SOAH DOCKET NO. 473-18-3981
PUC DOCKET NO. 48401

APPLICATION OF TEXAS-NEW MEXICO POWER COMPANY FOR AUTHORITY TO CHANGE RATES	§ § §	BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS

DIRECT TESTIMONY AND EXHIBITS

OF

DAVID J. GARRETT

ON BEHALF OF

ALLIANCE OF TEXAS-NEW MEXICO POWER MUNICIPALITIES

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I. INTRODUCTION

Q. STATE YOUR NAME AND OCCUPATION.

A. My name is David J. Garrett. I am a consultant specializing in public utility regulation. I am the managing member of Resolve Utility Consulting, PLLC. I focus my practice on the primary capital recovery mechanisms for public utility companies: cost of capital and depreciation.

Q. SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I received a B.B.A. with a major in Finance, an M.B.A. and a Juris Doctor from the University of Oklahoma. I worked in private legal practice for several years before accepting a position as assistant general counsel at the Oklahoma Corporation Commission in 2011. At the Oklahoma Commission, I worked in the Office of General Counsel in regulatory proceedings. In 2012, I began working for the Public Utility Division as a regulatory analyst providing testimony in regulatory proceedings. After leaving the Oklahoma Commission, I formed Resolve Utility Consulting, PLLC, where I have represented various consumer groups, state agencies, and municipalities in utility regulatory proceedings, primarily in the areas of cost of capital and depreciation. I am a Certified Depreciation Professional with the Society of Depreciation Professionals. I am also a Certified Rate of Return Analyst with the Society of Utility and Regulatory Financial Analysts. A more complete description of my qualifications and regulatory experience is included in my curriculum vitae.[1]

[1] Exhibit DJG-1.

Q. WHOSE BEHALF ARE YOU TESTIFYING IN THIS PROCEEDING?

A. I am testifying on behalf of Alliance of Texas-New Mexico Power Municipalities ("ATM").

Q. DESCRIBE THE PURPOSE AND SCOPE OF YOUR TESTIMONY IN THIS PROCEEDING.

A. I am addressing the direct testimony and depreciation study of Dane A. Watson filed on behalf of Texas-New Mexico Power Company ("TNMP" or the "Company"). My testimony proposes several adjustments to TNMP's proposed depreciation rates.

II. EXECUTIVE SUMMARY

Q. SUMMARIZE THE KEY POINTS OF YOUR TESTIMONY.

A. In the context of utility ratemaking, "depreciation" refers to a cost allocation system designed to measure the rate by which a utility may recover its capital investments in a systematic and rational manner. I employed a well-established depreciation system and used actuarial and simulated plant record analyses to statistically analyze the Company's depreciable assets in order to develop reasonable depreciation rates in this case. The table below compares ATM's and TNMP's proposed depreciation accrual by plant function.[2]

Figure 1:
Summary Depreciation Accrual Comparison

Plant Function	Plant Balance 12/31/2017	TNMP Proposed Accrual	ATM Proposed Accrual	Accrual Difference
Transmission	392,099,866	14,655,496	11,505,659	(3,149,837)
Distribution	1,036,021,891	46,091,322	38,437,874	(7,653,448)
General	23,586,874	714,987	715,070	84
Total	$ 1,451,708,630	$ 61,461,805	$ 50,658,604	**$ (10,803,200)**

2 Exhibit DJG-2.

ATM's total adjustment reduces the Company's proposed annual depreciation accrual by $10.8 million.[3]

Q. DESCRIBE WHY IT IS IMPORTANT NOT TO OVERESTIMATE DEPRECIATION RATES.

A. The issue of depreciation is essentially one of timing. Under the rate-base, rate-of-return model, the utility is allowed to recover the original cost of its prudent investments used and useful to provide service. Depreciation systems are designed to allocate those costs in a systematic and rational manner – specifically, over the service life of the utility's assets. If depreciation rates are overestimated (i.e., service lives are underestimated), it encourages economic inefficiency. Unlike competitive firms, regulated utility companies are not always incentivized by natural market forces to make the most economically efficient decisions. If a utility is allowed to recover the cost of an asset before the end of its useful life, this could incentivize the utility to unnecessarily replace the asset in order to increase rate base and ultimately increase earnings; this results in economic waste. Thus, from a public policy perspective, it is preferable for regulators to ensure that assets are not depreciated before the end of their true useful lives.

While underestimating the useful lives of depreciable assets could financially harm current ratepayers and encourage economic waste, unintentionally overestimating depreciable lives (i.e., underestimating depreciation rates) does not harm the Company. This is because if an asset's life is overestimated, there are a variety of measures that regulators can use to ensure the utility is not financially harmed and recovers the full cost of its plant investment. One such measure would be the use of a regulatory asset account. In that case, the Company's original cost investment in these assets would remain in the Company's rate base until they are recovered. Thus, the process of depreciation strives for a perfect match between actual and estimated useful life. When these estimates are not exact, however, it is better from a public policy perspective that useful lives are not underestimated.

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[3] *See* Exhibits DJG-2 and DJG-3.

III. REGULATORY STANDARDS

Q. DISCUSS THE STANDARD BY WHICH REGULATED UTILITIES ARE ALLOWED TO RECOVER DEPRECIATION EXPENSE.

A. In *Lindheimer v. Illinois Bell Telephone Co.*, the U.S. Supreme Court stated that "depreciation is the loss, not restored by current maintenance, which is due to all the factors causing the ultimate retirement of the property. These factors embrace wear and tear, decay, inadequacy, and obsolescence."[4] The *Lindheimer* Court also recognized that the original cost of plant assets, rather than present value or some other measure, is the proper basis for calculating depreciation expense.[5] Moreover, the *Lindheimer* Court found:

> [T]he company has the burden of making a convincing showing that the amounts it has charged to operating expenses for depreciation have not been excessive. That burden is not sustained by proof that its general accounting system has been correct. The calculations are mathematical, but the predictions underlying them are essentially matters of opinion.[6]

Thus, TNMP bears the burden of making a convincing showing that its proposed depreciation rates are not excessive.

Q. IN THIS CASE, HAS TNMP MADE A CONVINCING SHOWING THAT ITS PROPOSED DEPRECIATION RATES ARE NOT EXCESSIVE?

A. For some accounts, TNMP has demonstrated that its proposed rates are reasonable; however, for several accounts the Company has not made a convincing showing that all of its proposed rates are not excessive in my opinion. That is, some of TNMP's proposed

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4 *Lindheimer v. Illinois Bell Tel. Co.*, 292 U.S. 151, 167 (1934).

5 *Id*. (Referring to the straight-line method, the *Lindheimer* Court stated that "[a]ccording to the principle of this accounting practice, the loss is computed upon the actual cost of the property as entered upon the books, less the expected salvage, and the amount charged each year is one year's pro rata share of the total amount."). The original cost standard was reaffirmed by the Court in *Federal Power Commission v. Hope Natural Gas Co.*, 320 U.S. 591, 606 (1944). The *Hope* Court stated: "Moreover, this Court recognized in [*Lindheimer*], supra, the propriety of basing annual depreciation on cost. By such a procedure the utility is made whole and the integrity of its investment maintained. No more is required."

6 *Id*. at 169.

depreciation rates are excessive and should be adjusted to a more reasonable level, pursuant to the recommendations made in this testimony and as further discussed below.

Q. SHOULD DEPRECIATION REPRESENT AN ALLOCATED COST OF CAPITAL TO OPERATIONS, RATHER THAN A MECHANISM TO DETERMINE LOSS OF VALUE?

A. Yes. While the *Lindheimer* case and other early literature recognized depreciation as a necessary expense, the language indicated that depreciation was primarily a mechanism to determine loss of value.[7] Adoption of this "value concept" would require annual appraisals of extensive utility plant assets and is thus not practical in this context. Rather, the "cost allocation concept" recognizes that depreciation is a cost of providing service, and that in addition to receiving a "return on" invested capital through the allowed rate of return, a utility should also receive a "return of" its invested capital in the form of recovered depreciation expense. The cost allocation concept also satisfies several fundamental accounting principles, including verifiability, neutrality, and the matching principle.[8] The definition of "depreciation accounting" published by the American Institute of Certified Public Accountants ("AICPA") properly reflects the cost allocation concept:

> Depreciation accounting is a system of accounting that aims to distribute cost or other basic value of tangible capital assets, less salvage (if any), over the estimated useful life of the unit (which may be a group of assets) in a systematic and rational manner. It is a process of allocation, not of valuation.[9]

Thus, the concept of depreciation as "the allocation of cost has proven to be the most useful and most widely used concept."[10]

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[7] *See* Frank K. Wolf & W. Chester Fitch, *Depreciation Systems* 71 (Iowa State University Press 1994).

[8] National Association of Regulatory Utility Commissioners, *Public Utility Depreciation Practices* 12 (NARUC 1996).

[9] American Institute of Accountants, *Accounting Terminology Bulletins Number 1: Review and Résumé* 25 (American Institute of Accountants 1953).

[10] Wolf *supra* n. 7, at 73.

IV. ANALYTIC METHODS

Q. DISCUSS THE DEFINITION AND PURPOSE OF A DEPRECIATION SYSTEM, AS WELL AS THE DEPRECIATION SYSTEM YOU EMPLOYED FOR THIS PROJECT.

A. The regulatory standards set forth above do not mandate a specific procedure for conducting depreciation analyses. These standards, however, direct that analysts use a system for estimating depreciation rates that will result in the "systematic and rational" allocation of capital recovery for the utility. Over the years, analysts have developed "depreciation systems" designed to analyze grouped property in accordance with this standard. A depreciation system may be defined by several primary parameters: 1) a <u>method</u> of allocation; 2) a <u>procedure</u> for applying the method of allocation; 3) a <u>technique</u> of applying the depreciation rate; and 4) a <u>model</u> for analyzing the characteristics of vintage property groups.[11] In this case, I used the straight-line method, the average life procedure, the remaining life technique, and the broad group model. This system would be denoted as an "SL-AL-RL-BG" system. This depreciation system conforms to the regulatory standards set forth above and is commonly used by depreciation analysts in regulatory proceedings. I provide a more detailed discussion of depreciation system parameters, theories, and equations in Appendix A.

Q. DID MR. WATSON USE A SIMILAR DEPRECIATION SYSTEM IN HIS ANALYSIS?

A. Yes. Essentially, Mr. Watson and I used the same depreciation system to develop our proposed depreciation rates. Thus, the discrepancy in our recommendations is not driven by the use of different depreciation systems.

Q. DESCRIBE THE PROCESS YOU USED TO ANALYZE THE COMPANY'S DEPRECIABLE PROPERTY.

A. The study of retirement patterns of industrial property is derived from the actuarial process used to study human mortality. Just as actuarial analysts study historical human

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[11] *See* Wolf *supra* n. 7, at 70, 140.

mortality data to estimate how long people will survive, depreciation analysts study historical plant retirement data to estimate how long property will survive. The most common actuarial method used by depreciation analysts is called the "retirement rate method." In the retirement rate method, original property data, including additions, retirements, transfers, and other transactions, are organized by vintage and transaction year.[12] The retirement rate method is ultimately used to develop an "observed life table," ("OLT") which shows the percentage of property surviving at each age interval. This pattern of property retirement is described as a "survivor curve." The survivor curve derived from the observed life table, however, must be fitted and smoothed with a complete curve in order to determine the ultimate average life of the group.[13] The most widely used survivor curves for this curve-fitting process were developed at Iowa State University in the early 1900s and are commonly known as the "Iowa curves."[14] A more detailed explanation of how the Iowa curves are used in the actuarial analysis of depreciable property is set forth in Appendix C.

Actuarial analysis, however, requires "aged" data. Aged data refers to a collection of property data for which the dates of placements, retirements, transfers, and other actions are known. In keeping aged data, when a utility retires an asset, it would not only record the year it was retired, but it would also track the year the asset was placed into service, or the "vintage" year. The Company, however, did not have aged data available for any of its transmission and distribution accounts. When aged data is not available, and the year-end balances of each account are known, analysts must "simulate" an actuarial analysis by estimating the proportion that each vintage group contributed to year-end balances. For this reason, simulated data is not as reliable as aged data. In order to analyze accounts that do not contain aged data, analysts use the "simulated plant record"

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12 The "vintage" year refers to the year that a group of property was placed in service (aka "placement" year). The "transaction" year refers to the accounting year in which a property transaction occurred, such as an addition, retirement, or transfer (aka "experience" year).

13 See Appendix C for a more detailed discussion of the actuarial analysis used to determine the average lives of grouped industrial property.

14 *See* Appendix B for a more detailed discussion of the Iowa curves.

("SPR") method.[15] Thus, Mr. Watson and I both used the SPR method to analyze TNMP's accounts for which aged data was unavailable. Under the straight-line method of calculating depreciation rates, essentially two estimates are required – service life and net salvage. I will discuss these components separately below.

V. SERVICE LIFE ANALYSIS

Q. DESCRIBE THE PROCESS YOU USED TO ESTIMATE SERVICE LIVES FOR THE COMPANY'S DEPRECIABLE ACCOUNTS.

A. To develop service life estimates for TNMP's accounts, I obtained and analyzed the Company's actuarial and simulated plant data. Specifically, simulated plant analysis was used to analyze the Company's transmission and distribution assets, while actuarial analysis was used to analyze the Company's general plant assets. I will discuss each process separately below.

A. ACTUARIAL ANALYSIS

Q. PLEASE DESCRIBE THE ACTUARIAL ANALYSIS PROCESS.

A. I used the Company's historical property data and created an observed life table ("OLT") for each account. The data points on the OLT can be plotted to form a curve (the "OLT curve"). The OLT curve is not a theoretical curve, rather, it is actual observed data from the Company's records that indicate the rate of retirement for each property group. An OLT curve by itself, however, is rarely a smooth curve, and is often not a "complete" curve (i.e., it does not end at zero percent surviving). To calculate average life (the area under a curve), a complete survivor curve is required. The Iowa curves are empirically-derived curves based on the extensive studies of the actual mortality patterns of many different types of industrial property. The curve-fitting process involves selecting the best Iowa curve to fit the OLT curve. This can be accomplished through a combination of visual and mathematical curve-fitting techniques, as well as professional judgment. The first step of my approach to curve-fitting involves visually inspecting the OLT curve

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[15] The SPR Method is further discussed in Appendix D.

for any irregularities. For example, if the "tail" end of the curve is erratic and shows a sharp decline over a short period of time, it may indicate that this portion of the data is less reliable, as further discussed below. After visually inspecting the OLT curve, I use a mathematical curve-fitting technique which essentially involves measuring the distance between the OLT curve and the selected Iowa curve in order to get an objective assessment of how well the curve fits. After selecting an Iowa curve, I observe the OLT curve along with the Iowa curve on the same graph to determine how well the curve fits. I may repeat this process several times for any given account to ensure that the most reasonable Iowa curve is selected.

Q. ARE YOU RECOMMENDING ADJUSTMENTS TO ANY OF TNMP'S GENERAL PLANT ACCOUNTS BASED ON YOUR ACTUARIAL ANALYSIS?

A. No. However, it is important to understand that actuarial analysis based on sufficient historical data will produce more reliable results than simulated plant analysis. This is important because, as discussed further below, the simulated plant analysis for many of TNMP's transmission and distribution accounts produced service life estimates remarkably shorter than those observed among other utilities that use aged data and actuarial analysis. All else held constant, shorter service life estimates result in higher depreciation rates and expense for customers. In the discussions below regarding my simulated plant analysis, I will show examples of actuarial analysis conducted for the same accounts for other utilities to show the contrasting estimates in service lives. It is important for the Commission to balance the following two factors: 1) considering the service lives indicated by TNMP's own historical data; and 2) realizing that because TNMP's historical data for its transmission and distribution accounts is not "aged" (i.e., actuarial analysis cannot be performed on it), it will produce less reliable results than the service life estimates for other utilities that were based on aged data. Therefore, it is important for the Commission to give some weight and consideration to the service life estimates for other utilities that were based on actuarial analysis of aged data when determining the most reasonable service life estimates for TNMP's accounts.

B. SIMULATED PLANT RECORD ANALYSIS

Q. DESCRIBE THE SIMULATED PLANT RECORD METHOD OF ANALYSIS.

A. As discussed above, when aged data is not available, we must "simulate" the actuarial data required for remaining life analysis. For TNMP's transmission and distribution accounts, both Mr. Watson and I conducted an analysis using the simulated plant record ("SPR") model, because the Company does not keep aged data for these accounts. The SPR method involves analyzing the Company's unaged data by choosing an Iowa curve that best simulates that actual year-end account balances in the account.[16]

Q. DESCRIBE THE METRICS USED TO ASSESS THE FIT OF A SELECTED IOWA CURVE IN THE SPR MODEL.

A. There are two primary metrics used to measure the fit of the Iowa curve selected to describe an SPR account. The first is the "conformance index" ("CI"). The CI is the average observed plant balance for the tested years, divided by the square root of the average sum of squared differences between the simulated and actual balances plant balances.[17] A higher CI indicates a better fit. Alex Bauhan, who developed the CI, also proposed a scale for measuring the value of the CI, as follows.

Figure 2:
Conformance Index Scale

CI	Value
> 75	Excellent
50 – 75	Good
25 – 50	Fair
< 25	Poor

The second metric used to assess the accuracy of an Iowa curve chosen for SPR analysis is called the "retirement experience index" ("REI") which was also proposed by Bauhan.

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[16] A detailed discussion of the SPR method is included in Appendix D.

[17] Bauhan, A. E., "Life Analysis of Utility Plant for Depreciation Accounting Purposes by the Simulated Plant Record Method," 1947, Appendix of the EEl, 1952.

The REI measures the length of retirement experience in an account. A greater retirement experience indicates more reliability in the analytical results for an account. Bauhan proposed a similar scale for the REI, as follows.

Figure 3:
Retirement Experience Index Scale

REI	**Value**
> 75%	Excellent
50% – 75%	Good
33% – 50%	Fair
17% – 33%	Poor
0% – 17%	Valueless

According to Bauhan, "[i]n order for a life determination to be considered entirely satisfactory, it should be required that both the retirements experience index and the conformance index be "Good" or better."[18] However, for some of TNMP's accounts there is no Iowa curve available that produces a result of at least "Good" under both scales. This further highlights the relative unreliability of TNMP's unaged historical data for these accounts, and why it can be helpful to also consider the service life estimates approved for other utilities that were based on actuarial analyses of superior, aged data.

Q. PLEASE SUMMARIZE THE GENERAL DIFFERENCES BETWEEN YOUR SERVICE LIFE ESTIMATES AND THE COMPANY'S SERVICE LIFE ESTIMATES FOR THESE ACCOUNTS.

A. In this case I am proposing service life adjustments to six of TNMP's transmission and distribution accounts. In my opinion, Mr. Watson's proposed service lives for these accounts is too short and thus results in excessive depreciation accruals and expense amounts. My opinions are based in part on TNMP's historical data, but because the Company's data is relatively unreliable, I also considered the approved service lives for the transmission and distribution assets for electric utilities that keep aged data for these accounts. For example, I will provide comparisons between Mr. Watson's service life

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18 *Id*. (emphasis added).

estimates for TNMP with service lives recently approved in Southwestern Electric Power Company's ("SWEPCO") rate case for some accounts.[19] As discussed below, the service lives estimated by Mr. Watson for some accounts are remarkably shorter than those approved by the Commission for SWEPCO. Mr. Watson's underestimation of these service lives results in unreasonably high depreciation rates and expense for TNMP's customers. In the following sections, I provide detailed discussion regarding the six accounts to which I propose service life adjustments.

Q. DO YOU HAVE ANY OTHER GENERAL CRITICISMS OF MR. WATSON'S SERVICE LIFE ESTIMATES?

A. Yes. In discussing his service life estimates for many of TNMP's accounts, Mr. Watson has apparently relied heavily upon the expectations of Company personnel with regard to how long the assets will be in service. TNMP is the applicant in this case, and it has hired an independent expert in Mr. Watson to develop service life estimates based on specialized, statistical analysis of the Company's historical retirement data for an issue that heavily affects the Company's cash flow. To the extent TNMP employees have simply told the Company's independent depreciation expert how long they think the Company's assets will survive, I think that is problematic and calls into question the objectivity and accuracy of TNMP's proposed depreciation rates. The problem is compounded by virtue of the fact that intervening parties, such as ATM, do not enjoy the same type of access to TNMP employees, and are not readily able to investigate the accuracy of those employees' opinions.

Q. DESCRIBE OTHER CRITICISMS YOU HAVE REGARDING MR. WATSON'S SERVICE LIFE ESTIMATES.

A. The service life estimates for some of the Company's accounts are remarkably shorter than the service lives approved by this Commission for other utilities that were based on independent actuarial analysis of far more reliable data. To be clear, it is not that I believe pertinent information cannot be obtained from Company personnel with regard to

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19 *Application of Southwestern Electric Power Company for Authority to Change Rates*, PUC Docket No. 46449.

future plans that might indicate the future mortality characteristics for a particular account may differ than the characteristics indicated by the historical data, and Mr. Watson has provided some of that type of information is his depreciation study. However, to the extent Mr. Watson has based his service life estimate for a particular account on the service life estimate provided by representatives of the applicant, I think the Commission should give little weight to that estimate. In other words, I believe that service life estimates indicated by the actuarial analysis of aged data (and to a lesser extent, the analysis of historical simulated data) provides more objective and unbiased indications of service lives than the unsubstantiated opinions of TNMP employees who are not depreciation experts and who have not filed testimony in this case.

1. Account 355 – Poles and Fixtures

Q. DESCRIBE MR. WATSON'S SERVICE LIFE ESTIMATE FOR ACCOUNT 355.

A. Mr. Watson selected the R2-46 Iowa curve for this account, which means he estimates that TNMP's poles and fixtures have an average service life of 46 years.

Q. DO YOU AGREE WITH MR. WATSON'S ESTIMATE?

A. No. A 46-year service life estimate for Account 355 is the shortest estimate for this account that I can recall ever having seen. In my experience, utilities typically depreciate the assets in this account based on an average service life of about 55 years, and as long as 65 years.

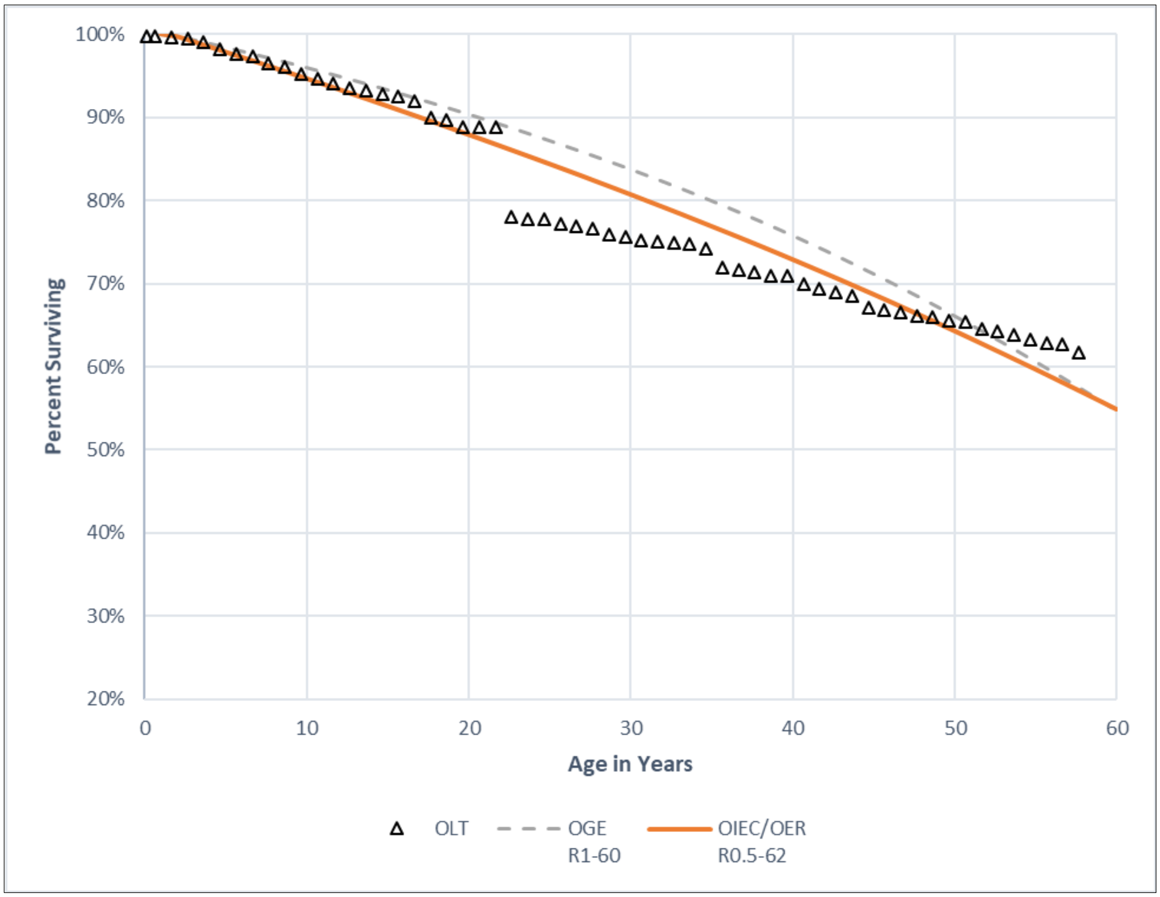
Q. PLEASE DISCUSS AND ILLUSTRATE THE ACTUARIAL ANALYSIS USED TO ANALYZE THE SERVICE LIFE FOR THIS ACCOUNT FOR A UTILITY THAT MAINTAINS AGED DATA.

A. Recently, in Oklahoma Gas & Electric's ("OG&E") recently completed rate case, the utility depreciation witness recommended a 60-year average service life for this account, which is 14 years longer than Mr. Watson's recommendation.[20] This was based upon actuarial analysis performed on historical aged data under the retirement rate method.

[20] *See* Direct Testimony of John J. Spanos filed January 16, 2018 before the Oklahoma Corporation Commission, Cause No. PUD 201700496.

Using the same analytical process, I recommended a 62-year average life based upon an Iowa R0.5-62 curve. Ultimately, as part of the settlement of that case, the parties agreed to maintain the current depreciation rate for this account, which was actually based upon an even longer average service life of 65 years. The graph below shows the observed survivor curve that was derived from the historical aged data for OG&E's Account 355, along with the two competing Iowa curves.[21]

Figure 4:
OG&E Account 355 Service Life Estimate Based on Aged Data



In contrast, it is not possible to develop the same kind of reliable historical retirement pattern for TNMP's Account 355 (i.e., the OLT curve in the graph above) because the

[21] *See* Responsive Testimony of David J. Garrett filed May 2, 2018 before the Oklahoma Corporation Commission, Cause No. PUD 201700496.

Company does not maintain aged data for this account. Regardless, a service life estimate of only 46 years for this account is unreasonable in my opinion.

Q. WHAT IS YOUR RECOMMENDATION FOR THIS ACCOUNT?

A. I recommend the L1-55 curve for this account. This estimate considers TNMP's own simulated historical data, as well as the service life indications typically observed for this account in the industry. Specifically, the L1-55 curve provides rankings of "Good" in both the CI and REI scales.[22]

2. Account 356 – Overhead Conductors and Devices

Q. DESCRIBE MR. WATSON'S SERVICE LIFE ESTIMATE FOR ACCOUNT 356.

A. Mr. Watson selected the R2.5-54 curve for this account. According to the SPR analysis, this curve results in a CI score of 37.4 and an REI score of 99. According to the metrics discussed above, a CI score this low indicates that the SPR analysis for this account is not satisfactory. In fact, no Iowa curve applied to the overall testing band for this account produced an acceptable CI score.

Q. DO YOU AGREE WITH MR. WATSON'S ESTIMATE?

A. No. A 54-year average service life estimate for Account 356 is too low in my opinion, when compared to the service lives estimated by other utilities for this account. This results in an unreasonably high proposed depreciation expense for this account.

Q. DID THE COMMISSION RECENTLY ADOPT YOUR RECOMMENDATION OF A 70-YEAR AVERAGE SERVICE LIFE FOR THIS ACCOUNT IN THE SWEPCO CASE?

A. Yes. Unlike TNMP, SWEPCO maintains aged data for its mass property accounts, which means it is more reliable for the purpose of estimating average life. In the SWEPCO case, the company's witness proposed a 65-year service life for Account 356.[23] Based on

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[22] *See* Exhibit DJG-8.

[23] *See Application of Southwestern Electric Power Company for Authority to Change Rates*, Docket No. 46449, Direct Testimony and Exhibits of David A. Davis (Dec. 16, 2016).

mathematical curve fitting, I argued for a 70-year service life and the Commission agreed with my proposal.[24]

Q. PLEASE DISCUSS AND ILLUSTRATE THE ACTUARIAL ANALYSIS USED TO ANALYZE THE SERVICE LIFE FOR SWEPCO'S ACCOUNT 356.

A. Unlike with SPR analysis, when depreciation analysts analyze adequate historical aged data under the retirement rate method, it produces original survivor curves that are often ideal for conventional Iowa curve-fitting techniques. As shown in the graph below, SWEPCO's aged data produces an "OLT" curve (the black triangles) that forms a typical retirement rate pattern observed in grouped utility assets.[25]

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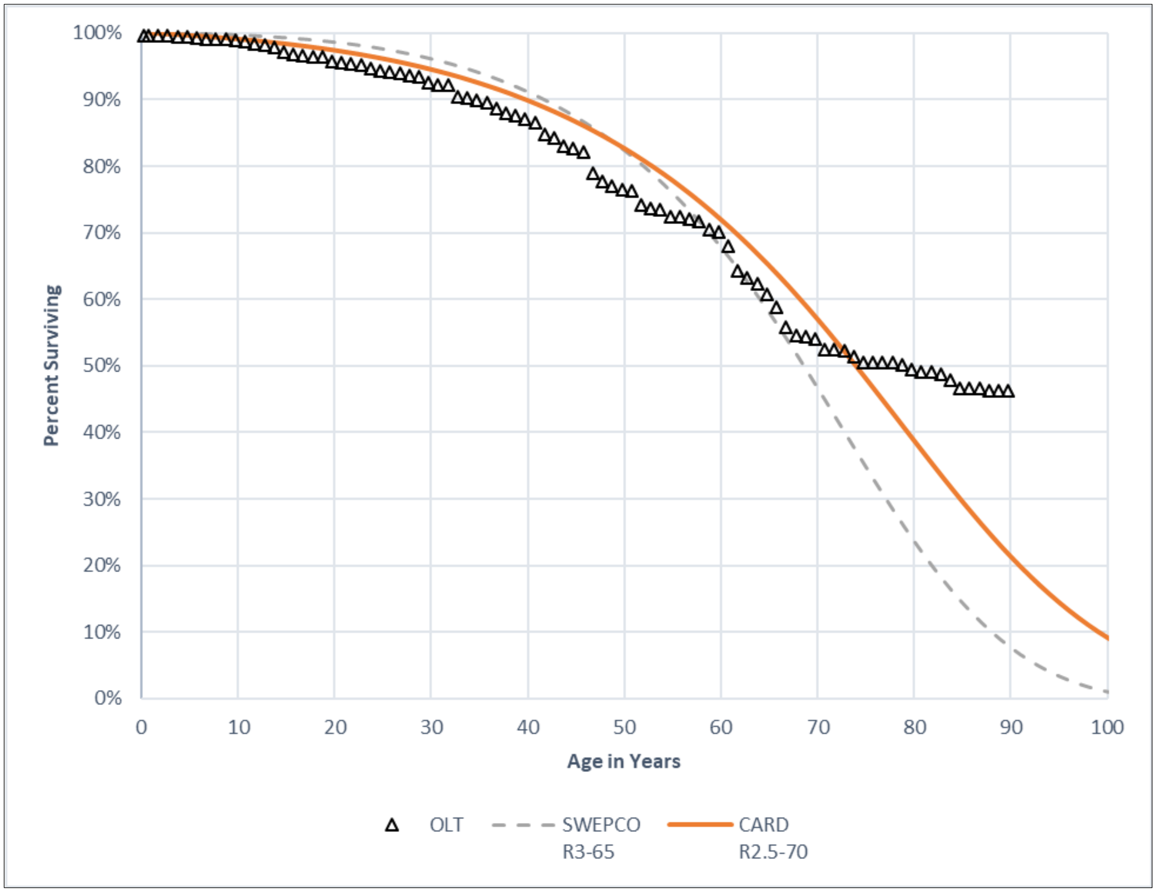
[24] *See Application of Southwestern Electric Power Company for Authority to Change Rates*, Docket No. 46449, Order on Rehearing, Finding of Fact 184 (Mar. 19, 2018).

