



2022 DEPRECIATION STUDY

CALCULATED ANNUAL DEPRECIATION ACCRUAL RATES
APPLICABLE TO COMMON PLANT IN SERVICE
as of December 31, 2021

Prepared for Montana-Dakota Utilities Co.
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SECTION 1

1 STUDY HIGHLIGHTS

Pursuant to Montana-Dakota Utilities Co.'s ("MDU" or the "Company") request, Concentric Advisors, ULC ("Concentric") conducted a depreciation study related to the common general plant accounts, as of December 31, 2021. The purpose of the study is to determine the annual depreciation accrual rates and amounts applicable to the original cost of common utility plant, as of December 31, 2021.

The depreciation rates are based on the broad group Straight-Line method using the Average Life Group ("ALG") procedure and were applied on a Remaining Life basis. The calculations were based on attained ages and estimated average service life and forecasted net salvage characteristics for each depreciable group of assets. Variances between the calculated accrued depreciation and the book accumulated depreciation, as at December 31, 2021, are amortized over the composite remaining life of assets.

MDU's accounting policy has not changed since the last depreciation study.

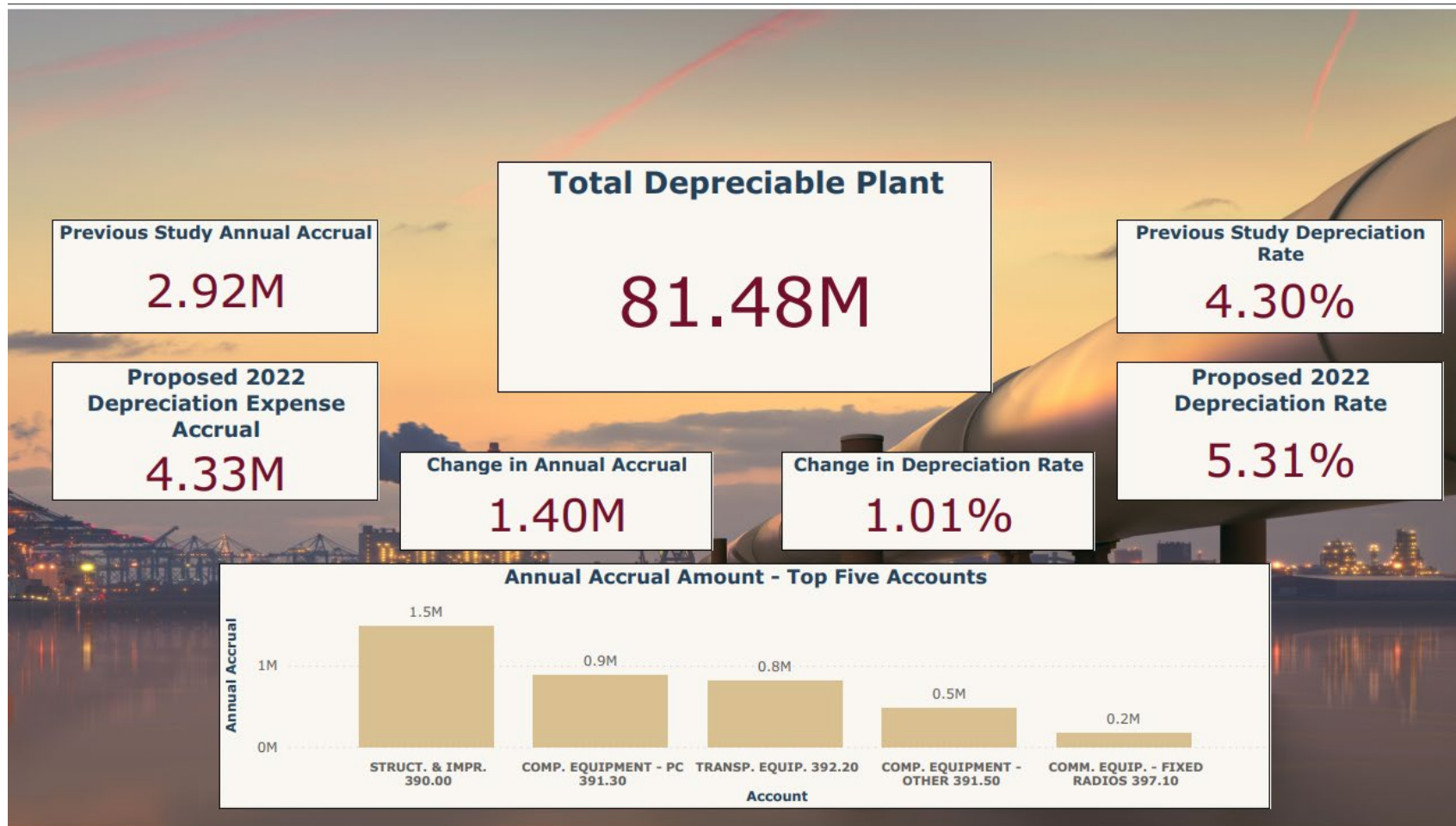
Concentric recommends the calculated annual depreciation accrual rates set forth herein apply specifically to common plant in service, as of December 31, 2021. The annual depreciation accrual rates are summarized by tables related to:

- the total required annual accrual amounts;
- the annual accrual requirements related to the recovery of the original cost of the investment; and
- the annual accrual amount related to the recovery of the expected net salvage requirements at the time of retirement.

Finally, this study results in an annual depreciation expense accrual related to the recovery of original cost and net salvage requirement of \$4.3 million, when applied to depreciable plant study balances, as of December 31, 2021, of \$81.5 million. The study results are summarized at an aggregate functional group level as follows:

SUMMARY OF ORIGINAL COST, ACCRUAL PERCENTAGES AND AMOUNTS

Plant Group / Accounts	Original Cost	Previous Study Annual Accrual		Recommended Annual Accrual	
General Plant	\$81,481,558	4.30%	\$2,924,572	5.31%	\$4,327,970
TOTAL	\$81,481,558	4.30%	\$2,924,572	5.31%	\$4,327,970





SECTION 2

2 BASIS OF THE STUDY

2.1 Scope

This study sets forth the results of the depreciation study for the common general plant assets of MDU, to determine the annual depreciation accrual rates and amounts for book purposes applicable to the original cost of investment as of December 31, 2021. The rates and amounts are based on the Straight-Line Method, incorporating the ALG Procedure applied on a Remaining Life Basis. This study also describes the concepts, methods and judgments which underlie the recommended annual depreciation accrual rates related to the MDU assets in service, as of December 31, 2021.

The service life estimates resulting from the study were based on:

- informed professional judgment which incorporated analyses of historical plant retirement data recorded through December 31, 2021;
- a review of MDU company practice and outlook, as they relate to plant operation and retirement; and
- consideration of current practice in the electric and gas system industries, including knowledge of service life estimates used for other electric and gas system companies.

The depreciation accrual rates presented herein are based on generally-accepted methods and procedures for calculating depreciation. The estimated survivor curves used in this study are based on studies incorporating actual data through 2021 for most accounts.

2.2 Plan of Study

This study is presented in the following order:

Section 1:	Study Highlights, presents a brief summary of the depreciation study and results
Section 2:	Contains statements with respect to the plan and the basis of the study
Section 3:	Development of the Required Depreciation Rates, presents descriptions of the methods used and factors considered in the service life study
Section 4:	Calculation of Annual and Accrued Depreciation, presents the methods and procedures used in the calculation of depreciation
Section 5:	Results of Study, presents summaries by depreciable group of annual and accrued depreciation in Tables 1, 1A, and 1B.
Section 6:	Presents the results of the Retirement Rate Analysis
Section 7:	Presents the results of the Net Salvage Study
Section 8:	Presents the results of the Detailed Depreciation Calculations
Section 9:	Estimation of Survivor Curves, is an overview of Iowa curves and the Retirement Rate Analysis
Section 10:	Estimation of Net Salvage discusses the methodology used in calculating net salvages



2.3 Depreciation

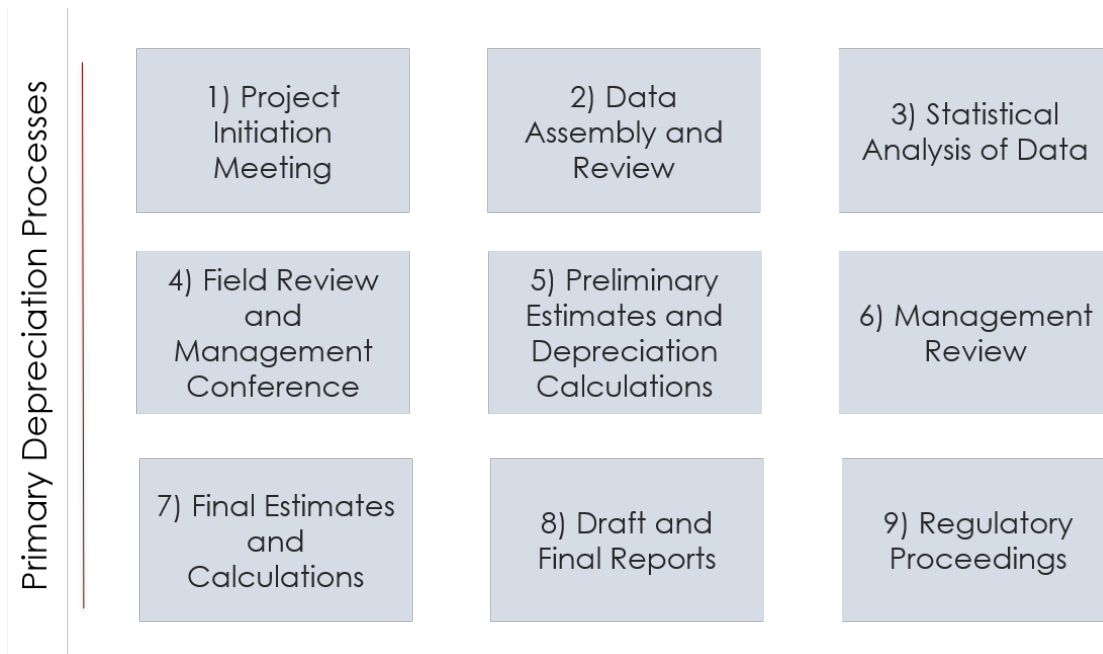
A full and comprehensive depreciation study includes the following components:

1. supported recommendations regarding Average Service Life estimates for each account;
2. supported recommendations regarding estimated Net Salvage requirements for each account;
3. selection of an appropriate grouping procedure;
4. detailed calculation of the depreciation rate utilizing the estimated Average Service Life and Net Salvage requirements; and
5. a document explaining the procedures followed and justifying the results in a format suitable for submission to senior management and regulatory authorities.

A diagram of the nine primary processes followed by Concentric in the development of the depreciation study is provided below. Each of the steps is undertaken by Concentric using proprietary software.

For most accounts, the annual and accrued depreciation were calculated by the Straight-Line Method using the ALG Procedure. For certain general plant accounts, the annual and accrued depreciation are based on amortization accounting. Both types of calculations were based on original cost, attained ages and an estimate of service lives.

Consistent with the current MDU practice, amortization accounting continues to be recommended for certain general plant accounts because of the disproportionate plant accounting effort required in these accounts. Many regulated utilities in North America have received approval to adopt amortization accounting for these accounts.





2.4 Information Provided by MDU

MDU has provided Concentric with the required information, as of December 31, 2021 for all accounts being studied in this study. This information includes the following:

- Current balances by vintage year for each account (aged balances) through December 31, 2021. The balances provide the amount of investment sorted by installation year. This file is only inclusive of plant in service and does not include any retirement information;
- retirement transactions for all accounts through December 31, 2021. The transactions include information regarding the transaction year of the retirement, the installation year of the asset being retired, and the original cost of the asset being retired; and
- cost of removal and gross salvage transactions for all accounts requiring the recovery of net salvage through December 31, 2021. The transactions include information regarding the transaction year of the retirement, the costs associated with the retirement, and any gross salvage proceeds from the sale or reuse of the property.

2.5 Data Reconciliation

The above data was reviewed and reconciled to Company control schedules to ensure accuracy and reasonableness in use of the calculations developed in this study. These checks include:

- that the surviving investment by account equals (or can be reconciled to) the Company's gross plant in service and accumulated depreciation ledger balances;
- that the surviving investment in each vintage is not negative. In other words, this check confirms that the sum of retirements from any given vintage have not exceeded the amount of plant additions to the vintage; and
- that any adjusting transactions are properly accounted for within the databases.



SECTION 3

3 DEVELOPMENT OF THE REQUIRED DEPRECIATION RATES

3.1 Depreciation

The development of the depreciation calculations requires the input of an average service life, a retirement dispersion curve (i.e. Iowa curve) and net salvage recommendations (i.e. the depreciation parameters). Additionally, to complete the depreciation calculations, the calculation methods must be established. Specifically, the selection of the depreciation method must establish three types of additional input:

1. the choice of a depreciation method;
2. a basis upon which to apply the method, and
3. in the case of group assets, a procedure to use in grouping the assets.

In this study, the depreciation rates for MDU have been calculated in accordance with the Straight-Line method, the ALG procedure and applied using the Remaining Life technique where any accumulated depreciation variances are trued-up within the depreciation rate calculations over the composite remaining life of each account.

Depreciation, as applied to depreciable plant, means the loss in service value not restored by current maintenance, incurred in connection with the consumption or prospective retirement of common plant in the course of service from causes which are known to be in current operation and against which the utility is not protected by insurance. Among the causes to be given consideration are wear and tear, decay, action of the elements, inadequacy, obsolescence, changes in the art and changes in demand and requirements of public authorities.¹

When considering the action of the elements, the average service life and net salvage calculations have considered large catastrophic events that have occurred and impacted the life estimates of utilities across North America. The average service life of utilities has been influenced by events including:

- forest fires;
- earthquakes;
- tornadoes;
- ice storms;
- wind-storms;
- large scale flooding;
- fires;
- lightning;
- intentional actions of third parties;
- hoar frost; and
- other natural forces of nature.

¹ The National Association of Railroad and Utilities Commissioners, Uniform System of Accounts for Gas Utilities.



Depreciation, as used in accounting, is a method of distributing fixed capital costs, less net salvage, over a period of time by allocating annual amounts to expense. Each annual amount of such depreciation expense is part of that year's total cost of providing utility service. Normally, the period of time over which the fixed capital cost is allocated to the cost of service is equal to the period of time over which an item renders service - that is, the item's service life. The most prevalent method of allocation is to distribute an equal amount of cost to each year of service life. This method is known as the Straight-Line method of depreciation.

The calculation of annual and accrued depreciation based on the Straight-Line method requires the estimation of survivor curves and is described in the following sections of this report. The development of the proposed depreciation rates also requires the selection of group depreciation procedures, as discussed below.

3.1.1 Study Depreciation Methods and Procedures

When more than a single item of property is under consideration, a group procedure for depreciation is appropriate because normally all of the items within a group do not have identical service lives but have lives that are dispersed over a range of time. There are two primary group procedures, namely, the Average Life Group (ALG) and Equal Life Group (ELG) procedures.

In the ALG Procedure, the rate of annual depreciation is based on the average service life of the group. This rate is applied to the surviving balances of the group's cost. A characteristic of this procedure is that the cost of plant retired prior to average life is not fully recouped at the time of retirement, whereas the cost of plant retired subsequent to the average life is more than fully recouped. Over the entire life cycle, the portion of cost not recouped prior to average life is balanced by the cost recouped subsequent to average life.

In the Equal Life Group Procedure, also known as the Unit Summation Procedure, the property group is subdivided according to service life. That is, each equal life group includes that portion of the property which experiences the life of that specific group. The relative size of each equal life group is determined from the property's life dispersion curve. The calculated depreciation for the property group is the summation of the calculated depreciation based on the service life of each equal life unit.

For most accounts, the annual and accrued depreciation were calculated by the Straight-Line Method using the ALG Procedure. For certain general plant accounts, the annual and accrued depreciation are based on amortization accounting. Both types of calculations were based on original cost, attained ages and an estimate of service lives.

While the Equal Life Group Procedure provides an enhanced matching of depreciation expense to the consumption of service value, the Straight-Line Method, Average Life Group Procedure is a commonly used depreciation calculation that has been widely accepted in jurisdictions throughout North America including MDU in prior studies. Concentric recommends its continued use.

Amortization accounting is used for certain general plant accounts because of the disproportionate plant accounting effort required in these accounts. Many regulated utilities in North America have received approval to adopt amortization accounting for these accounts. This study calculates the annual and accrued depreciation using the Straight-Line Method and ALG Procedure for most



accounts. For certain general plant accounts, the annual and accrued depreciation are based on amortization accounting. Both types of calculations were based on original cost, attained ages and estimates of service lives. Variances between the calculated accrued depreciation and the book accumulated depreciation are amortized over the composite remaining life of each account within the remaining life calculations.

Continued monitoring and maintenance of the accumulated depreciation reserve at the account level is recommended. Concentric has determined an amortization amount to correct the present variance with the calculated accrued depreciation (theoretical reserve) over the composite remaining life of each account.

3.1.2 Changes Since Last MDU Full Depreciation Study

The depreciation rates calculated in this study were calculated on the same manner as used in the prior full depreciation study – i.e. using the straight-line method, the ALG Procedure applied on a remaining life basis. However, Concentric notes that in the application of the remaining life basis, the prior study calculated the remaining life on a broad average basis, whereas Concentric incorporates a refinement into the remaining life calculations based on a weighted investment by vintage approach. The vintaged remaining life approach weighs the calculations of remaining life on an allocation of the actual book accumulated depreciation account by the Calculated Accumulated Depreciation (CAD) factor determined for each vintage of plant in service. This method is described as a CAD weighted calculation in the textbook *Depreciation Systems* by Frank K. Wolf and W. Chester Fitch, published by the Iowa State University in 1994 under the title “Adjustments” within the Broad Group Model.

In contrast, the remaining life calculations in prior studies was based on a broad averaging of the composite remaining life. The method is also discussed as the Amortization Method (AM) in *Depreciation Systems* under the title “Adjustments” within the Broad Group Model.

When depreciation rates are calculated utilizing a remaining life technique, the depreciation rate is established by dividing the undepreciated value of each group of assets (after consideration to the net salvage requirements) by the composite remaining life of the group of assets. This calculation is made for each vintage surviving investment as of the date of the study (December 31, 2021), and then composited into a calculation for the account or group as a whole. This calculation requires two estimates:

1. The actual booked accumulated depreciation for each vintage within each account.

MDU does not track the booked accumulated depreciation reserve by vintage within each account. Rather the depreciation expense is calculated at an account level and booked to accumulated depreciation at the same account level. Concentric notes that this is the practice employed by virtually all regulated utilities. As such, the accumulated depreciation by account is allocated within the account to each vintage, on the basis of the calculated accumulated depreciation by vintage. The calculated accumulated depreciation is a function of the estimated survivor curve, the average service life estimate, the net salvage estimates and the achieved age of each vintage.



2. The estimated remaining life of each vintage with each account. The estimated remaining life of each vintage is a direct function of the achieved age of each vintage, the estimated survivor curve and the average service life estimate.

Once the above two estimates are determined (the allocated booked reserve by vintage and the average remaining life of each vintage), an annual accrual requirement for each vintage is determined by dividing the net book value for each vintage (considering the estimated future salvage requirements) by the average remaining life of the vintage. The annual requirement for each vintage is summed at the account level and divided into the sum of the accounts original cost surviving as of December 31, 2021.

