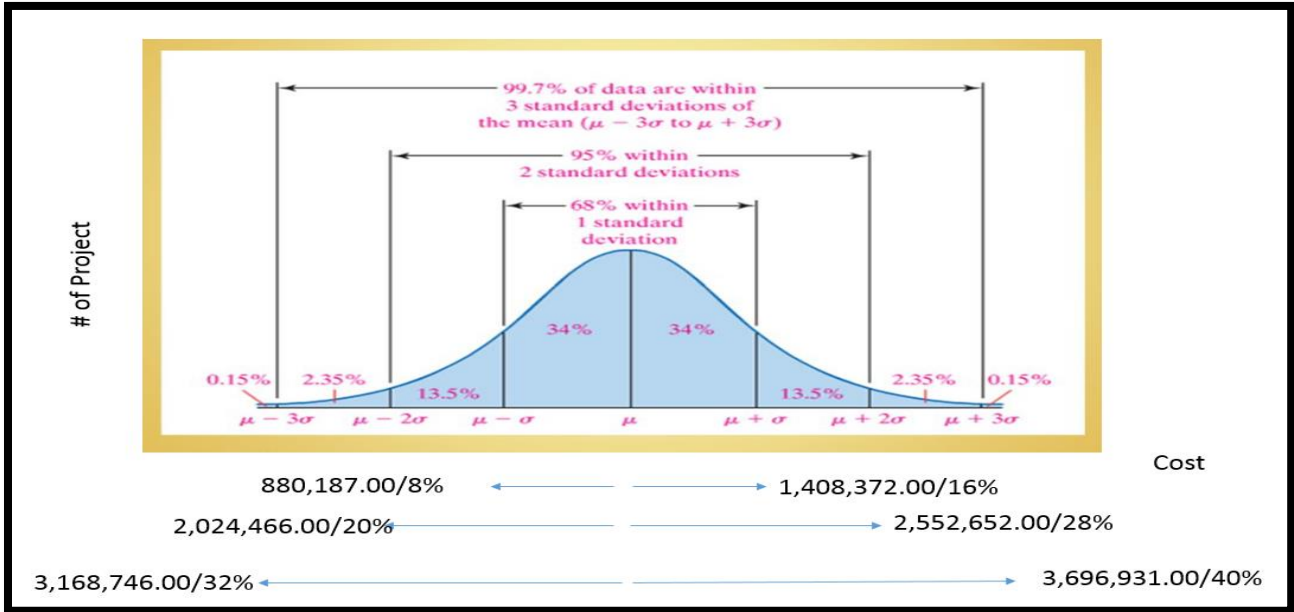
Chart (CA2) Average cost /% Average cost (2005-2015) for Calcasieu Parish

Appendix L

Vernon Parish (VE)

	Time		Cost (2005-2015)		Present value 2015	
Average	-17.4		$ 89,598.00		$ 101,698.00	
Standared Deviation	24.4		$ 426,895.00		$ 483,019.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-42	7	$ (337,297.00)	$ 516,492.00	$ (381,321.32)	$ 584,717.31
95%	-66	31	$ (764,192.00)	$ 943,387.00	$ (864,340.63)	$ 1,067,736.62
99.70%	-91	56	$ (1,191,086.00)	$ 1,370,282.00	$ (1,347,359.94)	$ 1,550,755.93
	% Day Average		% Cost Average		% Average at net present value	
Average	-21%		0%		0%	
Standared Deviation	21%		7%		9%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-42%	0%	-7%	7%	-9%	9%
95%	-63%	21%	-14%	14%	-18%	18%
99.70%	-84%	42%	-21%	21%	-27%	27%

TABLE (VE) Normal Distribution and Standard Deviation for Vernon Parish
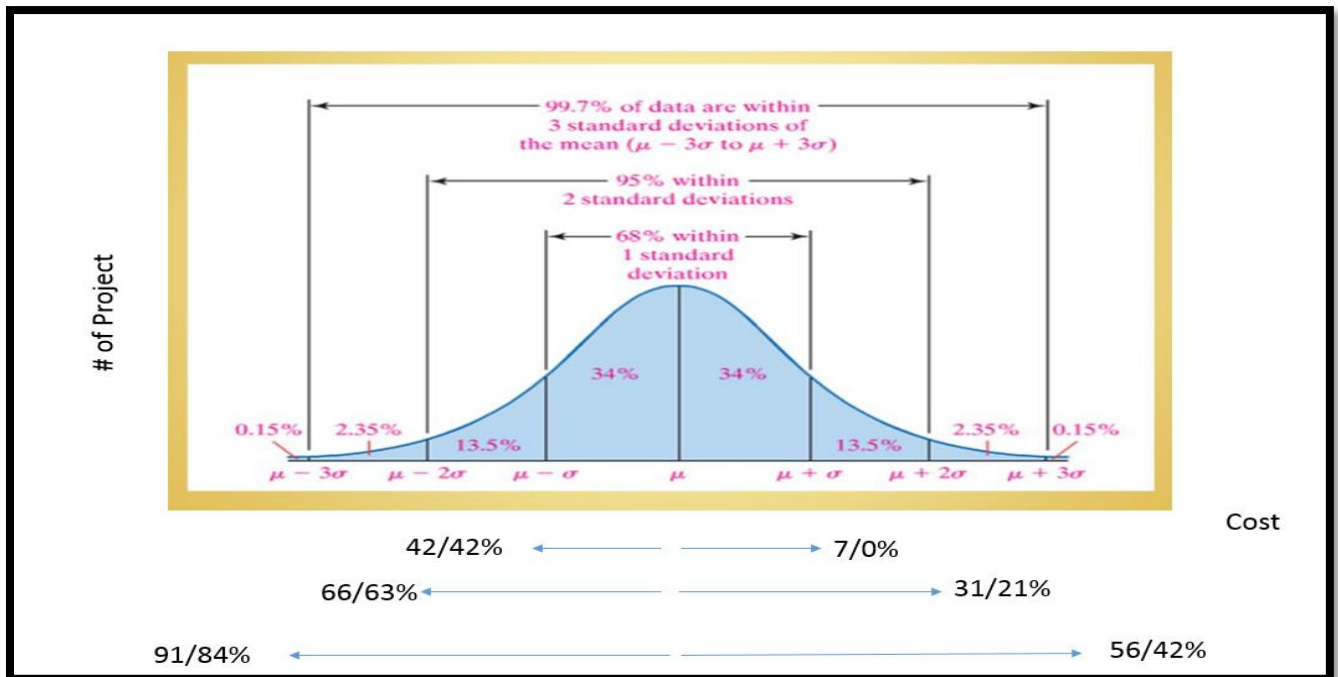
Chart (VE1) Average day/ % Average day for Vernon Parish

99.7% of data are within
3 standard deviations of
the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)

95% within
2 standard deviations

68% within
1 standard
deviation

34%   34%

0.15%   2.35%   13.5%   13.5%   2.35%   0.15%

$\mu - 3\sigma$ $\mu - 2\sigma$ $\mu - \sigma$ μ $\mu + \sigma$ $\mu + 2\sigma$ $\mu + 3\sigma$

# of Project

Cost

337,297.00/7% ← → 516,492.00/7%

764,192.00/14% ← → 943,387.00/14%

1,191,086.00/21% ← → 1,370,282.00/21%
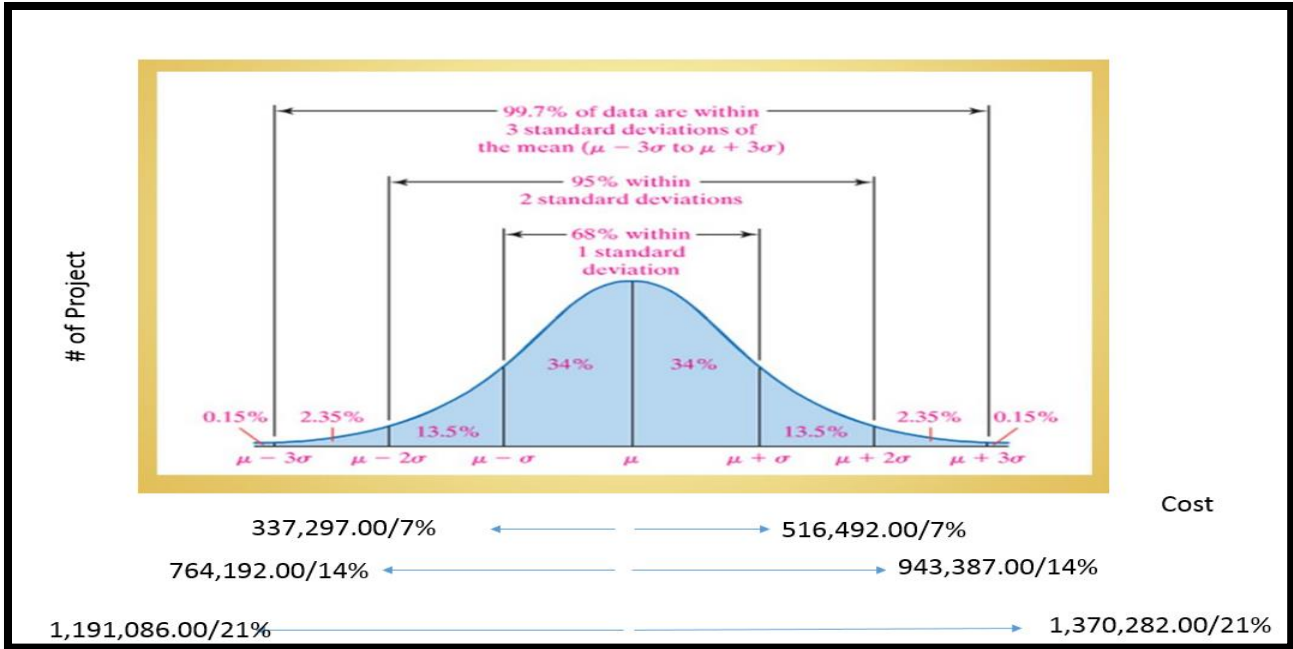
Chart (VE2) Average cost /% Average cost (2005-2015) for Vernon Parish

Winn Parish (WN)

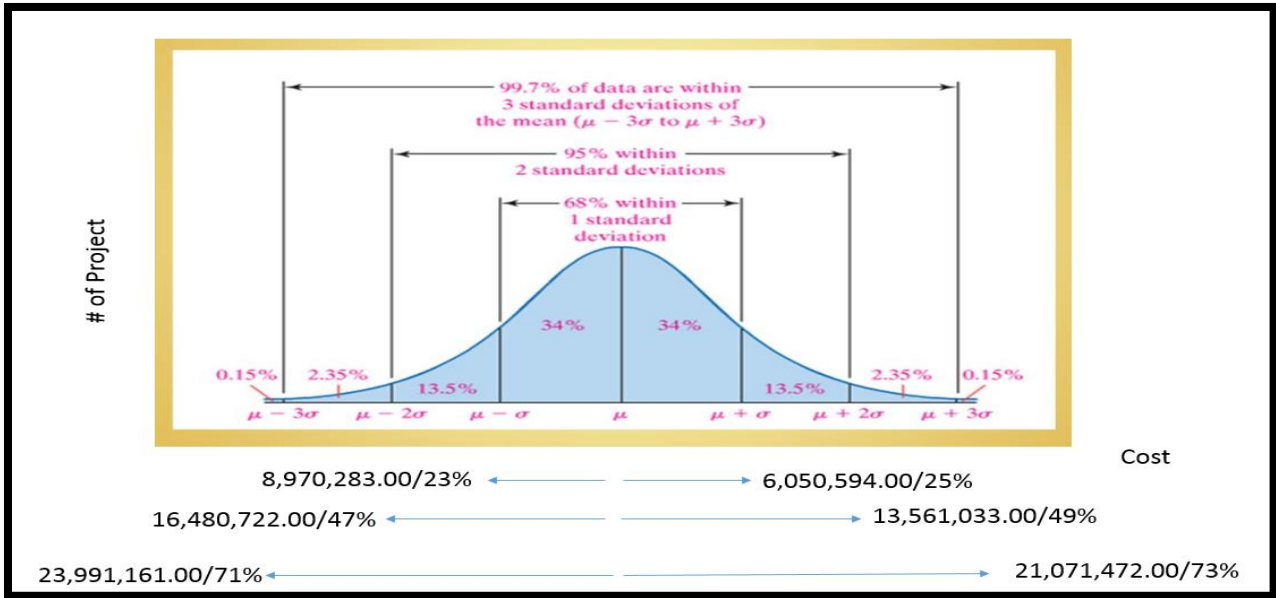|	Time		Cost (2005-2015)		Present value 2015	
Average	-11.6		$ 82,731.00		$ (1,684.00)	
Standared Deviation	12.2		$ 432,469.00		$ 72,214.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-24	1	$ (66,641.00)	$ 64,353.00	$ (73,897.94)	$ 70,530.92
95%	-36	13	$ (132,138.00)	$ 129,850.00	$ (146,112.37)	$ 142,745.35
99.70%	-48	25	$ (197,635.00)	$ 195,347.00	$ (218,326.79)	$ 214,959.77
	% Day Average		*% Cost Average*		*% Average at net present value*	
Average	-20%		-2%		-2%	
Standared Deviation	23%		11%		13%	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-43%	3%	-13%	9%	-15%	11%
95%	-66%	26%	-24%	20%	-28%	24%
99.70%	-89%	49%	-35%	31%	-41%	37%

TABLE (WN1) Normal Distribution and Standard Deviation for Winn Parish
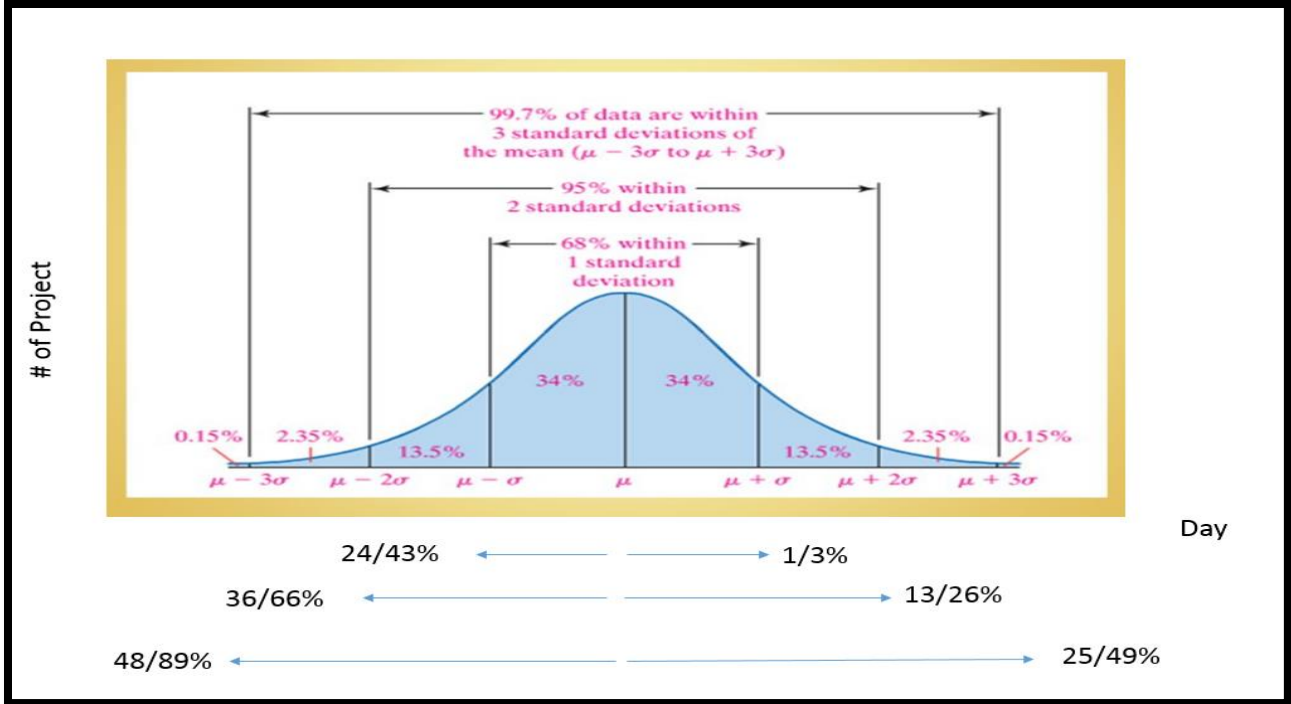
Chart (WN1) Average day/ % Average day for Winn Parish
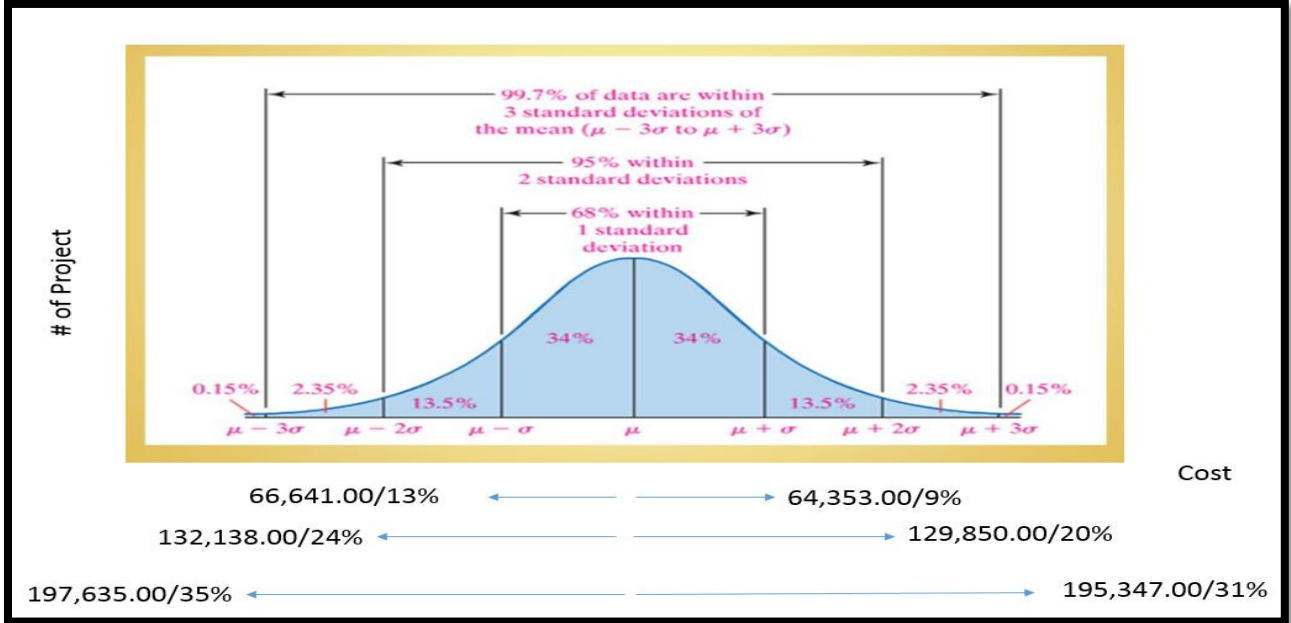
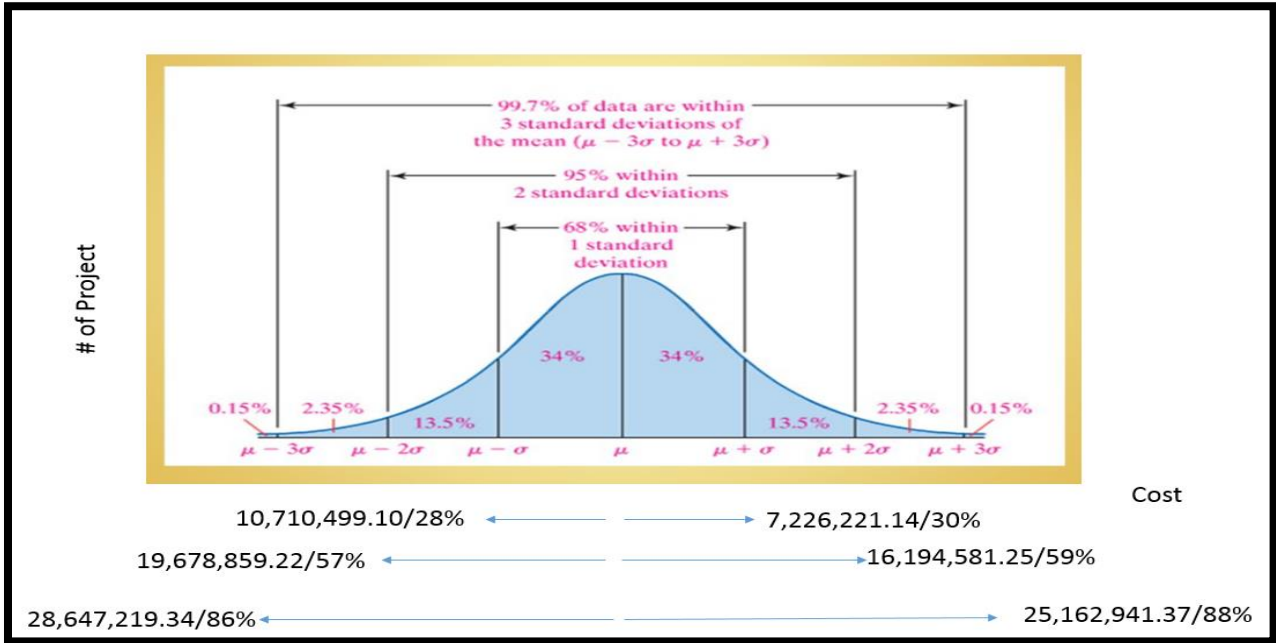**Chart (WN2) Average cost /% Average cost (2005-2015) for Winn Parish**

Natchitoches Parish (NC)

	Time		Cost (2005-2015)		Present value 2015	
Average	-15.7		$ 24,305.00		$ 24,537.00	
Standared Deviation	27.5		$ 179,739.00		$ 187,585.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-43	12	$ (155,434.00)	$ 204,044.00	$ (163,048.31)	$ 212,121.79
95%	-71	39	$ (335,173.00)	$ 383,783.00	$ (350,633.37)	$ 399,706.84
99.70%	-98	67	$ (514,912.00)	$ 563,522.00	$ (538,218.42)	$ 587,291.90
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-23%		0%		0%	
Standared Deviation	20%		5%		6%	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-43%	-3%	-5%	5%	-6%	6%
95%	-63%	17%	-10%	10%	-12%	12%
99.70%	-83%	37%	-15%	15%	-18%	18%

TABLE (NC) Normal Distribution and Standard Deviation for Natchitoches Parish
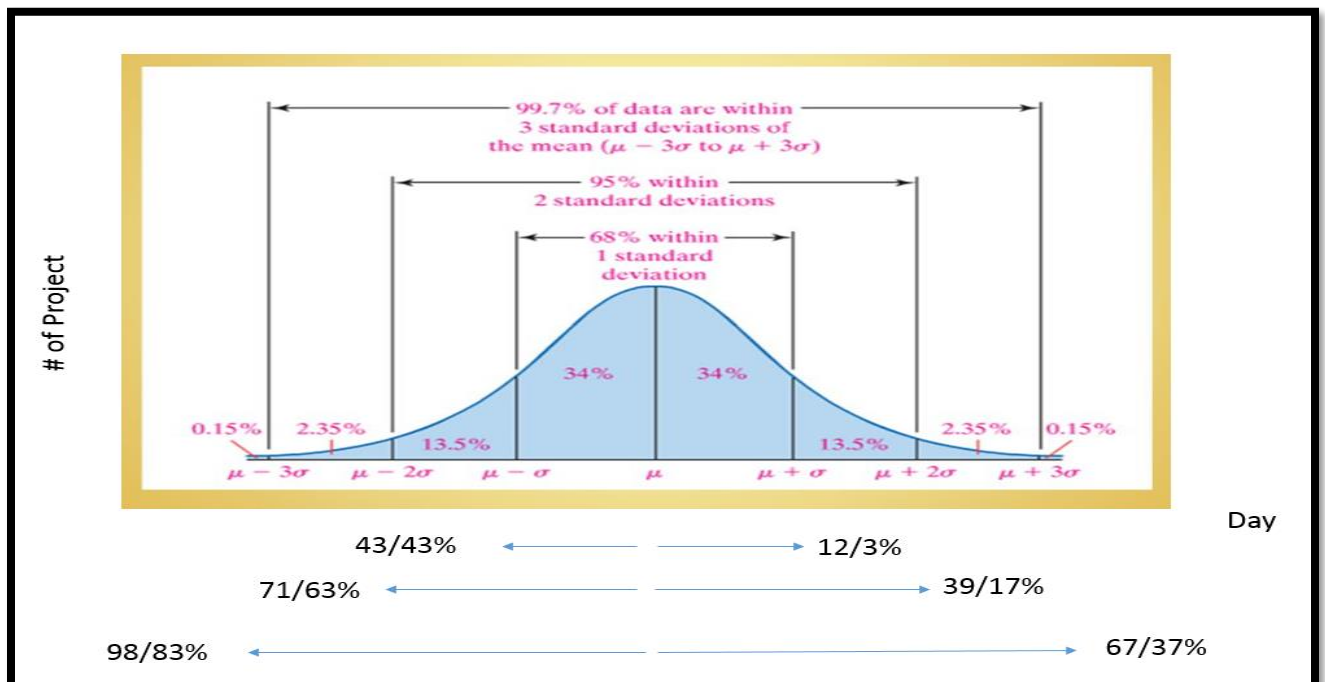
Chart (NC1) Average day/ % Average day for Natchitoches Parish

155,434.00/5% ←——————→ 204,044.00/5%

335,173.00/10% ←——————→ 383,783.00/10%

514,912.00/15% ←——————————→ 563,522.00/15%
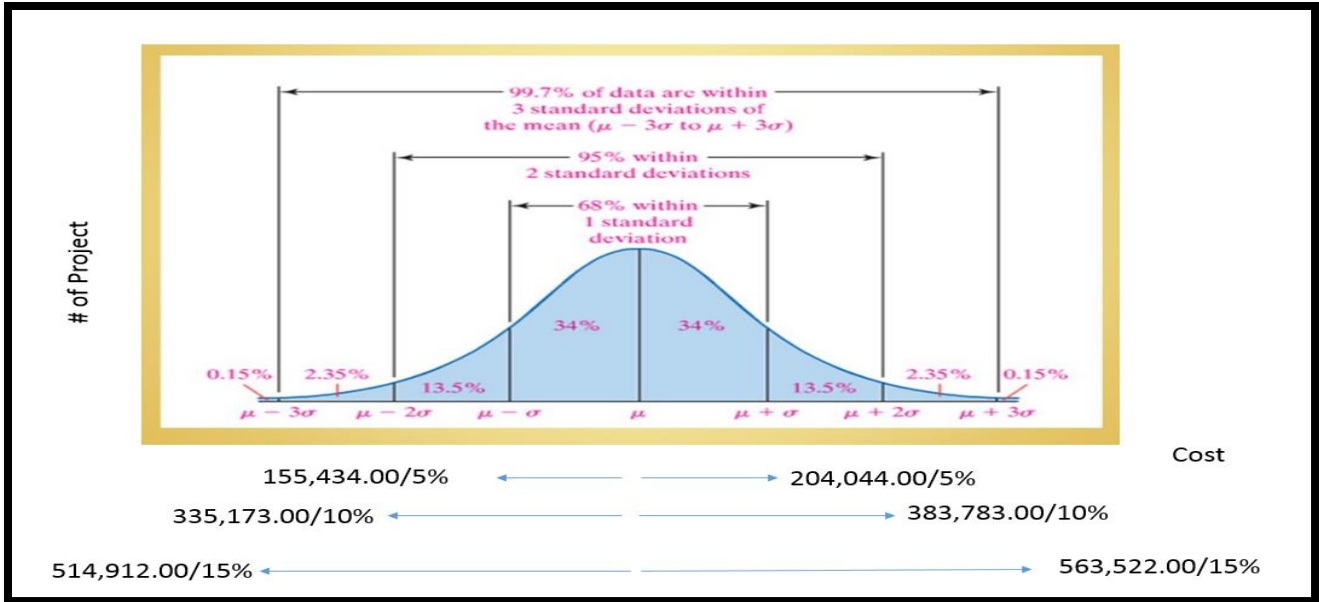
Chart (NC2) Average cost /% Average cost (2005-2015) for Natchitoches Parish

