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NEBRASKA PUBLIC EMPLOYEES RETIREMENT SYSTEMS

Experience Study
Study Period: Four Years Ending June 30, 2015 or December 31, 2015

November 17, 2016

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November 17, 2016

Public Employees Retirement Board
Nebraska Public Employees Retirement System
Post Office Box 94816
Lincoln, NE 68509

Dear Members of the Board:

It is a pleasure to submit this report of our investigation of the experience of the Nebraska Public Employees Retirement System (NPERS) for the four-year period ending in 2015. For the Schools, Patrol, and Judges Plans, this is the period July 1, 2011 to June 30, 2015, while for the County and State Cash Balance Plans the period was January 1, 2012 through December 31, 2015. The study was based on the data submitted by NPERS for the annual valuations of each of the plans. In preparing this report we relied, without audit, on the data provided.

The purpose of this report is to present the results of our review of the actuarial methods and assumptions used in the actuarial valuations of the NPERS plans. With the Board's approval of the recommendations in this report, these assumptions and methods would be used in the July 1, 2016 and January 1, 2017 actuarial valuations.

We hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board (ASB) and the Code of Professional Conduct and Qualification Standards for Public Statements of Actuarial Opinion of the American Academy of Actuaries.

We further certify that, in our opinion, the assumptions developed in this report satisfy Actuarial Standards of Practice, in particular, No. 27 (Selection of Economic Assumptions for Measuring Pension Obligations) and No. 35 (Selection of Demographic and Other Non-economic Assumptions for Measuring Pension Obligations).

We are available to answer any questions on the material contained in the report, or to provide explanations or further details as may be appropriate. We are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein.

We would like to acknowledge the help given by NPERS' staff in the preparation of the data for this investigation.

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I, Patrice A. Beckham, F.S.A., am a member of the American Academy of Actuaries and a Fellow of the Society of Actuaries, and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

I, Brent A. Banister, F.S.A., am a member of the American Academy of Actuaries and a Fellow of the Society of Actuaries, and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Sincerely,

Patrice Beckham

Patrice A. Beckham, FSA, EA, FCA, MAAA
Principal and Consulting Actuary

Brent A. Banister

Brent A. Banister, PhD, FSA, EA, FCA, MAAA
Chief Pension Actuary

Introduction

The purpose of an actuarial valuation is to provide a timely best estimate of the ultimate costs of a retirement system. Actuarial valuations of the Nebraska Public Employees Retirement System (NPERS) five plans (School Retirement System, Judges Retirement System, State Patrol Retirement System, State Cash Balance Plan, and County Cash Balance Plan) are prepared annually to determine the actuarial contribution rate required to fund them on an actuarial reserve basis, i.e. the current assets plus future contributions, along with investment earnings will be sufficient to provide the benefits promised by the system. The valuations require the use of certain assumptions with respect to the occurrence of future events, such as rates of death, termination of employment, retirement age, and salary changes to estimate the obligations of the system.

The basic purpose of an experience study is to determine whether the actuarial assumptions currently in use have adequately anticipated the actual emerging experience. This information, along with the professional judgment of system personnel and advisors, is used to evaluate the appropriateness of continued use of the current actuarial assumptions. When analyzing experience and assumptions, it is important to recognize that actual experience is reported in the short term while assumptions are intended to be long-term estimates of experience. Therefore, actual experience is expected to vary from study period to study period, without necessarily indicating a change in assumptions is needed.

At the request of the Nebraska Public Employees Retirement Board (PERB), Cavanaugh Macdonald Consulting, LLC (CMC), performed a study of the experience of the NPERS plans, for the four-year periods ending in 2015. For the Schools, Patrol, and Judges plans, this is the period July 1, 2011 to June 30, 2015, while for the County and State plans the period was January 1, 2012 through December 31, 2015. This report presents the results, analysis, and resulting recommendations of our study. It is anticipated that the changes, if approved, will first be reflected in the July 1, 2016 and January 1, 2017 actuarial valuations.

These assumptions have been developed in accordance with generally recognized and accepted actuarial principles and practices that are consistent with the applicable Actuarial Standards of Practice adopted by the Actuarial Standards Board (ASB). While the recommended assumptions represent our best estimate of future experience, there are other reasonable assumption sets that could be supported by the results of this experience study. Those other sets of reasonable assumptions could produce liabilities and costs that are either higher or lower.

Our Philosophy

Similar to an actuarial valuation, the calculation of actual and expected experience is a fairly mechanical process, and differences between actuaries in this area are generally minor. However, the setting of assumptions differs, as it is more art than science. In this report, we have recommended changes to certain assumptions. To explain our thought process, we offer a brief summary of our philosophy:

- **Don't Overreact**: When we see significant changes in experience, we generally do not adjust our rates to reflect the entire difference. We will typically recommend rates somewhere between the old rates and the new experience. If the experience during the next study period shows the same result, we will probably recognize the trend at that point in time or at least move further in the direction of the observed experience. On the other hand, if experience returns closer to its prior level, we will not have overreacted, possibly causing volatility in the actuarial contribution rates.

- **Anticipate Trends**: If there is an identified trend that is expected to continue, we believe that this should be recognized. An example is the retiree mortality assumption. It is an established trend that people are living longer. Therefore, we believe the best estimate of liabilities in the valuation should reflect the expected increase in life expectancy.

- **Simplify**: In general, we attempt to identify which factors are significant and eliminate or ignore the ones that do not materially improve the accuracy of the liability projections.

Actuarial Methods

The basic actuarial methodologies used in the valuation process include the;

- actuarial cost method,
- asset valuation method and
- unfunded actuarial accrued liability (UAAL) amortization methodology.

The actuarial cost method and UAAL amortization method are set in statute, but we nonetheless review them to determine if there is reason to propose any legislative changes. **Based on our review, we recommend that all of the current actuarial methods be retained.**

Summary of Recommendations – Economic Assumptions

Economic assumptions are some of the most visible and significant assumptions used in the valuation process. The items in the broad economy modeled by these assumptions can be very volatile over short periods of time, as clearly seen in the economic downturn in 2008 followed by the rebound in many financial markets in the years following. Our goal is to try to find the emerging long-term trends in the midst of this volatility so that we can then apply reasonable assumptions.

We note that the Nebraska Investment Council (NIC), the entity responsible for investing and managing NPERS' assets, has just completed an asset-liability study. While the study did not recommend any change to the current asset allocation, it did suggest the Council consider expanding into some less liquid investment classes. If this consideration leads to a significant revision of the portfolio allocation in the future, we may suggest that the recommendations in this study be reviewed as well.

Most of the economic assumptions used by actuaries are developed through a building-block approach. For example, the expected return on assets is based on the expectation for inflation plus the expected real return on assets. At the core of the economic assumptions is the inflation assumption. As we discuss later in the report, based on the historical trends of inflation, the market pricing of inflation, and the Chief Actuary of the Social Security Administration's view of inflation, we are recommending a decrease in the inflation assumption from 3.25% to 2.75%. While some might argue that inflation will be even lower in the future, we believe this approach is consistent with our desire to avoid overreacting.

With the change in inflation assumption, other economic assumptions that build upon it are also impacted. We are recommending that the long-term expected return on assets be lowered to 7.50%, reflecting the lower inflation assumption. Likewise, we recommend the payroll growth assumption be decreased to 3.50%, reflecting lower anticipated price inflation.

The following table summarizes the current and proposed economic assumptions:

	Current Assumptions	Proposed Assumptions
Price Inflation	3.25%	2.75%
Long-term Investment Return	8.00%/7.75%*	7.50%
Wage Inflation (above price inflation)	0.75%	0.75%
General Wage Growth (also used for Payroll Growth)	4.00%	3.50%
Total Salary Increase	Varies with service	Adjust for 0.50% change in inflation
Cash Balance Interest Crediting Rate	6.75%	6.25%

*The current investment return assumption is 8.00% for the final pay defined benefit plans, and 7.75% for the cash balance defined benefit plans.

Although we have recommended a change in the set of economic assumptions, we recognize that there may be other sets of economic assumptions which are also reasonable for purposes of funding NPERS. For example, we have typically reflected conservatism to the degree we would classify as moderate. Some actuaries (and/or boards) might be more risk averse and desire a greater degree of conservatism, while others are more risk tolerant and would choose less cautious assumptions. Actuarial Standards of Practice allow for this difference in approach and perspective, as long as the assumptions are reasonable and consistent.

Summary of Recommendations – Demographic Assumptions

In the experience study, actual experience for the study period is compared to that expected based on the actuarial assumption. The analysis is most commonly performed based on counts, i.e. each member is one exposure as to the probability of the event occurring and one occurrence if the event actually occurs. Comparing the incidence of the event to what was expected (called the Actual-to-Expected ratio, or A/E ratio) then provides the basis for our analysis. However, we also use a methodology termed the liability-weighted approach to analyze the experience. The exposure and actual occurrences are then multiplied by the member's estimated benefit level to provide the liability-weighted experience. This approach is particularly insightful when analyzing experience in a non-homogenous group. While we reviewed experience on both a count and liability-weighted basis, our experience is that the liability-weighted experience tends to be a better basis to set assumptions. Therefore, we assigned more credibility to the liability-weighted results in evaluating experience and developing new assumptions, if necessary.

The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying in recent years. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*. This ASOP requires the pension actuary to make and disclose a specific

recommendation with respect to future improvements in mortality after the valuation date. There have been significant improvements in longevity in the past, although there are different opinions about future expectations. We believe it is prudent to anticipate that the trend will continue to some degree in the future. Therefore, we believe it is appropriate to reflect some future mortality improvement as part of the mortality assumption.

There are two widely-used approaches for reflecting future improvements in mortality:

(1) Static table with "margin"
(2) Generational mortality

The first approach to reflecting mortality improvements is through the use of a static mortality table with "margin." Under this approach, the A/E ratio is intentionally targeted to be over 100% so that mortality can improve without creating actuarial losses. While there is no formal guideline for the amount of margin required (how far above 100% is appropriate for the A/E ratio), we typically prefer to have a margin of around 10% at the core retirement ages. The goal is still for the general shape of the curve to be a reasonable fit to the observed experience. Depending on the magnitude and duration of mortality improvement, the margin may decrease and eventually become insufficient. If and when that occurs, the assumption would need to be updated.

Another approach, referred to as generational mortality, directly anticipates future improvements in mortality by using a different set of mortality rates for each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain "built-in" mortality improvements, e.g., a member who turns age 65 in 2035 has a longer life expectancy than a member who turns age 65 in 2020. When using generational mortality, the A/E ratios for the observed experience are set near 100% as future mortality improvements will be taken into account directly in the actuarial valuation process.

The current mortality assumption for NPERS is a static table, the 1994 Group Annuity Mortality Table, projected to 2015, with a one year age set-back. The results of the experience analysis indicated that this table no longer provided a margin for future mortality improvements, and in fact, anticipated fewer deaths than actually occurred during the study period (A/E ratio under 100%). Despite our attempts, we did not find a standard published mortality table that would closely match the NPERS experience observed during the period at key ages. We believe any new assumption recommended should represent a reasonable fit to the observed experience, recognizing that this is the first time "benefit-weighted analysis" has been performed so the credibility of results on that basis is somewhat limited. Ultimately, we modified the RP-2014 Healthy Annuitant White Collar Mortality Table by scaling it to better fit the actual experience. Given that only four years of data were used and the size of the group is not large enough to be fully credible, adjustments to the recommended table may be needed in the next study. We also recommended the System move to the generational mortality approach using a variation of the MP-2015 Mortality Improvement Scale.

The following is general list of the recommended changes to the demographic assumptions:

- **Mortality**: Changes to active, retiree, and disabled mortality tables, reflecting improved mortality experience and, therefore, longer life expectancy, including generational mortality improvements.

- **Retirement**: Minor changes in retirement rates for Schools, Judges, and State Cash Balance Plans

- **Disability**: Change Schools rates to gender-distinct to better reflect observed experience

- **Termination of employment**: Change to rates based solely on service for State and County Cash Balance Plans, and minor adjustments to rates for Schools and Patrol.

Financial Impact

The financial impact of the suggested assumption changes was estimated by performing additional valuations using the July 1, 2015 or January 1, 2016 valuation data, as appropriate. The cost impact, illustrated in the table on the following pages, is based on the July 1, 2015 or January 1, 2016 valuation using the recommended set of assumptions, as outlined in this report.

When this set of assumptions is actually used, in the July 1, 2016 or January 1, 2017 valuations, we expect the relative impact to be similar to the results shown here (as a percentage of the actuarial accrued liability and normal cost). However, the actual impact may vary due to underlying changes that occur between valuation dates. Of particular note, the comparability may be affected by the actual investment return experience during the year.

Comparison of Valuation Results and Costs SCHOOLS	7/1/15 Valuation Baseline	Demographic Changes	All Assumption Changes
Actuarial Liability ($M)	10,778	11,276	11,554
Actuarial Assets ($M)	9,486	9,486	9,486
Unfunded Actuarial Accrued Liability (UAAL) ($M)	1,293	1,790	2,068
Funded Ratio	88%	84%	82%
Normal Cost Rate	12.11%	13.04%	13.48%
UAAL Amortization Rate	4.92%	6.45%	7.34%
Total Actuarial Rate	17.03%	19.49%	20.82%
Statutory Contribution Rate	21.66%	21.66%	21.66%
Contribution Shortfall	0.00%	0.00%	0.00%

Numbers may not add due to rounding.

Comparison of Valuation Results and Costs PATROL	7/1/15 Valuation Baseline	Demographic Changes	All Assumption Changes
Actuarial Liability ($M)	410.2	423.7	437.4
Actuarial Assets ($M)	356.4	356.4	356.4
Unfunded Actuarial Accrued Liability (UAAL) ($M)	53.8	67.3	80.9
Funded Ratio	87%	84%	81%
Normal Cost Rate	28.85%	29.52%	30.84%
UAAL Amortization Rate	12.74%	15.44%	18.25%
Total Actuarial Rate	41.59%	44.96%	49.09%
Statutory Contribution Rate	32.00%	32.00%	32.00%
Contribution Shortfall	9.59%	12.96%	17.09%
Additional State Contribution	$2,725,738	$3,683,583	$4,857,441

Numbers may not add due to rounding.

Comparison of Valuation Results and Costs JUDGES	7/1/15 Valuation Baseline	Demographic Changes	All Assumption Changes
Actuarial Liability ($M)	162.1	170.4	174.3
Actuarial Assets ($M)	157.4	157.4	157.4
Unfunded Actuarial Accrued Liability (UAAL) ($M)	4.7	13.0	16.9
Funded Ratio	97%	92%	90%
Normal Cost Rate	21.94%	23.58%	24.26%
UAAL Amortization Rate	1.46%	3.61%	4.64%
Total Actuarial Rate	23.40%	27.19%	28.90%
Member Contribution Rate	7.65%	7.65%	7.65%
Employer Required Rate	15.75%	19.54%	21.25%
Required Amount ($M)	3.5	4.3	4.6
Expected Court Fees ($M	3.6	3.6	3.6
Contribution Shortfall ($M)	0.0	0.7	1.1

Numbers may not add due to rounding

Comparison of Valuation Results and Costs STATE CASH BALANCE	1/1/16 Valuation Baseline	Demographic Changes	All Assumption Changes
Actuarial Liability ($M)	1,304	1,346	1,344
Actuarial Assets ($M)	1,337	1,337	1,337
Unfunded Actuarial Accrued Liability (UAAL) ($M)	(33)	9	7
Funded Ratio	103%	99%	99%
Normal Cost Rate	10.80%	10.65%	10.48%
UAAL Amortization Rate	(0.50%)	0.13%	0.11%
Total Actuarial Rate	10.30%	10.78%	10.59%
Statutory Contribution Rate	12.29%	12.29%	12.29%
Contribution Shortfall	0.00%	0.00%	0.00%

Numbers may not add due to rounding.

Comparison of Valuation Results and Costs COUNTY CASH BALANCE	1/1/16 Valuation Baseline	Demographic Changes	All Assumption Changes
Actuarial Liability ($M)	390.8	401.1	398.2
Actuarial Assets ($M)	400.0	400.0	400.0
Unfunded Actuarial Accrued Liability (UAAL) ($M)	(9.2)	1.0	(1.8)
Funded Ratio	102%	100%	100%
Normal Cost Rate	10.29%	10.26%	10.07%
UAAL Amortization Rate	(0.34%)	0.04%	(0.07%)
Total Actuarial Rate	9.95%	10.30%	10.00%
Statutory Contribution Rate	11.63%	11.63%	11.63%
Contribution Shortfall	0.00%	0.00%	0.00%

Numbers may not add due to rounding.

ACTUARIAL COST METHOD

The systematic financing of a pension plan requires that contributions be made in an orderly fashion while a member is actively employed, so that the accumulation of these contributions, together with investment earnings should be sufficient to provide promised benefits and cover administration expenses. The actuarial valuation is the process used to determine when money should be contributed; i.e., as part of the budgeting process.

The actuarial valuation will not impact the amount of benefits paid or the actual cost of those benefits. In the long run, actuaries cannot change the costs of the pension plan, regardless of the funding method used or the assumptions selected. However, the choice of actuarial methods and assumptions **will** influence the incidence of costs.

The valuation or determination of the present value of all future benefits to be paid by the System reflects the assumptions that best seem to describe anticipated future experience. The choice of a funding method does not impact the determination of the present value of future benefits. The funding method determines only the incidence or allocation of cost. In other words, the purpose of the funding method is to allocate the present value of future benefits determination into annual costs. In order to do this allocation, it is necessary for the funding method to "break down" the present value of future benefits into two components: (1) that which is attributable to the past (2) and that which is attributable to the future. The excess of that portion attributable to the past over the plan assets is then amortized over a period of years. Actuarial terminology calls the part attributable to the past the "past service liability" or the "actuarial accrued liability". The portion of the present value of future benefits allocated to the future is commonly known as the "present value of future normal costs", with the specific piece of it allocated to the current year being called the "normal cost". The difference between the plan assets and actuarial accrued liability is called the "unfunded actuarial accrued liability".

Two key points should be noted. First, there is no single "correct" funding method. Second, the allocation of the present value of future benefits, and hence cost, to the past for amortization and to the future for annual normal cost payments is not necessarily in a one-to-one relationship with service credits earned in the past and future service credits to be earned.

There are various actuarial cost methods, each of which has different characteristics, advantages and disadvantages. However, Governmental Accounting Standard Board Statement Numbers 67 and 68 require that the Entry Age Normal cost method be used for financial reporting. Most systems do not want to use a different actuarial cost method for funding and financial reporting. In addition, the Entry Age Normal method has been the most common funding method for public systems for many years. This is the cost method currently used by NPERS.

The rationale of the Entry Age Normal (EAN) cost method is that the cost of each member's benefit is determined to be a level percentage of his salary from date of hire to the end of his employment with the employer. This level percentage multiplied by the member's annual salary is referred to as the normal cost and is that portion of the total cost of the employee's benefit which is allocated to the current year. The portion of the present value of future benefits allocated to the future is determined by multiplying this percentage times the present value of the member's assumed earnings for all future years including the current year. The Entry Age Normal actuarial accrued liability is then developed by subtracting from the present value of future benefits that portion of costs allocated to the future. To determine the unfunded actuarial accrued liability, the value of plan assets is subtracted from the Entry Age Normal actuarial

accrued liability. The current year's cost to amortize the unfunded actuarial accrued liability is developed by applying an amortization factor.

It is to be expected that future events will not occur exactly as anticipated by the actuarial assumptions in each year. Actuarial gains/losses from experience under this actuarial cost method can be directly calculated and are reflected as a decrease/increase in the unfunded actuarial accrued liability. Consequently, the gain/loss results in a decrease/increase in the amortization payment, and therefore the contribution rate.

Considering that the Entry Age Normal cost method is the most commonly used cost method by public plans, that it develops a normal cost rate that tends to be stable and less volatile, and is the required cost method under calculations required by Governmental Accounting Standard Numbers 67 and 68, **we recommend the Entry Age Normal actuarial cost method be retained.**

ACTUARIAL VALUE OF ASSETS

In preparing an actuarial valuation, the actuary must assign a value to the assets of the fund. An adjusted market value is often used to smooth out the volatility that is reflected in the market value of assets. This is because most employers would rather have annual costs remain relatively smooth, as a percentage of payroll or in actual dollars, as opposed to a cost pattern that is extremely volatile.

The actuary does not have complete freedom in assigning this value. The Actuarial Standards Board also has basic principles regarding the calculation of a smoothed asset value, Actuarial Standard of Practice No. 44 (ASOP 44), *Selection and Use of Asset Valuation Methods for Pension Valuations.*

ASOP 44 provides that the asset valuation method should bear a reasonable relationship to the market value. Furthermore, the asset valuation method should be likely to satisfy both of the following:

- Produce values within a reasonable range around market value, AND
- Recognize differences from market value in a reasonable amount of time.

In lieu of both of the above, the standard will be met if <u>either</u> of the following requirements is satisfied:

- There is a sufficiently narrow range around the market value, OR
- The method recognizes differences from market value in a sufficiently short period.

These rules or principles prevent the asset valuation methodology from being used to manipulate annual funding patterns. No matter what asset valuation method is used, it is important to note that, like a cost method or actuarial assumptions, the asset valuation method does not affect the true cost of the plan; it only impacts the incidence of cost.

NPERS values assets, for actuarial valuation purposes, based on the principle that the difference between actual and expected investment returns should be subject to partial recognition to smooth out fluctuations in the total return achieved by the fund from year to year. This philosophy is consistent with the long-term nature of a retirement system. Under the current method in statute, the dollar amount of the difference between the actual investment return on the market value of assets and the assumed investment return on the market value of assets is recognized equally over a five-year period. This methodology is the asset smoothing method most commonly used by public plans and we believe that it meets actuarial standards under ASOP 44. **We recommend the current asset valuation method be retained**.

AMORTIZATION OF UAAL

As described earlier, actuarial accrued liability is the portion of the actuarial present value of future benefits that are not included in future normal costs. Thus it represents the liability that, in theory, should have been funded through normal costs for past service. Unfunded actuarial accrued liability (UAAL) exists when the actuarial accrued liability exceeds the actuarial value of plan assets. These deficiencies can result from (i) plan improvements that have not been completely paid for, (ii) experience that is less favorable than expected, (iii) assumption changes that increase liabilities, or (iv) contributions that are less than the actuarial contribution rate.

There are a variety of different methods that can be used to amortize the UAAL. Each method results in a different payment stream and, therefore, has cost implications. For each methodology, there are three characteristics:

- The period over which the UAAL is amortized,
- The rate at which the amortization payment increases, and
- The number of components of UAAL (separate amortization bases).

Amortization Period: The amortization period can be either closed or open. If it is a closed amortization period, the number of years remaining in the amortization period declines by one in each future valuation. Alternatively, if the amortization period is an open or rolling period, the amortization period does not decline but is reset to the same number each year. This approach essentially "refinances" the System's debt (UAAL) every year.

Amortization Payment: The level dollar amortization method is similar to the method in which a home owner pays off a mortgage. The liability, once calculated, is financed by a constant fixed dollar amount, based on the amortization period until the liability is extinguished. This results in the liability steadily decreasing while the payments, though remaining level in dollar terms, in all probability decrease as a percentage of payroll. (Even if a plan sponsor's population is not growing, inflationary salary increases will usually be sufficient to increase the aggregate covered payroll).

The rationale behind the level percentage of payroll amortization method is that since normal costs are calculated to be a constant percentage of pay, the unfunded actuarial accrued liability should be paid off in the same manner. When this method of amortizing the unfunded actuarial accrued liability is adopted, the initial amortization payments are lower than they would be under a level dollar amortization payment method, but the payments increase at a fixed rate each year so that ultimately the annual payment far exceeds the level dollar payment. The expectation is that total payroll will increase at the same rate so that the amortization payments will remain constant, as a percentage of payroll. In the initial years, the level percentage of payroll amortization payment is often less than the interest accruing on the unfunded actuarial accrued liability meaning that even if there are no experience losses, the dollar amount of the unfunded actuarial accrued liability will grow (called negative amortization). This is particularly true if the plan sponsor is paying off the unfunded actuarial accrued liability over a long period, such as 20 or more years.

Amortization Bases: The UAAL can either be amortized as one single amount or as components or "layers", each with a separate amortization base, payment and period. If the UAAL is amortized as one amount, the UAAL is recalculated each year in the valuation and experience gains/losses or other changes in the UAAL are folded into the single UAAL amortization base. The amortization payment is then the total UAAL divided by an amortization factor for the applicable amortization period.

If separate amortization bases are maintained, the UAAL is composed of multiple amortization bases, each with its own payment schedule and remaining amortization period. In each valuation, the unexpected change in the UAAL is established as a new amortization base over the appropriate amortization period beginning on that valuation date. The UAAL is then the sum of all of the outstanding amortization bases on the valuation date and the UAAL payment is the sum of all of the amortization payments on the existing amortization bases. This approach provides transparency in that the current UAAL is paid off over a fixed period of time and the remaining components of the UAAL are clearly identified. Adjustments to the UAAL in future years are also separately identified in each future year. One downside of this approach is that it can create some discontinuities in contribution rates when UAAL layers/components are fully paid off. If this occurs, it likely would be far in the future, with adequate time to address any adjustments needed.

Current NPERS Actuarial Amortization Method: The current amortization method used by NPERS for the defined benefit plans includes an initial amortization base (established in 2006 for the final pay plans) with payments over a closed 30 year period, determined as a level percentage of payroll for the final pay plans. The cash balance plans use closed 25 year periods and determine amortization payments as a level dollar amount. For all of the plans, a new base is created each year that includes all of the unanticipated changes in the UAAL for the year. These new bases are amortized in a consistent time frame and basis. Whenever a plan has a total UAAL of $0 or less (i.e. there is an actuarial surplus), all of the amortization bases are eliminated and the net surplus is amortized over 30 years.

While the current method, set by statute, is not unreasonable, we do note that over the last few years, the Government Finance Officers Association (GFOA) and the Conference of Consulting Actuaries (CCA) have published guidance on their opinion of "best practices" regarding public pension plan funding, including the length of the amortization period. Although these recommendations are not binding, they do point to an increased focus on developing amortization policies that are designed to pay down the UAAL in a meaningful way over a reasonable period. In particular, this guidance would encourage a more rapid amortization of the annual incremental pieces, paying them off in 15 to 20 years. However, given the funding policy of the NPERS plans and the goal of funding with a fixed contribution rate, an argument can be made for using a longer amortization period. Therefore, **we are not recommending a change to the current amortization method.**

Economic assumptions include the long-term investment return, price inflation, wage inflation (the across-the-board portion of salary increases), payroll growth assumption, interest crediting rate for the Cash Balance Plans, and the cost-of-living adjustment assumption. The merit salary scale is actually a demographic assumption, but it is being discussed with the economic assumptions because the total salary increase assumption includes the wage inflation assumption. Unlike demographic assumptions, economic assumptions do not lend themselves to analysis based solely upon internal historical patterns, because both salary increases and investment return are influenced more by external forces which are difficult to accurately predict over the long term. The investment return and salary increase assumptions are generally selected on the basis of expectations in an inflation-free environment and then increased by the long-term expectation for price inflation.

Sources of data considered in the analysis and selection of the economic assumptions included:

- Historical observations of price and wage inflation statistics and investment returns.
- The 2016 Social Security Trustees Report.
- Future expectations of the Nebraska Investment Council (NIC) and their consultant (Aon Hewitt), along with the expectations of other investment consultants (Horizon Actuarial Survey).
- U. S. Department of the Treasury bond rates.
- Assumptions used by other large public retirement systems, based on the Public Fund Survey, published by the National Association of State Retirement Administrators.