This process results in each vintage's calculated net book value to be depreciated over an appropriate remaining life. This vintage weighting on CAD approach to the remaining life calculations is widely considered to be the most accurate. Concentric agrees and views this methodology as the correct and most appropriate calculation.

3.1.3 Survivor Curves

The use of an average service life or a property group implies that the various units in the group have different lives. Thus, the average life may be obtained by determining the separate lives of each of the units, or by constructing a survivor curve plotting the number of units which survive at successive ages using the retirement rate method of analysis.

The range of survivor characteristics usually experienced by utility and industrial properties is encompassed by a system of generalized survivor curves known as the Iowa type curves. The Iowa curves *"...were sorted into three groups according to whether the mode was to the left, approximately coincident with, or to the right of the average-life ordinate. The curves in each of these three groups were then sub-classified in accordance with the height of the mode, taking also into consideration the distance of the mode to the left or right of the average life."*² The Iowa curves are described as L-type (i.e. left-moded), R-type (i.e. right-moded), and S-type (i.e. symmetrical). Further development resulted in the introduction of O-type (i.e. origin-moded curves) where the greatest frequency of retirement occurs at the origin, or immediately after age zero. Individual type curves are further depicted with numerical subscripts which represent the relative heights of the modes of the frequency curves within each family.

The program that is used by Concentric for statistical smooth curve fitting utilizes an internal "goodness-of-fit" criterion known as the Residual Measure. This Residual Measure is based on a least squares solution of the differences between the stub curve (or original data points) and smooth survivor curve which also requires a balancing of the differences above and below the stub curve.

The criterion of goodness-of-fit is the mean square of the differences between the points on the stub and fitted smooth survivor curves. The residual measure, or standard error of estimate, shown in the output format is the square root of this mean square. As such, the lower the Residual Measure the better the statistical fit between the analyzed Iowa curve and the observed data points. Concentric

² Robley Winfrey, Statistical Analyses of Industrial Property Retirements, Bulletin 125 revised (Engineering Research Institute, Iowa State University, 1935) 65



follows the widely used practice of fitting Iowa curves up to one percent of the maximum exposures. This standard practice is utilized to minimize the influence of typically small retirements applied to similarly small exposures which may unduly affect the Iowa curve fitting process. However, Concentric will recognize the observed data points beyond the one percent of maximum exposures if it is determined that the additional data is a valid consideration for life recommendation.

A discussion of the general concept of survivor curves and retirement rate method is presented in Section 9.

3.1.4 Survivor Curve and Net Salvage Judgments

The service life and net salvage estimates used in the depreciation and amortization calculations were based on informed professional judgment which incorporated a review of management's plans, policies and outlook, a general knowledge of the electric and gas utility industries, and comparisons of the service life and net salvage estimates from Concentric's studies of other utilities. The use of survivor curves, to reflect the expected dispersion of retirement, provides a consistent method of estimating depreciation for plant. Iowa type survivor curves were used to depict the estimated survivor curves for the plant accounts not subject to amortization accounting.

The procedure for estimating service lives consisted of compiling historical data for the plant accounts or depreciable groups, analyzing this history through the use of widely accepted techniques, and forecasting the survivor characteristics for each depreciable group on the basis of interpretations of the historical data and the probable future. The forecasting of a probable future included management and operational staff interviews. The combination of the historical experience and the probable future yielded estimated survivor curves from which the average service lives were derived.

The resultant depreciation rates are summarized in the applicable tables of this study (Section 5). The depreciation rates should be reviewed periodically to reflect the changes that result from plant and reserve account activity. A depreciation reserve deficiency or surplus will develop if future capital expenditures vary significantly from those anticipated in this study.

The estimates of net salvage for the mass property accounts were based mostly in part on historical data related to actual retirement activity for the years 1968 through 2021, for most accounts. Gross salvage and cost of removal as recorded to the depreciation reserve account and related to experienced retirements were used. Concentric notes the data from the previous depreciation consultant was used and considered in the historic net salvage analysis, but more relevancy was placed on the more recent data from 2009 through 2021 provided directly to Concentric by MDU. Percentages of the cost of plant retired were calculated for each component of net salvage on an annual, three-year, five-year, and on a cumulative moving average basis.

The following discussion, dealing with a number of accounts which comprise the majority of the investment analyzed, presents an overview of the factors considered by Concentric in the determination of the average service life and net salvage estimates. The survivor curve estimates for the remainder of the accounts not discussed in the following sections were based on similar considerations.



ACCOUNT 390 – STRUCTURES AND IMPROVEMENTS

Investment \$	Investment %	Previously Approved Curves	Concentric Recommended Curve	Previously Approved Salvage	Concentric Recommended Salvage
\$57,959,115	71.13%	38-R3	40-R2	0%	-5%

The investment in Structures and Improvements is approximately \$57.9 million, representing 71 percent of the total depreciable plant studied. The retirements, additions and other plant transactions, for the period 1952 through 2021, were analyzed by the retirement rate method. Retirements, for the period 2009 through 2021, of \$7,806,923.44 were recorded for this period. The currently approved life parameter is an Iowa 38-R3 that produced a fit with a related residual measure of 3.0467. An Iowa 40-R2 produced a better fit with a residual measure of 2.5362, as depicted on page 6-2. Discussions with MDU operational and management staff indicated that the Iowa 40-R2 is a good representation of the historical life and future expectations. Based on the above discussion and considerations, and on Concentric's experience, an Iowa 40-R2 is a reasonable expectation for the investment in this account. As such, Concentric recommends an Iowa 40-R2 to represent the future expectations for the investment in this account.

This account currently has a previously approved net salvage of zero percent. This account has shown a wide range in historical net salvage activity since 1968. The range has been from negative 31 percent to positive 43 percent. A three-year band produces results that range from over negative 1,000 percent to over positive 100 percent. The five-year band ranges from over negative 500 to over positive 1,000 percent. The full depth band averages positive 21 percent. At this time, Concentric recommends that a slight step down to a negative five percent net salvage estimate be used in the depreciation calculations within this study.

ACCOUNT 392.1- TRANSPORTATION EQUIPMENT – TRAILERS

Investment \$	Investment %	Previously Approved Curves	Concentric Recommended Curve	Previously Approved Salvage	Concentric Recommended Salvage
\$18,482	0.02%	25-L1	25-R1	20%	15%

The investment in this account relates to Transportation Equipment - Trailers. The investment in this account is approximately \$18 thousand, representing 0.02 percent of the total depreciable plant studied. The retirements, additions and other plant transactions, for the period 1937 through 2021, were analyzed by the retirement rate method. Retirements, for the period 2009 through 2021, of \$55,565.59 were recorded for this period. The currently approved life parameter is an Iowa 25-L1 which produced a fit with a related residual measure of 1.748. An Iowa 25-R1 produced a fit with a related residual measure of 1.7738, as depicted on page 6-6. Discussions with MDU operational and management staff indicated that the Iowa 25-R1 is a good representation of the historical life and future expectations. Based on the above and considerations, and on Concentric's experience, an Iowa 25-R1 is a reasonable expectation for the investment in this account. As such, Concentric recommends an Iowa 25-R1 to represent the future expectations for the investment in this account.

This account currently has an approved net salvage of positive 20 percent. This account has shown a limited range in the historical net salvage activity with low retirements since 2013. At this time,



Concentric recommends that a positive 15 percent net salvage estimate be used in the depreciation calculations within this study.

ACCOUNT 392.2 – TRANSPORTATION EQUIPMENT – VEHICLES

Investment \$	Investment %	Previously Approved Curves	Concentric Recommended Curve	Previously Approved Salvage	Concentric Recommended Salvage
\$8,552,949	10.5%	9-R3	10-L2.5	20%	20%

The investment in this account relates to Transportation Equipment – Vehicles. This includes everything from $\frac{1}{4}$ ton trucks to $\frac{3}{4}$ ton trucks, service trucks, and trucks with cranes.

The investment in Transportation Equipment - Vehicles is approximately \$8.5 million, representing 10.5 percent of the total depreciable plant studied. The retirements, additions and other plant transactions, for the period 1979 through 2021, were analyzed by the retirement rate method. Retirements, for the period 2009 through 2021, of \$7,601,423.76 were recorded for this period. The currently approved life parameter for the MDU account is an Iowa 9-R3 that produced a fit with a related residual measure of 0.2624. Data analysis and discussion with MDU personnel indicated that a slight adjustment to a 10-L2.5, with a residual measure of 0.1571, produced a better visual and mathematical fit, and is a reasonable expectation for the investment in this account. As such, Concentric recommends an Iowa 10-L2.5 going forward to represent the future expectations for the investment in this account.

This account currently has an approved net salvage of positive 20 percent. This account has shown a close range in historical net salvage activity since 2009. The range has been from positive 31 percent to positive 82 percent. A three-year band produces results that range from positive 15 percent to positive 49 percent. The five-year band ranges from positive 18 percent to positive 68 percent. The full depth band averages positive 31 percent. At this time, Concentric recommends that a positive 20 percent net salvage estimate continue to be used in the depreciation calculations within this study.



SECTION 4

4 CALCULATION OF ANNUAL AND ACCRUED DEPRECIATION

4.1 Calculation of Annual and Accrued Amortization

Amortization is the gradual extinguishment of an amount in an account by distributing such amount over a fixed period, over the life of the asset or liability to which it applies, or over the period during which it is anticipated the benefit will be realized. Normally, the distribution of the amount is in equal amounts to each year of the amortization period.

The calculation of annual and accrued amortization requires the selection of an amortization period. The amortization periods used in this report were based on judgment which incorporated a consideration of the period during which the assets will render most of their service, the amortization period and service lives used by other utilities, and the service life estimates previously used for the asset under depreciation accounting.

Amortization accounting is proposed for a number of accounts that represent numerous units of property, but a very small portion of depreciable plant in service. The accounts and their amortization periods are as follows:

Account	Title	Investment	Recommended Amortization Period in Years
391.1	Office Furniture & Equipment	\$2,130,096	15
391.3	Computer Equipment – PC	\$3,638,802	5
391.5	Computer Equipment – Other	\$2,045,305	5
393.0	Stores Equipment	\$174,519	30
394.1	Tools, Shop, & Garage Equipment	\$759,520	20
394.3	Vehicle Maintenance Equipment	\$46,590	20
394.4	Vehicle Refueling Equipment	\$3,815	20
397.1	Communication Equipment – Fixed Radios	\$2,454,294	15
397.2	Communication Equipment – Mobile Radios	\$1,069,272	15
397.3	General Telephone Communication Equipment	\$681,544	10
397.5	Supervisory & Telemetry Equipment	\$15,704	10
397.8	Network Equipment	\$387,937	5
398.0	Miscellaneous Equipment	\$1,543,614	25

For the purpose of calculating annual amortization amounts, as of December 31, 2021, the book depreciation reserve for each plant account (or sub-account) is assigned or allocated to vintages. The book reserve assigned to vintages with an age greater than the amortization period is equal to the vintage's original cost. The remaining book reserve is allocated among vintages with an age less than



the amortization period in proportion to the calculated accrued amortization. The calculated accrued amortization is equal to the original cost multiplied by the ratio of the vintage's age to its amortization period. The annual amortization amount is determined by dividing the future amortizations (original cost less allocated book reserve) by the remaining period of amortization for the vintage.

4.2 Monitoring of Book Accumulated Depreciation

The calculated accrued depreciation or amortization represents that portion of the depreciable cost which will not be allocated to expense through future depreciation accruals, if current forecasts of service life characteristics materialize and are used as a basis for depreciation accounting. Thus, the calculated accrued depreciation provides a measure of the book accumulated depreciation. The use of this measure is recommended in the amortization of book accumulated depreciation variances to insure complete recovery of capital over the life of the property.

The recommended amortization of the variance between the book accumulated depreciation and the calculated accrued depreciation is based on an amortization period equal to the composite remaining life for each property group where the variance exceeds five percent of the calculated accrued depreciation.

The composite remaining life for use in the calculation of accumulated depreciation variances is derived by developing the composite sum of the individual vintage remaining lives.



SECTION 5

5 RESULTS OF THE STUDY

5.1 Qualification of Results

The calculated annual and accrued depreciation are the principal results of the study and are shown in Tables 1, 1A, and 1B, related to investment as of December 31, 2021. Continued surveillance and periodic revisions are normally required to maintain continued use of appropriate annual depreciation accrual rates. An assumption that accrual rates can remain unchanged over a long period of time implies a disregard for the inherent variability in service lives and salvage and for the change of the composition of property in service. The annual accrual rates and the accrued depreciation were calculated in accordance with the Straight-Line method, using the ALG procedure, based on estimates which reflect considerations of current historical evidence and expected future conditions.

5.2 Description of Detailed Tabulations

The following tables provide summaries by account of the original cost of investment, calculated and booked accumulated depreciation amounts, the required amount of annual depreciation expense, the required depreciation rate to be applied against the original cost of the account and the estimated composite remaining life of the surviving plant in service.

The detailed calculations of annual depreciation applicable to depreciable assets, as of December 31, 2021, are presented in account sequence starting in Section 5 – Page 5-2. The tables indicate the estimated average survivor curves used in the calculations. The tables set forth (for each installation year) the original cost, calculated accrued depreciation and the calculated annual accrual.

MONTANA-DAKOTA UTILITIES CO. - COMMON PLANT

TABLE 1. REVISED SUMMARY OF SERVICE LIFE AND NET SALVAGE ESTIMATES AND CALCULATED ANNUAL AND ACCRUED DEPRECIATION RELATED TO THE RECOVERY OF AVERAGE ORIGINAL COST IN COMMON PLANT AS OF DECEMBER 31, 2021

- TOTAL -

ACCOUNT	DESCRIPTION	ESTIMATED SURVIVOR CURVE	NET SALVAGE PERCENT	SURVIVING ORIGINAL COST AS OF 12/31/2021	CALCULATED ACCRUED DEPRECIATION	BOOK RESERVE	ACCRUAL AMOUNT	RATE	REMAINING LIFE
GENERAL PLANT									
390.0	STRUCTURES & IMPROVEMENTS	40-R2	-5	57,959,115	16,797,415	17,279,728	1,490,513	2.57%	29.0
391.1	OFFICE FURNITURE & EQUIPMENT	15-SQ	0	2,130,096	1,006,971	980,352	144,983	6.81%	7.9
391.3	COMPUTER EQUIPMENT - PC	5-SQ	0	3,638,802	1,803,390	1,465,895	886,780	24.37%	2.5
391.5	COMPUTER EQUIPMENT - OTHER	5-SQ	0	2,045,305	990,748	806,878	484,639	23.70%	2.6
392.1	TRANSPORTATION EQUIPMENT - TRAILERS	25-R1	15	18,482	4,321	4,252	633	3.42%	18.1
392.2	TRANSPORTATION EQUIPMENT	10-L2.5	20	8,552,949	2,647,624	1,941,593	825,496	9.65%	6.1
393.0	STORES EQUIPMENT	30-SQ	0	174,519	44,725	50,428	5,123	2.94%	22.3
394.1	TOOLS, SHOP, & GARAGE EQUIPMENT	20-SQ	0	759,520	329,182	602,422	9,640	1.27%	11.3
394.3	VEHICLE MAINTENANCE EQUIPMENT	20-SQ	0	46,590	36,560	36,561	2,328	5.00%	4.3
394.4	VEHICLE REFUELING EQUIPMENT	20-SQ	0	3,815	3,147	3,815	-	0.00%	3.5
397.1	COMMUNICATION EQUIPMENT - FIXED RADIOS	15-SQ	0	2,454,294	1,108,474	1,075,983	172,894	7.04%	8.2
397.2	COMMUNICATION EQUIPMENT - MOBILE RADIOS	15-SQ	0	1,069,272	658,235	644,848	75,385	7.05%	5.8
397.3	GENERAL TELEPHONE COMMUNICATION EQUIPMENT	10-SQ	0	681,544	508,725	483,979	80,619	11.83%	2.5
397.5	SUPERVISORY & TELEMETERING EQUIPMENT	10-SQ	0	15,704	11,645	7,698	4,356	27.74%	2.6
397.8	NETWORK EQUIPMENT	5-SQ	0	387,937	187,973	139,218	97,514	25.14%	2.6
398.0	MISCELLANEOUS EQUIPMENT	25-SQ	0	1,543,614	529,827	695,508	47,067	3.05%	16.4
TOTAL GENERAL PLANT				81,481,558	26,668,962	26,219,158	4,327,970	5.31%	
TOTAL COMMON PLANT STUDIED				81,481,558	26,668,962	26,219,158	4,327,970	5.31%	
PLANT NOT STUDIED									
303.0	MISCELLANEOUS INTANGIBLE PLANT			68,089,437					
389.0	LAND & LAND RIGHTS GENERAL			3,285,775					
392.3	AIRCRAFT EQUIPMENT			5,104,289					
TOTAL PLANT				157,961,059					

MONTANA-DAKOTA UTILITIES CO. - COMMON PLANT

**TABLE 1A. REVISED SUMMARY OF SERVICE LIFE AND NET SALVAGE ESTIMATES AND CALCULATED ANNUAL AND
ACCRUED DEPRECIATION RELATED TO THE RECOVERY OF AVERAGE ORIGINAL COST IN COMMON PLANT AS OF DECEMBER 31, 2021
- LIFE -**

ACCOUNT	DESCRIPTION	ESTIMATED SURVIVOR CURVE	NET SALVAGE PERCENT	SURVIVING ORIGINAL COST AS OF 12/31/2021	CALCULATED ACCRUED DEPRECIATION	BOOK RESERVE	ACCRAAL AMOUNT	RATE	REMAINING LIFE
GENERAL PLANT									
390.0	STRUCTURES & IMPROVEMENTS	40-R2	0	57,959,115	15,997,538	18,045,786	1,318,028	2.27%	29.0
391.1	OFFICE FURNITURE & EQUIPMENT	15-SQ	0	2,130,096	1,006,971	980,352	144,983	6.81%	7.9
391.3	COMPUTER EQUIPMENT - PC	5-SQ	0	3,638,802	1,803,390	1,465,895	886,780	24.37%	2.5
391.5	COMPUTER EQUIPMENT - OTHER	5-SQ	0	2,045,305	990,748	806,878	484,639	23.70%	2.6
392.1	TRANSPORTATION EQUIPMENT - TRAILERS	25-R1	15	18,482	4,321	4,252	633	3.42%	18.1
392.2	TRANSPORTATION EQUIPMENT	10-L2.5	20	8,552,949	2,647,624	1,941,593	825,496	9.65%	6.1
393.0	STORES EQUIPMENT	30-SQ	0	174,519	44,725	50,428	5,123	2.94%	22.3
394.1	TOOLS, SHOP, & GARAGE EQUIPMENT	20-SQ	0	759,520	329,182	602,422	9,640	1.27%	11.3
394.3	VEHICLE MAINTENANCE EQUIPMENT	20-SQ	0	46,590	36,560	36,561	2,328	5.00%	4.3
394.4	VEHICLE REFUELING EQUIPMENT	20-SQ	0	3,815	3,147	3,815	-	0.00%	3.5
397.1	COMMUNICATION EQUIPMENT - FIXED RADIOS	15-SQ	0	2,454,294	1,108,474	1,075,983	172,894	7.04%	8.2
397.2	COMMUNICATION EQUIPMENT - MOBILE RADIOS	15-SQ	0	1,069,272	658,235	644,848	75,385	7.05%	5.8
397.3	GENERAL TELEPHONE COMMUNICATION EQUIPMENT	10-SQ	0	681,544	508,725	483,979	80,619	11.83%	2.5
397.5	SUPERVISORY & TELEMETERING EQUIPMENT	10-SQ	0	15,704	11,645	7,698	4,356	27.74%	2.6
397.8	NETWORK EQUIPMENT	5-SQ	0	387,937	187,973	139,218	97,514	25.14%	2.6
398.0	MISCELLANEOUS EQUIPMENT	25-SQ	0	1,543,614	529,827	695,508	47,067	3.05%	16.4
TOTAL GENERAL PLANT				81,481,558	25,869,085	26,985,216	4,155,485	5.10%	
TOTAL COMMON PLANT STUDIED				81,481,558	25,869,085	26,985,216	4,155,485	5.10%	
PLANT NOT STUDIED									
303.0	MISCELLANEOUS INTANGIBLE PLANT			68,089,437					
389.0	LAND & LAND RIGHTS GENERAL			3,285,775					
392.3	AIRCRAFT EQUIPMENT			5,104,289					
TOTAL PLANT				157,961,059					