Grant Parish (GR)

	Time		Cost (2005-2015)		Present value 2015	
Average	-10.9		$ (29,886.00)		$ (38,906.00)	
Standared Deviation	13.4		$ (132,394.00)		$ 156,023.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-24	2	$ (162,279.00)	$ 102,508.00	$ (194,928.93)	$ 117,116.84
95%	-38	16	$ (294,673.00)	$ 234,901.00	$ (350,951.81)	$ 273,139.73
99.70%	-51	29	$ (427,067.00)	$ 367,295.00	$ (506,974.70)	$ 429,162.61
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-20%		-2%		-2%	
Standared Deviation	24%		8%		9%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-44%	4%	-10%	6%	-11%	7%
95%	-68%	28%	-18%	14%	-20%	16%
99.70%	-92%	52%	-26%	22%	-29%	25%

TABLE (GR) Normal Distribution and Standard Deviation for Grant Parish
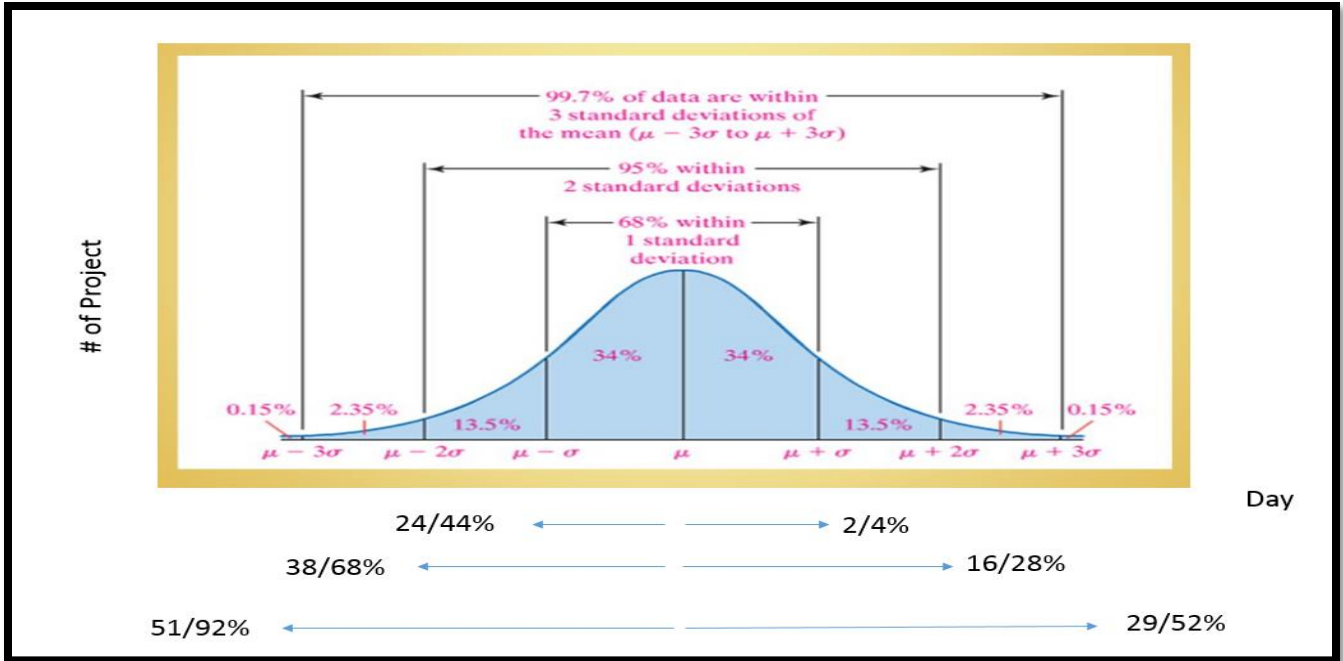
Chart (GR1) Average day/ % Average day for Grant Parish
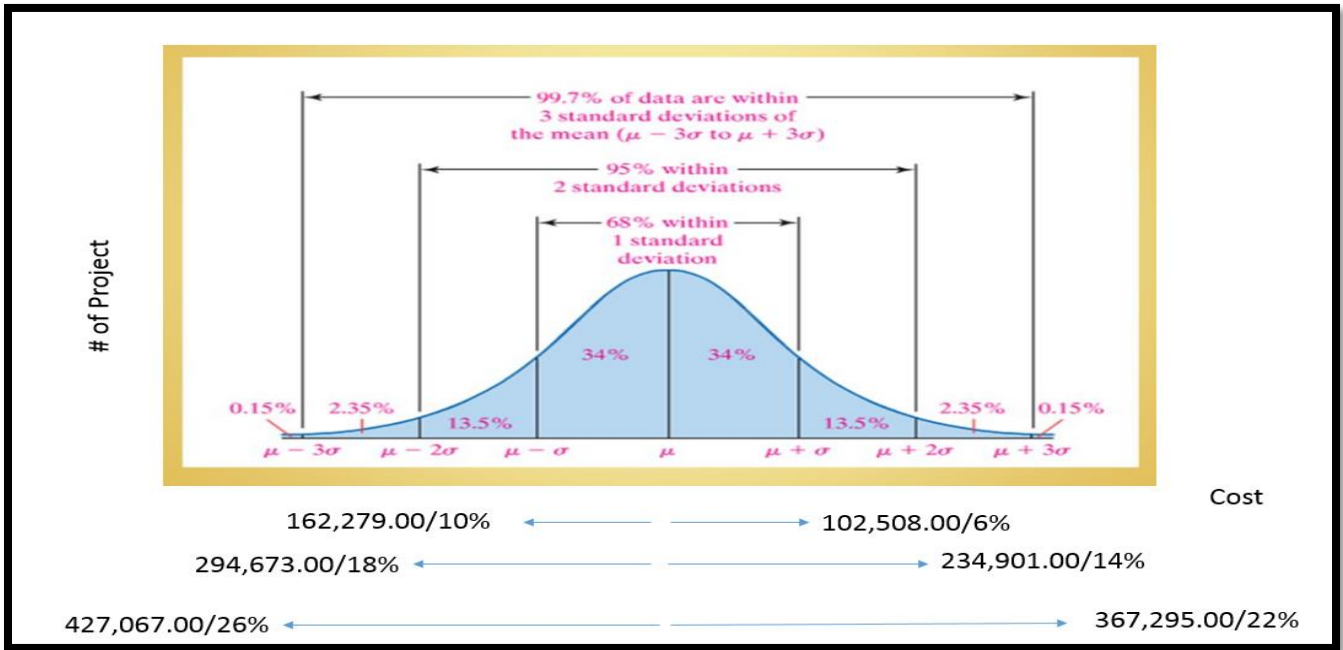
Chart (GR2) Average cost /% Average cost (2005-2015) for Grant Parish

Rapides Parish (RA)

	Time		Cost (2005-2015)		Present value 2015	
Average	-13.7		$ 1,530.00		$ 7,194.00	
Standared Deviation	17.6		$ 200,004.00		$ 234,834.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-31	4	$ (198,474.00)	$ 201,534.00	$ (244,007.42)	$ 239,015.46
95%	-49	21	$ (398,478.00)	$ 401,538.00	$ (485,518.87)	$ 480,526.90
99.70%	-66	39	$ (598,482.00)	$ 601,542.00	$ (727,020.31)	$ 722,038.34
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-23%		1%		1%	
Standard Deviation	21%		9%		10%	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-44%	-2%	-8%	10%	-9%	11%
95%	-65%	19%	-17%	19%	-19%	21%
99.70%	-86%	40%	-26%	28%	-29%	31%

TABLE (RA) Normal Distribution and Standard Deviation for Rapides Parish
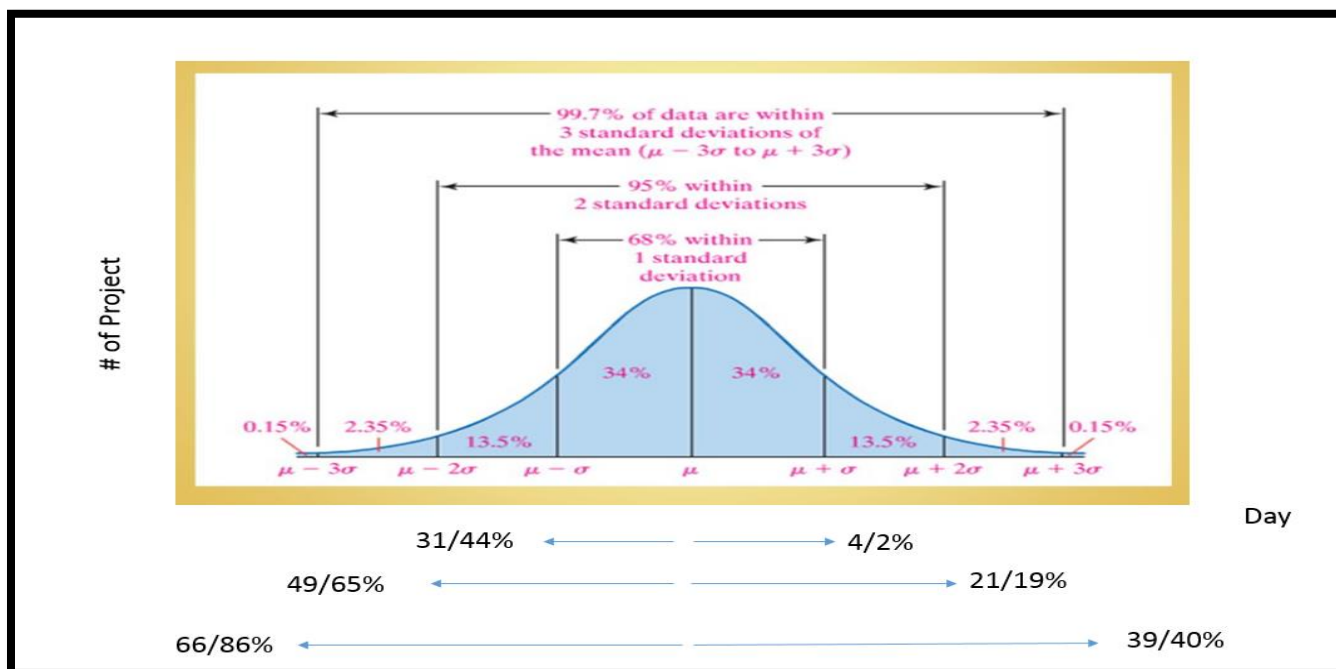
**Chart (RA1) Average day/ % Average day for Rapides Parish**
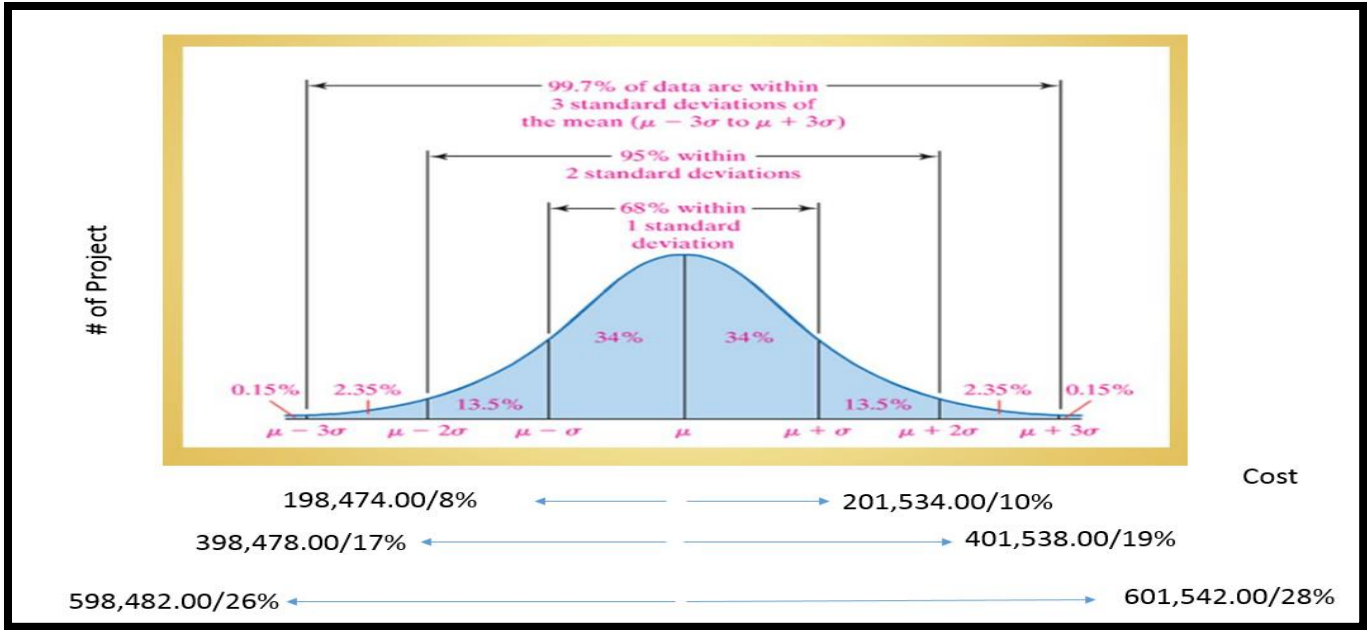
Chart (RA2) Average cost /% Average cost (2005-2015) for Rapides Parish

Avoyelles Parish (AV)

	Time		Cost (2005-2015)		Present value 2015	
Average	-5.4		$ 37,427.00		$ (48,453.00)	
Standared Deviation	8.8		$ 119,178.00		$ 146,886.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-14	3	$ (156,606.00)	$ 81,751.00	$ (195,338.87)	$ 98,432.38
95%	-23	12	$ (275,784.00)	$ 200,929.00	$ (342,224.49)	$ 245,318.00
99.70%	-32	21	$ (394,962.00)	$ 320,108.00	$ (489,110.12)	$ 392,203.62
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-4%		-3%		-4%	
Standared Deviation	32%		10%		11%	
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**	**Overrun**
68%	-36%	28%	-13%	7%	-15%	7%
95%	-68%	60%	-23%	17%	-26%	18%
99.70%	-100%	92%	-33%	27%	-37%	29%

TABLE (AV) Normal Distribution and Standard Deviation for Avoyelles Parish
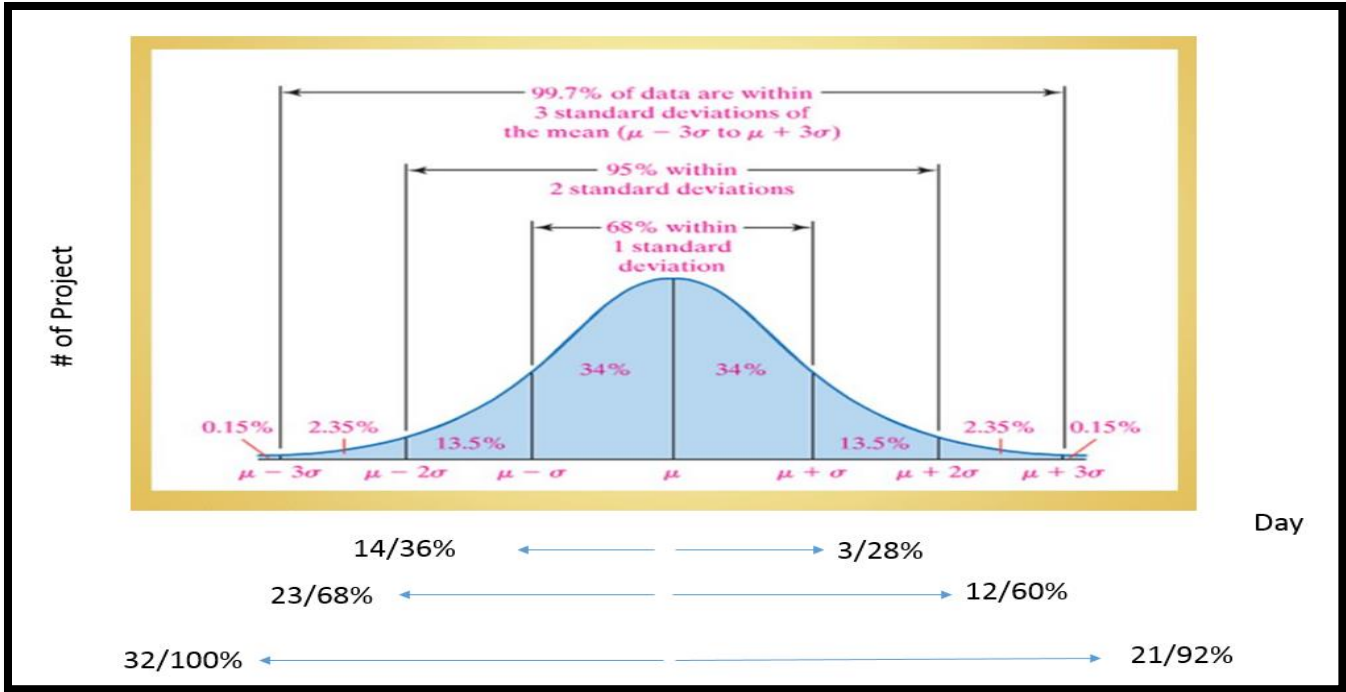
Chart (AV1) Average day/ % Average day for Avoyelles Parish
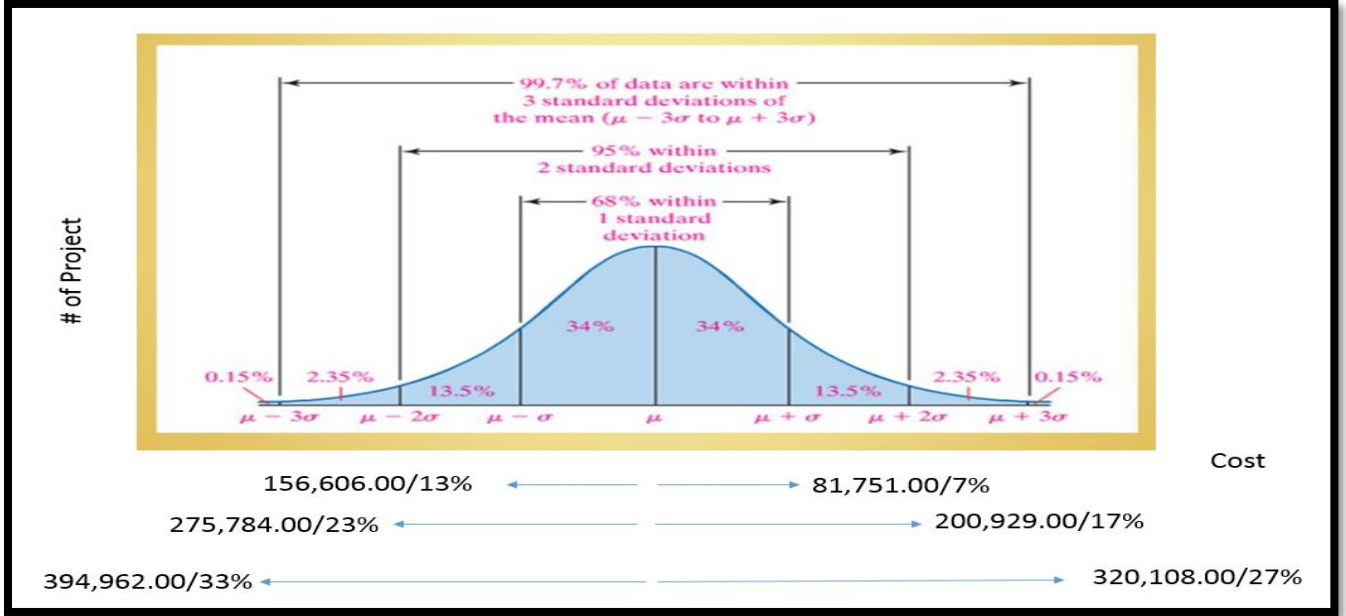
Chart (VA2) Average cost /% Average cost (2005-2015) for Avoyelles Parish

Appendix M

District 58 Parishes

Franklin Parish (FK)

	Time		Cost (2005-2015)		Present value 2015	
Average	-9.4		$ 41,298.00		$ 49,012.00	
Standard Deviation	16.6		$ 143,461.00		$ 168,550.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-26	7	$ (102,163.00)	$ 184,759.00	$ (119,538.53)	$ 217,562.10
95%	-43	24	$ (245,624.00)	$ 328,219.00	$ (288,088.85)	$ 386,112.41
99.70%	-59	40	$ (389,085.00)	$ 4,721,680.00	$ (456,639.17)	$ 554,662.73
	% Day Average		% Cost Average		% Average at net present value	
Average	-20%		2%		3%	
Standard Deviation	24%		9%		10%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-44%	4%	-7%	11%	-7%	13%
95%	-68%	28%	-16%	20%	-17%	23%
99.70%	-92%	52%	-25%	29%	-27%	33%

TABLE (FK) Normal Distribution and Standard Deviation for Franklin Parish
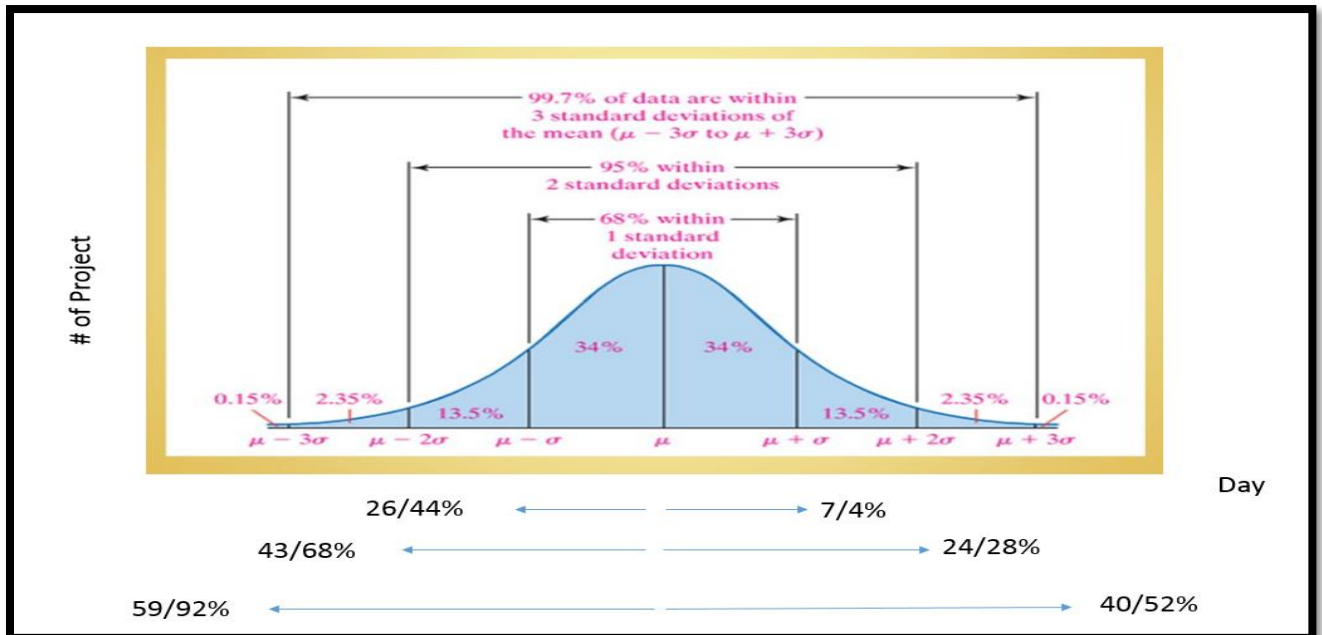
Chart (FK1) Average day/ % Average day for Franklin Parish
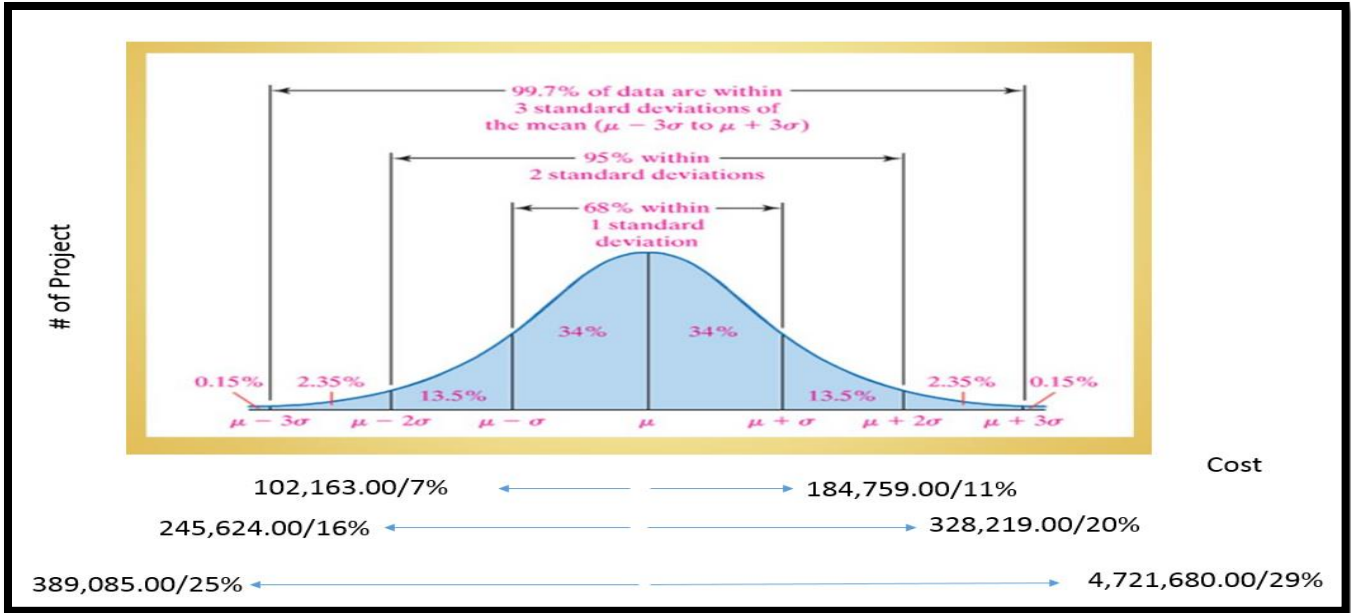
Chart (FK2) Average cost /% Average cost (2005-2015) for Franklin Parish

Tensas Parish (TS)

	Time		Cost (2005-2015)		Present value 2015	
Average	-13		$ 8,766.00		$ 8,374.00	
Standared Deviation	20.5		$ 72,272.00		$ 84,683.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-34	7	$ (63,506.00)	$ 81,038.00	$ (76,308.89)	$ 93,056.83
95%	-54	28	$ (135,778.00)	$ 153,310.00	$ (160,991.75)	$ 177,739.69
99.70%	-75	49	$ (208,050.00)	$ 225,582.00	$ (245,674.61)	$ 262,422.54
	% Day Average		% Cost Average		% Average at net present value	
Average	-21%		0%		0%	
Standared Deviation	26%		7%		8%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-47%	5%	-7%	7%	-8%	8%
95%	-73%	31%	-14%	14%	-16%	16%
99.70%	-99%	57%	-21%	21%	-24%	24%