Guidance regarding the selection of economic assumptions for measuring pension obligations is provided by Actuarial Standard of Practice (ASOP) No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*. Because no one knows what the future holds, an actuary must use professional judgment to estimate possible future economic outcomes, based on a mixture of past experience, future expectations, and professional judgment.

ACTUARIAL STANDARD OF PRACTICE NUMBER 27

Actuarial Standards of Practice are issued by the Actuarial Standards Board to provide guidance to actuaries with respect to certain aspects of performing actuarial work. As mentioned earlier, Actuarial Standard of Practice Number 27 (ASOP 27) is the standard that addresses the selection of economic assumptions for measuring pension obligations. Therefore, our analysis of the expected rate of return, as well as other economic assumptions, was performed following the guidance in ASOP 27.

Due to the application of ASOP 27, it may be informative for others to be aware of the basic content of ASOP 27. The standard applies to the selection of economic assumptions to measure obligations under any defined benefit pension plan that is not a social insurance program (e.g., Social Security).

With respect to relevant data, the standard recommends the actuary review appropriate recent and long-term historical economic data, but advises the actuary not to give undue weight to recent experience. Furthermore, it advises the actuary to consider that some historical economic data may not be appropriate for use in developing assumptions for future periods due to changes in the underlying environment. In addition, with respect to any particular valuation, each economic assumption should be consistent with all other economic assumptions over the measurement period.

ASOP 27 recognizes that economic data and analyses are available from a variety of sources, including representatives of the plan sponsor, investment advisors, economists, and other professionals. The actuary is permitted to incorporate the views of experts, but the selection or advice must reflect the actuary's professional judgment.

SECTION 3 – ECONOMIC ASSUMPTIONS

Since the last experience study for NPERS was performed, the Actuarial Standards Board has issued a revised version of ASOP 27. The prior standard included the use of a "best estimate range" in developing economic assumptions. The current standard calls for the actuary to select a single "reasonable" assumption. For this purpose, an assumption is deemed reasonable if it has the following characteristics:

a. it is appropriate for the purpose of the measurement;

b. it reflects the actuary's professional judgment;

c. it takes into account historical and current economic data that is relevant as of the measurement date;

d. it reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and

e. it has no significant bias (i.e., it is neither significantly optimistic nor pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included.

The standard goes on to discuss a "range of reasonable assumptions" which in part states "the actuary should also recognize that different actuaries will apply different professional judgment and may choose different reasonable assumptions. As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice."

The remaining section of this report will address the relevant types of economic assumptions used in the actuarial valuation to determine the obligations of the System. In our opinion, the economic assumptions proposed in this report have been developed in accordance with ASOP No. 27.

The following table summarizes the current and proposed economic assumptions:

	Current Assumptions	Proposed Assumptions
Price Inflation	3.25%	2.75%
Investment Return	8.00%/7.75%	7.50%
General Wage Growth	4.00%	3.50%
Payroll Growth	4.00%	3.50%
Cost-of-Living Adjustment	2.50%	2.25%
Cash Balance Interest Credit Rate	6.75%	6.25%

PRICE INFLATION

Use in the Valuation: Future price inflation has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return, wage inflation, salary increases, payroll growth, interest crediting rate (Cash Balance Plans) and expected COLA's. Under ASOP 27, the price inflation assumption must be consistent among all economic assumptions.

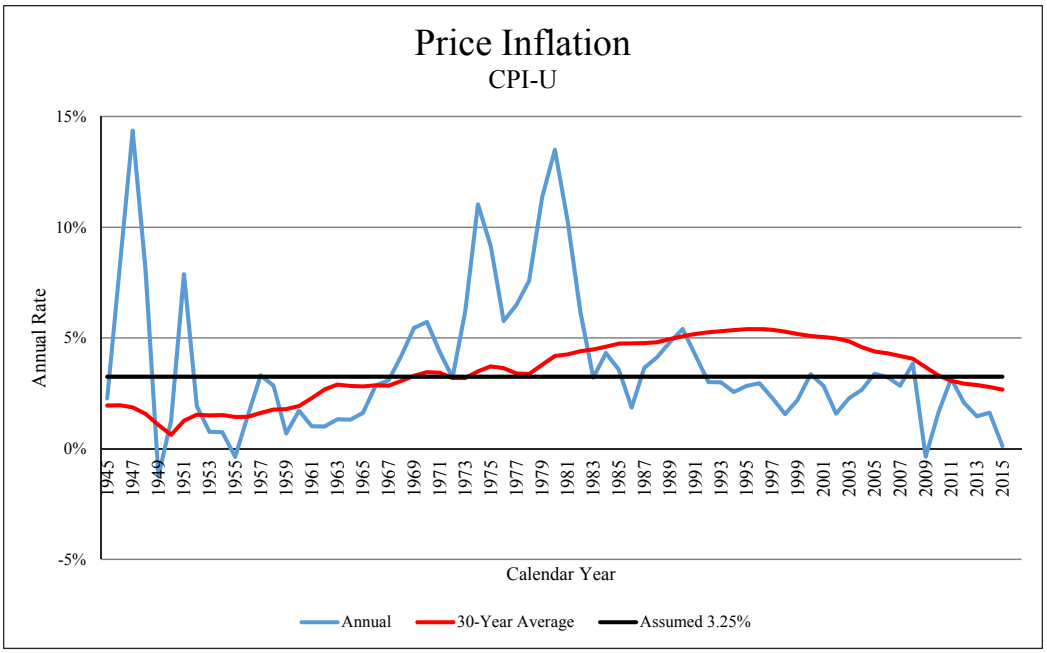
The long-term relationship between price inflation and investment return has long been recognized by economists. The basic principle is that the investor demands a more or less level "real return" – the excess of actual investment return over price inflation. If inflation rates are expected to be high, investment return rates are also expected to be high, while low inflation rates are expected to result in lower expected investment returns, at least in the long run.

The current assumption for price inflation is 3.25% per year.

Past Experience: Although economic activities, in general, and inflation in particular, do not lend themselves to prediction solely on the basis of historical analysis, historical patterns and long-term trends are factors to be considered in developing the inflation assumption. The Consumer Price Index, US City Average, All Urban Consumers, CPI-U, has been used as the basis for reviewing historical levels of price inflation. The following table provides historical annualized rates and annual standard deviations of the CPI-U over periods ending December 31st.

Period	Number of Years	Annualized Rate of Inflation	Annual Standard Deviation
2005 - 2015	10	1.95	1.29
1995 - 2015	20	2.23	1.05
1985 – 2015	30	2.67	1.21
1975 – 2015	40	3.78	2.77
1965 – 2015	50	4.12	2.82
1955 – 2015	60	3.70	2.76
1926 – 2015	89	2.96%	3.86%

The following graph illustrates the historical annual change in price inflation, measured as of December 31 for each of the last 70 years, as well as the thirty year rolling average.



Over more recent periods, measured from December 31, 2015, the average annual rate of increase in the CPI-U has been below 3.00%. The period of high inflation from 1973 to 1981 has a significant impact on the averages over periods which include these years. Further, the average rate of 2.96% over the entire 89-year period is above the average rate of 2.67% for the prior 30 years (1985 to 2015). The volatility of the annual rates in more recent years has been markedly lower as indicated by the significantly lower annual standard deviations. Many experts attribute the lower average annual rates and lower volatility to the increased efforts of the Fed since the early 1980's to stabilize price inflation.

Forecasts of Inflation

Bond Market Expectations: Additional information to consider in formulating this assumption is obtained from measuring the spread on Treasury Inflation Protected Securities (TIPS) and from the prevailing economic forecasts. The spread between the nominal yield on treasury securities (bonds) and the inflation indexed yield on TIPS of the same maturity is referred to as the "breakeven rate of inflation" and represents the bond market's expectation of inflation over the period to maturity.

The table below provides the calculation of the breakeven rate of inflation as of December 31, 2015.

Years to Maturity	Nominal Bond Yield	TIPS Yield	Breakeven Rate of Inflation
10	2.27%	0.73%	1.54%
20	2.67	1.07	1.60
30	3.01	1.28	1.73

As this data indicates, the bond market is anticipating low inflation of under 2% for both the short and long term. However, that expectation may be heavily influenced by the current low interest rate environment created by the Fed's manipulation of the bond market along with central banks around the world. Whether price inflation returns to the higher rates observed historically and if so, when, remains to be seen.

Social Security Administration: Although many economists forecast lower inflation than the assumption used by most retirement plans, they are generally looking at a shorter time horizon than is appropriate for a pension valuation. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the most recent report (June 2016), the projected ultimate average annual increase in the CPI over the next 75 years was estimated to be 2.60%, under the intermediate (best estimate) cost assumption. The range of inflation assumptions used in the Social Security 75-year modeling, which includes a low and high cost scenario, in addition to the intermediate cost projection, was 2.00% to 3.20%.

Peer System Comparison: While we do not recommend the selection of any assumption based on what other systems use, it does provide another set of relevant information to consider. The National Association of State Retirement Administrators (NASRA) Public Fund Survey collects information on the assumptions used by 126 large retirement systems. The median inflation assumption in the most recent Public Fund Survey was 3.0% which compares to 4.0% back in the 2001 Survey. There has been a definite decline in this assumption over the past 10-15 years.

While actuarial standards caution against assigning too much weight to recent experience, several factors lead us to believe the current inflation assumption should be reduced. Actual inflation for the last 20- and 30-year periods has 2.7% or less, the bond markets reflect an expectation of inflation below 2.0%, the inflation assumption used by the Chief Actuary of the Social Security Administration in their 75-year projections is 2.6%, and the median inflation assumption in the Public Fund Survey is 3.0%, based on assumptions used in 2014 valuations (likely trending lower since then). All this suggests that there may have been a fundamental change away from the longer-term historical norms. Based on the information presented above**, we recommend a reduction in the inflation assumption to 2.75%.**

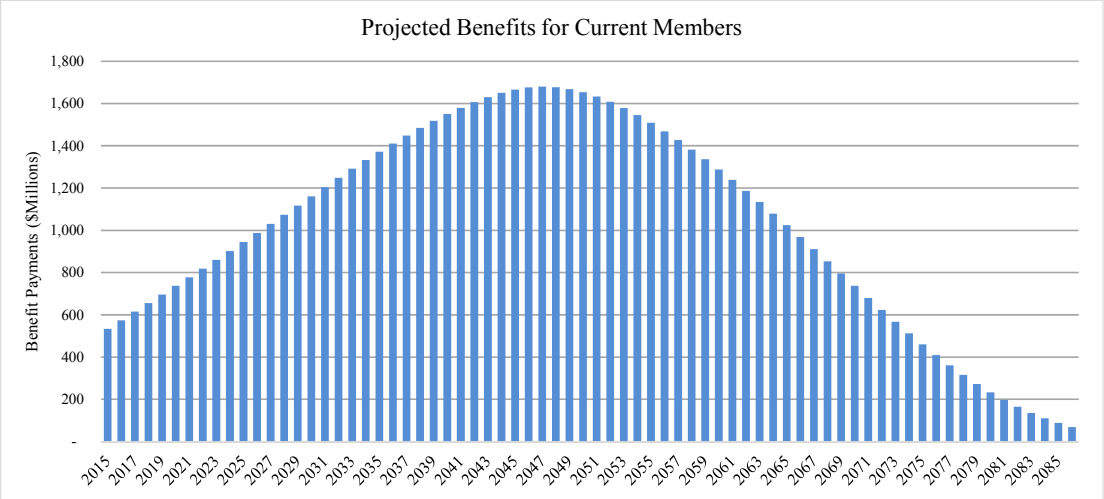
Consumer Price Inflation	
Current Assumption	3.25%
Recommended Assumption	2.75%

INVESTMENT RETURN

Use in the Valuation: The investment return assumption reflects the anticipated returns on the current and future assets. It is one of the primary determinants in the allocation of the expected cost of the System's benefits, providing a discount of the estimated future benefit payments to reflect the time value of money. Generally, the investment return assumption should be set with consideration of the asset allocation policy, expected long-term real rates of return on the specific asset classes, the underlying price inflation rate, and investment expenses.

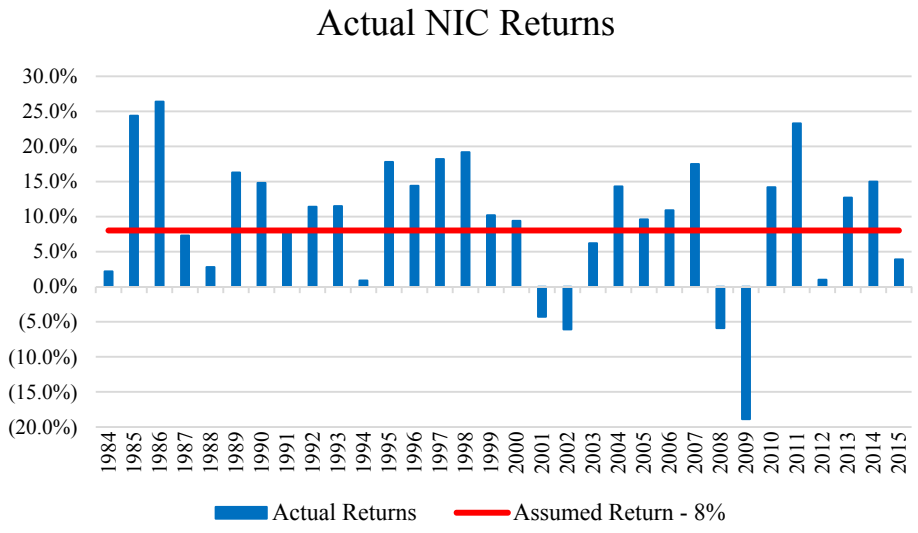
The current investment return assumption is 8.00% per year for the final pay plans (School, Patrol, and Judges) and 7.75% for the cash balance plans (State and County). It should be noted that these assumptions are currently net of all investment-related expenses, as well as administrative expenses. This assumption is for the nominal rate of return and is composed of two components. The first component is price inflation (previously discussed). Any excess return over price inflation is referred to as the real rate of return. The real rate of return, based on the current set of assumptions, is 4.75% for the final pay plans and 4.50% for the cash balance plans. It is worth noting that the investments are pooled for the five plans and based on one asset allocation, so the selection of different investment return assumptions by the type of plan would be based on considerations other than the expected return. For example, the way the benefits are earned in the final average pay and cash balance plans are very different, so there may be some rationale for differing assumptions. We recognize that there are historical factors that may have affected the adoption of the current assumptions as well.

Long Term Perspective: Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon in order to make prudent choices regarding how to invest the trust funds. For actuarial calculations, we typically consider very long periods of time. For example, a newly-hired employee who is 25 years old may work for 35 years, to age 60, and live another 30 years, to age 90 (or longer). The retirement system would receive contributions for the first 35 years and then pay out benefits for the next 30 years. During the entire 65-year period, the system is investing assets related to the member. For such a typical career employee, more than one-half of the investment income earned on assets accumulated to pay benefits is received after the employee retires. In addition, in an open, ongoing system like NPERS, the stream of benefit payments is continually increasing as new hires replace current members who leave covered employment due to death, termination of employment, and retirement. This difference in the time horizon used by actuaries and investment consultants is frequently a source of debate and confusion when setting economic assumptions. The following graph illustrates the long duration of the expected benefit payments for School members on July 1, 2015.



NPERS Historical Returns: One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the timeframe used, especially if the year-to-year results vary widely. In addition, the asset allocation can also impact the investment returns so comparing results over long periods when different asset allocations were in place may not be meaningful.

The following graph shows the actual fiscal year (June 30) returns for the NPERS portfolio for the last 32 years. Despite significant volatility in the results from year to year the actual geometric (compound) return was 6.9% for the last 10 years, 7.8% for the last 20 years, and 9.0% for the last 30 years. Current expected long-term returns are much lower than those actually earned in the past, reflecting a view of the capital markets that differs markedly from what has been experienced in the past.



ANNUALIZED RETURNS through 6/30/15			
5-Year Return:	11.5%	20-Year Return:	7.8%
10-Year Return:	6.9%	30-Year Return:	9.0%

Forward Looking Analysis: ASOP 27 provides that the actuary may rely on outside experts in setting economic assumptions. As mentioned earlier, NPERS' assets are held and invested by the Nebraska Investment Council (NIC) who relies on a variety of internal experts and external consultants to assist with investing the funds. As part of their duties, the NIC has its investment consultant, Aon, periodically perform asset-liability studies, along with comprehensive reviews of the expected return of the various asset classes in which the NPERS portfolio is invested. We believe it is appropriate to consider the results of Aon's work as one factor in assessing expected future returns.

We also recognize that there can be differences of opinion among investment professionals regarding future return expectations. Horizon Actuarial Services prepares an annual study in which they survey various investment advisors (29 were included in the 2015 study) and provide ranges of results as well as averages. This information provides an additional perspective on what a broad group of investment experts anticipate for future investment returns.

We do note that Aon recently completed a comprehensive Asset/Liability Study for the NIC. While the study did not recommend any changes to the current asset allocation, it did suggest that the NIC begin to consider some additional illiquid investment classes. If this leads to any significant change in the asset allocation of the portfolio, it may require us to revisit the recommendation for the investment return assumption.

Our forward looking analysis used the real rates of return in Aon's capital market assumptions from the first quarter of 2016 and NPERS' target asset allocation. Using projection results produces an expected range of real rates of return over a 50 year time horizon. Looking at one year's results produces an expected real return of 4.56%, but also has a high standard deviation or measurement of volatility. By expanding the time horizon, the average return does not change much, but the volatility declines significantly. The table below provides a summary of results.

Aon's Capital Market Assumptions							
Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	5.28%	12.37%	-13.76%	-3.38%	4.56%	13.15%	26.77%
5	4.70	5.49	-4.07	0.93	4.56	8.32	13.97
10	4.63	3.88	-1.62	1.98	4.56	7.20	11.13
20	4.60	2.74	0.15	2.73	4.56	6.42	9.16
30	4.58	2.24	0.95	3.06	4.56	6.08	8.30
50	4.57	1.73	1.75	3.40	4.56	5.73	7.45

The percentile results are the percentage of random returns over the time span shown that are expected to be less than the amount indicated. Thus for the 10-year time span, 5% of the real rates of return are expected to be below negative 1.62% and 95% are expected to be above that. As the time span increases, the results begin to converge. Over a 50-year time span, the results indicate a 25% probability that real returns will be below 3.40% and a 25% probability they will be above 5.73%. There is a 50% probability that the real return will be 4.56% or above and a 50% probability that the real return will be below 4.56%.

For a broader view of expected returns, we used the average capital market assumptions of the 29 investment consultants included in the 2015 Horizon Actuarial Survey which yielded the following results:

2015 Horizon Actuarial Survey of Capital Market Assumptions							
Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	5.80%	12.05%	-12.81%	-2.62%	5.13%	13.49%	26.67%
5	5.27	5.35	-3.30	1.59	5.13	8.79	14.28
10	5.20	3.78	-0.90	2.62	5.13	7.71	11.52
20	5.17	2.67	0.83	3.35	5.13	6.95	9.61
30	5.16	2.18	1.61	3.67	5.13	6.61	8.78
50	5.15	1.69	2.39	4.00	5.13	6.28	7.95

While we often assign greater weight to the capital market assumptions of a system's own investment advisor, we recognize that there are some aspects of the current investment environment that may be significantly different from the past. One approach in setting assumptions (which we believe to be used by Aon) is to base many of the fundamental market assumptions on the current Treasury yield curve. To this, adjustments are made for credit quality, liquidity, risk, etc. These models draw on historical spreads to help provide an estimate of current expectations. However, because of actions by governments and central banks around the world to influence interest rates, it is possible that the current pricing of Treasuries and other fixed income products may be artificially influenced. If this is the case, then the linkage from Treasuries on up in these capital market models may be different from the historical norms and the resulting assumptions may be distorted. However, because there is no way to prove or disprove this assertion at the present time, we find some degree of confidence in looking at the pooled result of 29 investment firms, including most major investment consultants. Consequently, we believe there is value in considering both sets of capital market assumptions in our analysis.

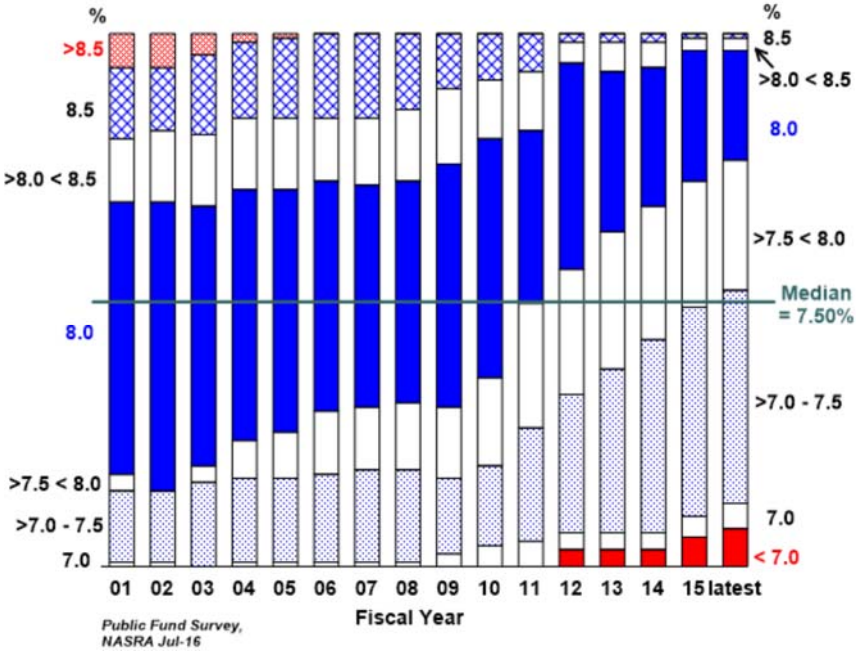
Frequently investment consultants develop their expected return assumptions based on a timeframe of 5 to 10 years. Therefore, those assumptions may not necessarily be appropriate for the longer timeframe used by actuaries (30 to 50 years). Since both Aon and the Horizon Survey have developed 20-year market return assumptions, the expected returns from their assumptions are reasonably in line with the timeframe used by actuaries. We also note that Aon updates their capital market assumption quarterly. Since we expect to perform an experience study only every four years, we are also hesitant to base our assumption solely on the most recent quarterly estimate from the investment consultants.

If the investment return assumption was set equal to the expected return based on the capital market assumptions each year or even in every experience study, it could create significant fluctuations in the system's funded ratio and the corresponding actuarial contribution rate. Our goal is to choose an assumption that will be reasonable over the long term (30 to 50 years) with adjustments only when there are compelling changes to investment policy, changes in the underlying inflation assumption, or evidence of a change in the long-term trends in the capital markets. We do not believe that we should automatically recommend changing the actuarial assumption up or down whenever Aon's capital market assumptions produce an expected return higher or lower than the current assumption. Additional analysis and discussion are needed before a change is implemented.

Peer System Comparison: While we do not recommend the selection of an investment return assumption be based on the assumptions used by other systems, it does provide another set of relevant information to consider as long as we recognize that asset allocation varies from system to system. The following graph shows the change in the distribution of the investment return assumption from fiscal year 2001 through 2015 (and some 2016 information) for the 120+ large public retirement systems included in the National Association of State Retirement Administrators (NASRA) Public Fund Survey. The assumed rate of return is heavily influenced by the asset allocation of the system, so comparisons must be made cautiously.

As the graph below indicates, the investment return assumptions used by public plans have decreased over the last decade, likely impacted by a corresponding decrease in the underlying inflation assumption from 4.0% to 3.0% over the same period. It is worth noting that the median investment return assumption in fiscal year 2012 dropped from 8.00% to 7.75% and has remained there for the last few years. However, as the graph indicates the number of systems using an assumption above 8.0% is very small. In addition, although 8.0% is still a commonly used assumption the number of systems using 8.0% has continued to decline since 2012. We believe we will continue to see more of the systems who are using an 8.0% or higher assumption move to a lower expected return as future experience studies are completed.

Change in distribution of investment return assumptions, FY 01 to present



Recommendation: By actuarial standards we are required to maintain a long-term perspective in setting all assumptions, including the investment return assumption. Therefore, we believe we must be careful not to let recent experience or the short-term expectations impact our judgment regarding the appropriateness of the current assumption over the long term.

This is a particularly challenging time to develop a recommendation for the investment return assumption. We need to recognize that there is no right answer to the question as no one knows what the future holds. After reviewing all of the available information, **we recommend an investment return assumption of 7.50%**, based on the 2.75% inflation assumption and the 4.75% real rate of return (midway between the real returns obtained by using Aon's capital market assumption and the 2015 Horizon survey).

Investment Return	
Current Assumption	8.00%
• Final Pay Plans	7.75%
• Cash Balance Plans	
Recommended Assumption (all Plans)	7.50%

COST OF LIVING ADJUSTMENTS

The final pay plans provide for an annual COLA based on actual inflation up to 2.5% (Tier 1) or 1.0% (Tier 2). For Tier 1, the current assumption is 2.50% until the Purchasing Power Floor is reached, and 3.25% thereafter. Because Tier 2 does not have the Purchasing Power floor, the assumption is 1% for all years.

While the proposed inflation assumption of 2.75% exceeds the COLA limit, it is important to remember that the inflation assumption represents the expected average rate of inflation, recognizing that variability exists. This variation means that there will likely be some years when the COLA granted will be less than 2.5%, and even some years when it may be less than 1%. It also means that most retirees will never reach the Purchasing Power Floor when a higher COLA might apply.

Using the actual COLA plan provisions, we examined the distribution of expected COLA's using the inflation assumption of 2.75% and a 1 % standard deviation. This choice of standard deviation is intentionally on the low end of typical assumptions for the variability of inflation, but it was selected to provide some conservatism since it results in a higher COLA assumption. The resulting median COLA for Tier 1 members was 2.21%. Based on our analysis, ***we recommend that the COLA assumption be set at 2.25% for Tier 1 and 1.0% for Tier 2 members.*** Under the new assumptions, the Purchasing Power Floor is not expected to apply until 59 years after retirement, so we do not believe it needs to be reflected as part of the assumption.

WAGE INFLATION

Background: Wage inflation, thought of as the "across the board" rate of salary increases, is composed of the price inflation assumption combined with an assumption for the real rate of wage increases. In constructing the individual salary increase assumption, the wage inflation assumption is further combined with an assumption for service-based salary increases (called a merit scale). The service-based salary increase assumption is discussed later in this section of the report. The current assumption for the real rate of wage increase is 0.75%.

The excess of wage growth over price inflation represents the increase in the standard of living, also called productivity growth. There has been debate on the issue of whether public sector employees will receive, over the long term, the same rewards for productivity as employees in the private sector, where productivity is more readily measurable. To our knowledge, no definitive research has been completed on this topic. Nevertheless, it is our opinion that public sector employees will eventually receive similar productivity increases as those participating in the remainder of the economy, even if there is a time lag.