MONTANA-DAKOTA UTILITIES CO. - COMMON PLANT

TABLE 1B. REVISED SUMMARY OF SERVICE LIFE AND NET SALVAGE ESTIMATES AND CALCULATED ANNUAL AND ACCRUED DEPRECIATION RELATED TO THE RECOVERY OF NET SALVAGE IN COMMON PLANT AS OF DECEMBER 31, 2021
- NET SALVAGE -

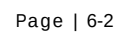
ACCOUNT	DESCRIPTION	ESTIMATED SURVIVOR CURVE	NET SALVAGE PERCENT	SURVIVING ORIGINAL COST AS OF 12/31/2021	CALCULATED ACCRUED DEPRECIATION	BOOK RESERVE	ACCRUAL AMOUNT	RATE
GENERAL PLANT								
390.0	STRUCTURES & IMPROVEMENTS	40-R2	-5	57,959,115	799,877	(766,058)	172,485	0.30%
391.1	OFFICE FURNITURE & EQUIPMENT	15-SQ	0	2,130,096	-	-	-	0.00%
391.3	COMPUTER EQUIPMENT - PC	5-SQ	0	3,638,802	-	-	-	0.00%
391.5	COMPUTER EQUIPMENT - OTHER	5-SQ	0	2,045,305	-	-	-	0.00%
392.1	TRANSPORTATION EQUIPMENT - TRAILERS	25-R1	0	18,482	-	-	-	0.00%
392.2	TRANSPORTATION EQUIPMENT	10-L2.5	0	8,552,949	-	-	-	0.00%
393.0	STORES EQUIPMENT	30-SQ	0	174,519	-	-	-	0.00%
394.1	TOOLS, SHOP, & GARAGE EQUIPMENT	20-SQ	0	759,520	-	-	-	0.00%
394.3	VEHICLE MAINTENANCE EQUIPMENT	20-SQ	0	46,590	-	-	-	0.00%
394.4	VEHICLE REFUELING EQUIPMENT	20-SQ	0	3,815	-	-	-	0.00%
397.1	COMMUNICATION EQUIPMENT - FIXED RADIOS	15-SQ	0	2,454,294	-	-	-	0.00%
397.2	COMMUNICATION EQUIPMENT - MOBILE RADIOS	15-SQ	0	1,069,272	-	-	-	0.00%
397.3	GENERAL TELEPHONE COMMUNICATION EQUIPMENT	10-SQ	0	681,544	-	-	-	0.00%
397.5	SUPERVISORY & TELEMETERING EQUIPMENT	10-SQ	0	15,704	-	-	-	0.00%
397.8	NETWORK EQUIPMENT	5-SQ	0	387,937	-	-	-	0.00%
398.0	MISCELLANEOUS EQUIPMENT	25-SQ	0	1,543,614	-	-	-	0.00%
TOTAL GENERAL PLANT				81,481,558	799,877	(766,058)	172,485	0.21%
TOTAL COMMON PLANT STUDIED				81,481,558	799,877	(766,058)	172,485	0.21%
PLANT NOT STUDIED								
303.0	MISCELLANEOUS INTANGIBLE PLANT			68,089,437				
389.0	LAND & LAND RIGHTS GENERAL			3,285,775				
392.3	AIRCRAFT EQUIPMENT			5,104,289				
TOTAL PLANT				157,961,059				



SECTION 6

6 RETIREMENT RATE ANALYSIS

Actual and Smooth Survivor Curves



MDU Common

Account 390.00 - Structures & Improvements

Placement Band - 1952 - 2021 Experience Band - 2009 - 2021

RETIREMENT RATE ANALYSIS

Age at Begin of Interval	Exposures at Beginning of Age Interval	Retirements During Age Interval	Retmt Ratio	Survivor Ratio	% Surviving
0	65,766,039	13,475	0.00020	0.99980	100.00
0.5	65,679,966	39,092	0.00060	0.99940	99.98
1.5	57,830,913	20,887	0.00036	0.99964	99.92
2.5	56,318,909	1,003,331	0.01782	0.98218	99.88
3.5	52,804,475	3,429,736	0.06495	0.93505	98.10
4.5	45,614,835	263,478	0.00578	0.99422	91.73
5.5	43,986,084	142,215	0.00323	0.99677	91.20
6.5	43,276,893	110,672	0.00256	0.99744	90.91
7.5	27,321,253	24,730	0.00091	0.99909	90.68
8.5	26,974,929	4,989	0.00018	0.99982	90.60
9.5	25,865,503	13,890	0.00054	0.99946	90.58
10.5	25,422,780	0	0.00000	1.00000	90.53
11.5	23,139,844	16,504	0.00071	0.99929	90.53
12.5	23,123,340	40,006	0.00173	0.99827	90.47
13.5	22,285,383	48,884	0.00219	0.99781	90.31
14.5	22,065,083	4,793	0.00022	0.99978	90.11
15.5	22,040,286	15,872	0.00072	0.99928	90.09
16.5	18,129,628	33,129	0.00183	0.99817	90.03
17.5	16,870,206	112,893	0.00669	0.99331	89.87
18.5	16,566,860	130,387	0.00787	0.99213	89.27
19.5	16,029,336	0	0.00000	1.00000	88.57
20.5	15,862,316	59,046	0.00372	0.99628	88.57
21.5	15,171,557	144,610	0.00953	0.99047	88.24
22.5	14,844,554	51,782	0.00349	0.99651	87.40
23.5	14,607,148	40,651	0.00278	0.99722	87.09
24.5	13,922,697	9,569	0.00069	0.99931	86.85
25.5	13,624,592	136,345	0.01001	0.98999	86.79
26.5	23,910,259	227,418	0.00951	0.99049	85.92

MDU Common

Account 390.00 - Structures & Improvements

Placement Band - 1952 - 2021 Experience Band - 2009 - 2021

27.5	21,009,324	148,104	0.00705	0.99295	85.10
28.5	20,522,861	27,625	0.00135	0.99865	84.50
29.5	20,166,019	139,561	0.00692	0.99308	84.39
30.5	19,921,820	24	0.00000	1.00000	83.81
31.5	19,820,262	21,480	0.00108	0.99892	83.81
32.5	19,764,835	8,757	0.00044	0.99956	83.72
33.5	19,746,416	35,112	0.00178	0.99822	83.68
34.5	19,705,848	130,913	0.00664	0.99336	83.53
35.5	19,190,872	38,262	0.00199	0.99801	82.98
36.5	18,083,098	101,848	0.00563	0.99437	82.81
37.5	11,575,849	63,298	0.00547	0.99453	82.34
38.5	10,681,923	0	0.00000	1.00000	81.89
39.5	7,282,278	0	0.00000	1.00000	81.89
40.5	6,991,807	10,837	0.00155	0.99845	81.89
41.5	6,462,831	629,902	0.09747	0.90253	81.76
42.5	4,657,096	97,810	0.02100	0.97900	73.79
43.5	4,532,160	-13,846	-0.00306	1.00306	72.24
44.5	4,021,935	6,046	0.00150	0.99850	72.46
45.5	3,972,989	0	0.00000	1.00000	72.35
46.5	3,972,989	9,424	0.00237	0.99763	72.35
47.5	3,937,914	27,540	0.00699	0.99301	72.18
48.5	3,812,362	0	0.00000	1.00000	71.68
49.5	3,363,329	11,960	0.00356	0.99644	71.68
50.5	3,293,627	29,387	0.00892	0.99108	71.42
51.5	3,261,294	18,061	0.00554	0.99446	70.78
52.5	3,074,356	67,113	0.02183	0.97817	70.39
53.5	738,579	49,944	0.06762	0.93238	68.85
54.5	523,232	2,459	0.00470	0.99530	64.19
55.5	150,655	0	0.00000	1.00000	63.89
56.5	143,620	2,816	0.01961	0.98039	63.89
57.5	80,158	0	0.00000	1.00000	62.64

MDU Common

Account 390.00 - Structures & Improvements

Placement Band - 1952 - 2021 Experience Band - 2009 - 2021

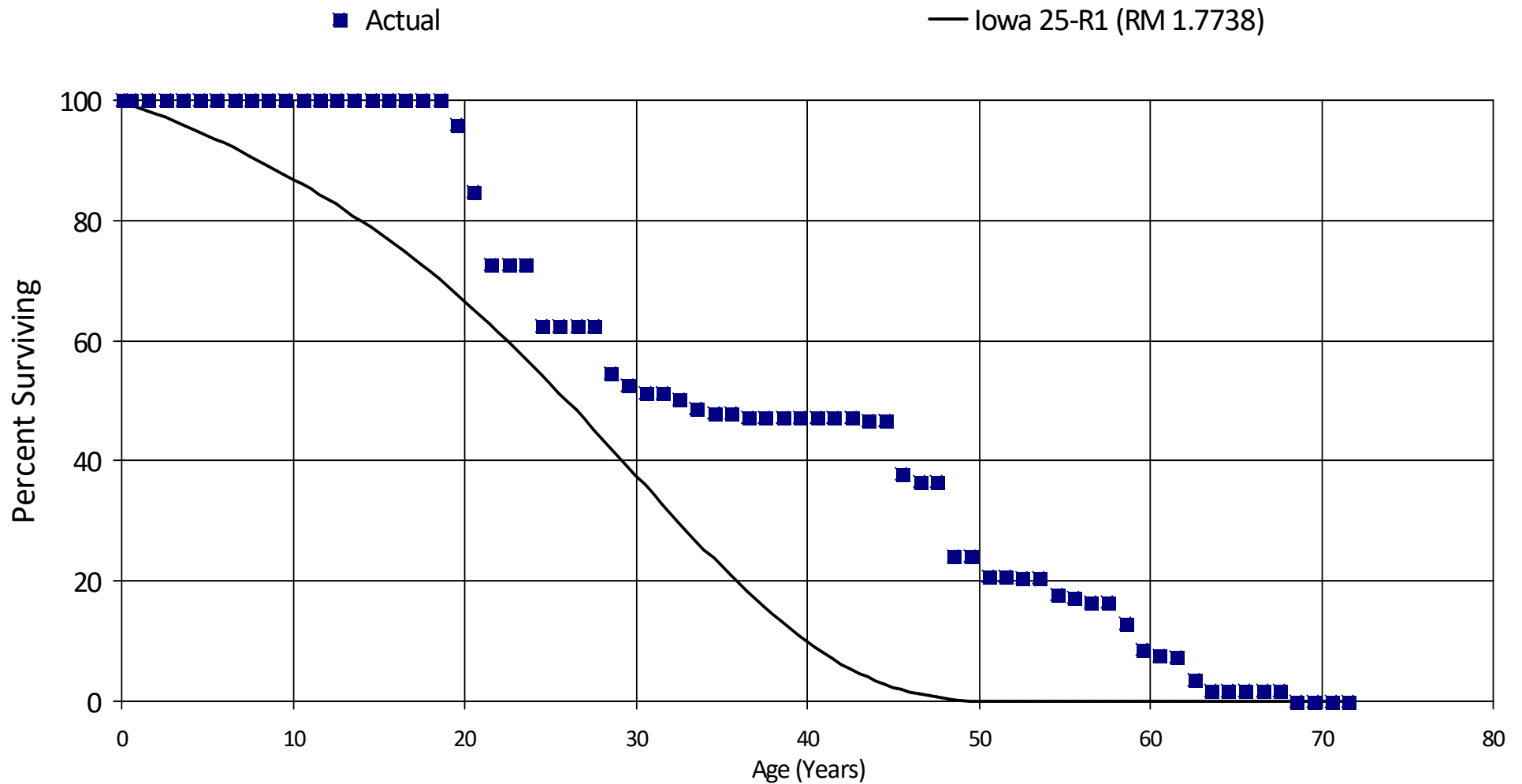
58.5	82,900	630	0.00760	0.99240	62.64
59.5	67,751	891	0.01315	0.98685	62.16
60.5	65,325	0	0.00000	1.00000	61.34
61.5	63,239	0	0.00000	1.00000	61.34
62.5	62,367	185	0.00297	0.99703	61.34
63.5	61,320	0	0.00000	1.00000	61.16
64.5	9,503	2,393	0.25182	0.74818	61.16
65.5	4,602	0	0.00000	1.00000	45.76
66.5	4,585	0	0.00000	1.00000	45.76
67.5	1,102	0	0.00000	1.00000	45.76
68.5	-2,393	0	0.00000	1.00000	45.76
Totals:		7,806,920			

MDU Common

Account 392.10 - Transportation Equipment - Trailers

Placement Band - 1937 - 2021 Experience Band - 2009 - 2021

Actual and Smooth Survivor Curves



MDU Common

Account 392.10 - Transportation Equipment - Trailers

Placement Band - 1937 - 2021 Experience Band - 2009 - 2021

RETIREMENT RATE ANALYSIS

Age at Begin of Interval	Exposures at Beginning of Age Interval	Retirements During Age Interval	Retmt Ratio	Survivor Ratio	% Surviving
0	74,048	0	0.00000	1.00000	100.00
0.5	74,048	0	0.00000	1.00000	100.00
1.5	74,048	0	0.00000	1.00000	100.00
2.5	74,048	0	0.00000	1.00000	100.00
3.5	74,048	0	0.00000	1.00000	100.00
4.5	74,048	0	0.00000	1.00000	100.00
5.5	74,048	0	0.00000	1.00000	100.00
6.5	74,048	0	0.00000	1.00000	100.00
7.5	74,048	0	0.00000	1.00000	100.00
8.5	71,565	0	0.00000	1.00000	100.00
9.5	62,980	0	0.00000	1.00000	100.00
10.5	55,566	0	0.00000	1.00000	100.00
11.5	55,566	0	0.00000	1.00000	100.00
12.5	55,566	0	0.00000	1.00000	100.00
13.5	55,566	0	0.00000	1.00000	100.00
14.5	55,566	0	0.00000	1.00000	100.00
15.5	55,566	0	0.00000	1.00000	100.00
16.5	55,566	0	0.00000	1.00000	100.00
17.5	55,566	0	0.00000	1.00000	100.00
18.5	55,566	2,295	0.04130	0.95870	100.00
19.5	53,271	6,178	0.11597	0.88403	95.87
20.5	47,093	6,781	0.14399	0.85601	84.75
21.5	40,312	0	0.00000	1.00000	72.55
22.5	40,312	0	0.00000	1.00000	72.55
23.5	40,312	5,664	0.14050	0.85950	72.55
24.5	34,648	0	0.00000	1.00000	62.36
25.5	34,648	0	0.00000	1.00000	62.36
26.5	34,648	0	0.00000	1.00000	62.36

MDU Common

Account 392.10 - Transportation Equipment - Trailers

Placement Band - 1937 - 2021 Experience Band - 2009 - 2021

27.5	34,648	4,278	0.12347	0.87653	62.36
28.5	30,371	1,112	0.03661	0.96339	54.66
29.5	29,258	748	0.02557	0.97443	52.66
30.5	28,511	0	0.00000	1.00000	51.31
31.5	28,511	611	0.02143	0.97857	51.31
32.5	27,900	776	0.02781	0.97219	50.21
33.5	27,123	448	0.01652	0.98348	48.81
34.5	26,675	0	0.00000	1.00000	48.00
35.5	26,675	402	0.01507	0.98493	48.00
36.5	26,272	0	0.00000	1.00000	47.28
37.5	26,272	0	0.00000	1.00000	47.28
38.5	26,272	0	0.00000	1.00000	47.28
39.5	26,272	0	0.00000	1.00000	47.28
40.5	26,272	0	0.00000	1.00000	47.28
41.5	26,272	0	0.00000	1.00000	47.28
42.5	26,272	365	0.01389	0.98611	47.28
43.5	25,907	0	0.00000	1.00000	46.62
44.5	25,907	4,902	0.18921	0.81079	46.62
45.5	21,005	671	0.03194	0.96806	37.80
46.5	20,334	0	0.00000	1.00000	36.59
47.5	20,334	6,950	0.34179	0.65821	36.59
48.5	13,384	0	0.00000	1.00000	24.08
49.5	13,384	1,758	0.13135	0.86865	24.08
50.5	11,627	0	0.00000	1.00000	20.92
51.5	11,627	254	0.02185	0.97815	20.92
52.5	11,373	0	0.00000	1.00000	20.46
53.5	11,373	1,439	0.12652	0.87348	20.46
54.5	9,934	333	0.03352	0.96648	17.87
55.5	9,601	417	0.04343	0.95657	17.27
56.5	9,184	0	0.00000	1.00000	16.52
57.5	9,184	2,021	0.22005	0.77995	16.52

MDU Common

Account 392.10 - Transportation Equipment - Trailers

Placement Band - 1937 - 2021 Experience Band - 2009 - 2021

58.5	7,163	2,418	0.33755	0.66245	12.88
59.5	4,745	551	0.11611	0.88389	8.53
60.5	4,195	56	0.01335	0.98665	7.54
61.5	4,139	2,155	0.52066	0.47934	7.44
62.5	1,984	1,012	0.51008	0.48992	3.57
63.5	972	0	0.00000	1.00000	1.75
64.5	972	0	0.00000	1.00000	1.75
65.5	972	0	0.00000	1.00000	1.75
66.5	972	0	0.00000	1.00000	1.75
67.5	972	947	0.97447	0.02553	1.75
68.5	25	0	0.00000	1.00000	0.04
69.5	25	0	0.00000	1.00000	0.04
70.5	25	0	0.00000	1.00000	0.04
71.5	25	25	1.00000		0.04