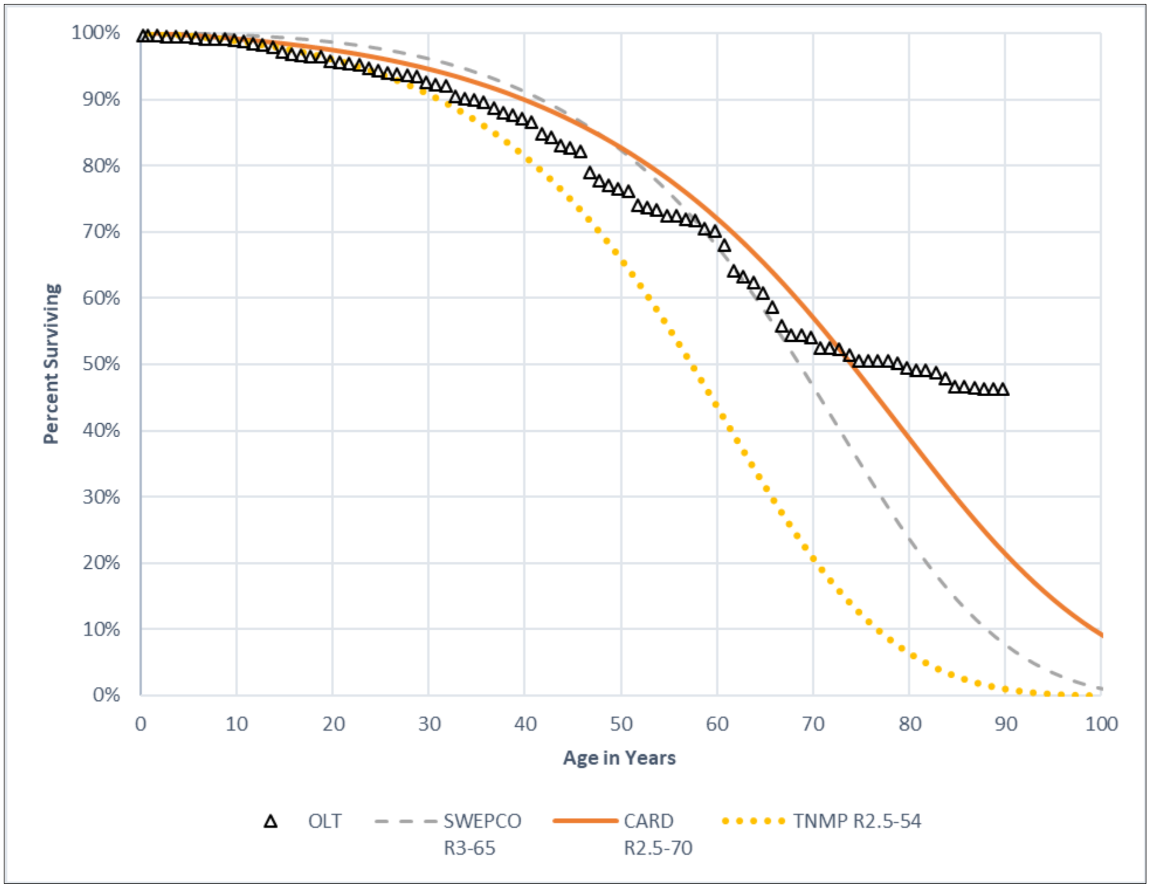
[25] *See Application of Southwestern Electric Power Company for Authority to Change Rates*, Docket No. 46449, Direct Testimony and Exhibits of David J. Garrett (Apr. 25, 2017).

Figure 5:
SWEPCO Account 356 Service Life Estimates Based on Aged Data



Using reasonable visual and mathematical curve fitting techniques, SWEPCO's witness and I estimated average service lives for this account of 65 years and 70 years respectively. For illustration purposes, the graph below shows the same OLT curve and two Iowa curves from the SWEPCO case, along with the R2.5-54 curve recommended by TNMP for this account.

Figure 6:
SWEPCO Account 356 Service Life with TNMP's R2.5-54 Curve



As shown in the graph, the curve utilized by TNMP would be too short when applied to SWEPCO's aged retirement data for this account.

Q. WHAT IS YOUR RECOMMENDATION FOR THIS ACCOUNT?

A. Given the unreliability of the SPR results for this account as indicated by the low CI score, as well as the fact that other utilities utilize significantly higher average service lives for this account, I think it would be reasonable to select an Iowa curve with a longer average service life from the SPR analysis than 54 years. Accordingly, I recommend applying the R2-59 curve to Account 356.[26] An average life of 59 years balances the service life indications from TNMP's relatively unreliable historical data with service life

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[26] *See* Exhibit DJG-8.

indications for this account observed for utilities with more reliable aged data, including the 70-year average life recently ordered by this Commission for SWEPCO.

3. Account 362 – Station Equipment

Q. DESCRIBE MR. WATSON'S SERVICE LIFE ESTIMATE FOR ACCOUNT 362.

A. Mr. Watson selected the R2.5-42 curve for this account.

Q. DO YOU AGREE WITH MR. WATSON'S ESTIMATE?

A. No. As with the two accounts discussed above, Mr. Watson's recommended service life is markedly shorter than what is observed among other utilities for this account, which is typically between 50 – 60 years. For example, in El Paso Electric Company's last depreciation study, the company's expert recommended a 60-year life for this account.[27] More recently in SWEPCO's rate case, the Commission ordered a 55-year average life for this account.[28] Mr. Watson's underestimation of the service life for this account would result in an unreasonably high depreciation expense for TNMP customers.

Q. WHAT IS YOUR RECOMMENDATION FOR THIS ACCOUNT?

A. I recommend applying the L1.5-49 curve for this account. The L1.5-49 curve actually ranks higher on the CI scale than the curve proposed by Mr. Watson, and still has a "Good" retirement experience score of 90, according to the REI scale discussed above.[29] Moreover, a 49-year average service life balances the service life indications from TNMP's unaged data with the longer service lives utilized by other Texas utilities for this account.

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[27] *See Application of El Paso Electric Company to Change Rates*, Docket No. 44941, Schedule D-5, 2014 Depreciation Study conducted by Gannett Fleming and sponsored by John J. Spanos.

[28] *See Application of Southwestern Electric Power Company for Authority to Change Rates*, Docket No. 46449, Order on Rehearing, Finding of Fact 186 (Mar. 19, 2018).

[29] *See* Exhibit DJG-8.

4. Account 366 – Underground Conduit

Q. DESCRIBE MR. WATSON'S SERVICE LIFE ESTIMATE FOR ACCOUNT 366.

A. Mr. Watson selected the R3-43 curve for this account, which means he is proposing an average service life of only 43 years. No Iowa curve for this account produced a "Good" CI score in the SPR analysis, including the Iowa curve selected by Mr. Watson.

Q. DO YOU AGREE WITH MR. WATSON'S ESTIMATE?

A. No. As with the other accounts discussed above, Mr. Watson's recommended service life is significantly shorter than what is observed among other utilities for this account. In fact, the Commission recently ordered a 70-year average service life for SWEPCO's underground conduit account. In the SWEPCO case, the company's witness recommended a 70-year average service life for this account and no party to the case disagreed with that estimate.[30] In Public Service Company of Oklahoma's ("PSO") recent rate case, the commission found that a 78-year average life was reasonable for this account, which is nearly twice as long as the average service life proposed by Mr. Watson in this case for the same account.[31] Moreover, the estimates made for this account in the recent SWEPCO and PSO cases were based on adequate, aged historical plant data suitable for actuarial analysis and conventional Iowa curve-fitting techniques. Again, this type of data is more reliable than the unaged data provided by TNMP in this case.

Q. PLEASE ILLUSTRATE THE RETIREMENT RATE YOU HAVE OBSERVED IN THIS ACCOUNT WHEN DERIVED FROM MORE RELIABLE AGED DATA.

A. In the PSO case discussed above, the company's witness recommended a 65-year average life for Account 366 and I recommended a 78-year average life as estimated through

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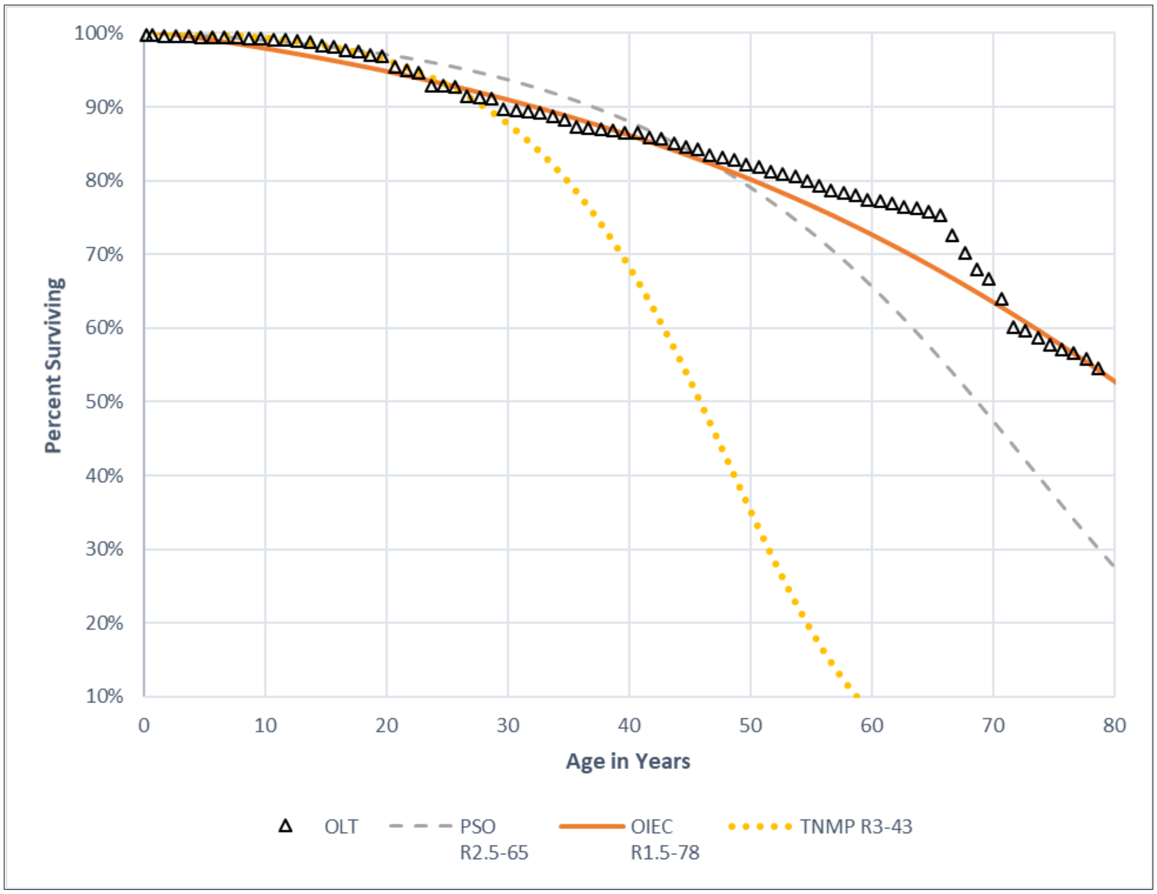
[30] *See Application of Southwestern Electric Power Company for Authority to Change Rates*, Docket No. 46449, Direct Testimony and Exhibits of David A. Davis (Dec. 16, 2016).

[31] *See* Final Order No. 672864 in Cause No. PUD 201700151 before the Corporation Commission of Oklahoma (Jan. 31, 2018), adopting Report and Recommendation of the Administrative Law Judge, p. 28 of 239, ¶ 109 (adopting depreciation rates proposed by the Oklahoma Attorney General); *see also* Responsive Testimony of William W. Dunkel, filed September 21, 2017 in Cause No. PUD 201700151 on behalf of the Oklahoma Attorney General.

visual and mathematical Iowa curve-fitting techniques. The graph below shows the OLT curve (i.e., the curve derived from the utility's historical data in black triangles), along with the two Iowa curves proposed in the PSO case. As shown in the graph, the R1.5-78 curve tracks very well with the historical retirement pattern in this account.

Figure 7:
PSO Account 366 Service Life Estimates Based on Aged Data



When a utility keeps adequate aged data, depreciation analysts can use the actuarial retirement rate method to develop observed survivor curves like the OLT curve shown above. These curves make average life estimates more accurate and reliable. In this case, however, we must use the less reliable SPR method. For visual reference, the graph above also shows the R3-43 Iowa curve, which is what Mr. Watson has proposed in this case. As shown in the graph, the R3-43 curve would have been far too short to accurately describe the historical and projected retirement rate of PSO's underground conduit. The

Oklahoma commission ultimately ordered a 78-year average service life for Account 366, which was recommended by multiple parties in the case.

Q. WHAT IS YOUR RECOMMENDATION FOR THIS ACCOUNT?

A. I recommend applying the L2-52 curve for this account. As with the curve selected by Mr. Watson, the L2-52 scores "Good" on the REI scale and "Fair" on the CI scale.[32] However, the 52-average life derived from the L2-52 is at least a little closer to the typical range of service life estimates utilized by other utilities for this account. In fact, a 52-year average life is still much closer to Mr. Watson's 43-year estimate than the Commission's approval of a 70-year average life for SWEPCO's underground conduit account, as well as the 78-year average life utilized by PSO. Thus, in my opinion, the L2-52 curve balances the service life indications from TNMP's unaged data with the substantially longer service lives utilized by other utilities for this account, which were estimated based on superior historical data. In my opinion, TNMP has not made the required "convincing showing" that its proposed depreciation rate for this account is not excessive.[33]

5. Account 368 – Transformers

Q. DESCRIBE MR. WATSON'S SERVICE LIFE ESTIMATE FOR ACCOUNT 368.

A. Mr. Watson selected the R1-47 curve for this account, which means he is proposing an average service life of 47 years.

Q. DO YOU AGREE WITH MR. WATSON'S ESTIMATE?

A. No. Mr. Watson's 47-year service life recommendation is shorter than what is observed in this account for other utilities based on more reliable statistical data.

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[32] *See* Exhibit DJG-8.

[33] *Lindheimer v. Illinois Bell Tel. Co.*, 292 U.S. 151, 169 (1934).

Q. WHAT IS YOUR RECOMMENDATION FOR THIS ACCOUNT?

A. I recommend applying the R0.5-53 curve for this account. Unlike several of the accounts discussed above, there are Iowa curves available for this account that rate as "Good" or better under both the CI and REI scales. The R0.5-53 curve scores "Good" under both the CI and REI scales and has a substantially higher CI score than the curve proposed by Mr. Watson (65 vs. 51), while still having an "Excellent" REI score of 82.[34] Thus, even based on the SPR analysis alone, I would recommend the R0.5-53 curve for this account.

6. Account 369 – Overhead Services

Q. DESCRIBE MR. WATSON'S SERVICE LIFE ESTIMATE FOR ACCOUNT 369.

A. Mr. Watson selected the R2-37 curve for this account, which means he is proposing an average service life of only 37 years. This is by far the shortest average life proposal I have ever seen for Account 369. The R2-37 curve selected by Mr. Watson has a very poor CI score of only 11, making the SPR analysis for this account essentially irrelevant. Thus, while it is always important to check the reasonableness of a service life recommendation by at least considering it relative to industry norms, it is especially important in this case for this account given the poor quality of the historical statistical data and SPR analysis.

Q. DO YOU AGREE WITH MR. WATSON'S ESTIMATE?

A. No. In my experience, the average service life for this account typically utilized by utilities is around 55 years. In fact, the Commission recently ordered a 55-year service life for this account in the SWEPCO case, which is nearly 20 years longer than Mr. Watson's proposal in this case.[35] In the PSO case discussed above, the utility's witness recommended a 60-year life for this account based on more reliable statistical data.[36]

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34 *See* Exhibit DJG-8.

35 *See Application of Southwestern Electric Power Company for Authority to Change Rates*, Docket No. 46449, Direct Testimony and Exhibits of David A. Davis (Dec. 16, 2016). (SWEPCO's witness David Davis recommended a 55-year service life for Account 369 and no party to the case disagreed).

36 *See* Direct Testimony of John J. Spanos before the Oklahoma Corporation Commission, Cause No. PUD 201700151, Exhibit JJS-2, p. VI-6.

Multiple parties in the case agreed, and the Oklahoma commission ordered a 60-year service life for this account.

Q. WHAT IS YOUR RECOMMENDATION FOR THIS ACCOUNT?

A. I recommend applying the L1-44 curve for this account. Although the SPR analysis for this account does not have any acceptable overall results for any Iowa curve, the L1-44 curve nonetheless has a higher CI score than the curve selected by Mr. Watson, while still maintaining a "Good" REI score.[37] More importantly, an average service life of 44 years is much closer to industry norms for this account (about 55 years) than the 37 years proposed by Mr. Watson. In my opinion, TNMP has not made the required "convincing showing" that its proposed depreciation rate for this account is not excessive.[38] Even the 44-year average life I have proposed is likely still to short to accurately describe a reasonable average life for this account, which is typically in the range of 50 – 60 years. At the very least, the L1-44 curve balances the questionable service life indications from TNMP's unaged data with the substantially longer service lives utilized by other utilities for this account, which were estimated based on more reliable historical data

VI. NET SALVAGE ANALYSIS

Q. DESCRIBE THE CONCEPT OF NET SALVAGE.

A. If an asset has any value left when it is retired from service, a utility might decide to sell the asset. The proceeds from this transaction are called "gross salvage." The corresponding expense associated with the removal of the asset from service is called the "cost of removal." The term "net salvage" equates to gross salvage less the cost of removal. Often, the net salvage for utility assets is a negative number (or percentage) because the cost of removing the assets from service exceeds any proceeds received from selling the assets. When a negative net salvage rate is applied to an account to calculate the depreciation rate, it results in increasing the total depreciable base to be recovered

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[37] *See* Exhibit DJG-8.

[38] *Lindheimer v. Illinois Bell Tel. Co.*, 292 U.S. 151, 169 (1934).

over a particular period of time and increases the depreciation rate. Therefore, a greater negative net salvage rate equates to a higher depreciation rate and expense, all else held constant.

Q. DESCRIBE HOW YOU ANALYZED THE COMPANY'S NET SALVAGE RATES.

A. In this case, I examined the Company's historical net salvage data over different periods of time. I also considered net salvage rates typically observed in the industry by account.

Q. PLEASE DESCRIBE MR. WATSON'S NET SALVAGE RECOMMENDATIONS.

A. For many of TNMP's accounts, Mr. Watson is proposing net salvage rates that are significantly higher than those currently approved for the Company. In particular, there are six accounts in which Mr. Watson's proposed net salvage rate is at least twice as high (i.e., a 100% increase) than the currently-approved net salvage rate. The table below shows these accounts.

Figure 8:
Current and Proposed Net Salvage Rate Comparison

Account No.	Description	Approved Net Salvage	Watson's Proposal
353.00	Station Equipment	-5%	-10%
355.00	Poles And Fixtures	-30%	-100%
356.00	Overhead Conductors And Devices	-30%	-100%
362.00	Station Equipment	0%	-10%
364.00	Poles, Towers And Fixtures	-40%	-100%
365.00	Overhead Conductors And Devices	-30%	-100%
366.00	Underground Conduit	-10%	-20%
367.00	Underground Conductors And Devices	0%	-30%
369.00	Overhead Services	-40%	-100%
369.10	Underground Services	-10%	-100%
370.00	Meters	-2%	-5%
370.10	Meters- Load Research	-2%	-5%
370.30	Meters Non Analog	-2%	-5%
371.00	Installations On Customers Premises	-10%	-20%
371.10	Leased Flood Lighting	0%	-10%
373.00	Street Lighting And Signal Systems	-10%	-20%

In fact, out of TNMP's 23 transmission and distribution accounts, Mr. Watson is proposing net salvage rates for 16 accounts that are at least twice as high as the currently-approved net salvage rates. While I would generally agree that TNMP's historical data suggest that current net salvage rates should increase for many accounts, Mr. Watson's proposed increases are excessive in my opinion. While net salvage rates can certainly change over time, I have not seen proposed increases this substantial between consecutive rate cases.

Q. PLEASE DESCRIBE YOUR NET SALVAGE RATE ADJUSTMENTS.

A. I am recommending net salvage rate adjustments on six accounts. For these accounts, Mr. Watson is recommending substantial net salvage rates of -100% that are up to 10 times greater than the currently-approved net salvage rates. This is excessive. The table below shows the currently-approved net salvage rates for these six accounts, along with my proposal, Mr. Watson's proposal, and for a comparison, the net salvage rates recently approved by the Commission in the SWEPCO case.

Figure 9:
Proposed Net Salvage Rate Comparison

Account No.	Description	TNMP Approved	Watson's Proposal	Garrett's Proposal	SWEPCO Approved
355.00	Poles And Fixtures	-30%	-100%	-60%	-65%
356.00	Overhead Conductors And Devices	-30%	-100%	-60%	-42%
364.00	Poles, Towers And Fixtures	-40%	-100%	-80%	-54%
365.00	Overhead Conductors And Devices	-30%	-100%	-60%	-38%
369.00	Overhead Services	-40%	-100%	-80%	-74%
369.10	Underground Services	-10%	-100%	-20%	NA

For these accounts, I am recommending net salvage rates that represent a 100% increase (or double) the currently-approved net salvage rates for TNMP. In my opinion, it is generally unreasonable for net salvage rates to increase by more than 100% between consecutive rate cases.[39] As shown in the chart, the net salvage rates I recommend for these accounts are closer (though still generally greater) to the rates the Commission approved in the SWEPCO case and the net salvage rates typically observed in the industry for these accounts. While the net salvage rates I recommend still represent a substantial 100% increases from TNMP's current rates and are generally greater than those observed in the industry, they are nonetheless more reasonable than the increases proposed by Mr. Watson.

[39] Although this is less of concern at lower amounts, such as an increase from -2% to -6%.

VII. RESERVE REALLOCATION

Q. DID BOTH YOU AND MR. WATSON UTILIZE THE REMAINING LIFE TECHNIQUE AS PART OF YOUR DEPRECIATION SYSTEM?

A. Yes. By using the remaining life technique instead of the whole life technique, Mr. Watson and I both chose to allocate the depreciable base for each account over the remaining life of the group instead of the average life.

Q. WHAT IS THE MAIN PURPOSE OF USING THE REMAINING LIFE TECHNIQUE INSTEAD OF THE WHOLE LIFE TECHNIQUE?

A. One of the main reasons that analysts employ the remaining life technique is that there is no need to make a separate adjustment to rebalance or reallocate the theoretical reserve to bring it closer to the book reserve. The authoritative texts are clear that when using the remaining life technique, no separate reallocation of the theoretical reserve (or "Calculated Accumulated Depreciation" or "CAD") is required or even necessary. According to Wolf:

> Users of remaining life depreciation often do not explicitly calculate the CAD. As previously discussed, calculation of the CAD is implicit in the use of the remaining life method of adjustment, because the variation between the CAD and the accumulated provision for depreciation is automatically amortized over the remaining life.[40]

The NARUC manual also agrees that no separate reallocation of the theoretical reserve is required when using the remaining life technique:

> The desirability of using the remaining life technique is that any necessary adjustments of depreciation reserves, because of changes to the estimates of life on net salvage, are accrued automatically over the remaining life of the property.[41]

Thus, the primary purpose of the remaining life technique is the fact that a separate adjustment to the theoretical reserve is not required.

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40 Wolf *supra* n. 7, at 178 (emphasis added).

41 NARUC *supra* n. 8, at 65.

Q. DID MR. WATSON MAKE A SEPARATE ADJUSTMENT TO REALLOCATE THE RESERVE DESPITE USING THE REMAINING LIFE TECHNIQUE?

A. Yes. Despite the fact that it is neither required nor necessary when using the remaining life technique, Mr. Watson reallocated the theoretical reserve for each account based on his proposed depreciation parameters (Iowa curve, net salvage, etc.).[42]

Q. DOES THE METHOD YOU USED TO CALCULATE YOUR PROPOSED DEPRECIATION RATES UNDER THE REMAINING LIFE TECHNIQUE MORE CLOSELY ADHERE TO AUTHORITATIVE DEPRECIATION TEXTS?

A. Yes. As discussed, above, when using the remaining life technique, it is unnecessary to conduct a separate, manual reserve reallocation based on the theoretical reserve derived from the analyst's proposed depreciation parameters. It is more appropriate to simply use the actual book reserve balance at the study date when calculated depreciation rates under the remaining life technique.

Q. DOES THE DISCREPANCY BETWEEN YOUR APPROACH AND MR. WATSON'S APPROACH REGARDING THE DEPRECIATION RESERVE RESULT IN A MATERIAL DIFFERENCE IN YOUR PROPOSED DEPRECIATION ACCRUALS IN THIS CASE?

A. No. In this case, the variations in our methods regarding the reserve reallocation do not have a material impact on our proposed depreciation rates and accruals. The difference in our proposed depreciation rates is influenced almost exclusively by the differences in our proposed service lives and net salvage rates for the accounts discussed above.

VIII. CONCLUSION AND RECOMMENDATION

Q. SUMMARIZE THE KEY POINTS OF YOUR TESTIMONY.

A. In my opinion, adjustments should be made to TNMP's proposed depreciation rates for several accounts due to the Company's failure to make a convincing showing that the proposed depreciation rates for these accounts is not excessive. Specifically, I recommend service life adjustments to six accounts, and I also recommend net salvage

[42] *See* Exhibit DAD-2, p. 12 (Section IV).

rate adjustments to six accounts. Regarding service life, it is clear that TNMP's proposed service lives for these six accounts are unreasonably short, which would result in unreasonably high depreciation rates for customers. The historical data provided by TNMP to support these service life proposals are less reliable than the aged historical data maintained by the other utilities discussed in this testimony. My recommended service lives represent a balance between the shorter service lives indicated by TNMP's unaged historical data and the longer service lives utilized by utilities that maintain superior, aged historical data. Regarding net salvage, TNMP is proposing net salvage rates in this case that are up to 10 times greater than the rates approved by the Commission in its last rate case. I made reasonable adjustments to six accounts that still result in net salvage rates that are twice as high as the currently-approved rates. My recommended salvage rates give consideration to the higher (i.e., more negative) net salvage rates indicated by the Company's historical data while avoiding the unreasonableness of increasing net salvage rates by up to 10 times the currently-approved rates.

Q. WHAT IS ATM'S RECOMMENDATION TO THE COMMISSION REGARDING TNMP'S DEPRECIATION RATES?

A. ATM recommends that the Commission adopt the proposed depreciation rates presented in Exhibit DJG-3, which would result in an adjustment reducing the Company's proposed annual depreciation accrual by $10.3 million.[43]

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes. I reserve the right to supplement this testimony as needed with any additional information that has been requested from the Company but not yet provided. To the extent I did not address an opinion expressed by the Company, it does not constitute an agreement with such opinion.

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[43] *See* Exhibit DJG-2 and Exhibit DJG-3. These adjustments apply to the depreciation accrual for plant as of 12-31-17 and do not represent an exact adjustment to depreciation expense.

SOAH DOCKET NO. 473-18-3981
PUC DOCKET NO. 48401

APPLICATION OF TEXAS-NEW	**§**	**BEFORE THE STATE OFFICE**
MEXICO POWER COMPANY FOR	**§**	**OF**
AUTHORITY TO CHANGE RATES	**§**	**ADMINISTRATIVE HEARINGS**

DIRECT TESTIMONY AND EXHIBITS OF

DAVID J. GARRETT

APPENDIX A:

THE DEPRECIATION SYSTEM

THE DEPRECIATION SYSTEM

A depreciation accounting system may be thought of as a dynamic system in which estimates of life and salvage are inputs to the system, and the accumulated depreciation account is a measure of the state of the system at any given time.[44] The primary objective of the depreciation system is the timely recovery of capital. The process for calculating the annual accruals is determined by the factors required to define the system. A depreciation system should be defined by four primary factors: 1) a method of allocation; 2) a procedure for applying the method of allocation to a group of property; 3) a technique for applying the depreciation rate; and 4) a model for analyzing the characteristics of vintage groups comprising a continuous property group.[45] The figure below illustrates the basic concept of a depreciation system and includes some of the available parameters.[46]

There are hundreds of potential combinations of methods, procedures, techniques, and models, but in practice, analysts use only a few combinations. Ultimately, the system selected must result in the systematic and rational allocation of capital recovery for the utility. Each of the four primary factors defining the parameters of a depreciation system is discussed further below.

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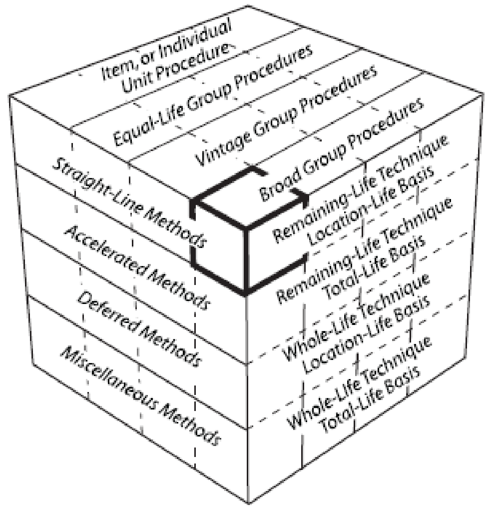
[44] Wolf *supra* n. 7, at 69-70.

[45] *Id.* at 70, 139-40.

[46] Edison Electric Institute, *Introduction to Depreciation* (inside cover) (EEI April 2013). Some definitions of the terms shown in this diagram are not consistent among depreciation practitioners and literature due to the fact that depreciation analysis is a relatively small and fragmented field. This diagram simply illustrates the some of the available parameters of a depreciation system.

Figure 10:
The Depreciation System Cube



1. Allocation Methods

The "method" refers to the pattern of depreciation in relation to the accounting periods. The method most commonly used in the regulatory context is the "straight-line method" – a type of age-life method in which the depreciable cost of plant is charged in equal amounts to each accounting period over the service life of plant.[47] Because group depreciation rates and plant balances often change, the amount of the annual accrual rarely remains the same, even when the straight-line method is employed.[48] The basic formula for the straight-line method is as follows:[49]

[47] NARUC *supra* n. 8, at 56.

[48] *Id*.

[49] *Id*.

Equation 1:
Straight-Line Accrual

$$Annual\ Accrual = \frac{Gross\ Plant - Net\ Salavage}{Service\ Life}$$

Gross plant is a known amount from the utility's records, while both net salvage and service life must be estimated in order to calculate the annual accrual. The straight-line method differs from accelerated methods of recovery, such as the "sum-of-the-years-digits" method and the "declining balance" method. Accelerated methods are primarily used for tax purposes and are rarely used in the regulatory context for determining annual accruals.[50] In practice, the annual accrual is expressed as a rate which is applied to the original cost of plant in order to determine the annual accrual in dollars. The formula for determining the straight-line rate is as follows:[51]

Equation 2:
Straight-Line Rate

$$Depreciation\ Rate\ \% = \frac{100 - Net\ Salvage\ \%}{Service\ Life}$$

2. Grouping Procedures

The "procedure" refers to the way the allocation method is applied through subdividing the total property into groups.[52] While single units may be analyzed for depreciation, a group plan of depreciation is particularly adaptable to utility property. Employing a grouping procedure allows for a composite application of depreciation rates to groups of similar property, rather than excessively conducting calculations for each unit. Whereas an individual unit of

[50] *Id*. at 57.

[51] *Id*. at 56.

[52] Wolf *supra* n. 7, at 74-75.

property has a single life, a group of property displays a dispersion of lives and the life characteristics of the group must be described statistically.[53] When analyzing mass property categories, it is important that each group contains homogenous units of plant that are used in the same general manner throughout the plant and operated under the same general conditions.[54]

The "average life" and "equal life" grouping procedures are the two most common. In the average life procedure, a constant annual accrual rate based on the average life of all property in the group is applied to the surviving property. While property having shorter lives than the group average will not be fully depreciated, and likewise, property having longer lives than the group average will be over-depreciated, the ultimate result is that the group will be fully depreciated by the time of the final retirement.[55] Thus, the average life procedure treats each unit as though its life is equal to the average life of the group. In contrast, the equal life procedure treats each unit in the group as though its life was known.[56] Under the equal life procedure the property is divided into subgroups that each has a common life.[57]

3. Application Techniques

The third factor of a depreciation system is the "technique" for applying the depreciation rate. There are two commonly used techniques: "whole life" and "remaining life." The whole life technique applies the depreciation rate on the estimated average service life of a group, while

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[53] *Id*. at 74.

[54] NARUC *supra* n. 8, at 61-62.

[55] *See* Wolf *supr*a n. 7, at 74-75.

[56] *Id*. at 75.

[57] *Id*.

the remaining life technique seeks to recover undepreciated costs over the remaining life of the plant.[58]

In choosing the application technique, consideration should be given to the proper level of the accumulated depreciation account. Depreciation accrual rates are calculated using estimates of service life and salvage. Periodically these estimates must be revised due to changing conditions, which cause the accumulated depreciation account to be higher or lower than necessary. Unless some corrective action is taken, the annual accruals will not equal the original cost of the plant at the time of final retirement.[59] Analysts can calculate the level of imbalance in the accumulated depreciation account by determining the "calculated accumulated depreciation," (a.k.a. "theoretical reserve" and referred to in these appendices as "CAD"). The CAD is the calculated balance that would be in the accumulated depreciation account at a point in time using current depreciation parameters.[60] An imbalance exists when the actual accumulated depreciation account does not equal the CAD. The choice of application technique will affect how the imbalance is dealt with.

Use of the whole life technique requires that an adjustment be made to accumulated depreciation after calculation of the CAD. The adjustment can be made in a lump sum or over a period of time. With use of the remaining life technique, however, adjustments to accumulated depreciation are amortized over the remaining life of the property and are automatically included

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[58] NARUC *supra* n. 8, at 63-64.

[59] Wolf *supra* n. 7, at 83.