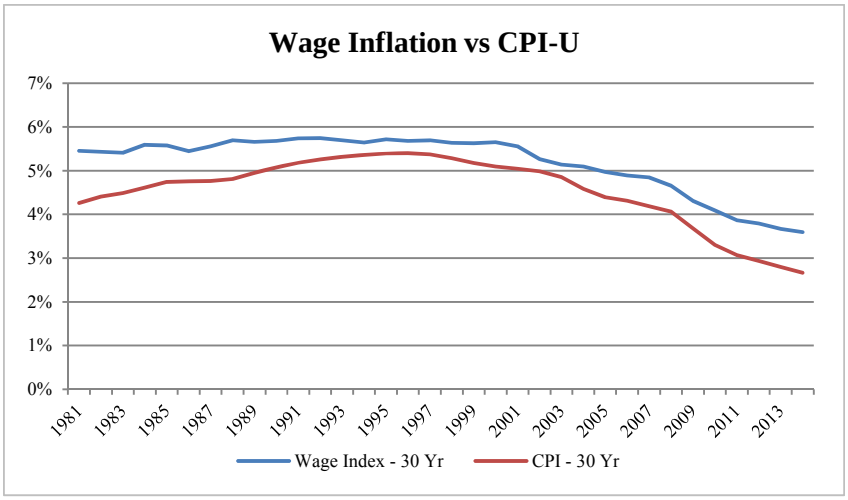
Historical Perspective: We have used statistics from the Social Security System on the National Average Wage back to 1951. Because the National Average Wage is based on all wage earners in the country, it can be influenced by the mix of jobs (full-time vs. part-time, manufacturing vs. service, etc.) as well as by changes in some segments of the workforce that are not seen in all segments (e.g. regional changes or growth in computer technology). Further, if compensation is shifted between wages and benefits, the wage index would not accurately reflect increases in total compensation. NPERS membership is composed exclusively of governmental employees working in Nebraska, whose wages and benefits are somewhat linked as a result of state and local tax revenues, funding allocations, and governing policies. Because the competition for workers can, in the long term, extend across industries and geography, the broad national earnings growth will have some impact on NPERS members. In the shorter term, however, the wage growth of NPERS and the nation may be less correlated.

The excess of wage growth over price inflation represents the real wage inflation rate. Although real wage inflation has been very low in recent years, likely due to the recovery from the 2008 financial crisis, our focus must remain on the long term. The following table shows the compounded wage growth over various periods, along with the comparable price inflation rate for the same period. The differences represent the real wage inflation rate. The data for each year is documented in Exhibit 3.

Decade	General Wage Growth	CPI Incr.	Real Wage Inflation
2004-2014	2.7%	2.3%	0.4%
1994-2004	4.1%	2.5%	1.6%
1984-1994	3.9%	3.6%	0.3%
1974-1984	7.2%	7.8%	(0.6%)
1964-1974	5.8%	4.7%	1.1%
1954-1964	3.8%	1.5%	2.3%

Period	General Wage Growth	CPI Incr.	Real Wage Inflation
2004-2014	2.7%	2.3%	0.4%
1994-2014	3.4%	2.4%	1.0%
1984-2014	3.6%	2.8%	0.8%
1974-2014	4.5%	4.0%	0.5%
1964-2014	4.7%	4.2%	0.5%
1954-2014	4.6%	3.7%	0.9%

Similar information over rolling thirty year periods is shown in the following graph:



Forecasts of Future Wages: The wage index used for the historical analysis is projected forward by the Office of the Chief Actuary of the Social Security Administration in their 75-year projections. In the June, 2016 the annual increase in the National Average Wage Index under the intermediate cost assumption (best estimate) was 3.8%, 1.2% higher than the Social Security intermediate inflation assumption of 2.6% per year. The range of the assumed real wage inflation in the 2016 Trustees report was 0.5% to 1.8% per year.

While history for the last 50 years indicates a low productivity increase (around 0.50%), the Social Security projections assume larger increases (over 1.0%). Based on data available and our professional judgment, **we recommend that the long-term assumed real wage inflation remain 0.75% per year.**

PAYROLL GROWTH

The payment on the unfunded actuarial accrued liability is determined as a level percent of payroll. Therefore, the valuation requires an assumption regarding future annual increases in covered payroll. The wage inflation assumption is typically used for this purpose. The current assumption of 4.0% is the same as the wage inflation assumption.

The current payroll growth assumption also reflects the assumption that there will be no future growth in number of active members. With no assumed growth in active membership, future salary growth due only to general wage increases is anticipated. If increases should occur not only because of wage increases but also because of additional active members, there will be a larger pool of covered payroll over which to spread the payment on the unfunded actuarial accrued liability, which would result in lower UAAL payments as a percent of payroll. The uncertainties in light of current conditions in public employment and the national economy in general, along with actual experience, argue against anticipating any increase in active membership for funding purposes.

We recommend the payroll growth assumption, used to amortize the UAAL, be lowered from 4.00% to 3.5%, reflecting the 0.50% decrease in the inflation assumption.

TOTAL SALARY INCREASE

Estimates of future salaries are based on assumptions for two types of increases:

- Increases in each individual's salary due to promotion or longevity (often called a merit scale), and
- Increases in the general wage level of the membership, which are directly related to price and wage inflation.

Earlier in this report, we recommended a general wage growth assumption of 3.50% (2.75% inflation and 0.75% real wage growth). Therefore, the merit scale will be added to the 3.50% wage inflation assumption to develop the total individual salary increase assumption.

Analysis of the merit salary scale is complicated by the fact that a retirement system receives only the total salary paid, which includes both the underlying wage inflation component of salary increases and the merit salary scale. Furthermore, there is often a delay in the actual price and wage inflation compared to when it impacts salary increases for active members. As a result, it is difficult to isolate the merit scale for purposes of measuring the actual experience. In addition, the budget challenges for governmental employers during this study period is likely to have impacted the actual salary increases granted to individual members.

For our first step, we compared individual salary increases using total reported salary for all members active in two consecutive periods (e.g. 2011 and 2012, 2012 and 2013, etc.). Because each plan is composed of different types of jobs and possibly different employers, this analysis is performed by plan.

Schools

The following table contains a summary of the actual versus expected salary increases during the study period:

Average Increase in Salaries			
Year	**Actual**	**Expected**	**Difference**
2011-12	4.27%	5.77%	(1.50%)
2012-13	3.91%	5.76%	(1.85%)
2013-14	4.51%	5.76%	(1.25%)
2014-15	5.05%	5.77%	(0.72%)
All years	4.45%	5.77%	(1.32%)

Since inflation is a component of the salary increase assumption, we would expect actual salary increases to be lower than the current assumption when actual price and wage inflation is lower than the assumption. During the study period price inflation was around 1.2%, compared to the current assumption of 3.25%, and the increase in the national average wage index was 2.8% compared to the current assumption of 4.00%. This information suggests that we could expect wage increases to be 1.2% to 2.0% lower than expected, simply as a function of the overall economy. As noted in the table above, the actual increases were about 1.3% lower. Recognizing that government revenues have been significantly lower since the Great Recession, it is not surprising that the actual wage growth slightly lagged the rates expected.

Given the economic situation during the study period, it is difficult to assign much credibility to the salary experience observed. However, based on the observed patterns of salary growth by duration (years of service), we believe it is appropriate to retain the merit scale, but note that with the change in the assumption for inflation from 3.25% to 2.75%, the total salary scale will also be reduced by 0.50% at all durations.

Patrol

The following table contains a summary of the actual versus expected salary increases during the study period:

Average Increase in Salaries			
Year	**Actual**	**Expected**	**Difference**
2011-12	1.89%	5.79%	3.90%
2012-13	2.03%	5.78%	3.75%
2013-14	3.45%	5.84%	2.39%
2014-15	4.47%	5.74%	1.27%
All years	2.93%	5.79%	2.86%

Comparing the Patrol differences to the Schools differences indicates that there is more than just the broad economy having an effect on Patrol salary increases. In light of the general budget pressures on governments in the region, particularly at the state level, we are hesitant to recommend any change in this assumption other than the reduction arising from the change in the inflation assumption. If the next experience study shows a continued pattern of low salary increases rather than some degree of catch-up, we will consider a revision to this assumption.

Judges

The following table contains a summary of the actual versus expected salary increases during the study period:

Average Increase in Salaries			
Year	**Actual**	**Expected**	**Difference**
2011-12	0.45%	4.00%	3.55%
2012-13	2.05%	4.00%	1.95%
2013-14	3.86%	4.00%	0.14%
2014-15	5.80%	4.00%	(1.80%)
All years	3.13%	4.00%	0.87%

The salary increase assumption for the Judges plan is the general wage increase assumption, i.e., no merit component. This reflects the fact that there is little to no promotional opportunity within the judicial system. The total salary increases actually were slightly ahead of the growth in the national average wage index during the study period, suggesting that changing the assumption to 3.50% (the proposed wage growth assumption) is reasonable going forward.

State Cash Balance

The following table contains a summary of the actual versus expected salary increases during the study period:

Average Increase in Salaries			
Year	**Actual**	**Expected**	**Difference**
2012	2.27%	4.46%	2.19%
2013	5.80%	4.41%	-1.39%
2014	6.11%	4.43%	-1.68%
2015	4.86%	4.45%	-0.41%
All years	4.88%	4.43%	-0.45%

The actual salary increases observed in the State Cash Balance Plan exhibit some differences from those observed in the defined benefit plans. Most of the increases occurred in the early years of employment and because the State Cash Balance Plan is still relatively new, there are more active members and covered wages in those early durations than there would be in a more mature plan.

Because of the challenging economic environment during the study period and the years leading up to it, we are hesitant to change the salary scale at this time based on just four years of data. (Note that large increases could come in poor economic times if the mix of new hires was skewed to those jobs that have larger initial increases.) If this trend continues in the next experience study, some adjustment to the merit scale increases in the early years of employment may be considered.

County Cash Balance

The following table contains a summary of the actual versus expected salary increases during the study period:

Average Increase in Salaries			
Year	**Actual**	**Expected**	**Difference**
2012	4.47%	4.83%	0.36%
2013	4.53%	4.79%	0.26%
2014	0.87%	4.78%	3.91%
2015	8.33%	4.77%	-3.56%
All years	4.79%	4.79%	0.00%

The comments regarding the State Cash Balance plan apply equally to the County Cash Balance plan.

INTEREST CREDITS ON ACCOUNT BALANCES

Both the final pay plans and the cash balance plans apply interest credits to member account balances. These rates are tied to government bonds or indices, so they are a function of the economic conditions.

Cash Balance Interest Credits: The Cash Balance plans credit interest to the member accounts (for both the member and employer credits). This rate is set in statute as the greater of 5% and the applicable federal mid-term rate plus 1.5%. Based on Aon's long-term expectation of intermediate US government bonds (0.4% real return) and using a 2% standard deviation, we estimate that the effective compound return for the interest credits would be around 5.7% (with 2.75% inflation). Because this assumption is significant in estimating future plan benefits, we believe it is important to include some degree of conservatism, so we recommend that the assumption be set at 6.25%.

Defined Benefit Interest Credits: The Defined Benefit plans also credit interest to the member contribution accounts although the cost impact is far less significant than the Cash Balance Plans. This interest crediting rate is set by the PERB rather than set in statute, and has been set equal to the one-year U.S. Treasury rate in practice. Long term, this rate should be approximately equal to expected inflation. We recommend using 3% for this rate to provide a small degree of conservatism.

Exhibit 1

U.S. Consumer Price Index

December of:	Index	Increase	December of:	Index	Increase
1928	17.1				
1929	17.2	0.6 %	**1973**	46.2	8.7%
1930	16.1	-6.4	**1974**	51.9	12.3
1931	14.6	-9.3	**1975**	55.5	6.9
1932	13.1	-10.3	**1976**	58.2	4.9
1933	13.2	0.8	**1977**	62.1	6.7
1934	13.4	1.5	**1978**	67.7	9.0
1935	13.8	3.0	**1979**	76.7	13.3
1936	14.0	1.4	**1980**	86.3	12.5
1937	14.4	2.9	**1981**	94.0	8.9
1938	14.0	-2.8	**1982**	97.6	3.8
1939	14.0	0.0	**1983**	101.3	3.8
1940	14.1	0.7	**1984**	105.3	3.9
1941	15.5	9.9	**1985**	109.3	3.8
1942	16.9	9.0	**1986**	110.5	1.1
1943	17.4	3.0	**1987**	115.4	4.4
1944	17.8	2.3	**1988**	120.5	4.4
1945	18.2	2.2	**1989**	126.1	4.6
1946	21.5	18.1	**1990**	133.8	6.1
1947	23.4	8.8	**1991**	137.9	3.1
1948	24.1	3.0	**1992**	141.9	2.9
1949	23.6	-2.1	**1993**	145.8	2.7
1950	25.0	5.9	**1994**	149.7	2.7
1951	26.5	6.0	**1995**	153.5	2.5
1952	26.7	0.8	**1996**	158.6	3.3
1953	26.9	0.7	**1997**	161.3	1.7
1954	26.7	-0.7	**1998**	163.9	1.6
1955	26.8	0.4	**1999**	168.3	2.7
1956	27.6	3.0	**2000**	174.0	3.4
1957	28.4	2.9	**2001**	176.7	1.6
1958	28.9	1.8	**2002**	180.9	2.4
1959	29.4	1.7	**2003**	184.3	1.9
1960	29.8	1.4	**2004**	190.3	3.3
1961	30.0	0.7	**2005**	196.8	3.4
1962	30.4	1.3	**2006**	201.8	2.5
1963	30.9	1.6	**2007**	210.0	4.1
1964	31.2	1.0	**2008**	210.2	0.1
1965	31.8	1.9	**2009**	215.9	2.7
1966	32.9	3.5	**2010**	219.2	1.5
1967	33.9	3.0	**2011**	225.7	3.0
1968	35.5	4.7	**2012**	229.6	1.7
1969	37.7	6.2	**2013**	233.0	1.5
1970	39.8	5.6	**2014**	234.8	0.8
1971	41.1	3.3	**2015**	236.5	0.8
1972	42.5	3.4			

Exhibit 2

National Average Wage Index

	Index	Increase		Index	Increase
1927	$1,159.14				
1928	1,162.53	0.3%	**1972**	$ 7,133.80	9.8%
1929	1,196.88	3.0	**1973**	7,580.16	6.3
1930	1,164.95	(2.7)	**1974**	8,030.76	5.9
1931	1,086.09	(6.8)	**1975**	8,630.92	7.5
1932	954.02	(12.2)	**1976**	9,226.48	6.9
1933	892.58	(6.4)	**1977**	9,779.44	6.0
1934	929.34	4.1	**1978**	10,556.03	7.9
1935	968.53	4.2	**1979**	11,479.46	8.7
1936	1,008.20	4.1	**1980**	12,513.46	9.0
1937	1,071.58	6.3	**1981**	13,773.10	10.1
1938	1,047.39	(2.3)	**1982**	14,531.34	5.5
1939	1,076.41	2.8	**1983**	15,239.24	4.9
1940	1,106.41	2.8	**1984**	16,135.07	5.9
1941	1,228.81	11.1	**1985**	16,822.51	4.3
1942	1,455.70	18.5	**1986**	17,321.82	3.0
1943	1,661.79	14.2	**1987**	18,426.51	6.4
1944	1,796.28	8.1	**1988**	19,334.04	4.9
1945	1,865.46	3.9	**1989**	20,099.55	4.0
1946	2,009.14	7.7	**1990**	21,027.98	4.6
1947	2,205.08	9.8	**1991**	21,811.60	3.7
1948	2,370.53	7.5	**1992**	22,935.42	5.2
1949	2,430.52	2.5	**1993**	23,132.67	0.9
1950	2,570.33	5.8	**1994**	23,753.53	2.7
1951	2,799.16	8.9	**1995**	24,705.66	4.0
1952	2,973.32	6.2	**1996**	25,913.90	4.9
1953	3,139.44	5.6	**1997**	27,426.00	5.8
1954	3,155.64	0.5	**1998**	28,861.44	5.2
1955	3,301.44	4.6	**1999**	30,469.84	5.6
1956	3,532.36	7.0	**2000**	32,154.82	5.5
1957	3,641.72	3.1	**2001**	32,921.92	2.4
1958	3,673.80	0.9	**2002**	33,252.09	1.0
1959	3,855.80	5.0	**2003**	34,064.95	2.4
1960	4,007.12	3.9	**2004**	35,648.55	4.6
1961	4,086.76	2.0	**2005**	36,952.94	3.7
1962	4,291.40	5.0	**2006**	38,651.41	4.6
1963	4,396.64	2.5	**2007**	40,405.48	4.5
1964	4,576.32	4.1	**2008**	41,334.97	2.3
1965	4,658.72	1.8	**2009**	40,711.61	-1.5
1966	4,938.36	6.0	**2010**	41,673.83	2.4
1967	5,213.44	5.6	**2011**	42,979.61	3.1
1968	5,571.76	6.9	**2012**	44,321.67	3.1
1969	5,893.76	5.8	**2013**	44,888.16	1.3
1970	6,186.24	5.0	**2014**	46,481.52	3.5
1971	6,497.08	5.0			

Exhibit 3

Annual Rates of Price and Wage Inflation

Calendar Year Ends	National Wage Index	National Price CPI Index	National Implied Productivity Increase
1985	4.3%	3.8%	0.5%
1986	3.0%	1.1%	1.8%
1987	6.4%	4.4%	2.0%
1988	4.9%	4.4%	0.5%
1989	4.0%	4.6%	-0.7%
1990	4.6%	6.1%	-1.5%
1991	3.7%	3.1%	0.7%
1992	5.2%	2.9%	2.3%
1993	0.9%	2.7%	-1.9%
1994	2.7%	2.7%	0.0%
1995	4.0%	2.5%	1.5%
1996	4.0%	3.3%	1.6%
1997	5.8%	1.7%	4.1%
1998	5.2%	1.6%	3.6%
1999	5.6%	2.7%	2.9%
2000	5.5%	3.4%	2.1%
2001	2.4%	1.5%	0.8%
2002	1.0%	2.4%	-1.4%
2003	2.4%	1.9%	0.6%
2004	4.6%	3.3%	1.4%
2005	3.7%	3.4%	0.3%
2006	4.6%	2.5%	2.1%
2007	4.5%	4.1%	0.4%
2008	2.3%	0.1%	2.2%
2009	-1.5%	2.7%	-4.2%
2010	2.4%	1.5%	0.9%
2011	3.1%	3.0%	0.1%
2012	3.1%	1.7%	1.4%
2013	1.3%	1.5%	-0.2%
2014	3.5%	0.8%	2.7%

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Actuarial Standard of Practice No. 35 (ASOP 35) provides guidance to actuaries regarding the selection of demographic and other non-economic assumptions for measuring pension obligations. ASOP 35 states that the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the defined benefit plan that is the subject of the measurement. A reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

The actuary should follow the following steps in selecting the demographic assumptions:

1. Identify the types of assumptions. Types of demographic assumptions include but are not limited to retirement, mortality, termination of employment, disability, election of optional forms of payment, administrative expenses, family composition, and treatment of missing or incomplete data. The actuary should consider the purpose and nature of the measurement, the materiality of each assumption, and the characteristics of the covered group in determining which types of assumptions should be incorporated into the actuarial model.

2. Consider the relevant assumption universe. The relevant assumption universe includes experience studies or published tables based on the experience of other representative populations, the experience of the plan sponsor, the effects of plan design, and general trends.

3. Consider the assumption format. The assumption format includes whether assumptions are based on parameters such as gender, age or service. The actuary should consider the impact the format may have on the results, the availability of relevant information, the potential to model anticipated plan experience, and the size of the covered population.

4. Select the specific assumptions. In selecting an assumption the actuary should consider the potential impact of future plan design as well as the factors listed above.

5. Evaluate the reasonableness of the selected assumption. The assumption should be expected to appropriately model the contingency being measured. The assumption should not be anticipated to produce significant actuarial gains or losses.

ASOP 35 General Considerations and Application: Each individual demographic assumption should satisfy the criteria of ASOP 35. In selecting demographic assumptions the actuary should also consider: the internal consistency between the assumptions, materiality, cost effectiveness, and the combined effect of all assumptions. At each measurement date the actuary should consider whether the selected assumptions continue to be reasonable, but the actuary is not required to do a complete assumption study at each measurement date. In addition, ASOP 35 requires the actuary to include a specific assumption with respect to expected mortality improvements after the measurement date. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP 35.

Overview of Analysis: The purpose of a study of demographic experience is to compare what actually happened to the individual members of the System during the study period (July 1, 2011 through June 30, 2015, or January 1, 2012 through December 31, 2015) with what was expected to happen based on the actuarial assumptions. Four years is a relatively short observation period for experience given the assumptions are being set with a long-term time horizon in mind. Therefore, we have considered the results of the prior Experience Study when practical to do so. However, the underlying data from the prior Study

is not available so those results are not included directly in our results. In future experience studies for NPERS, we will likely aggregate results for certain assumptions to provide more credibility or to provide more detail.

Studies of demographic experience generally involve three steps:

- First, the number of members changing membership status, called decrements, during the study is tabulated by age, duration, gender, group, and membership class as appropriate (active, retired, etc.).

- Next, the number of members expected to change status is calculated by multiplying certain membership statistics, called exposure, by the expected rates of decrement.

- Finally, the number of actual decrements is compared with the number of expected decrements. The comparison is called the actual to expected ratio (A/E Ratio), and is expressed as a percentage.

In general, if the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements, or rates of decrement, by age, sex, or duration deviates significantly from the expected pattern, new assumptions are considered. Recommended revisions are normally not an exact representation of the experience during the observation period. Judgment is required to anticipate future experience from past trends and current evidence, including a determination of the amount of weight (credibility) to assign to the most recent experience.

In our analysis, we use a methodology to analyze the experience that we call a liability-weighted approach. The liability is approximated by using the member's compensation and years of service to estimate the member's benefit level. The exposure and actual occurrences are then multiplied by the benefit level to provide the liability-weighted experience. (For retiree mortality, the weight is simply the benefit amount.) This approach is particularly insightful when analyzing experience in a non-homogenous group. While we reviewed experience on both a count and liability-weighted basis, we have generally found the liability-weighted experience to be a better basis to set assumptions. Therefore, we assign more credibility to the liability-weighted results in evaluating experience and developing new assumptions, if necessary.

Revised rates of decrement are tested by using them to recalculate the expected number of decrements during the study period, and the results are shown as revised A/E Ratios.

Retiree Mortality: One of the most important demographic assumptions in the valuation is mortality because it projects the length of time benefits are expected to be paid to current and future retirees and beneficiaries. If members live longer than expected, the true cost of future benefit obligations will be understated.

Over the last few generations, rates of mortality have been declining, meaning people are generally living longer. Furthermore, the experience of large, public retirement systems that include school employees indicate that school groups, and teachers in particular, continue to exhibit better mortality than the average working population.

There are distinct differences in the mortality rates of males and females, healthy retired members, disabled retired members and non-retired members. Because of those differences in mortality, these groups are studied separately.

Actuaries use various adjustments to standard mortality tables in order to match the observed mortality rates of a specific retirement system:

(1) Age adjustments
(2) Collar adjustment
(3) Scaling of rates

The first of these adjustments is an age adjustment that can be either a "setback" or a "set forward". A one-year age setback treats all members as if they were one year younger than they truly are when applying the rates in the mortality table. So, a one year set back would treat a 61 year old retiree as if he will exhibit the mortality of a 60 year old in the standard mortality table.

The second adjustment is called a collar adjustment. There are both "white collar" and "blue collar" variants of some of the newer mortality tables. These variants, which are not necessarily limited to populations that have only white or blue collar employees, provide options which may result in a better fit of the assumed mortality to actual experience.

The third adjustment that can be used is to "scale" a mortality table by multiplying the probabilities of death by factors less than one (to reflect better mortality) or factors greater than one (to reflect poorer mortality). Scaling factors can be applied to an entire table or a portion of the table. Of course, if needed, actuaries may use two or even all three of these methods to develop an appropriate table to model the mortality of the specific plan population.

The current post-retirement mortality assumption for healthy retirees, used for all five plans, is the 1994 Group Annuity Mortality Table (94GAM) projected to 2015 using projection scale AA, with ages set back one year for both males and females.

The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying with the intent to remain on the leading edge of the issue. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*. This ASOP requires the pension actuary to make and disclose a specific recommendation with respect to future improvements in mortality after the valuation date although it does not require that an actuary assume there will be future improvements. There have been significant improvements in longevity in the past, although there are different opinions about future expectations. We believe it is prudent to anticipate that the trend will continue to some degree in the future.

Therefore, we believe it is appropriate to reflect some future mortality improvement as part of the mortality assumption.

There are two widely-used ways to reflect future improvements in mortality:

(1) Static table with "margin"
(2) Generational mortality

The first approach to reflecting mortality improvements is through the use of a static mortality table with "margin." Under this approach, the A/E ratio is intentionally targeted to be over 100% so that mortality can improve without creating actuarial losses. This approach is mandated by the Internal Revenue Service for determining minimum funding amounts for corporate pension plans as mortality improvements are projected seven years for retirees and 15 years for actives. While there is no formal guideline for the amount of margin required (how far above 100% is appropriate for the A/E ratio), we typically prefer to have a margin of around 10% at the core retirement ages. The goal is still for the general shape of the curve to be a reasonable fit to the observed experience. Depending on the magnitude and duration of mortality improvement, the margin would decrease and eventually may become insufficient. When that occurs, the assumption would need to be updated.

Another approach, referred to as generational mortality, directly anticipates future improvements in mortality by using a different set of mortality rates for each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain "built-in" mortality improvements, e.g., a member who turns age 65 in 2035 has a longer life expectancy than a member who turns age 65 in 2020. When using generational mortality, the A/E ratios for the observed experience are set near 100% as future mortality improvements will be taken into account directly in the actuarial valuation process.

The table below shows the life expectancy at age 65, an indication of how long a new retiree would expect to receive monthly payments, at various points in time.

	Male Life Expectancy	Female Life Expectancy
Year	**Generational**	**Generational**
2016	22.7	24.6
2026	23.0	25.0
2036	23.4	25.3
2046	23.7	25.6

Life expectancy at age 65 in years

There is a wide range of opinion with respect to future expectations of mortality and the underlying assumptions regarding mortality improvement reflect some subjectivity.

Reliable statistical analysis of mortality requires very large data sets. Because of the size of the Patrol and Judges plans, there is insufficient data to perform any significant credible analysis. The Cash Balance plans are still relatively new and the lump sum option has resulted in even fewer retirees, limiting the usefulness of the retiree mortality experience in those two plans. Even the size of the School group is not large enough to be fully credible without a number of years of data. One option would be to study the mortality

experience for the Schools plan alone and then use standard tables, based on professional judgment, to set the assumptions for the other four plans. However, in keeping with NPERS' tradition of using a common mortality table for all five plans, we have instead combined the data for all five plans and performed the mortality study on an aggregate basis. We typically would aggregate the actual and expected experience from the prior study to improve the credibility of the results. However, since the prior report was performed by another actuarial firm the underlying data was not available. In future experience studies, we will likely include at least two study periods in our analysis of mortality experience.

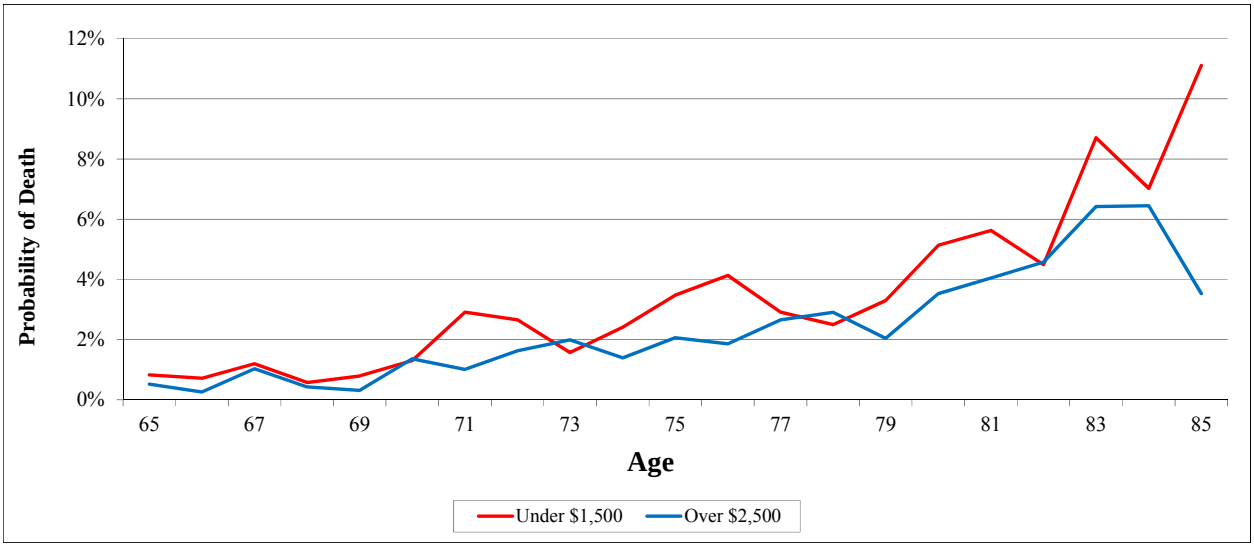
Some additional discussion of the use of a common mortality table may be desirable. Judges generally exhibit mortality that is as good, if not better than, that of the Schools population. Because the Cash Balance members have a choice of electing an annuity or lump sum at retirement, there is potential for some degree of anti-selection (healthier members elect to receive monthly benefits and less healthy members elect the lump sum), so the use of a mortality table based on the experience of a group with better mortality than the state and county as a whole is appropriate. Lastly, because the physical requirements to become a state patrol officer are rigorous, it is not unreasonable to expect this group to have mortality similar to that of the School group. Consequently, we believe the choice of a common mortality table for all groups is reasonable.