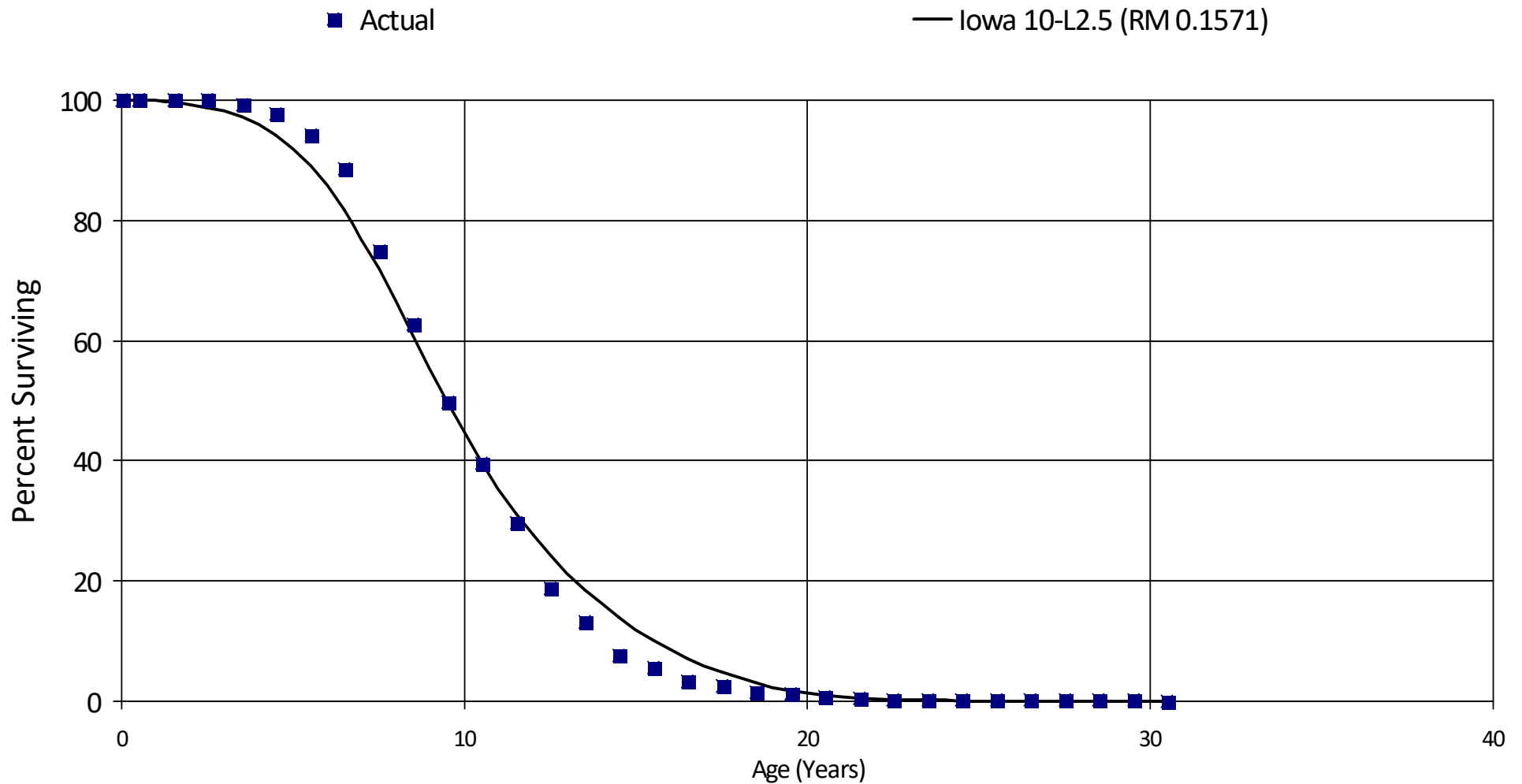
Totals: 55,567

MDU Common

Account 392.20 - Transportation Equipment

Placement Band - 1979 - 2021 Experience Band - 2009 - 2021

Actual and Smooth Survivor Curves



MDU Common

Account 392.20 - Transportation Equipment

Placement Band - 1979 - 2021 Experience Band - 2009 - 2021

RETIREMENT RATE ANALYSIS

Age at Begin of Interval	Exposures at Beginning of Age Interval	Retirements During Age Interval	Retmt Ratio	Survivor Ratio	% Surviving
0	16,154,373	0	0.00000	1.00000	100.00
0.5	15,921,146	0	0.00000	1.00000	100.00
1.5	14,926,282	13,683	0.00092	0.99908	100.00
2.5	13,066,738	85,792	0.00657	0.99343	99.91
3.5	12,019,875	196,860	0.01638	0.98362	99.25
4.5	10,971,841	387,493	0.03532	0.96468	97.62
5.5	9,209,486	538,637	0.05849	0.94151	94.17
6.5	7,744,781	1,209,555	0.15618	0.84382	88.66
7.5	5,936,758	968,739	0.16318	0.83682	74.81
8.5	4,799,794	989,697	0.20620	0.79380	62.60
9.5	3,476,252	705,665	0.20300	0.79700	49.69
10.5	2,583,629	648,788	0.25111	0.74889	39.60
11.5	1,896,318	697,431	0.36778	0.63222	29.66
12.5	1,198,887	358,698	0.29919	0.70081	18.75
13.5	840,189	345,824	0.41160	0.58840	13.14
14.5	467,451	127,299	0.27233	0.72767	7.73
15.5	340,151	141,041	0.41464	0.58536	5.62
16.5	199,110	48,943	0.24581	0.75419	3.29
17.5	150,167	54,251	0.36127	0.63873	2.48
18.5	95,916	24,033	0.25056	0.74944	1.58
19.5	58,994	22,124	0.37502	0.62498	1.18
20.5	36,870	12,603	0.34182	0.65818	0.74
21.5	24,268	15,588	0.64233	0.35767	0.49
22.5	8,680	0	0.00000	1.00000	0.18
23.5	8,680	0	0.00000	1.00000	0.18
24.5	8,680	0	0.00000	1.00000	0.18
25.5	8,680	0	0.00000	1.00000	0.18
26.5	8,680	0	0.00000	1.00000	0.18

MDU Common

Account 392.20 - Transportation Equipment

Placement Band - 1979 - 2021 Experience Band - 2009 - 2021

27.5	8,680	0	0.00000	1.00000	0.18
28.5	8,680	0	0.00000	1.00000	0.18
29.5	8,680	8,680	1.00005	-0.00005	0.18
30.5	0	0	0.00000	0.00000	0.00
Totals:		7,601,424			



SECTION 7

7 NET SALVAGE

Montana-Dakota Utilities Co. - Common Plant
ACCOUNT 390 - GENERAL PLANT - STRUCTURES & IMPROVEMENTS
SUMMARY OF BOOK SALVAGE

Year	Regular Retirements	Cost of Removal Amount	Cost of Removal Percent	Gross Salvage Amount	Gross Salvage Percent	Net Salvage Amount	Net Salvage Percent	3-Year Amount	3-Year Percent	5-Year Amount	5-Year Percent	Historical Amount	Historical Percent
1968	4,756	40	1	(662)	(14)	622	13					622	13
1969	23,146	979	4	(350)	(2)	(629)	-3					-3	0
1970	9,536	1,402	15	(5,551)	(58)	4,149	44	1,381	11			1,381	11
1971	56	1,458	2,626	(816)	(1,470)	(642)	-1,156	960	9			875	9
1972	89,020	100	0	(20,851)	(23)	20,751	23	8,086	25	4,850	19	4,850	19
1973	823	-	0	(556)	(68)	556	68	6,888	23	4,837	20	4,135	19
1974	6,649	2,381	36	0	0	(2,381)	-36	6,309	20	4,487	21	3,204	17
1975	0	-		0		0		-608	-24	3,657	19	3,204	17
1976	699	18	3	0	0	(18)	-3	-800	-33	3,782	19	2,801	17
1977	33,563	7,368	22	(10)	(0)	(7,358)	-22	-2,459	-22	-1,840	-22	1,672	9
1978	5,945	471	8	(167)	(3)	(304)	-5	-2,560	-19	-2,012	-21	1,475	8
1979	362	29	8	2	1	(31)	-9	-2,564	-19	-1,542	-19	1,338	8
1980	36,429	-	0	(46,043)	(126)	46,043	126	15,236	107	7,666	50	5,063	29
1981	386	-	0	0	0	0	0	15,337	124	7,670	50	5,063	29
1982	2,390	-	0	35,198	1,473	(35,198)	-1,473	3,615	28	2,102	23	1,966	12
1983	151,268	17,106	11	(52,055)	(34)	34,949	23	-83	0	9,152	24	4,322	17
1984	0	-		(240)		240		-3	0	9,207	24	4,050	17
1985	29,321	-	0	0	0	0	0	11,730	19	-2	0	4,050	15
1986	353,206	23,017	7	(463)	(0)	(22,554)	-6	-7,438	-6	-4,513	-4	2,387	5
1987	114,669	178,551	156	(7)	(0)	(178,544)	-156	-67,033	-40	-33,182	-26	-8,256	-16
1988	1,066	44,428	4,168	(20)	(2)	(44,408)	-4,167	-81,835	-52	-49,053	-49	-10,264	-21
1989	2,908	1,362	47	0	0	(1,362)	-47	-74,771	-189	-49,374	-49	-9,796	-21
1990	1,179	4,184	355	0	0	(4,184)	-355	-16,651	-969	-50,210	-53	-9,515	-22
1991	11,318	21,000	186	0	0	(21,000)	-186	-8,848	-172	-49,899	-190	-10,062	-24
1992	6,400	59,486	929	0	0	(59,486)	-929	-28,223	-448	-26,088	-570	-12,309	-31
1993	66,938	11,015	16	(5,500)	(8)	(5,515)	-8	-28,667	-102	-18,309	-103	-12,013	-29
1994	76,340	3,348	4	(53)	(0)	(3,296)	-4	-22,765	-46	-18,696	-58	-11,650	-27
1995	249,269	48,516	19	(188,096)	(75)	139,580	56	43,590	33	10,057	12	-5,601	-11
1996	174,572	22,546	13	(26,753)	(15)	4,207	2	46,830	28	15,098	13	-5,224	-9
1997	97788.56	4,265	4	(45,364)	(46)	41,099	42	61,629	35	35,215	26	-3,508	-6
1998	255,812	40,399	16		0	(40,399)	-16	1,636	1	28,238	17	-4,825	-7
1999	303792.23	12,226	4	(30,685)	(10)	18,459	6	6,386	3	32,589	15	-4,023	-6
2000	172,070	30,935	18	(10,284)	(6)	(20,651)	-12	-14,197	-6	543	0	-4,577	-6
2001	109,760	14,719	13		0	(14,719)	-13	-5,637	-3	-3,242	-2	-4,904	-6
2002	110,036	29,202	27		0	(29,202)	-27	-21,524	-16	-17,302	-9	-5,663	-7
2003	16416	-	0		0	0	0	-14,640	-19	-9,223	-6	-5,663	-7
2004	0	26,474		(639,099)		612,625		194,474	461	109,611	134	13,073	17
2005	(32,273)	225	(1)		0	(225)	1	204,133	-3,862	113,696	279	12,682	17
2006	13,529	9,973	74	(330,000)	(2,439)	320,028	2,365	310,809	-4,975	180,645	839	21,463	30
2007	45,025	14,205	32	(111,000)	(247)	96,795	215	138,866	1,585	205,845	2,410	23,555	33
2008	26,949	2,070	8		0	(2,070)	-8	138,251	485	205,430	1,930	22,863	33

Montana-Dakota Utilities Co. - Common Plant
ACCOUNT 390 - GENERAL PLANT - STRUCTURES & IMPROVEMENTS
SUMMARY OF BOOK SALVAGE

Year	Regular Retirements	Cost of Removal Amount	Cost of Removal Percent	Gross Salvage Amount	Gross Salvage Percent	Net Salvage Amount	Net Salvage Percent	3-Year Amount	3-Year Percent	5-Year Amount	5-Year Percent	Historical Amount	Historical Percent
2009	542,058	41,867	8	(526,444)	(97)	484,577	89	193,101	94	179,821	151	35,013	43
2010	59,049	3,138		(244)		(2,894)		159,871	76	179,287	131	34,041	42
2011	88,464	19,861	22	(453)	(1)	(19,408)	-22	154,091	67	111,400	73	32,705	40
2012	192,754	3,872	2	(250)	(0)	(3,622)	-2	-8,641	-8	91,316	50	31,819	38
2013	11,998					0		-7,677	-8	91,730	51	31,819	38
2014	762,013	1,212	0		0	(1,212)	0	-1,611	0	-5,427	-2	31,033	31
2015	28,556	93,108	326		0	(93,108)	-326	-31,440	-12	-23,470	-11	28,146	28
2016	4,973,129	120,759	2	(1,250,383)	(25)	1,129,624	23	345,101	18	206,337	17	53,179	25
2017	177,483	191,183	108	(91,149)	(51)	(100,034)	-56	312,161	18	187,054	16	49,774	24
2018	165,707	28,937	17	(1,000)	(1)	(27,937)	-17	333,884	19	181,467	15	48,085	23
2019	282,192	60,776	22	(9,760)	(3)	(51,016)	-18	-59,662	-29	171,506	15	45,977	22
2020	301,002	77,992	26		0	(77,992)	-26	-52,315	-21	174,529	15	43,394	21
2021	222,519.29	124,870	56	(179,182)	(81)	54,312	24	-24,899	-9	-40,533	-18	43,617	21
TOTAL	10,378,043	1,401,070	13.50	-3,538,286	(34.09)	2,137,217	20.59						

Montana-Dakota Utilities Co. - Common Plant
ACCOUNT 392.1 - GENERAL PLANT - TRANSPORTATION EQUIPMENT - TRAILERS
SUMMARY OF BOOK SALVAGE

Year	Regular Retirements	Cost of Removal Amount	Cost of Removal Percent	Gross Salvage Amount	Gross Salvage Percent	Net Salvage Amount	Net Salvage Percent	3-Year Amount	3-Year Percent	5-Year Amount	5-Year Percent	Historical Amount	Historical Percent
2005	0			(3,500)		3,500						3,500	0
2006	0					0						3,500	0
2007	0			(950)		950		1,483	0			2,225	0
2008	0			(4,850)		4,850		1,933	0			3,100	0
2009	26,134	0		(385)	(1)	385	1	3,228	37	1,937	37	2,421	37
2010	6,896	0		(476)	(7)	476	7	3,387	31	1,332	20	2,032	31
2011	10,083	0		(680)	(7)	680	7	3,614	25	1,468	17	1,807	25
2012	12,453	0		(2,853)	(23)	2,853	23	1,336	14	1,849	17	1,956	25
2013						0		1,178	16	879	8	1,956	25
2014						0		951	23	802	14	1,956	25
2015						0		0	0	707	16	1,956	25
2016						0		0	0	571	23	1,956	25
2017				(4,155)		4,155		1,385	0	831	0	2,231	32
2018				(3,720)		3,720		2,625	0	1,575	0	2,397	39
2019				(19,050)		19,050		8,975	0	5,385	0	4,062	73
2020						0		7,590	0	5,385	0	4,062	73
2021						0		6,350	0	5,385	0	4,062	73
TOTAL	55,566	0	0.00	-40,619	(73.10)	40,619	73.10						

Montana-Dakota Utilities Co. - Common Plant
ACCOUNT 392.2 - GENERAL PLANT - TRANSPORTATION EQUIPMENT - VEHICLES
SUMMARY OF BOOK SALVAGE

Year	Regular Retirements	Cost of Removal Amount	Cost of Removal Percent	Gross Salvage Amount	Gross Salvage Percent	Net Salvage Amount	Net Salvage Percent	3-Year Amount	3-Year Percent	5-Year Amount	5-Year Percent	Historical Amount	Historical Percent
2004	0			(124,143)		124,143						124,143	0
2005	0			(74,531)		74,531						99,337	0
2006	0			(112,620)		112,620		103,765	0			103,765	0
2007	0			(143,063)		143,063		110,071	0			113,589	0
2008	0			(123,203)		123,203		126,295	0	115,512	0	115,512	0
2009	943,733		0	(192,584)	(20)	192,584	20	152,950	49	129,200	68	128,357	82
2010	465,031		0	(126,147)	(27)	126,147	27	147,311	31	139,523	50	128,042	64
2011	137,474		0	(33,401)	(24)	33,401	24	117,377	23	123,680	40	116,211	60
2012	228,230		0	(85,168)	(37)	85,168	37	81,572	29	112,100	32	112,762	57
2013	65,494		0	(49,347)	(75)	49,347		55,972	39	97,329	26	106,421	58
2014	507,650		0	(128,676)	(25)	128,676	25	87,730	33	84,548	30	108,444	51
2015	565,400		0	(135,436)	(24)	135,436	24	104,486	28	86,405	29	110,693	46
2016	1,307,335		0	(135,238)	(10)	135,238	10	133,117	17	106,773	20	112,581	35
2017	832,091	(2)	(0)	(127,071)	(15)	127,073	15	132,582	15	115,154	18	113,616	31
2018	487,481	(15)	(0)	(170,917)	(35)	170,932	35	144,414	16	139,471	19	117,437	32
2019	873,014		0	(198,937)	(23)	198,937	23	165,647	23	153,523	19	122,531	31
2020	734,877		0	(250,036)	(34)	250,036	34	206,635	30	176,443	21	130,031	31
2021	453,616		0	(146,366)	(32)	146,366		198,446	29	178,669	26	130,939	31
TOTAL	7,601,424	(17)	(0.00)	-2,356,882	(31.01)	2,356,899	31.01						



SECTION 8

8 DETAILED DEPRECIATION CALCULATIONS

MDU Common

Account #: 390.00 - Structures & Improvements

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life

Survivor Curve: R2

ASL: 40

Net Salvage: -5%

Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1953	1,101.98	1,112	1,144	0.9888	13	1.55	8	68.5
1954	863.89	866	891	0.9819	16	1.82	9	67.5
1956	2,508.43	2,478	2,549	0.9677	85	2.37	36	65.5
1957	8,477.14	8,310	8,548	0.9604	353	2.66	133	64.5
1958	708.02	689	709	0.9531	35	2.94	12	63.5
1959	413.04	399	410	0.9462	23	3.23	7	62.5
1960	2,078.30	1,990	2,048	0.9383	135	3.52	38	61.5
1961	1,232.59	1,171	1,205	0.9308	90	3.81	24	60.5
1962	5,940.05	5,598	5,759	0.9234	478	4.10	117	59.5
1964	18,983.94	17,601	18,107	0.9084	1,826	4.68	390	57.5
1965	3,056.19	2,810	2,891	0.9008	318	4.97	64	56.5
1966	143,317.20	130,649	134,400	0.8931	16,083	5.27	3,051	55.5
1967	161,052.17	145,537	149,716	0.8853	19,389	5.57	3,478	54.5
1968	806,161.69	721,976	742,707	0.8774	103,763	5.88	17,638	53.5
1969	49,712.30	44,110	45,377	0.8693	6,821	6.20	1,101	52.5
1971	35,288.82	30,706	31,588	0.8525	5,466	6.85	798	50.5
1972	423,317.91	364,546	375,014	0.8437	69,470	7.19	9,657	49.5
1973	29,001.76	24,707	25,416	0.8346	5,035	7.55	667	48.5
1974	16,140.20	13,596	13,986	0.8253	2,961	7.91	374	47.5
1976	36,819.79	30,275	31,144	0.8056	7,516	8.68	866	45.5
1977	299,565.32	243,149	250,131	0.7952	64,413	9.08	7,095	44.5
1978	6,271.01	5,021	5,166	0.7845	1,419	9.50	149	43.5
1979	516,956.94	408,091	419,809	0.7734	122,996	9.93	12,390	42.5
1980	243,249.46	189,177	194,609	0.7619	60,803	10.37	5,862	41.5
1981	178,300.70	136,511	140,430	0.7501	46,785	10.83	4,319	40.5
1982	1,478,135.25	1,113,244	1,145,209	0.7379	406,833	11.31	35,975	39.5
1983	320,357.51	237,151	243,961	0.7253	92,415	11.80	7,832	38.5
1984	2,770,584.09	2,014,235	2,072,070	0.7123	837,043	12.30	68,027	37.5