[60] NARUC *supra* n. 8, at 325.

in the annual accrual.[61] This is one reason that the remaining life technique is popular among practitioners and regulators. The basic formula for the remaining life technique is as follows:[62]

Equation 3:
Remaining Life Accrual

$$Annual\ Accrual = \frac{Gross\ Plant - Accumulated\ Depreciation - Net\ Salvage}{Average\ Remaining\ Life}$$

The remaining life accrual formula is similar to the basic straight-line accrual formula above with two notable exceptions. First, the numerator has an additional factor in the remaining life formula: the accumulated depreciation. Second, the denominator is "average remaining life" instead of "average life." Essentially, the future accrual of plant (gross plant less accumulated depreciation) is allocated over the remaining life of plant. Thus, the adjustment to accumulated depreciation is "automatic" in the sense that it is built into the remaining life calculation.[63]

4. Analysis Model

The fourth parameter of a depreciation system, the "model," relates to the way of viewing the life and salvage characteristics of the vintage groups that have been combined to form a continuous property group for depreciation purposes.[64] A continuous property group is created when vintage groups are combined to form a common group. Over time, the characteristics of the property may change, but the continuous property group will continue. The two analysis models used among practitioners, the "broad group" and the "vintage group," are two ways of

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[61] NARUC *supra* n. 8, at 65 ("The desirability of using the remaining life technique is that any necessary adjustments of [accumulated depreciation] . . . are accrued automatically over the remaining life of the property. Once commenced, adjustments to the depreciation reserve, outside of those inherent in the remaining life rate would require regulatory approval.").

[62] *Id*. at 64.

[63] Wolf *supra* n. 7, at 178.

[64] *See* Wolf *supra* n. 7, at 139 (I added the term "model" to distinguish this fourth depreciation system parameter from the other three parameters).

viewing the life and salvage characteristics of the vintage groups that have been combined to form a continuous property group.

The broad group model views the continuous property group as a collection of vintage groups that each has the same life and salvage characteristics. Thus, a single survivor curve and a single salvage schedule are chosen to describe all the vintages in the continuous property group. In contrast, the vintage group model views the continuous property group as a collection of vintage groups that may have different life and salvage characteristics. Typically, there is not a significant difference between vintage group and broad group results unless vintages within the applicable property group experienced dramatically different retirement levels than anticipated in the overall estimated life for the group. For this reason, many analysts utilize the broad group procedure because it is more efficient.

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APPLICATION OF TEXAS-NEW MEXICO POWER COMPANY FOR AUTHORITY TO CHANGE RATES	**§ § §**	**BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS**

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DAVID J. GARRETT

APPENDIX B:

IOWA CURVES

IOWA CURVES

Early work in the analysis of the service life of industrial property was based on models that described the life characteristics of human populations.[65] This explains why the word "mortality" is often used in the context of depreciation analysis. In fact, a group of property installed during the same accounting period is analogous to a group of humans born during the same calendar year. Each period the group will incur a certain fraction of deaths / retirements until there are no survivors. Describing this pattern of mortality is part of actuarial analysis and is regularly used by insurance companies to determine life insurance premiums. The pattern of mortality may be described by several mathematical functions, particularly the survivor curve and frequency curve. Each curve may be derived from the other so that if one curve is known, the other may be obtained. A survivor curve is a graph of the percent of units remaining in service expressed as a function of age.[66] A frequency curve is a graph of the frequency of retirements as a function of age. Several types of survivor and frequency curves are illustrated in the figures below.

1. Development

The survivor curves used by analysts today were developed over several decades from extensive analysis of utility and industrial property. In 1931 Edwin Kurtz and Robley Winfrey used extensive data from a range of 65 industrial property groups to create survivor curves representing the life characteristics of each group of property.[67] They generalized the 65 curves into 13 survivor curve types and published their results in *Bulletin 103: Life Characteristics of*

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[65] Wolf *supra* n. 7, at 276.

[66] *Id*. at 23.

[67] *Id*. at 34.

Physical Property. The 13 type curves were designed to be used as valuable aids in forecasting probable future service lives of industrial property. Over the next few years, Winfrey continued gathering additional data, particularly from public utility property, and expanded the examined property groups from 65 to 176.[68] This resulted in 5 additional survivor curve types for a total of 18 curves. In 1935, Winfrey published *Bulletin 125: Statistical Analysis of Industrial Property Retirements*. According to Winfrey, "[t]he 18 type curves are expected to represent quite well all survivor curves commonly encountered in utility and industrial practices."[69] These curves are known as the "Iowa curves" and are used extensively in depreciation analysis in order to obtain the average service lives of property groups. (Use of Iowa curves in actuarial analysis is further discussed in Appendix C.)

In 1942, Winfrey published *Bulletin 155: Depreciation of Group Properties*. In Bulletin 155, Winfrey made some slight revisions to a few of the 18 curve types, and published the equations, tables of the percent surviving, and probable life of each curve at five-percent intervals.[70] Rather than using the original formulas, analysts typically rely on the published tables containing the percentages surviving. This is because absent knowledge of the integration technique applied to each age interval, it is not possible to recreate the exact original published table values. In the 1970s, John Russo collected data from over 2,000 property accounts reflecting observations during the period 1965 – 1975 as part of his Ph.D. dissertation at Iowa State. Russo essentially repeated Winfrey's data collection, testing, and analysis methods used

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[68] *Id*.

[69] Robley Winfrey, *Bulletin 125: Statistical Analyses of Industrial Property Retirements* 85, Vol. XXXIV, No. 23 (Iowa State College of Agriculture and Mechanic Arts 1935).

[70] Robley Winfrey, Bulletin 155: *Depreciation of Group Properties* 121-28, Vol XLI, No. 1 (The Iowa State College Bulletin 1942); *see also* Wolf supra n. 7, at 305-38 (publishing the percent surviving for each Iowa curve, including "O" type curve, at one percent intervals).

to develop the original Iowa curves, except that Russo studied industrial property in service several decades after Winfrey published the original Iowa curves. Russo drew three major conclusions from his research:[71]

1. No evidence was found to conclude that the Iowa curve set, as it stands, is not a valid system of standard curves;
2. No evidence was found to conclude that new curve shapes could be produced at this time that would add to the validity of the Iowa curve set; and
3. No evidence was found to suggest that the number of curves within the Iowa curve set should be reduced.

Prior to Russo's study, some had criticized the Iowa curves as being potentially obsolete because their development was rooted in the study of industrial property in existence during the early 1900s. Russo's research, however, negated this criticism by confirming that the Iowa curves represent a sufficiently wide range of life patterns, and that though technology will change over time, the underlying patterns of retirements remain constant and can be adequately described by the Iowa curves.[72]

Over the years, several more curve types have been added to Winfrey's 18 Iowa curves. In 1967, Harold Cowles added four origin-modal curves. In addition, a square curve is sometimes used to depict retirements which are all planned to occur at a given age. Finally, analysts commonly rely on several "half curves" derived from the original Iowa curves. Thus, the term "Iowa curves" could be said to describe up to 31 standardized survivor curves.

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[71] *See* Wolf *supra* n. 7, at 37.

[72] *Id*.

2. Classification

The Iowa curves are classified by three variables: modal location, average life, and variation of life. First, the mode is the percent life that results in the highest point of the frequency curve and the "inflection point" on the survivor curve. The modal age is the age at which the greatest rate of retirement occurs. As illustrated in the figure below, the modes appear at the steepest point of each survivor curve in the top graph, as well as the highest point of each corresponding frequency curve in the bottom graph.

The classification of the survivor curves was made according to whether the mode of the retirement frequency curves was to the left, to the right, or coincident with average service life. There are three modal "families" of curves: six left modal curves (L0, L1, L2, L3, L4, L5); five right modal curves (R1, R2, R3, R4, R5); and seven symmetrical curves (S0, S1, S2, S3, S4, S5, S6).[73] In the figure below, one curve from each family is shown: L0, S3 and R1, with average life at 100 on the x-axis. It is clear from the graphs that the modes for the L0 and R1 curves appear to the left and right of average life respectively, while the S3 mode is coincident with average life.

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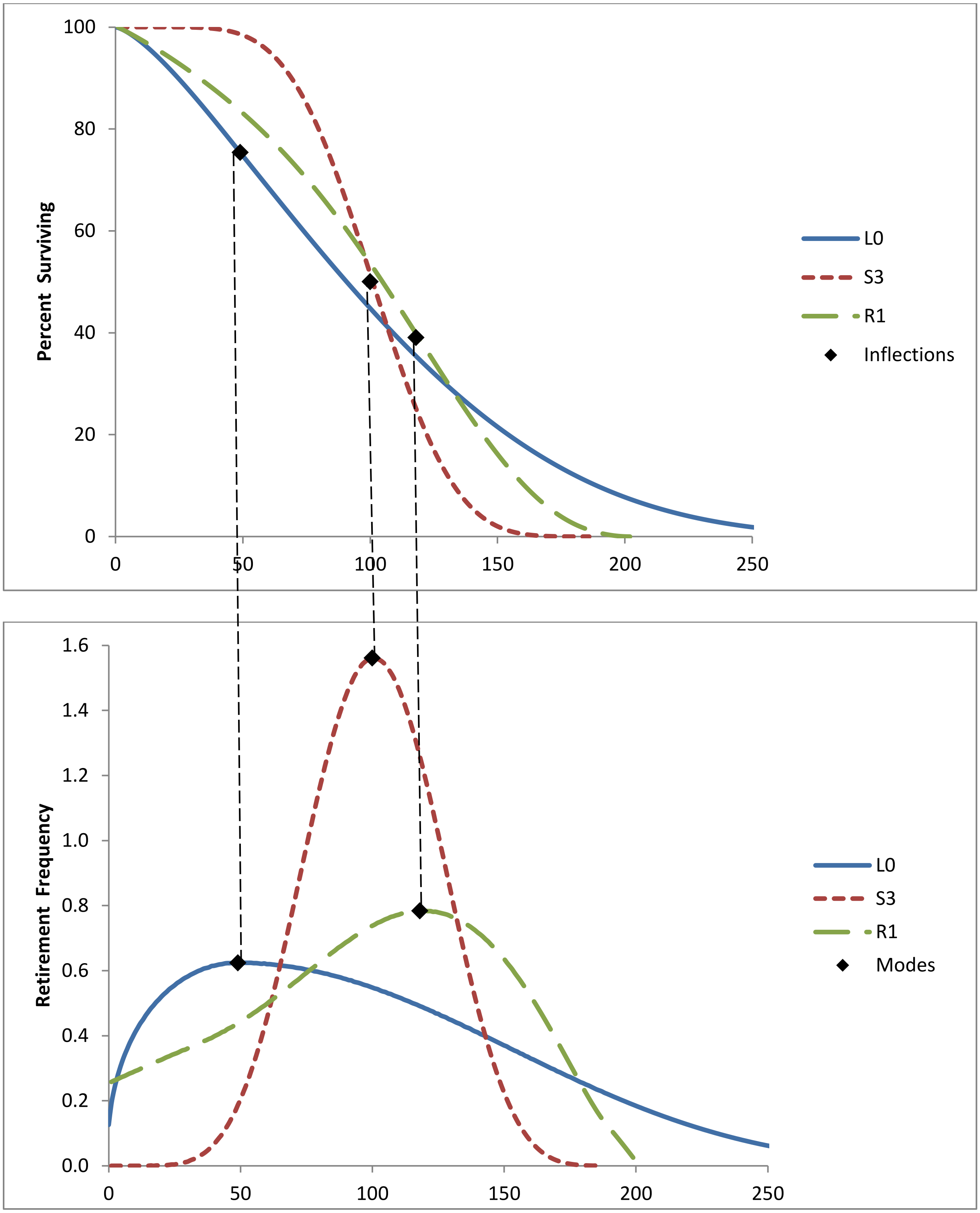
[73] In 1967, Harold A. Cowles added four origin-modal curves known as "O type" curves. There are also several "half" curves and a square curve, so the total amount of survivor curves commonly called "Iowa" curves is about 31 (see NARUC supra n. 8, at 68).

Figure 11:
Modal Age Illustration



The second Iowa curve classification variable is average life. The Iowa curves were designed using a single parameter of age expressed as a percent of average life instead of actual age. This was necessary in order for the curves to be of practical value. As Winfrey notes:

> Since the location of a particular survivor on a graph is affected by both its span in years and the shape of the curve, it is difficult to classify a group of curves unless one of these variables can be controlled. This is easily done by expressing the age in percent of average life."[74]

Because age is expressed in terms of percent of average life, any particular Iowa curve type can be modified to forecast property groups with various average lives.

The third variable, variation of life, is represented by the numbers next to each letter. A lower number (e.g., L1) indicates a relatively low mode, large variation, and large maximum life; a higher number (e.g., L5) indicates a relatively high mode, small variation, and small maximum life. All three classification variables – modal location, average life, and variation of life – are used to describe each Iowa curve. For example, a 13-L1 Iowa curve describes a group of property with a 13-year average life, with the greatest number of retirements occurring before (or to the left of) the average life, and a relatively low mode. The graphs below show these 18 survivor curves, organized by modal family.

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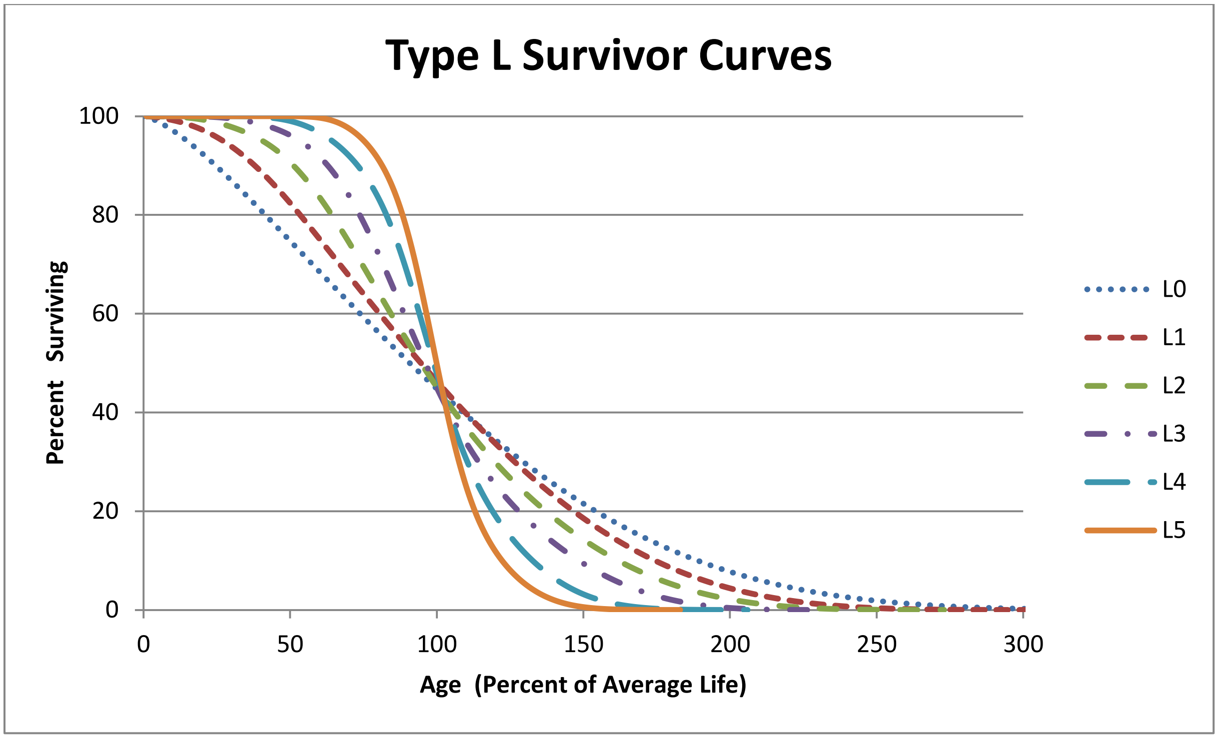
[74] Winfrey, *Bulletin 125: Statistical Analyses of Industrial Property Retirements* 60, Vol. XXXIV, No. 23 (Iowa State College of Agriculture and Mechanic Arts 1935).

Figure 12:
Type L Survivor and Frequency Curves



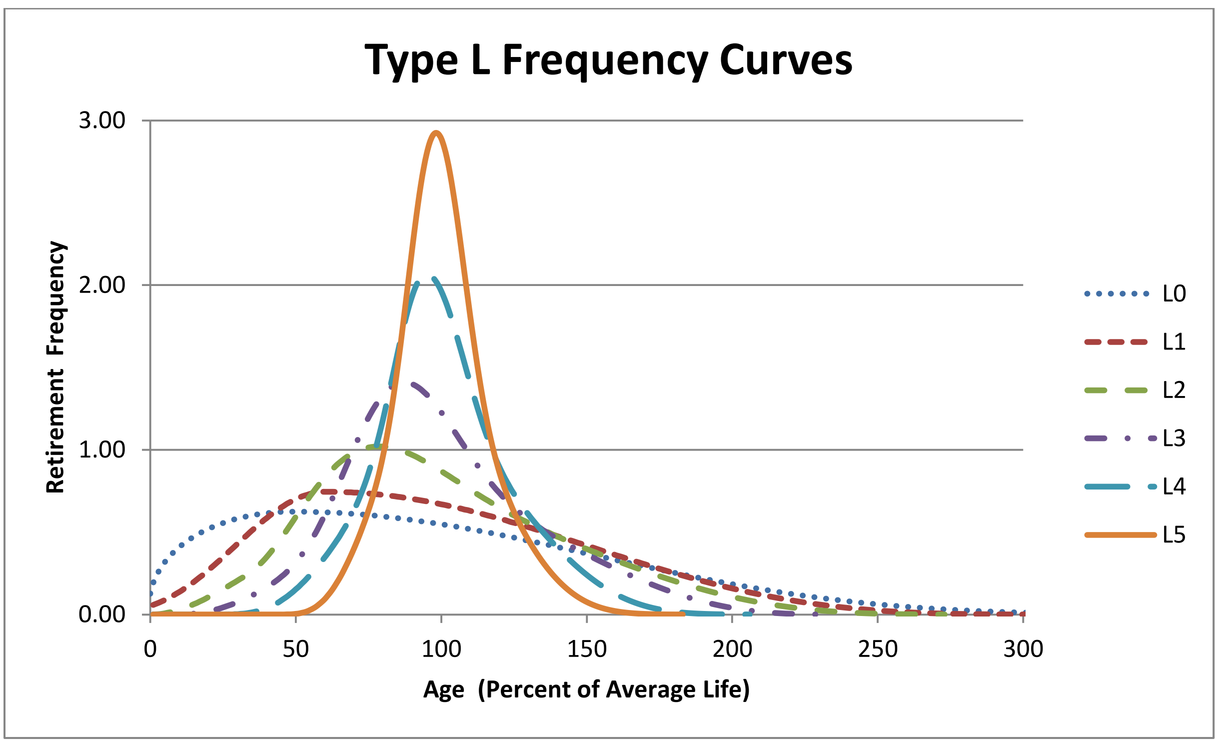
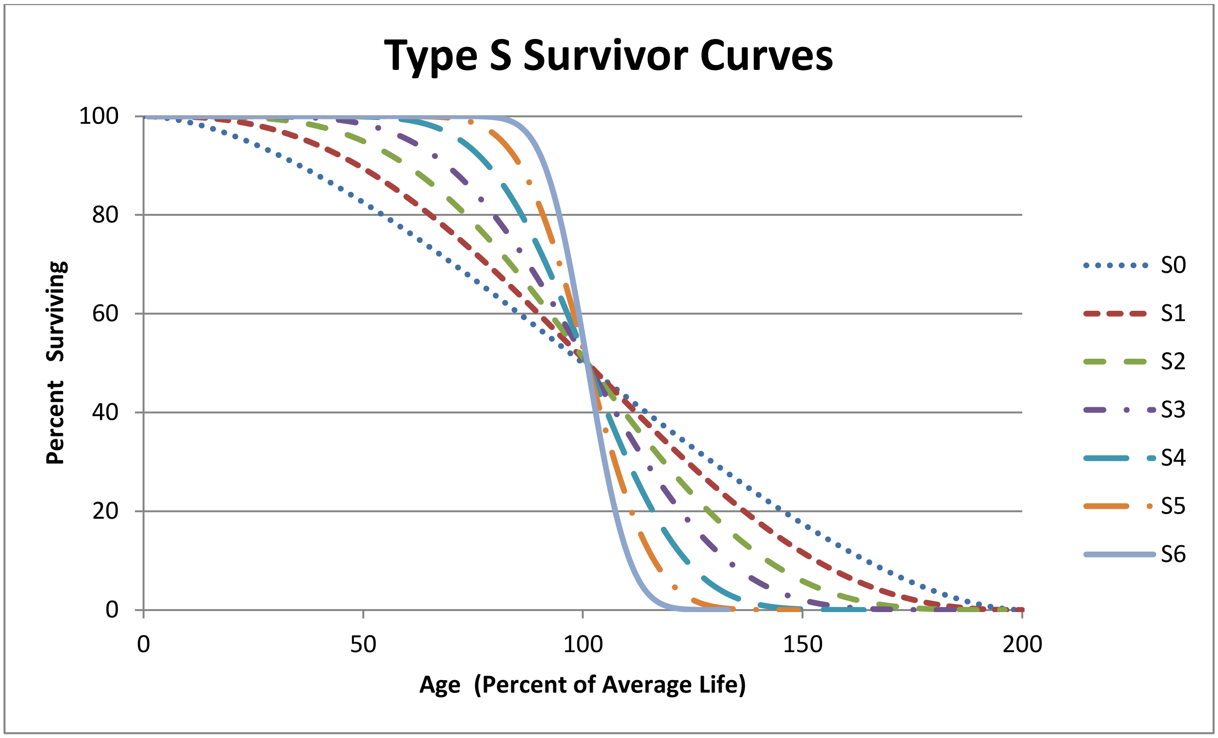


Figure 13:
Type S Survivor and Frequency Curves



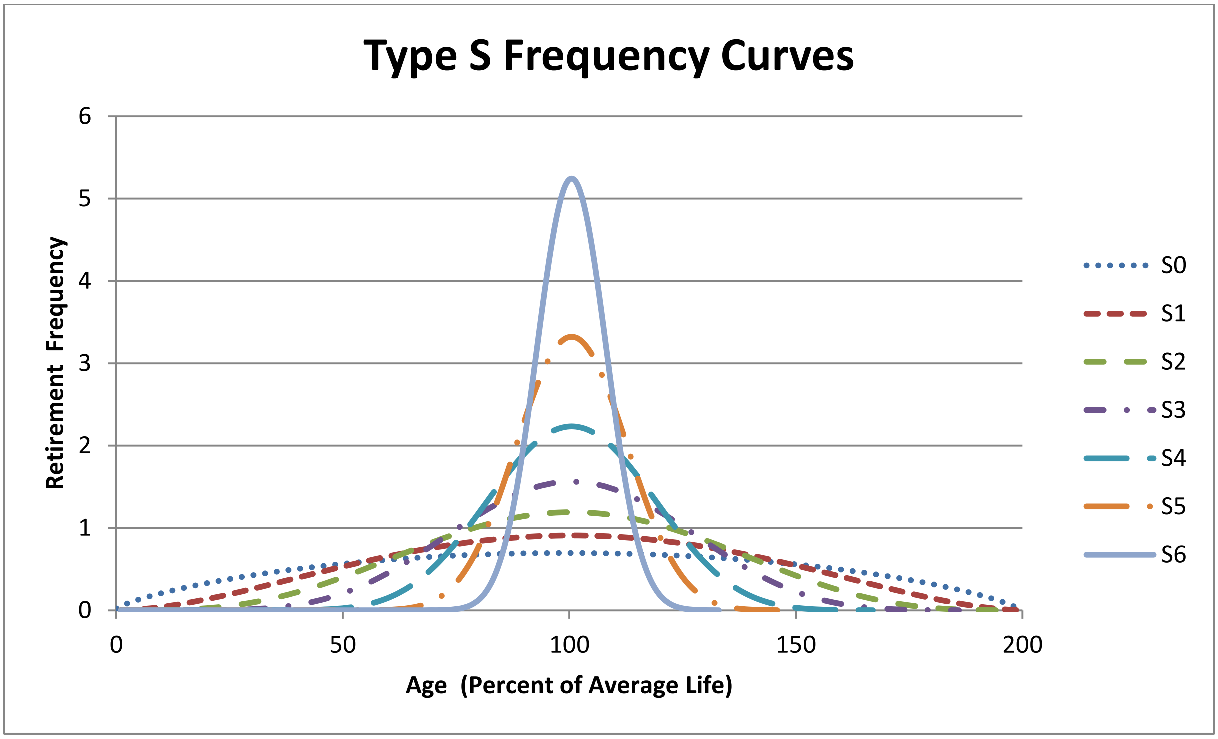
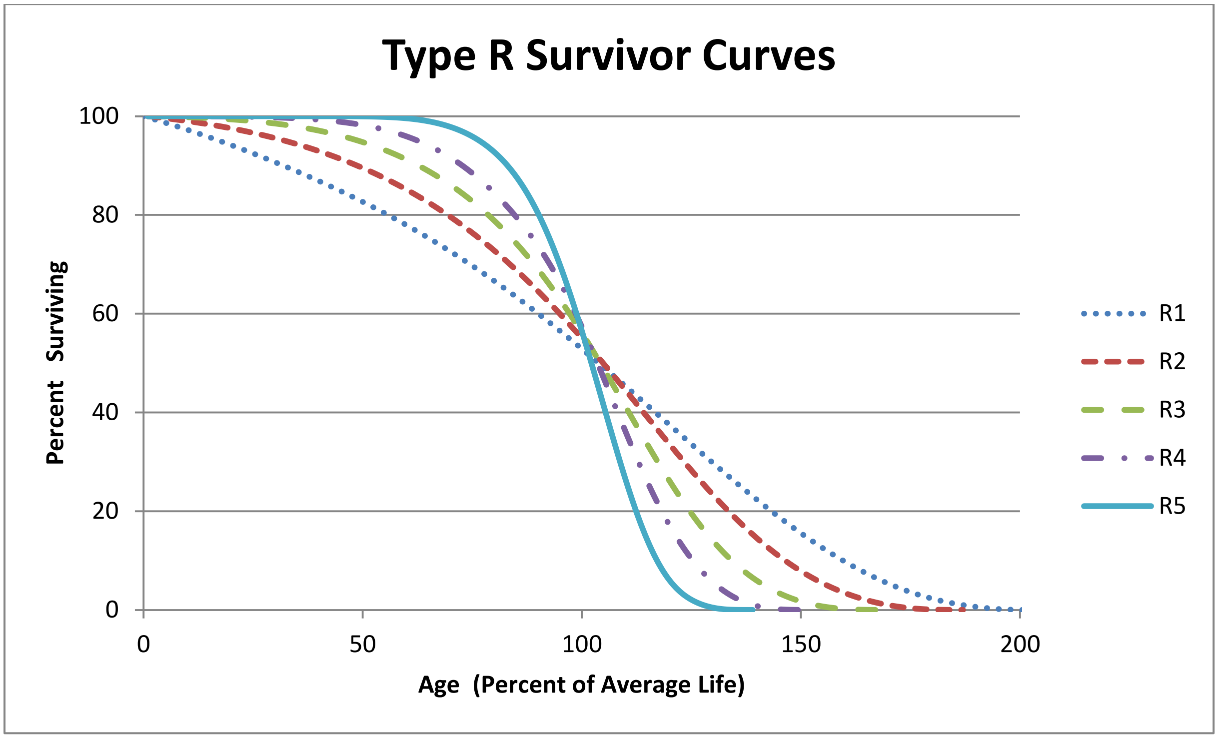
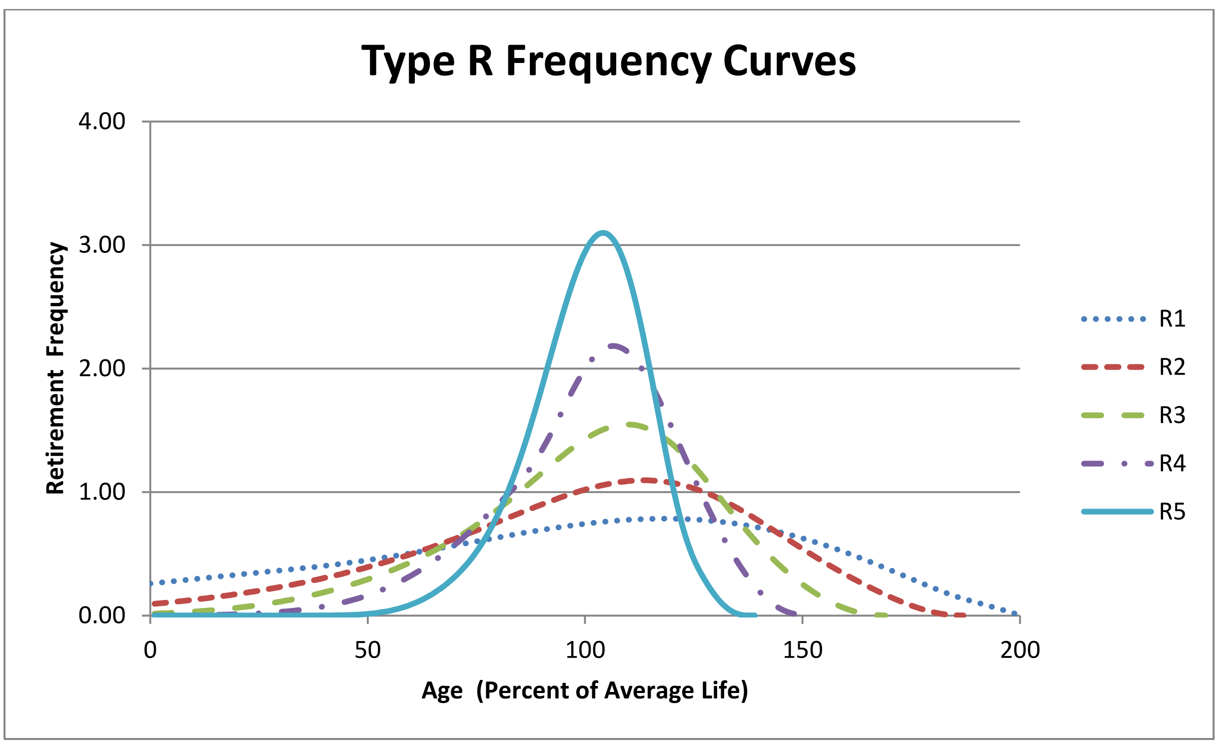


Figure 14:
Type R Survivor and Frequency Curves





As shown in the graphs above, the modes for the L family frequency curves occur to the left of average life (100% on the x-axis), while the S family modes occur at the average, and the R family modes occur after the average.

3. Types of Lives

Several other important statistical analyses and types of lives may be derived from an Iowa curve. These include: 1) average life; 2) realized life; 3) remaining life; and 4) probable life. The figure below illustrates these concepts. It shows the frequency curve, survivor curve, and probable life curve. Age M_x on the x-axis represents the modal age, while age AL_x represents the average age. Thus, this figure illustrates an "L type" Iowa curve since the mode occurs before the average.[75]

First, average life is the area under the survivor curve from age zero to maximum life. Because the survivor curve is measured in percent, the area under the curve must be divided by 100% to convert it from percent-years to years. The formula for average life is as follows:[76]

Equation 4:
Average Life

$$Average\ Life = \frac{Area\ Under\ Survivor\ Curve\ from\ Age\ 0\ to\ Max\ Life}{100\%}$$

Thus, average life may not be determined without a complete survivor curve. Many property groups being analyzed will not have experienced full retirement. This results in a "stub" survivor curve. Iowa curves are used to extend stub curves to maximum life in order for the average life calculation to be made (see Appendix C).

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[75] From age zero to age M_x on the survivor curve, it could be said that the percent surviving from this property group is decreasing at an increasing rate. Conversely, from point M_x to maximum on the survivor curve, the percent surviving is decreasing at a decreasing rate.

[76] *See* NARUC *supra* n. 8, at 71.

Realized life is similar to average life, except that realized life is the average years of service experienced to date from the vintage's original installations.[77] As shown in the figure below, realized life is the area under the survivor curve from zero to age RL_X. Likewise, unrealized life is the area under the survivor curve from age RL_X to maximum life. Thus, it could be said that average life equals realized life plus unrealized life.

Average remaining life represents the future years of service expected from the surviving property.[78] Remaining life is sometimes referred to as "average remaining life" and "life expectancy." To calculate average remaining life at age x, the area under the estimated future portion of the survivor curve is divided by the percent surviving at age x (denoted S_X). Thus, the average remaining life formula is:

Equation 5:
Average Remaining Life

$$Average\ Remaining\ Life = \frac{Area\ Under\ Survivor\ Curve\ from\ Age\ x\ to\ Max\ Life}{S_X}$$

It is necessary to determine average remaining life in order to calculate the annual accrual under the remaining life technique.