Healthy Retiree Mortality – Males: The following chart shows the exposures, actual deaths, and expected deaths for the key retirement ages of 60 to 85, along with the actual to expected ratio under the current assumption for each year in the experience study. The variation from year to year is evident in the Year 2 results which are very different from that observed in other years. This is not unexpected given the size of the group.

				A/E Ratio	
	Exposure	Actual	Expected	Count	Weighted
Year 1	5,514	110	115	96%	79%
Year 2	5,914	94	123	76%	57%
Year 3	6,148	124	129	96%	83%
Year 4	6,413	116	137	85%	71%
Total	**23,989**	**444**	**504**	**88%**	**72%**

The actual experience indicates that the current assumption for male retirees is predicting too many deaths, i.e., the A/E ratio is less than 100%. Because the current table is a static table (one set of mortality rates apply in all years), we prefer the A/E ratio be around 110% rather than 88%. Of more concern, however, is that the A/E ratio, when experience is weighted based on benefit amounts, is even further below 100%. This indicates that the amount of liability actually being released as a result of retiree deaths is not being accurately anticipated. One cause of this discrepancy is the difference in mortality patterns between retirees with lower monthly benefits and those with higher monthly benefits. The following graph illustrates this difference. Members with lower benefit amounts (the red line) have generally higher rates of death than members with larger benefit amounts (the blue line). Members with benefit amounts in the middle range are not included, but were also studied. They have mortality rates between those with the high and low benefit amounts.

NPERS Mortality Rates Based on Monthly Annuity Amount



We attempted to find a standard mortality table with age or collar adjustments that would be a good fit for the observed experience at all ages, with a focus on the key retirement ages of 60 to 80. A new mortality table, denoted as the RP-2014 Mortality Table, was published by the Society of Actuaries (SOA) in October of 2014. It was created to replace the RP-2000 Mortality Table as the mortality table required for use in the valuation of corporate pension plans. A mortality improvement projection scale, MP-2014, was also published with the RP-2014 Mortality Table for use in projecting future mortality improvements. Using an additional year of data, the MP-2015 scale was published in 2015 as an updated version of MP-2014 scale. We would point out that the public plan data submitted to the SOA for purposes of this mortality study was excluded because it was "materially different" than the rest of the data submitted (corporate plans). This does not necessarily mean the RP-2014 Mortality Table is inappropriate for use by public sector plans, but it does suggest that blind adoption of that table may not be wise, either.

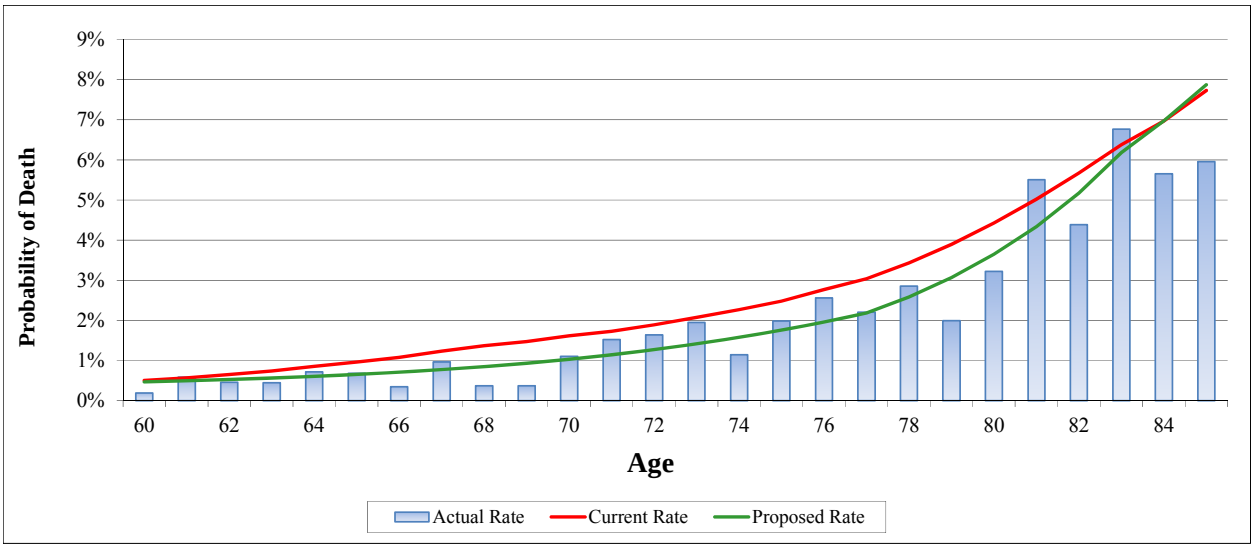
Despite our attempts, we did not find a standard published table with age or collar adjustments that would closely match the NPERS experience observed during the period at key ages. Yet, we believe any new assumption recommended should represent a reasonable fit to the observed experience, recognizing that this is the first time "benefit-weighted analysis" has been performed so the credibility of results on that basis is somewhat limited. Ultimately, we modified the RP-2014 Healthy Annuitant White Collar Male Mortality Table by scaling it to better fit the actual experience. Given that only four years of data were used and the size of the group is not large enough to be fully credible, adjustments to the recommended table may be needed in the next study as additional data becomes available. Based on the limited credibility of the observed data and our philosophy of moving part of the way, we targeted developing a mortality table that produced an AE ratio of around 95% so as to not over react to the recent experience.

The MP-2015 scale is a two dimensional projection scale and varies not only by age, but also by year of birth, increasing the sophistication of the projections to more accurately model the broad mortality improvements observed in the United States. In comparing it with other projection scales we have used in the past and the data patterns we observed in the NPERS data at older ages, we were not comfortable with directly adopting the MP-2015 Scale. Given the variety of opinions on future mortality patterns, the Society of Actuaries provides a tool and information for actuaries who choose to adjust the published projection

scales. These were used in conjunction with the Social Security Administration's long term mortality improvement expectation to develop a projection scale that, in our opinion, is more appropriate for NPERS.

The actual and expected experience for healthy male retirees is shown in the graph below. As discussed earlier, the AE ratio is usually set near 100% when using generational mortality because the generational projection directly reflects the assumed improvement in mortality in the future. **The proposed mortality assumption results in a weighted A/E ratio of 96% over ages 60 to 85.**

NPERS Male Retiree Mortality



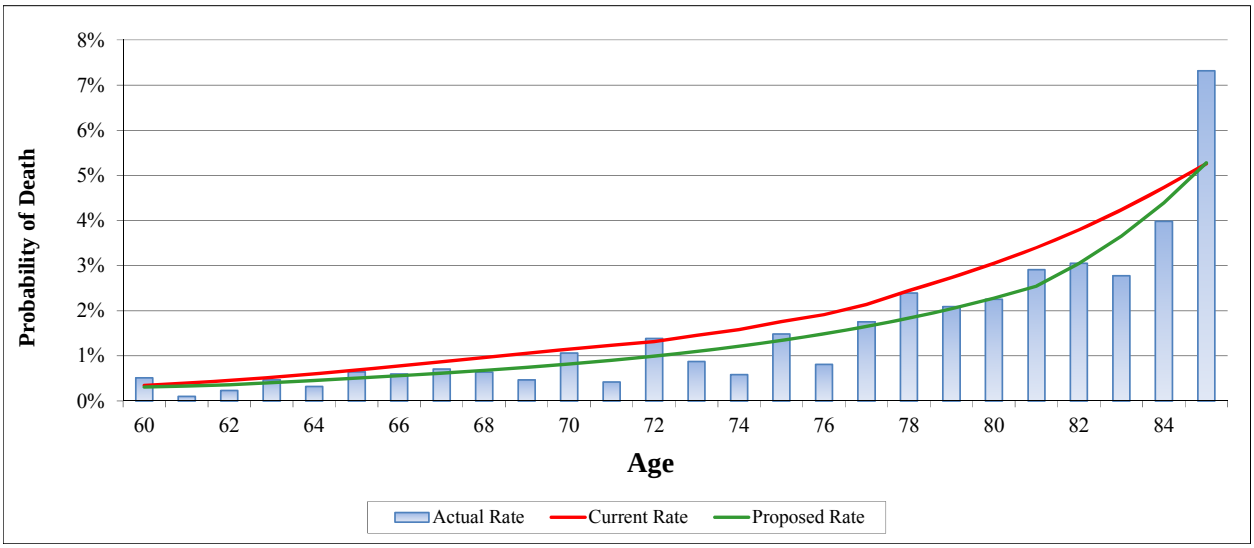
Healthy Retiree Mortality – Females: The following chart shows the exposures, actual deaths, and expected deaths for ages 60 to 85, along with the actual to expected ratio under the current assumption for each year in the experience study. As was observed for males, the experience in one of the four years was quite different from the other three. Again, this is to be expected given the size of the group, but also points out that the credibility of the observed data is somewhat limited.

				A/E Ratio	
	Exposure	Actual	Expected	Count	Weighted
Year 1	10,054	129	154	84%	67%
Year 2	11,106	147	168	88%	81%
Year 3	11,703	136	255	53%	57%
Year 4	12,573	163	189	86%	99%
Total	**45,436**	**575**	**689**	**83%**	**76%**

Similar to the male data, the actual experience for females indicates that the current assumption for female retirees is anticipating too many deaths. While the difference between the count and weighted A/E ratios (76% versus 83%) is not as significant as was observed for males (72% versus 88%), it still indicates that the mortality assumption for females needs to be strengthened.

Using the same approach as was used for males, a proposed mortality table was developed that produces a weighted A/E ratio of 98% over ages 60 to 85.

NPERS Female Retiree Mortality



Healthy Retiree Mortality – Summary: For both males and females, we considered whether to use a static table or a generational table. We wish to stress that both of these approaches are acceptable under Actuarial Standards of Practice, are commonly used by public retirement systems, and may be used appropriately for valuations and cost projections. Our preference is usually the generational approach. Further, after discussing risk management considerations with the Board, we believe that the generational approach is most consistent with the Board's view on risk mitigation. In ultimately deciding on the mortality assumption, the following are some of the factors that were considered:

- Whether mortality will continually improve in a manner similar to that observed in the past is unknown. Of relevance is that the MP-2015 Improvement Scale reflected less mortality improvements than the MP-2014 Improvement Scale. An updated Scale (MP-2016) will be released later this year. In fact, the Society of Actuaries has indicated their intent to update this projection scale annually.

- The Society of Actuaries is conducting a study of public plan mortality and, as a result, may issue a table more suitable for public plans.

- Some adjustment to the mortality assumption is likely to be needed in future experience studies because the proposed assumption is based on only four years of experience for a relatively small group and is based on benefit-weighted analysis which is a new approach for NPERS.

- The current optional form factors and the actuarial basis for converting cash balance accounts and defined contribution accounts to annuities are set in statute and use a mortality table that is related to the current valuation mortality table (although the mortality basis has not consistently been modified with prior experience studies). If the factors were to be updated so they are based on the same mortality table as is used in the valuation, the generational table may present some challenges. However, we have dealt with this in other states and believe a reasonable approach can be developed for NPERS if a change is desired.

Beneficiaries: The mortality of beneficiaries applies to the survivors of members who receive a joint and survivor option. There are fewer members receiving benefits under the joint and survivor options which can produce more volatility in the observed mortality rates. Based on the limited data, **we recommend standard convention be followed and the same mortality assumption be used for beneficiaries as is used for retired members.**

Post-retirement Mortality for Disabled Members: The valuation assumes that disabled members, in general, will not live as long as retired members who met the regular service retirement eligibility. In addition, future life expectancies for disabled members are not expected to increase as significantly as the future life expectancies for healthy retirees.

Because of the limited number of exposures and deaths for disabled members, it makes sense to use the standard disabled table that is the companion to the retiree mortality table. **We recommend the RP-2014 Disabled Lives Table be used without generational improvement.**

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SECTION 6 – ACTIVE MORTALITY

The active member mortality assumption models eligibility for death benefits prior to retirement. Currently, the assumption is the based on the retiree mortality assumption (94GAM projected to 2015, ages set back one year), using 55% of the rates for males and 40% for females.

Because the probability of death prior to retirement is very low, this assumption has a much smaller impact on the valuation results than the post-retirement mortality assumption. Further, because it is a comparatively rare event, it is difficult to get meaningful analysis from a study of this size. Complicating the issue, because of the manner in which the Cash Balance provisions are administered, active member deaths cannot be distinguished from terminations of employment. As a result, our analysis was restricted to the final pay plans only.

It is common practice to use the same set of tables for active mortality as is used for retiree mortality. The RP-2014 family of tables has both annuitant tables (used as the underlying table for retirees) and employee tables. Since the retiree mortality is based on the RP-2014 Healthy Annuitant White Collar Tables with adjustments, we propose starting with those tables for the active mortality assumption. **Based on this approach, we propose using the RP-2014 Employee White Collar Male Mortality Table multiplied by 100% and the RP-2014 Employee White Collar Female Mortality Table multiplied by 55% for males and females, respectively.**

The following table shows that the proposed assumption provides a better estimate of the observed experience than the current assumption. In either case, the assumption has a very minor impact upon the overall cost of the plan.

			Current Assumption		Proposed Assumption
Gender	**Exposure**	**Actual**	**Expected**	**A/E Ratio**	**A/E Ratio**
Males	38,971	59	39	151%	107%
Females	117,256	57	53	108%	98%

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The valuation uses several different assumptions to anticipate when retirement benefits will commence for members. One of the most significant factors affecting retirement patterns is, not surprisingly, the provisions governing when a member is eligible to retire. Additionally, provisions regarding eligibility for special benefits, subsidies, options, or any other special features may also influence retirement patterns. For NPERS, this results in separate retirement assumptions for each of the five plans.

Schools

Members of the Schools plan may retire with an unreduced benefit after reaching age 65 (and being vested) or after reaching age 55 and meeting the "Rule of 85" when the member's age plus service is at least 85. Early (reduced) retirement is available to members who are at least age 60 with five years of service. Although there are two benefit tiers for School members, the new tier was recently implemented so essentially all of the experience during the study period is for Tier 1 members. Both groups have the same eligibility, but the benefits for Tier 2 are lower and may eventually affect retirement patterns. At this point, however, we do not anticipate any material behavior change.

For this discussion, the focus is on the type of retirement a member is eligible to receive. Early retirement is the term used when the accrued benefit is reduced by an early retirement factor to reflect the longer payment period. Unreduced retirement occurs when such a factor is not applied. Currently, there are separate retirement rates based on early or unreduced retirement (including Rule of 85).

A summary of the actual and expected experience during the study period for retirement is shown in the table below:

Retirement Experience

				A/E Ratio	
	Exposures	**Actual**	**Expected**	**Count**	**Weighted**
Early retirement	7,105	786	884	89%	80%
Unreduced retirement	19,471	4,092	4,617	89%	94%
Total	**26,576**	**4,878**	**5,501**	**89%**	**93%**

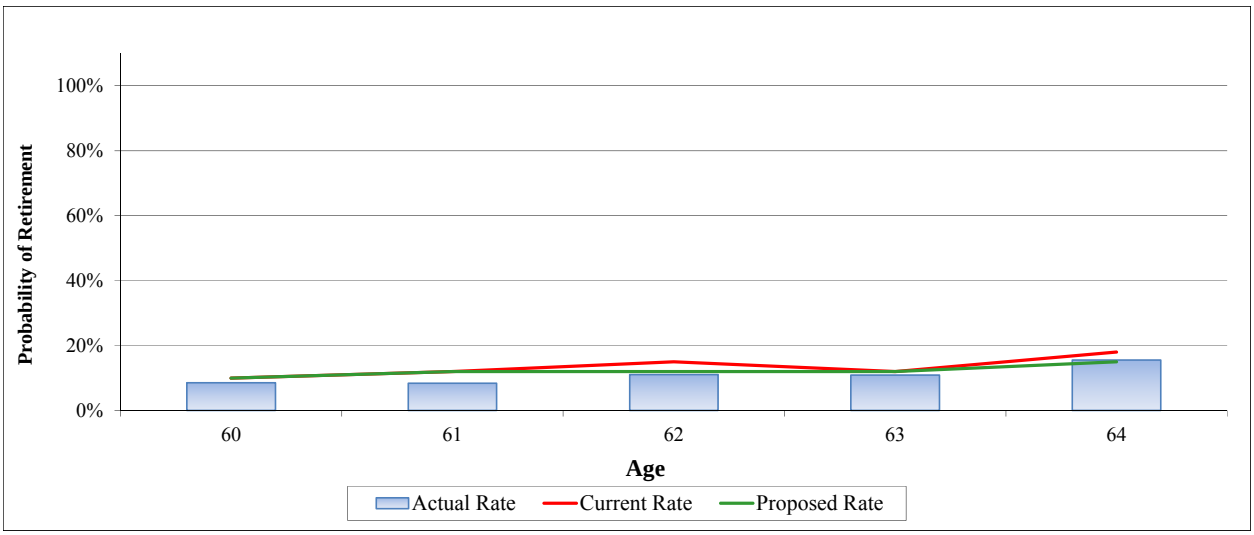
A discussion of our findings is included below.

Early Retirement: The following table shows the exposures, actual and expected retirements, and the A/E ratio for members who were eligible to retire with reduced early retirement benefits.

Early Retirement Experience

				A/E Ratio	
	Exposures	**Actual**	**Expected**	**Count**	**Weighted**
July 1, 2011 to June 30, 2012	1,746	219	216	108%	104%
July 1, 2012 to June 30, 2013	1,780	161	221	73%	64%
July 1, 2013 to June 30, 2014	1,820	217	227	96%	84%
July 1, 2014 to June 30, 2015	1,759	189	221	86%	71%
Total	**7,105**	**786**	**884**	**89%**	**80%**

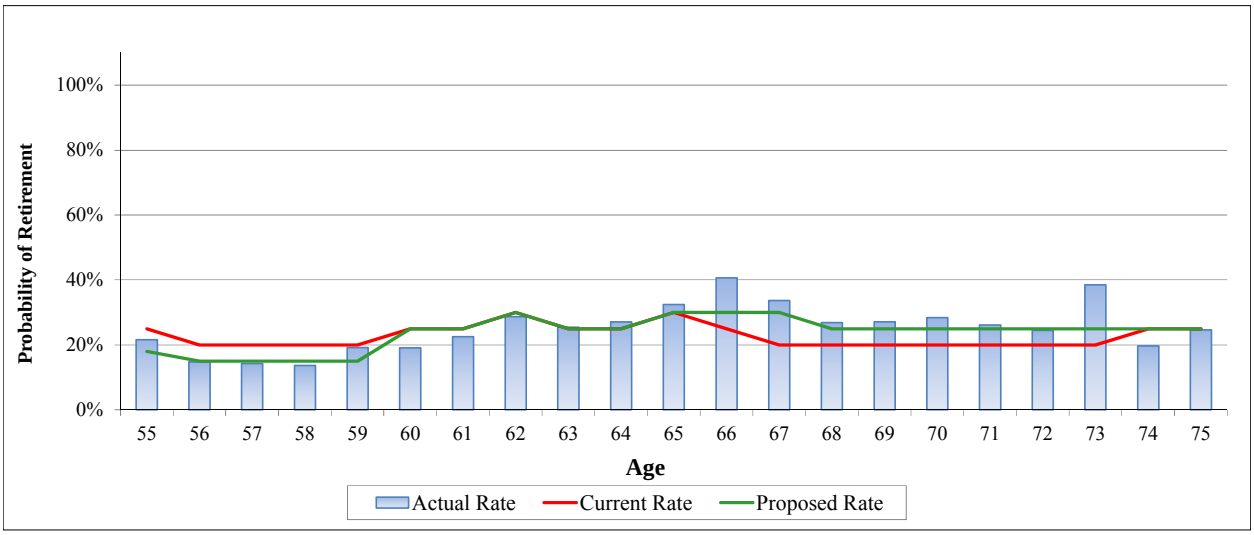
Overall, there were fewer early retirements than expected during the study period (A/E ratio of 80% on a liability weighted basis). We also note there was a fair amount of volatility year to year, so we would prefer to be cautious in adjusting rates to reflect the recent experience and only move part of the way. Based on the observed data, we recommend the proposed assumption (green line), shown in the graph below, which results in an A/E ratio of 85%.



Unreduced Retirement: Unreduced retirement experience shows some of the same year to year volatility as observed in early retirement. The following table indicates that the actual experience was, on the whole, closer to the expected rates, especially using liability weighted results.

Unreduced Retirement Experience					
				A/E Ratio	
	Exposures	Actual	Expected	Count	Weighted
July 1, 2011 to June 30, 2012	4,879	1,278	1,151	111%	121%
July 1, 2012 to June 30, 2013	4,652	753	1,100	68%	74%
July 1, 2013 to June 30, 2014	4,977	1,033	1,184	87%	90%
July 1, 2014 to June 30, 2015	4,963	1,028	1,183	87%	91%
Total	**19,471**	**4,092**	**4,617**	**89%**	**94%**

While the A/E ratios do not by themselves make a compelling case for a change, we do note that at ages under 60 the current rates predict more retirements than observed, while at ages over 65, the current rates anticipate fewer retirements than observed. We recommend the proposed assumption for unreduced retirement (green line), shown in the graph below, which results in an A/E ratio of 102%. Not only does this move the A/E ratio closer to 100%, but more importantly it improves the quality of the fit of the assumption to actual experience.



Patrol

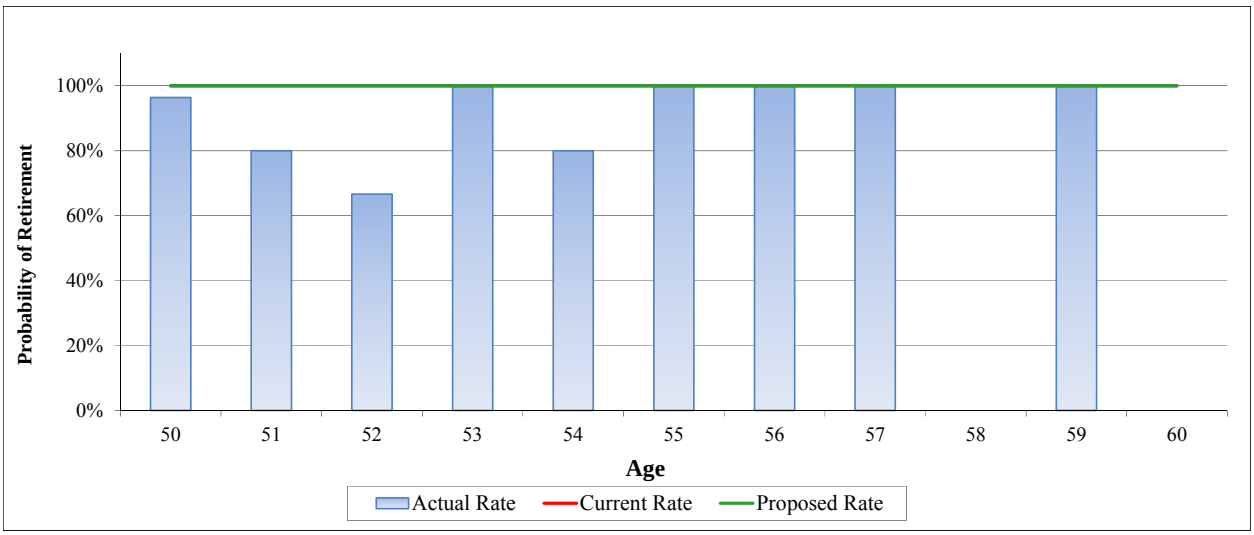
Members of the Patrol plan may retire with an unreduced benefit after 30 or more years of service, regardless of age, after age 50 with 25 or more years of service, or at age 55 with 10 or more years of service. Early (reduced) retirement is available to members who are at least age 50. Retirement is mandatory at age 60.

The Patrol plan also offers a Deferred Retirement Option Plan (DROP) that allows members who are age 50 with 25 years of service to apply for retirement benefits, but then remain in active employment up to five years (but not beyond age 60) during which time the retirement benefit payments are accumulated in their "DROP account". Upon ultimate cessation of employment, the accumulated DROP account balance is available as a lump sum and the monthly amounts previously directed into the DROP account are paid to the member as retirement benefits. From a retirement plan perspective, election into DROP has the same impact as retirement (benefit payments commence and contributions stop). Therefore, we performed the analysis of retirement and DROP together.

Because Patrol members are typically hired before age 45, early retirement rates effectively only apply to those members who are age 50 to 55 who have not yet reached 25 years of service. The current assumption for early retirement is 3% in each year. During the study period, there were 94 exposures to early retirement and one member elected early retirement, a rate of approximately 1%. Because of the limited number of exposures, we are not suggesting that a change be made at this time, but in the next experience study, we will be able to aggregate these results and determine if lower rates might be warranted.

The next group of individuals studied were eligible for unreduced retirement because they were at least 55 with 10 years of service, but had not yet reached 25 years of service. There were only 41 exposures for this group in the study period, and only 6 members retired (they were either age 59 or 60). The current assumption for those under 60 is that 10% will retire each year and that 100% retire at the age 60 mandatory retirement age. In this case, we have even less exposures to consider than we did with early retirement, so we again believe it is appropriate to leave the rates unchanged for now and wait for the next study. It should be noted that the limited number of exposures means this assumption has a limited cost impact.

Finally, for those who reached 25 years of service (and attained age 50), 51 of the 55 eligible members retired (see the following graph), and three of the remaining four retired the following year. As discussed earlier, we are considering both retirement and entering DROP to be equivalent events since they affect the retirement plan essentially the same way. Based on this, we believe it reasonable to keep the assumption of 100% probability of retirement at 25 years of service.