MDU Common

Account #: 390.00 - Structures & Improvements

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life

Survivor Curve: R2

ASL: 40

Net Salvage: -5%

Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1985	505,787.81	360,806	371,166	0.6989	159,912	12.82	12,469	36.5
1986	233,540.28	163,317	168,007	0.6851	77,210	13.36	5,779	35.5
1988	4,844.35	3,246	3,339	0.6565	1,747	14.47	121	33.5
1989	4,397.52	2,880	2,963	0.6416	1,655	15.05	110	32.5
1991	59,438.01	37,055	38,119	0.6108	24,291	16.25	1,495	30.5
1992	153,963.54	93,480	96,164	0.5948	65,498	16.87	3,882	29.5
1993	301,888.43	178,276	183,395	0.5786	133,588	17.50	7,632	28.5
1994	2,219,352.92	1,272,963	1,309,515	0.5619	1,020,806	18.15	56,244	27.5
1995	552,945.17	307,591	316,423	0.5450	264,169	18.81	14,045	26.5
1996	288,535.48	155,421	159,884	0.5277	143,078	19.48	7,345	25.5
1997	643,800.12	335,236	344,862	0.5102	331,129	20.16	16,422	24.5
1998	182,161.40	91,529	94,157	0.4923	97,112	20.86	4,656	23.5
1999	182,391.90	88,260	90,794	0.4741	100,717	21.57	4,670	22.5
2000	631,714.02	293,778	302,214	0.4556	361,086	22.28	16,204	21.5
2001	167,019.55	74,475	76,613	0.4369	98,757	23.01	4,291	20.5
2002	407,136.47	173,635	178,621	0.4178	248,872	23.75	10,477	19.5
2003	190,452.63	77,472	79,696	0.3985	120,279	24.50	4,909	18.5
2004	1,226,294.00	474,335	487,955	0.3790	799,654	25.26	31,651	17.5
2005	3,894,785.97	1,427,704	1,468,698	0.3591	2,620,827	26.04	100,664	16.5
2006	20,003.59	6,923	7,122	0.3391	13,882	26.82	518	15.5
2007	171,416.43	55,767	57,369	0.3187	122,619	27.61	4,442	14.5
2008	797,951.24	242,851	249,825	0.2982	588,024	28.41	20,701	13.5
2010	2,282,936.10	597,345	614,497	0.2564	1,782,586	30.03	59,356	11.5
2011	428,832.46	102,907	105,861	0.2351	344,413	30.86	11,161	10.5
2012	1,104,436.85	240,834	247,749	0.2136	911,910	31.69	28,773	9.5
2013	321,593.54	63,012	64,821	0.1920	272,852	32.54	8,386	8.5
2014	15,844,968.08	2,750,706	2,829,689	0.1701	13,807,528	33.39	413,565	7.5
2015	566,977.13	85,649	88,108	0.1480	507,218	34.25	14,811	6.5

MDU Common

Account #: 390.00 - Structures & Improvements

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life
Survivor Curve: R2
ASL: 40
Net Salvage: -5%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2016	1,365,272.00	175,199	180,230	0.1257	1,253,306	35.11	35,695	5.5
2017	3,759,904.19	396,279	407,658	0.1033	3,540,242	35.98	98,381	4.5
2018	2,511,103.30	206,614	212,547	0.0806	2,424,112	36.87	65,756	3.5
2019	1,491,116.43	87,951	90,477	0.0578	1,475,196	37.75	39,075	2.5
2020	7,809,961.18	277,351	285,315	0.0348	7,915,144	38.65	204,805	1.5
2021	72,597.36	862	887	0.0116	75,341	39.55	1,905	0.5
TOTAL	57,959,115.14	16,797,415	17,279,728		43,577,343		1,490,513	

COMPOSITE ANNUAL ACCRUAL RATE	2.57%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.30
COMPOSITE AVERAGE AGE (YEARS)	14.00
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	28.96

MDU Common

Account #: 391.10 - Office Furniture & Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life

Survivor Curve: SQ

ASL: 15

Net Salvage: 0%

Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	168,807.34	163,180	158,867	0.9411	9,941	0.50	9,940	14.5
2008	81,864.85	73,678	71,731	0.8762	10,134	1.50	6,756	13.5
2010	32,157.67	24,654	24,002	0.7464	8,155	3.50	2,330	11.5
2011	74,683.24	52,278	50,896	0.6815	23,787	4.50	5,286	10.5
2012	216,594.23	137,176	133,550	0.6166	83,044	5.50	15,099	9.5
2013	137,346.05	77,829	75,772	0.5517	61,574	6.50	9,473	8.5
2014	551,783.78	275,892	268,599	0.4868	283,185	7.50	37,758	7.5
2015	232,350.52	100,685	98,024	0.4219	134,327	8.50	15,803	6.5
2016	76,630.17	28,098	27,355	0.3570	49,275	9.50	5,187	5.5
2017	62,199.61	18,660	18,167	0.2921	44,033	10.50	4,194	4.5
2018	37,293.50	8,702	8,472	0.2272	28,822	11.50	2,506	3.5
2019	53,306.88	8,884	8,650	0.1623	44,657	12.50	3,573	2.5
2020	356,250.74	35,625	34,683	0.0974	321,567	13.50	23,820	1.5
2021	48,827.31	1,628	1,585	0.0325	47,243	14.50	3,258	0.5
TOTAL	2,130,095.89	1,006,971	980,352		1,149,744		144,983	

COMPOSITE ANNUAL ACCRUAL RATE 6.81%

THEORETICAL ACCUMULATED DEPRECIATION FACTOR 0.46

COMPOSITE AVERAGE AGE (YEARS) 7.09

DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS) 7.91

MDU Common

Account #: 391.30 - Computer Equipment - PC

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life
Survivor Curve: SQ
ASL: 5
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2017	475,481.03	427,933	347,848	0.7316	127,633	0.50	127,633	4.5
2018	961,371.69	672,960	547,019	0.5690	414,352	1.50	276,235	3.5
2019	495,525.06	247,763	201,395	0.4064	294,130	2.50	117,652	2.5
2020	1,420,457.68	426,137	346,388	0.2439	1,074,070	3.50	306,877	1.5
2021	285,966.55	28,597	23,245	0.0813	262,722	4.50	58,383	0.5
TOTAL	3,638,802.01	1,803,390	1,465,895		2,172,907		886,780	

COMPOSITE ANNUAL ACCRUAL RATE	24.37%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.40
COMPOSITE AVERAGE AGE (YEARS)	2.48
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	2.52

MDU Common

Account #: 391.50 - Computer Equipment - Other

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life
Survivor Curve: SQ
ASL: 5
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2017	260,962.58	234,866	191,278	0.7330	69,684	0.50	69,684	4.5
2018	223,116.29	156,181	127,196	0.5701	95,920	1.50	63,947	3.5
2019	656,663.26	328,332	267,397	0.4072	389,266	2.50	155,706	2.5
2020	904,563.36	271,369	221,006	0.2443	683,557	3.50	195,302	1.5
TOTAL	2,045,305.49	990,748	806,878		1,238,428		484,639	

COMPOSITE ANNUAL ACCRUAL RATE	23.70%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.39
COMPOSITE AVERAGE AGE (YEARS)	2.42
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	2.58

MDU Common

Account #: 392.10 - Transportation Equipment - Trailers

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life
Survivor Curve: R1
ASL: 25
Net Salvage: 15%
Truncation Year:

Year		Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2011		7,414.01	1,857	1,828	0.2900	4,474	17.63	254	10.5
2012		8,585.60	1,955	1,924	0.2637	5,374	18.30	294	9.5
2013		2,482.58	508	500	0.2371	1,610	18.98	85	8.5
TOTAL		18,482.19	4,321	4,252		11,458		633	

COMPOSITE ANNUAL ACCRUAL RATE	3.42%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.23
COMPOSITE AVERAGE AGE (YEARS)	9.77
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	18.12

MDU Common

Account #: 392.20 - Transportation Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life

Survivor Curve: L2.5

ASL: 10

Net Salvage: 20%

Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2002	12,889.32	8,700	6,380	0.6187	3,932	1.56	2,515	19.5
2007	26,914.31	16,167	11,856	0.5506	9,676	2.49	3,883	14.5
2010	38,523.34	21,013	15,409	0.5000	15,409	3.18	4,843	11.5
2011	186,957.73	99,052	72,638	0.4857	76,928	3.38	22,777	10.5
2012	333,845.03	171,905	126,064	0.4720	141,012	3.56	39,572	9.5
2013	168,225.10	83,656	61,348	0.4558	73,233	3.78	19,353	8.5
2014	598,467.61	282,723	207,330	0.4330	271,444	4.09	66,289	7.5
2015	926,067.25	404,588	296,698	0.4005	444,156	4.54	97,855	6.5
2016	1,374,862.37	535,713	392,857	0.3572	707,033	5.13	137,840	5.5
2017	851,173.46	282,506	207,171	0.3042	473,767	5.85	80,969	4.5
2018	961,071.79	255,519	187,380	0.2437	581,477	6.68	87,091	3.5
2019	1,845,860.99	358,718	263,060	0.1781	1,213,629	7.57	160,304	2.5
2020	994,864.15	118,052	86,572	0.1088	709,320	8.52	83,285	1.5
2021	233,226.92	9,313	6,830	0.0366	179,752	9.50	18,920	0.5
TOTAL	8,552,949.37	2,647,624	1,941,593		4,900,766		825,496	

COMPOSITE ANNUAL ACCRUAL RATE 9.65%

THEORETICAL ACCUMULATED DEPRECIATION FACTOR 0.23

COMPOSITE AVERAGE AGE (YEARS) 4.58

DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS) 6.13

MDU Common

Account #: 393.00 - Stores Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life
Survivor Curve: SQ
ASL: 30
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1995	10,272.04	9,074	10,231	0.9960	41	3.50	12	26.5
1999	9,502.32	7,127	8,036	0.8456	1,467	7.50	196	22.5
2000	12,486.01	8,948	10,089	0.8081	2,397	8.50	282	21.5
2007	4,385.78	2,120	2,390	0.5450	1,996	15.50	129	14.5
2014	41,481.25	10,370	11,693	0.2819	29,788	22.50	1,324	7.5
2017	15,127.75	2,269	2,559	0.1691	12,569	25.50	493	4.5
2018	15,273.31	1,782	2,009	0.1315	13,264	26.50	501	3.5
2019	22,339.62	1,862	2,099	0.0940	20,241	27.50	736	2.5
2020	13,367.66	668	754	0.0564	12,614	28.50	443	1.5
2021	30,283.24	505	569	0.0188	29,714	29.50	1,007	0.5
TOTAL	174,518.98	44,725	50,428		124,091		5,123	

COMPOSITE ANNUAL ACCRUAL RATE	2.94%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.29
COMPOSITE AVERAGE AGE (YEARS)	7.69
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	22.31

MDU Common

Account #: 394.10 - Tools, Shop & Garage Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life

Survivor Curve: SQ

ASL: 20

Net Salvage: 0%

Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2004	46,034.92	40,281	46,035	1.0000	0	2.50	0	17.5
2005	30,657.04	25,292	30,657	1.0000	0	3.50	0	16.5
2006	34,082.71	26,414	34,083	1.0000	0	4.50	0	15.5
2007	15,616.53	11,322	15,617	1.0000	0	5.50	0	14.5
2008	46,070.14	31,097	46,070	1.0000	0	6.50	0	13.5
2009	6,617.89	4,136	6,618	1.0000	0	7.50	0	12.5
2010	29,472.55	16,947	29,473	1.0000	0	8.50	0	11.5
2011	64,949.37	34,098	64,949	1.0000	0	9.50	0	10.5
2012	39,091.97	18,569	39,092	1.0000	0	10.50	0	9.5
2013	33,002.84	14,026	33,003	1.0000	0	11.50	0	8.5
2014	97,204.70	36,452	97,205	1.0000	0	12.50	0	7.5
2015	68,621.75	22,302	68,622	1.0000	0	13.50	0	6.5
2016	42,870.94	11,790	24,282	0.5664	18,589	14.50	1,282	5.5
2017	120,692.81	27,156	49,697	0.4118	70,996	15.50	4,580	4.5
2018	25,947.90	4,541	8,310	0.3203	17,638	16.50	1,069	3.5
2019	27,070.16	3,384	6,192	0.2288	20,878	17.50	1,193	2.5
2020	11,763.56	882	1,615	0.1373	10,149	18.50	549	1.5
2021	19,751.73	494	904	0.0458	18,848	19.50	967	0.5
TOTAL	759,519.51	329,182	602,422		157,098		9,640	

COMPOSITE ANNUAL ACCRUAL RATE 1.27%

THEORETICAL ACCUMULATED DEPRECIATION FACTOR 0.79

COMPOSITE AVERAGE AGE (YEARS) 8.67

DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS) 11.33

MDU Common

Account #: 394.30 - Vehicle Maintenance Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life
Survivor Curve: SQ
ASL: 20
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2003	9,575.67	8,857	8,858	0.9251	718	1.50	478	18.5
2004	3,101.37	2,714	2,714	0.8750	388	2.50	155	17.5
2006	8,048.09	6,237	6,237	0.7750	1,811	4.50	402	15.5
2007	25,864.74	18,752	18,752	0.7250	7,113	5.50	1,293	14.5
TOTAL	46,589.87	36,560	36,561		10,028		2,328	

COMPOSITE ANNUAL ACCRUAL RATE	5.00%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.78
COMPOSITE AVERAGE AGE (YEARS)	15.69
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	4.31

MDU Common

Account #: 394.40 - Vehicle Refueling Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life
Survivor Curve: SQ
ASL: 20
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2005	3,814.65	3,147	3,815	1.0000	0	3.50	0	16.5
TOTAL	3,814.65	3,147	3,815		0		0	

COMPOSITE ANNUAL ACCRUAL RATE	0.00%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	1.00
COMPOSITE AVERAGE AGE (YEARS)	16.50
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.50

MDU Common

Account #: 397.10 - Radio Communications Equipment - Fixed

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life

Survivor Curve: SQ

ASL: 15

Net Salvage: 0%

Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	6,750.02	6,525	6,334	0.9383	416	0.50	416	14.5
2008	25,327.84	22,795	22,127	0.8736	3,201	1.50	2,134	13.5
2009	678,246.85	565,206	548,639	0.8089	129,608	2.50	51,843	12.5
2010	67,374.52	51,654	50,140	0.7442	17,235	3.50	4,924	11.5
2011	91,653.20	64,157	62,277	0.6795	29,376	4.50	6,528	10.5
2012	27,015.84	17,110	16,609	0.6148	10,407	5.50	1,892	9.5
2013	155,578.42	88,161	85,577	0.5501	70,001	6.50	10,769	8.5
2014	184,685.25	92,343	89,636	0.4853	95,049	7.50	12,673	7.5
2015	54,109.51	23,447	22,760	0.4206	31,349	8.50	3,688	6.5
2016	92,224.08	33,816	32,824	0.3559	59,400	9.50	6,253	5.5
2017	127,555.40	38,267	37,145	0.2912	90,410	10.50	8,611	4.5
2018	158,855.85	37,066	35,980	0.2265	122,876	11.50	10,685	3.5
2019	140,371.08	23,395	22,709	0.1618	117,662	12.50	9,413	2.5
2020	345,707.09	34,571	33,557	0.0971	312,150	13.50	23,122	1.5
2021	298,839.12	9,961	9,669	0.0324	289,170	14.50	19,943	0.5
TOTAL	2,454,294.07	1,108,474	1,075,983		1,378,311		172,894	

COMPOSITE ANNUAL ACCRUAL RATE 7.04%

THEORETICAL ACCUMULATED DEPRECIATION FACTOR 0.44

COMPOSITE AVERAGE AGE (YEARS) 6.77

DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS) 8.23

MDU Common

Account #: 397.20 - Radio Communications Equipment - Mobile

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life

Survivor Curve: SQ

ASL: 15

Net Salvage: 0%

Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	1,255.68	1,214	1,189	0.9473	66	0.50	66	14.5
2008	95,101.86	85,592	83,851	0.8817	11,251	1.50	7,501	13.5
2009	265,292.40	221,077	216,581	0.8164	48,711	2.50	19,485	12.5
2010	61,810.83	47,388	46,425	0.7511	15,386	3.50	4,396	11.5
2011	56,091.35	39,264	38,465	0.6858	17,626	4.50	3,917	10.5
2012	64,821.15	41,053	40,218	0.6205	24,603	5.50	4,473	9.5
2013	51,295.64	29,068	28,476	0.5551	22,819	6.50	3,511	8.5
2014	97,289.52	48,645	47,655	0.4898	49,634	7.50	6,618	7.5
2015	232,388.11	100,702	98,654	0.4245	133,735	8.50	15,733	6.5
2016	72,591.10	26,617	26,075	0.3592	46,516	9.50	4,896	5.5
2017	44,636.05	13,391	13,118	0.2939	31,518	10.50	3,002	4.5
2018	11,664.67	2,722	2,666	0.2286	8,998	11.50	782	3.5
2020	15,034.10	1,503	1,473	0.0980	13,561	13.50	1,005	1.5
TOTAL	1,069,272.46	658,235	644,848		424,424		75,385	

COMPOSITE ANNUAL ACCRUAL RATE 7.05%

THEORETICAL ACCUMULATED DEPRECIATION FACTOR 0.60

COMPOSITE AVERAGE AGE (YEARS) 9.23

DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS) 5.77

MDU Common

Account #: 397.30 - General Telephone Communication Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life

Survivor Curve: SQ

ASL: 10

Net Salvage: 0%

Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2012	22,514.99	21,389	20,349	0.9038	2,166	0.50	2,166	9.5
2013	368,021.74	312,818	297,602	0.8087	70,420	1.50	46,947	8.5
2014	48,423.02	36,317	34,551	0.7135	13,872	2.50	5,549	7.5
2015	145,186.63	94,371	89,781	0.6184	55,406	3.50	15,830	6.5
2017	97,398.06	43,829	41,697	0.4281	55,701	5.50	10,127	4.5
TOTAL	681,544.44	508,725	483,979		197,565		80,619	

COMPOSITE ANNUAL ACCRUAL RATE	11.83%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.71
COMPOSITE AVERAGE AGE (YEARS)	7.46
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	2.54

MDU Common

Account #: 397.50 - Supervisory & Telemetry Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life

Survivor Curve: SQ

ASL: 10

Net Salvage: 0%

Truncation Year:

		Accumulated		ALG					
Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Depreciation Factor	Net Book Value	Remaining Life	Annual Accrual	Average Age	
2012	3,111.92	2,956	1,954	0.6280	1,158	0.50	1,158	9.5	
2013	10,073.86	8,563	5,660	0.5619	4,413	1.50	2,942	8.5	
2021	2,517.81	126	83	0.0331	2,435	9.50	256	0.5	
TOTAL	15,703.59	11,645	7,698		8,006		4,356		

COMPOSITE ANNUAL ACCRUAL RATE27.74%

THEORETICAL ACCUMULATED DEPRECIATION FACTOR0.49

COMPOSITE AVERAGE AGE (YEARS)7.42

DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)2.58

MDU Common

Account #: 397.80 - Network Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life
Survivor Curve: SQ
ASL: 5
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2017	7,670.26	6,903	5,113	0.6666	2,557	0.50	2,557	4.5
2018	8,414.86	5,890	4,363	0.5184	4,052	1.50	2,702	3.5
2019	332,413.29	166,207	123,097	0.3703	209,316	2.50	83,726	2.5
2020	25,144.25	7,543	5,587	0.2222	19,557	3.50	5,588	1.5
2021	14,293.86	1,429	1,059	0.0741	13,235	4.50	2,941	0.5
TOTAL	387,936.52	187,973	139,218		248,718		97,514	

COMPOSITE ANNUAL ACCRUAL RATE	25.14%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.36
COMPOSITE AVERAGE AGE (YEARS)	2.42
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	2.58

MDU Common

Account #: 398.00 - Miscellaneous Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2021

ALG - Remaining Life

Survivor Curve: SQ

ASL: 25

Net Salvage: 0%

Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2002	49,732.75	38,792	49,733	1.0000	0	5.50	0	19.5
2003	14,581.60	10,790	14,582	1.0000	0	6.50	0	18.5
2004	19,429.45	13,601	18,626	0.9587	803	7.50	107	17.5
2005	11,868.04	7,833	10,282	0.8664	1,586	8.50	187	16.5
2006	230,098.97	142,661	187,273	0.8139	42,826	9.50	4,508	15.5
2007	14,821.03	8,596	11,284	0.7614	3,537	10.50	337	14.5
2008	48,220.36	26,039	34,182	0.7089	14,039	11.50	1,221	13.5
2010	74,799.68	34,408	45,167	0.6038	29,632	13.50	2,195	11.5
2011	31,820.28	13,365	17,544	0.5513	14,277	14.50	985	10.5
2012	385,182.19	146,369	192,140	0.4988	193,042	15.50	12,454	9.5
2013	44,771.16	15,222	19,982	0.4463	24,789	16.50	1,502	8.5
2014	123,724.15	37,117	48,724	0.3938	75,000	17.50	4,286	7.5
2015	10,522.97	2,736	3,592	0.3413	6,931	18.50	375	6.5
2016	8,540.63	1,879	2,467	0.2888	6,074	19.50	311	5.5
2017	12,051.42	2,169	2,848	0.2363	9,204	20.50	449	4.5
2018	21,759.78	3,046	3,999	0.1838	17,761	21.50	826	3.5
2019	170,767.52	17,077	22,417	0.1313	148,351	22.50	6,593	2.5
2020	67,708.05	4,062	5,333	0.0788	62,375	23.50	2,654	1.5
2021	203,213.70	4,064	5,335	0.0263	197,879	24.50	8,077	0.5
TOTAL	1,543,613.73	529,827	695,508		848,105		47,067	

COMPOSITE ANNUAL ACCRUAL RATE 3.05%

THEORETICAL ACCUMULATED DEPRECIATION FACTOR 0.45

COMPOSITE AVERAGE AGE (YEARS) 8.58

DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS) 16.42



SECTION 9

9 ESTIMATION OF SURVIVOR CURVES

9.1 Average Service Life

All assets have a service life, which is defined as “the period of time from its installation until it is retired from service”³. All account groups of property are made up of various assets with differing service lives and investment values. To calculate a depreciation rate, one must first calculate an average life for all assets in a single account. This can be done by ascertaining the age at retirement for every asset in an account and plotting it as a percentage of the units surviving at each age interval (a “Survivor Curve”). From the average life for each account, remaining lives can then be found which are then used to calculate the annual depreciation accruals and ultimately depreciation rate. A discussion of the general concept of survivor curves is presented and the Iowa type survivor curves are reviewed.