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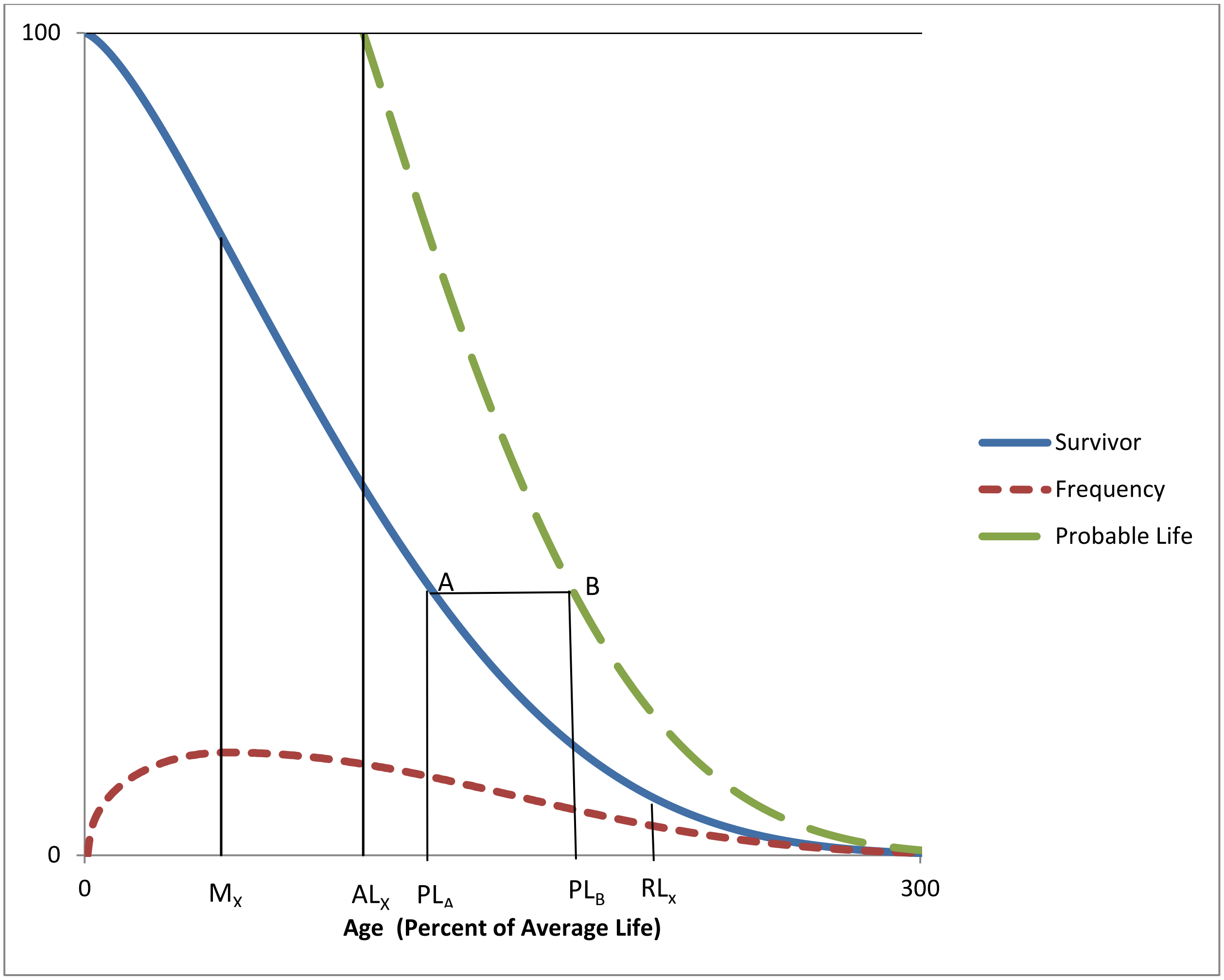
[77] *Id*. at 73.

[78] *Id*. at 74.

Figure 15:
Iowa Curve Derivations



Finally, the probable life may also be determined from the Iowa curve. The probable life of a property group is the total life expectancy of the property surviving at any age and is equal to the remaining life plus the current age.[79] The probable life is also illustrated in this figure. The probable life at age PL_A is the age at point PL_B. Thus, to read the probable life at age PL_A, see the corresponding point on the survivor curve above at point "A," then horizontally to point "B" on the probable life curve, and back down to the age corresponding to point "B." It is no

[79] Wolf *supra* n. 7, at 28.

coincidence that the vertical line from AL_X connects at the top of the probable life curve. This is because at age zero, probable life equals average life.

SOAH DOCKET NO. 473-18-3981
PUC DOCKET NO. 48401

APPLICATION OF TEXAS-NEW	**§**	**BEFORE THE STATE OFFICE**
MEXICO POWER COMPANY FOR	**§**	**OF**
AUTHORITY TO CHANGE RATES	**§**	**ADMINISTRATIVE HEARINGS**

DIRECT TESTIMONY AND EXHIBITS OF

DAVID J. GARRETT

APPENDIX C:

ACTUARIAL ANALYSIS

ACTUARIAL ANALYSIS

Actuarial science is a discipline that applies various statistical methods to assess risk probabilities and other related functions. Actuaries often study human mortality. The results from historical mortality data are used to predict how long similar groups of people who are alive will live today. Insurance companies rely on actuarial analysis in determining premiums for life insurance policies.

The study of human mortality is analogous to estimating service lives of industrial property groups. While some humans die solely from chance, most deaths are related to age; that is, death rates generally increase as age increases. Similarly, physical plant is also subject to forces of retirement. These forces include physical, functional, and contingent factors, as shown in the table below.[80]

Figure 16:
Forces of Retirement

Physical Factors	Functional Factors	Contingent Factors
Wear and tear Decay or deterioration Action of the elements	Inadequacy Obsolescence Changes in technology Regulations Managerial discretion	Casualties or disasters Extraordinary obsolescence

While actuaries study historical mortality data in order to predict how long a group of people will live, depreciation analysts must look at a utility's historical data in order to estimate the average lives of property groups. A utility's historical data is often contained in the Continuing Property Records ("CPR"). Generally, a CPR should contain 1) an inventory of

[80] NARUC *supra* n. 8, at 14-15.

property record units; 2) the association of costs with such units; and 3) the dates of installation and removal of plant. Since actuarial analysis includes the examination of historical data to forecast future retirements, the historical data used in the analysis should not contain events that are anomalous or unlikely to recur.[81] Historical data is used in the retirement rate actuarial method, which is discussed further below.

The Retirement Rate Method

There are several systematic actuarial methods that use historical data in order to calculate observed survivor curves for property groups. Of these methods, the retirement rate method is superior, and is widely employed by depreciation analysts.[82] The retirement rate method is ultimately used to develop an observed survivor curve, which can be fitted with an Iowa curve discussed in Appendix B in order to forecast average life. The observed survivor curve is calculated by using an observed life table ("OLT"). The figures below illustrate how the OLT is developed. First, historical property data are organized in a matrix format, with placement years on the left forming rows, and experience years on the top forming columns. The placement year (a.k.a. "vintage year" or "installation year") is the year of placement of a group of property. The experience year (a.k.a. "activity year") refers to the accounting data for a particular calendar year. The two matrices below use aged data – that is, data for which the dates of placements, retirements, transfers, and other transactions are known. Without aged data, the retirement rate actuarial method may not be employed. The first matrix is the exposure matrix,

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[81] *Id*. at 112-13.

[82] Anson Marston, Robley Winfrey & Jean C. Hempstead, *Engineering Valuation and Depreciation* 154 (2nd ed., McGraw-Hill Book Company, Inc. 1953).

which shows the exposures at the beginning of each year.[83] An exposure is simply the depreciable property subject to retirement during a period. The second matrix is the retirement matrix, which shows the annual retirements during each year. Each matrix covers placement years 2003–2015, and experience years 2008-2015. In the exposure matrix, the number in the 2009 experience column and the 2003 placement row is $192,000. This means at the beginning of 2012, there was $192,000 still exposed to retirement from the vintage group placed in 2003. Likewise, in the retirement matrix, $19,000 of the dollars invested in 2003 was retired during 2012.

Figure 17:
Exposure Matrix

	Experience Years Exposures at January 1 of Each Year (Dollars in 000's)									
Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
2003	261	245	228	211	**192**	173	152	131	131	11.5 - 12.5
2004	267	252	236	220	202	**184**	165	145	297	10.5 - 11.5
2005	304	291	277	263	248	232	**216**	198	536	9.5 - 10.5
2006	345	334	322	310	298	284	270	**255**	**847**	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	1,201	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	1,581	6.5 - 7.5
2009		377	366	356	346	336	327	319	1,986	5.5 - 6.5
2010			381	369	358	347	336	327	2,404	4.5 - 5.5
2011				386	372	359	346	334	2,559	3.5 - 4.5
2012					395	380	366	352	2,722	2.5 - 3.5
2013						401	385	370	2,866	1.5 - 2.5
2014							410	393	2,998	0.5 - 1.5
2015								416	3,141	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	23,268	

[83] Technically, the last numbers in each column are "gross additions" rather than exposures. Gross additions do not include adjustments and transfers applicable to plant placed in a previous year. Once retirements, adjustments, and transfers are factored in, the balance at the beginning of the next account period is called an "exposure" rather than an addition.

Figure 18:
Retirement Matrix

Placement Years	Experience Years / Retirments During the Year (Dollars in 000's) 2008	2009	2010	2011	2012	2013	2014	2015	Total During Age Interval	Age Interval
2003	16	17	18	19	**19**	20	21	23	23	11.5 - 12.5
2004	15	16	17	17	18	**19**	20	21	43	10.5 - 11.5
2005	13	14	14	15	16	17	**17**	18	59	9.5 - 10.5
2006	11	12	12	13	13	14	15	**15**	**71**	8.5 - 9.5
2007	10	11	11	12	12	13	13	14	82	7.5 - 8.5
2008	9	9	10	10	11	11	12	13	91	6.5 - 7.5
2009		11	10	10	9	9	9	8	95	5.5 - 6.5
2010			12	11	11	10	10	9	100	4.5 - 5.5
2011				14	13	13	12	11	93	3.5 - 4.5
2012					15	14	14	13	91	2.5 - 3.5
2013						16	15	14	93	1.5 - 2.5
2014							17	16	100	0.5 - 1.5
2015								18	112	0.0 - 0.5
Total	74	89	104	121	139	157	175	194	1,052	

These matrices help visualize how exposure and retirement data are calculated for each age interval. An age interval is typically one year. A common convention is to assume that any unit installed during the year is installed in the middle of the calendar year (i.e., July 1st). This convention is called the "half-year convention" and effectively assumes that all units are installed uniformly during the year.[84] Adoption of the half-year convention leads to age intervals of 0-0.5 years, 0.5-1.5 years, etc., as shown in the matrices.

The purpose of the matrices is to calculate the totals for each age interval, which are shown in the second column from the right in each matrix. This column is calculated by adding each number from the corresponding age interval in the matrix. For example, in the exposure matrix, the total amount of exposures at the beginning of the 8.5-9.5 age interval is $847,000. This number was calculated by adding the numbers shown on the "stairs" to the left (192+184+216+255=847). The same calculation is applied to each number in the column. The

[84] Wolf *supra* n. 7, at 22.

amounts retired during the year in the retirements matrix affect the exposures at the beginning of each year in the exposures matrix. For example, the amount exposed to retirement in 2008 from the 2003 vintage is $261,000. The amount retired during 2008 from the 2003 vintage is $16,000. Thus, the amount exposed to retirement in 2009 from the 2003 vintage is $245,000 ($261,000 - $16,000). The company's property records may contain other transactions which affect the property, including sales, transfers, and adjusting entries. Although these transactions are not shown in the matrices above, they would nonetheless affect the amount exposed to retirement at the beginning of each year.

The totaled amounts for each age interval in both matrices are used to form the exposure and retirement columns in the OLT, as shown in the chart below. This chart also shows the retirement ratio and the survivor ratio for each age interval. The retirement ratio for an age interval is the ratio of retirements during the interval to the property exposed to retirement at the beginning of the interval. The retirement ratio represents the probability that the property surviving at the beginning of an age interval will be retired during the interval. The survivor ratio is simply the complement to the retirement ratio (1 – retirement ratio). The survivor ratio represents the probability that the property surviving at the beginning of an age interval will survive to the next age interval.

Figure 19:
Observed Life Table

Age at Start of Interval	Exposures at Start of Age Interval	Retirements During Age Interval	Retirement Ratio	Survivor Ratio	Percent Surviving at Start of Age Interval
A	B	C	D = C / B	E = 1 - D	F
0.0	3,141	112	0.036	0.964	**100.00**
0.5	2,998	100	0.033	0.967	**96.43**
1.5	2,866	93	0.032	0.968	**93.21**
2.5	2,722	91	0.033	0.967	**90.19**
3.5	2,559	93	0.037	0.963	**87.19**
4.5	2,404	100	0.042	0.958	**84.01**
5.5	1,986	95	0.048	0.952	**80.50**
6.5	1,581	91	0.058	0.942	**76.67**
7.5	1,201	82	0.068	0.932	**72.26**
8.5	847	71	0.084	0.916	**67.31**
9.5	536	59	0.110	0.890	**61.63**
10.5	297	43	0.143	0.857	**54.87**
11.5	131	23	0.172	0.828	**47.01**
					38.91
Total	23,268	1,052			

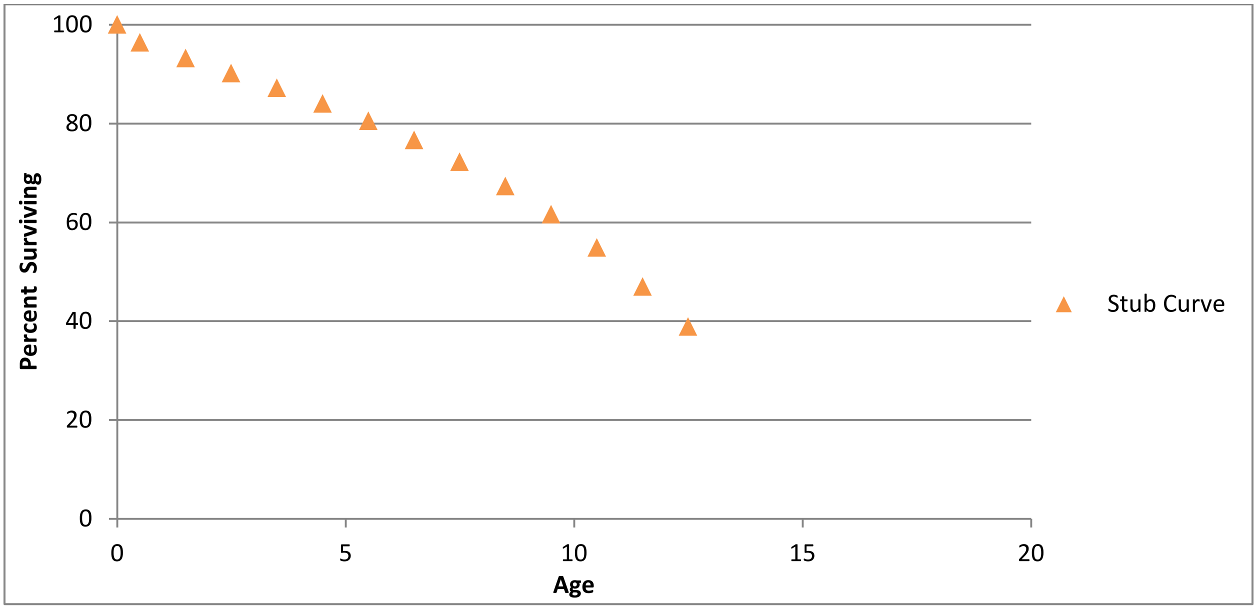
Column F on the right shows the percentages surviving at the beginning of each age interval. This column starts at 100% surviving. Each consecutive number below is calculated by multiplying the percent surviving from the previous age interval by the corresponding survivor ratio for that age interval. For example, the percent surviving at the start of age interval 1.5 is 93.21%, which was calculated by multiplying the percent surviving for age interval 0.5 (96.43%) by the survivor ratio for age interval 0.5 (0.967)[85].

The percentages surviving in Column F are the numbers that are used to form the original survivor curve. This particular curve starts at 100% surviving and ends at 38.91% surviving. An

[85] Multiplying 96.43 by 0.967 does not equal 93.21 exactly due to rounding.

observed survivor curve such as this that does not reach zero percent surviving is called a “stub” curve. The figure below illustrates the stub survivor curve derived from the OLT table above.

Figure 20:
Original “Stub” Survivor Curve



The matrices used to develop the basic OLT and stub survivor curve provide a basic illustration of the retirement rate method in that only a few placement and experience years were used. In reality, analysts may have several decades of aged property data to analyze. In that case, it may be useful to use a technique called “banding” in order to identify trends in the data.

Banding

The forces of retirement and characteristics of industrial property are constantly changing. A depreciation analyst may examine the magnitude of these changes. Analysts often use a technique called “banding” to assist with this process. Banding refers to the merging of several years of data into a single data set for further analysis, and it is a common technique associated with the retirement rate method.[86] There are three primary benefits of using bands in depreciation analysis:

1. Increasing the sample size. In statistical analyses, the larger the sample size in relation to the body of total data, the greater the reliability of the result;

2. Smooth the observed data. Generally, the data obtained from a single activity or vintage year will not produce an observed life table that can be easily fit; and

3. Identify trends. By looking at successive bands, the analyst may identify broad trends in the data that may be useful in projecting the future life characteristics of the property.[87]

Two common types of banding methods are the "placement band" method and the "experience band" method." A placement band, as the name implies, isolates selected placement years for analysis. The figure below illustrates the same exposure matrix shown above, except that only the placement years 2005-2008 are considered in calculating the total exposures at the beginning of each age interval.

[86] NARUC *supra* n. 8, at 113.

[87] *Id*.

Figure 21:
Placement Bands

Placement Years	Experience Years Exposures at January 1 of Each Year (Dollars in 000's) 2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
2003	261	245	228	211	192	173	152	131		11.5 - 12.5
2004	267	252	236	220	202	184	165	145		10.5 - 11.5
2005	304	291	277	263	248	232	216	198	198	9.5 - 10.5
2006	345	334	322	310	298	284	270	255	471	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	788	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	1,133	6.5 - 7.5
2009		377	366	356	346	336	327	319	1,186	5.5 - 6.5
2010			381	369	358	347	336	327	1,237	4.5 - 5.5
2011				386	372	359	346	334	1,285	3.5 - 4.5
2012					395	380	366	352	1,331	2.5 - 3.5
2013						401	385	370	1,059	1.5 - 2.5
2014							410	393	733	0.5 - 1.5
2015								416	375	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	9,796	

The shaded cells within the placement band equal the total exposures at the beginning of age interval 4.5–5.5 ($1,237). The same placement band would be used for the retirement matrix covering the same placement years of 2005 – 2008. This of course would result in a different OLT and original stub survivor curve than those that were calculated above without the restriction of a placement band.

Analysts often use placement bands for comparing the survivor characteristics of properties with different physical characteristics.[88] Placement bands allow analysts to isolate the effects of changes in technology and materials that occur in successive generations of plant. For example, if in 2005 an electric utility began placing transmission poles with a special chemical treatment that extended the service lives of the poles, an analyst could use placement bands to isolate and analyze the effect of that change in the property group's physical characteristics. While placement bands are very useful in depreciation analysis, they also possess an intrinsic

[88] Wolf *supra* n. 7, at 182.

dilemma. A fundamental characteristic of placement bands is that they yield fairly complete survivor curves for older vintages. However, with newer vintages, which are arguably more valuable for forecasting, placement bands yield shorter survivor curves. Longer "stub" curves are considered more valuable for forecasting average life. Thus, an analyst must select a band width broad enough to provide confidence in the reliability of the resulting curve fit yet narrow enough so that an emerging trend may be observed.[89]

Analysts also use "experience bands." Experience bands show the composite retirement history for all vintages during a select set of activity years. The figure below shows the same data presented in the previous exposure matrices, except that the experience band from 2011 – 2013 is isolated, resulting in different interval totals.

Figure 22:
Experience Bands

	Experience Years Exposures at January 1 of Each Year (Dollars in 000's)									
Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
2003	261	245	228	211	192	173	152	131		11.5 - 12.5
2004	267	252	236	220	202	184	165	145		10.5 - 11.5
2005	304	291	277	263	248	232	216	198	173	9.5 - 10.5
2006	345	334	322	310	298	284	270	255	376	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	645	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	752	6.5 - 7.5
2009		377	366	356	346	336	327	319	872	5.5 - 6.5
2010			381	369	358	347	336	327	959	4.5 - 5.5
2011				386	372	359	346	334	1,008	3.5 - 4.5
2012					395	380	366	352	1,039	2.5 - 3.5
2013						401	385	370	1,072	1.5 - 2.5
2014							410	393	1,121	0.5 - 1.5
2015								416	1,182	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	9,199	

The shaded cells within the experience band equal the total exposures at the beginning of age interval 4.5–5.5 ($1,237). The same experience band would be used for the retirement matrix

[89] NARUC *supra* n. 8, at 114.

covering the same experience years of 2011 – 2013. This of course would result in a different OLT and original stub survivor than if the band had not been used. Analysts often use experience bands to isolate and analyze the effects of an operating environment over time.[90] Likewise, the use of experience bands allows analysis of the effects of an unusual environmental event. For example, if an unusually severe ice storm occurred in 2013, destruction from that storm would affect an electric utility's line transformers of all ages. That is, each of the line transformers from each placement year would be affected, including those recently installed in 2012, as well as those installed in 2003. Using experience bands, an analyst could isolate or even eliminate the 2013 experience year from the analysis. In contrast, a placement band would not effectively isolate the ice storm's effect on life characteristics. Rather, the placement band would show an unusually large rate of retirement during 2013, making it more difficult to accurately fit the data with a smooth Iowa curve. Experience bands tend to yield the most complete stub curves for recent bands because they have the greatest number of vintages included. Longer stub curves are better for forecasting. The experience bands, however, may also result in more erratic retirement dispersion making the curve fitting process more difficult.

Depreciation analysts must use professional judgment in determining the types of bands to use and the band widths. In practice, analysts may use various combinations of placement and experience bands in order to increase the data sample size, identify trends and changes in life characteristics, and isolate unusual events. Regardless of which bands are used, observed survivor curves in depreciation analysis rarely reach zero percent. This is because, as seen in the OLT above, relatively newer vintage groups have not yet been fully retired at the time the

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[90] *Id*.

property is studied. An analyst could confine the analysis to older, fully retired vintage groups in order to get complete survivor curves, but such analysis would ignore some of the property currently in service and would arguably not provide an accurate description of life characteristics for current plant in service. Because a complete curve is necessary to calculate the average life of the property group, however, curve fitting techniques using Iowa curves or other standardized curves may be employed in order to complete the stub curve.

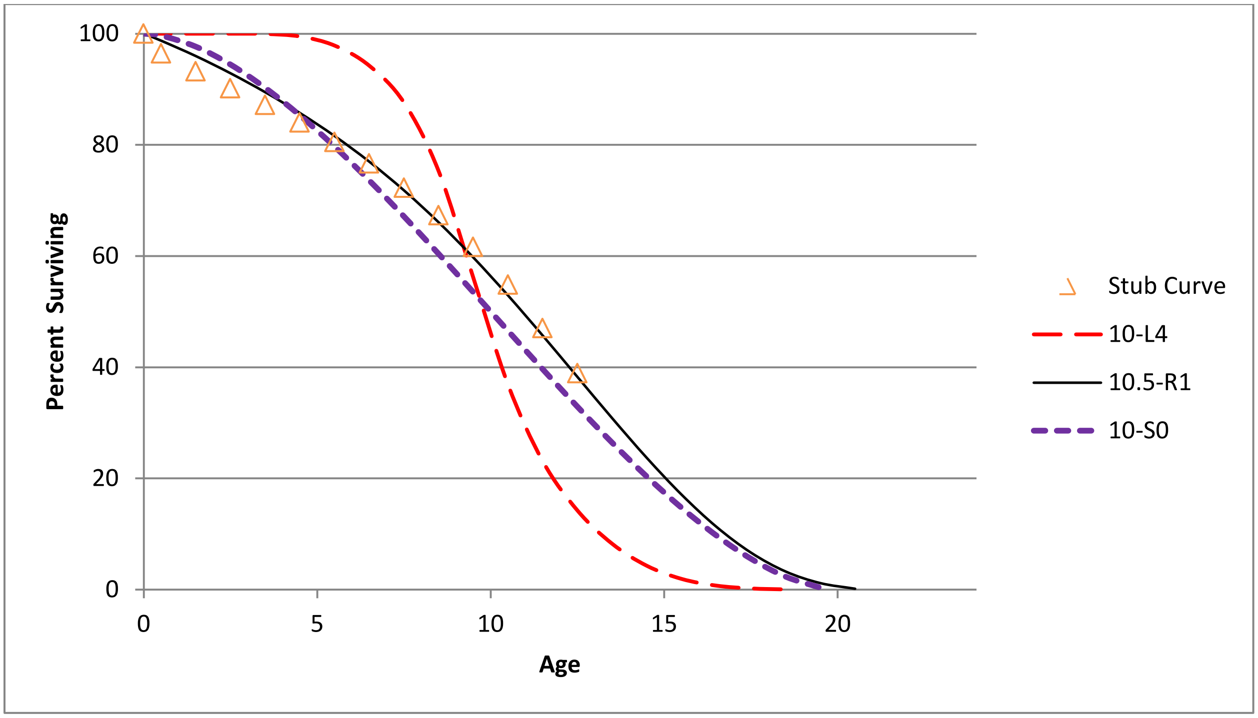
Curve Fitting

Depreciation analysts typically use the survivor curve rather than the frequency curve to fit the observed stub curves. The most commonly used generalized survivor curves used in the curve fitting process are the Iowa curves discussed above. As Wolf notes, if "the Iowa curves are adopted as a model, an underlying assumption is that the process describing the retirement pattern is one of the 22 [or more] processes described by the Iowa curves."[91]

Curve fitting may be done through visual matching or mathematical matching. In visual curve fitting, the analyst visually examines the plotted data to make an initial judgment about the Iowa curves that may be a good fit. The figure below illustrates the stub survivor curve shown above. It also shows three different Iowa curves: the 10-L4, the 10.5-R1, and the 10-S0. Visually, it is clear that the 10.5-R1 curve is a better fit than the other two curves.

[91] Wolf *supra* n. 7, at 46 (22 curves includes Winfrey's 18 original curves plus Cowles's four "O" type curves).

Figure 23:
Visual Curve Fitting



In mathematical fitting, the least squares method is used to calculate the best fit. This mathematical method would be excessively time consuming if done by hand. With the use of modern computer software however, mathematical fitting is an efficient and useful process. The typical logic for a computer program, as well as the software employed for the analysis in this testimony is as follows:

> First (an Iowa curve) curve is arbitrarily selected. . . . If the observed curve is a stub curve, . . . calculate the area under the curve and up to the age at final data point. Call this area the realized life. Then systematically vary the average life of the theoretical survivor curve and calculate its realized life at the age corresponding to the study date. This trial and error procedure ends when you find an average life such that the realized life of the theoretical curve equals the realized life of the observed curve. Call this the average life.
>
> Once the average life is found, calculate the difference between each percent surviving point on the observed survivor curve and the corresponding point on the Iowa curve. Square each difference and sum them. The sum of squares is used as a measure of goodness of fit for that particular Iowa type curve. This procedure is

> repeated for the remaining 21 Iowa type curves. The "best fit" is declared to be the type of curve that minimizes the sum of differences squared.[92]

Mathematical fitting requires less judgment from the analyst and is thus less subjective. Blind reliance on mathematical fitting, however, may lead to poor estimates. Thus, analysts should employ both mathematical and visual curve fitting in reaching their final estimates. This way, analysts may utilize the objective nature of mathematical fitting while still employing professional judgment. As Wolf notes: "The results of mathematical curve fitting serve as a guide for the analyst and speed the visual fitting process. But the results of the mathematical fitting should be checked visually and the final determination of the best fit be made by the analyst."[93]

In the graph above, visual fitting was sufficient to determine that the 10.5-R1 Iowa curve was a better fit than the 10-L4 and the 10-S0 curves. Using the sum of least squares method, mathematical fitting confirms the same result. In the chart below, the percentages surviving from the OLT that formed the original stub curve are shown in the left column, while the corresponding percentages surviving for each age interval are shown for the three Iowa curves. The right portion of the chart shows the differences between the points on each Iowa curve and the stub curve. These differences are summed at the bottom. Curve 10.5-R1 is the best fit because the sum of the squared differences for this curve is less than the same sum of the other two curves. Curve 10-L4 is the worst fit, which was also confirmed visually.

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[92] Wolf *supra* n. 7, at 47.

[93] *Id*. at 48.

Figure 24:
Mathematical Fitting

Age Interval	Stub Curve	Iowa Curves 10-L4	Iowa Curves 10-S0	Iowa Curves 10.5-R1	Squared Differences 10-L4	Squared Differences 10-S0	Squared Differences 10.5-R1
0.0	100.0	100.0	100.0	100.0	0.0	0.0	0.0
0.5	96.4	100.0	99.7	98.7	12.7	10.3	5.3
1.5	93.2	100.0	97.7	96.0	46.1	19.8	7.6
2.5	90.2	100.0	94.4	92.9	96.2	18.0	7.2
3.5	87.2	100.0	90.2	89.5	162.9	9.3	5.2
4.5	84.0	99.5	85.3	85.7	239.9	1.6	2.9
5.5	80.5	97.9	79.7	81.6	301.1	0.7	1.2
6.5	76.7	94.2	73.6	77.0	308.5	9.5	0.1
7.5	72.3	87.6	67.1	71.8	235.2	26.5	0.2
8.5	67.3	75.2	60.4	66.1	62.7	48.2	1.6
9.5	61.6	56.0	53.5	59.7	31.4	66.6	3.6
10.5	54.9	36.8	46.5	52.9	325.4	69.6	3.9
11.5	47.0	23.1	39.6	45.7	572.6	54.4	1.8
12.5	38.9	14.2	32.9	38.2	609.6	36.2	0.4
SUM					**3004.2**	**371.0**	**41.0**

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PUC DOCKET NO. 48401

APPLICATION OF TEXAS-NEW MEXICO POWER COMPANY FOR AUTHORITY TO CHANGE RATES	**§ § §**	**BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS**

DIRECT TESTIMONY AND EXHIBITS OF

DAVID J. GARRETT

APPENDIX D:

SIMULATED LIFE ANALYSIS

SIMULATED LIFE ANALYSIS

Aged data is required to perform actuarial analysis. That is, the collection of property data must contain the dates of placements, retirements, transfers, and other actions. When a utility's property records do not contain aged data, however, analysts may use another analytical method to simulate the missing data. The contrast between aged and unaged data is illustrated in the matrices below.[94] The first matrix is similar to the matrices in Appendix C used to demonstrate actuarial analysis.

Figure 25:
Aged Data Matrix

		End of Year Balances ($)								
Vintage	Installations	1997	1999	2001	2003	2005	2007	2009	2011	2013
1997	220	220	220	220	213	194	152	95	19	0
			250	250	248	235	198	143	31	4
1999	270		270	270	270	262	238	186	57	9
				285	285	282	268	225	91	26
2001	300			300	300	300	291	264	145	42
					320	320	317	301	241	103
2003	350				350	350	350	340	284	157
						375	375	371	325	219
2005	390					390	390	390	362	286
							405	405	392	344
2007	450						450	450	441	416
								480	480	478
2009	500							500	500	500
									580	580
2011	670								670	670
										790
2013	750									750
Balance		220	740	1325	1986	2708	3434	4150	4618	5374

The aged data matrix contains installation or "vintage" years in the first column and experience years in the top row. (Only every other year is shown in order to save space). This matrix

[94] See SDP Fundamentals 2014 pdf. 152.

contains aged data, meaning that the utility kept track of the age of plant when it was retired. In 2007, for example, $291 were remaining in service from the 2001 installation of $300. Likewise, in 2011, it was known that $57 were remaining in service from the 1999 vintage installation of $270. The amounts in each experience year column are added to arrive the year-end balances. Now assume that the amount of installations and retirements are the same for each year, but that the utility did not keep track of the age of plant when it was retired. The data matrix below contains the same data, except it is not aged. Thus, while the year-end balances are the same, the amount retired from each vintage in a given year is unknown.

Figure 26:
Unaged Data Matrix

		End of Year Balances ($)								
Vintage	Installations	1997	1999	2001	2003	2005	2007	2009	2011	2013
1997	220									
1999	270									
2001	300									
2003	350									
2005	390									
2007	450									
2009	500									
2011	670									
2013	750									
Balance		220	740	1325	1986	2708	3434	4150	4618	5374

Thus, in 2007 the company still had a year-end balance $3,434, but it is unknown how much of this amount surviving is attributable to each vintage group of property.

The method that depreciation analysts use to examine unaged data is called the "simulated plant record" method ("SPR").[95] The SPR method is used to simulate the retirement pattern for each vintage and to indicate the Iowa curve that best represent the life characteristics of the property being analyzed.[96] In other words, the SPR model may be used to "fill in" the unaged data matrix with simulated vintage balances for each experience year. The SPR model assumes that all vintages' additions retire in accordance with the same retirement pattern.[97]

Unlike with actuarial analysis, which indicates the best fitting Iowa curve type based on the input data, the SPR model requires the analyst or computer program to first choose an Iowa curve and test the results. This process is repeated until the analyst finds the curve that best matches the observed data is found.[98] Although the SPR method may be conducted manually, analysts typically rely on computer programs to make the process more efficient.

In the example presented below, the best fitting curve is the one that most closely simulates the actual balance of $4,150 for 2009. The chart below compares the actual and simulated vintage balances for the 2009 experience year using an Iowa 10-S3 curve. The 2009 simulated balances using the 10-S3 curve produce a year-end balance of $3,775. The actual balance, however, is $4,150. Thus, the 10-S3 curve produces a simulated balance that is $375 short of the actual balance.

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[95] Wolf 220. Cyrus Hill is generally credited with developing the principles used in the SPR method. In 1947, Alex Bauhan expanded the SPR method and developed several criteria used to measure the accuracy of simulated data, which he called the SPR method (See Bauhan, A. E., "Life Analysis of Utility Plant for Depreciation Accounting Purposes by the Simulated Plant Record Method," 1947, Appendix of the EEl, 1952.)