Judges

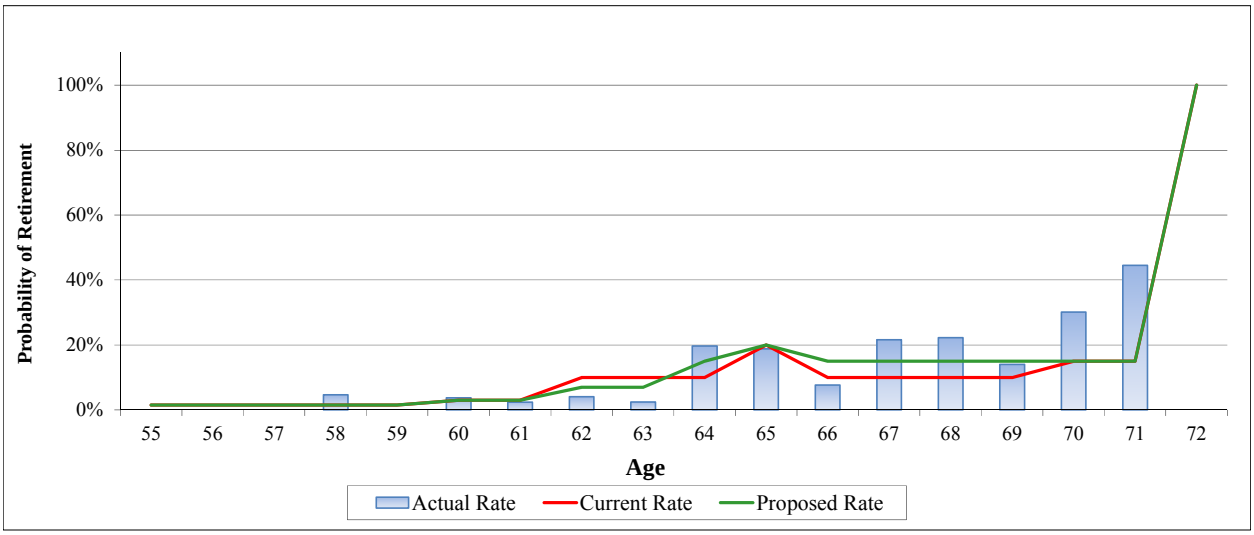
Under the Judges plan, unreduced retirement is available at age 65, regardless of service. Early retirement is available from ages 55 to 64, again without any minimum service requirement. It should be noted that the early retirement reduction for ages 62 to 64 is subsidized by using factors that produce less reduction than would be required for full actuarial equivalence. Coupled with the availability of Social Security at age 62, the increase in retirement rates at age 62 in the current assumption is very reasonable.

The following table summarizes the key results during the study period.

Retirement Experience					
				A/E Ratio	
	Exposures	Actual	Expected	Count	Weighted
Total	440	32	32	100%	116%

While the current rates anticipated the actual number of retirement, the weighted A/E ratio indicates that the individuals retiring have, on average, more liability that those who don't. Since pay for judges is fairly uniform, this really points to judges with more service retiring at greater rates than those with lower amounts of service. For instance, 126 of the 440 exposures (28%) were judges with 10 years or less of service. However, none of the retirements came from this group. Of course, because this group also tends to be younger and, therefore, have lower assumed retirement rates, only 4 retirements were actually expected.

We also observed that actual retirements below age 65 were lower than expected, while above age 65, more retirements than expected were observed. As a result, we propose some changes to the retirement rates as shown in the table below. Our proposed changes move the weighted A/E ratio from 116% to 101% and better fit the observed experience.



State Cash Balance

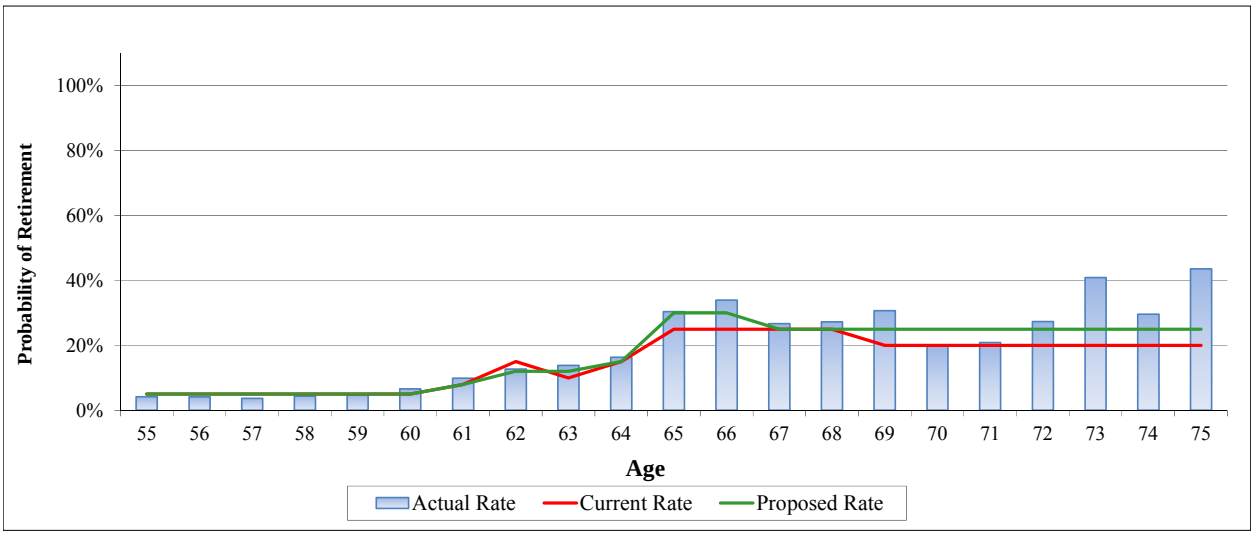
The State Cash Balance plan does not have any requirements for retiring, other than being vested. Because of the prevalence of age 55 as the earliest retirement age in the Schools and Judges plans and since vesting is automatic at age 55, regardless of the amount of service, it is customary to consider age 55 as the first eligible retirement age. Members ending employment prior to age 55 are considered to have terminated employment, while those ending employment after age 55 are considered to have retired.

Under the State Cash Balance plan, members may actually retire any time and either take their vested account balance as a lump sum, or receive an equivalent annuity. There is no distinction between early and unreduced retirement since the benefit amount is based on the account balance and member age. The younger the member's age at retirement, the lower the benefit amount.

The following table summarizes the retirement experience of the State Cash Balance plan during the study:

Retirement Experience					
				A/E Ratio	
	Exposures	Actual	Expected	Count	Weighted
2012	3,383	370	339	109%	136%
2013	4,052	283	404	70%	85%
2014	4,146	360	428	84%	118%
2015	4,124	390	434	90%	118%
Total	**15,705**	**1,403**	**1,605**	**87%**	**113%**

The significant difference in the count and weighted A/E ratios points to the fact that higher paid, longer service members, who in turn are expected to have larger account balances, are more likely than those with smaller account balances to retire at younger ages. As can be noted in the graph below, the difference between the actual and expected experience was especially pronounced at ages after 65, so we propose some changes in retirement rates to move part way toward the actual experience. The proposed assumption moves the weighted A/E ratio from 113% to 106%.



County Cash Balance

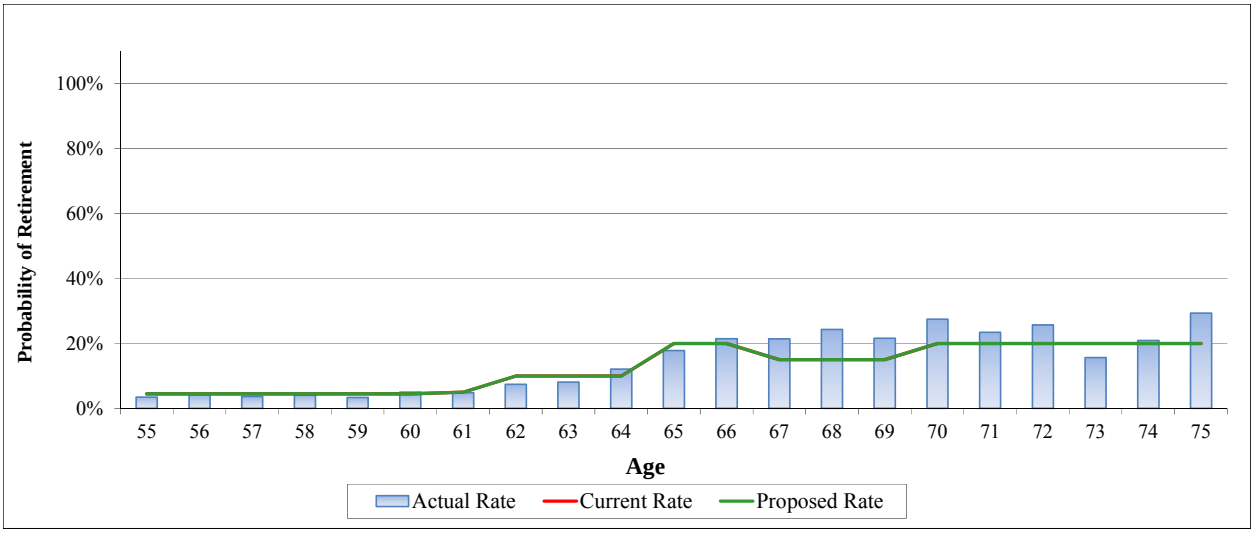
The County Cash Balance plan has the same considerations regarding retirement as does the State Cash Balance plan. Because of the different employment patterns between the state and the counties, however, the actual utilization of retirement may differ, and so it is necessary to perform a separate analysis.

The following table summarizes the experience of the County Cash Balance plan during the study:

Retirement Experience					
				A/E Ratio	
	Exposures	Actual	Expected	Count	Weighted
Calendar Year 2012	2,004	206	186	111%	106%
Calendar Year 2013	2,252	169	210	80%	77%
Calendar Year 2014	2,363	212	223	95%	104%
Calendar Year 2015	2,408	255	225	113%	127%
Total	**9,027**	**842**	**845**	**100%**	**104%**

Unlike the State Cash Balance plan retirement experience, the count and weighted A/E ratios for the County Cash Balance plan are more similar. In reviewing the following graph (using weighted observations), we note that there may be an argument to raise retirement rates for ages 67 to 69, but on a count basis, the actual number of retirements at each of the three ages was very close to the assumed 15% rate, so we are not proposing any changes in the County Cash Balance plan retirement rates at this time. When the next

experience study is performed, additional data will be available and greater credibility can be assigned to the observed experience.



CASH BALANCE LUMP SUM/ANNUITY ELECTION RATE

The State and County Cash Balance plans use an additional assumption in the valuation to better project future cash flows and estimate plan liabilities. Under the provisions of the plans, members may elect to receive a lump sum (rolled over to a tax qualified Individual Retirement Account, if desired), an annuity based on the value of the account balance, or a combination of the two. The current assumption is that 50% of the account balances will be paid as a lump sum and 50% will be paid as month benefits (annuitized).

By statute, the account balance is converted to monthly income based on an interest rate of 7.75% and a unisex blend of the 94 GAM Mortality Table (no age setback and no projection). As the result of the recent interest rate environment, the cost of annuities sold by insurance companies are currently much more expensive (i.e. lower monthly benefit for the same account balance) than the statutory conversion basis. New retirees may also value the fact that an annuity provides significant protection against outliving one's money. Thus, the election of annuities is partially a function of the economy (recent and expected) along with plan design.

The analysis of this assumption requires certain data which was not readily available for the January 1, 2011 valuation (performed by the prior actuary) and so only three years of data are included for this analysis. Anyone who took any portion of their benefit as an annuity were counted as electing an annuity. We analyzed both the number and the account balance weighted proportions of those who elected to receive any portion of their benefit as an annuity (called "Balance Weighted" in the table below. We also estimated the portion of the benefit taken as a lump sum by those who took both an annuity and a lump sum in order to a weighting which should best reflect the proportion of funds that are taken as an annuity or a lump sum(called "Lump Sum Weighted" in the table below). The results are as follows:

Annuitization Rate Experience Proportion Electing Annuity			
	Count Basis	**Balance Weighted**	**Lump Sum Weighted**
County	27%	46%	41%%
State	46%	57%	49%

Because this is the first time this analysis has been performed, to our knowledge, and because only three years of data were available, we are hesitant to assign a high degree of credibility to the results. The current 50% assumption seems reasonable, and we propose retaining it. We believe that this assumption should continue to be monitored, especially as the plans mature and account balances become more substantial.

MISCELLANEOUS ASSUMPTIONS

There are two minor assumptions that are used in the valuation process. For simplicity, we have included the discussion here since the most significant impact of these assumptions is on the retirement liability for the Patrol and Judges plans.

MARRIAGE ASSUMPTION

The current assumption is that 85% of School members and 100% of Patrol and Judges members are married. The assumption is not needed for the Cash Balance plans because the benefit paid at death or retirement does not vary by marital status. For Schools members, the value of the pre-retirement death benefit varies with marital status, while Patrol and Judges have normal payment forms that continue to the spouse upon the member's death.

The census data provided to us for the annual valuation does not include marital status. Beneficiary information is only reported for those retirees that receive a joint and survivor form of payment. With data supplied in this manner, there is no credible way to review this assumption. However, the impact of this assumption for the Schools plan is quite small and the use of 100% marriage assumption for the Patrol and Judges plans means the survivor provisions are valued conservatively. We believe the current assumptions are reasonable in our professional judgment and should be retained.

AGE OF BENFICIARY

Joint and survivor annuity benefit amounts are dependent on the member's and beneficiary's ages. The current assumption is that males are two years older than females in the Schools plan, and three years older for in the Patrol and Judges plans. There is insufficient data to accurately assess this assumption, but we find it reasonable and recommend that it be retained.

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One of the types of benefits provided to members is a disability benefit. Typically, the frequency of the occurrence of disability is dependent upon the membership type and the nature of the benefits provided. In the case of NPERS, only the School and Patrol plans have a disability assumption. The occurrence of disability in the Judges plan is quite rare, and because many judges are eligible for retirement, the cost to the system of a disability would be minor. The State Cash Balance plan and the County Cash Balance plan provide a disability benefit that is equal to the termination or retirement benefit (although the taxable nature of the annuity would change). Because the benefit does not differ, there is no tracking of disabilities in the data provided to the actuary. Because the disability benefits and the termination or retirement benefits are identical, any disability occurrence is included in those decrements and no separate assumption is required.

In our analysis of rates for Schools and Patrol, we considered only the count basis for developing A/E ratios. In our experience, the use of weighted rates is frequently distorted by lower salaries in the year leading up to a disability as the member typically first uses leaves from work to manage medical issues.

Schools

The unisex disability assumption was changed in the last experience study by lowering the rates at all ages. The table below indicates the actual and expected disability experience during the study period and the resulting A/E Ratios.

	Exposure	Actual	Expected	A/E Ratio
Total	154,096	51	59	86%

We also analyzed the actual experience separately for males and females. The A/E ratio for males in the current study was 121% and the A/E ratio for females in the current study was 77%. Based on this difference, we propose using separate male and female rates, resulting in A/E ratios of 113% and 87% respectively. While a very minor assumption, we still believe that this approach will improve the overall estimation of plan liabilities.

Patrol

During the study period, there were two Patrol disabilities compared with five expected. Given the small numbers involved, we do not see any compelling reason to propose any change.

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Not all active members on the valuation date are expected to continue working until retirement. Therefore, a termination of employment assumption is used to anticipate the probability that a member will leave covered employment at any given age. In analyzing the actual results, the number of terminations includes all members reported to have terminated employment. Some of these members subsequently receive refunds of their contributions, some return to active membership and some leave their contributions with the System until retirement and receive a monthly benefit. Explicit assumptions are made regarding the elections made by such terminated vested members. Non-vested members are assumed to elect a refund of their employee contribution account balance.

This section of the report summarizes the results of our study of terminations of employment for reasons other than death, retirement, or disability. Because of the types of jobs and employee characteristics vary significantly amongst the five plans, it is not surprising that each plan has a distinct termination assumption. In the case of the Schools plan, there are also noteworthy differences in termination patterns between males and females, and so gender-specific rates are developed.

Schools

As mention above, the gender-distinct termination rates are used for the Schools system. The rates are based on years of service, with employees with less service exhibiting higher incidences of turnover than the rates seen in employee with more service. A summary of the current experience is displayed in the following tables:

Termination Experience - Males

				A/E Ratio	
	Exposures	**Actual**	**Expected**	**Count**	**Weighted**
July 1, 2011 to June 30, 2012	7,576	487	559	87%	64%
July 1, 2012 to June 30, 2013	7,631	489	563	87%	62%
July 1, 2013 to June 30, 2014	7,780	594	584	102%	69%
July 1, 2014 to June 30, 2015	7,810	508	580	88%	55%
Total	**30,797**	**2,078**	**2,286**	**91%**	**62%**

Termination Experience - Females

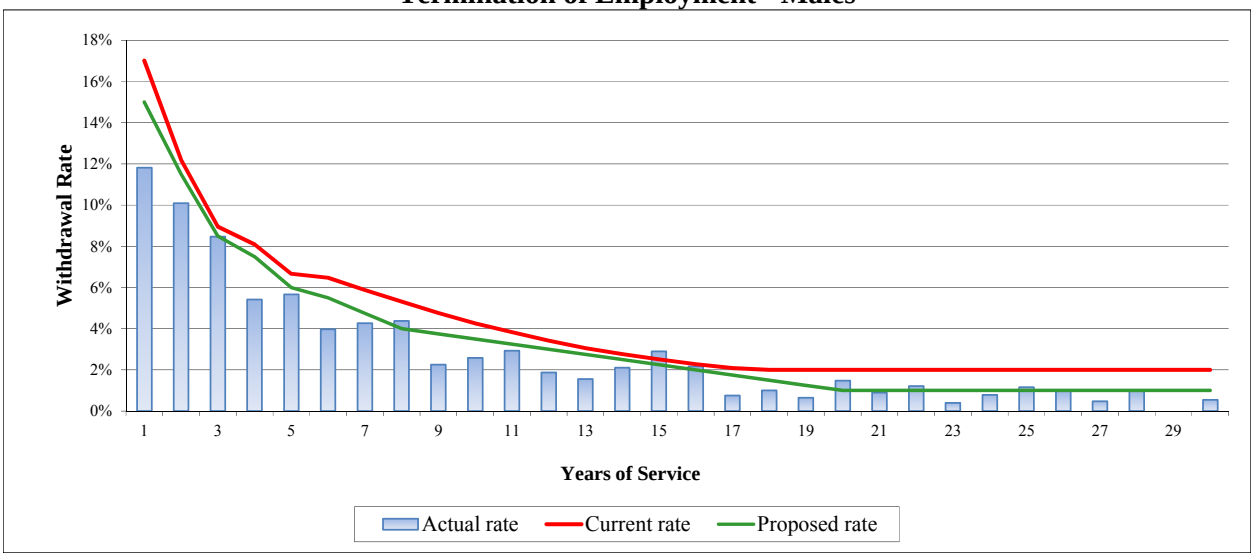
				A/E Ratio	
	Exposures	**Actual**	**Expected**	**Count**	**Weighted**
July 1, 2011 to June 30, 2012	24,722	1,973	2,155	92%	63%
July 1, 2012 to June 30, 2013	24,487	1,773	2,103	84%	63%
July 1, 2013 to June 30, 2014	24,873	2,209	2,176	102%	76%
July 1, 2014 to June 30, 2015	25,109	2,101	2,228	94%	70%
Total	**99,191**	**8,056**	**8,661**	**93%**	**68%**

As is evident from the charts, the current assumptions are estimating the number of terminations better than they are estimating the liability associated with those terminations. In our experience, this situation is common and results when the terminations are more common among members with lower salaries relative to higher compensated members. There are doubtless a number of factors that lead to this correlation, but

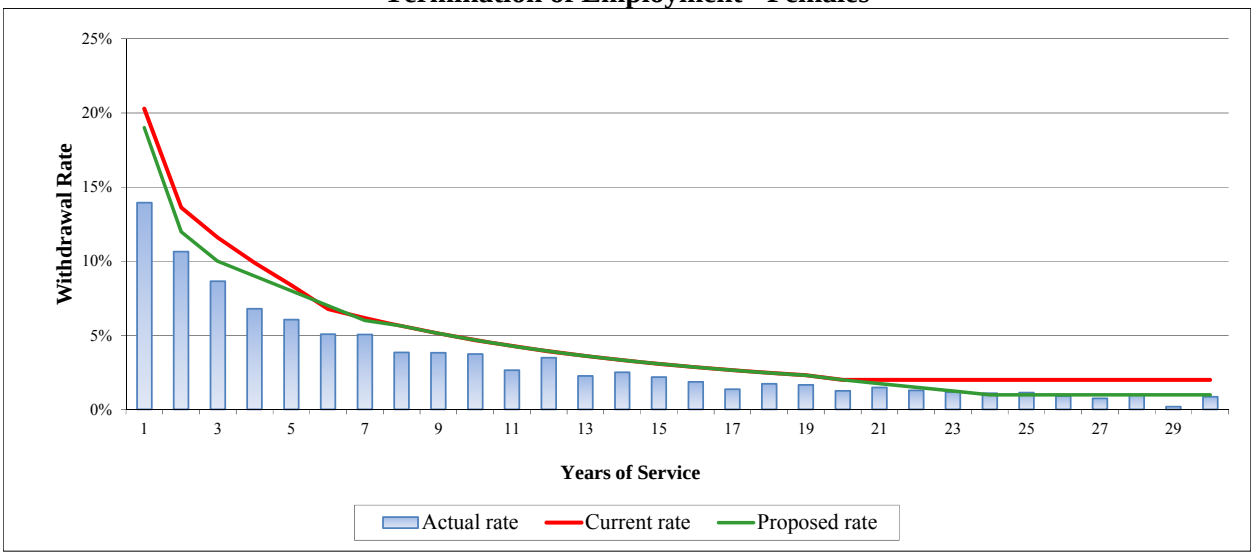
we do note from our experience with school systems that termination rates for teachers tend to be lower than termination rates for non-teachers. Because the compensation of teachers is typically higher than most non-certificated staff, the liability that exits with terminations is proportionately lower than the headcount reduction.

As a result of our analysis, we are proposing termination rates that gives more credibility to the weighted observations. For the male rates (weighted) shown below, our proposed rates (in green) move the count A/E ratio from 91% to 102% and the weighted A/E ratio from 62% to 83%. For the female rates, our proposed rates move the count A/E ratio from 93% to 99% and the weighted A/E ratio from 68% to 76%.

Termination of Employment - Males



Termination of Employment - Females

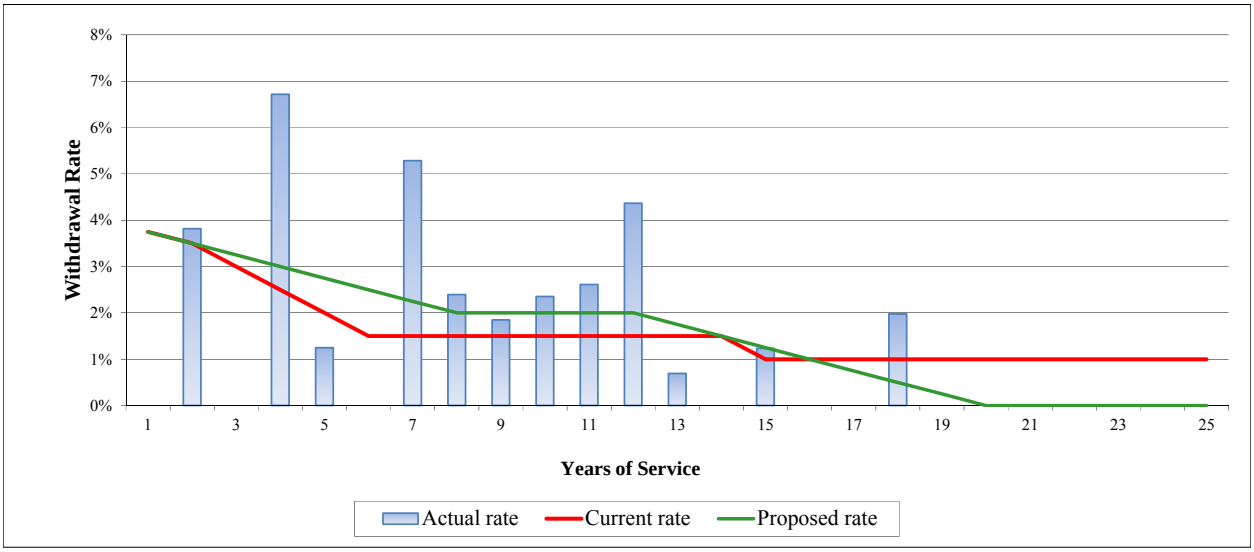


Patrol

Termination of employment in the Patrol plan is very low – there were just 27 terminations during the four years of study. The following table summarizes the results:

Termination Experience - Females					
				A/E Ratio	
	Exposures	Actual	Expected	Count	Weighted
Total	**1,416**	**27**	**23**	**120%**	**95%**

The graph shown below does not indicate any strong pattern to the terminations. We analyzed the results by age as well to see if that provided any insight, but it was also inconclusive. We also considered the results of the prior experience study in developing the proposed rates shown in the graph below. These proposed rates change the count A/E ratio from 120% to 107% and the weighted A/E ratio from 95% to 102%. We also believe the proposed rates provide a better prediction of behavior after 20 years of service.



Judges

Termination of employment for judges is a rare event, and so no assumption is used in the valuation. During the study period, no terminations were observed. We believe it is reasonable to continue to not use a termination of employment assumption.

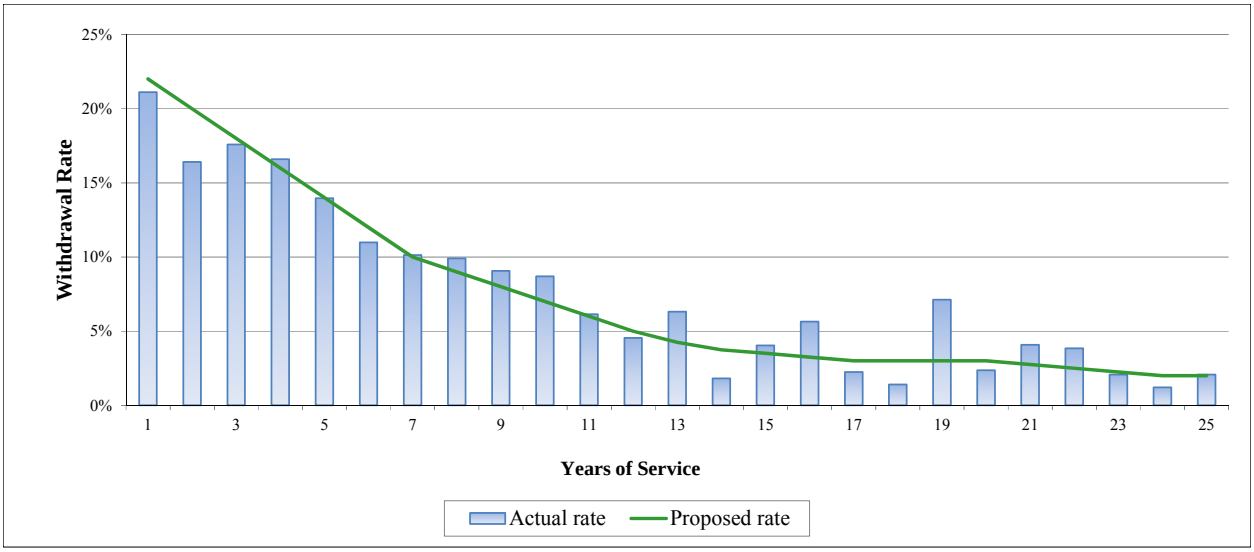
State Cash Balance

The current assumption used in the valuation of the State Cash Balance Plan is a "Select and Ultimate" assumption. In this type of assumption, there are rates of termination assumed for each year in the select period (the first five years) and then a different set of rates used for all years thereafter. Because there are separate assumptions for each of the first five years of service and then the ultimate period, we have combined all years in the study period in summarizing the results below:

Termination Experience					
				A/E Ratio	
Years	**Exposures**	**Actual**	**Expected**	**Count**	**Weighted**
First (Select)	3,989	878	525	167%	NA
Second (Select)	4,929	895	665	135%	125%
Third (.Select)	3,395	530	467	113%	105%
Fourth (Select)	2,747	516	353	146%	128%
Fifth (Select)	2,221	400	259	154%	138%
Ultimate	14,846	1,449	922	157%	123%
Total	**32,127**	**4,668**	**3,191**	**146%**	**123%**

Based on the termination of employment results from the prior experience study, it is not surprising that the current assumptions predicted fewer terminations than occurred. Rather than continuing to adjust the rates lower, however, we believe that a set of rates based solely on service is likely to better model the termination patterns. We considered separate rates for males and females, but did not find the difference to be significant enough to justify distinct assumptions. However, future experience studies should continue to study this assumption by gender to ensure differences do not unfold over time.