9.2 Survivor Curves

A survivor curve is defined as “a graph of the percent of units remaining in service expressed as a function of age”⁴. To calculate the average life of the group, the remaining life expectancy, the probable life and the frequency curve, one must first create a survivor curve. Figure 1 shows a typical 40-R4 smoothed survivor curve as well as the accompanying derived curves. The type 40-R4 refers to the Iowa type curve, whose designation will be explained in further detail in the next section

To calculate the average service life, one must calculate the area under the survivor curve and divide by the percent surviving at age zero. The remaining life is equal to the area under the survivor curve and to the right of the current age, divided by the percent surviving at the current age. In Figure 1, for example, the hatched area to the right of age 45 divided by 28.9 percent surviving balance represents the remaining life for an asset that has reached that age. The probable life is “the total life expectancy of the property surviving at any age and is equal to the remaining life plus the current age.”⁵ If the probable life of the property is calculated for each year of age, the probable life curve shown in the chart can be developed. The frequency curve is calculated by taking the difference between the percent surviving on successive years on the survivor curve⁶. Alternatively, frequency can be empirically determined by finding the amount of retirements at any given age. Plotting retirement frequency from the youngest to oldest ages and then taking the cumulative frequencies will generate percent surviving versus age.

³ Wolf, Frank K. and W. Chester Fitch, *Depreciation Systems* (Iowa State University Press, 1994), 21.

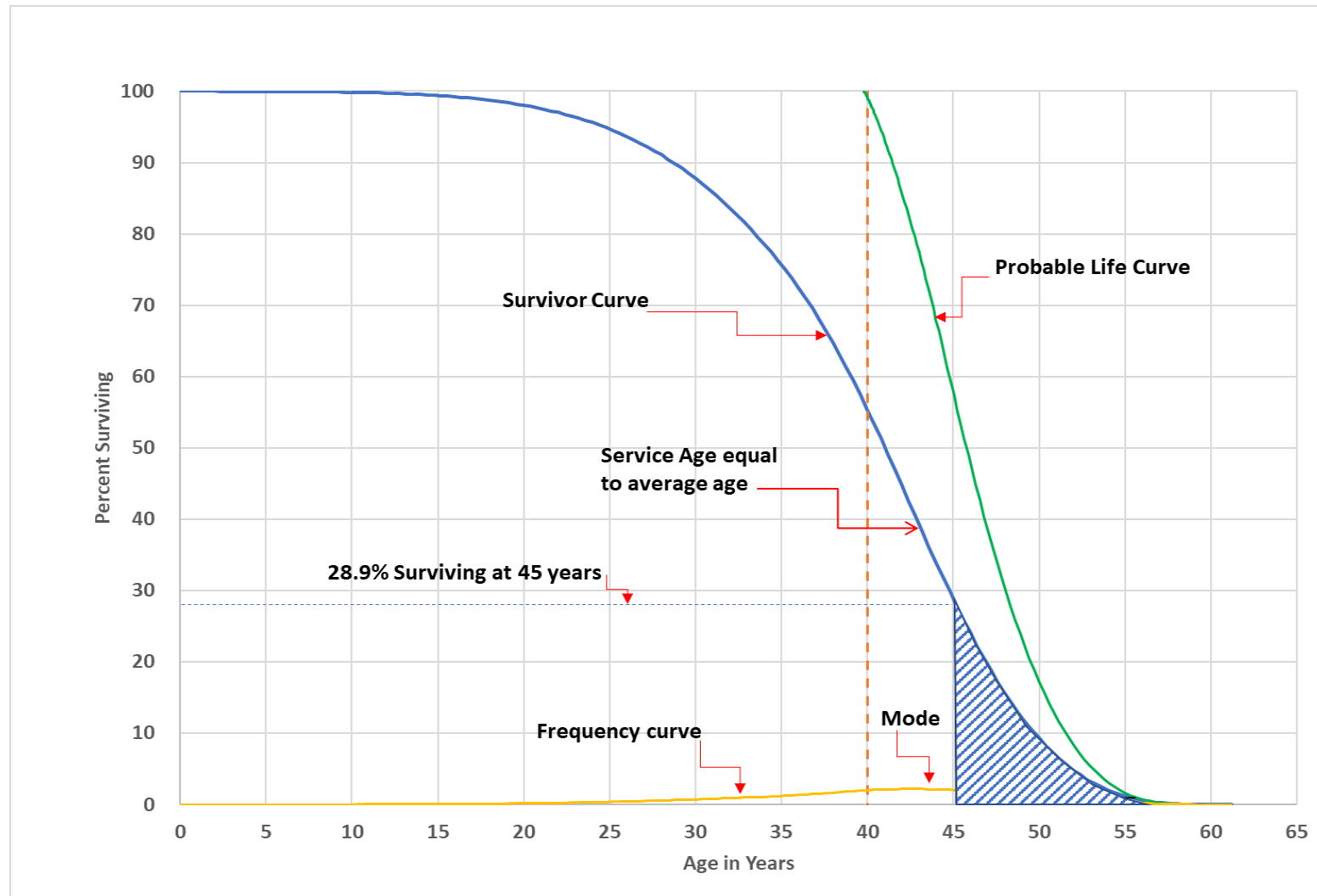
⁴ *Ibid*, 23.

⁵ *Ibid*, 29.

⁶ *Ibid*, 23-24.



FIGURE 1: TYPICAL SURVIVOR CURVE (40-R4) AND DERIVED CURVES





9.3 Iowa Type Curves

In 1931, Robley Winfrey and Edwin Kurtz of the Engineering Research Institute at Iowa State University published Bulletin 103, which laid the groundwork for what would eventually be known as the Iowa Curves. “The 13 type curves can be used as valuable aids in forecasting the probable future service lives of individual items and of groups of items of different kinds of physical equipment”⁷. The 13 curves described in Bulletin 103 eventually became a series of 22 generalized survivor curves which are used throughout the regulated utility industry. These 22 curves were described in Bulletin 125, published in 1967 by Harold A. Cowles, which became known as the Iowa curves.

The Iowa curves are organized with three variables: the average life of the plant; the location of the mode; and the variation of the life. All Iowa curves have both a letter and a number to represent the shape and height of the mode. The L curves, or left-moded curves, are used when the mode of the curve should be to the left of the average life. There are six L curves presented in Figure 2. The R curves, or right-moded, are used when the mode of the curve should be to the right of the average life. There are five R curves, which are presented in Figure 3. The S curves, or symmetrically-moded, are used when the mode is equal to the average life. There are seven S curves, which are presented in Figure 4. The O curves, or origin curves, are used when the mode occurs at age 0. There are four O curves, which are presented in Figure 5. There are some occasions where it is appropriate to use a half curve. In these cases, the curve is assumed to be exactly half way between the two curves.

In addition to Bulletin 125, Iowa curves have also been presented in subsequent Experiment Station bulletins and in the text *Engineering Valuation and Depreciation*⁸. In 1957, Frank V. B. Couch, Jr., an Iowa State College graduate student, submitted a thesis⁹ presenting his development of the fourth family consisting of the four O-type survivor curves.

⁷ *Ibid*, 21

⁸ Marston, Anson, Robley Winfrey and Jean C. Hempstead, *Engineering Valuation and Depreciation* (The Iowa State University Press, 1953)

⁹ Couch, Frank V. B., Jr., *Classification of Type O Retirement Characteristics of Industrial Property* Unpublished M.S. Thesis (Engineering Valuation, Library, Iowa State College, Ames, Iowa, 1957)