TABLE (TS) Normal Distribution and Standard Deviation for Tensas Parish
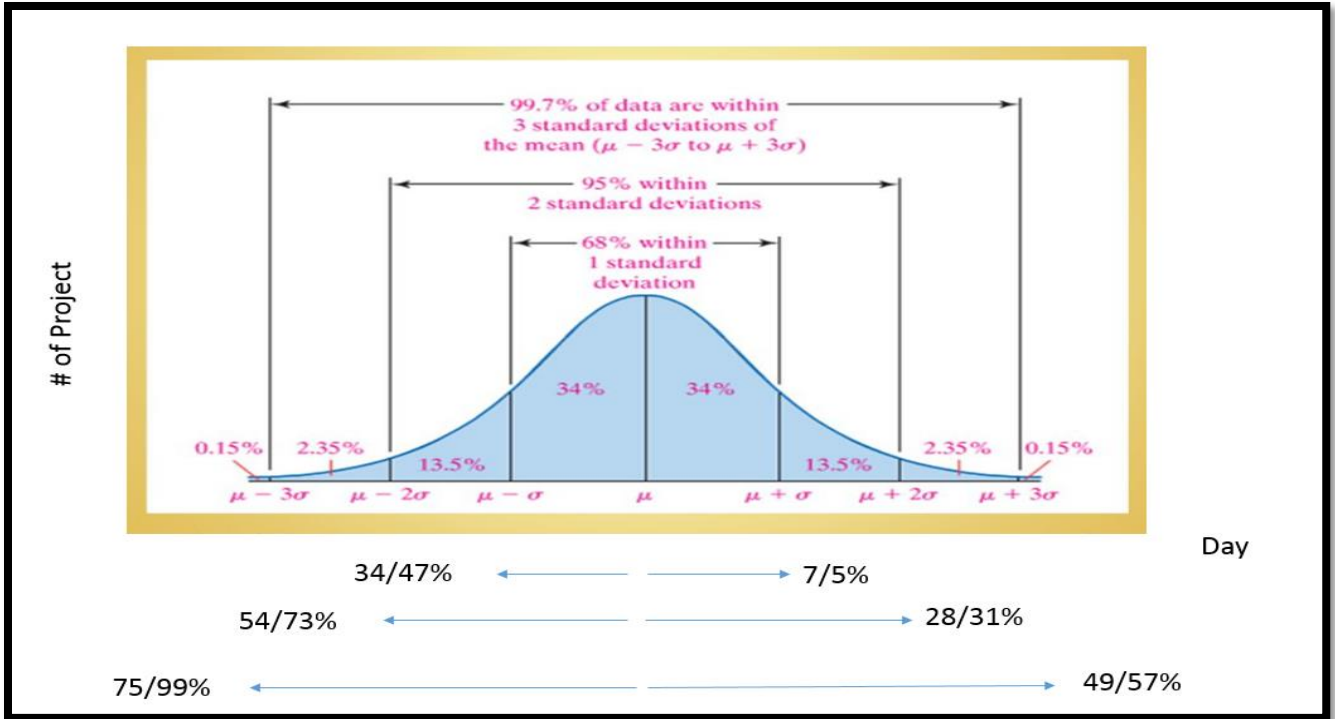
Chart (TS1) Average day/ % Average day for Tensas Parish
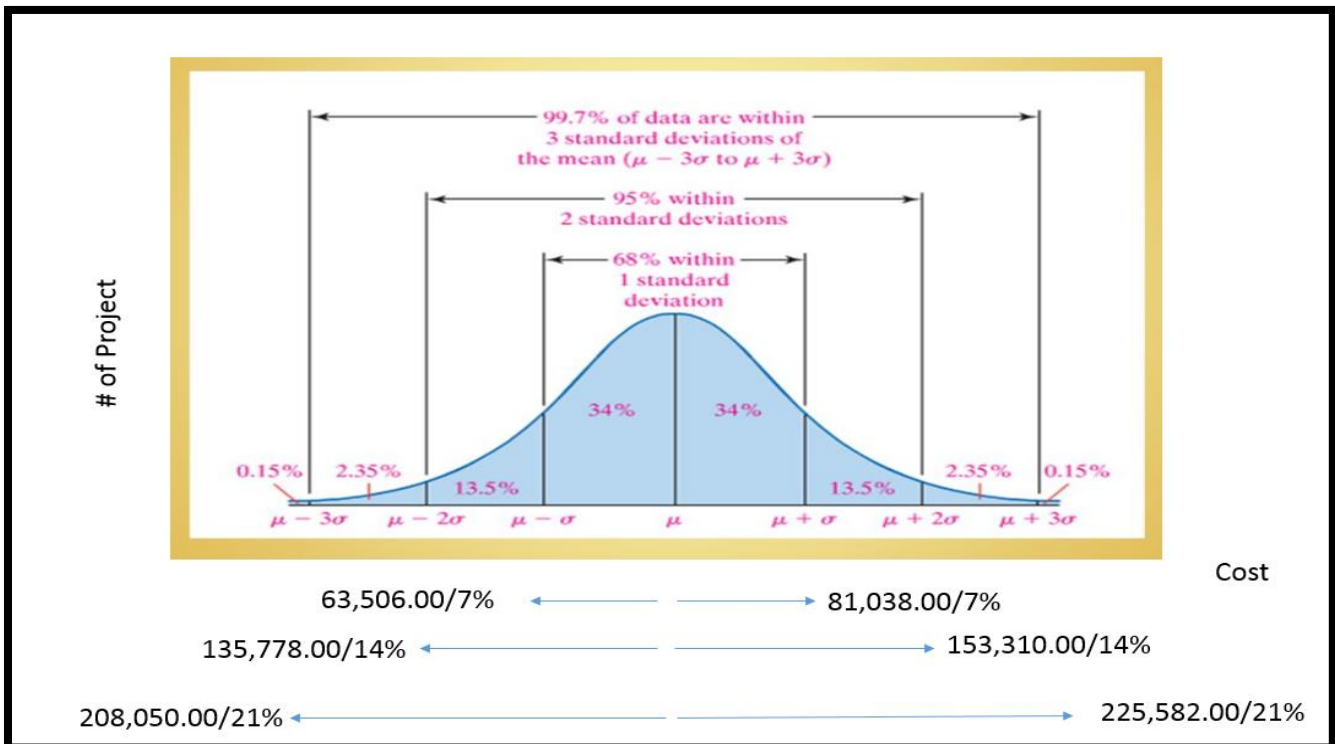
Chart (TS2) Average cost /% Average cost (2005-2015) for Tensas Parish

Concordia Parish (CO)

	Time		Cost (2005-2015)		Present value 2015	
Average	-12.5		$ 8,766.00		$ 8,374.00	
Standard Deviation	14.7		$ 72,272.00		$ 84,683.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-27	2	$ (31,479.00)	$ 80,444.00	$ (34,371.21)	$ 87,960.01
95%	-42	42	$ (87,441.00)	$ 136,406.00	$ (95,536.83)	$ 149,125.62
99.70%	-57	32	$ (143,403.00)	$ 192,368.00	$ (156,702.44)	$ 210,291.24
	% Day Average		*% Cost Average*		*% Average at net present value*	
Average	-21%		1%		1%	
Standard Deviation	23%		6%		6%	
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*
68%	-44%	2%	-5%	7%	-5%	7%
95%	-67%	25%	-11%	13%	-11%	13%
99.70%	-90%	48%	-17%	19%	-17%	19%

TABLE (CO) Normal Distribution and Standard Deviation for Concordia Parish
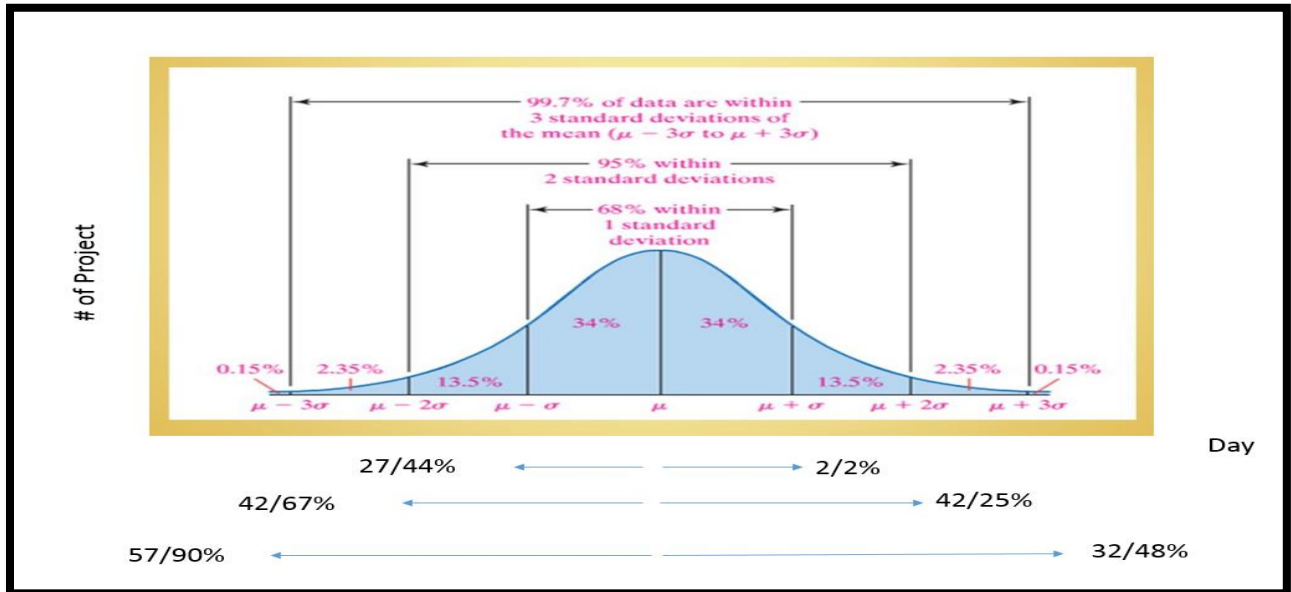
Chart (CO1) Average day/ % Average day for Concordia Parish

99.7% of data are within
3 standard deviations of
the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)

95% within
2 standard deviations

68% within
1 standard
deviation

# of Project

34%   34%

0.15%   2.35%   13.5%   13.5%   2.35%   0.15%

$\mu - 3\sigma$ $\mu - 2\sigma$ $\mu - \sigma$ μ $\mu + \sigma$ $\mu + 2\sigma$ $\mu + 3\sigma$

Cost

31,479.00/5%   →   80,444.00/7%

87,441.00/11%   ←   136,406.00/13%

143,403.00/17%   ←   192,368.00/19%
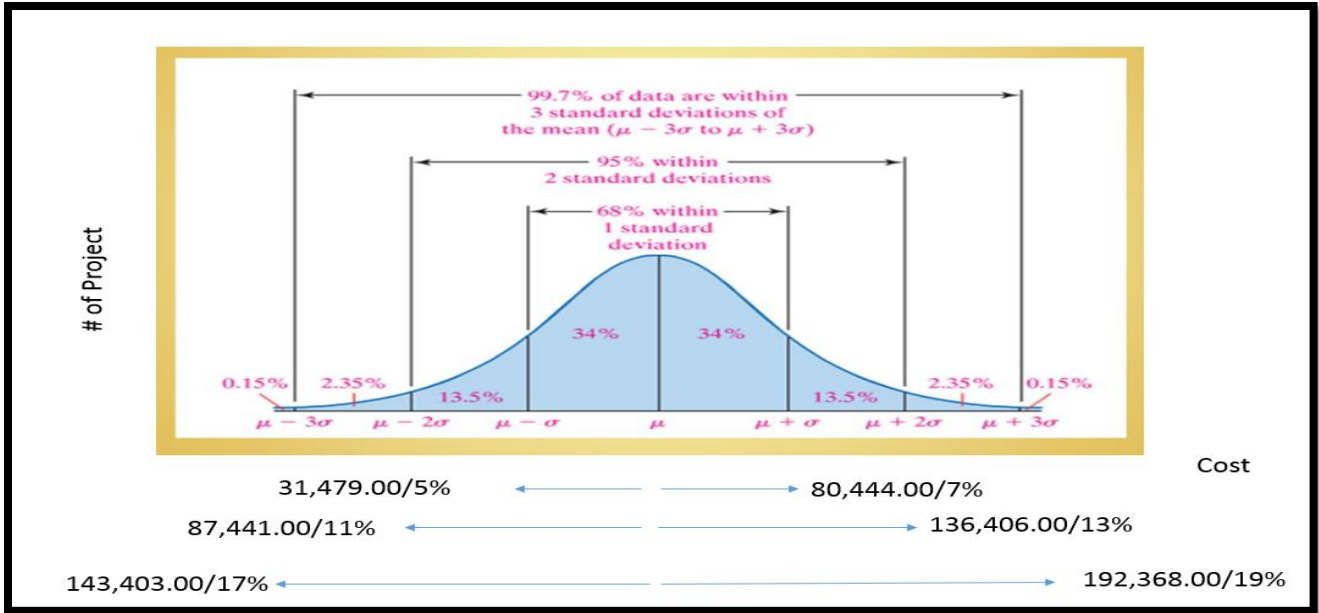
Chart (CO2) Average cost /% Average cost (2005-2015) for Concordia Parish

Caldwell Parish (CW)

	Time	Cost (2005-2015)		Present value 2015	
Average	-12	$ 448,135.00		$ 513,076.00	
Standared Deviation	12.2	$ 1,716,972.00		$ 1,990,252.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-24	0	$ (1,268,837.00)	$ 2,165,107.00	$ (1,477,175.62)	$ 2,503,328.23
95%	-36	12	$ (2,985,810.00)	$ 3,882,079.00	$ (3,467,427.55)	$ 4,493,580.16
99.70%	-48	25	$ (4,702,782.00)	$ 5,599,052.00	$ (5,457,679.48)	$ 6,483,832.09
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-21%		3%		3%	
Standared Deviation	22%		11%		12%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-43%	1%	-8%	14%	-9%	15%
95%	-65%	23%	-19%	25%	-21%	27%
99.70%	-87%	45%	-30%	36%	-33%	39%

TABLE (CW) Normal Distribution and Standard Deviation for Caldwell Parish
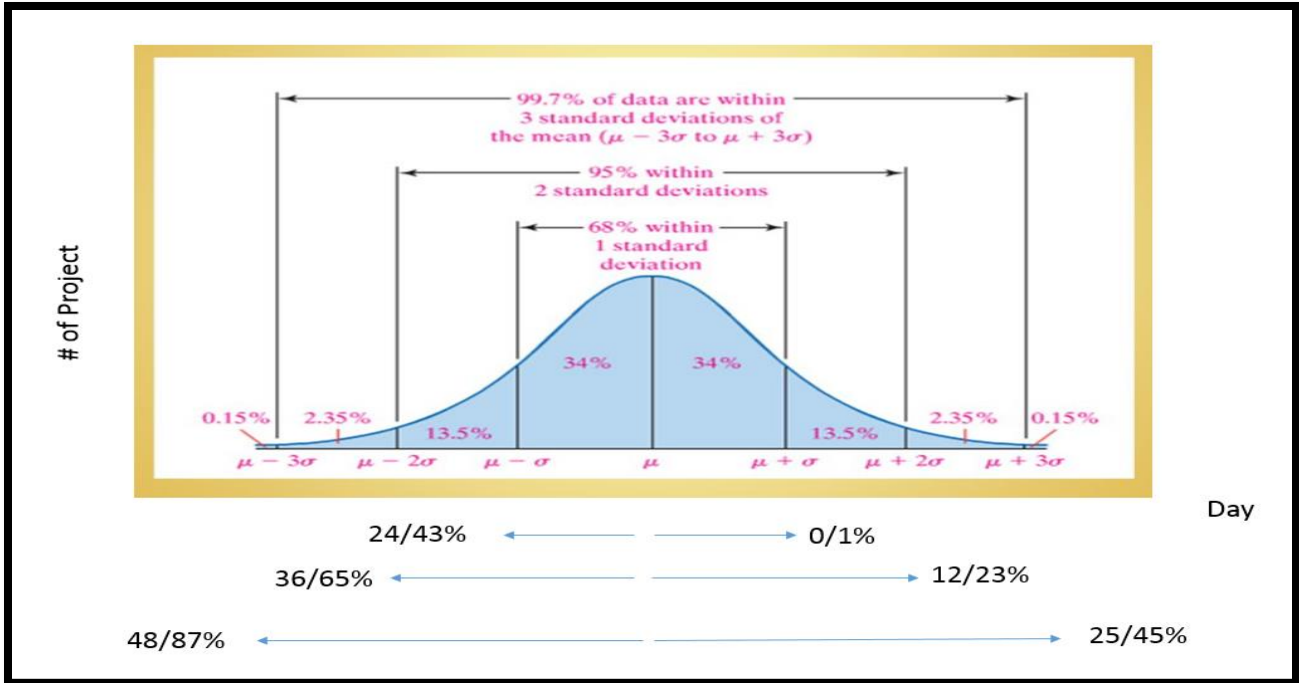
**Chart (CW1) Average day/ % Average day for Caldwell Parish**
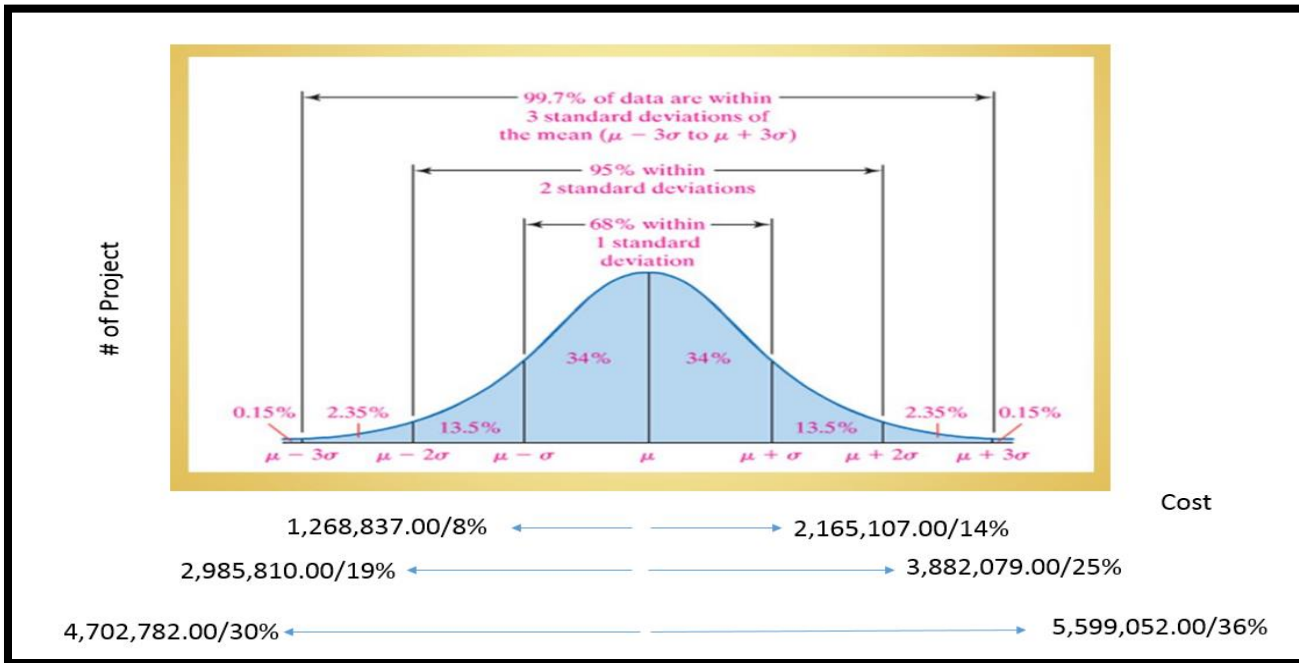
Chart (CW2) Average cost /% Average cost (2005-2015) for Caldwell Parish

LaSalle Parish (LS)

	Time	Cost (2005-2015)		Present value 2015	
Average	-12.3	$ 42,471.00		$ 49,058.00	
Standard Deviation	21.9	$ 102,765.00		$ 119,969.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-34	10	$ (60,294.00)	$ 145,235.00	$ (70,911.10)	$ 169,027.62
95%	-56	31	$ (163,058.00)	$ 248,000.00	$ (190,880.46)	$ 288,996.98
99.70%	-78	53	$ (265,823.00)	$ 350,765.00	$ (310,849.82)	$ 408,966.34
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-15%		4%		5%	
Standard Deviation	16%		7%		8%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-31%	1%	-3%	11%	-3%	13%
95%	-47%	17%	-10%	18%	-11%	21%
99.70%	-63%	33%	-17%	25%	-19%	29%

TABLE (LS) Normal Distribution and Standard Deviation for La Salle Parish
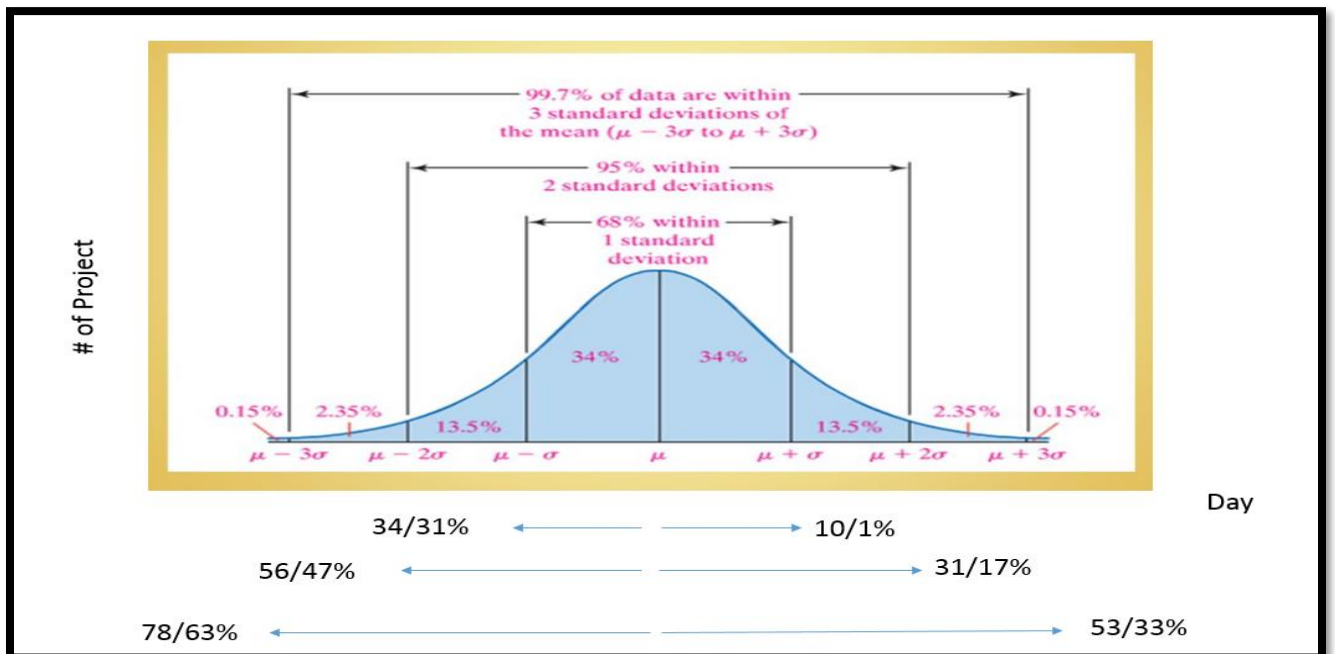
Chart (LS1) Average day/ % Average day for LaSalle Parish

99.7% of data are within 3 standard deviations of the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)

95% within 2 standard deviations

68% within 1 standard deviation

34%   34%

0.15%   2.35%   13.5%   13.5%   2.35%   0.15%

$\mu - 3\sigma$ $\mu - 2\sigma$ $\mu - \sigma$ μ $\mu + \sigma$ $\mu + 2\sigma$ $\mu + 3\sigma$

\# of Project

Cost

60,294.00/3% ←——→ 145,235.00/11%

163,058.00/10% ←——→ 248,000.00/18%

265,823.00/17% ←——→ 350,765.00/25%
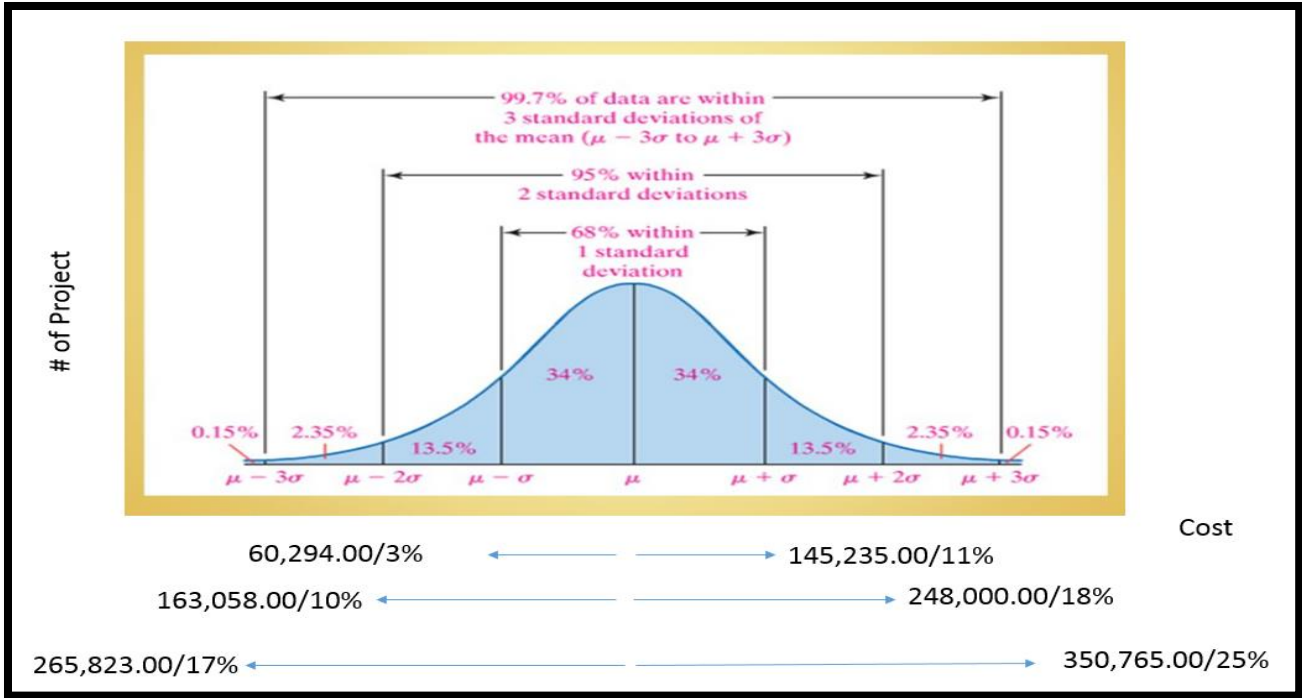
Chart (LS2) Average cost /% Average cost (2005-2015) for LaSalle Parish

Catahoula Parish (CT)

	Time		Cost (2005-2015)		Present value 2015	
Average	-12		$ 169,186.00		$ 188,132.00	
Standared Deviation	17.7		$ 378,187.00		$ 428,034.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-30	6	$ (209,001.00)	$ 547,374.00	$ (239,902.09)	$ 616,165.55
95%	-47	23	$ (587,188.00)	$ 925,561.00	$ (667,935.91)	$ 1,044,199.37
99.70%	-65	41	$ (965,376.00)	$ 1,303,749.00	$ (1,095,969.72)	$ 1,472,233.19
	% Day Average		% Cost Average		% Average at net present value	
Average	-15%		4%		5%	
Standared Deviation	23%		11%		13%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-38%	8%	-7%	15%	-8%	18%
95%	-61%	31%	-18%	26%	-21%	31%
99.70%	-84%	54%	-29%	37%	-34%	44%