[96] NARUC *supra* n. 8, at 106.

[97] *Id*. at 107.

[98] Wolf 222.

Figure 27:
SPR Calculation Using Iowa Curve 10-S3

Age Interval	Vintage Year	Installations	10-S3 % Surviving	Sim. Bal. 2009
12.5	1997	220	16	35
11.5	1998	250	28	69
10.5	1999	270	42	114
9.5	2000	285	58	165
8.5	2001	300	72	217
7.5	2002	320	84	269
6.5	2003	350	92	323
5.5	2004	375	97	363
4.5	2005	390	99	386
3.5	2006	405	100	404
2.5	2007	450	100	450
1.5	2008	480	100	480
0.5	2009	500	100	500
		Total Simulated Balance		3,775
		Total Actual Balance		4,150
		Difference		(375)

The process is repeated with another curve until the best fitting curve is found. Specifically, a curve with a longer average life should be chosen in order to increase the simulated balance. For this example, the 12-S3 curve produces a perfect fit for 2009, as shown in the figure below.

Figure 28:
SPR Calculation Using Iowa Curve 12-S3

Age Interval	Vintage Year	Installations	12-S3 % Surviving	Sim. Bal. 2009
12.5	1997	220	43	95
11.5	1998	250	57	143
10.5	1999	270	69	186
9.5	2000	285	79	225
8.5	2001	300	88	264
7.5	2002	320	94	301
6.5	2003	350	97	340
5.5	2004	375	99	371
4.5	2005	390	100	390
3.5	2006	405	100	405
2.5	2007	450	100	450
1.5	2008	480	100	480
0.5	2009	500	100	500
		Total Simulated Balance		4,150
		Total Actual Balance		4,150
		Difference		0

It is not a coincidence that there was an Iowa curve that produced a perfect fit. This is because when only one year is tested under the SPR model, there is always an Iowa curve that will produce a perfect simulation. Thus, it is important that more than one year is tested. The figures below will demonstrate that even though a particular curve may have fit perfectly for one test year, it may not necessarily be the best choice when multiple years are tested. The chart below shows the results of the Iowa 12-S3 curve when 2009, 2011, and 2013 are tested.

Figure 29:
SPR: Curve 12-S3: 2009, 2011, 2013

Vintage	Insts.	% Surv.	2009	% Surv.	2011	% Surv.	2013
1997	220	43	95	21	46	6	13
1998	250	57	143	31	78	12	30
1999	270	69	186	43	116	21	57
2000	285	79	225	57	162	31	88
2001	300	88	264	69	207	43	129
2002	320	94	301	79	253	57	182
2003	350	97	340	88	308	69	242
2004	375	99	371	94	353	79	296
2005	390	100	390	97	378	88	343
2006	405	100	405	99	401	94	381
2007	450	100	450	100	450	97	437
2008	480	100	480	100	480	99	475
2009	500	100	500	100	500	100	500
2010	580			100	580	100	580
2011	670			100	670	100	670
2012	790					100	790
2013	750					100	750
Simulated Balances			$ 4,150		$ 4,982		$ 5,963
Actual Balances			4,150		4,618		5,374
Difference			0		364		589
Difference Squared			0		132,496		346,921

SSD = 479,417 **MSD = 159,806** **√MSD = 400**

CI = $\frac{\text{Average Actual Bal}}{\sqrt{\text{MSD}}} = \frac{4,714}{400} =$ **12** **IV =** $\frac{1000}{\text{CI}} =$ **85**

While the 12-S3 curve provided a perfect simulation for 2009, it did not for years 2011 and 2013 because the life characteristics were different in these years. Since the 12-S3 curve produced simulated balances that were greater than the actual balances, a curve with a shorter average life should be analyzed. The figure below shows the SPR results from the same test years using an Iowa 10-S3 curve.

Figure 30:
SPR: Curve 10-S3: 2009, 2011, 2013

Vintage	Insts.	% Surv.	2009	% Surv.	2011	% Surv.	2013
1997	220	16	35	3	7	0	0
1998	250	28	70	8	20	1	3
1999	270	42	113	16	43	3	8
2000	285	58	165	28	80	8	23
2001	300	72	216	42	126	16	48
2002	320	84	269	58	186	28	90
2003	350	92	322	72	252	42	147
2004	375	97	364	84	315	58	218
2005	390	99	386	92	359	72	281
2006	405	100	405	97	393	84	340
2007	450	100	450	99	446	92	414
2008	480	100	480	100	480	97	466
2009	500	100	500	100	500	99	495
2010	580			100	580	100	580
2011	670			100	670	100	670
2012	790					100	790
2013	750					100	750
Simulated Balances			$ 3,775		$ 4,457		$ 5,323
Actual Balances			4,150		4,618		5,374
Difference			(375)		(161)		(51)
Difference Squared			140,625		25,921		2,601

SSD = 169,147 **MSD = 56,382** **√MSD = 237**

CI = Average Actual Bal / √MSD = 4,714 / 237 = **20**   **IV =** 1000 / CI = **50**

The 10-S3 curve resulted in a better fit than the 12-S3 curve, despite the fact that the 12-S3 provided a perfect fit for one year. Several useful tools to measure the accuracy of SPR results in discussed below.

There are several indices used to measure the fit of the chosen curve. Alex Bauhan developed the conformance index ("CI") to rank the optimal curves.[99] The CI is the average observed plant balance for the tested years, divided by the square root of the average sum of squared differences between the simulated and actual balances. The formula for the CI is shown below.

Equation 6:
Conformance Index

$$Conformance\ Index = \frac{Average\ of\ Actual\ Balances}{\sqrt{Average\ of\ Sum\ of\ Squared\ Differences}}$$

The previous figure above demonstrates the CI calculation. The difference between the actual and simulated balances was $375 in 2009, $161 in 2011, and $51 in 2013. The sum of these differences squared ("SSD") is 169,147 and the average of the SSD is 56,382 ("MSD"). The square root of the MSD is 237. The CI is the average of the three actual balances ($4,714) divided by 237, which equals 20. Bauhan proposed a scaled for measuring the value of the CI, which is shown below.

Figure 31:
Conformance Index Scale

CI	Value
> 75	Excellent
50 – 75	Good
25 – 50	Fair
< 25	Poor

99 Bauhan, A. E., "Life Analysis of Utility Plant for Depreciation Accounting Purposes by the Simulated Plant Record Method," 1947, Appendix of the EEl, 1952.

Thus, the CI of 20 calculated above indicates that the 12-S3 curve is a poor fit. According to Bauhan, any CI value less than 50 would be considered unsatisfactory.[100]

A related measure to the CI is the "index of variation" ("IV").[101] The IV is equal to 1,000 divided by the CI, as shown in the Figures above. Although the IV does not use a definite scale like the CI, it follows that the highest ranking curves are those with the lowest IVs. When divided by ten, the IV approximates the average difference between simulated and actual balances expressed as a percent of the average actual balance.[102] The IV resulting from the 12-S3 curve is 85, while the IV from the 10-S3 is 50, as shown above.

Another important statistical measure is the "retirements experience index" ("REI"), which measures the maturity of the account.[103] According to Bauhan, the CI alone cannot truly measure the validity of the chosen curve because the CI provides no indication of the sufficiency of the retirement experience.[104] A small REI implies that the history of the account may be too short to determine a best fitting Iowa curve. In other words, there may be many potential Iowa curves that could be fitted to a stub curve that is too short. This concept is illustrated in the graph below. This graph shows a stub survivor curve (the diamond-shaped points on the graph). The first seven data points of the stub survivor curve represent a small REI score. If an analyst was looking at only the first seven data points, it appears that several Iowa curves would provide a good fit, including the 10-S1, 8-L3, and 8-R3 (and several others not shown on the graph).

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[100] SDP pdf. 210.

[101] White, R.E. and H. A. Cowles, "A Test Procedure for the Simulated Plant Record Method of Life Analysis," Journal of the American Statistical Association, vol. 70 (1970): 1204-1212.

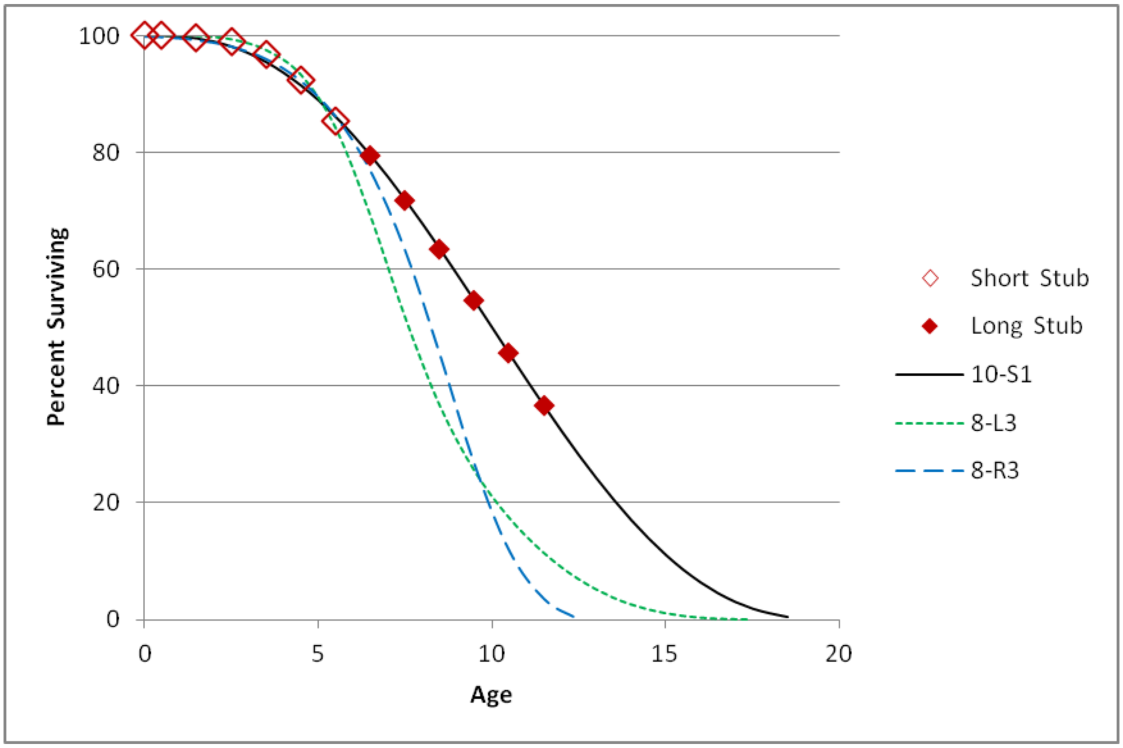
[102] NARUC 111.

[103] *See* SDP 210.

[104] SDP 210.

These curves, however, have significantly different life characteristics and average lives. Once the longer stub curve is taken into account, it is obvious that the 10-S1 curve provides the best fit.

Figure 32:
REI Illustration



Although the REI only applies to simulated analysis, the concept that a longer stub curve provides for better-fitting Iowa curves also applies to actuarial analysis.

The REI is mathematically calculated by dividing the balance from the oldest vintage in the test year at the end of the year by the initial installation amount. Referring to the top row of the SPR figure above, there were $220 of installations in 1997, and only $13 remaining in 2013. The REI for this account using the 12-S3 curve would be 94% (1 – (13/220)). An REI of 100% indicates that a complete curve was used in the simulation.

As with the CI, Bauhan also proposed a scale for the REI, as shown in the figure below. Thus, the REI of 94% from the account above using the 12-S3 curve would be considered excellent. This makes sense because the oldest vintage from that account had been nearly fully retired in the final test year.

Figure 33:
REI Scale

REI	Value
> 75%	Excellent
50% – 75%	Good
33% – 50%	Fair
17% – 33%	Poor
0% – 17%	Valueless

Both the REI and CI, however, must be considered when assessing the value of an Iowa curve under the SPR method. So while the REI of 94% is excellent, the same curve (12-S3) produced a CI of only 12, which is poor. According to Bauhan, in order for a curve to be considered entirely satisfactory, both the REI and CI should be “Good” or better (i.e., both above 50).

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DIRECT TESTIMONY AND EXHIBITS OF DAVID J. GARRETT

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EDUCATION

University of Oklahoma — Norman, OK
Master of Business Administration — 2014
Areas of Concentration: Finance, Energy

University of Oklahoma College of Law — Norman, OK
Juris Doctor — 2007
Member, American Indian Law Review

University of Oklahoma — Norman, OK
Bachelor of Business Administration — 2003
Major: Finance

PROFESSIONAL DESIGNATIONS

Society of Depreciation Professionals
Certified Depreciation Professional (CDP)

Society of Utility and Regulatory Financial Analysts
Certified Rate of Return Analyst (CRRA)

The Mediation Institute
Certified Civil / Commercial & Employment Mediator

WORK EXPERIENCE

Resolve Utility Consulting PLLC — Oklahoma City, OK
Managing Member — 2016 – Present
Provide expert analysis and testimony specializing in depreciation and cost of capital issues for clients in utility regulatory proceedings.

Oklahoma Corporation Commission — Oklahoma City, OK
Public Utility Regulatory Analyst — 2012 – 2016
Assistant General Counsel — 2011 – 2012
Represented commission staff in utility regulatory proceedings and provided legal opinions to commissioners. Provided expert analysis and testimony in depreciation, cost of capital, incentive compensation, payroll and other issues.

Perebus Counsel, PLLC — Oklahoma City, OK
Managing Member — 2009 – 2011
Represented clients in the areas of family law, estate planning, debt negotiations, business organization, and utility regulation.

Moricoli & Schovanec, P.C. — Oklahoma City, OK
Associate Attorney — 2007 – 2009
Represented clients in the areas of contracts, oil and gas, business structures and estate administration.

TEACHING EXPERIENCE

University of Oklahoma — Norman, OK
Adjunct Instructor – "Conflict Resolution" — 2014 – Present
Adjunct Instructor – "Ethics in Leadership"

Rose State College — Midwest City, OK
Adjunct Instructor – "Legal Research" — 2013 – 2015
Adjunct Instructor – "Oil & Gas Law"

PUBLICATIONS

American Indian Law Review — Norman, OK
"Vine of the Dead: Reviving Equal Protection Rites for Religious Drug Use" — 2006
(31 Am. Indian L. Rev. 143)

VOLUNTEER EXPERIENCE

Calm Waters — Oklahoma City, OK
Board Member — 2015 – Present
Participate in management of operations, attend meetings, review performance, compensation, and financial records. Assist in fundraising events.

Group Facilitator & Fundraiser — 2014 – Present
Facilitate group meetings designed to help children and families cope with divorce and tragic events. Assist in fundraising events.

St. Jude Children's Research Hospital — Oklahoma City, OK
Oklahoma Fundraising Committee — 2008 – 2010
Raised money for charity by organizing local fundraising events.

PROFESSIONAL ASSOCIATIONS

Oklahoma Bar Association 2007 – Present

Society of Depreciation Professionals 2014 – Present
Board Member – President 2017
Participate in management of operations, attend meetings, review performance, organize presentation agenda.

Society of Utility Regulatory Financial Analysts 2014 – Present

SELECTED CONTINUING PROFESSIONAL EDUCATION

Society of Depreciation Professionals — Austin, TX
"Life and Net Salvage Analysis" — 2015
Extensive instruction on utility depreciation, including actuarial and simulation life analysis modes, gross salvage, cost of removal, life cycle analysis, and technology forecasting.

Society of Depreciation Professionals — New Orleans, LA
"Introduction to Depreciation" and "Extended Training" — 2014
Extensive instruction on utility depreciation, including average lives and net salvage.

Society of Utility and Regulatory Financial Analysts — Indianapolis, IN
46th Financial Forum. "The Regulatory Compact: Is it Still Relevant?" — 2014
Forum discussions on current issues.

New Mexico State University, Center for Public Utilities — Santa Fe, NM
Current Issues 2012, "The Santa Fe Conference" — 2012
Forum discussions on various current issues in utility regulation.

Michigan State University, Institute of Public Utilities — Clearwater, FL
"39th Eastern NARUC Utility Rate School" — 2011
One-week, hands-on training emphasizing the fundamentals of the utility ratemaking process.

New Mexico State University, Center for Public Utilities — Albuquerque, NM
"The Basics: Practical Regulatory Training for the Changing Electric Industries" — 2010
One-week, hands-on training designed to provide a solid foundation in core areas of utility ratemaking.

The Mediation Institute — Oklahoma City, OK
"Civil / Commercial & Employment Mediation Training" — 2009
Extensive instruction and mock mediations designed to build foundations in conducting mediations in civil matters.

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Indiana Utility Regulatory Commission	Citizens Energy Group	45039	Depreciation rates, service lifes, net salvage	Indiana Office of Consumer Counselor
Public Utility Commission of Texas	Entergy Texas, Inc.	PUC 48371	Depreciation rates, decommissioning costs	Texas Municipal Group
Washington Utilities & Transportation Commission	Avista Corporation	UE-180167	Depreciation rates, service lives, net salvage	Washington Office of Attorney General
New Mexico Public Regulation Commission	Southwestern Public Service Company	17-00255-UT	Cost of capital and authorized rate of return	HollyFrontier Navajo Refining; Occidental Permian
Public Utility Commission of Texas	Southwestern Public Service Company	PUC 47527	Depreciation rates, plant service lives	Alliance of Xcel Municipalities
Public Service Commission of the State of Montana	Montana-Dakota Utilities Co.	D2017.9.79	Depreciation rates, service lives, net salvage	Montana Consumer Counsel
Florida Public Service Commission	Florida City Gas	20170179-GU	Cost of capital, depreciation rates	Florida Office of Public Counsel
Washington Utilities & Transportation Commission	Avista Corporation	UE-170485	Cost of capital and authorized rate of return	Washington Office of Attorney General
Wyoming Public Service Commission	Powder River Energy Corporation	10014-182-CA-17	Credit analysis, cost of capital	Private customer
Oklahoma Corporation Commission	Public Service Co. of Oklahoma	PUD 201700151	Depreciation, terminal salvage, risk analysis	Oklahoma Industrial Energy Consumers
Public Utility Commission of Texas	Oncor Electric Delivery Company	PUC 46957	Depreciation rates, simulated analysis	Alliance of Oncor Cities
Nevada Public Utilities Commission	Nevada Power Company	17-06004	Depreciation rates, service lives, net salvage	Nevada Bureau of Consumer Protection
Public Utility Commission of Texas	El Paso Electric Company	PUC 46831	Depreciation rates, interim retirements	City of El Paso
Idaho Public Utilities Commission	Idaho Power Company	IPC-E-16-24	Accelerated depreciation of North Valmy plant	Micron Technology, Inc.
Idaho Public Utilities Commission	Idaho Power Company	IPC-E-16-23	Depreciation rates, service lives, net salvage	Micron Technology, Inc.
Public Utility Commission of Texas	Southwestern Electric Power Company	PUC 46449	Depreciation rates, decommissioning costs	Cities Advocating Reasonable Deregulation

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Massachusetts Department of Public Utilities	Eversource Energy	D.P.U. 17-05	Cost of capital, capital structure, and rate of return	Sunrun Inc.; Energy Freedom Coalition of America
Railroad Commission of Texas	Atmos Pipeline - Texas	GUD 10580	Depreciation rates, grouping procedure	City of Dallas
Public Utility Commission of Texas	Sharyland Utility Co.	PUC 45414	Depreciation rates, simulated analysis	City of Mission
Oklahoma Corporation Commission	Empire District Electric Co.	PUD 201600468	Cost of capital, depreciation rates	Oklahoma Industrial Energy Consumers
Railroad Commission of Texas	CenterPoint Energy Texas Gas	GUD 10567	Depreciation rates, simulated plant analysis	Texas Coast Utilities Coalition
Arkansas Public Service Commission	Oklahoma Gas & Electric Co.	160-159-GU	Cost of capital, depreciation rates, terminal salvage	Arkansas River Valley Energy Consumers; Wal-Mart
Florida Public Service Commission	Peoples Gas	160-159-GU	Depreciation rates, service lives, net salvage	Florida Office of Public Counsel
Arizona Corporation Commission	Arizona Public Service Co.	E-01345A-16-0036	Cost of capital, depreciation rates, terminal salvage	Energy Freedom Coalition of America
Nevada Public Utilities Commission	Sierra Pacific Power Co.	16-06008	Depreciation rates, net salvage, theoretical reserve	Northern Nevada Utility Customers
Oklahoma Corporation Commission	Oklahoma Gas & Electric Co.	PUD 201500273	Cost of capital, depreciation rates, terminal salvage	Public Utility Division
Oklahoma Corporation Commission	Public Service Co. of Oklahoma	PUD 201500208	Cost of capital, depreciation rates, terminal salvage	Public Utility Division
Oklahoma Corporation Commission	Oklahoma Natural Gas Co.	PUD 201500213	Cost of capital, depreciation rates, net salvage	Public Utility Division

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EXHIBIT DJG-2:

SUMMARY DEPRECIATION ACCRUAL ADJUSTMENT

Summary Depreciation Accrual Adjustment

Plant Function	Plant Balance 12/31/2017	TNMP Proposed Accrual	ATM Proposed Accrual	Accrual Difference
Transmission	392,099,866	14,655,496	11,505,659	(3,149,837)
Distribution	1,036,021,891	46,091,322	38,437,874	(7,653,448)
General	23,586,874	714,987	715,070	84
Total	$ 1,451,708,630	$ 61,461,805	$ 50,658,604	**$ (10,803,200)**

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EXHIBIT DJG-3:

DETAILED RATE COMPARISON

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			TNMP Proposal		ATM Proposal		Difference	
Account No.	Description	Plant 12/31/2017	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	Transmission Plant							
350.10	Land Right of Way	7,840,743	0.82%	64,341	0.82%	64,341	0.00%	0
352.00	Structures And Improvements	4,098,857	2.00%	81,828	2.00%	81,828	0.00%	0
353.00	Station Equipment	158,155,354	3.17%	5,005,795	3.17%	5,012,632	0.00%	6,837
354.00	Towers And Fixtures	10,798,693	2.16%	233,076	2.18%	235,296	0.02%	2,221
355.00	Poles And Fixtures	139,763,597	4.57%	6,384,789	2.94%	4,106,659	-1.63%	-2,278,130
356.00	Overhead Conductors And Devices	71,442,623	4.04%	2,885,666	2.81%	2,004,903	-1.23%	-880,763
	TOTAL TRANSMISSION PLANT	392,099,866	3.74%	14,655,496	2.93%	11,505,659	-0.80%	-3,149,837
	Distribution Plant							
360.10	Land Right of Way	329,857	1.39%	4,597	1.39%	4,597	0.00%	0
361.00	Structures And Improvements	15,138,050	1.90%	287,507	1.90%	287,507	0.00%	0
362.00	Station Equipment	247,017,207	2.78%	6,868,370	2.22%	5,493,966	-0.56%	-1,374,404
364.00	Poles, Towers And Fixtures	193,345,426	4.77%	9,227,817	4.17%	8,061,570	-0.60%	-1,166,247
365.00	Overhead Conductors And Devices	170,409,294	4.53%	7,722,644	3.31%	5,644,895	-1.22%	-2,077,749
366.00	Underground Conduit	43,130,825	2.85%	1,228,783	2.11%	910,003	-0.74%	-318,780
367.00	Underground Conductors And Devices	82,214,515	3.37%	2,771,437	3.37%	2,769,127	0.00%	-2,311
368.00	Transformers	118,056,480	1.90%	2,237,182	1.59%	1,876,152	-0.31%	-361,031
369.00	Overhead Services	36,591,650	6.40%	2,341,008	3.64%	1,330,992	-2.76%	-1,010,016
369.10	Underground Services	42,327,335	5.60%	2,369,835	2.57%	1,086,303	-3.03%	-1,283,532
370.00	Meters	5,764,924	17.64%	1,016,848	17.64%	1,016,848	0.00%	0
370.10	Meters- Load Research	529,012	4.28%	22,639	4.28%	22,639	0.00%	0
370.20	Meters -AMS	56,580,770	15.18%	8,589,348	15.08%	8,530,090	-0.10%	-59,258
370.30	Meters Non Analog	2,087,066	10.73%	224,025	10.73%	224,025	0.00%	0
371.00	Installations On Customers Premises	2,712,480	14.49%	393,069	14.49%	393,052	0.00%	-18
371.10	Leased Flood Lighting	1,665,663	14.10%	234,868	14.10%	234,868	0.00%	0
373.00	Street Lighting And Signal Systems	18,121,337	3.04%	551,345	3.04%	551,241	0.00%	-103
	TOTAL DISTRIBUTION PLANT	1,036,021,891	4.45%	46,091,322	3.71%	38,437,874	-0.74%	-7,653,448

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			TNMP Proposal		ATM Proposal		Difference	
Account No.	Description	Plant 12/31/2017	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	General Plant							
390.00	Structures And Improvements	18,188,063	2.09%	379,516	2.09%	379,600	0.00%	84
392.00	Transportation Equipment	1,987,014	6.55%	130,110	6.55%	130,110	0.00%	0
392.10	Transportation Equipment- Heavy Equipment	28,756	7.81%	2,247	7.81%	2,247	0.00%	0
392.20	Transportation Equipment- Trailers	1,949,903	3.87%	75,549	3.87%	75,549	0.00%	0
392.40	Transportation Equipment- Lease Buy Back	20,018	0.00%	0	0.00%	0	0.00%	0
396.00	Power Operated Equipment	1,413,120	9.03%	127,565	9.03%	127,565	0.00%	0
	TOTAL GENERAL PLANT	23,586,874	3.03%	714,987	3.03%	715,070	0.00%	84
	TOTAL DEPRECIABLE PLANT STUDIED	**1,451,708,630**	**4.23%**	**61,461,805**	**3.49%**	**50,658,604**	**-0.74%**	**-10,803,200**

[1], [2] See depreciation study and errata testimony and workpapers of Dane A. Watson.
[3] Exhibit DJG-4
[4] = [3] - [2] ; Adjustments are to the proposed annual depreciation accrual corresponding to plant balances as of the depreciation study date

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EXHIBIT DJG-4:

DEPRECIATION RATE DEVELOPMENT

Depreciation Rate Development

Exhibit DJG-4

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
			Iowa Curve							Service Life		Net Salvage		Total	
Account No.	Description	Original Cost	Type	AL	Net Salvage	Depreciable Base	Book Reserve	Future Accruals	Remaining Life	Accrual	Rate	Accrual	Rate	Accrual	Rate
	Transmission Plant														
350.10	Land Right of Way	7,840,743	SQ	65	0%	7,840,743	5,071,816	2,768,927	#########	64,341	0.82%	0	0.00%	64,341	**0.82%**
352.00	Structures and Improvements	4,098,857	R0.5	49	0%	4,098,857	179,274	3,919,583	#########	81,828	2.00%	0	0.00%	81,828	**2.00%**
353.00	Station Equipment	158,155,354	R2.5	45	##########	173,970,889	20,135,709	153,835,180	#########	4,497,292	2.84%	515,340	0.33%	5,012,632	**3.17%**
354.00	Towers and Fixtures	10,798,693	R4	54	##########	12,418,497	2,869,853	9,548,644	#########	195,381	1.81%	39,915	0.37%	235,296	**2.18%**
355.00	Poles and Fixtures	139,763,597	L1	55	##########	223,621,756	22,477,614	201,144,141	#########	2,394,569	1.71%	1,712,090	1.22%	4,106,659	**2.94%**
356.00	Overhead Conductors and Devices	71,442,623	R2	59	##########	114,308,196	14,604,366	99,703,830	#########	1,142,937	1.60%	861,966	1.21%	2,004,903	**2.81%**
	TOTAL TRANSMISSION PLANT	392,099,866			##########	536,258,937	65,338,631	470,920,306	#########	8,376,348	2.14%	3,129,311	0.80%	11,505,659	**2.93%**
	Distribution Plant														
360.10	Land Right of Way	329,857	SQ	60	0%	329,857	87,477	242,379	#########	4,597	1.39%	0	0.00%	4,597	**1.39%**
361.00	Structures and Improvements	15,138,050	R0.5	49	##########	18,165,660	9,102,542	9,063,118	#########	191,463	1.26%	96,044	0.63%	287,507	**1.90%**
362.00	Station Equipment	247,017,207	L1.5	49	##########	271,718,928	49,158,374	222,560,554	#########	4,884,197	1.98%	609,768	0.25%	5,493,966	**2.22%**
364.00	Poles, Towers and Fixtures	193,345,426	R0.5	42	##########	348,021,767	81,146,056	266,875,711	#########	3,389,230	1.75%	4,672,340	2.42%	8,061,570	**4.17%**
365.00	Overhead Conductors and Devices	170,409,294	R0.5	44	##########	272,654,870	87,198,920	185,455,951	#########	2,532,752	1.49%	3,112,144	1.83%	5,644,895	**3.31%**
366.00	Underground Conduit	43,130,825	L2	52	##########	51,756,990	18,387,172	33,369,818	#########	674,766	1.56%	235,238	0.55%	910,003	**2.11%**
367.00	Underground Conductors and Devices	82,214,515	R2.5	40	##########	106,878,869	29,885,089	76,993,780	#########	1,882,059	2.29%	887,068	1.08%	2,769,127	**3.37%**
368.00	Transformers	118,056,480	R0.5	53	0%	118,056,480	36,631,504	81,424,976	#########	1,876,152	1.59%	0	0.00%	1,876,152	**1.59%**
369.00	Overhead Services	36,591,650	L1	44	##########	65,864,970	25,322,958	40,542,013	#########	369,951	1.01%	961,041	2.63%	1,330,992	**3.64%**
369.10	Underground Services	42,327,335	S4	41	##########	50,792,802	22,125,257	28,667,546	#########	765,520	1.81%	320,783	0.76%	1,086,303	**2.57%**
370.00	Meters	5,764,924	R1	10	-5%	6,053,170	759,891	5,293,280	#########	961,475	########	55,373	0.96%	1,016,848	**########**
370.10	Meters- Load Research	529,012	R5	24	-5%	555,463	181,687	373,776	#########	21,037	3.98%	1,602	0.30%	22,639	**4.28%**
370.20	Meters -AMS	56,580,770	SQ	7	0%	56,580,770	27,390,895	29,189,875	#########	8,530,090	########	0	0.00%	8,530,090	**########**
370.30	Meters Non Analog	2,087,066	R1	10	-5%	2,191,419	33,807	2,157,613	#########	213,190	########	10,835	0.52%	224,025	**########**
371.00	Installations On Customers Premises	2,712,480	R1.5	16	##########	3,254,976	1,825,648	1,429,328	#########	243,870	8.99%	149,181	5.50%	393,052	**########**
371.10	Leased Flood Lighting	1,665,663	S0.5	13	##########	1,832,229	1,121,934	710,295	#########	179,790	########	55,077	3.31%	234,868	**########**
373.00	Street Lighting and Signal Systems	18,121,337	R0.5	28	##########	21,745,605	10,086,537	11,659,067	#########	379,886	2.10%	171,356	0.95%	551,241	**3.04%**
	TOTAL DISTRIBUTION PLANT	1,036,021,891			##########	1,396,454,825	400,445,746	996,009,079	#########	27,100,024	2.62%	11,337,850	1.09%	38,437,874	**3.71%**
	General Plant														
390.00	Structures and Improvements	18,188,063	R2	50	-5%	19,097,466	1,390,291	17,707,175	#########	360,104	1.98%	19,495	0.11%	379,600	**2.09%**
392.00	Transportation Equipment	1,987,014	L4	12	18%	1,629,351	754,685	874,666	#########	183,313	9.23%	-53,204	-2.68%	130,110	**6.55%**
392.10	Transportation Equipment- Heavy Equipment	28,756	R2.5	10	18%	23,580	10,082	13,497	#########	3,109	########	-862	-3.00%	2,247	**7.81%**
392.20	Transportation Equipment- Trailers	1,949,903	L4	15	18%	1,598,920	711,044	887,877	#########	105,413	5.41%	-29,865	-1.53%	75,549	**3.87%**
392.40	Transportation Equipment- Lease Buy Back	20,018			18%	16,415	41,348	-24,933							
396.00	Power Operated Equipment	1,413,120	L4	14	18%	1,158,759	-55,843	1,214,602	#########	154,280	########	-26,715	-1.89%	127,565	**9.03%**
	TOTAL GENERAL PLANT	23,586,874			0%	23,524,491	2,851,607	20,672,884	#########	806,220	3.42%	-91,149	-0.39%	715,070	**3.03%**
	TOTAL PLANT STUDIED	**1,451,708,630**			**##########**	**1,956,238,253**	**468,635,984**	**1,487,602,269**	**#########**	**36,282,592**	**2.50%**	**14,376,012**	**0.99%**	**50,658,604**	**3.49%**

[1] Company depreciation study
[2] Average life and Iowa curve shape developed through actuarial analysis and professional judgment
[3] Weighted net salvage for life span accounts from weighted net salvage exhibit; net salvage for mass accounts developed through statistical analysis and professional judgment
[4] = [1]*(1-[3])
[5] Production theoretical reserve balances calculated without including blances for the Neches Station and Sabine Unit 2 (see ETI response to Staff 1-69); transmission, distribution and general book reserve balances at 12-31-17
[6] = [4] - [5]
[7] Composite remaining life based on Iowa cuve in [2]; see remaining life exhibit for detailed calculations
[8] = ([1] - [5]) / [7]
[9] = [8] / [1]
[10] = [12] - [8]
[11] = [13] - [9]
[12] = [6] / [7]
[13] = [12] / [1]

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EXHIBIT DJG-5:

DEPRECIATION PARAMETER COMPARISON

Depreciation Parameter Comparison

Account No.	Description	Current-Approved Iowa Curve Type	Current-Approved Iowa Curve AL	Current-Approved Net Salvage	TNMP Proposed Iowa Curve Type	TNMP Proposed Iowa Curve AL	TNMP Proposed Net Salvage	ATM Proposed Iowa Curve Type	ATM Proposed Iowa Curve AL	ATM Proposed Net Salvage
	Transmission Plant									
350.10	Land Right of Way	SQ	65	0%	SQ	65	0%	SQ	65	0%
352.00	Structures And Improvements	R2	41	-20%	R0.5	49	0%	R0.5	49	0%
353.00	Station Equipment	R2.5	45	-5%	R2.5	45	-10%	R2.5	45	-10%
354.00	Towers And Fixtures	R4	45	-30%	R4	54	-15%	R4	54	-15%
355.00	Poles And Fixtures	R3	40	-30%	R2	46	-100%	L1	55	-60%
356.00	Overhead Conductors And Devices	R3	50	-30%	R2.5	54	-100%	R2	59	-60%
	Distribution Plant									
360.10	Land Right of Way	SQ	60	0%	SQ	60	0%	SQ	60	0%
361.00	Structures And Improvements	R2	41	-20%	R0.5	49	-20%	R0.5	49	-20%
362.00	Station Equipment	R2.5	42	0%	R2.5	42	-10%	L1.5	49	-10%
364.00	Poles, Towers And Fixtures	S0.5	32	-40%	R0.5	42	-100%	R0.5	42	-80%
365.00	Overhead Conductors And Devices	R1	31	-30%	R0.5	44	-100%	R0.5	44	-60%
366.00	Underground Conduit	R2	40	-10%	R3	43	-20%	L2	52	-20%
367.00	Underground Conductors And Devices	R2	36	0%	R2.5	40	-30%	R2.5	40	-30%
368.00	Transformers	R1.5	41	0%	R1	47	0%	R0.5	53	0%
369.00	Overhead Services	R0.5	34	-40%	R2	37	-100%	L1	44	-80%
369.10	Underground Services	S4	30	-10%	S4	41	-100%	S4	41	-20%
370.00	Meters	R1	27	-2%	R1	10	-5%	R1	10	-5%
370.10	Meters- Load Research	R5	24	-2%	R5	24	-5%	R5	24	-5%
370.20	Meters -AMS	SQ	7	0%	SQ	7	0%	SQ	7	0%
370.30	Meters Non Analog	R1	27	-2%	R1	10	-5%	R1	10	-5%
371.00	Installations On Customers Premises	R1.5	13	-10%	R1.5	16	-20%	R1.5	16	-20%
371.10	Leased Flood Lighting	S0.5	10	0%	S0.5	13	-10%	S0.5	13	-10%
373.00	Street Lighting And Signal Systems	R3	20	-10%	R0.5	28	-20%	R0.5	28	-20%
	General Plant									
390.00	Structures And Improvements	NR	40	NR	R2	50	-5%	R2	50	-5%
392.00	Transportation Equipment	S3	7	9%	L4	12	18%	L4	12	18%
392.10	Transportation Equipment- Heavy Equipment	S3	7	9%	R2.5	10	18%	R2.5	10	18%
392.20	Transportation Equipment- Trailers	S3	7	9%	L4	15	18%	L4	15	18%
392.40	Transportation Equipment- Lease Buy Back	NR	NR	NR	NR	NR	18%	NA	NA	18%
396.00	Power Operated Equipment	R1	15	10%	L4	14	18%	L4	14	18%

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EXHIBIT DJG-6:

SIMULATED PLANT RECORD ANALYSIS AND GRAPHICAL BALANCE FIT SUMMARIES

TNMP

Electric Division

355.00 Poles and Fixtures

Simulated Plant Record Analysis Calculated As Of 12/31/2017

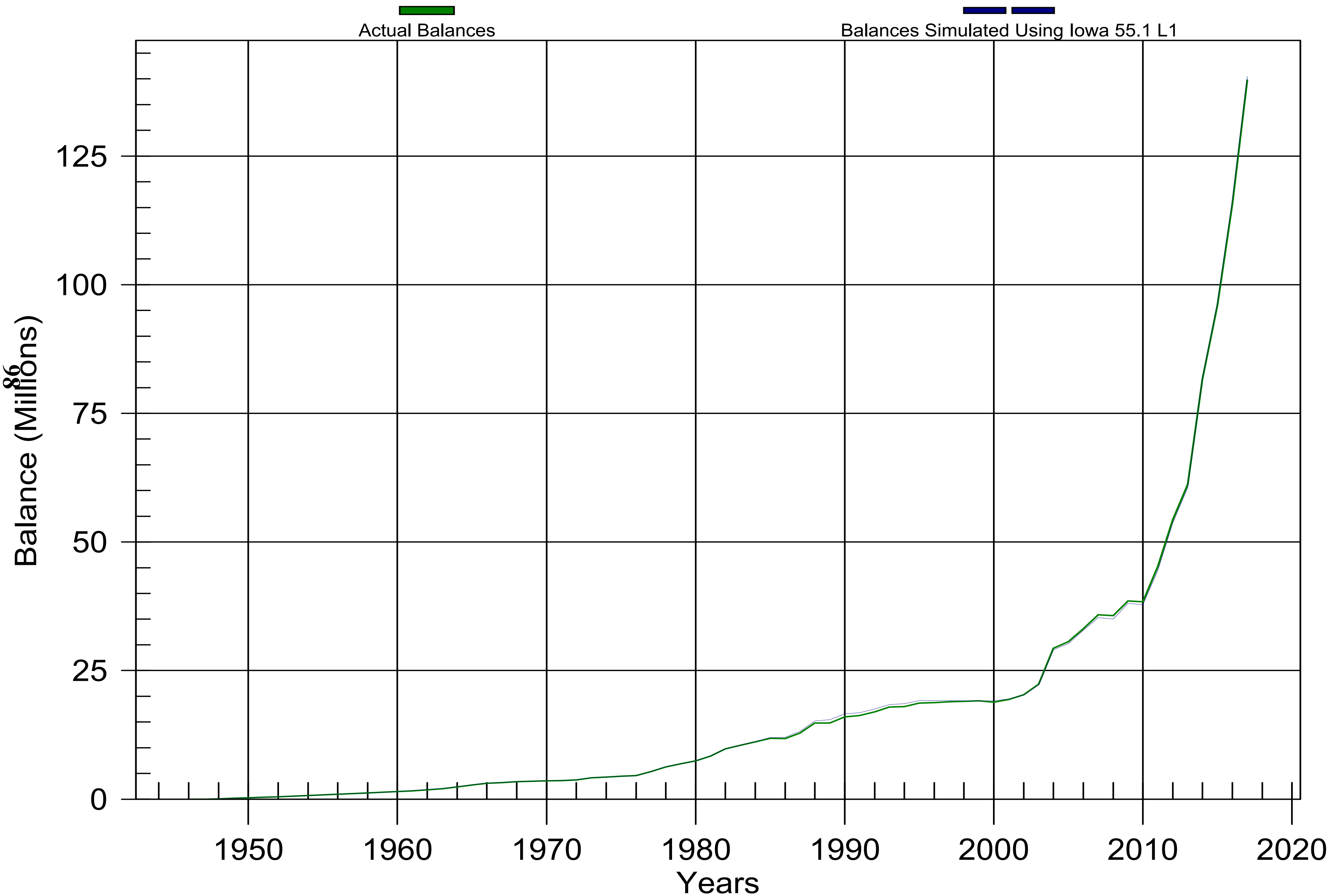
Simulated Balances Method

No. Of Test Points -	72
Interval Between Test Points -	1
First Test Point -	1946
Last Test Point -	2017

Curve Type	Average Service Life	Sum Of Squares Difference	Conformance Index	Index Of Variation	Ret Exp Index
O4	182.63 Yrs.	3.1313E+12	85.88	11.64	40.22
O3	131.84 Yrs.	3.1517E+12	85.61	11.68	41.24
SC	81.28 Yrs.	3.1947E+12	85.03	11.76	43.98
O1	81.28 Yrs.	3.1947E+12	85.03	11.76	43.98
O2	91.31 Yrs.	3.1981E+12	84.98	11.77	44.01
R0.5	67.78 Yrs.	3.4287E+12	82.07	12.18	51.98
R1	57.09 Yrs.	4.0350E+12	75.66	13.22	66.59
S.5	64.84 Yrs.	4.2232E+12	73.95	13.52	56.12
R1.5	50.81 Yrs.	5.0364E+12	67.72	14.77	82.50
L0	71.31 Yrs.	5.2766E+12	66.16	15.11	55.33
L0.5	62.22 Yrs.	5.9059E+12	62.54	15.99	63.45
S0	53.81 Yrs.	6.7226E+12	58.61	17.06	72.23
R2	46.16 Yrs.	7.0464E+12	57.25	17.47	95.00
L1	55.09 Yrs.	7.4025E+12	55.86	17.90	72.29
S0.5	49.38 Yrs.	7.7362E+12	54.64	18.30	82.76
L1.5	50.41 Yrs.	8.3625E+12	52.55	19.03	80.48
R2.5	43.47 Yrs.	9.1812E+12	50.16	19.94	99.06
S1	45.84 Yrs.	9.5779E+12	49.11	20.36	91.88
L2	46.63 Yrs.	9.9388E+12	48.21	20.74	87.43
S1.5	43.75 Yrs.	1.0670E+13	46.53	21.49	96.65
L3	42.09 Yrs.	1.1952E+13	43.96	22.75	96.43
R3	41.22 Yrs.	1.1956E+13	43.95	22.75	100.00
S2	41.97 Yrs.	1.2321E+13	43.30	23.10	99.33
SQ	36.00 Yrs.	1.3112E+13	41.97	23.83	100.00
S6	36.47 Yrs.	1.3301E+13	41.67	24.00	100.00
L4	39.22 Yrs.	1.3758E+13	40.97	24.41	99.93
S5	37.03 Yrs.	1.3883E+13	40.79	24.52	100.00
L5	37.75 Yrs.	1.3901E+13	40.76	24.53	100.00
S3	39.81 Yrs.	1.4120E+13	40.44	24.73	100.00
S4	38.09 Yrs.	1.4562E+13	39.83	25.11	100.00
R5	37.28 Yrs.	1.4603E+13	39.77	25.14	100.00
R4	38.88 Yrs.	1.4953E+13	39.30	25.44	100.00

TNMP

Electric Division
355.00 Poles and Fixtures
Actual And Simulated Balances 1946-2017



TNMP
Electric Division
356.00 Overhead Conductors and Devices

Simulated Plant Record Analysis Calculated As Of 12/31/2017

Simulated Balances Method

No. Of Test Points -	88
Interval Between Test Points -	1
First Test Point -	1930
Last Test Point -	2017

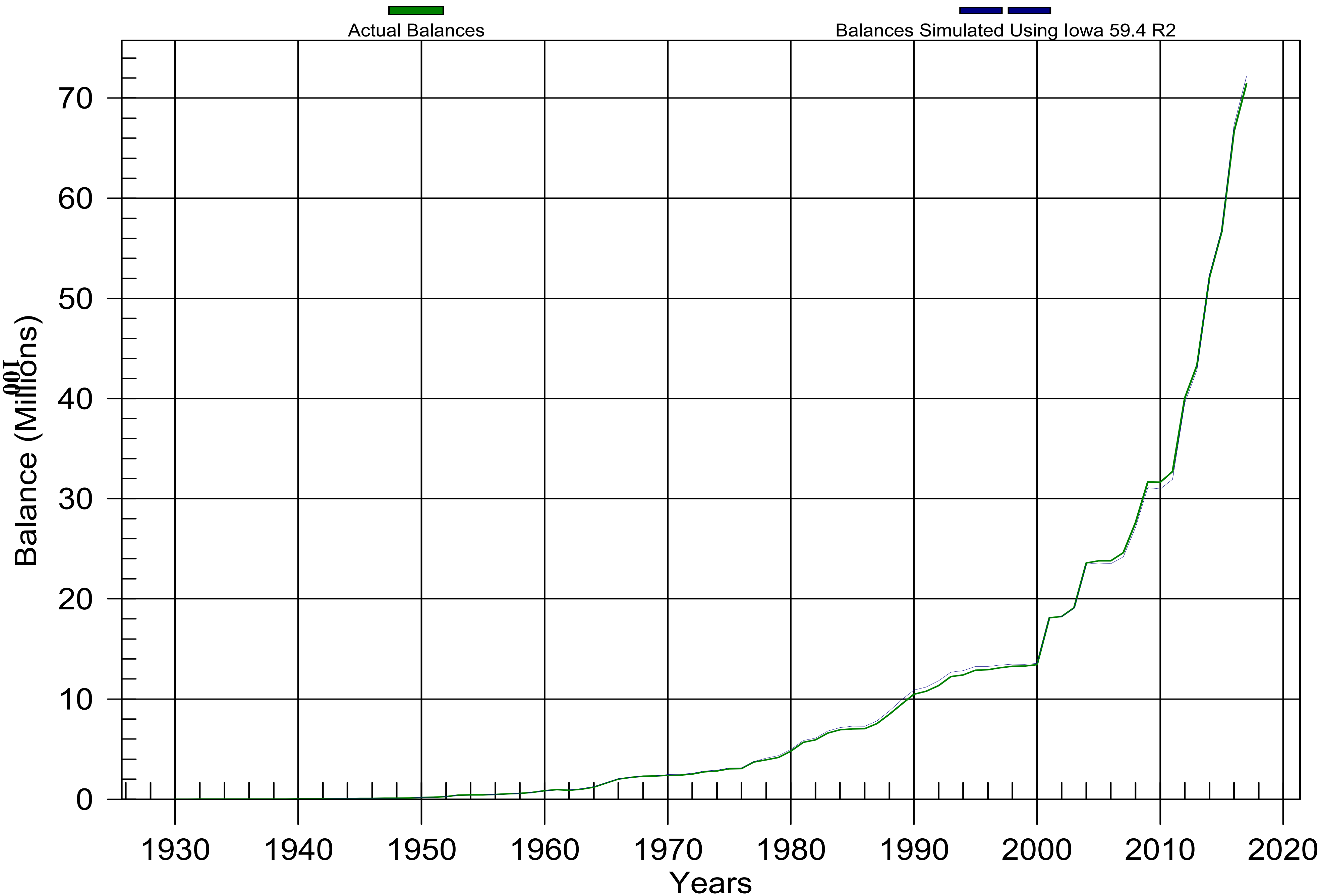
Curve Type	Average Service Life	Sum Of Squares Difference	Conformance Index	Index Of Variation	Ret Exp Index
SC	133.75 Yrs.	4.5915E+12	42.88	23.32	32.71
O1	133.75 Yrs.	4.5915E+12	42.88	23.32	32.71
O2	150.25 Yrs.	4.5928E+12	42.87	23.33	32.73
R0.5	107.38 Yrs.	4.6618E+12	42.55	23.50	37.52
R1	84.50 Yrs.	4.8273E+12	41.82	23.91	49.76
S.5	97.44 Yrs.	4.9312E+12	41.37	24.17	43.91
R1.5	70.06 Yrs.	5.0515E+12	40.88	24.46	69.47
O3	201.00 Yrs.	5.2164E+12	.00	.00	34.04
L0	104.48 Yrs.	5.3014E+12	39.90	25.06	45.92
L0.5	86.78 Yrs.	5.4837E+12	39.23	25.49	55.27
R2	59.38 Yrs.	5.5449E+12	39.02	25.63	91.20
S0	73.16 Yrs.	5.7446E+12	38.33	26.09	63.50
L1	72.69 Yrs.	5.9440E+12	37.68	26.54	67.08
S0.5	64.28 Yrs.	6.0232E+12	37.43	26.71	77.28
R2.5	53.69 Yrs.	6.0335E+12	37.40	26.74	98.86
L1.5	64.22 Yrs.	6.2605E+12	36.72	27.23	77.81
S1	57.22 Yrs.	6.5676E+12	35.85	27.89	90.43
L2	57.31 Yrs.	6.8391E+12	35.13	28.46	87.17
S1.5	53.34 Yrs.	6.8579E+12	35.08	28.50	96.81
R3	49.38 Yrs.	6.8960E+12	34.99	28.58	100.00
S2	50.06 Yrs.	7.3662E+12	33.85	29.54	99.66
L3	50.03 Yrs.	7.7190E+12	33.07	30.24	97.33
S3	46.53 Yrs.	8.1441E+12	32.19	31.06	100.00
R4	45.63 Yrs.	8.2648E+12	31.96	31.29	100.00
L4	45.88 Yrs.	8.7136E+12	31.12	32.13	99.98
S4	44.22 Yrs.	9.1730E+12	30.33	32.97	100.00
L5	43.91 Yrs.	9.7524E+12	29.42	33.99	100.00
R5	43.63 Yrs.	9.8248E+12	29.31	34.12	100.00
S5	43.16 Yrs.	1.0335E+13	28.58	34.99	100.00
S6	42.72 Yrs.	1.1736E+13	26.82	37.29	100.00
SQ	42.00 Yrs.	1.4074E+13	24.49	40.83	100.00
O4	201.00 Yrs.	2.4123E+13	.00	.00	43.68

TNMP

Electric Division

356.00 Overhead Conductors and Devices

Actual And Simulated Balances 1930-2017



TNMP
Electric Division
362.00 Station Equipment

Simulated Plant Record Analysis Calculated As Of 12/31/2017

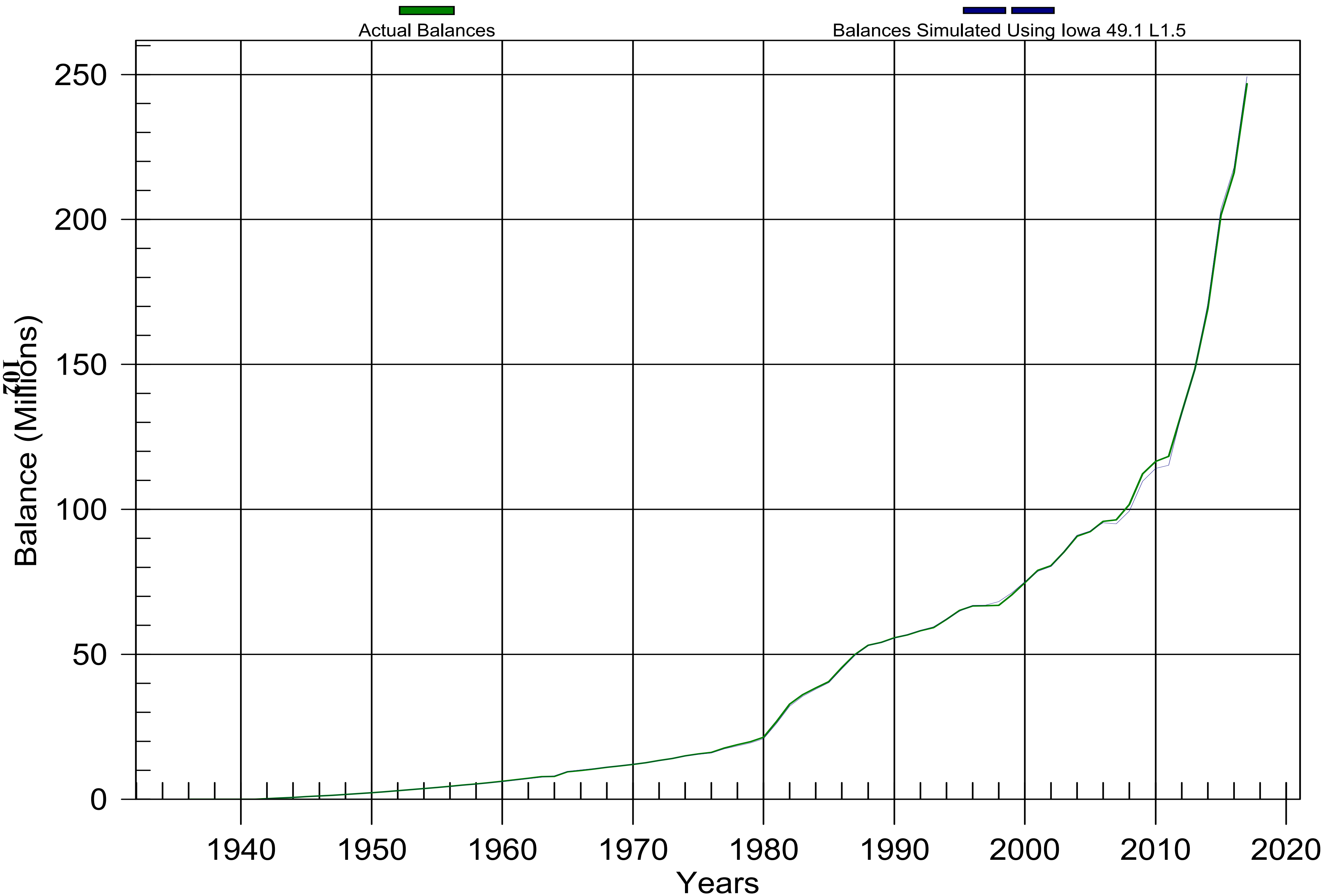
Simulated Balances Method

No. Of Test Points -	82
Interval Between Test Points -	1
First Test Point -	1936
Last Test Point -	2017

Curve Type	Average Service Life	Sum Of Squares Difference	Conformance Index	Index Of Variation	Ret Exp Index
S5	36.25 Yrs.	2.3828E+13	80.88	12.36	100.00
S6	35.59 Yrs.	2.6713E+13	76.38	13.09	100.00
L5	36.94 Yrs.	2.7394E+13	75.43	13.26	100.00
R5	36.53 Yrs.	2.8492E+13	73.96	13.52	100.00
S4	37.31 Yrs.	3.0860E+13	71.07	14.07	100.00
L4	38.47 Yrs.	3.5492E+13	66.27	15.09	100.00
L3	41.34 Yrs.	3.9096E+13	63.14	15.84	99.52
R4	38.13 Yrs.	4.0940E+13	61.70	16.21	100.00
S3	39.06 Yrs.	4.1746E+13	61.10	16.37	100.00
R2.5	42.44 Yrs.	4.4247E+13	59.35	16.85	100.00
R3	40.41 Yrs.	4.4297E+13	59.32	16.86	100.00
L2	45.69 Yrs.	4.5543E+13	58.50	17.09	94.63
R2	44.84 Yrs.	4.6763E+13	57.73	17.32	99.98
S2	41.25 Yrs.	4.6807E+13	57.70	17.33	100.00
S1.5	43.00 Yrs.	4.7386E+13	57.35	17.44	99.91
S1	45.00 Yrs.	5.0632E+13	55.48	18.02	99.10
L1.5	49.13 Yrs.	5.0758E+13	55.41	18.05	89.63
R1.5	48.69 Yrs.	5.5416E+13	53.03	18.86	96.20
S0.5	48.13 Yrs.	5.5651E+13	52.92	18.90	94.47
L1	53.41 Yrs.	5.8600E+13	51.57	19.39	82.90
S0	52.06 Yrs.	6.5489E+13	48.78	20.50	86.09
L0.5	59.59 Yrs.	6.9490E+13	47.36	21.12	74.52
R1	53.75 Yrs.	6.9736E+13	47.28	21.15	85.46
SQ	35.00 Yrs.	6.9996E+13	47.19	21.19	100.00
S.5	60.75 Yrs.	7.9879E+13	44.17	22.64	70.06
L0	67.56 Yrs.	8.2914E+13	43.36	23.06	65.87
R0.5	62.44 Yrs.	8.6233E+13	42.51	23.52	67.97
O2	82.84 Yrs.	9.7400E+13	40.00	25.00	55.20
SC	73.72 Yrs.	9.7412E+13	40.00	25.00	55.28
O1	73.72 Yrs.	9.7412E+13	40.00	25.00	55.28
O3	119.00 Yrs.	1.0175E+14	39.14	25.55	49.78
O4	164.44 Yrs.	1.0352E+14	38.80	25.77	48.01

TNMP

Electric Division
362.00 Station Equipment
Actual And Simulated Balances 1936-2017



TNMP

Electric Division

366.00 Underground Conduit

Simulated Plant Record Analysis Calculated As Of 12/31/2017

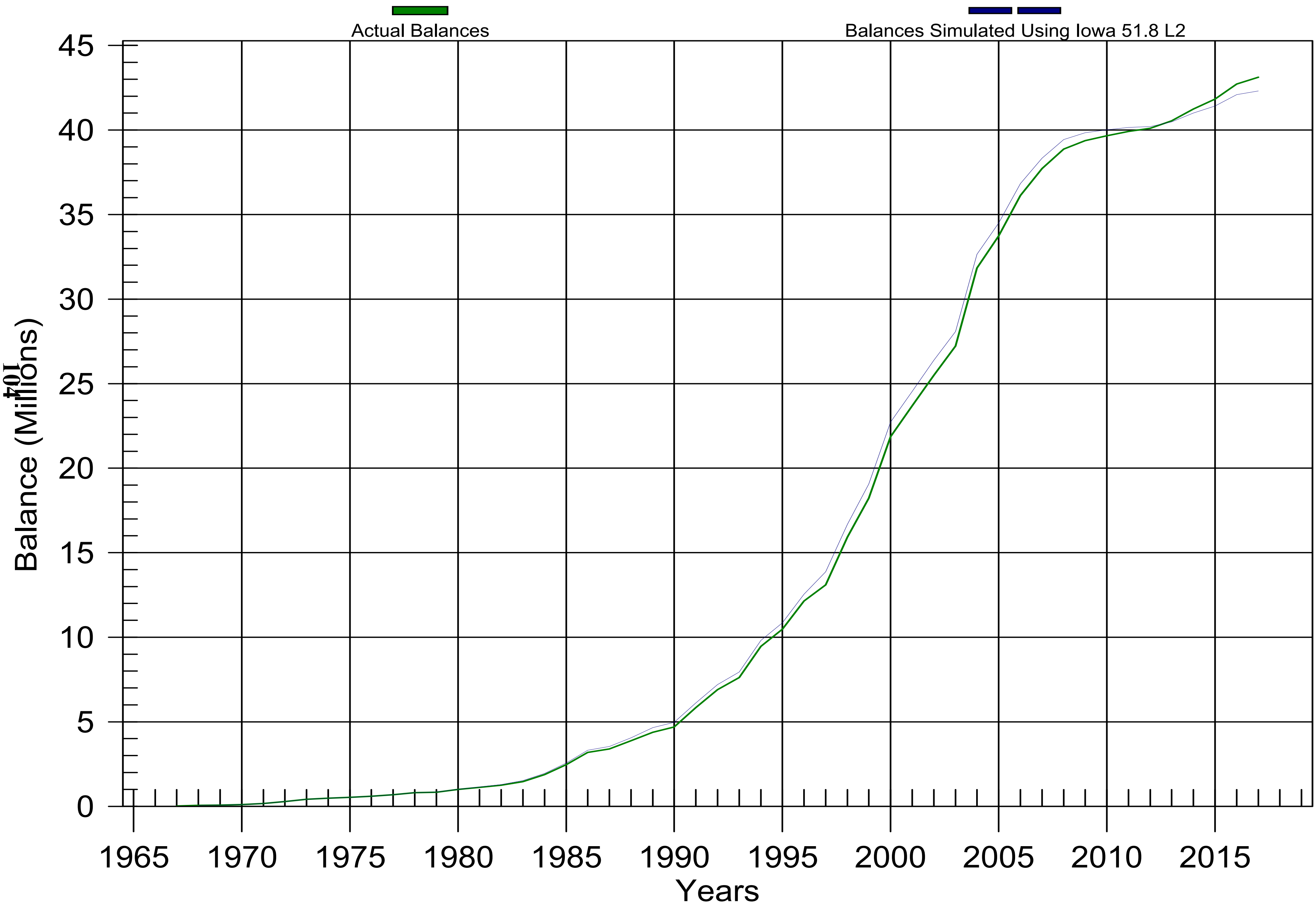
Simulated Balances Method

No. Of Test Points -	51
Interval Between Test Points -	1
First Test Point -	1967
Last Test Point -	2017

Curve Type	Average Service Life	Sum Of Squares Difference	Conformance Index	Index Of Variation	Ret Exp Index
SC	189.50 Yrs.	4.9281E+12	49.11	20.36	13.32
O1	189.50 Yrs.	4.9281E+12	49.11	20.36	13.32
R0.5	147.94 Yrs.	5.0096E+12	48.71	20.53	13.95
O2	201.00 Yrs.	5.0331E+12	.00	.00	14.12
R1	109.56 Yrs.	5.2311E+12	47.67	20.98	15.63
S.5	124.53 Yrs.	5.4518E+12	46.69	21.42	16.35
R1.5	83.69 Yrs.	5.5385E+12	46.32	21.59	18.88
L0	125.84 Yrs.	6.3408E+12	43.29	23.10	19.13
R2	62.50 Yrs.	6.4214E+12	43.02	23.24	28.56
L0.5	98.31 Yrs.	6.5953E+12	42.45	23.56	22.68
S0	80.09 Yrs.	7.3715E+12	40.15	24.90	25.20
R2.5	51.66 Yrs.	7.3854E+12	40.12	24.93	42.90
L1	74.59 Yrs.	7.6129E+12	39.51	25.31	31.33
S0.5	65.91 Yrs.	7.9820E+12	38.59	25.91	31.72
L1.5	62.47 Yrs.	8.3924E+12	37.63	26.57	39.20
R3	43.44 Yrs.	9.4194E+12	35.52	28.15	69.88
S1	54.03 Yrs.	9.4928E+12	35.38	28.26	44.08
L2	51.84 Yrs.	9.9842E+12	34.50	28.98	53.44
S1.5	48.16 Yrs.	1.0074E+13	34.35	29.11	55.10
S2	42.88 Yrs.	1.1283E+13	32.46	30.81	70.38
L3	41.88 Yrs.	1.1655E+13	31.93	31.31	75.83
R4	36.78 Yrs.	1.2150E+13	31.28	31.97	98.77
S3	37.66 Yrs.	1.2468E+13	30.88	32.39	91.56
L4	36.47 Yrs.	1.2748E+13	30.53	32.75	93.33
S4	34.38 Yrs.	1.3231E+13	29.97	33.36	99.77
L5	33.88 Yrs.	1.3283E+13	29.91	33.43	99.42
R5	33.38 Yrs.	1.3303E+13	29.89	33.46	100.00
S5	32.88 Yrs.	1.3473E+13	29.70	33.67	100.00
S6	32.28 Yrs.	1.3579E+13	29.58	33.80	100.00
SQ	32.00 Yrs.	1.3652E+13	29.51	33.89	100.00
O3	201.00 Yrs.	1.4022E+13	.00	.00	20.33
O4	201.00 Yrs.	4.4592E+13	.00	.00	27.48

TNMP

Electric Division
366.00 Underground Conduit
Actual And Simulated Balances 1967-2017



TNMP
Electric Division
368.00 Line Transformers

Simulated Plant Record Analysis Calculated As Of 12/31/2017

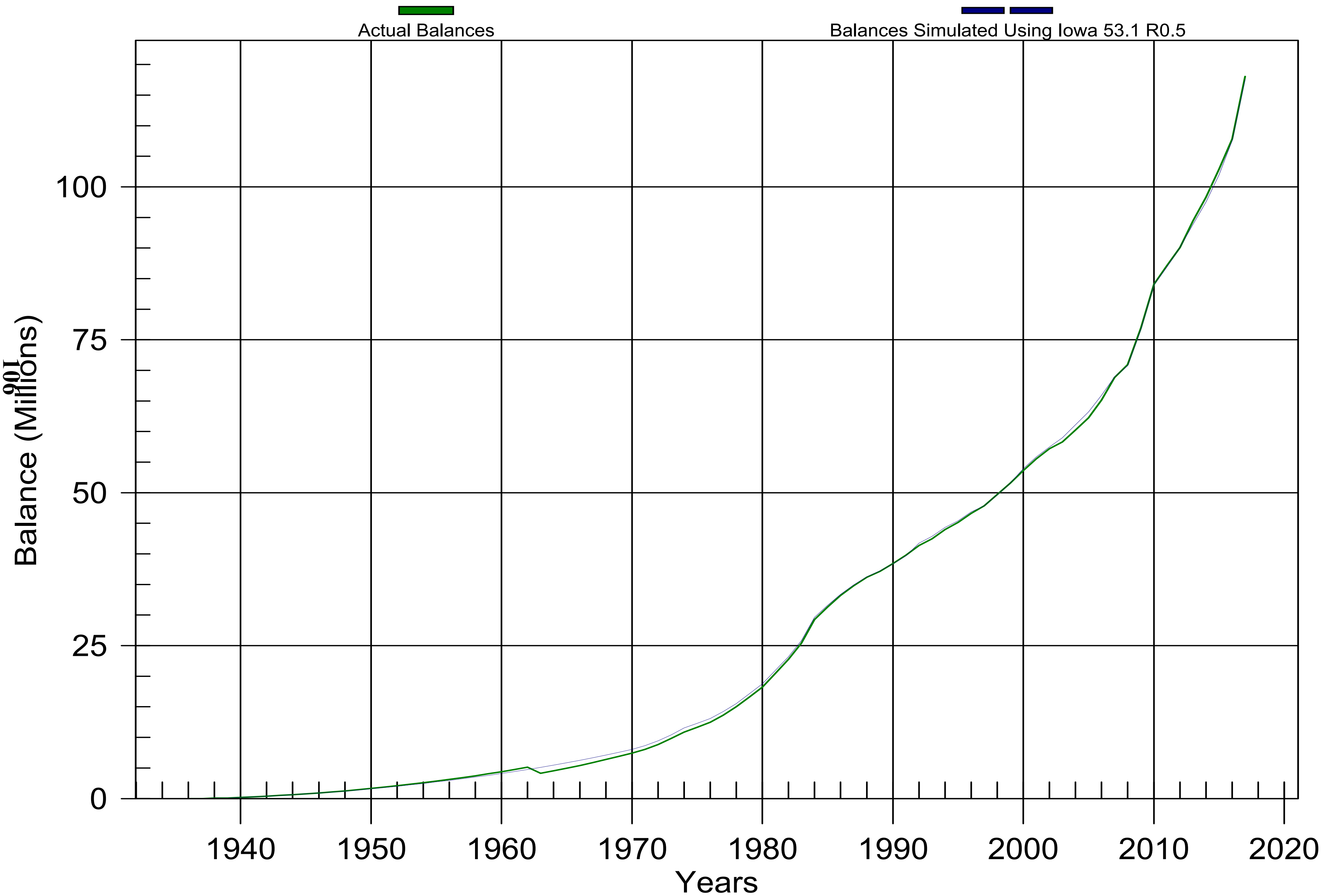
Simulated Balances Method

No. Of Test Points - 82
Interval Between Test Points - 1
First Test Point - 1936
Last Test Point - 2017