FIGURE 2: LEFT MODAL OR "L" IOWA TYPE SURVIVOR CURVES

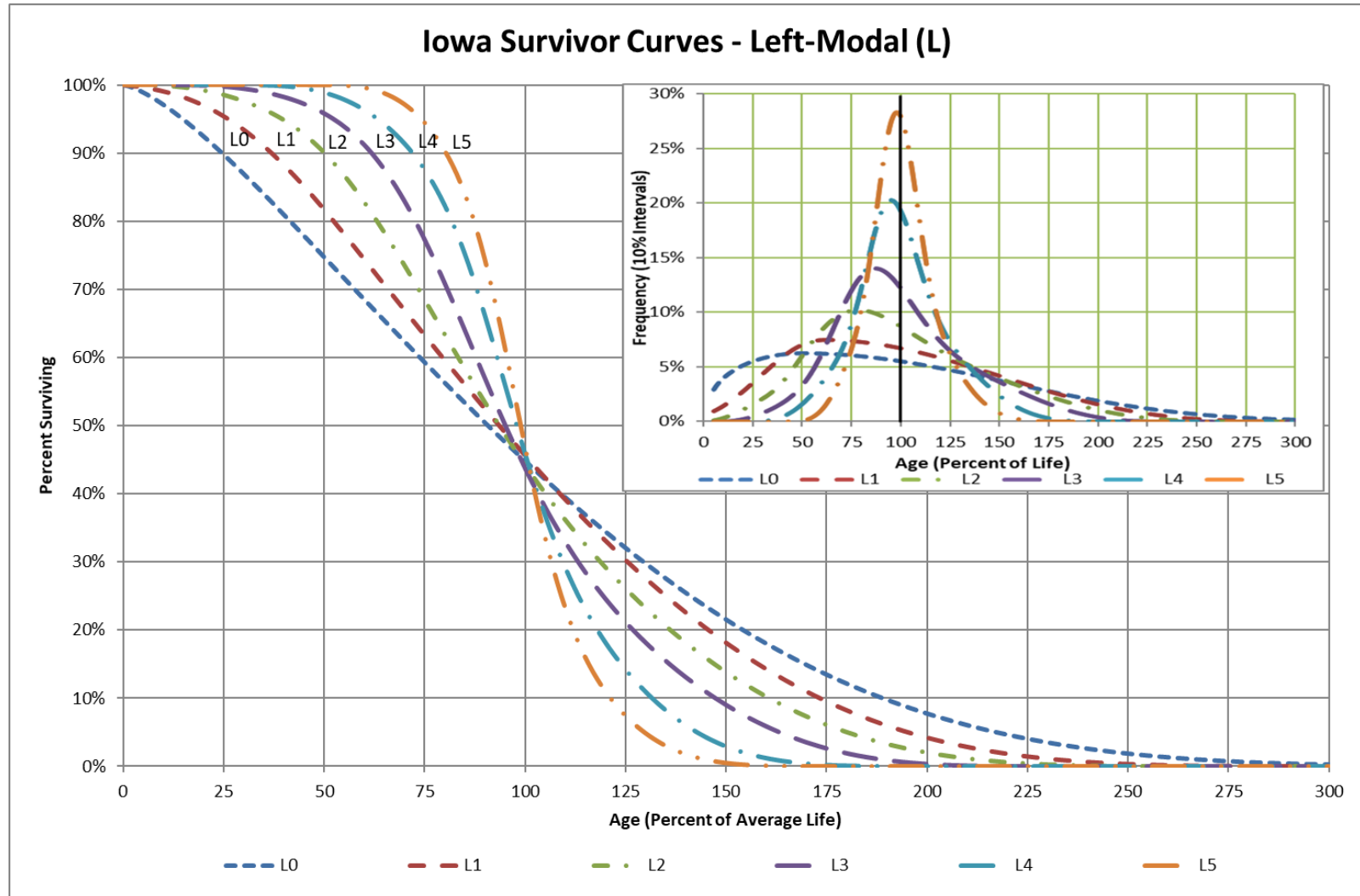




FIGURE 3: RIGHT MODAL OR "R" IOWA TYPE SURVIVOR CURVES

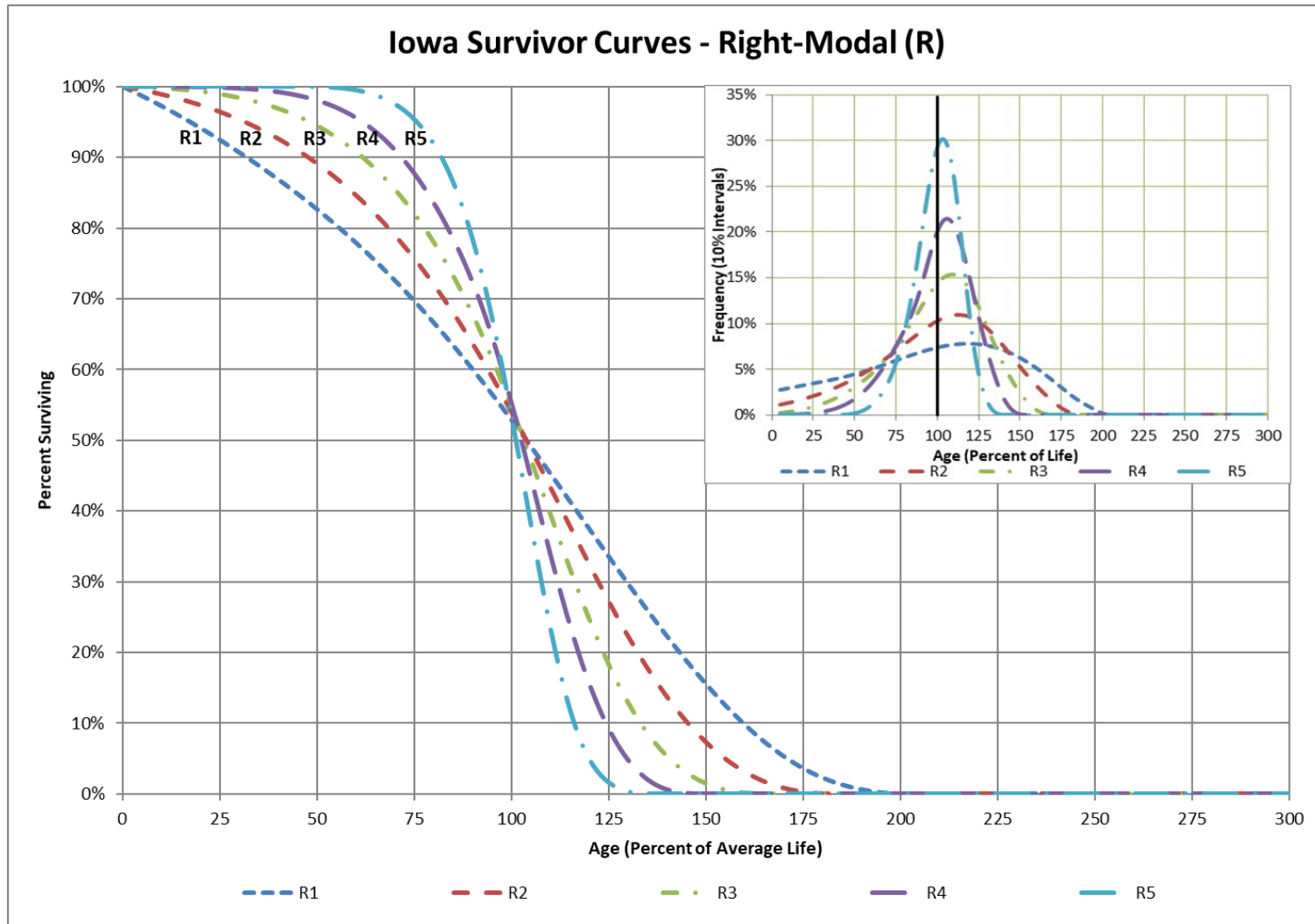




FIGURE 4: SYMMETRICAL OR "S" IOWA TYPE SURVIVOR CURVES

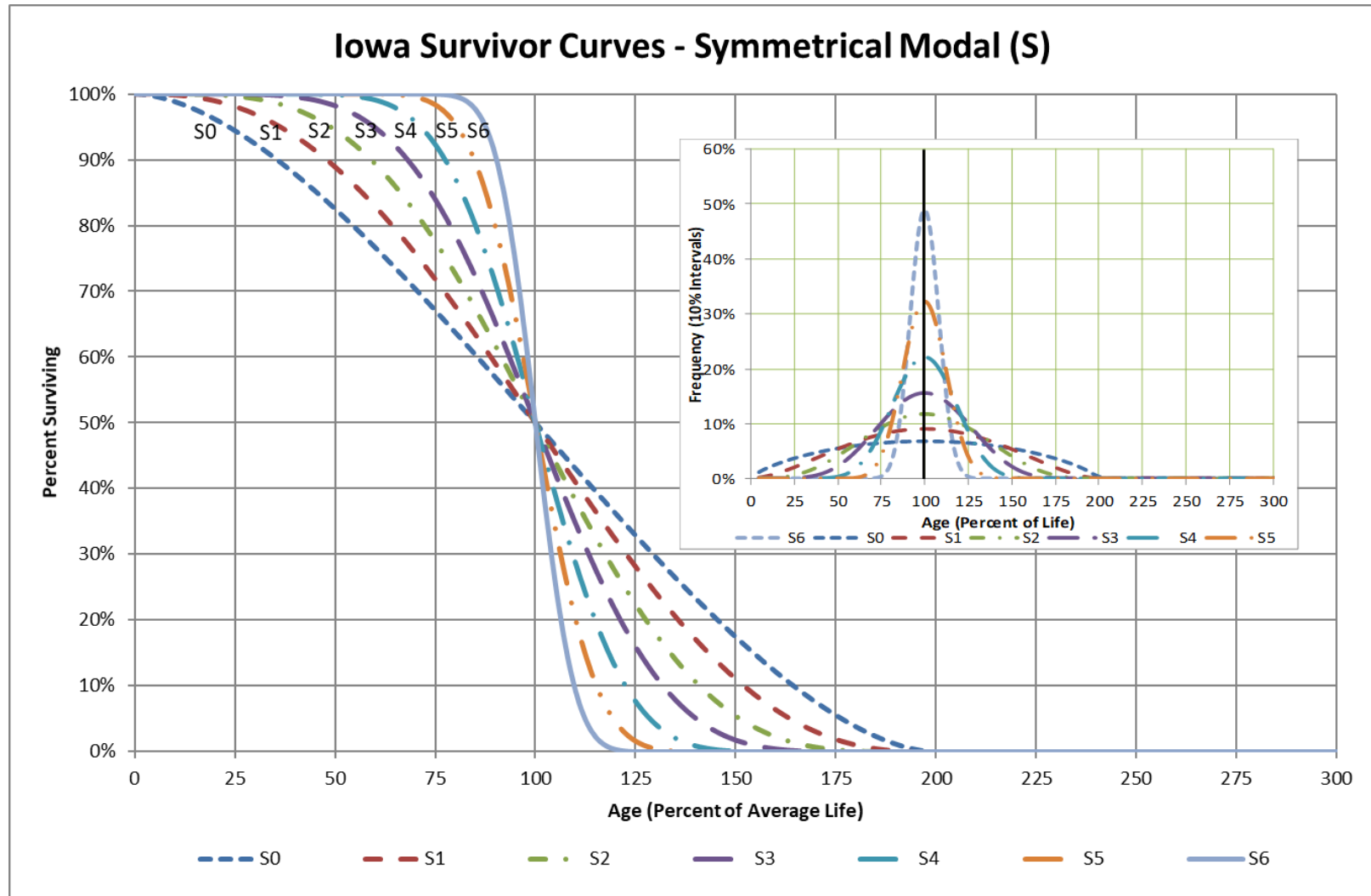
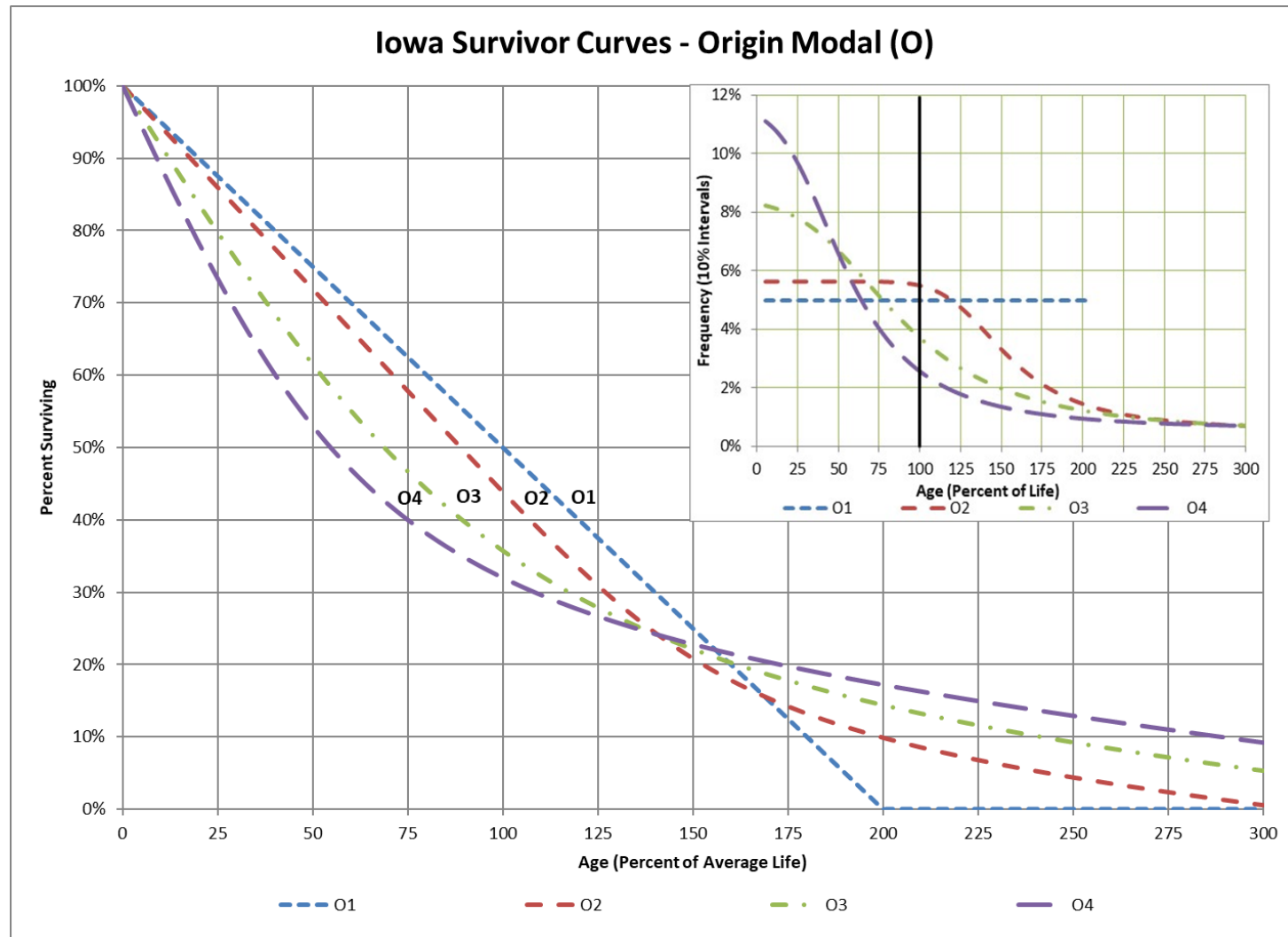




FIGURE 5: ORIGIN MODAL OR "O" IOWA TYPE SURVIVOR CURVES





9.4 Retirement Rate Method of Analysis

The retirement rate method is a widely accepted actuarial method used to create survivor curves. This method is also referred to as an original life table. These survivor curves can then be used to determine the average service life of a plant account. The retirement rate method is thoroughly explained in several publications, including Statistical Analyses of Industrial Property Retirements,¹⁰ Engineering Valuation and Depreciation¹¹ and Depreciation Systems¹².

The retirement rate method is a subgroup of the placement and the experience band methods, as described in “Depreciation Systems”. The placement band method creates a survivor curve which describes the life characteristics of assets placed into service during a selected timeframe. The experience band method creates a survivor curve which describes the life characteristics of assets removed from service during a selected time frame. The retirement rate method creates both placement and experience bands to give the most complete or representative data. An example of the calculations used in the development of a life table follows. The example includes schedules of annual aged property transactions, a schedule of plant exposed to retirement, a life table and illustrations of smoothing the stub survivor curve.

9.5 Schedules of Annual Transactions in Plant Records

The property group used to illustrate the retirement rate method is observed for the experience band 2008-2017 during which there were placements during the years 2003-2017. In order to illustrate the summation of the aged data by age interval, the data was compiled in the manner presented in Schedules 1 and 2. In Schedule 1 (page 9-10), the year of installation (year placed) and the year of retirement are shown. The age interval during which a retirement occurred is determined from this information. In the example which follows, \$10,000 of the asset invested in 2003 were retired in 2008. The \$10,000 retirement occurred during the age interval between 4 ½ and 5 ½ years (2008 - 2003) on the basis that approximately one-half of the amount of property was installed prior to and after July 1 of each year. That is, on the average, property installed during a year is placed in service at the midpoint of the year for the purpose of the analysis. All retirements also are stated as occurring at the midpoint of a one-year age interval of time, except the first age interval which encompasses only one-half year.

The total retirements occurring in each age interval in a band are determined by summing the amounts for each transaction year-installation year combination for that age interval. For example, the total of \$143,000 retired for age interval 4½-5½ is the sum of the retirements entered on Schedule 1 immediately above the stair step line drawn on the table beginning with the 2008 retirements of 2003 installations and ending with the 2016 retirements of the 2011 installations. Thus, the total amount of \$143,000 for age interval 4½-5½ equals the sum of:

$$\$10 + \$12 + \$13 + \$11 + \$13 + \$13 + \$15 + \$17 + \$19 + \$20 = \$143 \text{ k}$$

¹⁰ Anson, Winfrey & Hempstead, supra note 7

¹¹ Anson, Winfrey & Hempstead, supra note 7

¹² Wolf & Fitch, supra note 2



Other transactions which affect the group are recorded in a similar manner in Schedule 2 (page 9-11). The entries illustrated include transfers and sales. The entries which are credits to the plant account are shown in parentheses. The items recorded on this schedule are not totaled with the retirements but are used in developing the exposures at the beginning of each age interval.



SCHEDULE 1. RETIREMENTS FOR EACH YEAR 2008-2017 – SUMMARIZED BY AGE INTERVAL

Experience Band 2008-2017

Placement Band 2003-2017

Retirements (Thousands of Dollars)
Annual Survivors at the Beginning of the Year

Year Placed (1)	2008 (2)	2009 (3)	2010 (4)	2011 (5)	2012 (6)	2013 (7)	2014 (8)	2015 (9)	2016 (10)	2017 (11)	Total Durring Age Interval (12)	Age Interval (13)
2003	10	11	12	13	14	16	23	24	25	26	26	13½-14½
2004	11	12	13	15	16	18	20	21	22	19	44	12½-13½
2005	11	12	13	14	16	17	19	21	22	18	64	11½-12½
2006	8	9	10	11	11	13	14	15	16	17	83	10½-11½
2007	9	10	11	12	13	14	16	17	19	20	93	9½-10½
2008	4	9	10	11	12	13	14	15	16	20	105	8½-9½
2009		5	11	12	13	14	15	16	18	20	113	7½-8½
2010			6	12	13	15	16	17	19	19	124	6½-7½
2011				6	13	15	16	17	19	19	131	5½-6½
2012					7	14	16	17	19	20	143	4½-5½
2013						8	18	20	22	23	146	3½-4½
2014							9	20	22	25	150	2½-3½
2015								11	23	25	151	1½-2½
2016									11	24	153	½-1½
2017										13	80	0-½
Total	53	68	86	106	128	157	196	231	273	308	1,606	



SCHEDULE 2. OTHER TRANSACTIONS FOR EACH YEAR 2008-2017 – SUMMARIZED BY AGE INTERVAL

Experience Band 2008-2017

Placement Band 2003-2017

Acquisitions, Transfers and Sales (Thousands of Dollars)
Annual Survivors at the Beginning of the Year

Year Placed (1)	2008 (2)	2009 (3)	2010 (4)	2011 (5)	2012 (6)	2013 (7)	2014 (8)	2015 (9)	2016 (10)	2017 (11)	Total Durring Age Interval (12)	Age Interval (13)
2003	-	-	-	-	-	-	60 ^a	-	-	-	-	13½-14½
2004	-	-	-	-	-	-	-	-	-	-	-	12½-13½
2005	-	-	-	-	-	-	-	-	-	-	-	11½-12½
2006	-	-	-	-	-	-	-	(5) ^b	-	-	60	10½-11½
2007	-	-	-	-	-	-	-	6 ^a	-	-	-	9½-10½
2008	-	-	-	-	-	-	-	-	-	-	(5)	8½-9½
2009		-	-	-	-	-	-	-	-	-	-	7½-8½
2010			-	-	-	-	-	-	-	-	-	6½-7½
2011				-	-	-	-	(12) ^b	-	-	-	5½-6½
2012					-	-	-	-	22 ^a	-	-	4½-5½
2013						-	-	(19) ^b	-	-	10	3½-4½
2014							-	-	-	-	-	2½-3½
2015								-	-	(102) ^c	(121)	1½-2½
2016									-	-	-	½-1½
2017												0-½
Total	-	-	-	-	-	-	60	(30)	22	(102)	(50)	

^a Transfer Affecting Exposures at Beginning of Year

^b Transfer Affecting Exposures at End of Year

^c Sale with Continued Use

Parentheses denote Credit amount.



9.6 Schedule of Plant Exposed to Retirement

The development of the amount of plant exposed to retirement at the beginning of each age interval is illustrated in Schedule 3 (page 9-13). The surviving plant at the beginning of each year from 2007 through 2016 is recorded by year in the portion of the table titled "Annual Survivors at the Beginning of the Year." The last amount entered in each column is the amount of new plant added to the group during the year. The amounts entered in Schedule 3 for each successive year following the beginning balance or addition, are obtained by adding or subtracting the net entries shown on Schedules 1 and 2. For the purpose of determining the plant exposed to retirement, transfers-in are considered as being exposed to retirement in this group at the beginning of the year in which they occurred, and the sales and transfers-out are considered to be removed from the plant exposed to retirement at the beginning of the following year. Thus, the amounts of plant shown at the beginning of each year are the amounts of plant from each placement year considered to be exposed to retirement at the beginning of each successive transaction year. For example, the exposures for the installation year 2013 are calculated in the following manner:

Exposures at age 0	=	amount of addition	=	\$750,000
Exposures at age ½	=	\$750,000 - \$ 8,000	=	\$742,000
Exposures at age 1½	=	\$742,000 - \$18,000	=	\$724,000
Exposures at age 2½	=	\$724,000 - \$20,000 - \$19,000	=	\$685,000
Exposures at age 3½	=	\$685,000 - \$22,000	=	\$663,000

For the entire experience band 2008-2018, the total exposures at the beginning of an age interval are obtained by summing diagonally in a manner similar to the summing of the retirements during an age interval (Schedule 1). For example, the figure of 3,789, shown as the total exposures at the beginning of age interval 4½-5½, is obtained by summing:

$$\$255 + \$268 + \$ 284 + \$311 + \$334 + \$374 + \$405 + \$448 + \$501 + \$609 = \$3,789k$$



SCHEDULE 3 – PLANT EXPOSED TO RETIREMENT AT THE BEGINNING OF EACH YEAR, 2008 -2017 – SUMMARIZED BY AGE INTERVAL

Experience Band 2008 - 2017

Placement Band 2003-2017

Exposures (Thousands of Dollars)
Annual Survivors at the Beginning of the Year

Year Placed (1)	2008 (2)	2009 (3)	2010 (4)	2011 (5)	2012 (6)	2013 (7)	2014 (8)	2015 (9)	2016 (10)	2017 (11)	Total at Beginning of Age Interval (12)	Age Interval (13)
2003	255	245	234	222	209	195	239	216	192	167	167	13½-14½
2004	279	268	256	243	228	212	194	174	153	131	323	12½-13½
2005	307	296	284	271	257	241	224	205	184	162	531	11½-12½
2006	338	330	321	311	300	289	276	262	242	226	823	10½-11½
2007	376	367	257	346	334	321	307	267	280	261	1,097	9½-10½
2008	420 ^a	416	407	397	386	374	361	347	332	316	1,503	8½-9½
2009		460 ^a	455	444	432	419	405	390	374	356	1,952	7½-8½
2010			510 ^a	504	492	479	464	448	431	412	2,463	6½-7½
2011				580 ^a	574	561	546	530	501	482	3,057	5½-6½
2012					660 ^a	653	639	623	628	609	3,789	4½-5½
2013						750 ^a	742	724	685	663	4,332	3½-4½
2014							850 ^a	841	821	799	4,955	2½-3½
2015								960 ^a	949	923	5,719	1½-2½
2016									1,080 ^a	1,069	6,579	½-1½
2017										1,220 ^a	7,490	0-½
Total	1,975	2,382	2,724	3,318	3,872	4,494	5,247	5,987	6,852	7,796	44,780	

^a Additions during the year.

1555	1922	2214	2738	3212	3744	4397	5027	5772	6576	44780
420	460	510	580	660	750	850	960	1080	1220	0
1975	2382	2724	3318	3872	4494	5247	5987	6852	7796	44780



9.7 Original Life Tables

The original life table, illustrated in Schedule 4 (page 9-15) is developed from the totals shown on the schedules of retirements and exposures, Schedules 1 and 3, respectively. The exposures at the beginning of the age interval are obtained from the corresponding age interval of the exposure schedule, and the retirements during the age interval are obtained from the corresponding age interval of the retirement schedule. The retirement ratio is the result of dividing the retirements during the age interval by the exposures at the beginning of the age interval. The percent surviving at the beginning of each age interval is derived from survivor ratios, each of which equals one minus the retirement ratio. The percent surviving is developed by starting with 100 percent at age zero and successively multiplying the percent surviving at the beginning of each interval by the survivor ratio, i.e., one minus the retirement ratio for that age interval. The calculations necessary to determine the percent surviving at age 5½ are as follows:

Percent surviving at age 4½	=	88.15		
Exposures at age 4½	=	\$3,789,000		
Retirements from age 4½ to 5½	=	\$143,000		
Retirement Ratio	=	$\$143,000 \div \$3,789,000$	=	0.0377
Survivor Ratio	=	$1.000 - 0.0377$	=	0.9623
Percent surviving at age 5½	=	$(88.15) \times (0.9623)$	=	84.83

The totals of the exposures and retirements (columns 2 and 3) are shown for the purpose of checking with the respective totals in Schedules 1 and 3. The ratio of the total retirements to the total exposures, other than for each age interval, is meaningless. The original survivor curve is plotted from the original life table (column 6, Schedule 4). When the curve terminates at a percent surviving greater than zero, it is called a stub survivor curve. Survivor curves developed from retirement rate studies generally are stub curves.



SCHEDULE 4: ORIGINAL LIFE TABLE - CALCULATED BY THE RETIREMENT RATE METHOD

Experience Band 2008-2017				Placement Band 2003-2017	
Age at Beginning of Interval	Exposures at Beginning of Age Interval	Retirements During Age Interval	Retirement Ratio	Survivor Ratio	% Surviving at Beginning of Age Interval
0	7,490	80	0.0107	0.9893	100.00
0.5	6,579	153	0.0233	0.9767	98.93
1.5	5,719	151	0.0264	0.9736	96.62
2.5	4,955	150	0.0303	0.9697	94.07
3.5	4,332	146	0.0337	0.9663	91.22
4.5	3,789	143	0.0377	0.9623	88.15
5.5	3,057	131	0.0429	0.9571	84.83
6.5	2,463	124	0.0503	0.9497	81.19
7.5	1,952	113	0.0579	0.9421	77.11
8.5	1,503	105	0.0699	0.9301	72.65
9.5	1,097	93	0.0848	0.9152	67.57
10.5	823	83	0.1009	0.8991	61.84
11.5	531	64	0.1205	0.8795	55.6
12.5	323	44	0.1362	0.8638	48.9
13.5	167	26	0.1557	0.8443	42.24
					35.66
Total	44,780	1,606			

- Exposure and Retirement Amounts are in Thousands of Dollars
- Column 2 from Schedule 3, Column 12, Plant Exposed to Retirement.
- Column 3 from Schedule 1, Column 12, Retirements for Each Year.
- Column 4 = Column 3 divided by Column 2.
- Column 5 = 1.0000 minus Column 4.
- Column 6 = Column 5 multiplied by Column 6 as of the Preceding Age Interval.