**TABLE (CT) Normal Distribution and Standard Deviation for Catahoula Parish**

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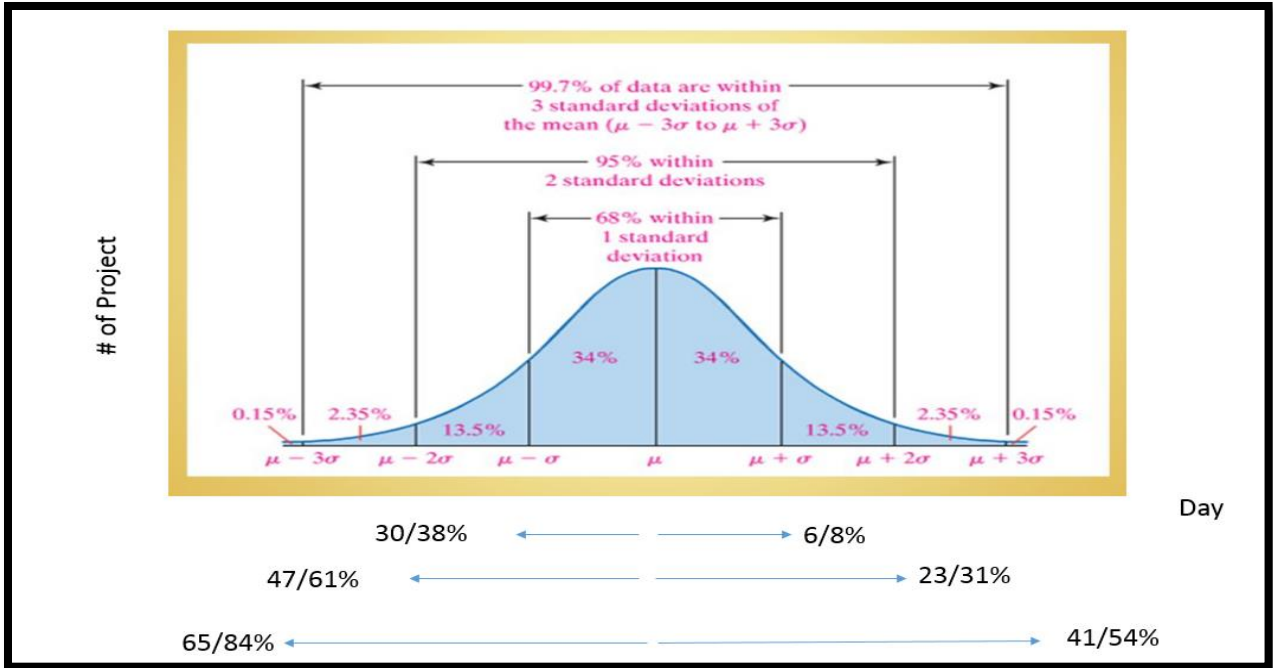
Chart (CT1) Average day/ % Average day for Catahoula Parish
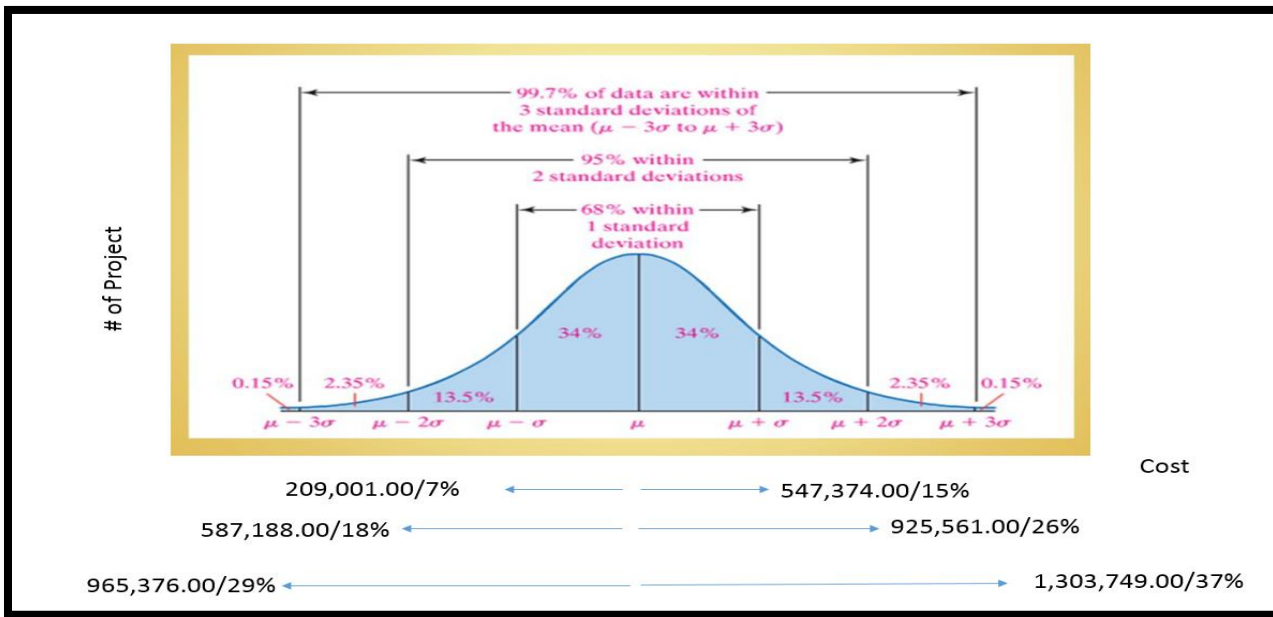
Chart (CT2) Average cost /% Average cost (2005-2015) for Catahoula Parish

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Appendix N
District 61 Parishes

East Feliciana Parish (EF)

	Time		Cost (2005-2015)			Present value 2015	
Average	-13.6		$ 13,873.00			$ 13,649.00	
Standared Deviation	52.7		$ 236,763.00			$ 271,240.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015		
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun		Overrun
68%	-66	39	$ (222,889.00)	$ 250,636.00	$ (257,590.86)	$	284,888.33
95%	-119	92	$ (459,652.00)	$ 487,398.00	$ (528,830.46)	$	556,127.93
99.70%	-172	144	$ (696,414.00)	$ 724,161.00	$ (800,070.06)	$	827,367.53
	% Day Average		% Cost Average		% Average at net present value		
Average	-9%		-1%		-2%		
Standared Deviation	22%		6%		6%		
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun		Overrun
68%	-31%	13%	-7%	5%	-8%		4%
95%	-53%	35%	-13%	11%	-14%		10%
99.70%	-75%	57%	-19%	17%	-20%		16%

TABLE (EF) Normal Distribution and Standard Deviation for East Feliciana Parish

Chart (EF1) Average day/ % Average day for East Feliciana Parish
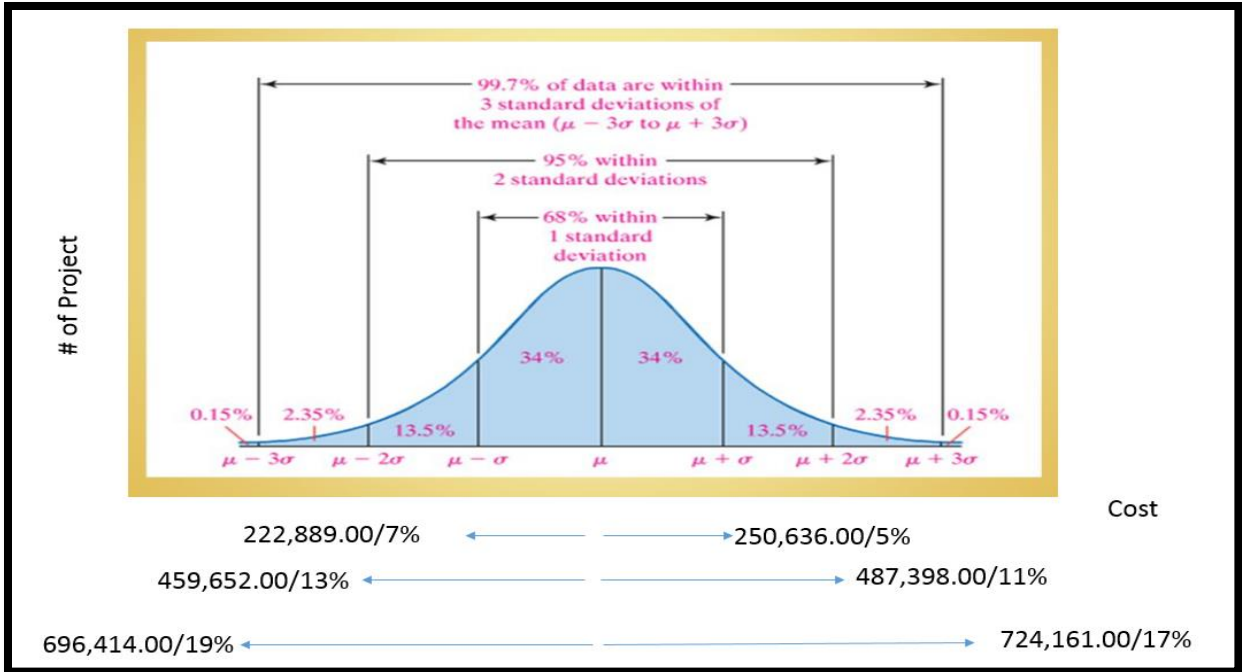
Chart (EF2) Average cost /% Average cost (2005-2015) for East Feliciana Parish

Ascension Parish (AS)

	Time		Cost (2005-2015)		Present value 2015	
Average	-9.9		$ 130,956.00		$ 139,309.00	
Standared Deviation	13.3		$ 381,667.00		$ 418,132.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-23	3	$ (250,711.00)	$ 512,623.00	$ (278,823.15)	$ 557,441.51
95%	-37	17	$ (632,378.00)	$ 894,290.00	$ (696,955.47)	$ 975,573.83
99.70%	-50	30	$ (1,014,044.00)	$ 1,275,956.00	$ (1,115,087.80)	$ 1,393,706.16
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-18%		5%		5%	
Standared Deviation	21%		17%		21%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-39%	3%	-12%	22%	-16%	26%
95%	-60%	24%	-29%	39%	-37%	47%
99.70%	-81%	45%	-46%	56%	-58%	68%

TABLE (AS) Normal Distribution and Standard Deviation for Ascension Parish
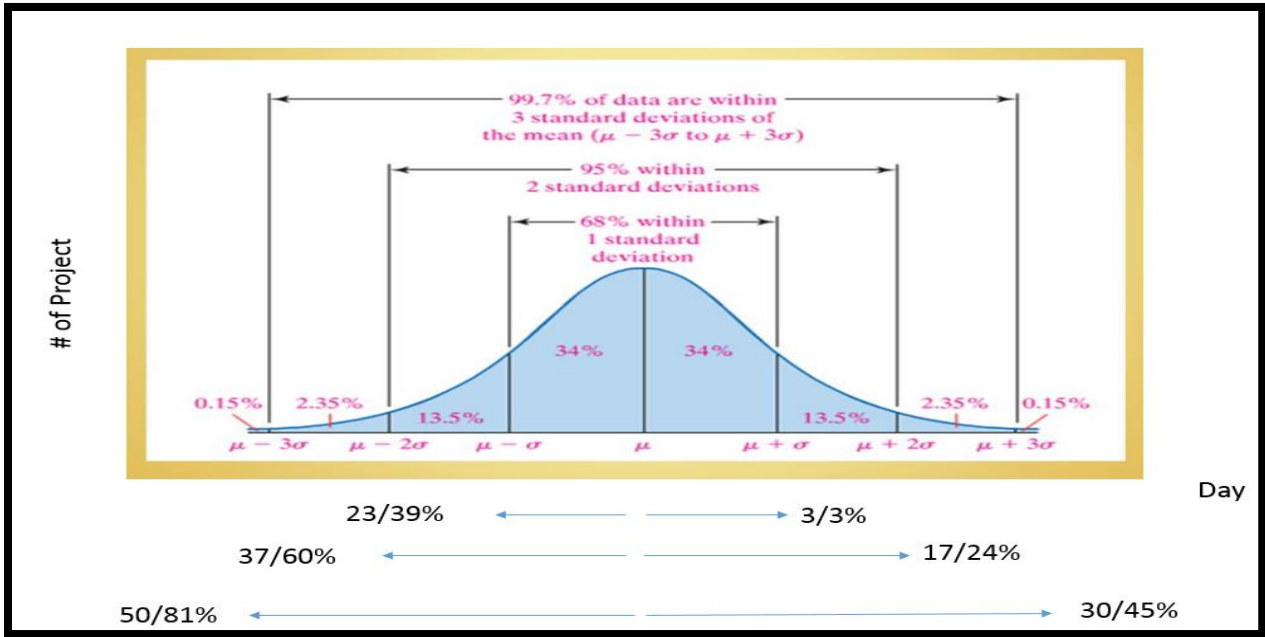
Chart (AS1) Average day/ % Average day for Ascension Parish
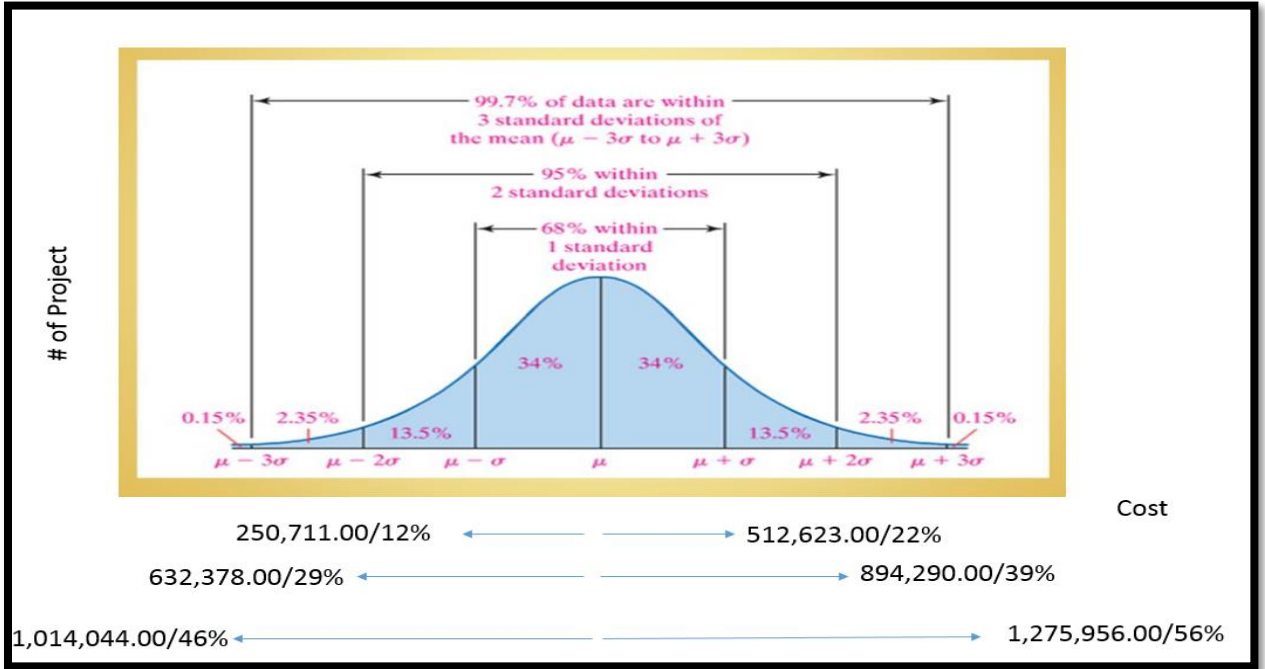
Chart (AS2) Average cost /% Average cost (2005-2015) for Ascension Parish

West Feliciana Parish (WF)

	Time		Cost (2005-2015)			Present value 2015	
Average	0.1		$ 206,744.00			$ 328,195.00	
Standared Deviation	29.8		$ 376,340.00			$ 546,474.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015		
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun		Overrun
68%	-30	30	$ (169,596.00)	$ 583,084.00	$ (193,869.78)	$	656,128.86
95%	-60	60	$ (545,936.00)	$ 959,425.00	$ (618,869.11)	$	1,081,128.18
99.70%	-89	90	$ (922,277.00)	$ 1,335,765.00	$ (1,043,868.43)	$	1,506,127.51
	% Day Average		% Cost Average		% Average at net present value		
Average	-3%		3%		3%		
Standared Deviation	24%		7%		8%		
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun	
68%	-27%	21%	-4%	10%	-5%	11%	
95%	-51%	45%	-11%	17%	-13%	19%	
99.70%	-75%	69%	-18%	24%	-21%	27%	

TABLE (WF) Normal Distribution and Standard Deviation for West Feliciana Parish
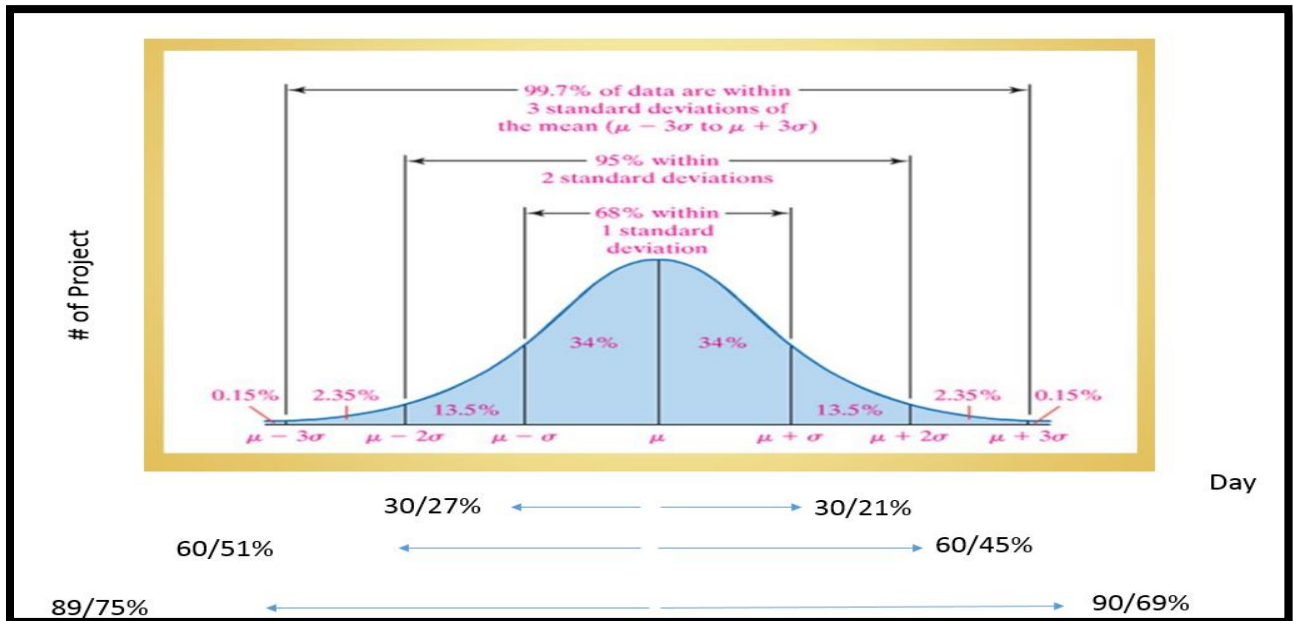
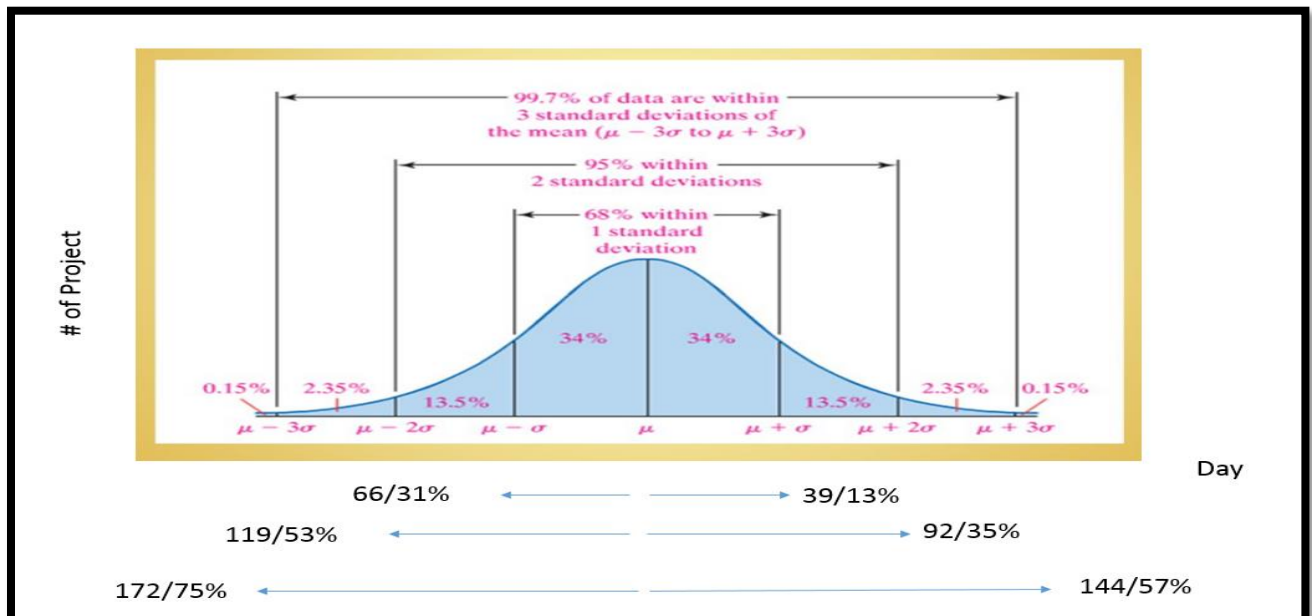**Chart (WF1) Average day/ % Average day for West Feliciana Parish**
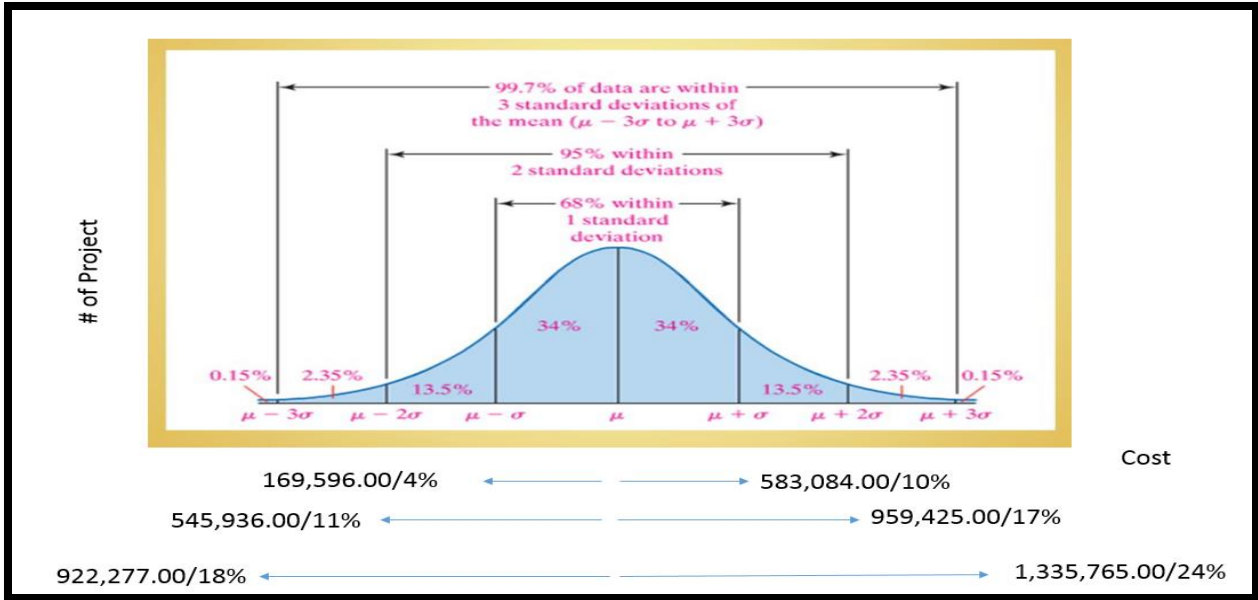
Chart (WF2) Average cost /% Average cost (2005-2015) for West Feliciana Parish

169,596.00/4% ← → 583,084.00/10%

545,936.00/11% ← → 959,425.00/17%

922,277.00/18% ← → 1,335,765.00/24%

Point Coupee Parish (PC)

	Time		Cost (2005-2015)		Present value 2015	
Average	-6.9		$ (23,213.00)		$ (18,042.00)	
Standared Deviation	13.1		$ 378,198.00		$ 430,579.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-20	6	$ (401,411.00)	$ 354,985.00	$ (448,620.56)	$ 412,536.99
95%	-33	19	$ (779,609.00)	$ 733,182.00	$ (879,199.34)	$ 843,115.77
99.70%	-46	33	$ (1,157,806.00)	$ 1,111,380.00	$ (1,309,778.12)	$ 1,273,694.55
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-16%		-3%		-3%	
Standared Deviation	23%		7%		8%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-39%	7%	-10%	4%	-11%	5%
95%	-62%	30%	-17%	11%	-19%	13%
99.70%	-85%	53%	-24%	18%	-27%	21%

TABLE (PC1) Normal Distribution and Standard Deviation for Point Coupee Parish
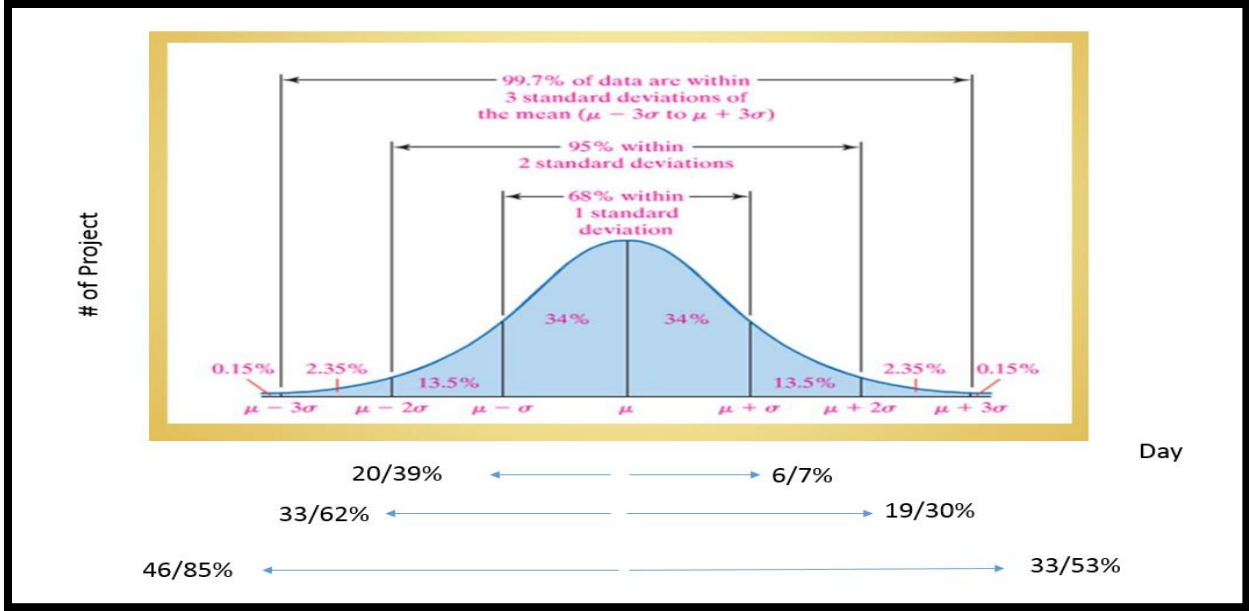
Chart (PC1) Average day/ % Average day for Point Coupee Parish
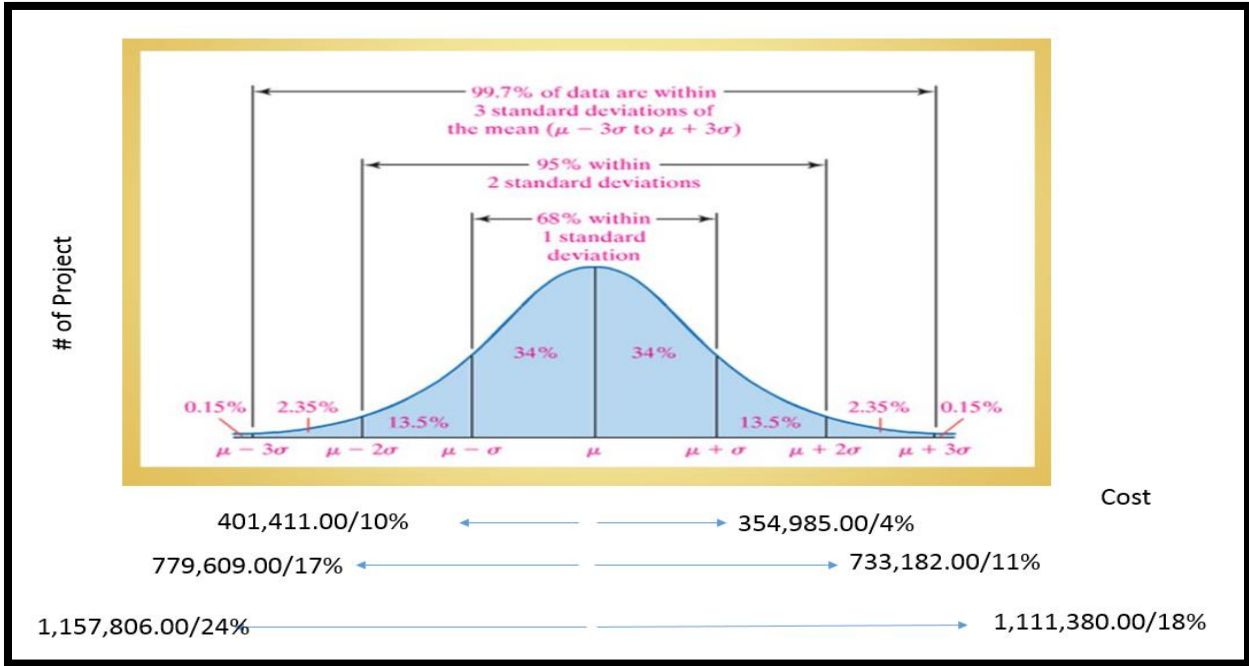
Chart (PC2) Average cost /% Average cost (2005-2015) for Point Coupee Parish