The results shown in the graph below show the proposed rates. The resulting A/E ratio is 107% on a count basis and 102% on a weighted basis.



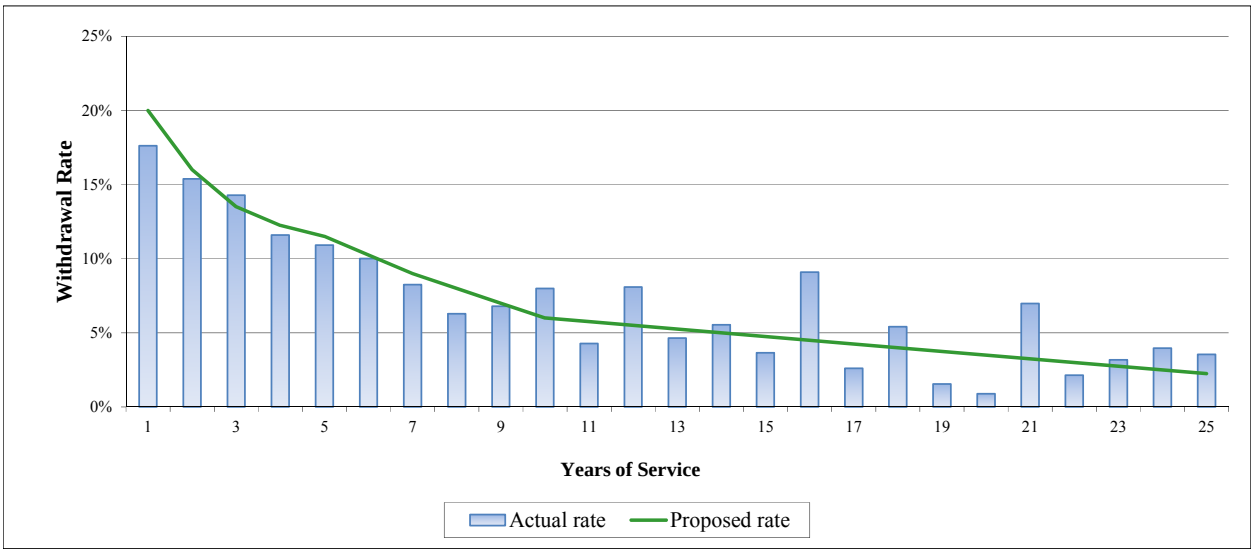
County Cash Balance

The current assumption for the County Cash Balance Plan is a "Select and Ultimate" assumption, just as is used for the State Cash Balance Plan. Again, because there are separate assumptions for each of the first five years of service and then the ultimate period, we have combined all years in the study period in summarizing the results in the following table:

Termination Experience					
				A/E Ratio	
Years	**Exposures**	**Actual**	**Expected**	**Count**	**Weighted**
First (Select)	2,973	566	345	164%	NA
Second (Select)	1,640	308	212	145%	123%
Third (.Select)	1,371	225	148	152%	129%
Fourth (Select)	1,163	185	116	159%	137%
Fifth (Select)	1,193	153	112	137%	122%
Ultimate	6,033	507	286	177%	136%
Total	**14,373**	**1,994**	**1,219**	**159%**	**132%**

As with the State Cash Balance plan, the results from the prior experience study caused us to expect that the current assumptions would predict fewer terminations than actually occurred. Similarly, rather than adjusting the current rates lower, we believe that a set of rates based solely on service is likely to better model the termination patterns. We also considered separate rates for males and females, but did not find the difference to be significant enough to justify distinct assumptions. Again, this should continue to be monitored in future studies.

The results shown in the graph below show these proposed rates. The resulting A/E ratio is 109% on a count basis and 99% on a weighted basis.



ELECTION OF A DEFERRED ANNUITY/REFUND

Some vested members who terminate active employment elect to receive a distribution of their member account balance, forfeiting their right to receive monthly benefits in the future, while others wait and take an annuity at retirement eligibility. For Schools and Patrol members, the current assumption is that the member will elect the most valuable option, i.e., the option with the higher present value (using the valuation assumptions for investment return and mortality). While actual experience may vary, this

approach is reasonable and protects NPERS against experience losses from the actual elections. We recommend the current approach be maintained.

Because the Judges System assumes no termination of employment, there is no need for an assumption regarding the election of a deferred annuity. This is noted here for completeness.

The State Cash Balance plan and the County Cash Balance plan both assume that all members who terminate employment (not eligible for retirement) take the lump sum value of their account. Because of the difference in interest crediting rates and discount rates, this is the most valuable alternative to the member, and so it is effectively the same approach as is used by the School and Patrol Plans. We also believe this is a reasonable approach and should be maintained.

Valuing Deferred Annuities: The prior section discussed the actuarial assumptions used to anticipate how current actives will choose to take a deferred benefit or a refund of member contributions upon termination of employment. In this section, we focus on vested members who have already terminated and not elected a refund. This group of deferred vested members, although small, represents a liability to the system which needs to be valued. For the State and County Plans, it suffices to just value the current account balance, while for the final pay plans, some estimate of the value of future benefit payments is needed.

Currently, the data available for deferred vested members does not include salary information that is sufficient to estimate a benefit amount payable at retirement. To obtain a reasonable estimate of the liability that exists for future benefits, a common actuarial practice is to take a multiple of the member account balance. Currently, the deferred vested liability is estimated as 2.0 times the sum of the deferred vested member account balances.

Because the vast majority of the deferred vested members are in the School group, our analysis was based solely on School members. We examined the deferred vested members who commenced benefits after July 1, 2012 and before June 30, 2015. For each person, we calculated the ratio of the account balance to the monthly benefit. The average ratio, weighted by account size, was 56.2, indicating that the account balance, on average, is sufficient for 4.7 years of benefit payments. We also determined that the average retirement age, weighted by benefit amount, was 62. The average current age of deferred vested members is 52. Based on all of these average values, the expected liability is 1.96 times the current account balance. Based on this finding, we recommend continuing to value the deferred vested liability as 2.0 times the sum of the deferred vested member account balances.

We wish to make two points. First, NPERS staff has been considering whether they might be able to provide appropriate salary information with the valuation data. If that is possible, this assumption can be eliminated and the liability can be valued directly. Second, because the member contribution rate has increased in recent years, we anticipate that this ratio of account balance to monthly benefit amount for new retirees is likely to change over time. Thus, this assumption should be reviewed each experience study to assure that it remains a reasonable estimate.

A. ACTUARIAL METHODS

1. **Calculation of Normal Cost and Actuarial Accrued Liability:** The method used to determine the normal cost and actuarial accrued liability was the Entry Age Actuarial Cost Method described below.

Entry Age Actuarial Cost Method

Projected pension and preretirement spouse's death benefits were determined for all active members under age 80. Cost factors designed to produce annual costs as a constant percentage of each member's expected compensation in each year from the assumed entry age to the assumed retirement age were applied to the projected benefits to determine the normal cost (the portion of the total cost of the plan allocated to the current year under the method). The normal cost is determined by summing intermediate results for active members under age 80 and determining an average normal cost rate which is then related to the total payroll of active members. The actuarial assumptions shown on the following page were used in determining the projected benefits and cost factors. The actuarial accrued liability for active members (the portion of the total cost of the plan allocated to prior years under the method) was determined as the excess of the actuarial present value of projected benefits over the actuarial present value of future normal costs.

The actuarial accrued liability for retired members and their beneficiaries currently receiving benefits, active members age 80 and over, terminated vested members and disabled members not yet receiving benefits was determined as the actuarial present value of the benefits expected to be paid. No future normal costs are payable for these members.

The actuarial accrued liability under this method at any point in time is the theoretical amount of the fund that would have been accumulated had annual contributions equal to the normal cost been made in prior years (it does not represent the liability for benefits accrued to the valuation date). The unfunded actuarial accrued liability is the excess of the actuarial accrued liability over the actuarial value of plan assets measured on the valuation date. The initial unfunded actuarial accrued liability established July 1, 2004, is amortized with a level dollar payment amount over 25 years. At subsequent valuation dates, amortization bases equal to changes in the unfunded actuarial accrued liability are established and amortized with a level dollar payment over a 25-year period. Intervening legislation made some periodic adjustments. Effective with the July 1, 2013 valuation for final pay plans, amortization payments were recalculated to amortize the remaining bases as a level percentage of expected payroll and new bases are amortized over 30 years. Cash Balance plans are still established and amortized with a level dollar payment over a 25-year period.

Under this Entry Age method, experience gains or losses, i.e., decreases or increases in accrued liabilities attributable to deviations in experience from the actuarial assumptions, adjust the unfunded actuarial accrued liability.

2. **Calculation of the Actuarial Value of Assets:** The actuarial value of assets is based on a five-year smoothing method and is determined by spreading the effect of each year's investment return in excess of or below the expected return. The Market Value of assets on the valuation date is reduced by the sum of the following:

   I. 80% of the return to be spread during the first year preceding the valuation date,
   II. 60% of the return to be spread during the second year preceding the valuation date,
   III. 40% of the return to be spread during the third year preceding the valuation date, and
   IV. 20% of the return to be spread during the fourth year preceding the valuation date.

B. VALUATION PROCEDURES

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of the employee cash balance account.

The compensation amounts used in the projection of benefits and liabilities for active members were prior plan year compensations.

Projected benefits were limited by the dollar limitation required by the Internal Revenue Code Section 415 as it applies to governmental plans and compensation limited by Section 401(a)(17).

ECONOMIC ASSUMPTIONS

1. Investment Return — 8.00% per annum, compounded annually, net of expenses.

2. Inflation — 3.25% per annum, compounded annually

3. Salary Increases — Rates vary by service. Sample rates are as follows:

Rates by Service	
Years	**Rate**
<1	9.00%
1	8.50
5	6.96
10	5.68
15	5.21
20	4.95
25	4.74
30	4.57
35	4.32
40+	4.00

4. Payroll Growth — 4.00% per annum

5. Investment on Employee Contributions — 4.25% per annum compounded annually.

6. Increase in Compensation And Benefit Limits — 3.25% per annum on the 401(a)(17) compensation limit and 415 benefit limit

DEMOGRAPHIC ASSUMPTIONS

1. Mortality — The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement.

   a. Healthy lives - Active members — 1994 Group Annuity Mortality Table, projected to 2015 using scale AA, set-back 1 year (55% of male rates for males, 40% of female rates for females)

   b. Healthy lives – Retired members and beneficiaries — 1994 Group Annuity Mortality Table, projected to 2015 using scale AA, set-back 1 year (sex distinct)

   c. Disabled lives — 1983 Railroad Retirement Board Disabled Annuitants Mortality set-back 1 year (unisex)

d. Healthy mortality rates and life expectancies are shown below at sample ages:

	Pre-retirement Mortality			
	Mortality Rate		Life Expectancy (Years)	
Sample Age	Males	Females	Males	Females
20	0.02%	0.01%	68.3	74.7
30	0.04	0.01	58.5	64.8
40	0.05	0.02	48.7	54.9
50	0.09	0.04	39.0	45.0
60	0.28	0.14	29.5	35.3
70	0.89	0.46	20.8	26.1

	Post-retirement Mortality			
	Mortality Rate		Life Expectancy (Years)	
Sample Age	Males	Females	Males	Females
50	0.16%	0.09%	33.4	36.4
60	0.51	0.35	24.1	26.9
70	1.62	1.14	16.0	18.4
80	4.43	3.05	9.2	11.0
90	12.55	9.82	4.5	5.4

e. Disabled mortality rates and life expectancies are shown below at sample ages:

Sample Age	Mortality Rate	Life Expectancy
30	1.02%	30.7
40	1.29	23.8
50	3.00	17.7
60	4.14	13.5
70	6.38	9.5
80	9.97	6.2

2. Retirement

Rates vary by age and eligibility for benefits. Rates are as follows:

Retirement Rates When Eligible for Unreduced Benefits	
Age	Rate
55	25%
56	20
57	20
58	20
59	20
60	25
61	25
62	30
63	25
64	25
65	30
66	25
67	20
68	20
69	20
70	20
71	20
72	20
73	20
74	25
75	25
76	25
77	25
78	35
79	35
80	100

Retirement Rates When Eligible for Reduced Benefits	
Age	Rate
60	10%
61	12
62	15
63	12
64	18

3. Termination

Rates vary by service.
Sample rates are as follows:

Rates by Service		
Years	Male	Female
<1	27.5%	31.7%
1	17.0	20.3
5	6.7	8.4
10	4.3	4.7
15	2.5	3.1
20+	2.0	2.0

4. Disability

Rates vary by age.
Sample rates are as follows:

Age	Rate
25	.00%
30	.00
35	.02
40	.02
45	.03
50	.04
55	.07
60	.09

OTHER ASSUMPTIONS

1. Form of Payment

Service annuity – Life annuity
Formula annuity – Five year certain and life annuity.

2. Marital Status
   a. Percent married — 85% married
   b. Spouse's age — Females assumed to be two years younger than males.

3. Administrative Expense

Investment return is assumed to be net of expenses.

4. Commencement age for deferred vested benefit

Age 62

5. Cost of Living Adjustment

Service annuity – none
Formula annuity – For members hired before January 1, 2013, it is 2.5% per annum, compounded annually and 3.25% per annum, compounded annually, after reaching 75% purchasing power floor benefit. For members hired on or after January 1, 2013, it is 1.0% per annum, compounded annually, and there is no floor for the purchasing power of the benefit.

6. State Contribution	State contributions for the current plan year are assumed to be contributed in a lump sum on the July 1 following the plan year end. These amounts from the prior plan year are treated as a contribution receivable on the plan's financial statements.

TECHNICAL VALUATION PROCEDURES

Data Procedures

Salaries for first year members are annualized by using the client's Calculated Salary field. For continuing active members, the Accumulated Salary field is used.

Other Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur mid-year, except that immediate retirement is assumed for those who are at or above the age at which retirement rates are 100%. Standard adjustments are made for multiple decrements.

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.

Future monthly benefit amounts are not calculated or available for deferred vested members. The benefit liability for deferred vested members was calculated by loading the accumulated member contribution balances for deferred vested members by 100% to estimate the value of deferred benefit payments.

ECONOMIC ASSUMPTIONS

1. Investment Return — 8.0% per annum, compounded annually, net of expenses.

2. Inflation — 3.25% per annum, compounded annually.

3. Salary Increase — Rates vary by service. Sample rates are as follows:

Rates by Service	
Years	**Rate***
<1	9.5%
5	6.6
10	5.6
15	5.5
20	5.5
25	5.5
30	4.0

* Projected pay at retirement is adjusted by 8.7% to reflect Halpin decision for members hired before January 4, 1979.

4. Payroll Growth — 4% per annum

5. Interest on Employee Contributions — 4.25% per annum, compounded annually.

6. Increases on Compensation And Benefit Limits — 3.25% per annum on the 401(a)(17) compensation limit and the 415 benefit limit

DEMOGRAPHIC ASSUMPTIONS

1. Mortality — The mortality assumption includes an appropriate amount of conservatism that reflects expected future mortality improvement.

   a. Healthy lives – Active members — 1994 Group Annuity Mortality Table, projected to 2015 using scale AA, set-back 1 year (sex distinct)

   b. Healthy lives – Retired members and beneficiaries — 1994 Group annuity Mortality table, projected to 2015 using scale AA, set-back 1 year (sex distinct)

   c. Disabled lives — 1983 Railroad Retirement Board Disabled Annuitants Mortality (unisex)

   d. Healthy mortality rates and life expectancies are shown below at sample ages:

	Pre-retirement Mortality			
	Mortality Rate		Life Expectancy (Years)	
Sample Age	Males	Females	Males	Females
20	0.03%	0.02%	62.3	65.8
30	0.07	0.03	52.6	55.9
40	0.09	0.05	42.9	46.1
50	0.16	0.09	33.4	36.4
60	0.51	0.35	24.1	26.9
70	1.62	1.14	16.0	18.4

	Post-retirement Mortality			
	Mortality Rate		Life Expectancy (Years)	
Sample Age	Males	Females	Males	Females
50	0.16%	0.09%	33.4	36.4
60	0.51	0.35	24.1	26.9
70	1.62	1.14	16.0	18.4
80	4.43	3.05	9.2	11.0
90	12.55	9.82	4.5	5.4

e. Disabled mortality rates and life expectancies are shown below at sample ages:

	Disabled Mortality	
Sample Age	Mortality Rate	Life Expectancy (Years)
30	1.06%	30.0
40	1.35	23.1
50	3.16	17.2
60	4.25	13.1
70	6.75	9.1
80	10.77	5.8

2. Retirement

Retirement is assumed to occur upon attaining certain age and service requirements. The retirement assumption varies depending on benefit eligibility and age at retirement.

Early/Normal Retirement Eligibility	Age and Service Requirements	Retirement Assumption
Reduced	Age 50 Service: 10 years	3% at each age
Unreduced	Age 55 Service: 10 years	10% at each age
Unreduced (Eligible for DROP)	Age 50 Service: 25 years	100% at each age
Unreduced (Mandatory)	Age 60	100% at each age

3. Termination

Rates vary by service. Sample rates are as follows:

Rates by Service	
Years	Rate
<1	4.0%
1	3.8
5	2.0
10	1.5
15	1.0
20	1.0
25+	1.0

4. Disability

Rates vary by age. Sample rates are as follows:

Rates by Age	
Age	Rate
25	.08%
30	.10
35	.13
40	.20
45	.31
50	.52
55	.91
60	1.36

OTHER ASSUMPTIONS

1. Form of Payment

75% Joint & Survivor Annuity. Deferred vesteds are assumed to take the greater of the present value of an annuity at earliest unreduced eligibility or a refund of contributions.

2. Marital Status	
a. Percent married	100% married
b. Spouse's age	Females assumed to be three years younger than males.
3. Children	All members are assumed to have one dependent child at death or retirement. The child is assumed to be 28 years younger than the member, and is assumed to always survive until age 19.
4. Administrative Expense	Investment return is assumed to be net of expenses.
5. Cost of living adjustments	2.5% per annum, compounded annually, and 3.25% per annum, compounded annually, after reaching 60% purchasing power floor benefit.
6. DROP participation	All members elect the DROP at the earliest possible date and remain in the DROP for 4 years or to age 60, if earlier.
7. State Contribution	Additional State contributions for the current plan year are assumed to be contributed in a lump sum on the July 1 following the plan year end. These amounts from the prior plan year are treated as a contribution receivable on the plan's financial statements.

TECHNICAL VALUATION PROCEDURES

Data Procedures

Salaries for first year members are annualized by using the client's Calculated Salary field. For continuing active members, the Accumulated Salary field is used.

When multiple records are received, the record with the oldest beneficiary date of birth is valued.

Other Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur mid-year, except that immediate retirement is assumed for those who are at or above the age at which retirement rates are 100%. Standard adjustments are made for multiple decrements

ECONOMIC ASSUMPTIONS

1. Investment Return	8.0% per annum, compounded annually, net of all expenses.
2. Inflation	3.25% per annum, compounded annually.
3. Salary Increases	Salaries are assumed to increase 4.0% each year.
4. Payroll Growth	4.0% per year
5. Interest on Employee Contributions	4.25% per annum, compounded annually.
6. Increases in Compensation And Benefit Limits	3.25% per annum on the 401(a)(17) compensation limit and 415 benefit limit

DEMOGRAPHIC ASSUMPTIONS

1. Mortality — The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement.

   a. Active Members — 1994 Group Annuity Mortality Table, projected to 2015 using scale AA, set-back 1 year (sex distinct with 55% of male rates for males and 40% of female rates for females)

   b. Retired Members — 1994 Group Annuity Mortality Table, projected to 2015 using scale AA, set-back 1 year (sex distinct)

   c. Mortality rates and life expectancies under the mortality tables are shown below at sample ages:

Pre-Retirement Mortality				
	Mortality Rate		Life Expectancy (years)	
Sample Age	Males	Females	Males	Females
20	0.02%	0.01%	68.3	74.7
30	0.04	0.01	58.5	64.8
40	0.05	0.02	48.7	54.9
50	0.09	0.04	39.0	45.0
60	0.28	0.14	29.5	35.3
70	0.87	0.46	20.8	26.1

Post-Retirement Mortality				
	Mortality Rate		Life Expectancy (years)	
Sample Age	Males	Females	Males	Females
50	0.16%	0.09%	33.4	36.4
60	0.51	0.35	24.1	26.9
70	1.62	1.14	16.0	18.4
80	4.43	3.05	9.2	11.0
90	12.55	9.82	4.5	5.4

2. Retirement — Rates vary by age. Rates are as follows:

Rates by Age	
Age	**Rate**
55-59	1.5%
60-61	3.0
62-64	10.0
65	20.0
66-69	10.0
70-71	15.0
72	100.0

3. Termination — None.

4. Disability — None.

OTHER ASSUMPTIONS

1. Form of Payment — Modified Cash Refund Annuity under prior plan benefit provisions. A 50% Joint & Survivor Benefit for members electing this provision under LB 1097, and new members hired after July 1, 2004. Deferred vesteds are assumed to take the greater of the present value of an annuity at age 63 or a refund of contributions.

2. Marital Status

   a. Percent married — 100% married

   b. Spouse's age — Females assumed to be three years younger than males.

3. Administrative Expense — Investment return is assumed to be net of expenses.

4. Cost of Living Adjustment — 2.50% per annum, compounded annually, and 3.25% per annum, compounded annually, after reaching 75% purchasing power floor benefit.

5. State Contribution — State contributions for the current plan year are assumed to be contributed in a lump sum on the July 1 following the plan year end. These amounts from the prior plan year are treated as a contribution receivable on the plan's financial statements.

TECHNICAL VALUATION PROCEDURES

Data Procedures

Client data caps active service at 20 years. While capping the benefit amount at 20 years of service, we keep a record of actual service beyond 20 years in order to remain consistent with the Entry Age Method.

Salaries for first year members are annualized by using the client's Calculated Salary field. For continuing active members, the Accumulated Salary field is used.

Other Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur mid-year, except that immediate retirement is assumed for those who are at or above the age at which retirement rates are 100%. Standard adjustments are made for multiple decrements.

ECONOMIC ASSUMPTIONS

1. Investment Return — 7.75% per annum, compounded annually, net of expenses.

2. Inflation — 3.25% per annum, compounded annually.

3. Interest Crediting Rate on Cash Balance Accounts — 6.75% per annum, compounded annually.

4. Annuitization Rate of Member & Employer Accumulated Balances — 7.75% per annum, compounded annually.

5. Salary Scale

	Annual Increase in Salary		
Service	Merit & Productivity	Inflation	Total
0	2.11%	3.25%	5.43%
1	1.98	3.25	5.30
2	1.79	3.25	5.10
3	1.49	3.25	4.79
4	1.27	3.25	4.56
5	1.19	3.25	4.48
6	1.16	3.25	4.44
7	1.14	3.25	4.43
8	1.10	3.25	4.38
9	1.06	3.25	4.35
10	1.03	3.25	4.31
11	1.02	3.25	4.30
12	0.98	3.25	4.26
13	0.94	3.25	4.22
14	0.92	3.25	4.20
15	0.89	3.25	4.17
16	0.85	3.25	4.13
17	0.82	3.25	4.10
18	0.81	3.25	4.09
19	0.78	3.25	4.06
20+	0.73	3.25	4.00

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

Mortality assumptions were based on actual experience during the last experience analysis and includes an allowance for expected future mortality improvement.

a. Active Members — 1994 Group annuity Mortality Table, setback 1 year, projected to 2015 (55% of male rates for males, 40% of female rates for females).

b. Retired members and beneficiaries — 1994 Group Annuity Mortality Table, setback 1 year, sex distinct projected to 2015 using Scale AA.

c. Mortality rates under the mortality table for active members are shown below at sample ages:

	Active Mortality Rate	
Sample Age	Males	Females
30	0.04%	0.01%
40	0.05	0.02
50	0.09	0.04
60	0.28	0.14
70	0.89	0.46
80	2.44	1.22

d. Life expectancies under the mortality table for active members are shown below at sample ages:

	Life Expectancy (Years)	
Sample Age	Males	Females
30	58.5	64.8
40	48.7	54.9
50	39.0	45.0
60	29.5	35.3
70	20.8	26.1
80	13.1	17.6

e. Mortality for Annuitization of Employee and Employer Cash Balance Accounts — 1994 Group Annuity Mortality Table, with 50 % Male, 50% Female blending.

Sample Age	Mortality Rate	Life Expectancy (Years)
55	0.34%	28.0
60	0.62	23.5
65	1.16	19.4
70	1.87	15.7
75	2.99	12.2
80	5.07	9.3

2. Retirement

Graduated rates by retirement age after 5 years of service.

Age	Annual Rates
55	5.0%
56	5.0
57	5.0
58	5.0
59	5.0
60	5.0
61	8.0
62	15.0
63	10.0
64	15.0
65	25.0
66	25.0
67	25.0
68	25.0
69-79	20.0
80	100.0

3. Termination

Graduated rates by age and service.

	Annual Rate Per 100 Members					
Age	<1	1-<2	2-<3	3-<4	4-<5	5+
20	17.0	16.0	15.0	13.5	12.0	13.3
25	17.0	16.0	15.0	13.5	12.0	13.3
30	17.0	16.0	15.0	13.5	12.0	10.3
35	17.0	16.0	15.0	13.5	12.0	7.5
40	17.0	16.0	15.0	13.5	12.0	6.4
45	17.0	16.0	15.0	13.5	12.0	4.8
50	17.0	16.0	15.0	13.5	12.0	4.0
55	17.0	16.0	15.0	13.5	12.0	4.0

4. Disability

None.

OTHER ASSUMPTIONS

1. Payment Assumptions

As shown in the table below, 50% of all members eligible for retirement are assumed to be paid in the form of an annuity and the other 50% in the form of a lump sum, and 100% of members eligible for all other types of benefits are assumed to be paid in the form of a lump sum. Deferred vested and non-vested members are assumed to take a refund of their account balance as of the valuation date.

Benefit	Assumed Form of Payment
Retirement	50% Lump Sum / 50% Annuity*
Vested	Lump Sum
Non-vested	Lump Sum
Disability	Lump Sum
Death	Lump Sum

*Five-year certain and life annuity.

2. Cost of Living Adjustment — None assumed, except 2.5% per year is used for retirees electing annuity payments with a COLA feature.