9.8 Smoothing the Original Survivor Curve

The smoothing of the original survivor curve eliminates any irregularities and serves as the basis for the preliminary extrapolation to zero percent surviving of the original stub curve. Even if the original survivor curve is complete from 100 percent to zero percent, it is desirable to eliminate any irregularities, as there is still an extrapolation for the vintages which have not yet lived to the age at which the curve reaches zero percent. In this study, the smoothing of the original curve with established type curves was used to eliminate irregularities in the original curve.

The Iowa type curves are used in this study to smooth those original stub curves which are expressed as percentages surviving at ages in years. Each original survivor curve was compared to the Iowa curves using visual and mathematical matching in order to determine the better fitting smooth curves. In Figures 6, 7, and 8, the original curve developed in Schedule 4 is compared with the L, S, and R Iowa type curves which most nearly fit the original survivor curve. In Figure 6, the L1 curve with an average life between 12 and 13 years appears to be the best fit. In Figure 7, the S0 type curve with a 12-year average life appears to be the best fit and appears to be better than the L1 fitting. In Figure 8, the R1 type curve with a 12-year average life appears to be the best fit and appears to be better than either the L1 or the S0.

In Figure 9, the three fittings, 12-L1, 12-S0 and 12-R1 are drawn for comparison purposes. It is probable that the 12-R1 Iowa curve would be selected as the most representative of the plotted survivor characteristics of the group.



FIGURE 6: ILLUSTRATION OF THE MATCHING OF AN ORIGINAL SURVIVOR CURVE WITH A L1 IOWA TYPE CURVE ORIGINAL AND SMOOTH SURVIVOR CURVES

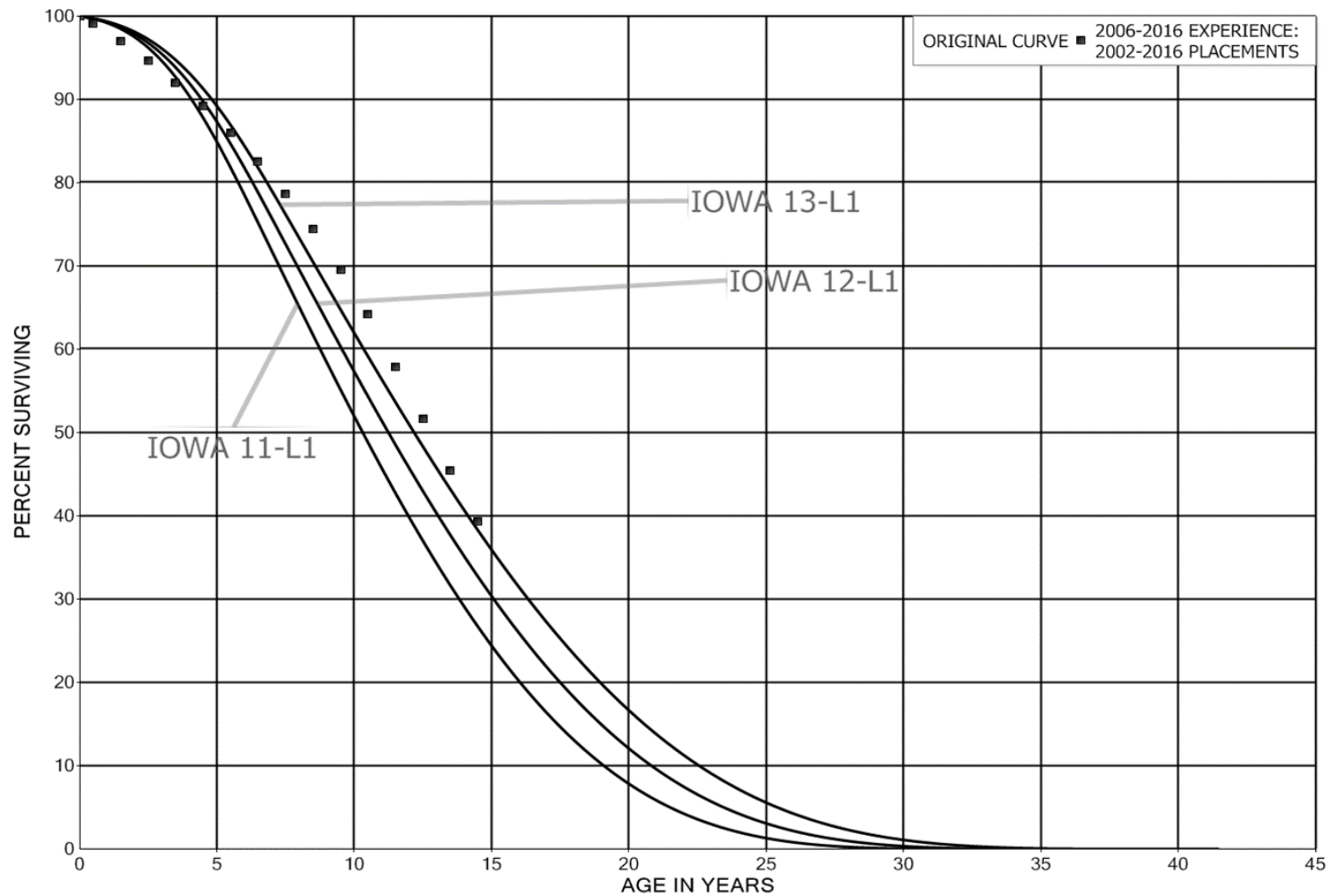




FIGURE 7: ILLUSTRATION OF THE MATCHING OF AN ORIGINAL SURVIVOR CURVE WITH A SO IOWA TYPE CURVE ORIGINAL AND SMOOTH SURVIVOR CURVES

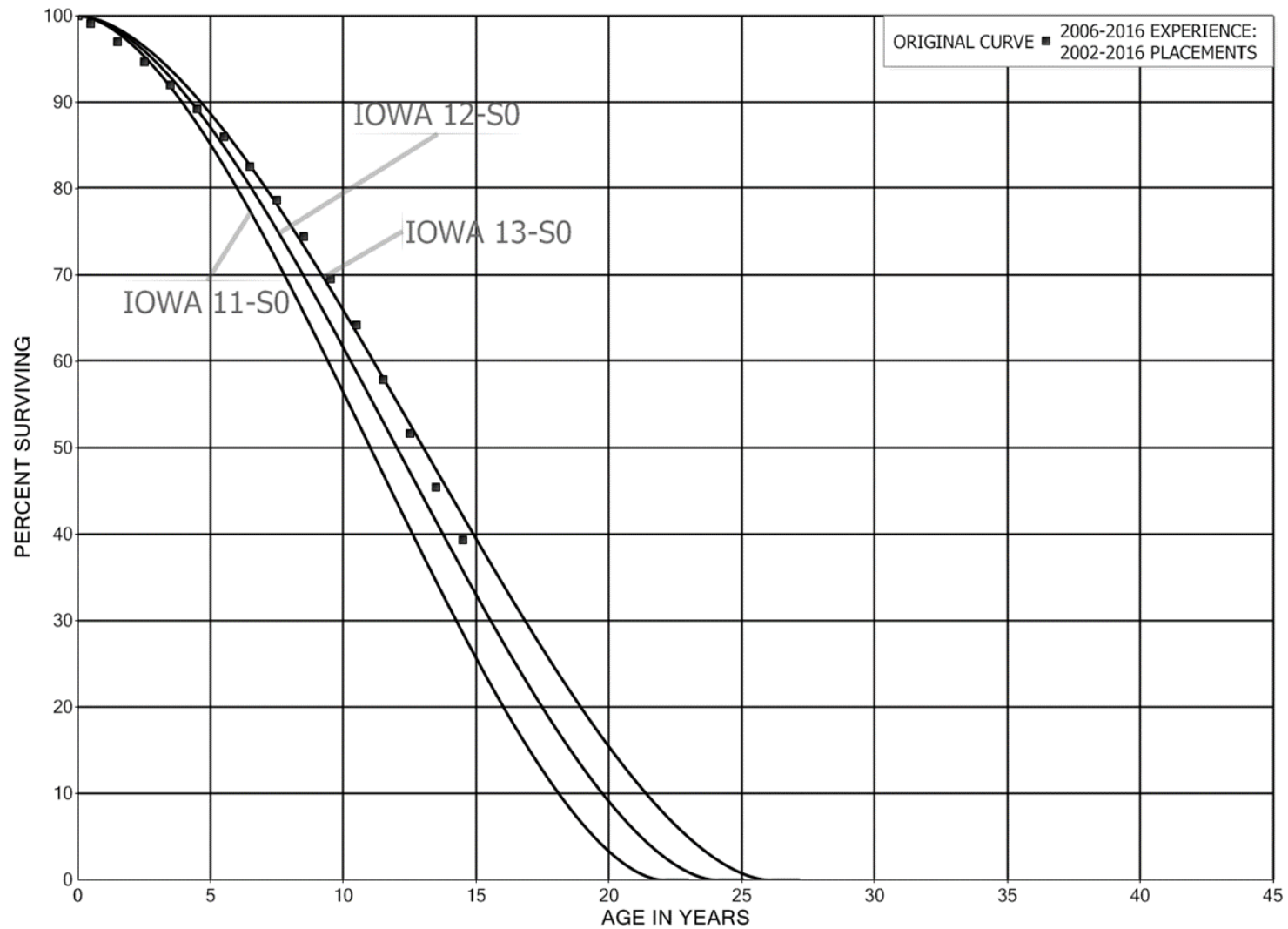




FIGURE 8: ILLUSTRATION OF THE MATCHING OF AN ORIGINAL SURVIVOR CURVE WITH A R1 IOWA TYPE CURVE ORIGINAL AND SMOOTH SURVIVOR CURVES

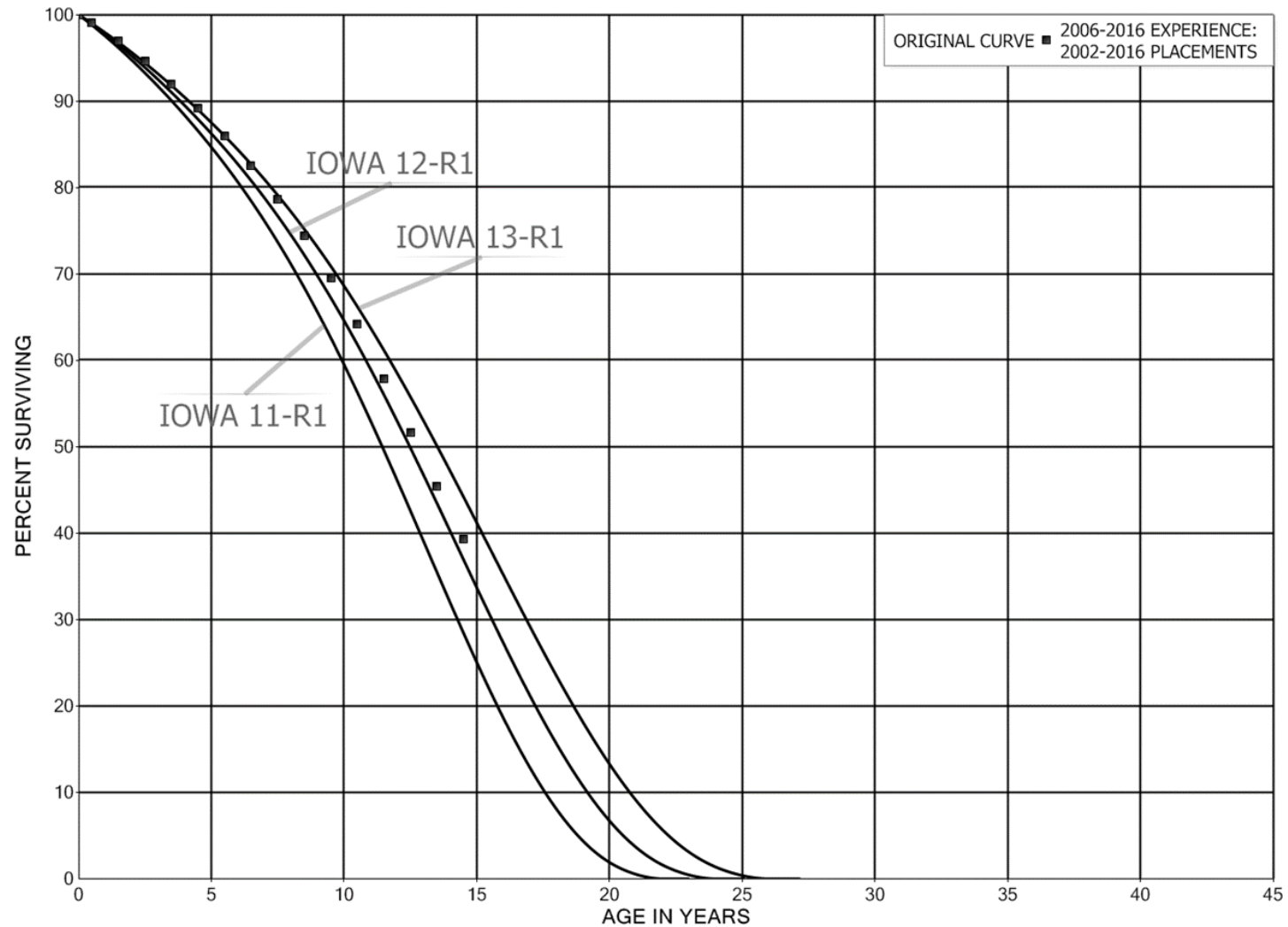
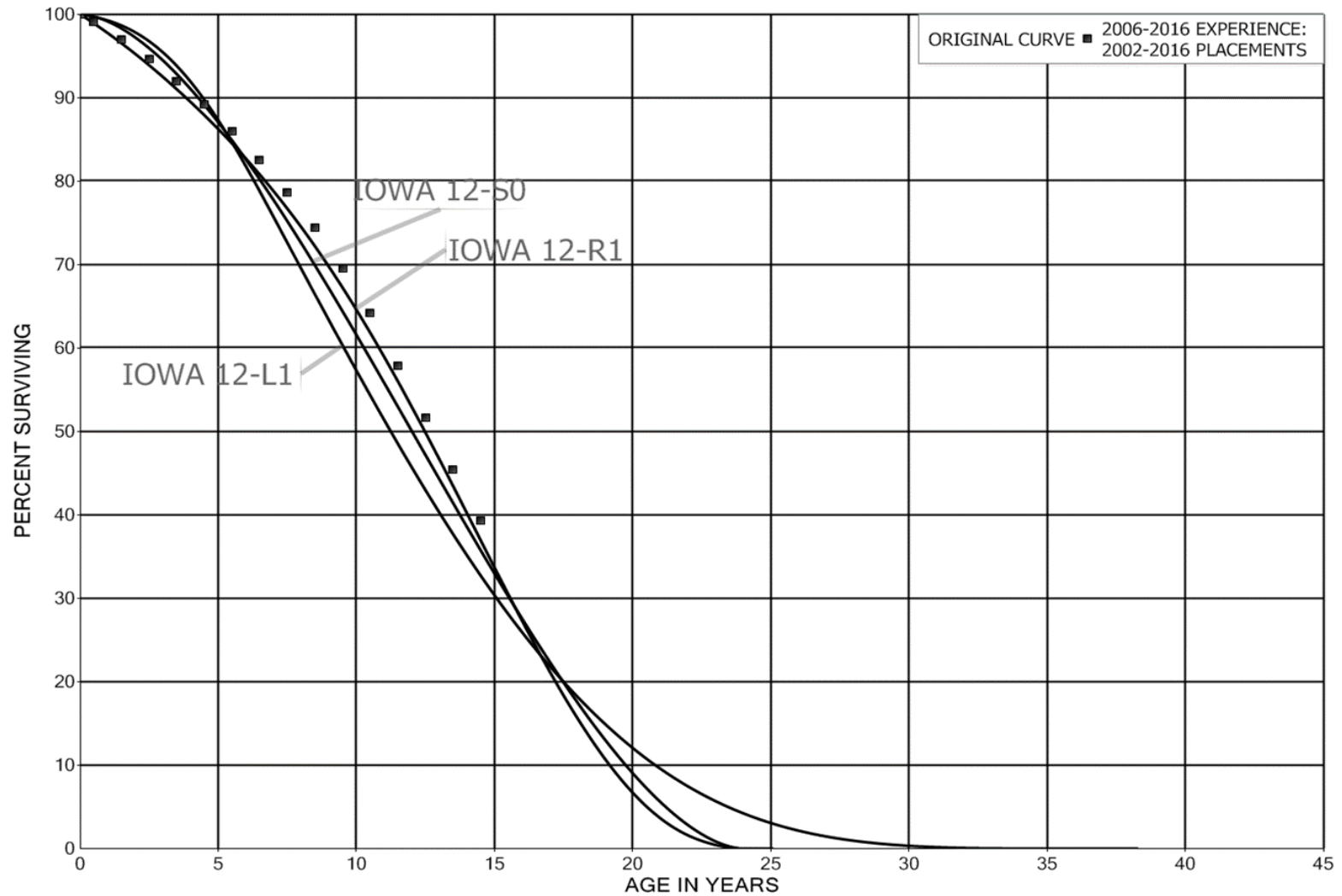




FIGURE 9: ILLUSTRATION OF THE MATCHING OF AN ORIGINAL SURVIVOR CURVE WITH A L1 IOWA TYPE CURVE ORIGINAL AND SMOOTH SURVIVOR CURVES





SECTION 10

10 ESTIMATION OF NET SALVAGE

The estimates of net salvage were based primarily on the professional judgment of Concentric, based in part on historical data, and in part through a comparison to Canadian peer companies. The analysis of historic net salvage activity considered gross salvage and cost of removal as recorded to the depreciation reserve account. Net salvages as a percentage of the cost of plant retired are calculated for each plant component on both annual and three-year moving average bases.

The net salvage percentages estimated are usually determined using the “Traditional Approach” for net salvage estimation. When a utility retires plant, the plant may be: (1) sold to a third party; (2) reused by the utility for additional service; (3) abandoned in place; or (4) physically removed. In the circumstances where the plant is sold or re-used, a salvage proceeds (or positive salvage amount) is normally recognized. In circumstances where the plant is abandoned in place or physically removed, a cost of removal expenditure (or negative salvage) is incurred. The net of these estimated gross salvage proceeds and the estimated costs of removal are expressed as a percentage of the account’s original cost to determine a net salvage percentage. In the circumstances where the salvage proceeds exceed the costs of retirement, a net positive salvage percentage exists. In the circumstances where the costs of removal exceed the salvage proceeds, a net negative salvage as a percentage of the original cost is the result.

The estimation of the net salvage as a percentage of original cost as developed using the traditional approach, includes the following five steps.

1. The annual retirement, gross salvage and cost of removal transactions for the period of analysis is extracted from the plant accounting systems.
2. A net salvage amount (gross salvage proceeds less cost of retirement) is calculated for each historic year. Additionally, a net salvage amount is also calculated for each historic three-year rolling band and the most recent five-year rolling band.
3. The net salvage amount determined above is compared to the original booked costs retired for each period in the manner described, which results in a net salvage percentage of original costs retired for each year, in addition to three-year rolling bands and the most recent five-year rolling band. The annual, the three-year rolling average, and the most recent five-year rolling average net salvage percentages are analyzed to determine a reasonable estimated net salvage percentage. At this point the net salvage percentage is based purely upon statistical analysis.
4. Each account is then compared to the net salvage percentage currently approved, compared to Canadian peer companies, and discussed with company engineering staff. Based on the statistical analysis, the review of current and Canadian peer company net salvage percentages, and with the professional judgment of Concentric, a net salvage percentage is determined for each account.
5. The net salvage percentage is then used in the depreciation rate calculations in the technical update or report.