West Baton Rouge Parish

	Time	Cost (2005-2015)		Present value 2015	
Average	-1.3	$ (2,066.00)		$ (7,326.00)	
Standared Deviation	12.7	$ 141,121.00		$ 153,172.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-14	11	$ (143,187.00)	$ 139,054.00	$ (160,498.09)	$ 145,846.67
95%	-27	24	$ (284,308.00)	$ 280,175.00	$ (313,670.47)	$ 299,019.05
99.70%	-39	37	$ (425,429.00)	$ 421,296.00	$ (466,842.82)	$ 452,191.43
	% Day Average		% Cost Average		% Average at net present value	
Average	-5%		-3%		-3%	
Standared Deviation	21%		11%		11%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-26%	16%	-14%	8%	-14%	8%
95%	-47%	37%	-25%	19%	-25%	19%
99.70%	-68%	58%	-36%	30%	-36%	30%

TABLE (WB) Normal Distribution and Standard Deviation for West Baton Rouge Parish

Chart (WB1) Average day/ % Average day for West Baton Rouge Parish

99.7% of data are within
3 standard deviations of
the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)

95% within
2 standard deviations

68% within
1 standard
deviation

34%   34%

0.15%   2.35%
          13.5%   13.5%   2.35%   0.15%

$\mu - 3\sigma$ $\mu - 2\sigma$ $\mu - \sigma$ μ $\mu + \sigma$ $\mu + 2\sigma$ $\mu + 3\sigma$

# of Project

Cost

143,187.00/14% ← → 139,054.00/8%

284,308.00/25% ← → 280,175.00/19%

425,429.00/36% ← → 421,296.00/30%
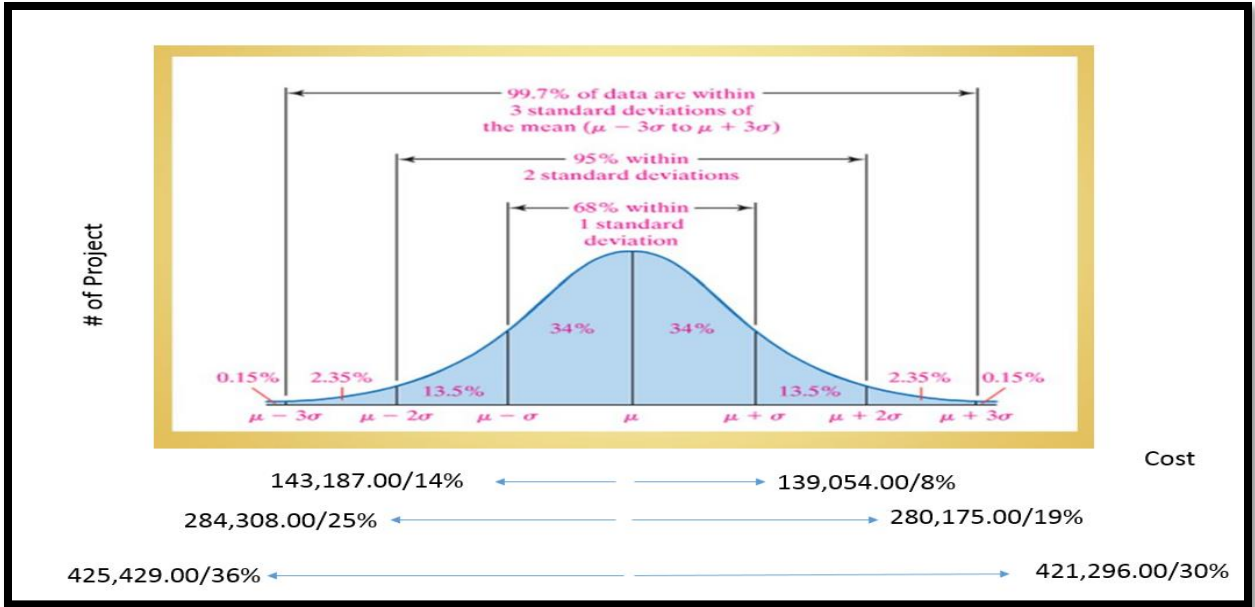
Chart (WB2) Average cost /% Average cost (2005-2015) for West Baton Rouge Parish

East Baton Rouge Parish (EB)

	Time		Cost (2005-2015)		Present value 2015	
Average	-0.4		$ 279,697.00		$ 301,833.00	
Standared Deviation	70.4		$ 1,577,878.00		$ 1,692,822.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-71	70	$ (1,298,181.00)	$ 1,857,575.00	$ (1,390,989.54)	$ 1,994,655.09
95%	-141	140	$ (2,876,060.00)	$ 3,435,453.00	$ (3,083,811.85)	$ 3,687,477.40
99.70%	-211	211	$ (4,453,938.00)	$ 5,013,331.00	$ (4,776,634.17)	$ 5,380,299.72
	% Day Average		% Cost Average		% Average at net present value	
Average	-2%		1%		2%	
Standared Deviation	3%		18%		22%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-5%	1%	-17%	19%	-20%	24%
95%	-8%	4%	-35%	37%	-42%	46%
99.70%	-11%	7%	-53%	55%	-64%	68%

TABLE (EB) Normal Distribution and Standard Deviation for East Baton Rouge Parish

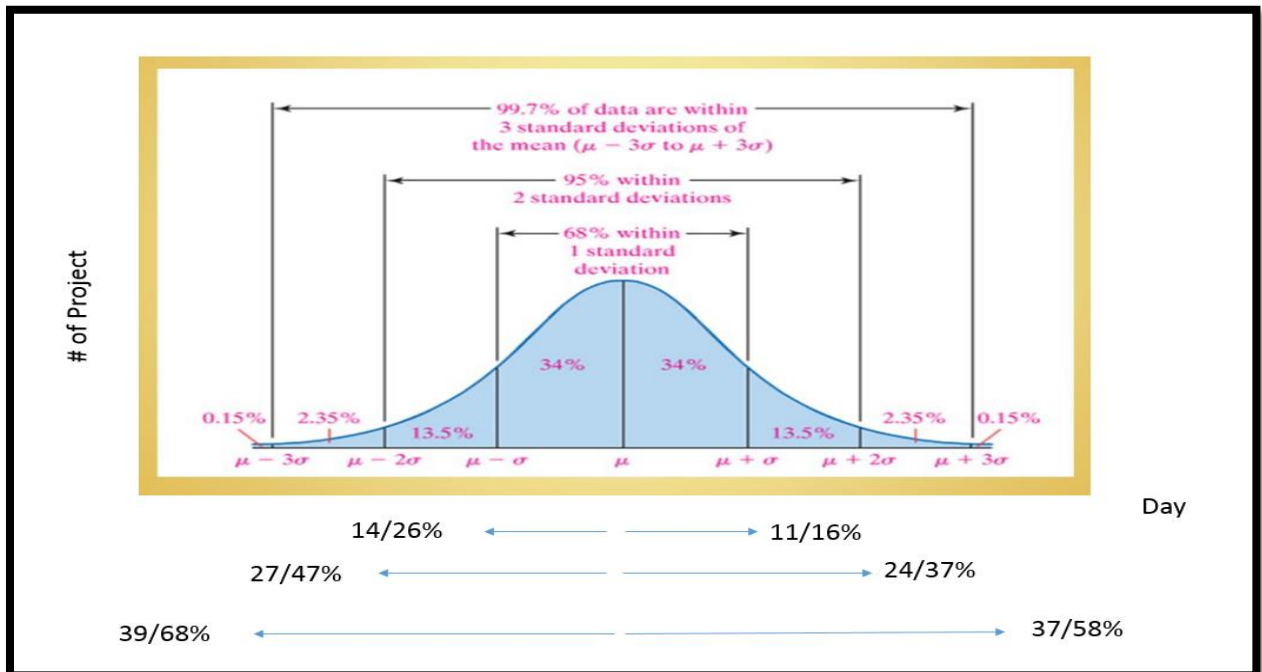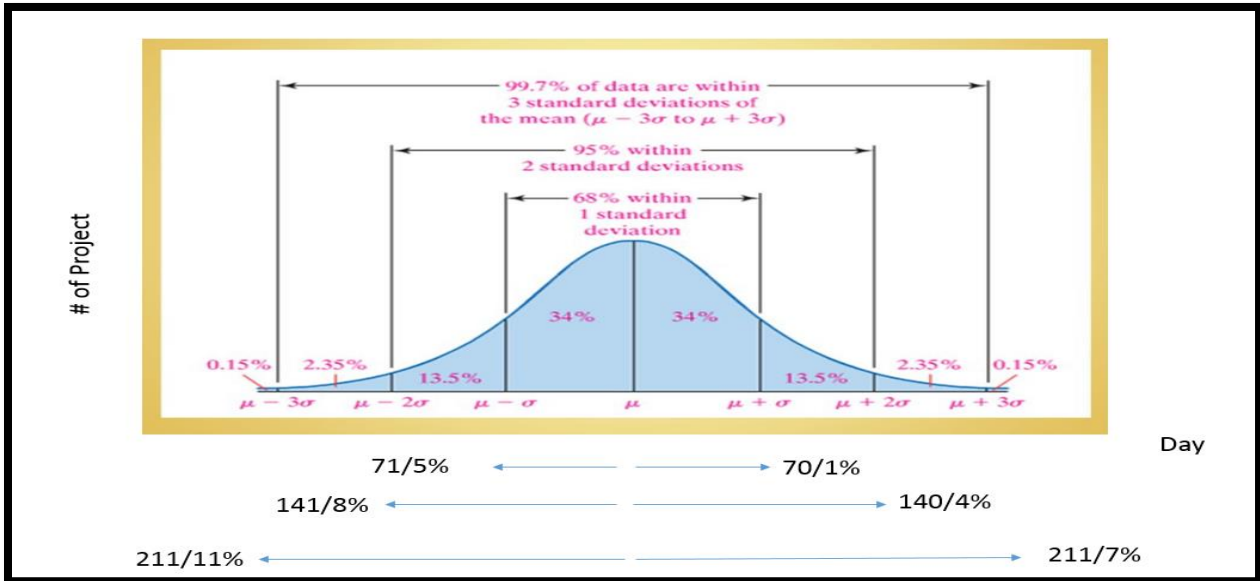**Chart (EB1) Average day/ % Average day for East Baton Rouge Parish**
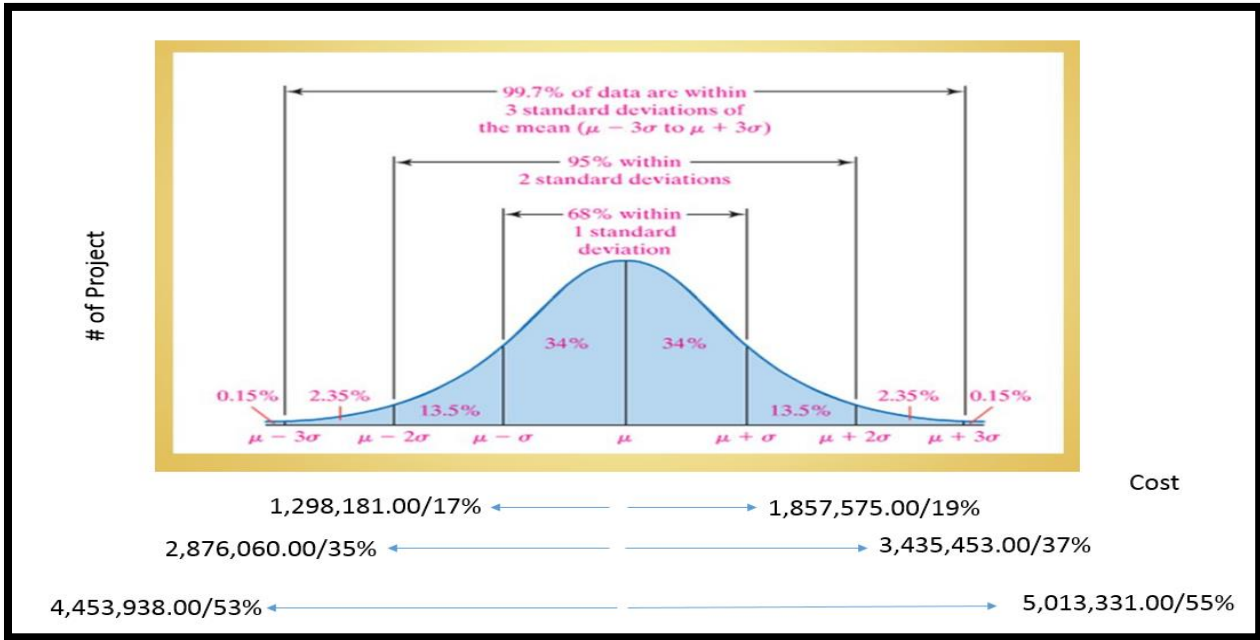
Chart (EB2) Average cost /% Average cost (2005-2015) for East Baton Rouge Parish

Assumption Parish (AN)

	Time		Cost (2005-2015)			Present value 2015		
Average	-5.8		$ 167,986.00			$ 181,703.00		
Standard Deviation	13.5		$ 567,110.00			$ 627,258.00		
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**			
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**		**Overrun**	
68%	-19	8	$ (399,124.00)	$ 735,095.00	$ (445,555.88)	$	808,961.02	
95%	-33	21	$ (966,234.00)	$ 1,302,205.00	$ (1,072,814.33)	$	1,436,219.46	
99.70%	-46	35	$ (1,533,343.00)	$ 1,869,314.00	$ (1,700,072.78)	$	2,063,477.91	
	% Day Average		**% Cost Average**		**% Average at net present value**			
Average	-13%		3%		3%			
Standard Deviation	24%		15%		17%			
	Ahead of Time	**Behind Time**	**Underrun**	**Overrun**	**Underrun**		**Overrun**	
68%	-37%	11%	-12%	18%	-14%		20%	
95%	-61%	35%	-27%	33%	-31%		37%	
99.70%	-85%	59%	-42%	48%	-48%		54%	

TABLE (AN1) Normal Distribution and Standard Deviation for Assumption Parish

Chart (AN1) Average day/ % Average day for Assumption Parish
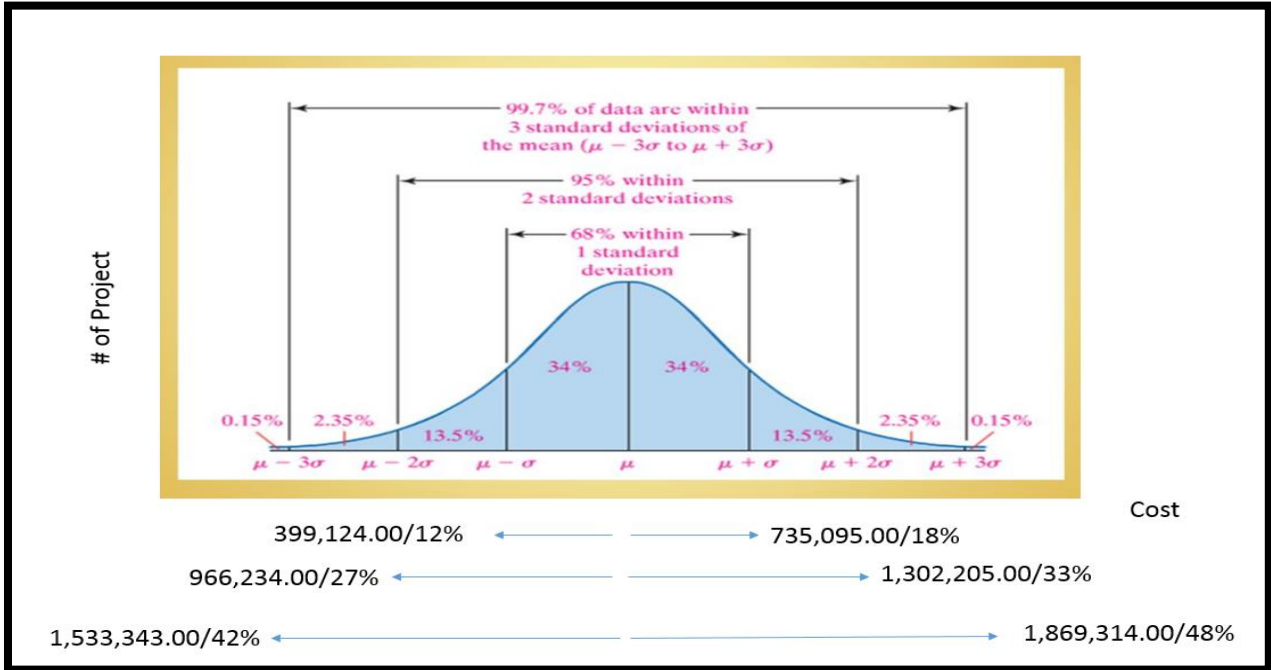
Chart (AN2) Average cost /% Average cost (2005-2015) for Assumption Parish

Appendix O

District 62 Parishes

Washington Parish (WA)

	Time		Cost (2005-2015)			Present value 2015	
Average	-5.1		$ 41,598.00			$ 45,949.00	
Standared Deviation	21.9		$ 168,592.00			$ 183,024.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**		
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*	
68%	-27	17	$ (126,994.00)	$ 210,189.00	$ (137,075.71)	$ 228,972.95	
95%	-49	39	$ (295,586.00)	$ 378,781.00	$ (320,100.04)	$ 411,997.28	
99.70%	-71	61	$ (464,178.00)	$ 547,373.00	$ (503,124.38)	$ 595,021.61	
	% Day Average		**% Cost Average**		**% Average at net present value**		
Average	-11%		-4%		-5%		
Standared Deviation	26%		22%		26%		
	Ahead of Time	*Behind Time*	*Underrun*	*Overrun*	*Underrun*	*Overrun*	
68%	-37%	15%	-26%	18%	-31%	21%	
95%	-63%	41%	-48%	40%	-57%	47%	
99.70%	-89%	67%	-70%	62%	-83%	73%	

TABLE (WA) Normal Distribution and Standard Deviation for Washington Parish
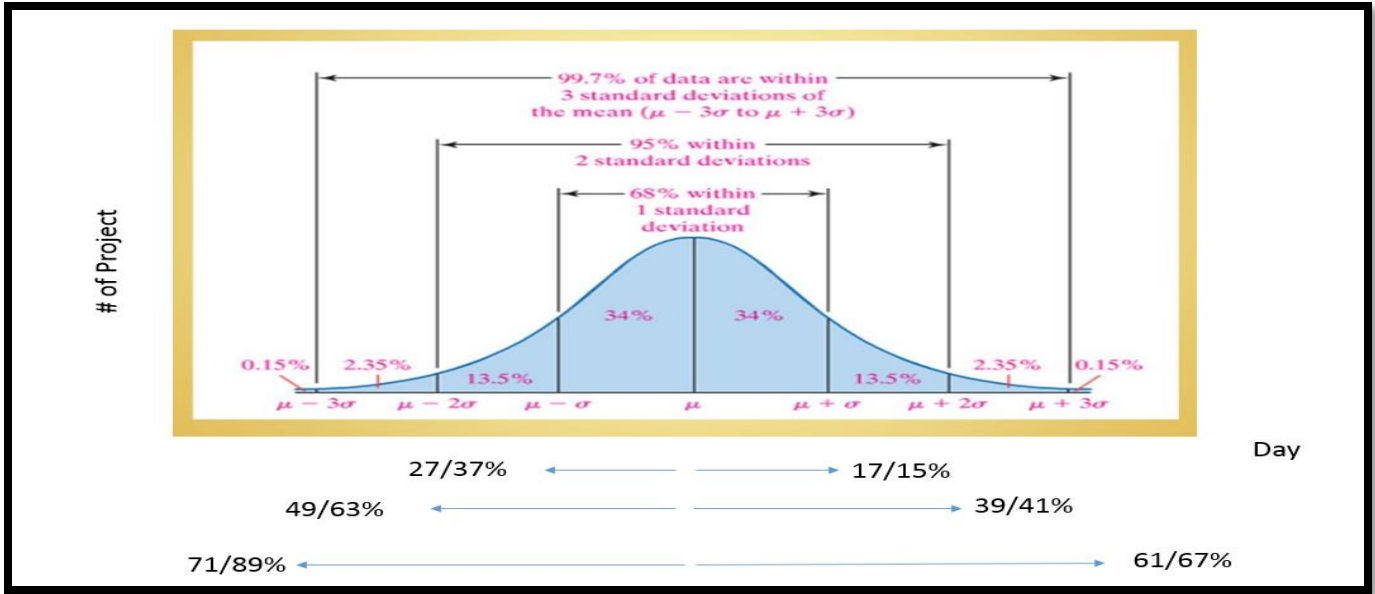
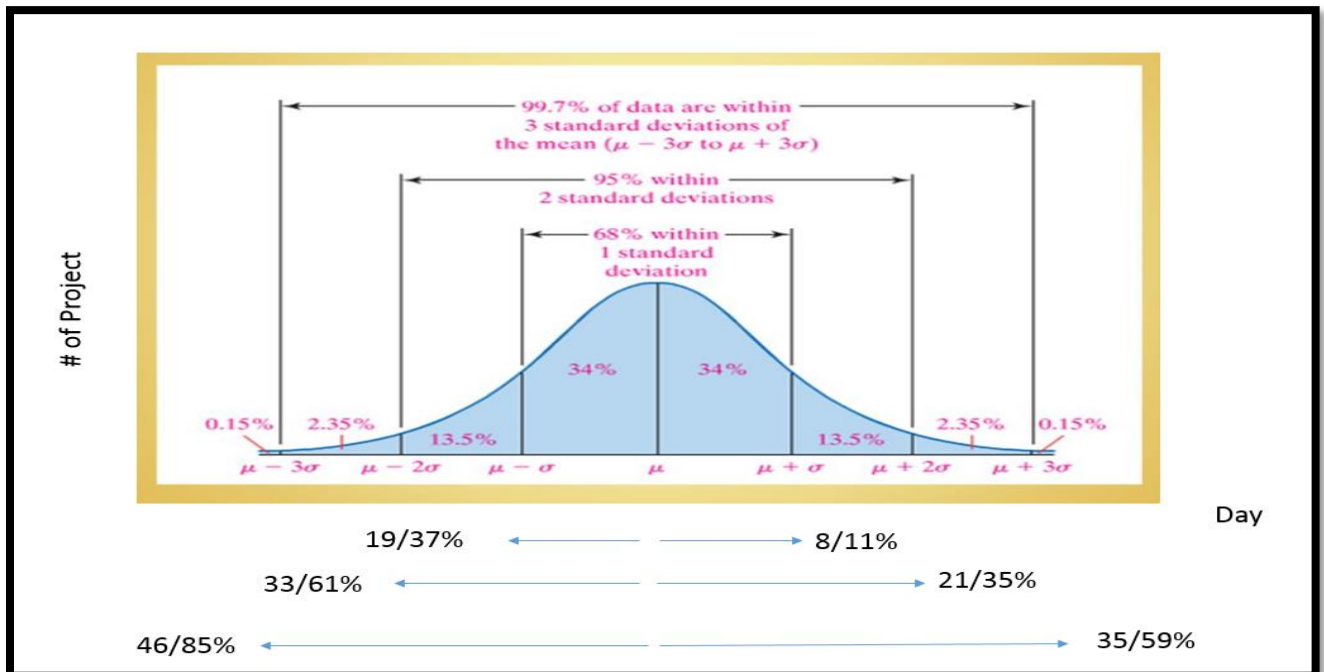**Chart (WA1) Average day/ % Average day for Washington Parish**
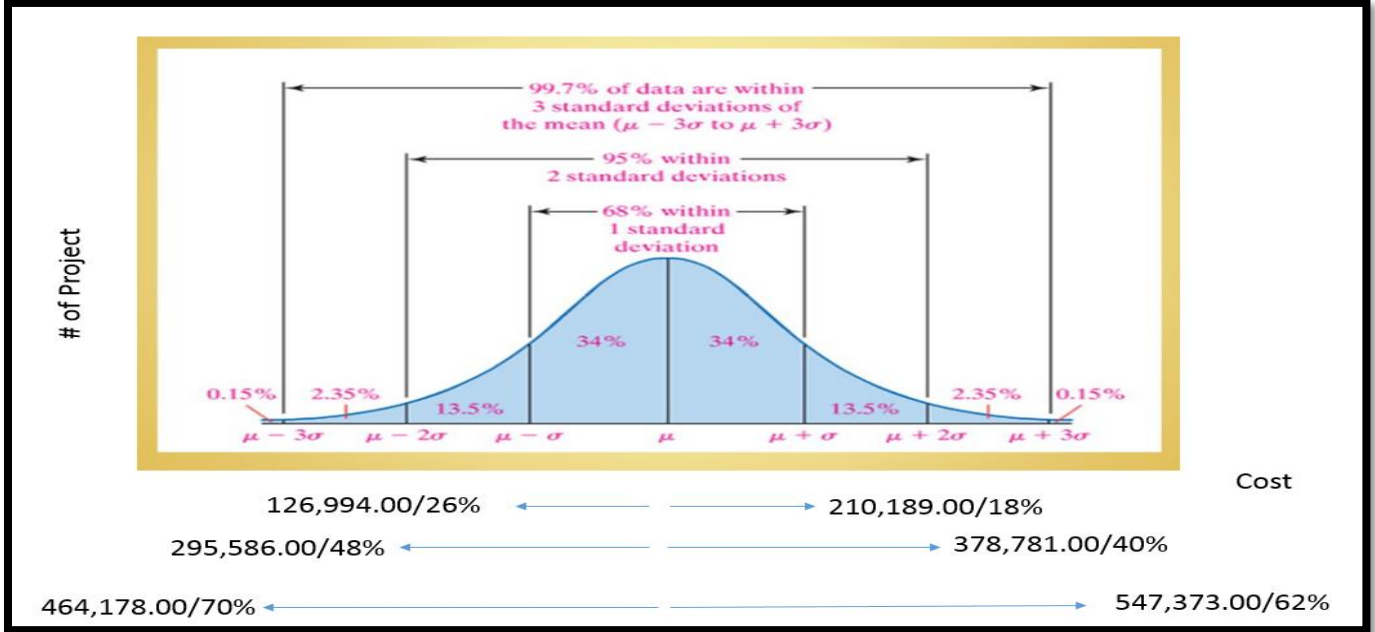
Chart (WA2) Average cost /% Average cost (2005-2015) for Washington Parish

Tangipahoa Parish (TG)

	Time		Cost (2005-2015)				Present value 2015		
Average	-6.4		$	50,480.00			$	55,022.00	
Standered Deviation	19.2		$	292,137.00			$	320,100.00	
	AVERAGE TIME		AVERAGE COST 2005-2015				AVERAGE COST 2015		
	Ahead of Time	Behind Time	Underrun		Overrun		Underrun		Overrun
68%	-26	13	$	(241,657.00)	$	342,616.00	$	(265,078.26)	$ 375,121.37
95%	-45	32	$	(533,794.00)	$	634,753.00	$	(585,178.08)	$ 695,221.19
99.70%	-64	51	$	(825,931.00)	$	926,890.00	$	(905,277.89)	$ 1,015,321.00
	% Day Average		% Cost Average				% Average at net present value		
Average	-12%		0%				0%		
Standered Deviation	28%		13%				14%		
	Ahead of Time	Behind Time	Underrun		Overrun		Underrun		Overrun
68%	-40%	16%	-13%		13%		-14%		14%
95%	-68%	44%	-26%		26%		-28%		28%
99.70%	-96%	72%	-39%		39%		-42%		42%