Curve Type	Average Service Life	Sum Of Squares Difference	Conformance Index	Index Of Variation	Ret Exp Index
O4	133.69 Yrs.	1.1130E+13	77.79	12.85	54.96
O3	97.25 Yrs.	1.1398E+13	76.87	13.01	57.52
O2	68.63 Yrs.	1.2325E+13	73.92	13.53	66.01
SC	61.06 Yrs.	1.2331E+13	73.91	13.53	66.73
O1	61.06 Yrs.	1.2331E+13	73.91	13.53	66.73
R0.5	53.13 Yrs.	1.5985E+13	64.91	15.41	81.62
S.5	52.41 Yrs.	1.9546E+13	58.70	17.04	81.66
L0	58.42 Yrs.	1.9904E+13	58.17	17.19	74.34
R1	47.16 Yrs.	2.5489E+13	51.41	19.45	95.69
L0.5	52.56 Yrs.	2.9627E+13	47.68	20.97	82.08
S0	46.50 Yrs.	3.7000E+13	42.67	23.44	94.54
R1.5	43.66 Yrs.	4.0209E+13	40.93	24.43	99.49
L1	47.97 Yrs.	4.6089E+13	38.23	26.16	88.97
S0.5	43.66 Yrs.	5.3574E+13	35.46	28.20	98.88
R2	40.91 Yrs.	6.2166E+13	32.92	30.38	100.00
L1.5	44.78 Yrs.	6.4150E+13	32.40	30.86	93.80
S1	41.31 Yrs.	7.6778E+13	29.62	33.76	100.00
R2.5	39.13 Yrs.	8.2733E+13	28.53	35.05	100.00
L2	42.19 Yrs.	9.1533E+13	27.13	36.86	97.15
S1.5	39.78 Yrs.	9.6063E+13	26.48	37.77	100.00
R3	37.66 Yrs.	1.0943E+14	24.81	40.31	100.00
S2	38.47 Yrs.	1.2058E+14	23.63	42.31	100.00
L3	38.84 Yrs.	1.3776E+14	22.11	45.22	99.89
R4	36.09 Yrs.	1.5237E+14	21.02	47.56	100.00
S3	36.84 Yrs.	1.5791E+14	20.65	48.42	100.00
L4	36.63 Yrs.	1.7330E+14	19.71	50.72	100.00
S4	35.72 Yrs.	1.9403E+14	18.63	53.67	100.00
R5	35.22 Yrs.	1.9943E+14	18.38	54.41	100.00
L5	35.59 Yrs.	2.0379E+14	18.18	55.01	100.00
S5	35.13 Yrs.	2.1556E+14	17.68	56.57	100.00
S6	34.84 Yrs.	2.2417E+14	17.33	57.69	100.00
SQ	35.00 Yrs.	2.2898E+14	17.15	58.31	100.00

TNMP

Electric Division
368.00 Line Transformers
Actual And Simulated Balances 1936-2017



TNMP
Electric Division
369.00 Overhead Services

Simulated Plant Record Analysis Calculated As Of 12/31/2017

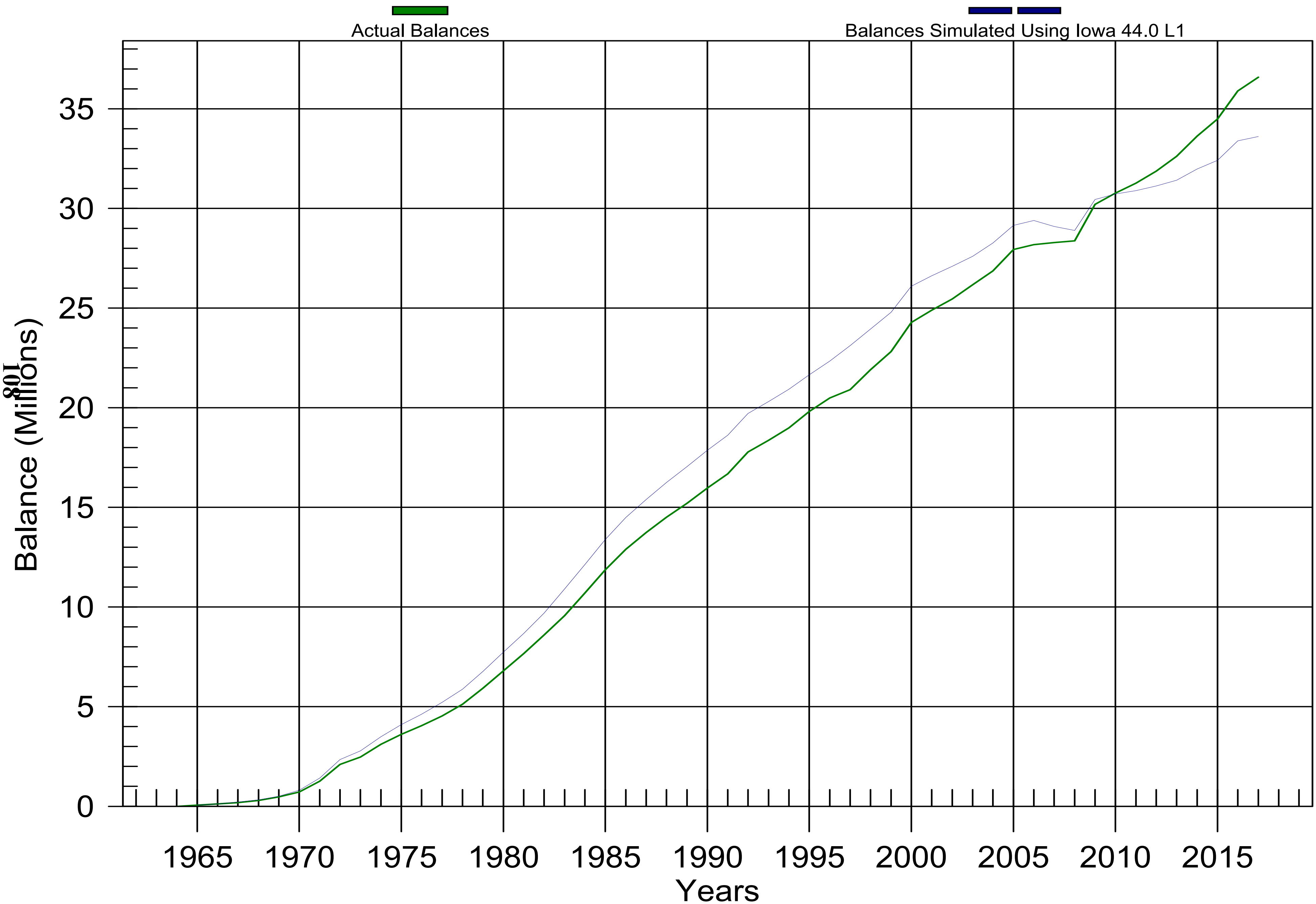
Simulated Balances Method

No. Of Test Points -	54
Interval Between Test Points -	1
First Test Point -	1964
Last Test Point -	2017

Curve Type	Average Service Life	Sum Of Squares Difference	Conformance Index	Index Of Variation	Ret Exp Index
O4	120.03 Yrs.	3.7733E+13	19.43	51.46	44.46
O3	87.34 Yrs.	3.9010E+13	19.11	52.33	45.60
SC	54.81 Yrs.	4.2054E+13	18.41	54.33	48.80
O1	54.81 Yrs.	4.2054E+13	18.41	54.33	48.80
O2	61.59 Yrs.	4.2084E+13	18.40	54.35	48.80
R0.5	47.72 Yrs.	5.1025E+13	16.71	59.84	56.19
S.5	47.44 Yrs.	6.0309E+13	15.37	65.06	57.62
L0	53.23 Yrs.	6.3323E+13	15.00	66.67	55.47
R1	42.50 Yrs.	6.8120E+13	14.46	69.15	67.09
L0.5	48.06 Yrs.	7.9806E+13	13.36	74.84	61.43
S0	42.47 Yrs.	8.9115E+13	12.64	79.09	67.75
R1.5	39.53 Yrs.	9.1074E+13	12.51	79.95	78.40
L1	44.03 Yrs.	1.0305E+14	11.76	85.05	67.73
S0.5	39.97 Yrs.	1.1116E+14	11.32	88.33	75.76
R2	37.31 Yrs.	1.2354E+14	10.74	93.12	88.68
L1.5	41.25 Yrs.	1.2685E+14	10.60	94.36	74.41
S1	37.97 Yrs.	1.4024E+14	10.08	99.21	83.51
R2.5	36.00 Yrs.	1.5682E+14	9.53	104.91	95.05
L2	39.00 Yrs.	1.5935E+14	9.46	105.76	80.49
S1.5	36.69 Yrs.	1.6554E+14	9.28	107.79	89.61
S2	35.59 Yrs.	1.9658E+14	8.51	117.46	94.67
R3	34.91 Yrs.	1.9790E+14	8.48	117.86	99.18
L3	36.06 Yrs.	2.1581E+14	8.13	123.08	90.35
S3	34.34 Yrs.	2.4920E+14	7.56	132.25	99.16
R4	33.81 Yrs.	2.6477E+14	7.34	136.32	100.00
L4	34.22 Yrs.	2.7109E+14	7.25	137.94	98.28
S4	33.47 Yrs.	3.0494E+14	6.84	146.30	99.99
L5	33.41 Yrs.	3.1862E+14	6.69	149.54	99.90
R5	33.16 Yrs.	3.2779E+14	6.59	151.68	100.00
S5	33.06 Yrs.	3.4262E+14	6.45	155.07	100.00
S6	32.94 Yrs.	3.6378E+14	6.26	159.79	100.00
SQ	33.00 Yrs.	3.7914E+14	6.13	163.13	100.00

TNMP

Electric Division
369.00 Overhead Services
Actual And Simulated Balances 1964-2017



SOAH DOCKET NO. 473-18-3981
PUC DOCKET NO. 48401

APPLICATION OF TEXAS-NEW	§	BEFORE THE STATE OFFICE
MEXICO POWER COMPANY FOR	§	OF
AUTHORITY TO CHANGE RATES	§	ADMINISTRATIVE HEARINGS

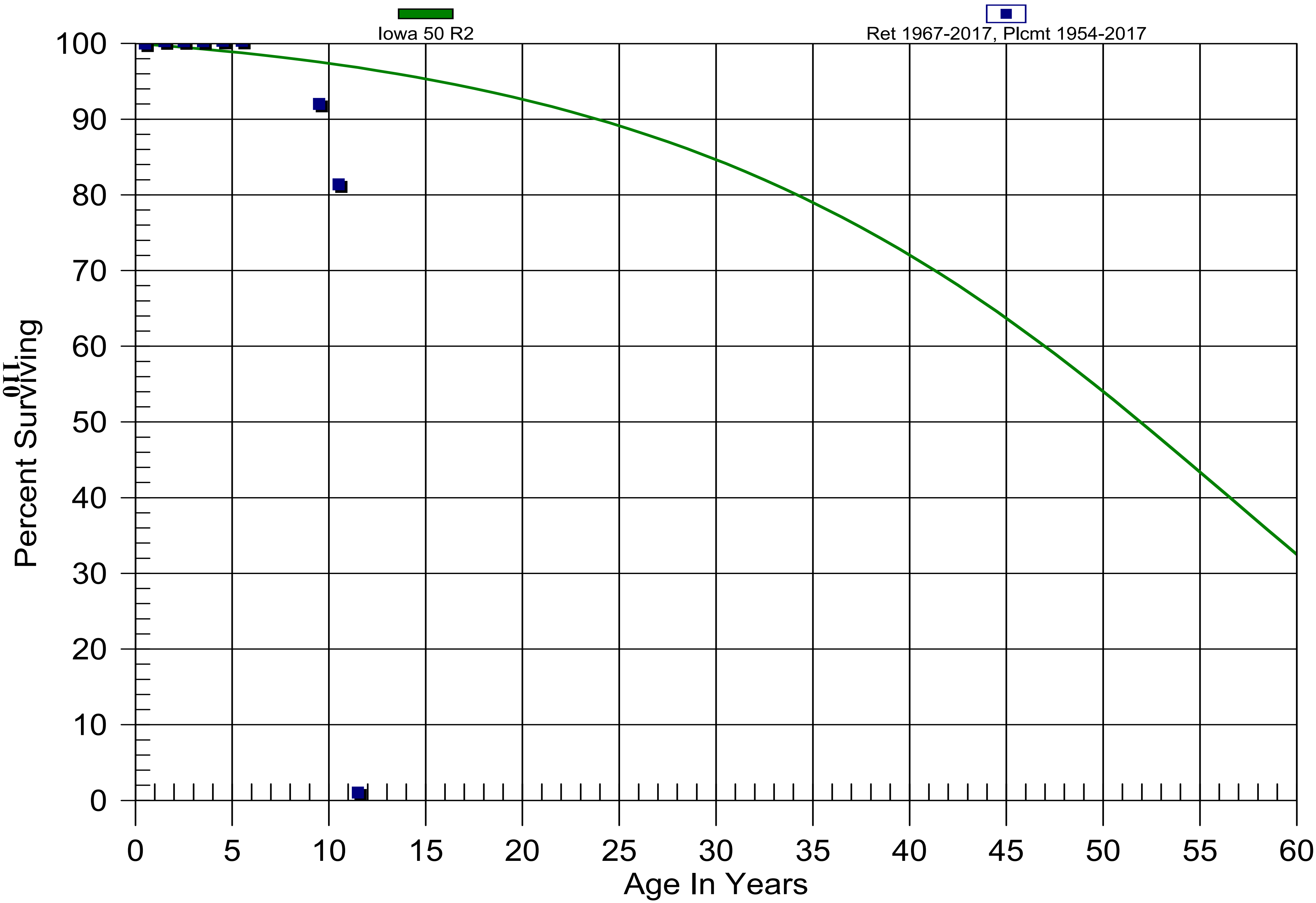
DIRECT TESTIMONY AND EXHIBITS OF DAVID J. GARRETT

EXHIBIT DJG-7:

ACTUARIAL OBSERVED LIFE TABLES AND IOWA CURVE CHARTS

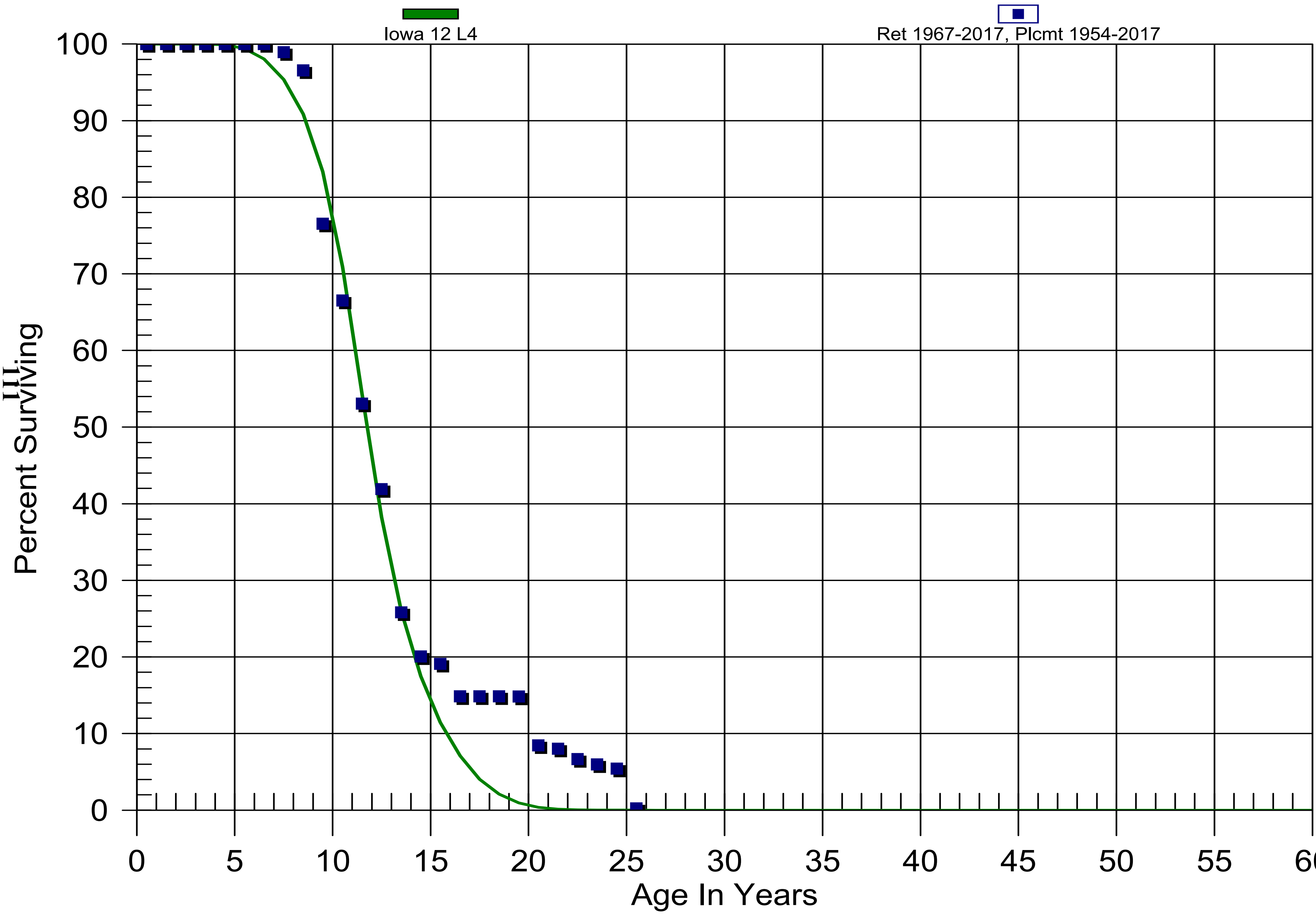
TNMP

Electric Division
390.00 Structures and Improvements
Original And Smooth Survivor Curves



TNMP

Electric Division
392.00 Transportation Equipment
Original And Smooth Survivor Curves

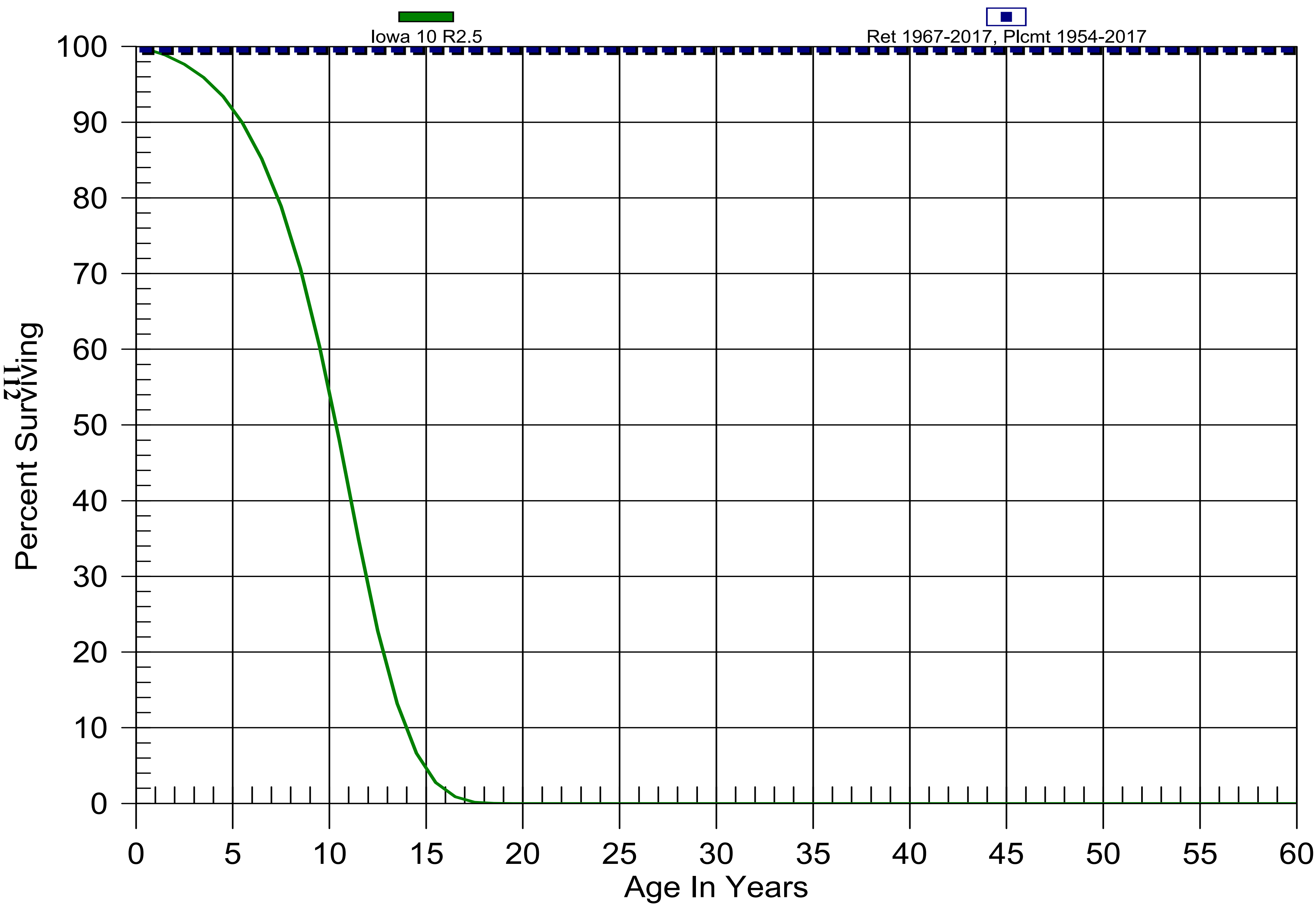


TNMP

Electric Division

392.10 Transportation Equipment - Heavy Equipment

Original And Smooth Survivor Curves

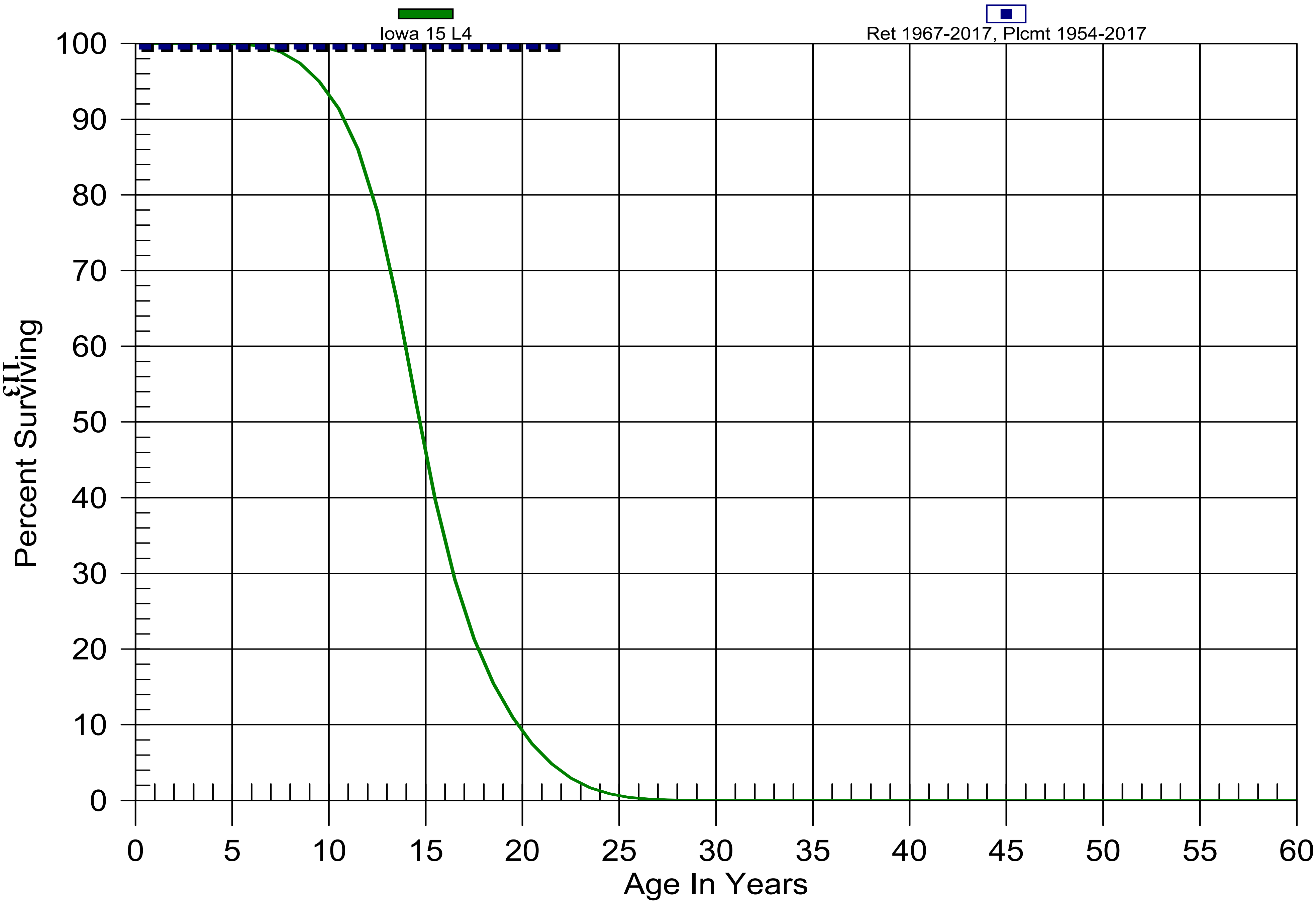


TNMP

Electric Division

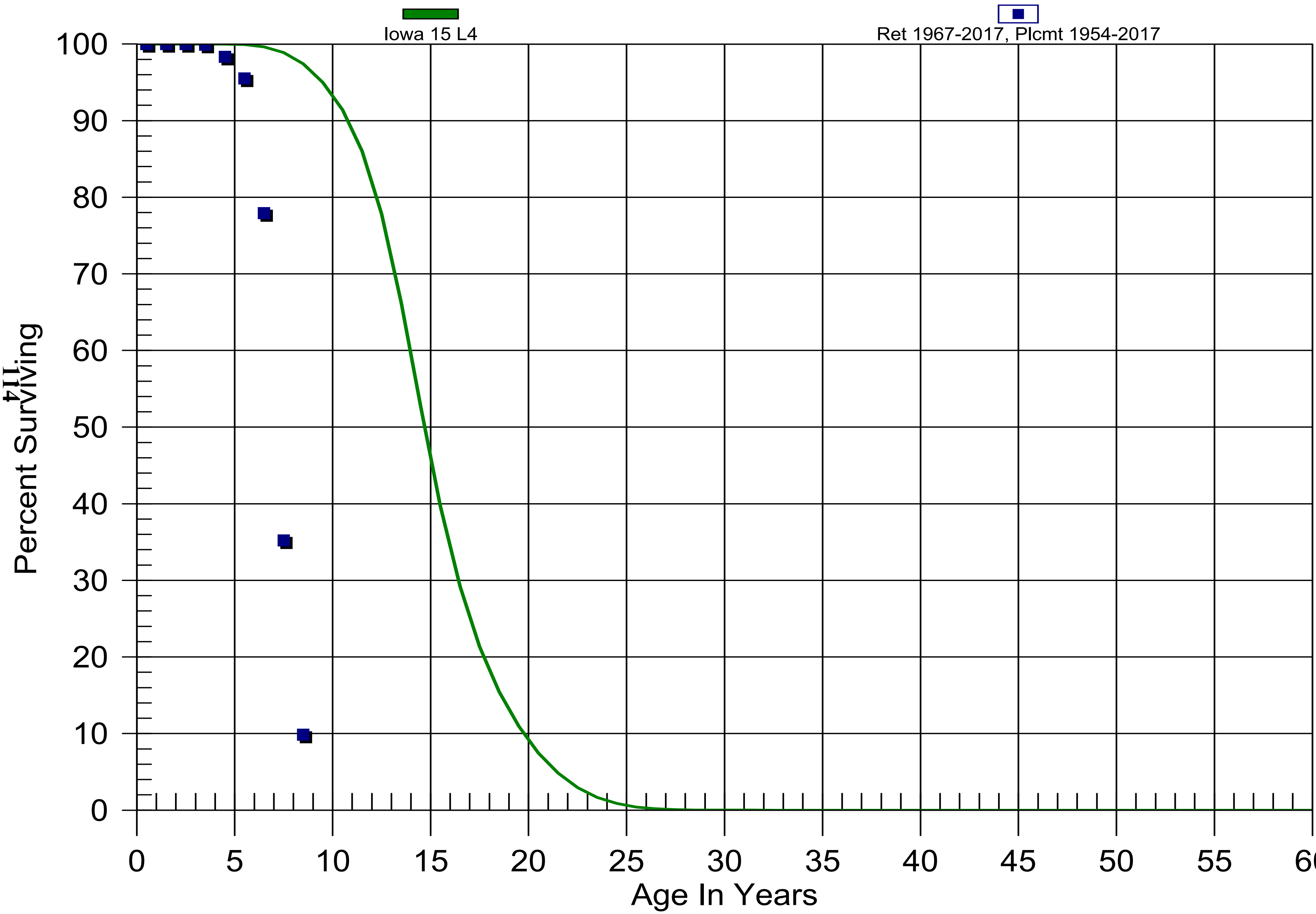
392.20 Transportation Equipment - Trailers

Original And Smooth Survivor Curves



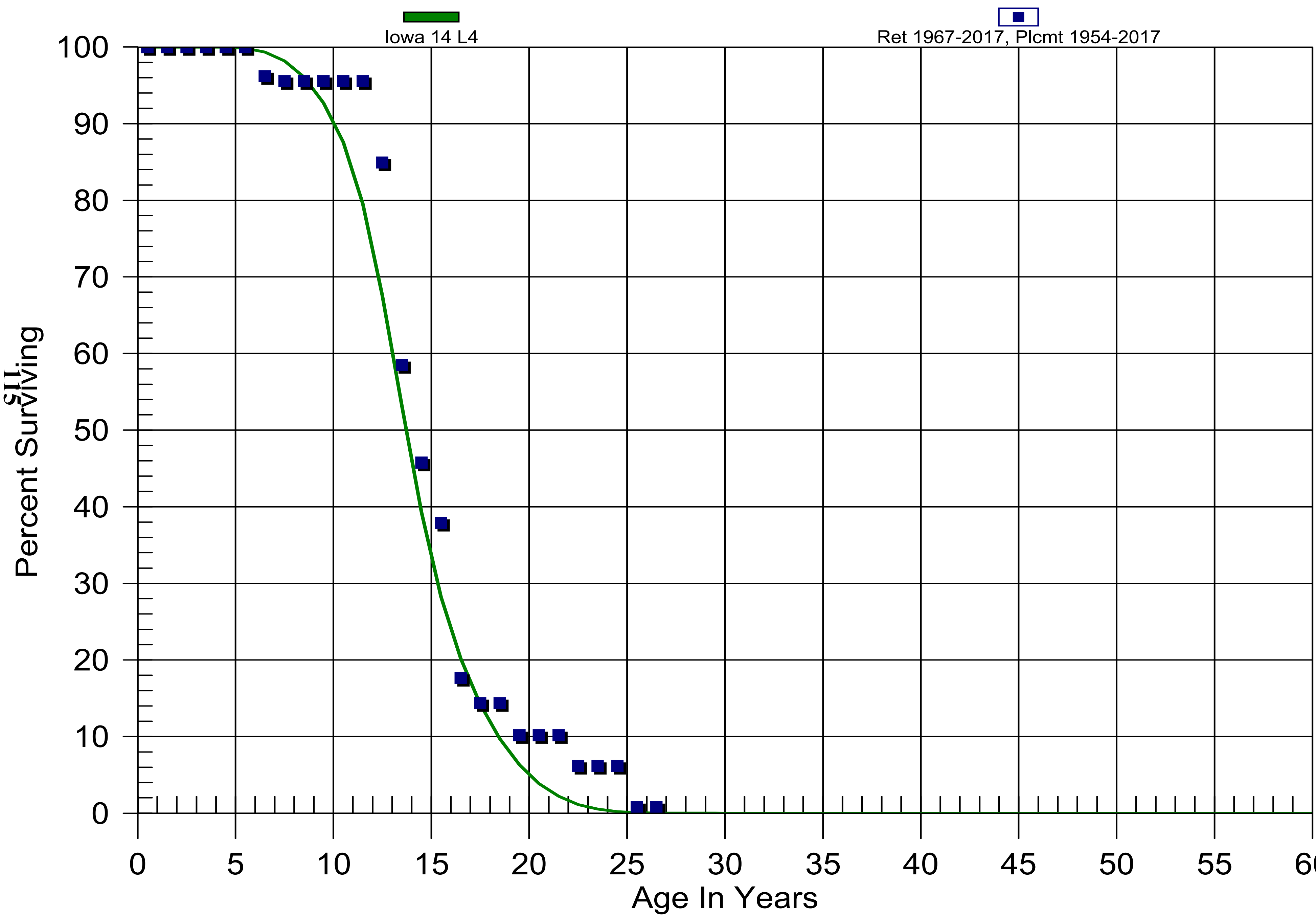
TNMP

Electric Division
392.40 Transportation Equipment - Lease Buy Back
Original And Smooth Survivor Curves