ECONOMIC ASSUMPTIONS

1. Investment Return — 7.75% per annum, compounded annually, net of expenses.

2. Inflation — 3.25% per annum, compounded annually.

3. Interest Crediting Rate on Cash Balance Accounts — 6.75% per annum, compounded annually.

4. Annuitization Rate of Member & Employer Accumulated Balances — 7.75% per annum, compounded annually.

5. Salary Scale — Graduated rates by service.

Service	Annual Increase in Salary		
	Merit & Productivity	Inflation	Total
0	5.08%	3.25%	8.50%
1	3.83%	3.25%	7.20%
2	2.66%	3.25%	6.00%
3	1.89%	3.25%	5.20%
4	1.40%	3.25%	4.70%
5	1.21%	3.25%	4.50%
6	1.07%	3.25%	4.35%
7	1.02%	3.25%	4.30%
8	1.02%	3.25%	4.30%
9	1.02%	3.25%	4.30%
≥10	1.02%	3.25%	4.30%

DEMOGRAPHIC ASSUMPTIONS

1. Mortality — Mortality assumptions were based on actual experience during the last experience analysis and includes an allowance for expected future mortality improvement.

a. Active Members — 1994 Group Annuity Mortality Table, setback 1 year, projected to 2015 (55% of male rates for males, 40% of female rates for females).

b. Retired members and beneficiaries — 1994 Group Annuity Mortality Table, setback 1 year, sex distinct projected to 2015 using Scale AA.

c. Mortality rates under the mortality table for active members are shown below at sample ages:

Sample Age	Active Mortality Rate	
	Males	Females
30	0.04%	0.01%
40	0.05	0.02
50	0.09	0.04
60	0.28	0.14
70	0.89	0.46
80	2.44	1.22

d. Life expectancies under the mortality table for active members are shown below at sample ages:

Sample Age	Life Expectancy (Years)	
	Males	Females
30	58.5	64.8
40	48.7	54.9
50	39.0	45.0
60	29.5	35.3
70	20.8	26.1
80	13.1	17.6

e. Mortality for Annuitization of Employee and Employer Cash Balance Accounts

1994 Group Annuity Mortality Table, with 50 % Male, 50% Female blending.

Sample Age	Mortality Rate	Life Expectancy (Years)
55	0.34%	28.0
60	0.62%	23.5
65	1.16%	19.4
70	1.87%	15.7
75	2.99%	12.2
80	5.07%	9.3

2. Retirement

Graduated rates by retirement age.

Age	Annual Rates
55	4.5%
56	4.5%
57	4.5%
58	4.5%
59	4.5%
60	4.5%
61	5.0%
62	10.0%
63	10.0%
64	10.0%
65	20.0%
66	20.0%
67	15.0%
68	15.0%
69	15.0%
70-79	20.0%
80	100.0%

3. Termination

Graduated rates by age and service.

	Annual Rate Per 100 Members					
Age	<1	1-<2	2-<3	3-<4	4-<5	5+
20	14.0	13.0	11.5	10.3	9.5	8.7
25	14.0	13.0	11.5	10.3	9.5	8.2
30	14.0	13.0	11.5	10.3	9.5	6.8
35	14.0	13.0	11.5	10.3	9.5	5.7
40	14.0	13.0	11.5	10.3	9.5	5.2
45	14.0	13.0	11.5	10.3	9.5	4.1
50	14.0	13.0	11.5	10.3	9.5	3.7
55	14.0	13.0	11.5	10.3	9.5	4.5

4. Disability

None.

OTHER ASSUMPTIONS

1. Payment Assumptions

As shown in the table below, 40% of all members eligible for retirement are assumed to be paid in the form of an annuity and the other 60% in the form of a lump sum, and 100% of members eligible for all other types of benefits are assumed to be paid in the form of a lump sum. Deferred vested and non-vested members are assumed to take a refund of their account balance as of the valuation date.

Benefit	Assumed Form of Payment
Retirement	60% Lump Sum / 40% Annuity*
Vested	Lump Sum
Non-vested	Lump Sum
Disability	Lump Sum
Death	Lump Sum

*Five-year certain and life annuity.

2. Cost of Living Adjustment

None assumed, except 2.5% per year is used for retirees electing annuity payments with a COLA feature.

A. ACTUARIAL METHODS

1. **Calculation of Normal Cost and Actuarial Accrued Liability:** The method used to determine the normal cost and actuarial accrued liability was the Entry Age Actuarial Cost Method described below.

Entry Age Actuarial Cost Method

Projected pension and preretirement spouse's death benefits were determined for all active members under age 80. Cost factors designed to produce annual costs as a constant percentage of each member's expected compensation in each year from the assumed entry age to the assumed retirement age were applied to the projected benefits to determine the normal cost (the portion of the total cost of the plan allocated to the current year under the method). The normal cost is determined by summing intermediate results for active members under age 80 and determining an average normal cost rate which is then related to the total payroll of active members. The actuarial assumptions shown on the following page were used in determining the projected benefits and cost factors. The actuarial accrued liability for active members (the portion of the total cost of the plan allocated to prior years under the method) was determined as the excess of the actuarial present value of projected benefits over the actuarial present value of future normal costs.

The actuarial accrued liability for retired members and their beneficiaries currently receiving benefits, active members age 80 and over, terminated vested members and disabled members not yet receiving benefits was determined as the actuarial present value of the benefits expected to be paid. No future normal costs are payable for these members.

The actuarial accrued liability under this method at any point in time is the theoretical amount of the fund that would have been accumulated had annual contributions equal to the normal cost been made in prior years (it does not represent the liability for benefits accrued to the valuation date). The unfunded actuarial accrued liability is the excess of the actuarial accrued liability over the actuarial value of plan assets measured on the valuation date. The initial unfunded actuarial accrued liability established July 1, 2004, is amortized with a level dollar payment amount over 25 years. At subsequent valuation dates, amortization bases equal to changes in the unfunded actuarial accrued liability are established and amortized with a level dollar payment over a 25-year period. Intervening legislation made some periodic adjustments. Effective with the July 1, 2013 valuation for final pay plans, amortization payments were recalculated to amortize the remaining bases as a level percentage of expected payroll and new bases are amortized over 30 years. Cash Balance plans are still established and amortized with a level dollar payment over a 25-year period.

Under this Entry Age method, experience gains or losses, i.e., decreases or increases in accrued liabilities attributable to deviations in experience from the actuarial assumptions, adjust the unfunded actuarial accrued liability.

2. **Calculation of the Actuarial Value of Assets:** The actuarial value of assets is based on a five-year smoothing method and is determined by spreading the effect of each year's investment return in excess of or below the expected return. The Market Value of assets on the valuation date is reduced by the sum of the following:

V. 80% of the return to be spread during the first year preceding the valuation date,

VI. 60% of the return to be spread during the second year preceding the valuation date,

VII. 40% of the return to be spread during the third year preceding the valuation date, and

VIII. 20% of the return to be spread during the fourth year preceding the valuation date.

B. VALUATION PROCEDURES

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of the employee cash balance account.

The compensation amounts used in the projection of benefits and liabilities for active members were prior plan year compensations.

Projected benefits were limited by the dollar limitation required by the Internal Revenue Code Section 415 as it applies to governmental plans and compensation limited by Section 401(a)(17).

ECONOMIC ASSUMPTIONS

1. Investment Return — 7.50% per annum, compounded annually, net of expenses.

2. Inflation — 2.75% per annum, compounded annually

3. Salary Increases — Rates vary by service. Sample rates are as follows:

Rates by Service	
Years	**Rate**
<1	8.50%
1	8.00
5	6.46
10	5.18
15	4.71
20	4.45
25	4.24
30	4.07
35	3.82
40+	3.50

4. Payroll Growth — 3.50% per annum

5. Investment on Employee Contributions — 3.00% per annum compounded annually.

6. Increase in Compensation And Benefit Limits — 2.75% per annum on the 401(a)(17) compensation limit and 415 benefit limit

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

   a. Healthy lives - Active members — RP-2014 White Collar Table for Employees (100% of male rates for males, 55% of female rates for females), projected generationally with MP-2015.

   b. Healthy lives – Retired members and beneficiaries — RP-2014 White Collar Table for Employees, set back two years, scaled (males: under 80, 1.008; over 80, 1.449; females: under 85, .924; over 85, 1.5855; geometrically blended), projected generationally from 2013 with a the SOA projection scale tool using a 0.5% ultimate 2035 rate in 2035

   c. Disabled lives — RP-2014 Disabled Lives Table (static table)

d. Healthy mortality rates and projection scale are shown below at sample ages:

	Pre-retirement Mortality	
	Mortality Rate	
Sample Age	Males	Females
20	0.03%	0.01%
30	0.03	0.01
40	0.04	0.02
50	0.12	0.05
60	0.33	0.11

	Post-retirement Mortality	
	Mortality Rate	
Sample Age	Males	Females
50	0.23%	0.17%
60	0.47	0.31
70	1.03	0.82
80	3.65	2.28
90	14.57	12.63

	Projection Scale – Post-retirement Mortality					
	Scale (2020)		Scale (2030)		Scale (2040)	
Sample Age	Males	Females	Males	Females	Males	Females
50	0.0252	0.0144	0.0080	0.0052	0.0050	0.0050
60	0.0083	0.0051	0.0066	0.0059	0.0050	0.0050
70	0.0088	0.0121	0.0061	0.0057	0.0050	0.0050
80	0.0114	0.0104	0.0057	0.0058	0.0050	0.0050
90	0.0109	0.0104	0.0057	0.0057	0.0046	0.0046

e. Disabled mortality rates are shown below at sample ages:

Sample Age	Males	Females
30	0.79%	0.30%
40	1.10	0.55
50	2.04	1.19
60	2.66	1.70
70	4.03	2.82
80	7.66	6.10

2. Retirement

Rates vary by age and eligibility for benefits. Rates are as follows:

Retirement Rates When Eligible for Unreduced Benefits	
Age	Rate
55	18%
56	15
57	15
58	15
59	15
60	25
61	25
62	30
63	25
64	25
65	30
66	30
67	30
68	25
69	25
70	25
71	25
72	25
73	25
74	25
75	25
76	25
77	25
78	35
79	35
80	100

Retirement Rates When Eligible for Reduced Benefits	
Age	Rate
60	10%
61	12
62	12
63	12
64	15

3. Termination

Rates vary by service.
Sample rates are as follows:

Rates by Service		
Years	Male	Female
<1	27.5%	31.7%
1	15.0	19.0
5	6.0	8.0
10	3.5	4.7
15	2.3	3.1
20	1.0	2.0
20+	1.0	1.0

4. Disability

Rates vary by age.
Sample rates are as follows:

Age	Male	Female
Under 35	.00%	.00%
35	.02	.01
40	.02	.01
45	.03	.03
50	.05	.04
55	.07	.06
60	.10	.08

OTHER ASSUMPTIONS

1. Form of Payment — Service annuity – Life annuity
Formula annuity – Five year certain and life annuity.

2. Marital Status
   a. Percent married — 85% married
   b. Spouse's age — Females assumed to be two years younger than males.

3. Administrative Expense — Investment return is assumed to be net of expenses.

4. Commencement age for deferred vested benefit — Age 62

5. Cost of Living Adjustment — Service annuity – none
Formula annuity – For members hired before January 1, 2013, it is 2.25% per annum. For members hired on or after January 1, 2013, it is 1.0% per annum, compounded annually.

6. State Contribution	State contributions for the current plan year are assumed to be contributed in a lump sum on the July 1 following the plan year end. These amounts from the prior plan year are treated as a contribution receivable on the plan's financial statements.

TECHNICAL VALUATION PROCEDURES

Data Procedures

Salaries for first year members are annualized by using the client's Calculated Salary field. For continuing active members, the Accumulated Salary field is used.

Other Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur mid-year, except that immediate retirement is assumed for those who are at or above the age at which retirement rates are 100%. Standard adjustments are made for multiple decrements.

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.

Future monthly benefit amounts are not calculated or available for deferred vested members. The benefit liability for deferred vested members was calculated by loading the accumulated member contribution balances for deferred vested members by 100% to estimate the value of deferred benefit payments.

ECONOMIC ASSUMPTIONS

1. Investment Return — 7.50% per annum, compounded annually, net of expenses.

2. Inflation — 2.75% per annum, compounded annually.

3. Salary Increase — Rates vary by service. Sample rates are as follows:

Rates by Service	
Years	**Rate**
<1	9.0%
5	6.1
10	5.1
15	5.0
20	5.0
25	5.0
30	3.5

4. Payroll Growth — 3.50% per annum

5. Interest on Employee Contributions — 3.00% per annum, compounded annually.

6. Increases on Compensation And Benefit Limits — 2.75% per annum on the 401(a)(17) compensation limit and the 415 benefit limit

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

   a. Healthy lives - Active members — RP-2014 White Collar Table for Employees (100% of male rates for males, 55% of female rates for females), projected generationally with MP-2015.

   b. Healthy lives – Retired members and beneficiaries — RP-2014 White Collar Table for Employees, set back two years, scaled (males: under 80, 1.008; over 80, 1.449; females: under 85, .924; over 85, 1.5855; geometrically blended), projected generationally from 2013 with a the SOA projection scale tool using a 0.5% ultimate 2035 rate in 2035

   c. Disabled lives — RP-2014 Disabled Lives Table (static table)

d. Healthy mortality rates and projection scale are shown below at sample ages:

	Pre-retirement Mortality	
	Mortality Rate	
Sample Age	Males	Females
20	0.03%	0.01%
30	0.03	0.01
40	0.04	0.02
50	0.12	0.05
60	0.33	0.11

	Post-retirement Mortality	
	Mortality Rate	
Sample Age	Males	Females
50	0.23%	0.17%
60	0.47	0.31
70	1.03	0.82
80	3.65	2.28
90	14.57	12.63

	Projection Scale – Post-retirement Mortality					
	Scale (2020)		Scale (2030)		Scale (2040)	
Sample Age	Males	Females	Males	Females	Males	Females
50	0.0252	0.0144	0.0080	0.0052	0.0050	0.0050
60	0.0083	0.0051	0.0066	0.0059	0.0050	0.0050
70	0.0088	0.0121	0.0061	0.0057	0.0050	0.0050
80	0.0114	0.0104	0.0057	0.0058	0.0050	0.0050
90	0.0109	0.0104	0.0057	0.0057	0.0046	0.0046

e. Disabled mortality rates are shown below at sample ages:

Sample Age	Males	Females
30	0.79%	0.30%
40	1.10	0.55
50	2.04	1.19
60	2.66	1.70
70	4.03	2.82
80	7.66	6.10

2. Retirement

Retirement is assumed to occur upon attaining certain age and service requirements. The retirement assumption varies depending on benefit eligibility and age at retirement.

Early/Normal Retirement Eligibility	Age and Service Requirements	Retirement Assumption
Reduced	Age 50 Service: 10 years	3% at each age
Unreduced	Age 55 Service: 10 years	10% at each age
Unreduced (Eligible for DROP)	Age 50 Service: 25 years	100% at each age
Unreduced (Mandatory)	Age 60	100% at each age

3. Termination

Rates vary by service. Sample rates are as follows:

Rates by Service	
Years	Rate
<1	4.00%
1	3.75
5	2.75
10	2.00
15	1.25
20+	0.0

4. Disability

Rates vary by age. Sample rates are as follows:

Rates by Age	
Age	Rate
25	.08%
30	.10
35	.13
40	.20
45	.31
50	.52
55	.91
60	1.36

OTHER ASSUMPTIONS

1. Form of Payment

75% Joint & Survivor Annuity. Deferred vesteds are assumed to take the greater of the present value of an annuity at earliest unreduced eligibility or a refund of contributions.

2. Marital Status	
a. Percent married	100% married
b. Spouse's age	Females assumed to be three years younger than males.
3. Children	All members are assumed to have one dependent child at death or retirement. The child is assumed to be 28 years younger than the member, and is assumed to always survive until age 19.
4. Administrative Expense	Investment return is assumed to be net of expenses.
5. Cost of living adjustments	2.25% per annum, compounded annually.
6. DROP participation	All members elect the DROP at the earliest possible date and remain in the DROP for 4 years or to age 60, if earlier.
7. State Contribution	Additional State contributions for the current plan year are assumed to be contributed in a lump sum on the July 1 following the plan year end. These amounts from the prior plan year are treated as a contribution receivable on the plan's financial statements.

TECHNICAL VALUATION PROCEDURES

Data Procedures

Salaries for first year members are annualized by using the client's Calculated Salary field. For continuing active members, the Accumulated Salary field is used.

When multiple records are received, the record with the oldest beneficiary date of birth is valued.

Other Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur mid-year, except that immediate retirement is assumed for those who are at or above the age at which retirement rates are 100%. Standard adjustments are made for multiple decrements.

ECONOMIC ASSUMPTIONS

1. Investment Return	7.5% per annum, compounded annually, net of all expenses.
2. Inflation	2.75% per annum, compounded annually.
3. Salary Increases	Salaries are assumed to increase 3.50% each year.
4. Payroll Growth	3.50% per year
5. Interest on Employee Contributions	3.00% per annum, compounded annually.
6. Increases in Compensation And Benefit Limits	2.75% per annum on the 401(a)(17) compensation limit and 415 benefit limit

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

a. Healthy lives - Active members	RP-2014 White Collar Table for Employees (100% of male rates for males, 55% of female rates for females), projected generationally with MP-2015.
b. Healthy lives – Retired members and beneficiaries	RP-2014 White Collar Table for Employees, set back two years, scaled (males: under 80, 1.008; over 80, 1.449; females: under 85, .924; over 85, 1.5855; geometrically blended), projected generationally from 2013 with a the SOA projection scale tool using a 0.5% ultimate 2035 rate in 2035
c. Disabled lives	RP-2014 Disabled Lives Table (static table)

d. Healthy mortality rates and projection scale are shown below at sample ages:

	Pre-retirement Mortality	
	Mortality Rate	
Sample Age	Males	Females
20	0.03%	0.01%
30	0.03	0.01
40	0.04	0.02
50	0.12	0.05
60	0.33	0.11

	Post-retirement Mortality	
	Mortality Rate	
Sample Age	Males	Females
50	0.23%	0.17%
60	0.47	0.31
70	1.03	0.82
80	3.65	2.28
90	14.57	12.63

	Projection Scale – Post-retirement Mortality					
	Scale (2020)		Scale (2030)		Scale (2040)	
Sample Age	Males	Females	Males	Females	Males	Females
50	0.0252	0.0144	0.0080	0.0052	0.0050	0.0050
60	0.0083	0.0051	0.0066	0.0059	0.0050	0.0050
70	0.0088	0.0121	0.0061	0.0057	0.0050	0.0050
80	0.0114	0.0104	0.0057	0.0058	0.0050	0.0050
90	0.0109	0.0104	0.0057	0.0057	0.0046	0.0046

e. Disabled mortality rates are shown below at sample ages:

Sample Age	Males	Females
30	0.79%	0.30%
40	1.10	0.55
50	2.04	1.19
60	2.66	1.70
70	4.03	2.82
80	7.66	6.10

2. Retirement — Rates vary by age. Rates are as follows:

Rates by Age	
Age	Rate
55-59	1.5%
60-61	3.0
62-63	7.0
64	15.0
65	20.0
66-71	15.0
72	100.0

3. Termination — None.

4. Disability — None.

OTHER ASSUMPTIONS

1. Form of Payment	Modified Cash Refund Annuity under prior plan benefit provisions. A 50% Joint & Survivor Benefit for members electing this provision under LB 1097, and new members hired after July 1, 2004. Deferred vesteds are assumed to take the greater of the present value of an annuity at age 63 or a refund of contributions.
2. Marital Status	
a. Percent married	100% married
b. Spouse's age	Females assumed to be three years younger than males.
3. Administrative Expense	Investment return is assumed to be net of expenses.
4. Cost of Living Adjustment	2.25% per annum, compounded annually for Tier 1 members, 1.00% per annum for Tier 2 members.
5. State Contribution	State contributions for the current plan year are assumed to be contributed in a lump sum on the July 1 following the plan year end. These amounts from the prior plan year are treated as a contribution receivable on the plan's financial statements.

TECHNICAL VALUATION PROCEDURES

Data Procedures

Client data caps active service at 20 years. While capping the benefit amount at 20 years of service, we keep a record of actual service beyond 20 years in order to remain consistent with the Entry Age Method.

Salaries for first year members are annualized by using the client's Calculated Salary field. For continuing active members, the Accumulated Salary field is used.

Other Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur mid-year, except that immediate retirement is assumed for those who are at or above the age at which retirement rates are 100%. Standard adjustments are made for multiple decrements.

ECONOMIC ASSUMPTIONS

1. Investment Return — 7.50% per annum, compounded annually, net of expenses.

2. Inflation — 2.75% per annum, compounded annually.

3. Interest Crediting Rate on Cash Balance Accounts — 6.25% per annum, compounded annually.

4. Annuitization Rate of Member & Employer Accumulated Balances — 7.75% per annum, compounded annually. (set statutorily)

5. Salary Scale

Service	Annual Increase
0	4.93%
1	4.80
2	4.60
3	4.29
4	4.06
5	3.98
6	3.94
7	3.93
8	3.88
9	3.85
10	3.81
11	3.80
12	3.76
13	3.72
14	3.70
15	3.67
16	3.63
17	3.60
18	3.59
19	3.56
20+	3.50

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

   a. Healthy lives - Active members — RP-2014 White Collar Table for Employees (100% of male rates for males, 55% of female rates for females), projected generationally with MP-2015.

   b. Healthy lives – Retired members and beneficiaries — RP-2014 White Collar Table for Employees, set back two years, scaled (males: under 80, 1.008; over 80, 1.449; females: under 85, .924; over 85, 1.5855; geometrically

blended), projected generationally from 2013 with a the SOA projection scale tool using a 0.5% ultimate 2035 rate in 2035

c. Disabled lives — RP-2014 Disabled Lives Table (static table)

d. Healthy mortality rates and projection scale are shown below at sample ages:

	Pre-retirement Mortality	
	Mortality Rate	
Sample Age	Males	Females
20	0.03%	0.01%
30	0.03	0.01
40	0.04	0.02
50	0.12	0.05
60	0.33	0.11

	Post-retirement Mortality	
	Mortality Rate	
Sample Age	Males	Females
50	0.23%	0.17%
60	0.47	0.31
70	1.03	0.82
80	3.65	2.28
90	14.57	12.63

	Projection Scale – Post-retirement Mortality					
	Scale (2020)		Scale (2030)		Scale (2040)	
Sample Age	Males	Females	Males	Females	Males	Females
50	0.0252	0.0144	0.0080	0.0052	0.0050	0.0050
60	0.0083	0.0051	0.0066	0.0059	0.0050	0.0050
70	0.0088	0.0121	0.0061	0.0057	0.0050	0.0050
80	0.0114	0.0104	0.0057	0.0058	0.0050	0.0050
90	0.0109	0.0104	0.0057	0.0057	0.0046	0.0046

e. Disabled mortality rates are shown below at sample ages:

Sample Age	Males	Females
30	0.79%	0.30%
40	1.10	0.55
50	2.04	1.19
60	2.66	1.70
70	4.03	2.82
80	7.66	6.10

f. Mortality for Annuitization of Employee and Employer Cash Balance Accounts

1994 Group Annuity Mortality Table, with 50 % Male, 50% Female blending.

Sample Age	Mortality Rate	Life Expectancy (Years)
55	0.34%	28.0
60	0.62	23.5
65	1.16	19.4
70	1.87	15.7
75	2.99	12.2
80	5.07	9.3

2. Retirement

Graduated rates by retirement age after 5 years of service.

Age	Annual Rates
55-60	5.0%
60	5.0
61	8.0
62	12.0
63	12.0
64	15.0
65	30.0
66	30.0
67-79	25.0
80	100.0

3. Termination

Service	Rate
<1	30.0%
1	22.0
5	14.0
10	7.0
15	3.5
20	3.0
25+	2.0

4. Disability

None.

OTHER ASSUMPTIONS

1. Payment Assumptions

As shown in the table below, 50% of all members eligible for retirement are assumed to be paid in the form of an annuity and the other 50% in the form of a lump sum, and 100% of members eligible for all other types of benefits are assumed to be paid in the form of a lump sum. Deferred vested and non-vested members are assumed to take a refund of their account balance as of the valuation date.

Benefit	Assumed Form of Payment
Retirement	50% Lump Sum / 50% Annuity*
Vested	Lump Sum
Non-vested	Lump Sum
Disability	Lump Sum
Death	Lump Sum

*Five-year certain and life annuity.

2. Cost of Living Adjustment

None assumed, except 2.5% per year is used for retirees electing annuity payments with a COLA feature.

ECONOMIC ASSUMPTIONS

1. Investment Return — 7.50% per annum, compounded annually, net of expenses.

2. Inflation — 2.75% per annum, compounded annually.

3. Interest Crediting Rate on Cash Balance Accounts — 6.25% per annum, compounded annually.

4. Annuitization Rate of Member & Employer Accumulated Balances — 7.75% per annum, compounded annually. (set statutorily)

5. Salary Scale — Graduated rates by service.

Service	Annual Increase
0	8.00%
1	6.70
2	5.50
3	4.70
4	4.20
5	4.00
6	3.85
7	3.80
8	3.80
9	3.80
10+	3.80

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

a. Healthy lives - Active members — RP-2014 White Collar Table for Employees (100% of male rates for males, 55% of female rates for females), projected generationally with MP-2015.

b. Healthy lives – Retired members and beneficiaries — RP-2014 White Collar Table for Employees, set back two years, scaled (males: under 80, 1.008; over 80, 1.449; females: under 85, .924; over 85, 1.5855; geometrically blended), projected generationally from 2013 with a the SOA projection scale tool using a 0.5% ultimate 2035 rate in 2035

c. Disabled lives — RP-2014 Disabled Lives Table (static table)

d. Healthy mortality rates and projection scale are shown below at sample ages:

	Pre-retirement Mortality	
	Mortality Rate	
Sample Age	Males	Females
20	0.03%	0.01%
30	0.03	0.01
40	0.04	0.02
50	0.12	0.05
60	0.33	0.11

	Post-retirement Mortality	
	Mortality Rate	
Sample Age	Males	Females
50	0.23%	0.17%
60	0.47	0.31
70	1.03	0.82
80	3.65	2.28
90	14.57	12.63

	Projection Scale – Post-retirement Mortality					
	Scale (2020)		Scale (2030)		Scale (2040)	
Sample Age	Males	Females	Males	Females	Males	Females
50	0.0252	0.0144	0.0080	0.0052	0.0050	0.0050
60	0.0083	0.0051	0.0066	0.0059	0.0050	0.0050
70	0.0088	0.0121	0.0061	0.0057	0.0050	0.0050
80	0.0114	0.0104	0.0057	0.0058	0.0050	0.0050
90	0.0109	0.0104	0.0057	0.0057	0.0046	0.0046

e. Disabled mortality rates are shown below at sample ages:

Sample Age	Males	Females
30	0.79%	0.30%
40	1.10	0.55
50	2.04	1.19
60	2.66	1.70
70	4.03	2.82
80	7.66	6.10

f. Mortality for Annuitization of Employee and Employer Cash Balance Accounts

1994 Group Annuity Mortality Table, with 50 % Male, 50% Female blending.

Sample Age	Mortality Rate	Life Expectancy (Years)
55	0.34%	28.0
60	0.62%	23.5
65	1.16%	19.4
70	1.87%	15.7
75	2.99%	12.2
80	5.07%	9.3

2. Retirement

Graduated rates by retirement age.

Age	Annual Rates
55-60	4.5%
61	5.0%
62-64	10.0%
65	20.0%
66	20.0%
67-69	15.0%
70-79	20.0%
80	100.0%

3. Termination

Graduated rates by age and service.

Service	Rate
<1	25.00%
1	20.00
5	11.50
10	6.00
15	4.75
20	3.50
25	2.25
26+	2.00

4. Disability

None.

OTHER ASSUMPTIONS

1. Payment Assumptions

As shown in the table below, 40% of all members eligible for retirement are assumed to be paid in the form of an annuity and the other 60% in the form of a lump sum, and 100% of members eligible for all other types of benefits are assumed to be paid in the form of a lump sum. Deferred vested and non-vested members are assumed to take a refund of their account balance as of the valuation date.

Benefit	Assumed Form of Payment
Retirement	60% Lump Sum / 40% Annuity*
Vested	Lump Sum
Non-vested	Lump Sum
Disability	Lump Sum
Death	Lump Sum

*Five-year certain and life annuity.