TABLE (TG) Normal Distribution and Standard Deviation for Tangipahoa Parish
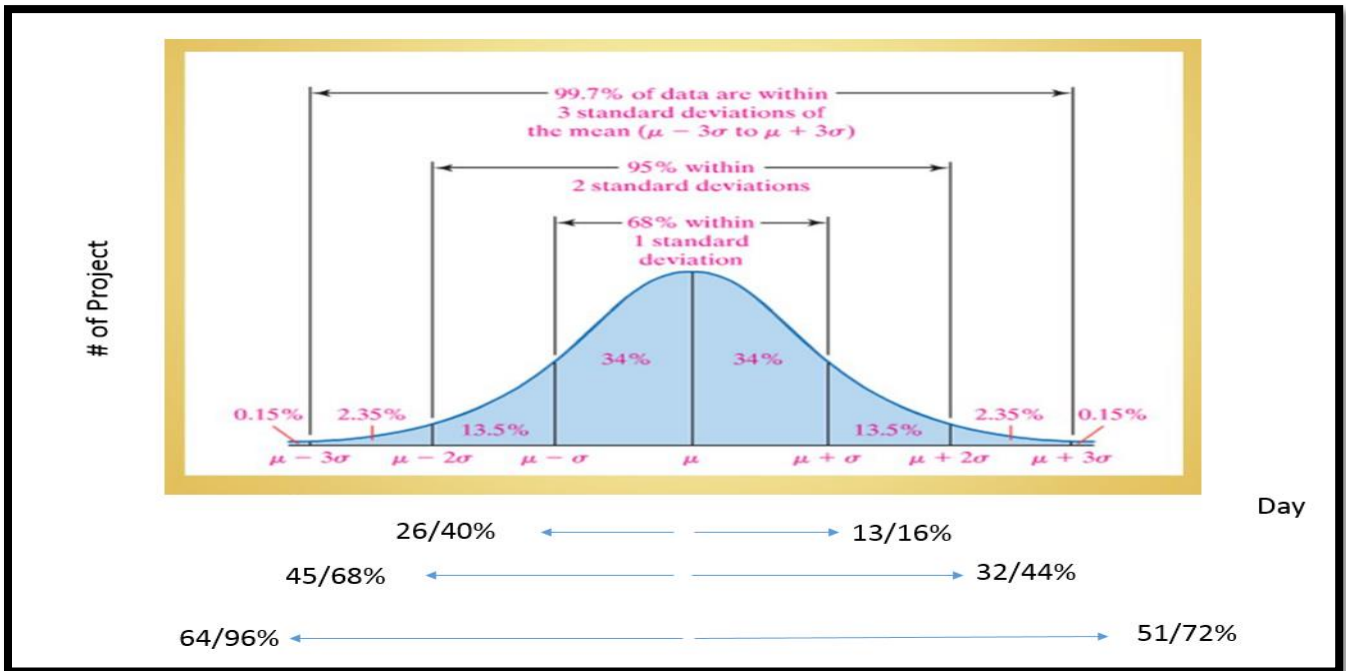
Chart (TG1) Average day/ % Average day for Tangipahoa Parish
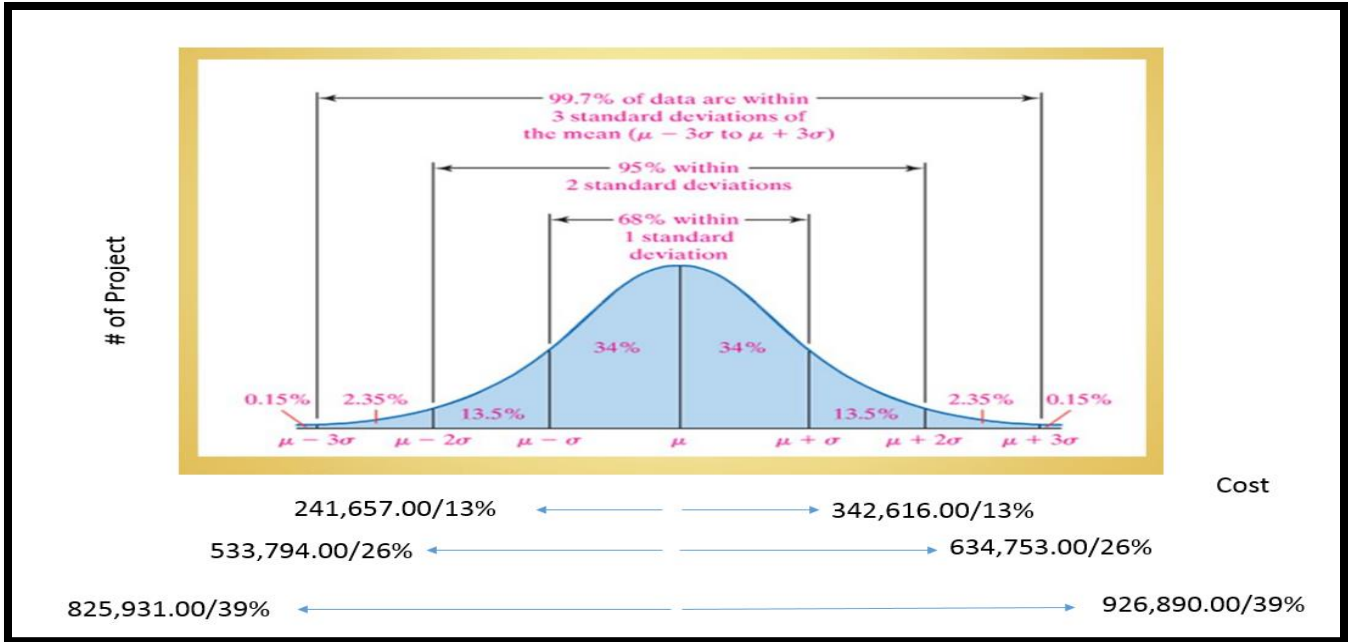
Chart (TG2) Average cost /% Average cost (2005-2015) for Tangipahoa Parish

Livingston Parish (LV)

	Time		Cost (2005-2015)		Present value 2015	
Average	-2.6		$ (49,701.00)		$ (50,045.00)	
Standared Deviation	17.7		$ 1,306,183.00		$ 1,352,127.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-20	15	$ (1,355,884.00)	$ 1,256,482.00	$ (1,402,172.03)	$ 1,302,081.44
95%	-38	33	$ (2,662,067.00)	$ 2,562,666.00	$ (2,745,298.76)	$ 2,654,208.17
99.70%	-56	50	$ (3,968,250.00)	$ 3,868,849.00	$ (4,106,425.49)	$ 4,006,334.90
	% Day Average		% Cost Average		% Average at net present value	
Average	-5%		0%		-1%	
Standard Deviation	25%		22%		26%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-30%	20%	-22%	22%	-27%	25%
95%	-55%	45%	-44%	44%	-53%	51%
99.70%	-80%	70%	-66%	66%	-79%	77%

**TABLE (LV) Normal Distribution and Standard Deviation for Livingston Parish**
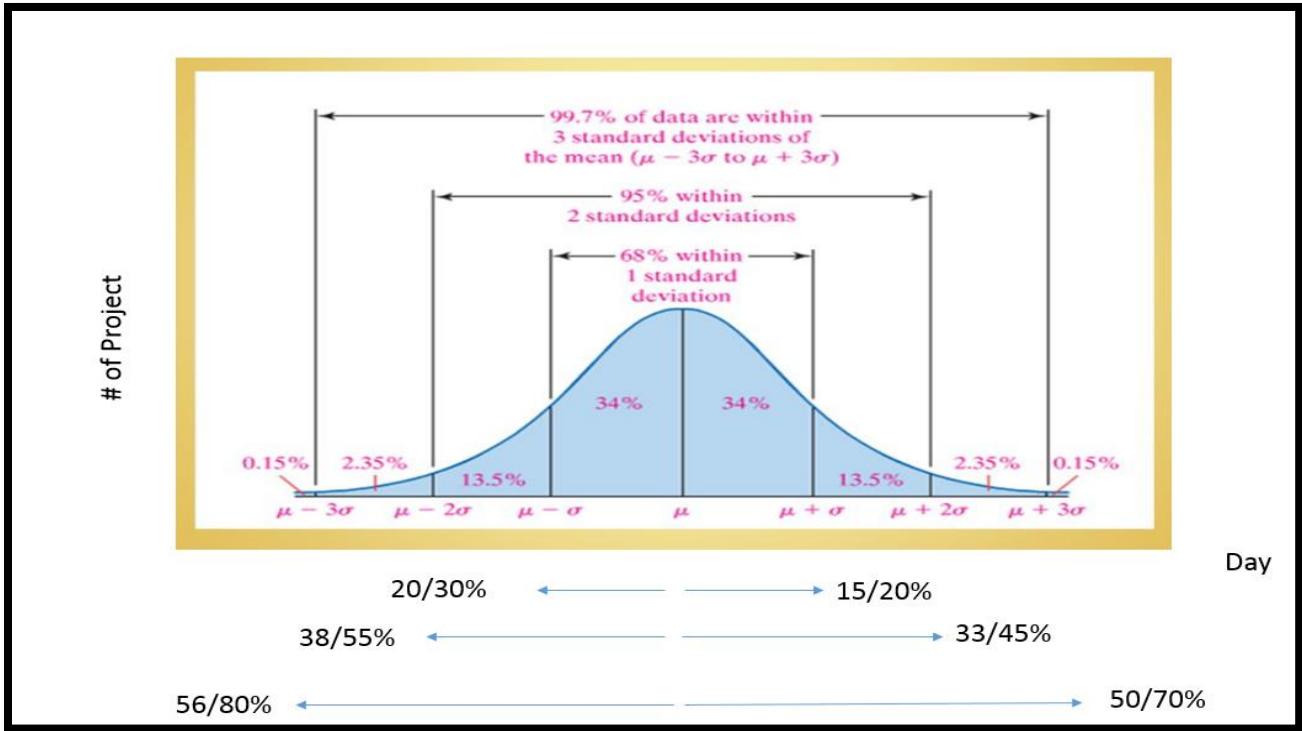
**Chart (LV1) Average day/ % Average day for Livingston Parish**
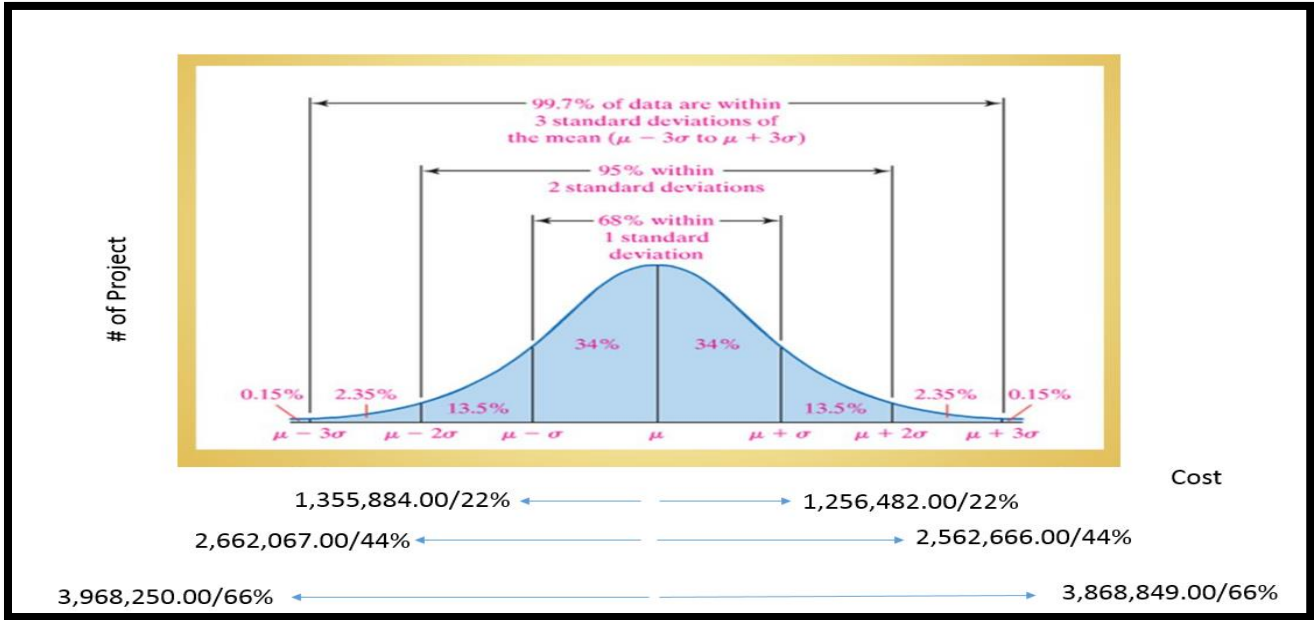
Chart (LV2) Average cost /% Average cost (2005-2015) for Livingston Parish

St. Helena Parish (HE)

	Time		Cost (2005-2015)		Present value 2015	
Average	-9.5		$ 12,266.00		$ 14,423.00	
Standared Deviation	25.3		$ 81,605.00		$ 96,128.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-35	16	$ (69,339.00)	$ 93,872.00	$ (81,704.48)	$ 110,551.26
95%	-60	41	$ (150,944.00)	$ 175,477.00	$ (177,832.36)	$ 206,679.13
99.70%	-84	66	$ (232,549.00)	$ 257,082.00	$ (273,960.23)	$ 302,807.01
	% Day Average		% Cost Average		% Average at net present value	
Average	-13%		1%		1%	
Standared Deviation	28%		6%		7%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-41%	15%	-5%	7%	-6%	8%
95%	-69%	43%	-11%	13%	-13%	15%
99.70%	-97%	71%	-17%	19%	-20%	22%

TABLE (HE) Normal Distribution and Standard Deviation for St. Helena Parish

Chart (HE1) Average day/ % Average day for St. Helena Parish

Chart (HE2) Average cost /% Average cost (2005-2015) for St. Helena Parish

The chart shows a normal distribution with the following annotations:
- 99.7% of data are within 3 standard deviations of the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)
- 95% within 2 standard deviations
- 68% within 1 standard deviation
- 34% and 34% (central regions)
- 0.15%, 2.35%, 13.5% (left tail regions)
- 13.5%, 2.35%, 0.15% (right tail regions)

X-axis labels: $\mu - 3\sigma$, $\mu - 2\sigma$, $\mu - \sigma$, μ, $\mu + \sigma$, $\mu + 2\sigma$, $\mu + 3\sigma$

Y-axis: # of Project

Cost annotations:
- 69,339.00/5% ↔ 93,872.00/7%
- 150,944.00/11% ↔ 175,477.00/13%
- 232,549.00/17% ↔ 257,082.00/19%

St. John Parish (JB)

	Time		Cost (2005-2015)		Present value 2015	
Average	-7		$ 22,278.00		$ 23,962.00	
Standared Deviation	11.1		$ 98,144.00		$ 109,184.00	
	AVERAGE TIME		**AVERAGE COST 2005-2015**		**AVERAGE COST 2015**	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-18	4	$ (75,866.00)	$ 120,422.00	$ (85,221.72)	$ 133,145.56
95%	-28	15	$ (174,010.00)	$ 218,566.00	$ (194,405.37)	$ (242,329.20)
99.70%	-39	26	$ (272,155.00)	$ 316,711.00	$ (303,589.01)	$ (351,512.85)
	% Day Average		**% Cost Average**		**% Average at net present value**	
Average	-15%		3%		3%	
Standared Deviation	22%		12%		14%	
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun
68%	-37%	7%	-9%	15%	-11%	17%
95%	-59%	29%	-21%	27%	-25%	31%
99.70%	-81%	51%	-33%	39%	-39%	45%

TABLE (JB1) Normal Distribution and Standard Deviation for St. John Parish

Chart (JB1) Average day/ % Average day for St. John Parish
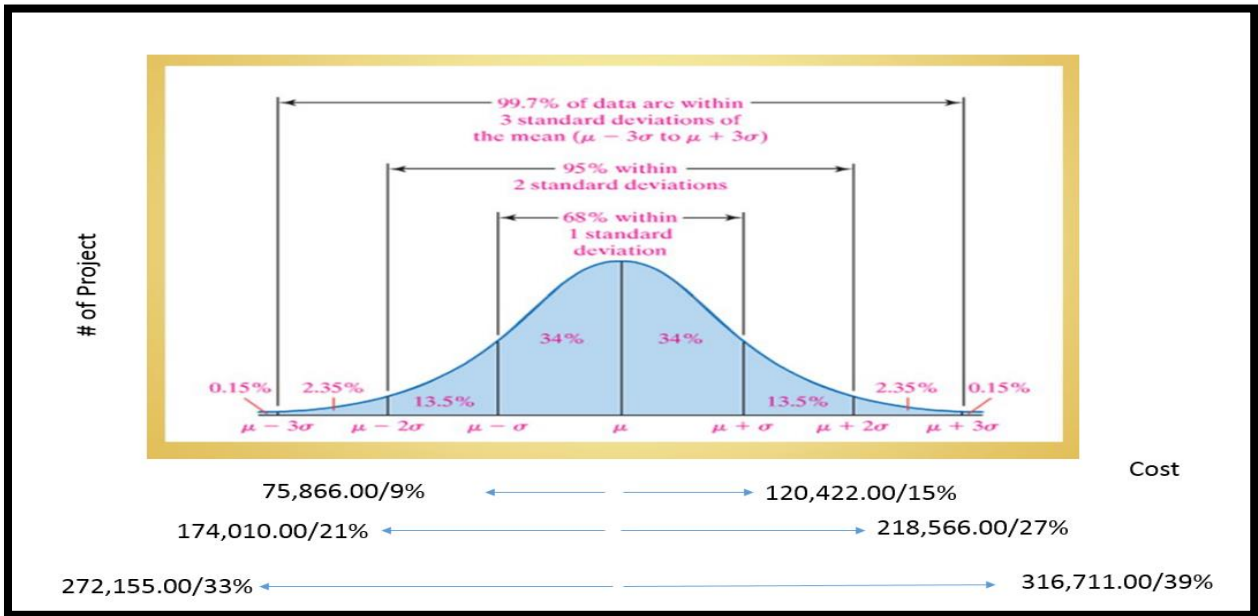
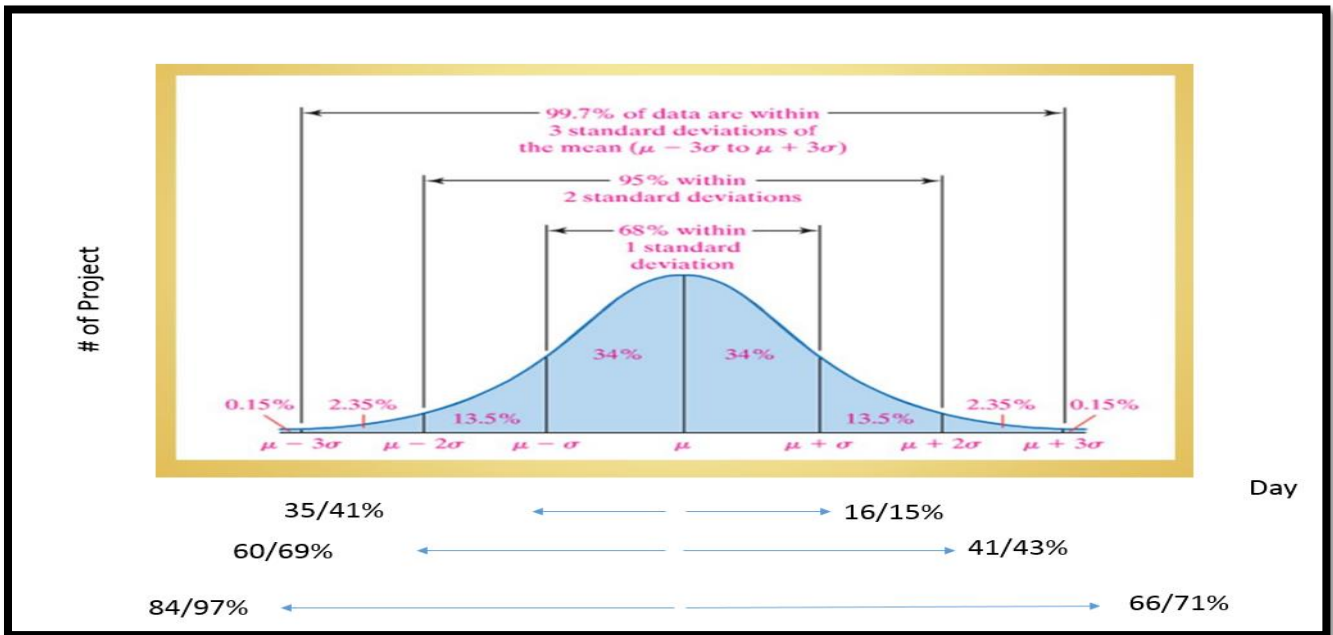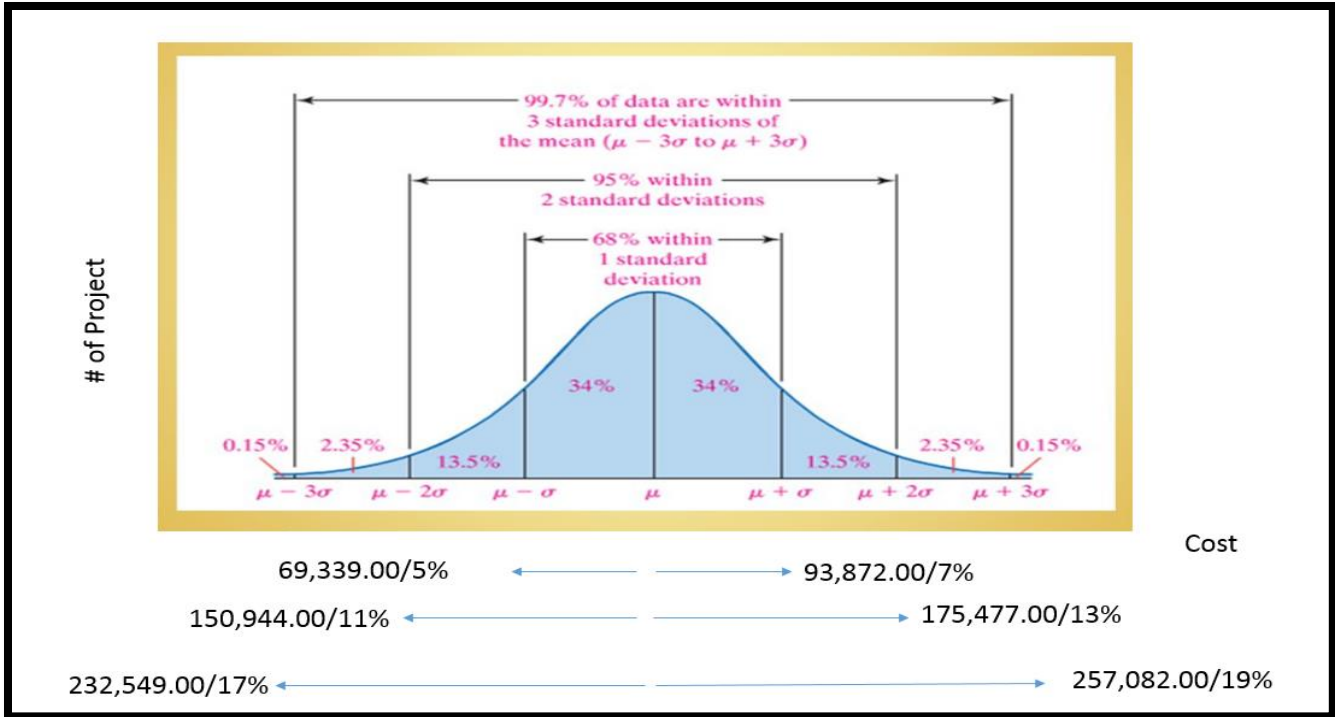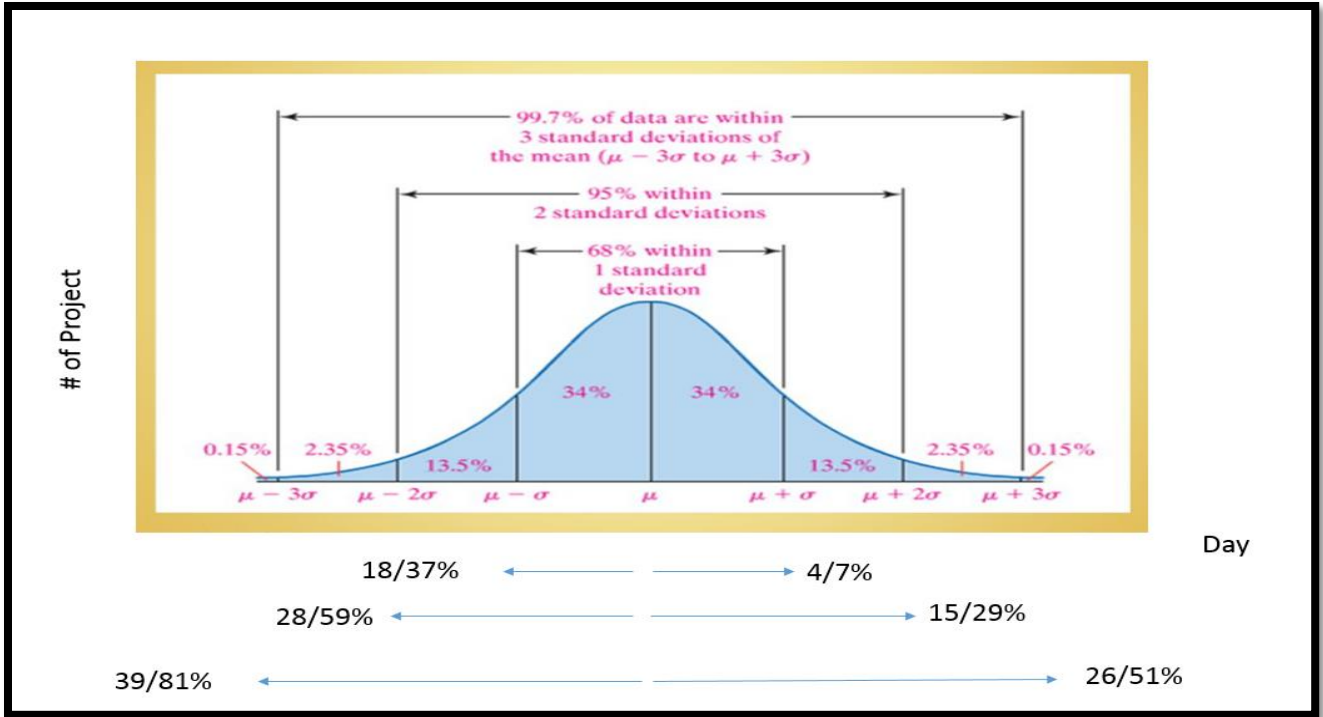**Chart (JB2) Average cost /% Average cost (2005-2015) for St. John Parish**

St. Tammany Parish (TA)

	Time		Cost (2005-2015)			Present value 2015	
Average	-6.4		$ 53,803.00			$ 58,980.00	
Standared Deviation	26.1		$ 621,651.00			$ 674,924.00	
	AVERAGE TIME		AVERAGE COST 2005-2015		AVERAGE COST 2015		
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun	
68%	-33	20	$ (567,848.00)	$ 675,454.00	$ (615,944.62)	$ 733,903.82	
95%	-59	46	$ (1,189,498.00)	$ 1,297,104.00	$ (1,290,868.84)	$ 1,408,828.04	
99.70%	-85	72	$ (1,811,149.00)	$ 1,918,755.00	$ (1,965,793.06)	$ 2,083,752.26	
	% Day Average		% Cost Average		% Average at net present value		
Average	-9%		3%		3%		
Standared Deviation	23%		21%		24%		
	Ahead of Time	Behind Time	Underrun	Overrun	Underrun	Overrun	
68%	-32%	14%	-18%	24%	-21%	27%	
95%	-55%	37%	-39%	45%	-45%	51%	
99.70%	-78%	60%	-60%	66%	-69%	75%	