TNMP

Electric Division
396.00 Power Operated Equipment
Original And Smooth Survivor Curves



SOAH DOCKET NO. 473-18-3981
PUC DOCKET NO. 48401

APPLICATION OF TEXAS-NEW	§	BEFORE THE STATE OFFICE
MEXICO POWER COMPANY FOR	§	OF
AUTHORITY TO CHANGE RATES	§	ADMINISTRATIVE HEARINGS

DIRECT TESTIMONY AND EXHIBITS OF DAVID J. GARRETT

EXHIBIT DJG-8:

SIMULATED PLANT RECORD REMAINING LIFE DEVELOPMENT

TNMP
Electric Division
355.00 Poles and Fixtures

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 55 **Survivor Curve:** L1

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1948	64,723.88	55.00	1,176.72	21.47	25,266.01
1949	78,598.63	55.00	1,428.98	21.75	31,082.70
1950	81,742.58	55.00	1,486.14	22.03	32,742.61
1951	85,012.28	55.00	1,545.58	22.31	34,489.55
1952	88,412.77	55.00	1,607.40	22.60	36,328.06
1953	91,949.28	55.00	1,671.70	22.89	38,262.84
1954	95,627.25	55.00	1,738.57	23.18	40,298.85
1955	99,452.34	55.00	1,808.11	23.47	42,443.24
1956	103,430.44	55.00	1,880.43	23.77	44,696.65
1957	107,567.65	55.00	1,955.65	24.07	47,067.83
1958	111,870.36	55.00	2,033.88	24.37	49,562.88
1959	116,345.17	55.00	2,115.23	24.67	52,188.17
1960	120,998.98	55.00	2,199.84	24.98	54,952.78
1961	172,808.13	55.00	3,141.77	25.29	79,453.48
1962	171,082.48	55.00	3,110.39	25.60	79,630.64
1963	177,925.78	55.00	3,234.81	25.92	83,834.94
1964	287,881.64	55.00	5,233.88	26.23	137,308.41
1965	302,142.02	55.00	5,493.15	26.56	145,873.81
1966	261,786.07	55.00	4,759.45	26.88	127,935.71
1967	121,492.14	55.00	2,208.81	27.21	60,095.67
1968	148,522.45	55.00	2,700.24	27.54	74,357.41
1969	90,527.17	55.00	1,645.84	27.87	45,870.78
1970	97,639.86	55.00	1,775.16	28.21	50,072.27
1971	32,202.18	55.00	585.46	28.55	16,713.40
1972	122,876.13	55.00	2,233.97	28.89	64,540.52
1973	359,795.77	55.00	6,541.33	29.24	191,247.53
1974	126,900.85	55.00	2,307.14	29.59	68,260.40

TNMP
Electric Division
355.00 Poles and Fixtures

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 55 *Survivor Curve:* L1

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1975	172,227.59	55.00	3,131.21	29.94	93,747.82
1976	91,323.38	55.00	1,660.32	30.30	50,301.93
1977	659,006.52	55.00	11,981.18	30.66	367,307.80
1978	853,118.77	55.00	15,510.27	31.02	481,141.39
1979	500,189.42	55.00	9,093.78	31.39	285,437.92
1980	502,950.31	55.00	9,143.97	31.76	290,407.40
1981	834,084.05	55.00	15,164.21	32.13	487,292.11
1982	1,145,450.28	55.00	20,825.06	32.51	677,089.50
1983	644,154.87	55.00	11,711.17	32.90	385,247.49
1984	637,844.90	55.00	11,596.45	33.28	385,955.35
1985	692,462.63	55.00	12,589.44	33.67	423,920.31
1986	100,115.25	55.00	1,820.16	34.07	62,009.84
1987	1,003,086.83	55.00	18,236.79	34.47	628,637.03
1988	1,752,161.31	55.00	31,855.47	34.88	1,111,157.04
1989	260,979.15	55.00	4,744.78	35.30	167,504.52
1990	1,017,876.68	55.00	18,505.68	35.74	661,331.44
1991	272,443.53	55.00	4,953.21	36.18	179,225.73
1992	675,973.13	55.00	12,289.65	36.65	450,360.54
1993	818,733.16	55.00	14,885.12	37.12	552,548.20
1994	230,143.22	55.00	4,184.16	37.62	157,391.26
1995	611,050.58	55.00	11,109.31	38.13	423,587.26
1996	117,399.22	55.00	2,134.40	38.66	82,517.47
1997	118,598.98	55.00	2,156.21	39.21	84,549.20
1998	87,506.01	55.00	1,590.92	39.78	63,291.72
1999	98,279.16	55.00	1,786.78	40.37	72,136.53
2000	181,543.37	55.00	3,300.58	40.99	135,278.34
2001	458,971.38	55.00	8,344.41	41.62	347,305.95

TNMP
Electric Division
355.00 Poles and Fixtures

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 55 **Survivor Curve:** L1

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
2002	783,392.58	55.00	14,242.60	42.28	602,148.99
2003	1,809,918.21	55.00	32,905.53	42.96	1,413,495.24
2004	5,797,642.91	55.00	105,405.05	43.65	4,601,192.70
2005	1,169,290.53	55.00	21,258.49	44.37	943,345.16
2006	2,323,051.80	55.00	42,234.64	45.12	1,905,568.60
2007	2,248,051.73	55.00	40,871.09	45.88	1,875,289.97
2009	2,758,804.38	55.00	50,156.92	47.47	2,381,070.82
2011	6,874,458.48	55.00	124,982.28	49.14	6,141,309.88
2012	9,445,747.18	55.00	171,730.03	50.00	8,586,240.92
2013	7,156,233.29	55.00	130,105.13	50.88	6,619,244.76
2014	21,478,623.97	55.00	390,495.82	51.77	20,215,727.85
2015	14,873,275.57	55.00	270,406.15	52.68	14,243,681.30
2016	20,396,697.69	55.00	370,825.68	53.60	19,875,323.51
2017	24,391,421.04	55.00	443,452.43	54.53	24,182,347.08
Total	139,763,597.32	55.00	2,540,996.16	48.98	124,447,245.00

Composite Average Remaining Life ... 48.98 Years

TNMP
Electric Division
356.00 Overhead Conductors and Devices

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 59 *Survivor Curve:* R2

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1932	13,034.62	59.00	220.93	6.69	1,477.53
1940	7,523.57	59.00	127.52	9.11	1,161.90
1941	7,749.28	59.00	131.34	9.44	1,239.29
1942	7,981.76	59.00	135.28	9.76	1,320.52
1943	8,221.21	59.00	139.34	10.09	1,406.51
1944	8,467.85	59.00	143.52	10.44	1,497.79
1945	8,721.88	59.00	147.83	10.78	1,593.89
1946	8,983.54	59.00	152.26	11.14	1,695.66
1947	9,253.04	59.00	156.83	11.50	1,803.41
1948	9,530.64	59.00	161.54	11.87	1,917.53
1949	21,039.49	59.00	356.60	12.25	4,368.31
1950	50,591.50	59.00	857.48	12.64	10,837.04
1951	19,229.51	59.00	325.92	13.04	4,248.65
1952	54,533.76	59.00	924.30	13.44	12,424.83
1953	132,924.52	59.00	2,252.95	13.86	31,223.05
1954	9,477.55	59.00	160.64	14.28	2,294.54
1955	8,180.83	59.00	138.66	14.72	2,041.04
1956	37,169.38	59.00	629.99	15.17	9,554.22
1957	49,708.04	59.00	842.51	15.62	13,160.10
1958	44,216.63	59.00	749.43	16.09	12,055.55
1959	100,318.02	59.00	1,700.30	16.56	28,160.81
1960	140,928.50	59.00	2,388.61	17.05	40,721.36
1961	95,296.06	59.00	1,615.18	17.54	28,335.16
1962	7,458.18	59.00	126.41	18.05	2,281.64
1963	100,105.17	59.00	1,696.69	18.57	31,500.62
1964	193,421.69	59.00	3,278.32	19.09	62,585.42
1965	355,205.38	59.00	6,020.41	19.63	118,166.14

TNMP
Electric Division
356.00 Overhead Conductors and Devices

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 59 *Survivor Curve:* R2

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1966	348,546.70	59.00	5,907.55	20.17	119,179.37
1967	145,267.52	59.00	2,462.15	20.73	51,036.31
1968	128,289.22	59.00	2,174.39	21.30	46,303.61
1969	15,489.17	59.00	262.53	21.87	5,741.74
1970	115,215.67	59.00	1,952.80	22.45	43,848.22
1971	18,205.69	59.00	308.57	23.05	7,112.43
1972	96,346.30	59.00	1,632.98	23.65	38,626.93
1973	215,263.93	59.00	3,648.53	24.27	88,541.08
1974	94,123.19	59.00	1,595.30	24.89	39,704.73
1975	189,265.01	59.00	3,207.87	25.52	81,866.83
1976	26,109.88	59.00	442.54	26.16	11,577.32
1977	590,049.69	59.00	10,000.81	26.81	268,106.22
1978	307,286.88	59.00	5,208.24	27.47	143,054.09
1979	225,444.44	59.00	3,821.08	28.13	107,499.91
1980	560,265.33	59.00	9,495.99	28.81	273,541.15
1981	825,580.02	59.00	13,992.84	29.49	412,642.61
1982	228,790.70	59.00	3,877.80	30.18	117,035.01
1983	657,242.96	59.00	11,139.68	30.88	343,988.73
1984	323,535.04	59.00	5,483.63	31.58	173,200.23
1985	148,131.84	59.00	2,510.70	32.30	81,095.15
1986	16,923.64	59.00	286.84	33.02	9,471.99
1987	503,758.77	59.00	8,538.26	33.75	288,163.92
1988	938,469.10	59.00	15,906.21	34.49	548,557.63
1989	1,031,276.03	59.00	17,479.20	35.23	615,811.80
1990	893,699.41	59.00	15,147.40	35.98	545,011.79
1991	291,635.53	59.00	4,942.96	36.74	181,600.36
1992	599,309.73	59.00	10,157.76	37.50	380,959.99

TNMP
Electric Division
356.00 Overhead Conductors and Devices

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

***Average Service Life:* 59** ***Survivor Curve:* R2**

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1993	821,956.47	59.00	13,931.42	38.27	533,214.77
1994	167,493.24	59.00	2,838.86	39.05	110,866.66
1995	432,323.39	59.00	7,327.49	39.84	291,915.51
1996	46,026.86	59.00	780.11	40.63	31,695.76
1997	175,386.46	59.00	2,972.64	41.43	123,145.12
1998	129,672.47	59.00	2,197.83	42.23	92,815.22
1999	36,513.95	59.00	618.88	43.04	26,636.77
2000	149,725.82	59.00	2,537.72	43.86	111,291.93
2001	4,211,035.91	59.00	71,373.26	44.68	3,188,776.21
2002	111,871.75	59.00	1,896.13	45.51	86,283.77
2003	827,148.38	59.00	14,019.42	46.34	649,623.81
2004	4,035,872.55	59.00	68,404.40	47.18	3,227,111.99
2005	200,894.12	59.00	3,404.97	48.02	163,512.75
2007	729,612.67	59.00	12,366.28	49.73	614,926.95
2008	2,751,925.22	59.00	46,642.65	50.59	2,359,505.43
2009	3,660,192.14	59.00	62,036.96	51.45	3,191,955.21
2011	1,094,919.59	59.00	18,557.90	53.20	987,243.51
2012	7,640,239.04	59.00	129,495.17	54.08	7,002,890.47
2013	3,402,122.86	59.00	57,662.92	54.96	3,169,294.59
2014	9,579,338.30	59.00	162,361.15	55.85	9,068,256.83
2015	4,628,721.65	59.00	78,452.66	56.75	4,451,920.43
2016	10,518,854.33	59.00	178,285.10	57.64	10,277,075.71
2017	5,047,982.36	59.00	85,558.75	58.55	5,009,221.29
Total	71,442,622.52	59.00	1,210,888.08	49.73	60,221,532.35

***Composite Average Remaining Life ...* 49.73 Years**

TNMP
Electric Division
362.00 Station Equipment

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 49 *Survivor Curve:* L1.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1942	29,975.74	49.00	611.73	14.28	8,738.07
1943	32,557.98	49.00	664.43	14.52	9,647.47
1944	35,326.97	49.00	720.94	14.76	10,639.54
1945	38,294.44	49.00	781.49	15.00	11,720.93
1946	41,471.53	49.00	846.33	15.24	12,898.38
1947	44,870.56	49.00	915.70	15.48	14,179.22
1948	48,504.55	49.00	989.86	15.73	15,571.29
1949	65,225.54	49.00	1,331.09	15.98	21,269.40
1950	66,380.58	49.00	1,354.66	16.23	21,984.48
1951	75,895.57	49.00	1,548.84	16.48	25,525.20
1952	81,770.48	49.00	1,668.73	16.73	27,923.23
1953	88,033.11	49.00	1,796.54	16.99	30,518.85
1954	94,705.83	49.00	1,932.71	17.24	33,326.25
1955	101,812.16	49.00	2,077.73	17.50	36,360.52
1956	109,376.93	49.00	2,232.11	17.76	39,637.68
1957	117,426.30	49.00	2,396.38	18.01	43,169.20
1958	125,987.76	49.00	2,571.10	18.27	46,983.96
1959	135,090.29	49.00	2,756.86	18.53	51,096.03
1960	154,762.34	49.00	3,158.32	18.80	59,360.73
1961	172,316.18	49.00	3,516.55	19.06	67,013.23
1962	184,445.54	49.00	3,764.08	19.32	72,716.69
1963	197,320.49	49.00	4,026.82	19.58	78,850.10
1964	210,980.94	49.00	4,305.60	19.84	85,442.22
1965	624,589.65	49.00	12,746.33	20.11	256,307.85
1966	200,891.27	49.00	4,099.69	20.37	83,523.49
1967	216,544.48	49.00	4,419.14	20.64	91,205.84
1968	233,296.41	49.00	4,761.00	20.91	99,532.53

TNMP
Electric Division
362.00 Station Equipment

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 49 **Survivor Curve:** L1.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1969	251,214.24	49.00	5,126.66	21.17	108,553.23
1970	270,366.43	49.00	5,517.51	21.44	118,320.65
1971	290,822.86	49.00	5,934.98	21.72	128,890.69
1972	414,875.15	49.00	8,466.58	21.99	186,200.56
1973	400,221.42	49.00	8,167.53	22.27	181,898.77
1974	522,721.23	49.00	10,667.45	22.55	240,586.55
1975	388,802.71	49.00	7,934.50	22.84	181,225.43
1976	307,906.08	49.00	6,283.60	23.13	145,353.70
1977	900,826.31	49.00	18,383.64	23.43	430,732.68
1978	719,658.70	49.00	14,686.46	23.73	348,582.88
1979	692,296.20	49.00	14,128.06	24.05	339,743.06
1980	1,047,952.81	49.00	21,386.13	24.37	521,144.96
1981	3,575,105.51	49.00	72,959.08	24.70	1,802,013.62
1982	4,094,500.37	49.00	83,558.64	25.04	2,092,318.59
1983	2,498,868.91	49.00	50,995.75	25.39	1,294,922.96
1984	1,879,114.94	49.00	38,348.10	25.76	987,766.28
1985	1,790,234.79	49.00	36,534.27	26.14	954,877.81
1986	3,737,301.59	49.00	76,269.10	26.53	2,023,384.38
1987	3,745,128.09	49.00	76,428.82	26.94	2,058,836.43
1988	2,893,203.16	49.00	59,043.13	27.36	1,615,575.13
1989	1,008,962.21	49.00	20,590.43	27.80	572,506.02
1990	1,510,415.79	49.00	30,823.86	28.26	871,235.85
1991	1,304,932.08	49.00	26,630.44	28.75	765,510.88
1992	1,517,461.48	49.00	30,967.64	29.25	905,741.12
1993	1,392,291.85	49.00	28,413.24	29.77	845,944.88
1994	2,722,250.00	49.00	55,554.40	30.32	1,684,481.25
1995	2,761,351.16	49.00	56,352.36	30.89	1,740,930.43

TNMP
Electric Division
362.00 Station Equipment

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 49 *Survivor Curve:* L1.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1996	2,197,268.01	49.00	44,840.82	31.49	1,412,044.44
1997	551,397.04	49.00	11,252.65	32.11	361,329.72
1998	1,632,000.04	49.00	33,305.09	32.75	1,090,891.46
1999	3,332,694.52	49.00	68,012.07	33.42	2,273,021.13
2000	4,068,794.67	49.00	83,034.06	34.11	2,832,165.69
2001	4,025,700.17	49.00	82,154.60	34.82	2,860,294.84
2002	2,194,885.87	49.00	44,792.20	35.54	1,592,007.37
2003	5,560,826.76	49.00	113,482.75	36.29	4,117,822.84
2004	6,208,940.22	49.00	126,709.14	37.05	4,694,278.71
2005	2,214,235.09	49.00	45,187.07	37.83	1,709,323.91
2006	3,566,915.56	49.00	72,791.94	38.63	2,811,872.67
2007	557,426.39	49.00	11,375.70	39.45	448,724.60
2008	5,238,381.65	49.00	106,902.44	40.28	4,306,156.62
2009	11,088,997.39	49.00	226,299.06	41.13	9,308,689.28
2010	5,354,946.22	49.00	109,281.23	42.01	4,590,388.48
2011	2,194,441.36	49.00	44,783.13	42.89	1,920,883.74
2012	18,936,954.98	49.00	386,456.50	43.80	16,925,585.90
2013	16,039,501.13	49.00	327,326.62	44.72	14,636,688.46
2014	23,750,007.89	49.00	484,679.03	45.65	22,124,996.20
2015	33,619,658.79	49.00	686,094.24	46.59	31,968,012.99
2016	15,688,905.40	49.00	320,171.83	47.55	15,224,349.29
2017	32,691,089.59	49.00	667,144.44	48.52	32,367,186.74
Total	246,880,608.43	49.00	5,038,223.77	40.51	204,079,136.23

Composite Average Remaining Life ... 40.51 Years

TNMP
Electric Division
366.00 Underground Conduit

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 52 *Survivor Curve:* L2

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1967	10,802.09	52.00	207.73	20.60	4,279.06
1968	18,792.94	52.00	361.40	20.84	7,532.15
1969	7,636.76	52.00	146.86	21.09	3,096.77
1970	18,810.71	52.00	361.74	21.33	7,717.70
1971	33,120.99	52.00	636.94	21.59	13,749.69
1972	63,459.16	52.00	1,220.37	21.84	26,658.21
1973	81,838.79	52.00	1,573.82	22.11	34,795.28
1974	36,376.17	52.00	699.54	22.38	15,654.92
1975	33,791.93	52.00	649.84	22.66	14,723.65
1976	42,502.04	52.00	817.35	22.95	18,754.04
1977	60,781.73	52.00	1,168.88	23.24	27,168.94
1978	85,086.74	52.00	1,636.28	23.55	38,541.24
1979	23,903.13	52.00	459.68	23.88	10,976.15
1980	121,062.50	52.00	2,328.13	24.22	56,379.29
1981	107,883.93	52.00	2,074.69	24.57	50,977.80
1982	108,238.47	52.00	2,081.51	24.94	51,919.96
1983	186,411.95	52.00	3,584.85	25.33	90,820.17
1984	344,817.24	52.00	6,631.10	25.75	170,723.24
1985	511,054.18	52.00	9,827.97	26.18	257,259.12
1986	641,367.86	52.00	12,334.00	26.63	328,485.99
1987	197,177.01	52.00	3,791.87	27.11	102,810.15
1988	447,081.93	52.00	8,597.73	27.62	237,467.08
1989	539,060.78	52.00	10,366.56	28.15	291,847.83
1990	298,693.54	52.00	5,744.11	28.71	164,933.31
1991	1,054,216.88	52.00	20,273.40	29.30	594,058.87
1992	1,022,231.59	52.00	19,658.30	29.92	588,174.75
1993	695,342.20	52.00	13,371.97	30.57	408,729.80

TNMP
Electric Division
366.00 Underground Conduit

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 52 *Survivor Curve:* L2

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1994	1,789,623.76	52.00	34,415.85	31.24	1,075,179.78
1995	1,018,906.77	52.00	19,594.36	31.94	625,905.86
1996	1,648,020.69	52.00	31,692.71	32.67	1,035,461.23
1997	1,318,223.48	52.00	25,350.46	33.43	847,347.32
1998	2,780,214.69	52.00	53,465.68	34.20	1,828,589.37
1999	2,380,399.03	52.00	45,776.91	34.99	1,601,937.19
2000	3,658,585.26	52.00	70,357.42	35.81	2,519,344.37
2001	1,854,614.86	52.00	35,665.68	36.64	1,306,618.94
2002	1,886,685.58	52.00	36,282.42	37.47	1,359,680.13
2003	1,745,071.06	52.00	33,559.06	38.33	1,286,214.68
2004	4,630,645.31	52.00	89,050.89	39.19	3,490,034.35
2005	1,912,700.10	52.00	36,782.70	40.07	1,473,838.69
2006	2,411,879.76	52.00	46,382.31	40.96	1,899,773.94
2007	1,593,832.20	52.00	30,650.62	41.86	1,283,099.97
2008	1,195,633.77	52.00	22,992.96	42.78	983,592.58
2009	524,852.59	52.00	10,093.32	43.71	441,142.75
2010	304,910.07	52.00	5,863.66	44.65	261,794.57
2011	279,494.86	52.00	5,374.90	45.60	245,082.53
2012	214,580.90	52.00	4,126.56	46.56	192,137.01
2013	454,572.62	52.00	8,741.78	47.53	415,536.67
2014	717,634.04	52.00	13,800.66	48.52	669,562.95
2015	637,337.73	52.00	12,256.50	49.51	606,773.27
2016	911,245.07	52.00	17,523.95	50.50	884,983.19
2017	469,617.69	52.00	9,031.11	51.50	465,102.54

TNMP
Electric Division
366.00 Underground Conduit

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 52 *Survivor Curve:* L2

Year	Original Cost	Avg. Service Life	Avg. Annual Accrual	Avg. Remaining Life	Future Annual Accruals
(1)	(2)	(3)	(4)	(5)	(6)
Total	43,130,825.13	52.00	829,439.09	36.67	30,416,969.03

Composite Average Remaining Life ... 36.67 Years

TNMP
Electric Division
368.00 Line Transformers

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 53 **Survivor Curve:** R0.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1938	2.34	53.00	0.04	11.47	0.51
1940	3.52	53.00	0.07	12.27	0.81
1941	3.87	53.00	0.07	12.67	0.93
1942	4.26	53.00	0.08	13.07	1.05
1943	4.68	53.00	0.09	13.47	1.19
1944	5.13	53.00	0.10	13.88	1.34
1945	5.62	53.00	0.11	14.29	1.51
1946	6.15	53.00	0.12	14.69	1.71
1947	6.71	53.00	0.13	15.11	1.91
1948	8.95	53.00	0.17	15.52	2.62
1949	9.75	53.00	0.18	15.94	2.93
1950	10.61	53.00	0.20	16.36	3.28
1951	11.54	53.00	0.22	16.79	3.65
1952	12.53	53.00	0.24	17.21	4.07
1953	13.59	53.00	0.26	17.65	4.52
1954	14.73	53.00	0.28	18.08	5.02
1955	15.95	53.00	0.30	18.52	5.57
1956	17.25	53.00	0.33	18.96	6.17
1957	18.64	53.00	0.35	19.41	6.83
1958	20.13	53.00	0.38	19.86	7.54
1959	21.72	53.00	0.41	20.31	8.32
1960	23.42	53.00	0.44	20.77	9.18
1961	25.22	53.00	0.48	21.23	10.10
1962	27.15	53.00	0.51	21.70	11.12
1963	29.21	53.00	0.55	22.17	12.22
1964	31.39	53.00	0.59	22.65	13.41
1965	33.72	53.00	0.64	23.13	14.71

TNMP
Electric Division
368.00 Line Transformers

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 53 **Survivor Curve: R0.5**

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1966	36.20	53.00	0.68	23.61	16.13
1967	38.83	53.00	0.73	24.10	17.65
1968	41.63	53.00	0.79	24.59	19.31
1969	44.61	53.00	0.84	25.09	21.11
1970	48.74	53.00	0.92	25.59	23.53
1971	59.45	53.00	1.12	26.09	29.27
1972	79.01	53.00	1.49	26.60	39.66
1973	95.25	53.00	1.80	27.12	48.74
1974	114.75	53.00	2.17	27.64	59.84
1975	83.94	53.00	1.58	28.16	44.60
1976	86.74	53.00	1.64	28.69	46.95
1977	121.38	53.00	2.29	29.22	66.92
1978	146.83	53.00	2.77	29.75	82.43
1979	175.52	53.00	3.31	30.29	100.32
1980	183.65	53.00	3.47	30.84	106.85
1981	248.38	53.00	4.69	31.39	147.08
1982	257.59	53.00	4.86	31.94	155.22
1983	306.94	53.00	5.79	32.49	188.17
1984	439.68	53.00	8.30	33.05	274.17
1985	244.77	53.00	4.62	33.61	155.23
1986	233.50	53.00	4.41	34.18	150.57
1987	207.11	53.00	3.91	34.74	135.77
1988	188.79	53.00	3.56	35.32	125.80
1989	152.07	53.00	2.87	35.89	102.98
1990	177.58	53.00	3.35	36.47	122.18
1991	194.28	53.00	3.67	37.05	135.80
1992	293.04	53.00	5.53	37.63	208.05

TNMP
Electric Division
368.00 Line Transformers

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 53 *Survivor Curve:* R0.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1993	182.79	53.00	3.45	38.21	131.79
1994	228.89	53.00	4.32	38.80	167.56
1995	185.89	53.00	3.51	39.39	138.14
1996	235.11	53.00	4.44	39.98	177.34
1997	183.73	53.00	3.47	40.57	140.63
1998	294.89	53.00	5.56	41.16	229.02
1999	304.16	53.00	5.74	41.76	239.63
2000	378.94	53.00	7.15	42.35	302.81
2001	321.19	53.00	6.06	42.95	260.29
2002	288.75	53.00	5.45	43.55	237.26
2003	278.27	53.00	5.25	44.15	231.80
2004	372.75	53.00	7.03	44.75	314.72
2005	369.87	53.00	6.98	45.35	316.49
2006	461.42	53.00	8.71	45.96	400.08
2007	515.77	53.00	9.73	46.56	453.09
2008	351.86	53.00	6.64	47.17	313.13
2009	951.53	53.00	17.95	47.77	857.69
2010	1,152.18	53.00	21.74	48.38	1,051.80
2011	541.45	53.00	10.22	48.99	500.51
2012	589.94	53.00	11.13	49.61	552.15
2013	689.11	53.00	13.00	50.22	652.95
2014	675.90	53.00	12.75	50.83	648.27
2015	812.19	53.00	15.32	51.45	788.44
2016	988.46	53.00	18.65	52.07	971.10
2017	1,675.06	53.00	31.60	52.69	1,665.24

TNMP
Electric Division
368.00 Line Transformers

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 53 *Survivor Curve:* R0.5

Year	Original Cost	Avg. Service Life	Avg. Annual Accrual	Avg. Remaining Life	Future Annual Accruals
(1)	(2)	(3)	(4)	(5)	(6)
Total	17,718.14	53.00	334.30	43.40	14,508.49

Composite Average Remaining Life ... 43.40 Years

TNMP
Electric Division
369.00 Overhead Services

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 44 *Survivor Curve:* L1

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1965	20,361.98	44.00	462.74	18.05	8,353.76
1966	28,990.23	44.00	658.83	18.34	12,083.69
1967	35,119.55	44.00	798.12	18.63	14,871.40
1968	46,881.27	44.00	1,065.42	18.93	20,166.35
1969	79,400.87	44.00	1,804.45	19.22	34,690.52
1970	138,552.96	44.00	3,148.73	19.53	61,483.56
1971	292,527.61	44.00	6,647.93	19.83	131,838.09
1972	453,052.06	44.00	10,295.98	20.14	207,349.66
1973	225,505.25	44.00	5,124.79	20.45	104,805.26
1974	378,152.04	44.00	8,593.82	20.77	178,459.78
1975	329,518.20	44.00	7,488.57	21.09	157,898.23
1976	298,686.97	44.00	6,787.91	21.41	145,310.15
1977	352,226.06	44.00	8,004.63	21.73	173,970.33
1978	404,278.93	44.00	9,187.57	22.06	202,716.04
1979	557,822.96	44.00	12,676.99	22.40	283,939.55
1980	633,857.40	44.00	14,404.93	22.74	327,514.48
1981	629,711.89	44.00	14,310.72	23.08	330,272.34
1982	713,502.02	44.00	16,214.92	23.43	379,838.56
1983	866,500.23	44.00	19,691.94	23.78	468,188.70
1984	903,818.01	44.00	20,540.01	24.13	495,644.73
1985	956,023.67	44.00	21,726.43	24.49	532,083.59
1986	881,568.70	44.00	20,034.38	24.85	497,936.37
1987	751,899.52	44.00	17,087.54	25.22	430,987.47
1988	748,372.60	44.00	17,007.39	25.60	435,310.94
1989	725,920.98	44.00	16,497.16	25.97	428,484.03
1990	779,022.81	44.00	17,703.94	26.36	466,601.20
1991	743,868.91	44.00	16,905.04	26.74	452,094.80

TNMP
Electric Division
369.00 Overhead Services

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2017
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 44 *Survivor Curve:* L1

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1992	1,072,989.17	44.00	24,384.57	27.14	661,699.50
1993	673,974.19	44.00	15,316.62	27.54	421,763.26
1994	712,108.94	44.00	16,183.27	27.95	452,288.31
1995	847,695.79	44.00	19,264.59	28.37	546,578.04
1996	843,755.66	44.00	19,175.05	28.81	552,466.69
1997	954,103.76	44.00	21,682.80	29.27	634,628.26
1998	1,047,701.88	44.00	23,809.89	29.75	708,287.56
1999	1,081,622.68	44.00	24,580.77	30.25	743,472.27
2000	1,589,341.08	44.00	36,119.09	30.77	1,111,276.96
2001	819,093.07	44.00	18,614.57	31.31	582,899.59
2002	794,465.07	44.00	18,054.88	31.88	575,678.91
2003	834,075.19	44.00	18,955.05	32.48	615,684.89
2004	1,023,187.41	44.00	23,252.78	33.10	769,756.57
2005	1,252,697.20	44.00	28,468.58	33.76	960,996.74
2006	622,782.54	44.00	14,153.25	34.43	487,350.75
2007	111,168.65	44.00	2,526.40	35.14	88,772.78
2008	211,242.48	44.00	4,800.66	35.87	172,194.13
2009	1,983,278.39	44.00	45,071.64	36.63	1,650,959.39
2010	723,627.94	44.00	16,445.04	37.41	615,267.20
2011	638,495.17	44.00	14,510.33	38.22	554,614.56
2012	702,164.89	44.00	15,957.28	39.05	623,199.06
2013	783,935.70	44.00	17,815.59	39.91	711,064.60
2014	1,071,871.22	44.00	24,359.16	40.79	993,590.47
2015	957,337.08	44.00	21,756.28	41.69	906,917.54
2016	1,512,361.03	44.00	34,369.66	42.60	1,464,194.51
2017	751,430.36	44.00	17,076.88	43.53	743,391.41

TNMP

Electric Division

369.00 Overhead Services

Original Cost Of Utility Plant In Service

And Development Of Composite Remaining Life as of December 31, 2017

Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 44 *Survivor Curve:* L1

Year	Original Cost	Avg. Service Life	Avg. Annual Accrual	Avg. Remaining Life	Future Annual Accruals
(1)	(2)	(3)	(4)	(5)	(6)
Total	36,591,650.22	44.00	831,575.57	30.46	25,331,887.55

Composite Average Remaining Life ... 30.46 Years

SOAH DOCKET NO. 473-18-3981
PUC DOCKET NO. 48401

APPLICATION OF TEXAS-NEW MEXICO POWER COMPANY FOR AUTHORITY TO CHANGE RATES	**§ § §**	**BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS**

DIRECT TESTIMONY AND EXHIBITS OF DAVID J. GARRETT

WORKPAPERS

PROVIDED ON THE ATTACHED CD

SOAH Docket No. 473-18-3981
PUC Docket No. 48401

Workpapers to the
Direct Testimony & Exhibits of
David J. Garrett

August 13, 2018