TABLE (TA) Normal Distribution and Standard Deviation for St. Tammany Parish
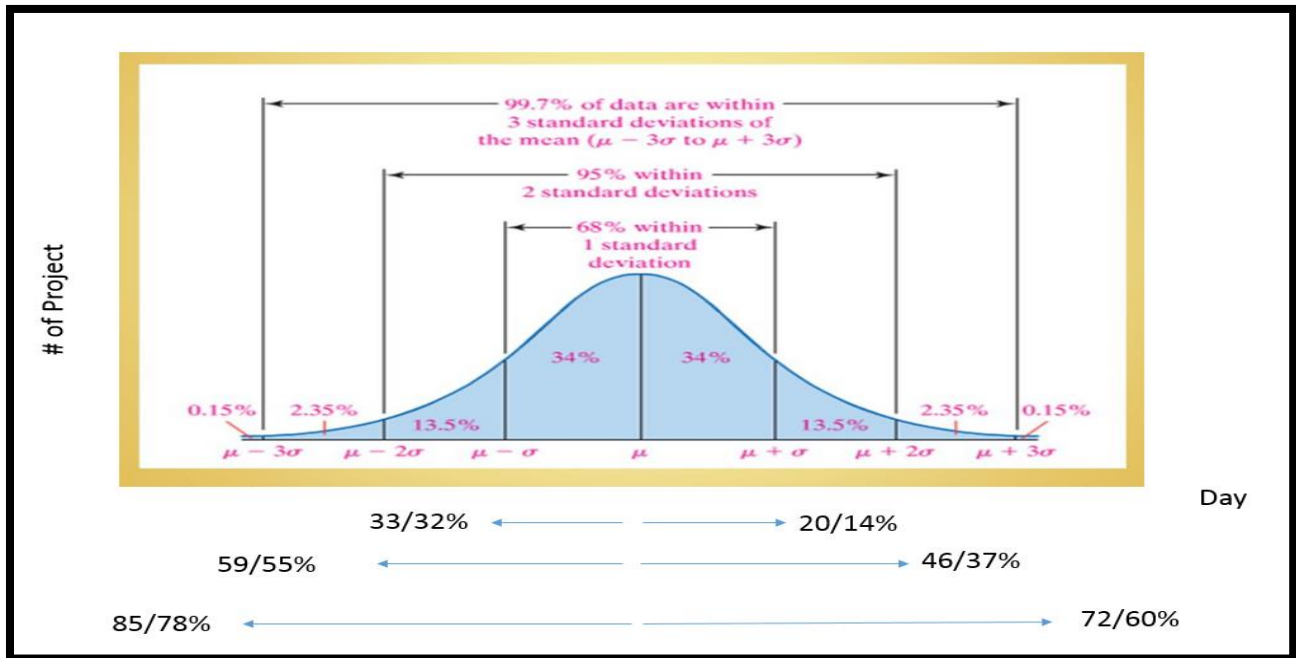
Chart (TA1) Average day/ % Average day for St. Tammany Parish

99.7% of data are within
3 standard deviations of
the mean ($\mu - 3\sigma$ to $\mu + 3\sigma$)

95% within
2 standard deviations

68% within
1 standard
deviation

34%   34%

0.15%   2.35%   13.5%   13.5%   2.35%   0.15%

$\mu - 3\sigma$ $\mu - 2\sigma$ $\mu - \sigma$ μ $\mu + \sigma$ $\mu + 2\sigma$ $\mu + 3\sigma$

# of Project

Cost

567,848.00/18% ⟷ 675,454.00/24%

1,189,498.00/39% ⟷ 1,297,104.00/45%

1,811,149.00/60% ⟷ 1,918,755.00/66%
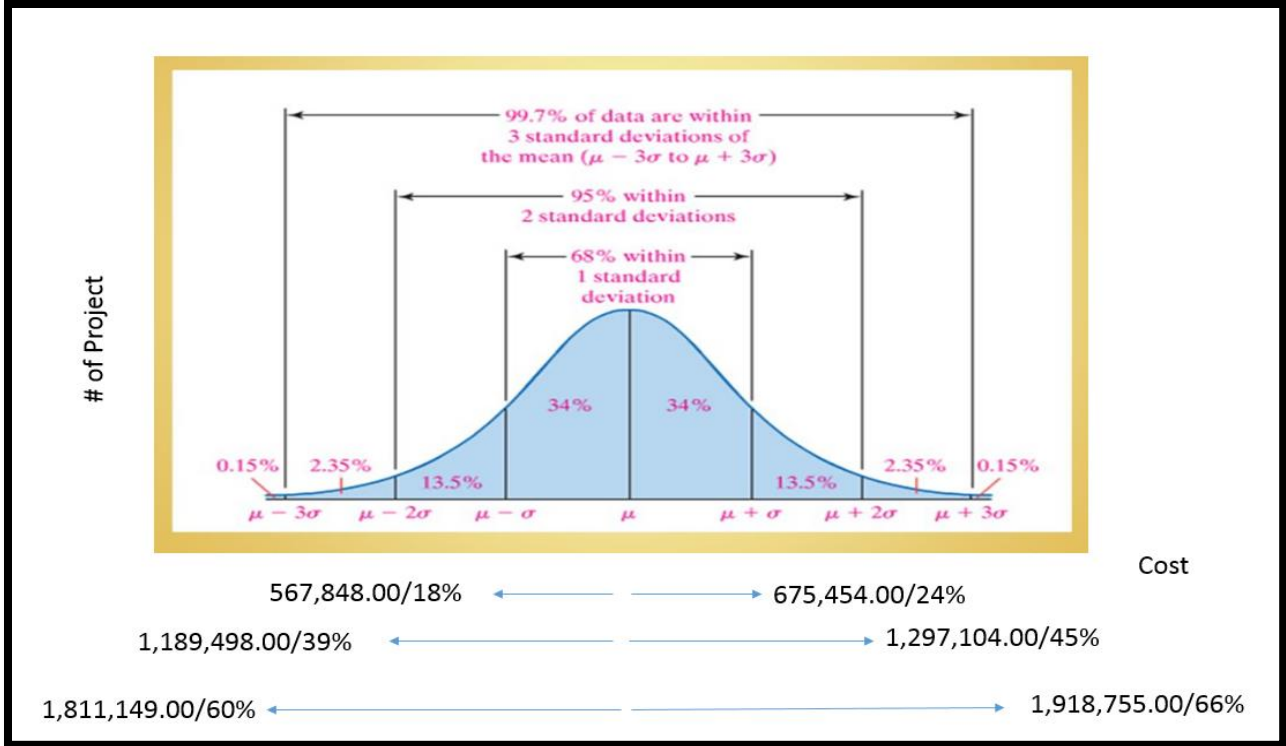
Chart (TA2) Average cost /% Average cost (2005-2015) for St. Tammany Parish

Appendix P

District 02

Lafourche Parish

Exhibit 1/02

St. Charles Parish

St. Charles- Time

y = 0.0789x - 11.053

Day Variance .... Linear (Day Variance)

St. Charles- % Cost

y = 2E-08x + 0.0352

% Cost Variance overrun/underrun

.... Linear (% Cost Variance overrun/underrun)

Exhibit 4/02

St. Bernard Parish

St. Bernard Parish- Time

$y = -0.0991x + 0.8181$

- Day Variance
- Linear (Day Variance)

St. Bernard Parish- Cost Variance

$y = 6E-08x - 0.1292$

- % Cost Variance overrun/underrun
- Linear (% Cost Variance overrun/underrun)

Exhibit 5/02

192

Orleans Parish

Orleans Parish- Time

$y = -0.2025x + 11.676$

Days Variance .... Linear (Days Variance)

Orleans Paris- % Variance

$y = -5E-09x + 0.0779$

% Cost Variance overrun/underrun

.... Linear (% Cost Variance overrun/underrun)

Exhibit 6/02

Jefferson Parish

Jefferson Parish- Time

y = -0.0761x + 1.3796

Jefferson Parish- % Cost

y = 9E-10x + 0.0331

Exhibit 7/02

194

District 03

District 03 {Parishes

Parishes	Schedule Performance "days variance"	Cost Performance "% Overrun/underrun"
Vermilion Parish [Exhibit 1/03]	Y=-0.1287* "Bid Days" + 6.2434	Y=1E-08* "Bid Amount" -0.0014
Acadia Parish [Exhibit 2/03]	Y=-0.0097* "Bid Days" − 5.2845	Y=-5E-08* "Bid Amount" + 0.0705
Evangeline Parish [Exhibit 3/03]	Y=-0.1185* "Bid Days" − 0.0458	Y=4E-08* "Bid Amount" -0.122
St. Landry Parish [Exhibit 4/03]	Y=0.0297* "Bid Days"- 9.1635	Y=4E-10* "Bid Amount" +0.0145
St. Mary Parish [Exhibit 5/03]	Y=-0.4222* "Bid Days"-19.117	Y=-2E-08* "Bid Amount" + 0.0668
Iberia Parish [Exhibit 6/03]	Y=0.0948* "Bid Days" − 7.4426	Y=-4E-09* "Bid Amount" +0.0634
Lafayette Parish [Exhibit 7/03]	Y=-0.3126* "Bid Days" + 17.782	Y=5E-10* "Bid Amount" + 0.0467
St. Martin Parish [Exhibit 8/03]	Y=0.0242* "Bid Days" − 6.7505	Y=-3E-09* "Bid Amount" +0.0073

Vermilion Parish

Vermilion Parish- Time

$y = -0.1287x + 6.2434$

Day Variance .... Linear (Day Variance)

Vermilion Parish- % Cost

$y = 1E-08x - 0.0014$

%Cost Variance overrun/underrun

.... Linear (%Cost Variance overrun/underrun)

Exhibit 1/03

Acadia Parish

3333333

Exhibit 2/03

Evangeline Parish

Exhibit 3/03

St. Landry Paris

St. Landry Parish- Time

y = 0.0297x - 9.1635

St. Landry Parish- % Cost

y = 4E-10x + 0.0145

Exhibit 4/03

St. Mary Parish

199

St.Mary Parish- Time

y = -0.4222x + 19.117

Day Variance · · · · · · · Linear (Day Variance)

St. Mary Parish- Time

y = -2E-08x + 0.0668

%Cost Variance overrun/underrun

· · · · · · · Linear (%Cost Variance overrun/underrun)

Exhibit 5/03

200

Iberia Parish

Iberia Parish- Time

$y = 0.0948x - 7.4426$

Day Variance ..... Linear (Day Variance)

Iberia Parish- % Cost

$y = -4E-09x + 0.0634$

%Cost Variance Overrun/Underrun

..... Linear (%Cost Variance Overrun/Underrun)

Exhibit 6/03

Lafayette Parish

Exhibit 7/03

202

St. Martin Parish

Exhibit 8/03

District 04

Parishes	Schedule Performance "days variance"	Cost Performance "Overrun/underrun"
Claiborne [Chart 1/04]	Y=- 0.1737* "Bid Days" -14.807	Y=0.0013* "Bid Amount" +0.0522
Desoto [Chart 2/04]	Y=0.1735* "Bid Days" -13.306	Y=0.0021* "Bid Amount"-0.0384
Red River [Chart 3/04]	Y=0.1179* "Bid Days" - 4.5429	Y=- 0.004* "Bid Amount" + 0.0211
Bienville [Chart 4/04]	Y=0.2* "Bid Days" -12.151	Y=0.0005* "Bid Amount" +0.0053
Webster [Chart 5/04]	Y=0.0837* "Bid Days" − 8.0766	Y=0.0006* "Bid Amount" - 0.0178
Bossier [Chart 6/04]	Y=-0.1457* "Bid Days" -3.1443	Y=-0.0002* "Bid Amount" +0.0042
Caddo [Chart 7/04]	Y=0.0494* "Bid Days" +2.3918	Y=-0.0004* "Bid Amount" +0.0256

Claiborne Parish

Claiborne Parish- Time

$y = -0.2125x - 0.7484$

Legend: Day Variance · · · · · · Linear (Day Variance)

Claiborn Parish-% Cost

$y = 1E-08x - 0.0561$

Legend: % Cost Variance Overrun/Underrun · · · · · · Linear (% Cost Variance Overrun/Underrun)

Exhibit 1/04

Desoto Parish

Desoto Parish - Time

$y = 0.0094x - 10.14$

Day Variance   Linear (Day Variance)

Desoto Parish- % Cost

$y = 4E-09x + 0.0014$

% Cost Variance Overrun/Underrun

Linear (% Cost Variance Overrun/Underrun)

Chart 2/04

Red River Parish

Red River Parish- Time

$y = 0.0213x - 5.2037$

Red River-% Cost

$y = 9E-10x - 0.0119$

Exhibit 3/04

Bienville Parish

Bienville Parish-Time

y = 0.1439x - 17.543

Legend: • Day Variance ⋯⋯ Linear (Day Variance)

Bienville Parish- % Cost

y = 3E-09x + 0.0116

Legend: • % Cost Variance Overrun/Underrun

⋯⋯ Linear (% Cost Variance Overrun/Underrun)

Exhibit 4/04

Webster Parish

Webster Parish-Time

$y = 0.0191x - 7.6209$

Series2 .... Linear (Series2)

Webster Parish- % Cost

$y = 4E-09x - 0.0117$

% Cost Variance Overrun/Underrun

.... Linear (% Cost Variance Overrun/Underrun)

Exhibit 5/04

Bossier Parish

Exhibit 6/04

210

Caddo Parish

Caddo Parish-Time

$y = 0.1657x - 14.947$

Day Variance .... Linear (Day Variance)

Caddo Parish- % Cost

$y = 1E-09x - 0.0104$

● % Cost Variance Overrun/Underrun

.... Linear (% Cost Variance Overrun/Underrun)

Exhibit 7/04

Appendix Q

District 05

Parish	Schedule Performance "days variance"	Cost Performance "Overrun/underrun"
Union **[Exhibit 1/05]**	Y=0.2014* "Bid Days"- 22.474	Y=2E-10* "Bid Amount"+0.003
West Carroll **[Exhibit 2/05]**	Y=-0.3833* "Bid Days" + 12.537	Y=-7E-08* "Bid Amount" + 0.0795
Jackson **[Exhibit 3/05]**	Y=0.1171* "Bid Days" -19.008	Y=3E-10* "Bid Amount" +0.0283
East Carroll **[Exhibit 4/05]**	Y=0.1189* "Bid Days" -18.68	Y=-1E-09* "Bid Amount" – 0.0113
Morehouse **[Exhibit 5/05]**	Y=0.0598* "Bid Days" – 15.486	Y=9E-09* "Bid Amount" +0.0005
Madison **[Exhibit 6/05]**	Y=-0.0151* "Bid Days" -7.1106	Y=9E-09* "Bid Amount" – 0.0136
Lincoln **[Exhibit 7/05]**	Y=0.098* "Bid Days" -12.5	Y=2E-09* "Bid Amount" +0.0005
Richland **[Exhibit 8/05]**	Y=-0.0766* "Bid Days" -1.9094	Y=-7E-09* "Bid Amount"-0.0003
Ouachita **[Exhibit 9/05]**	Y=-0.0167* "Bid Days" -7.1584	Y=9E-09* "Bid Amount" +0.0295

Union Parish

Exhibit 1/05

213

West Carroll Parish

West Carroll- Time

y = -0.3833x + 12.537

West Carroll- % Cost

y = -7E-08x + 0.0795

Exhibit 2/05

Jackson Parish

Jackson Parish- Time

y = 0.1171x - 19.008

- Day Variance
- Linear (Day Variance)

Jackson Parish-% Cost

y = 3E-10x + 0.0283

- % Cost Variance Overrun/Underrun
- Linear (% Cost Variance Overrun/Underrun)

Exhibit 3/05

215

East Carroll Parish

Exhibit 4/05

Morehouse Parish

Morehouse Parish- Time

$y = 0.0598x - 15.486$

Morehouse Parish- % Cost

$y = 9E-09x + 0.0005$

Exhibit 5/05

217

Madison Parish

Madison Parish- Time

y = -0.0151x - 7.1106

- Day Variance
- Linear (Day Variance)

Nadison Parish- % Cost

y = 9E-09x - 0.0136

- % Cost Variance Overrun/Underrun
- Linear (% Cost Variance Overrun/Underrun)

Exhibit 6/05

218

Lincoln Parish

Lincoln Parish-Time

y = 0.098x - 12.5

● Day Variance   ······· Linear (Day Variance)

Lincln Parish-% Cost

y = 2E-09x + 0.0005

● % Cost Variane Overrun/Underrun

······· Linear (% Cost Variane Overrun/Underrun)

Exhibit 7/05

Richland Parish

Richland Parish-Time

$y = -0.0766x - 1.9094$

Day Variance ⋯⋯ Linear (Day Variance)

Richland Parish-% Cost

$y = -7E-09x - 0.0003$

% Cost Variance Overrun/Underrun

⋯⋯ Linear (% Cost Variance Overrun/Underrun)

Exhibit 8/05

220

Ouachita Parish

Exhibit 9/05

Appendix R

District 07

Parish	Schedule Performance "days variance"	Cost Performance "Overrun/underrun"
Cameron Parish [Exhibit 1/07]	Y=-0.2329* "Bid Days" + 3.5076	Y=-2E-08* "Bid Amount" + 0.071
Allen Parish [Exhibit 2/07]	Y=-0.139* "Bid Days" − 0.5712	Y=9E-09* "Bid Amount" -0.0174
Beauregard Parish [Exhibit 3/07]	Y=-0.1361* "Bid Days" -8.4513	Y=7E-09* "Bid Amount" − 0.0079
Jefferson Davis Parish [Exhibit 4/07]	Y=0.0085* "Bid Days" − 3.4734	Y=1E-08* "Bid Amount"- 0.0329
Calcasieu Parish [Exhibit 5/07]	Y=0.0273* "Bid Days" − 10.441	Y=5E-09* "Bid Amount" +0.0254

Cameron Parish

Exhibit 1/07

Allen Parish

Allen Parish-Time

$y = -0.139x - 0.5712$

Legend: Day Variance — Linear (Day Variance)

Allen Parish-% Cost

$y = 9E-09x - 0.0174$

Legend: % Cost Variance Overrun/Underrun — Linear (% Cost Variance Overrun/Underrun)

Exhibit 2/07

Beauregard Parish

Exhibit 3/07

225

Jefferson Davis Parish

Exhibit 4/07

Calcasieu Parish

Calcasieu Parish- Time

$y = 0.0273x - 10.441$

Legend: Day Variance, Linear (Day Variance)

Calcasieu Parish-% Cost

$y = 5E-09x + 0.0254$

Legend: % Cost Variance Overrun/Underrun, Linear (% Cost Variance Overrun/Underrun)

Exhibit 5/07

Appendix S

District 8

The below equations are for **different Parishes under district 08:**

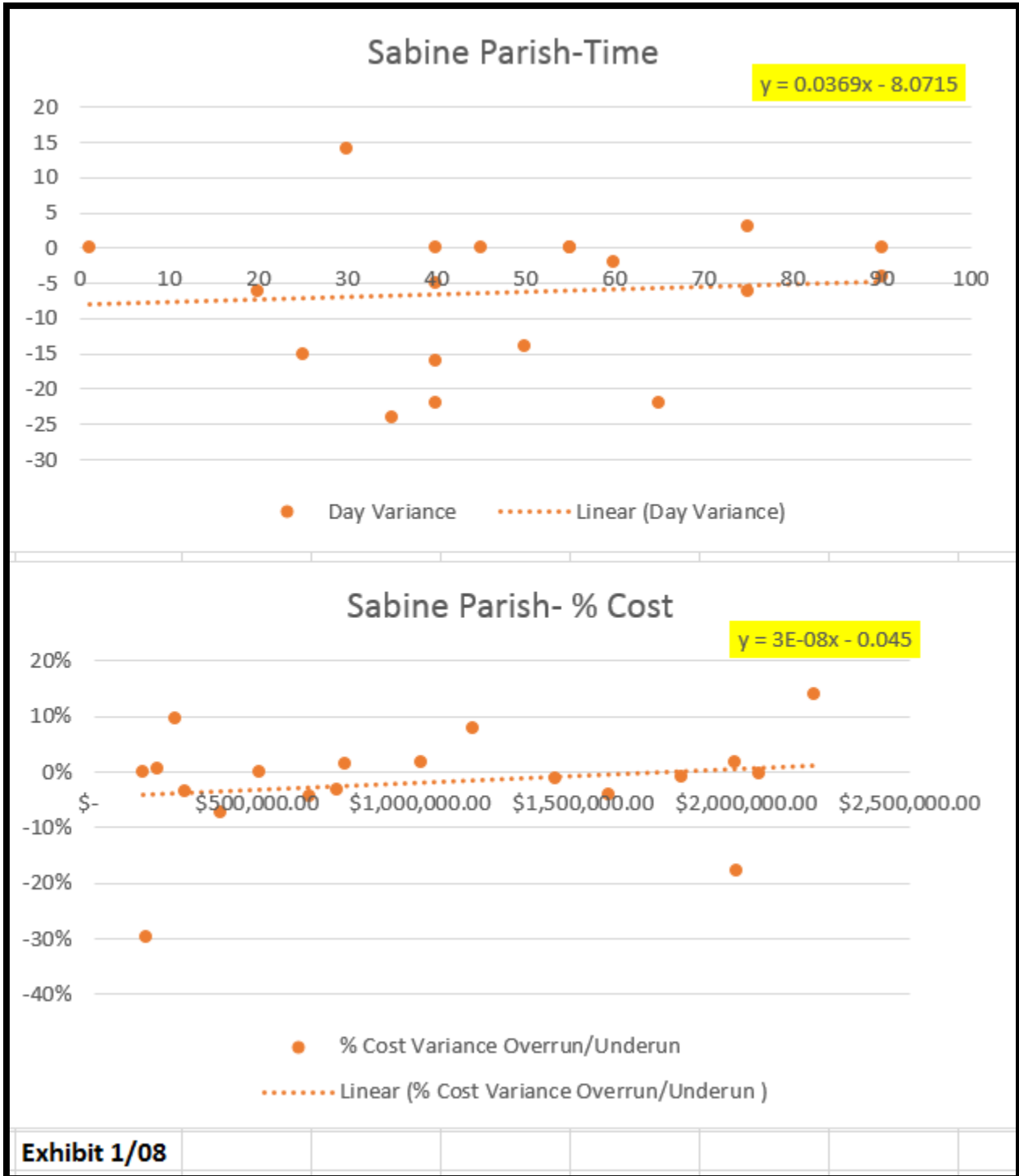| Parish	Schedule Performance "days variance"	Cost Performance "Overrun/underrun"
Sabine Parish **[Exhibit 1/08]**	Y=0.0369* "Bid Days"-8.0715	Y=3E-08* "Bid Amount"- 0.045
Vernon Parish **[Exhibit 2/08]**	Y=-0.0851* "Bid Days" -7.0972	Y=4E-09* "Bid Amount"- 0.0121
Winn Parish **[Exhibit 3/08]**	Y=-0.0065* "Bid Days" – 10.935	Y=2E-09* "Bid Amount"-0.0209
Natchitoches **[Exhibit 4/08]**	Y=-0.1294* "Bid Days" -1.3104	Y=2E-09* "Bid Amount"- 0.0019
Grant Parish **[Exhibit 5/08]**	Y=0.0202* "Bid Days" -12.533	Y=-3E-09* "Bid Amount"- 0.0113
Rapides Parish **[Exhibit 6/08]**	Y=-0.1302* "Bid Days" -3.9116	Y=-5E-09* "Bid Amount" +0.0188
Avoyelles Parish **[Exhibit 7/08]**	Y=-0.0425* "Bid Days" – 2.6605	Y=-1E-09* "Bid Amount"- 0.0294

Sabine Parish

Sabine Parish-Time

y = 0.0369x - 8.0715

Sabine Parish- % Cost

y = 3E-08x - 0.045

Exhibit 1/08

Vernon Parish

Vernon Parish- Time

$y = -0.0851x - 7.0972$

Day Variance ········· Linear (Day Variance)

Vernon Parish- % Cost

$y = 4E-09x - 0.0121$

● % Cost Variance Overrun/Underrun

········· Linear (% Cost Variance Overrun/Underrun)

Exhibit 2/08

230

Winn Parish

Exhibit 3/08

231

Natchitoches Parish

Exhibit 4/08

Grant Parish

Grant Parish-Time

$y = 0.0202x - 12.533$

Series2   Linear (Series2)

Grant Parish -%Cost

$y = -3E-09x - 0.0113$

% Cost Variance Overrun/Underrun

Linear (% Cost Variance Overrun/Underrun)

Exhibit 5/08

233

Rapides Parish

Rapides Parish-Time

y = -0.1302x - 3.9116

Day Variance ········· Linear (Day Variance)

Rapides Parish-% Cost

y = -5E-09x + 0.0188

● % Cost Variance Overrun/Underrun

········· Linear (% Cost Variance Overrun/Underrun)

Chart 6/08

Avoyelles Parish

Exhibit 7/08

235

Appendix X
District 58

Parish	Schedule Performance "days variance"	Cost Performance "Overrun/underrun"
Franklin Parish **[Exhibit 1/58]**	Y=-0.0749* "Bid Days" − 4.887	Y=3E-09* "Bid Amount" + 0.019
Tensas Parish **[Exhibit 2/58]**	Y= -0.2457* "Bid Days" − 0.4096	Y=6E-09* "Bid Amount"-0.0069
Concordia Parish **[Exhibit 3/58]**	Y=-0.3937* "Bid Days" + 8.6639	Y=2E-08* "Bid Amount"- 0.01
Caldwell Parish **[Exhibit 4/58]**	Y=0.024* "Bid Days" − 14.48	Y=9E-09* "Bid Amount"+0.0027
LaSalle Parish **[Exhibit 5/58]**	Y=-0.1984* "Bid Days" + 1.7869	Y=7E-09* "Bid Amount"+0.0342
Catahoula Parish **[Exhibit 6/58]**	Y=-0.0278* "Bid Days" -9.4087	Y=1E-09* "Bid Amount"+0.0412

Franklin Parish

Franklin Parish

y = -0.0749x - 4.887

- Day Variance
- Linear (Day Variance)

Franklin Parish-% Cost

y = 3E-09x + 0.019

- % Cost Variance Overrun/Underrun
- Linear (% Cost Variance Overrun/Underrun)

Exhibit 1/58

Tensas Parish

Tensas Parish- Time

y = -0.2457x + 0.4096

Day Variance   .... Linear (Day Variance)

Tensas Parish - % Cost

y = 6E-09x - 0.0069

● % Cost Variance Overrun/Underrun

.... Linear (% Cost Variance Overrun/Underrun)

Concordia Parish

Exhibit 3/58

Caldwell Parish

Caldwell Parish -Time

y = 0.024x - 14.48

Day Variance .... Linear (Day Variance)

Caldweell Parish- % Cost

y = 9E-09x + 0.0027

● % Cost Variance Overrun/Underrun

.... Linear (% Cost Variance Overrun/Underrun)

Exhibit 4/58

240

LaSalle Parish

LaSalle Parish- Time

y = -0.1984x + 1.7869

LaSalle Parish-% Cost

y = 7E-09x + 0.0342

Catahoula Parish

Exhibit 6/58

Appendix Y
District 61

The below equations are for **different Parishes under district 61:**

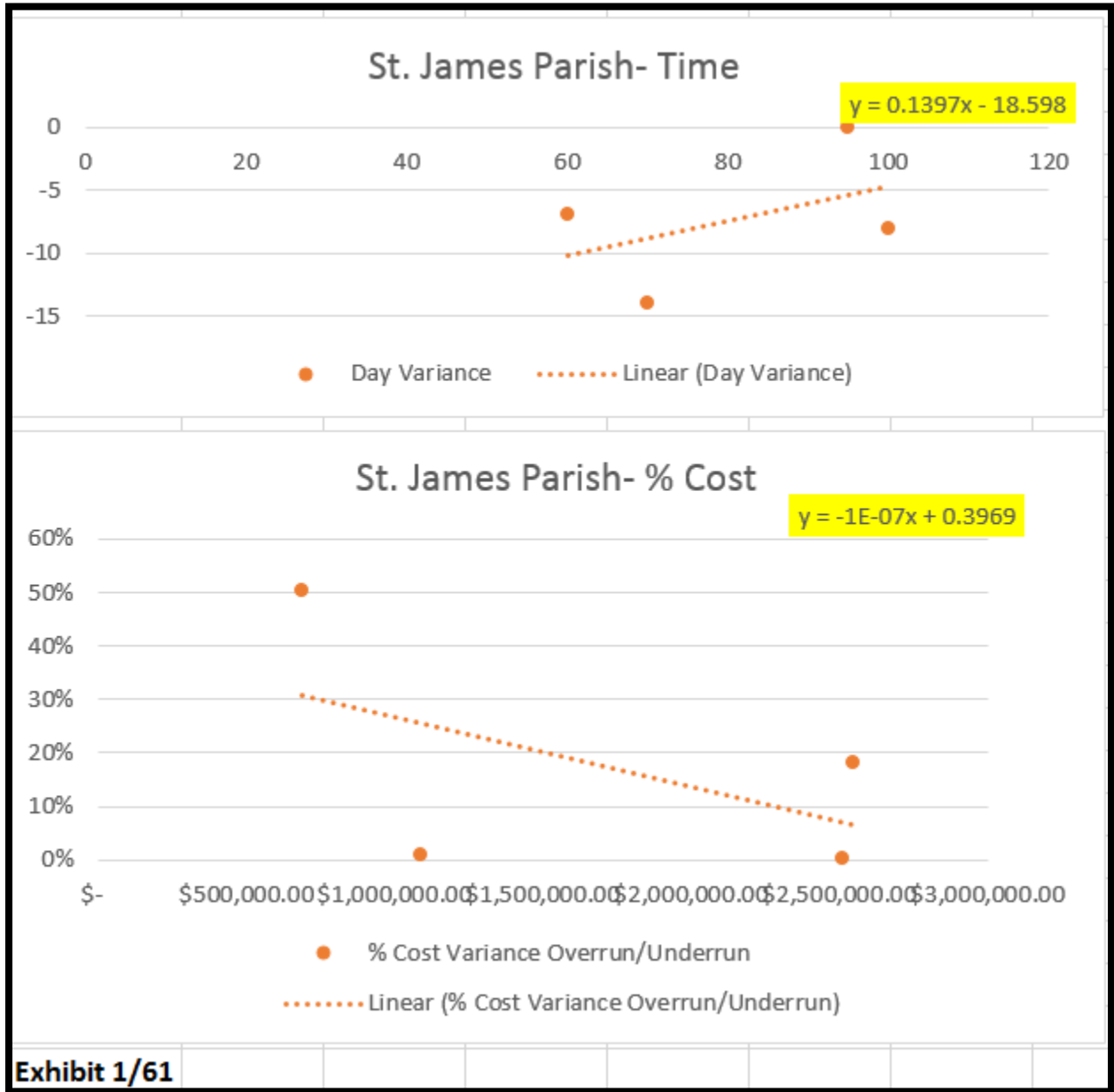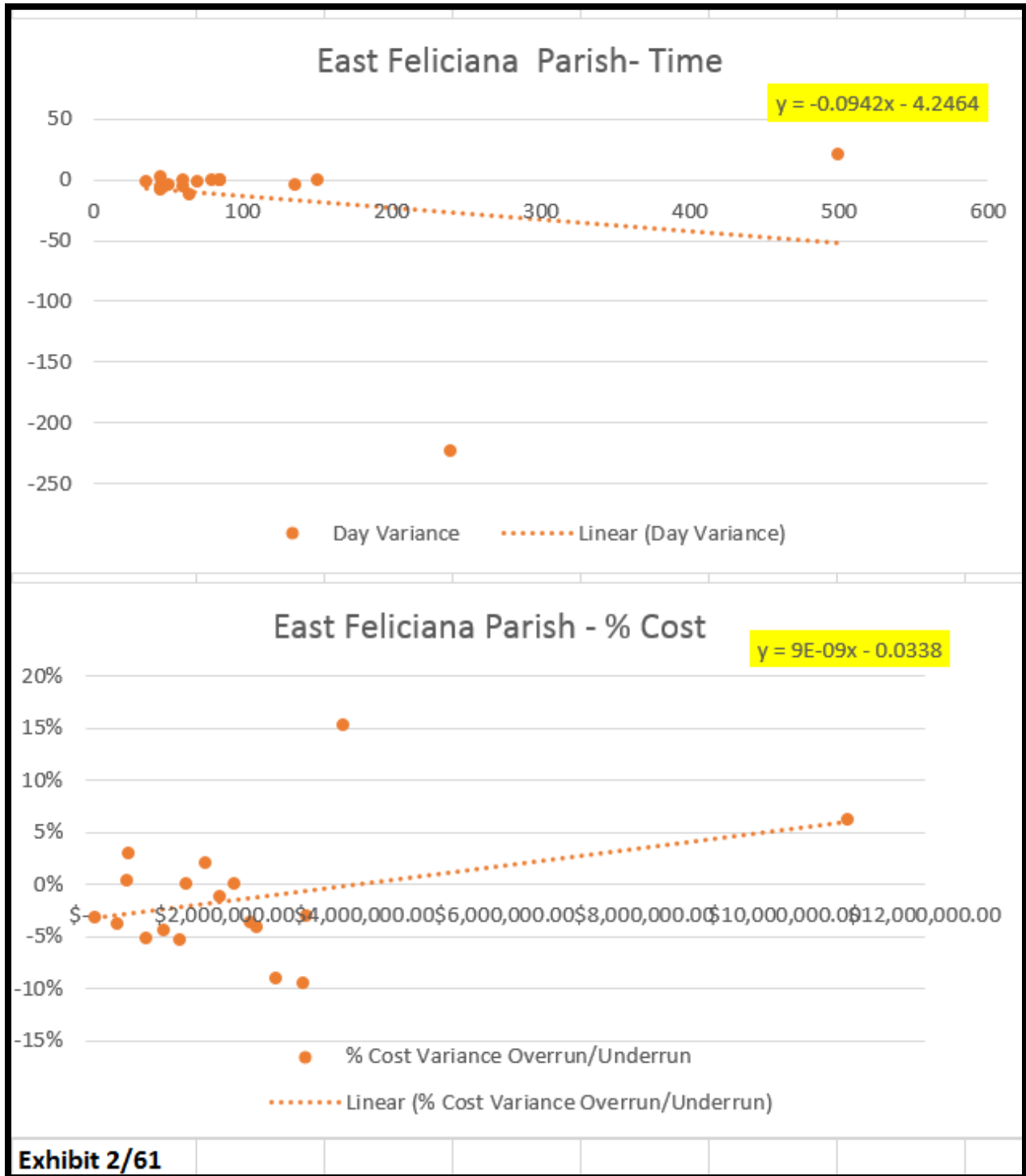| Parish	Schedule Performance "days variance"	Cost Performance "Overrun/underrun"
St. James Parish **[Exhibit 1/61]**	Y=0.1397* "Bid Days" − 18.598	Y=-1E-07* "Bid Amount"+ 0.3969
East Feliciana Parish **[Exhibit 2/61]**	Y=-0.0942* "Bid Days" -4.2464	Y=9E-09* "Bid Amount"- 0.0338
Iberville Parish **[Exhibit 3/61]**	Y=0.0256* "Bid Days" − 7.6076	Y=-1E-08* "Bid Amount"+0.0706
Ascension Parish **[Exhibit 4/61]**	Y=-0.0499* "Bid Days" − 6.7478	Y=2E-08* "Bid Amount" + 0.0147
West Feliciana Parish **[Exhibit 5/61]**	Y=-0.0154* "Bid Days" +3.7847	Y=1E-10* "Bid Amount"+ 0.029
Point Coupee Parish **[Exhibit 6/61]**	Y=0.0531* "Bid Days" - 12	Y=9E-09* "Bid Amount"-0.0508
West Baton Rouge Parish **[Exhibit 7/61]**	Y=0.1247* "Bid Days" − 9.5863	Y=2E-08* "Bid Amount"- 0.0602
East Baton Rouge Parish **[Exhibit 8/61]**	Y=0.0391* "Bid Days" -6.6246	Y=2E-09* "Bid Amount"+0.0063
Assumption Parish **[Exhibit 9/61]**	Y=0.0252* "Bid Days" − 8.3874	Y=2E-08* "Bid Amount"- 0.0206

St. James Parish

St. James Parish- Time

y = 0.1397x - 18.598

Day Variance ········· Linear (Day Variance)

St. James Parish- % Cost

y = -1E-07x + 0.3969

% Cost Variance Overrun/Underrun

········· Linear (% Cost Variance Overrun/Underrun)

Exhibit 1/61

East Feliciana Parish

East Feliciana Parish- Time

y = -0.0942x - 4.2464

East Feliciana Parish - % Cost

y = 9E-09x - 0.0338

Exhibit 2/61

245

Iberville Parish

Iberville Parish- Time

y = 0.0256x - 7.6076

Legend: Day Variance; Linear (Day Variance)

Iberville Parish - % Cost

y = -1E-08x + 0.0706

Legend: % Cost Variance Overrun/Underrun; Linear (% Cost Variance Overrun/Underrun)

Exhibit 3/61

246

Ascension Parish

Ascension Parish- Time

$y = -0.0499x - 6.7478$

Legend: Day Variance · Linear (Day Variance)

Ascension Parish-% Cost

$y = 2E\text{-}08x + 0.0147$

Legend: % Cost Variance Overrun/Underrun · Linear (% Cost Variance Overrun/Underrun)

Exhibit 4/61

West Feliciana Parish- Time

$y = -0.0154x + 3.7847$

West Feliciana Parish-% Cost

$y = 1E\text{-}10x + 0.029$

Exhibit 5/61

Point Coupee Parish

Point Coupee Parish-Time

y = 0.0531x - 12

Point Coupee Parish-% Cost

y = 9E-09x - 0.0508

Exhibit 6/61

West Baton Rouge Parish

West Baton Rouge Parish-Time

y = 0.1247x - 9.5863

West Baton Rouge Parish- % Cost

y = 2E-08x - 0.0602

Exhibit 7/61

East Baton Rouge Parish

East Baton Rouge-Time

$y = 0.0391x - 6.6246$

East Baton Rouge-% Cost

$y = 2E-09x + 0.0063$

Exhibit 8/61

Assumption Parish

Exhibit 9/61
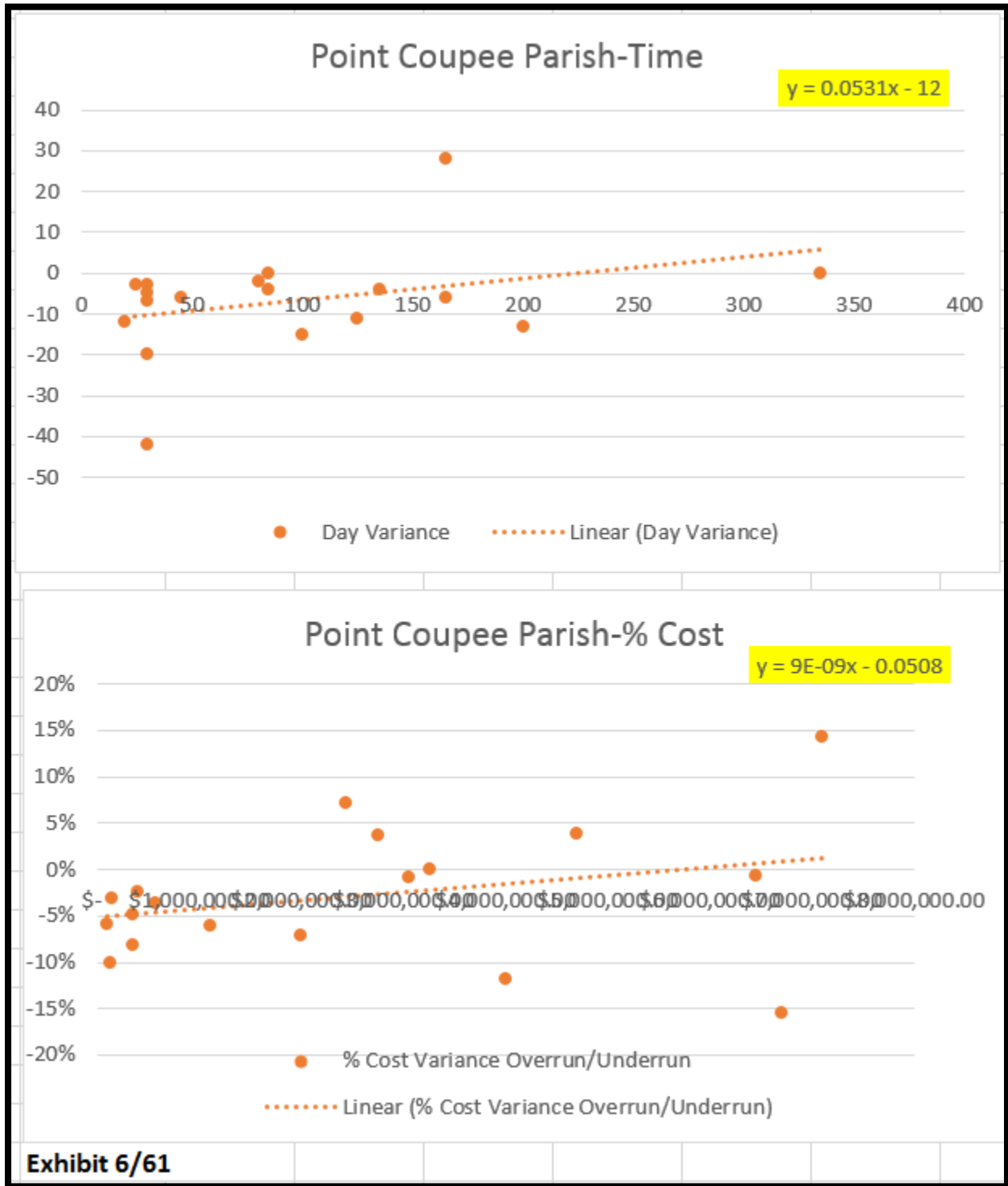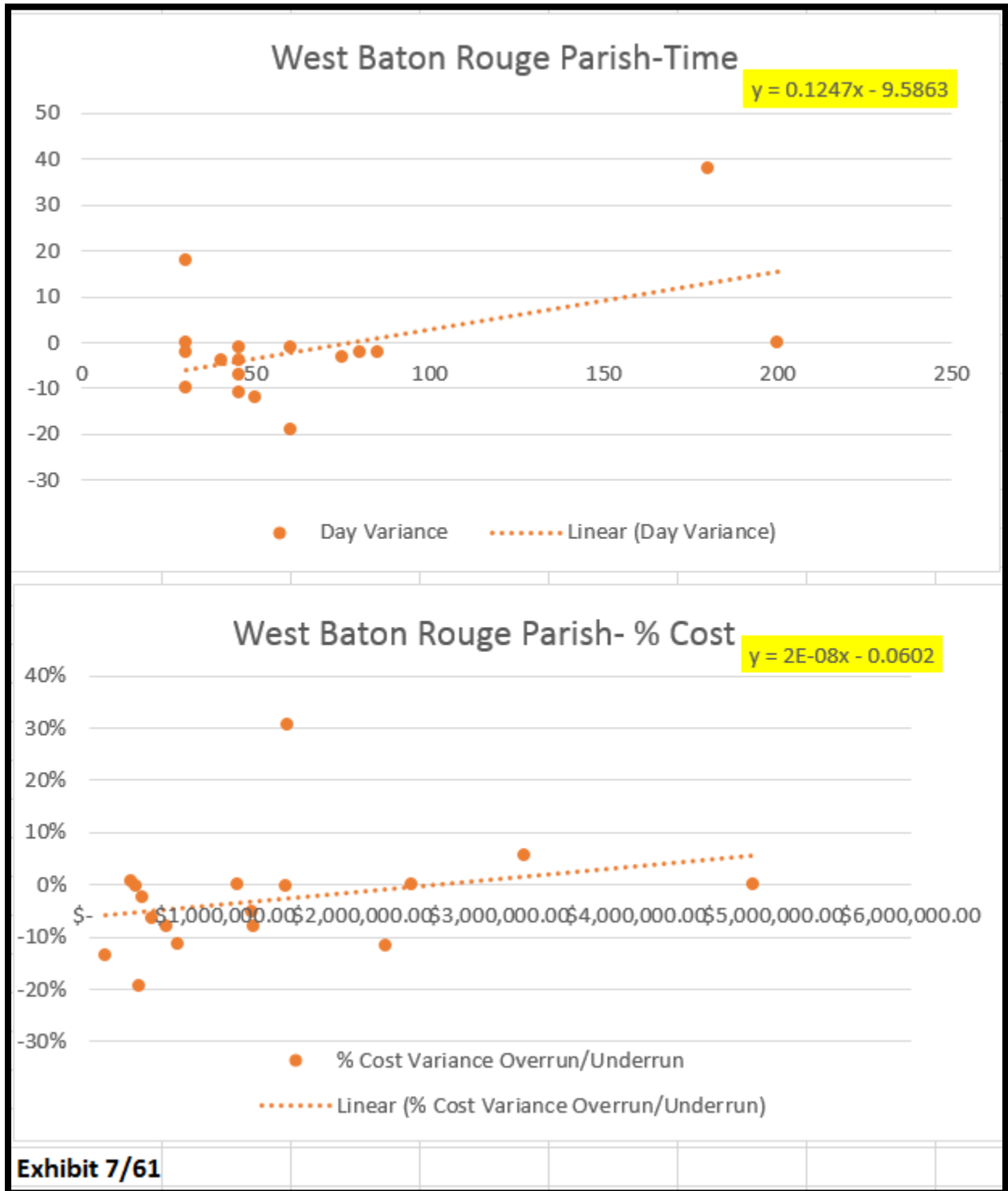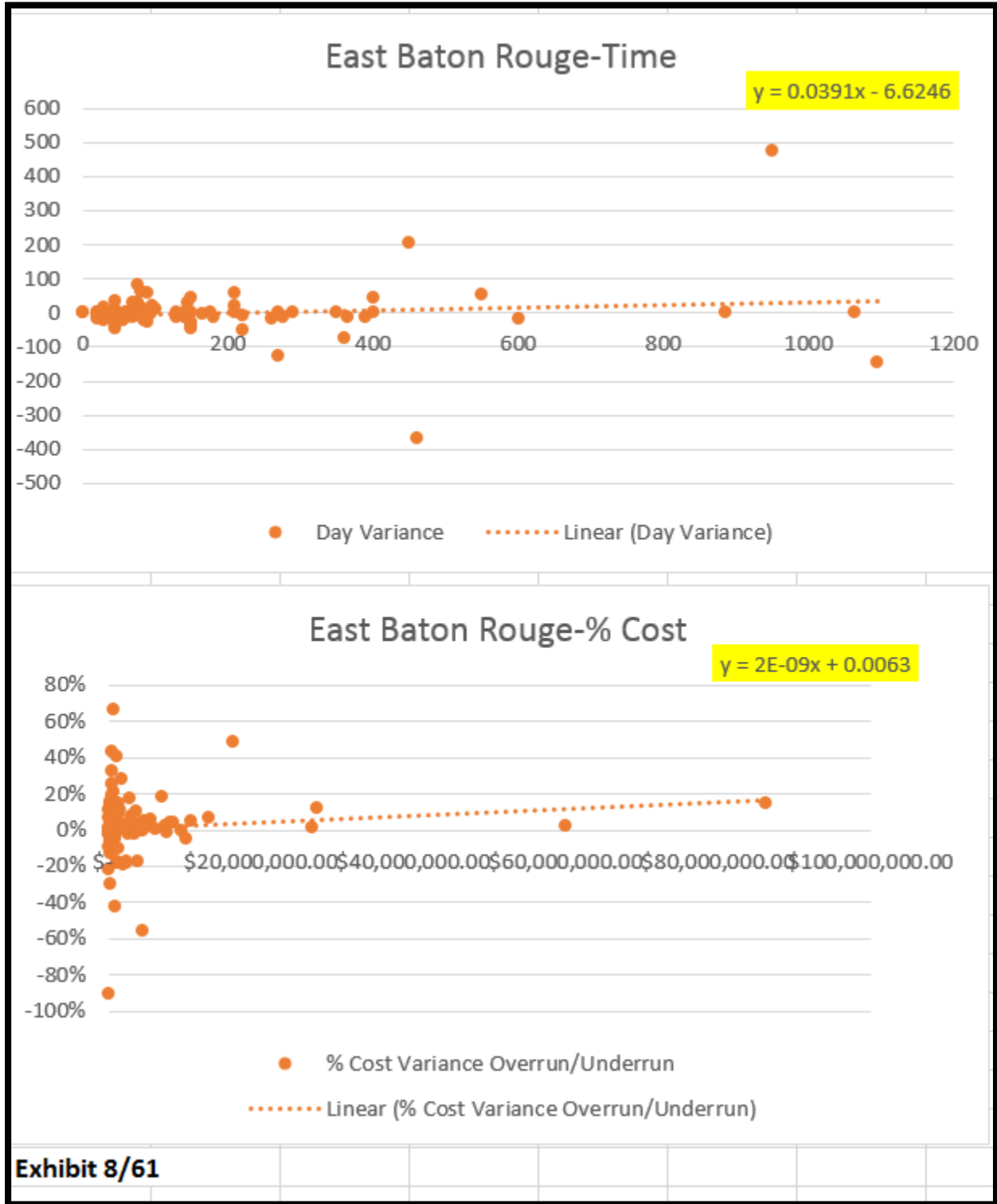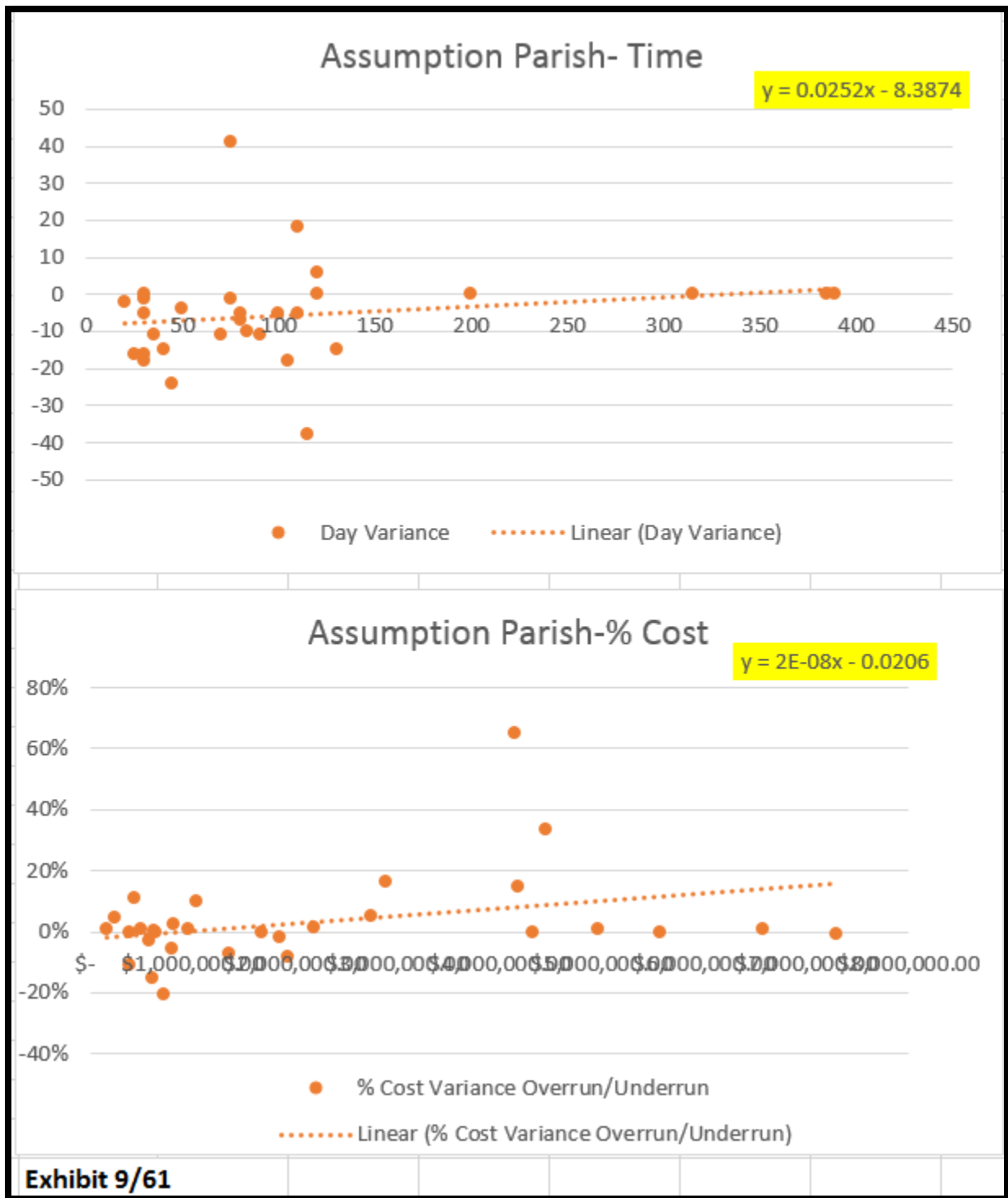
Appendix Z

District 62

The below equations are for **different Parishes under district 62:**

Parish	Schedule Performance "days variance"	Cost Performance "Overrun/underrun"
Washington Parish [Exhibit 1/62]	Y=0.0167* "Bid Days" -6.8249	Y=3E-08* "Bid Amount"-0.0946
Tangipahoa Parish [Exhibit 2/62]	Y=0.0086* "Bid Days" -7.1243	Y=2E-09* "Bid Amount"+5E-05
Livingston Parish [Exhibit 3/62]	Y=-0.0054* "Bid Days" -2.0291	Y=-1E-09* "Bid Amount"+ 0.0016
St. Helena Parish [Exhibit 4/62]	Y=-0.0606* "Bid Days" -3.8281	Y=4E-09* "Bid Amount"+0.0032
St. John Parish [Exhibit 5/62]	Y=0.0276* "Bid Days" -8.9198	Y=-4E-09* "Bid Amount"+0.0296
St. Tammany Parish [Exhibit 6/62]	Y=-0.0075* "Bid Days" -5.6228	Y=-9E-10* "Bid Amount"+ 0.0308

Washington Parish

Washington Parish-Time

$y = 0.0167x - 6.8249$

Day Variance ⋯⋯ Linear (Day Variance)

Washington Parish- % Cost

$y = 3E\text{-}08x - 0.0946$

● % Cost Variance Overrun/Underrun

⋯⋯ Linear (% Cost Variance Overrun/Underrun)

Exhibit 1/62

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Tangipahoa Parish

Tangipahoa Parish-Time

y = 0.0086x - 7.1243

Day Variance .... Linear (Day Variance)

Tangipahoa Parish-% Cost

y = 2E-09x + 5E-05

% Cost Variance Overrun/Underrun

.... Linear (% Cost Variance Overrun/Underrun)

Exhibit 2/62

Livingston Parish

Livingston Parish-Time

y = -0.0054x - 2.0291

Livingston Parish- % Cost

y = -1E-09x + 0.0016

Exhibit 3/62

St. Helena Parish

St. Helena Parish

$y = -0.0606x - 3.8281$

- Day Variance .... Linear (Day Variance)

St. Helena Parish-% Cost

$y = 4E-09x + 0.0032$

- % Cost Variance Overrun/Underrun
.... Linear (% Cost Variance Overrun/Underrun)

Exhibit 4/62

257

St. John Parish

St. John-Time

y = 0.0276x - 8.9198

Day Variance .... Linear (Day Variance)

St. John Parish -% Cost

y = -4E-09x + 0.0296

% Cost Variance Overrun/Underrun

.... Linear (% Cost Variance Overrun/Underrun)

Exhibit 5/62

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St. Tammany Parish

St. Tammany Parish- Time

y = -0.0075x - 5.6228

St. Tammany Parish- % Cost

y = -9E-10x + 0.0308

Exhibit 6/62

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Vita

The author Mahmoud Hamide was born in Damascus, Syria. He completed his Bachelors and Masters of Science in Civil Engineering at University of New Orleans, 1987 and 1998 respectively. Dr. Hamide has been working with the Louisiana Department of Transportation and Development since 1991 and currently holds the position of engineer 4. Dr. Hamide is holding the position of adjunct professor at the University of New Orleans and Delgado Community College. Dr. Hamide is certified Professional Engineering (PE) in the states of Louisiana and Alabama. Dr. Hamide and his spouse enjoy traveling and spending time with their family of three.