2. Cost of Living Adjustment

None assumed, except 2.5% per year is used for retirees electing annuity payments with a COLA feature.

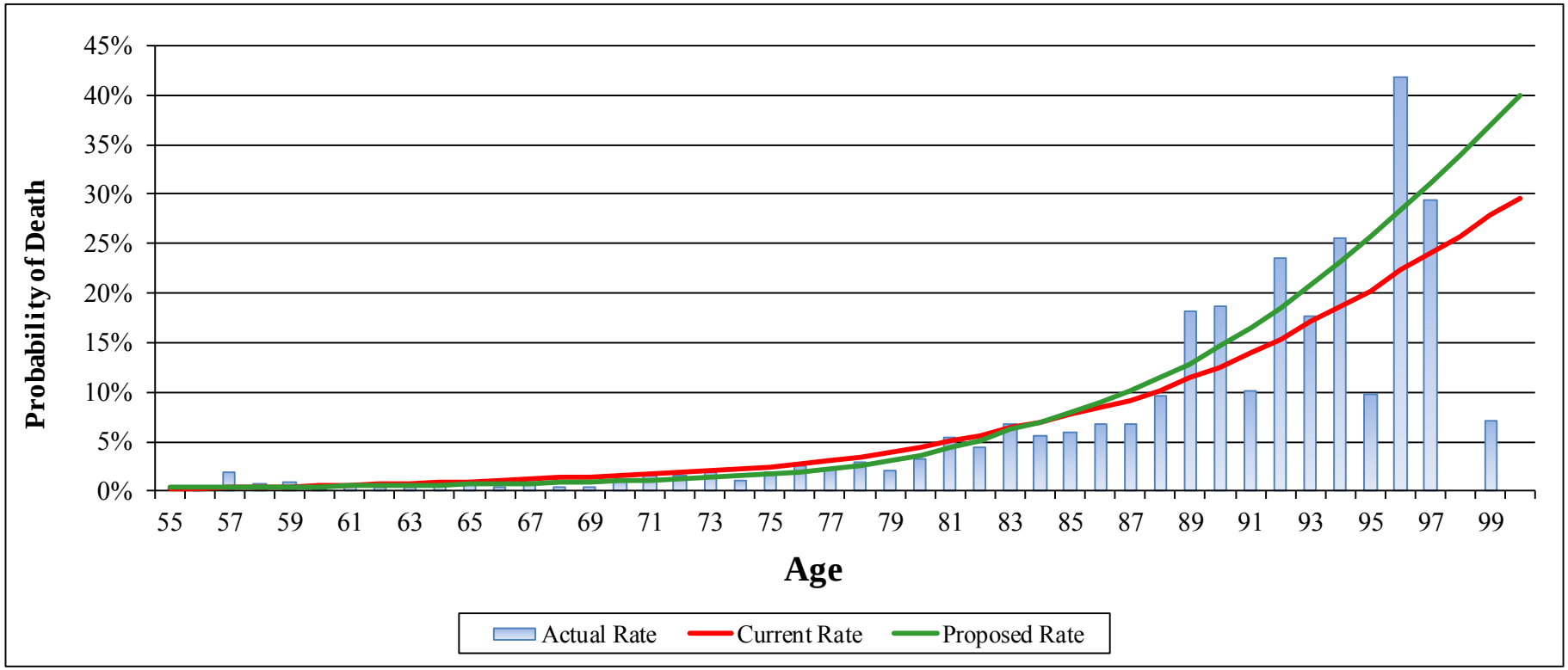
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-1

Probability of Death - Healthy Retirees

Males



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	992,036	1,241,208	1,020,200
Actual/Expected		80%	97%

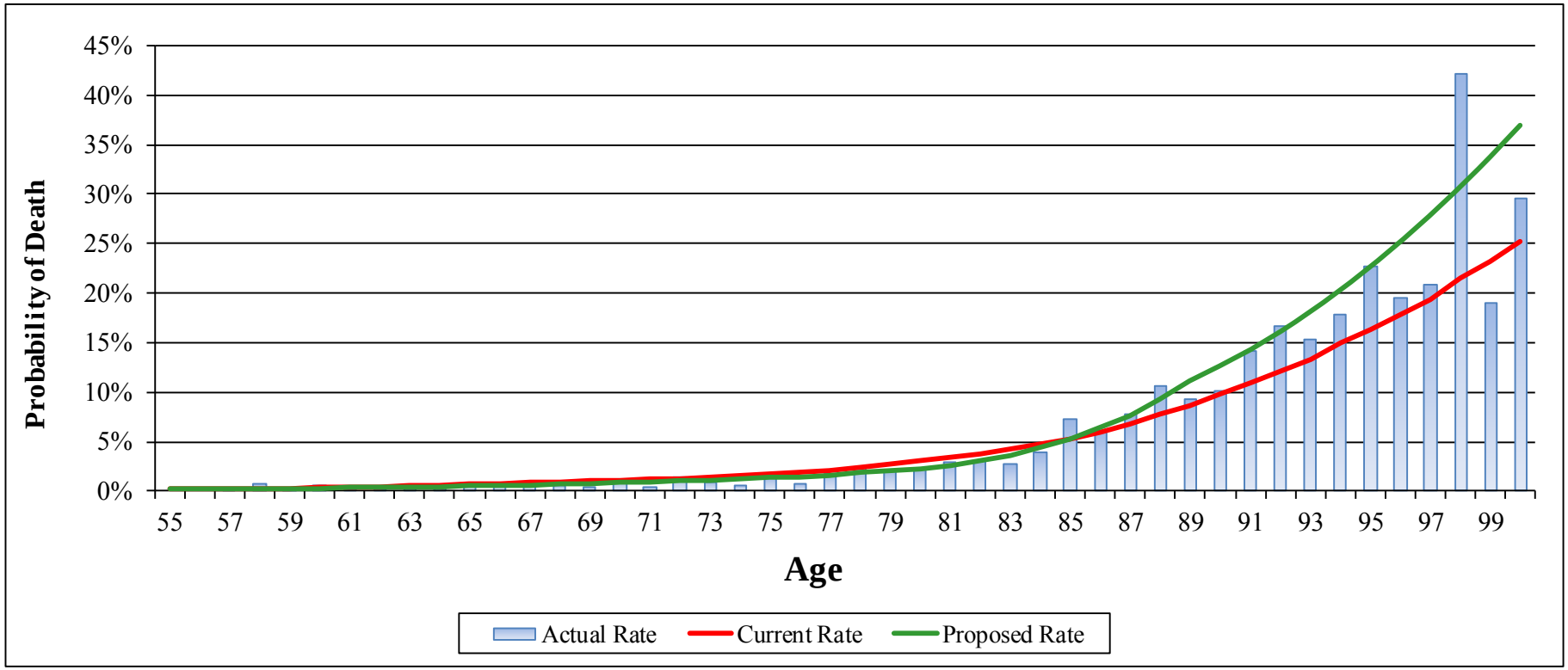
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-2

Probability of Death - Healthy Retirees

Females



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,079,764	1,224,332	1,119,735
Actual/Expected		88%	96%

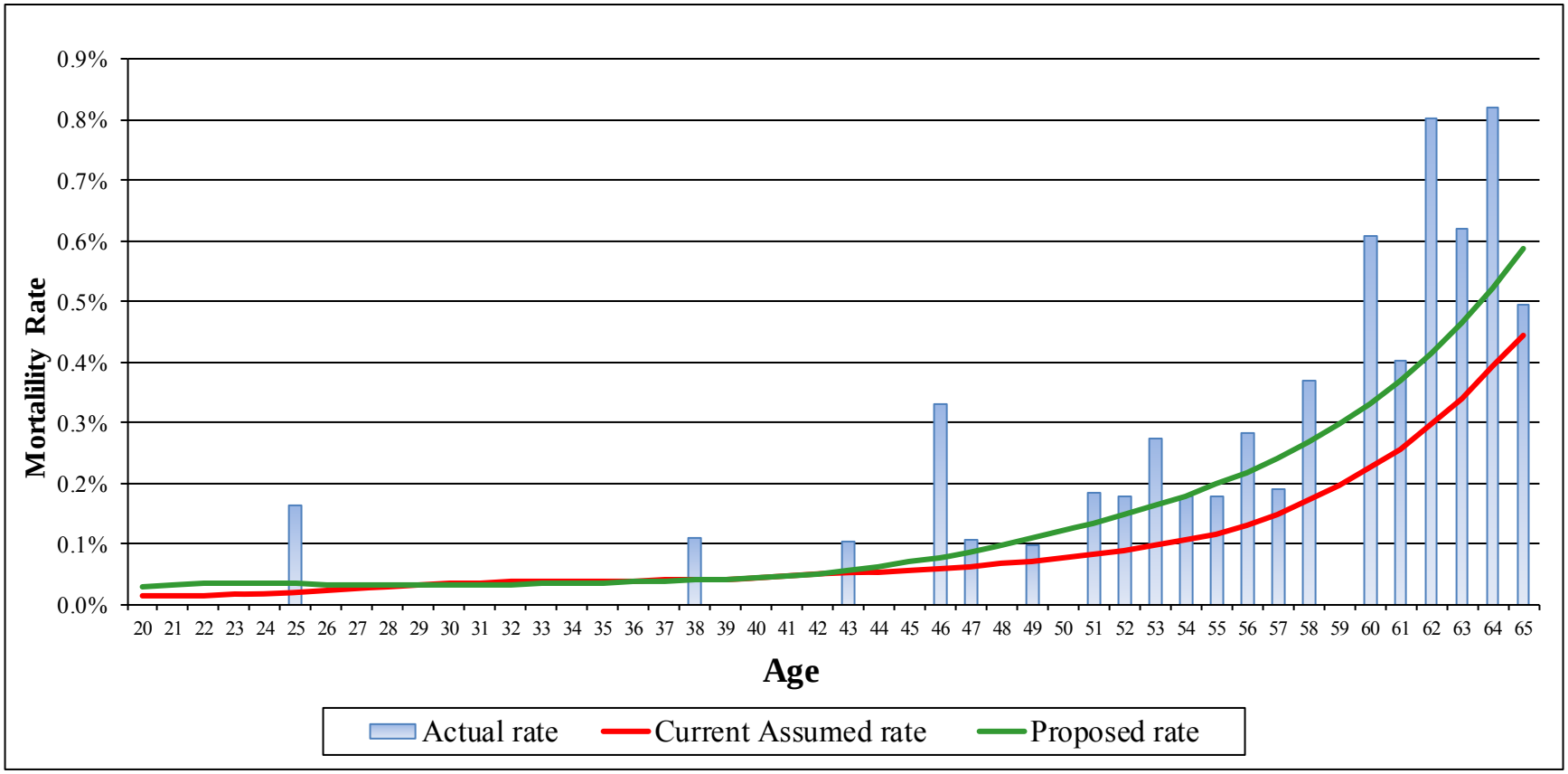
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-3

Probability of Death - Active Lives

Males



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Total Count	59	39	55
Actual/Expected		151%	107%

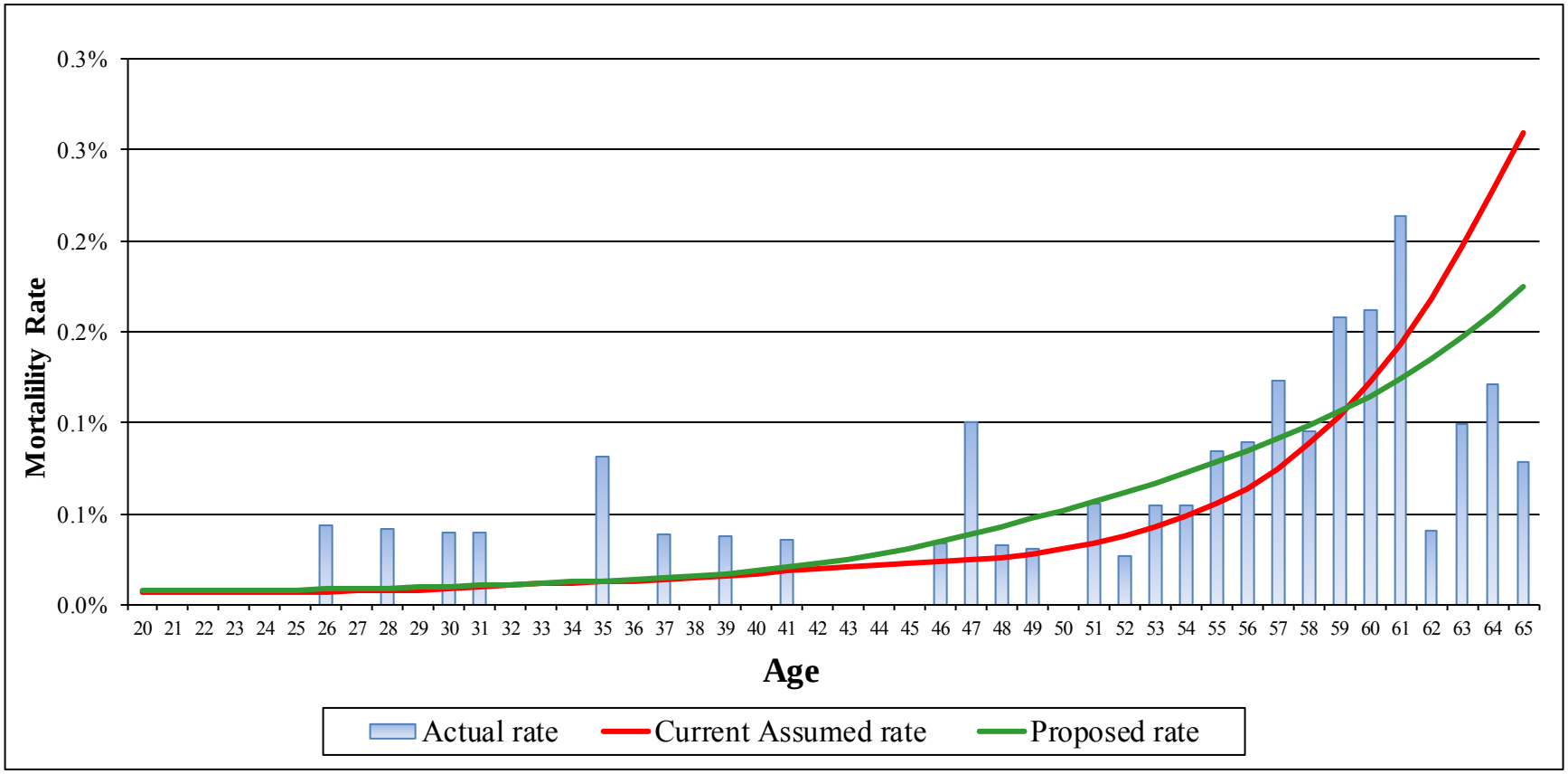
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-4

Probability of Death - Active Lives

Females



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Total Count	57	53	58
Actual/Expected		108%	98%

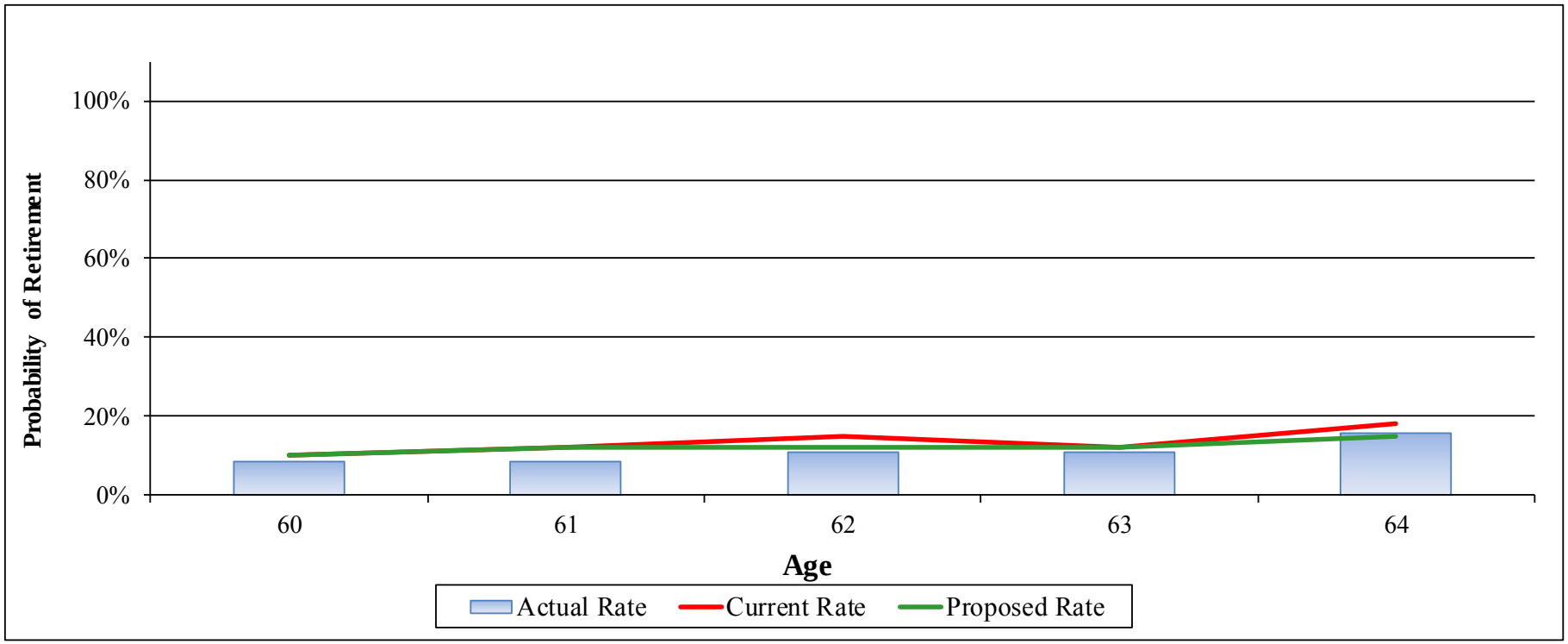
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-5

Retirement Rates

School - Early Retirement



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	334	419	393
Actual/Expected		80%	85%

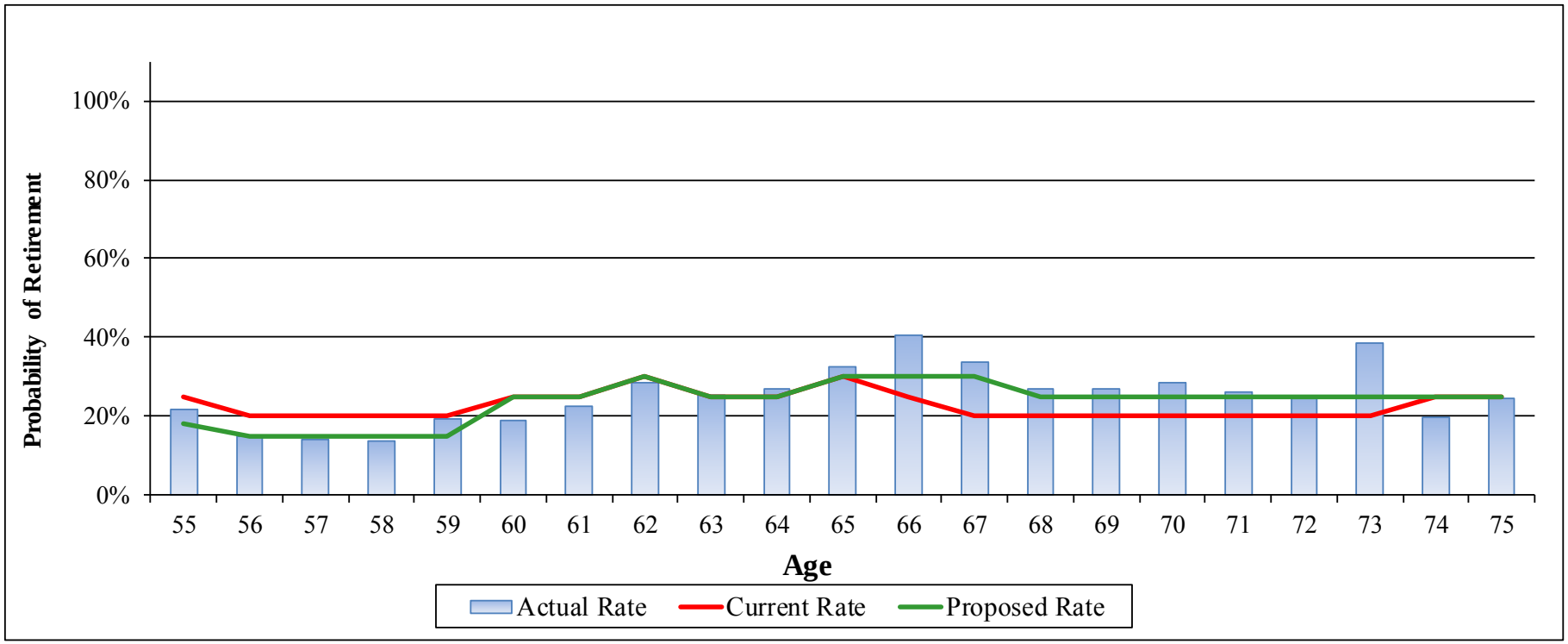
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-6

Retirement Rates

School - Unreduced Retirement



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	6,060	6,430	5,943
Actual/Expected		94%	102%

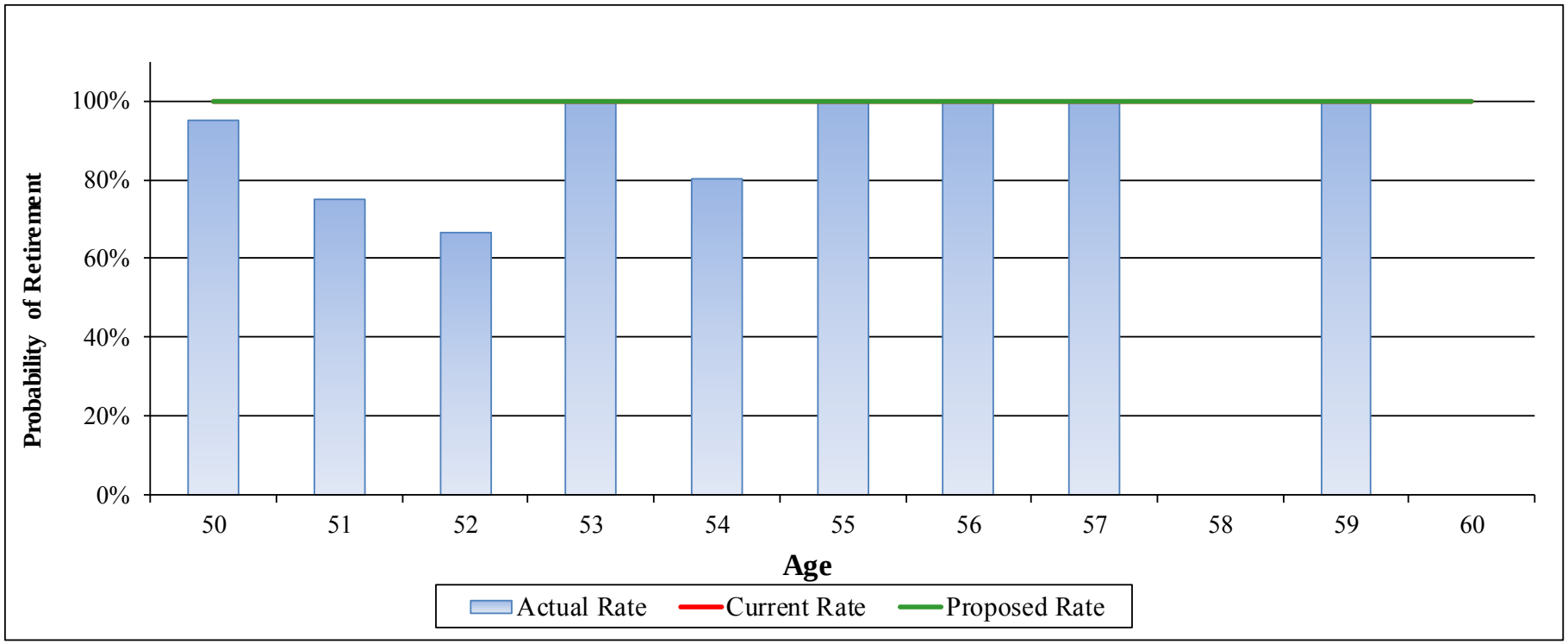
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-7

Retirement Rates

Patrol - Retirement/DROP after 25 Years



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	101	110	110
Actual/Expected		91%	91%

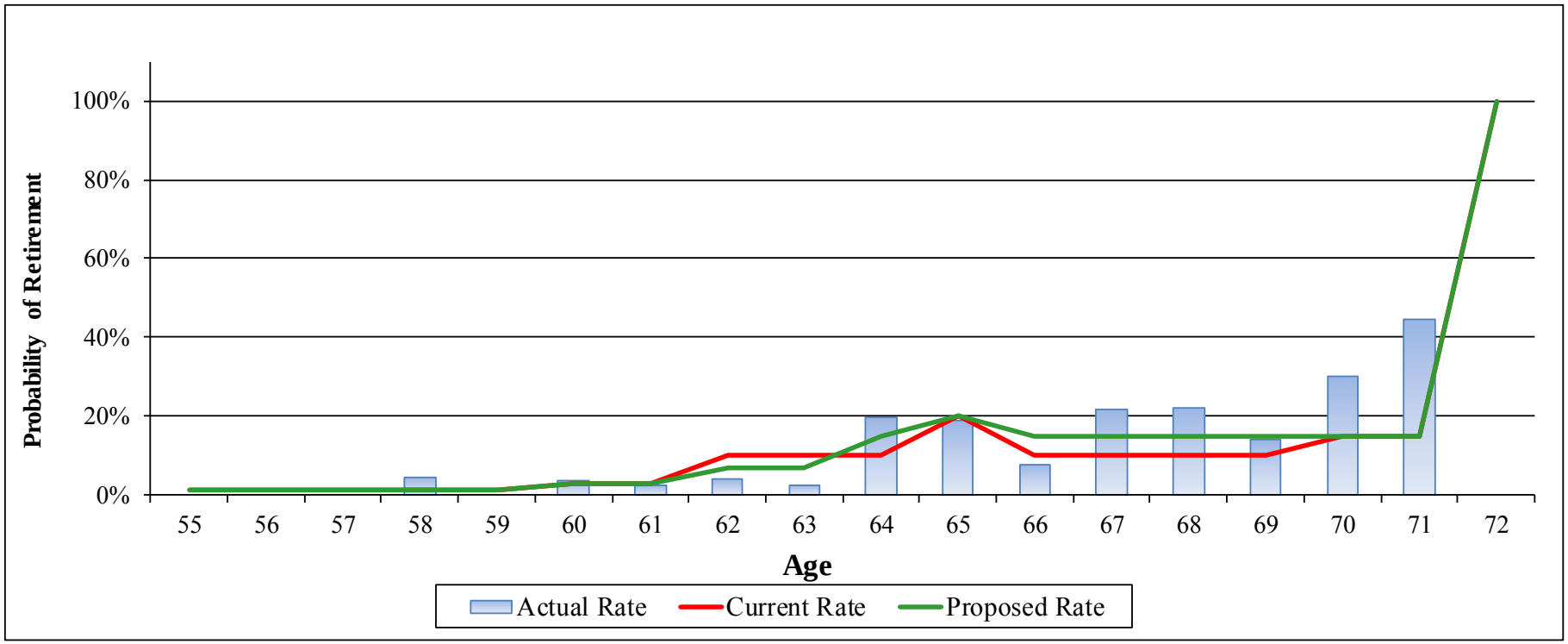
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-8

Retirement Rates

Judges - All Retirements



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	87	75	87
Actual/Expected		116%	101%

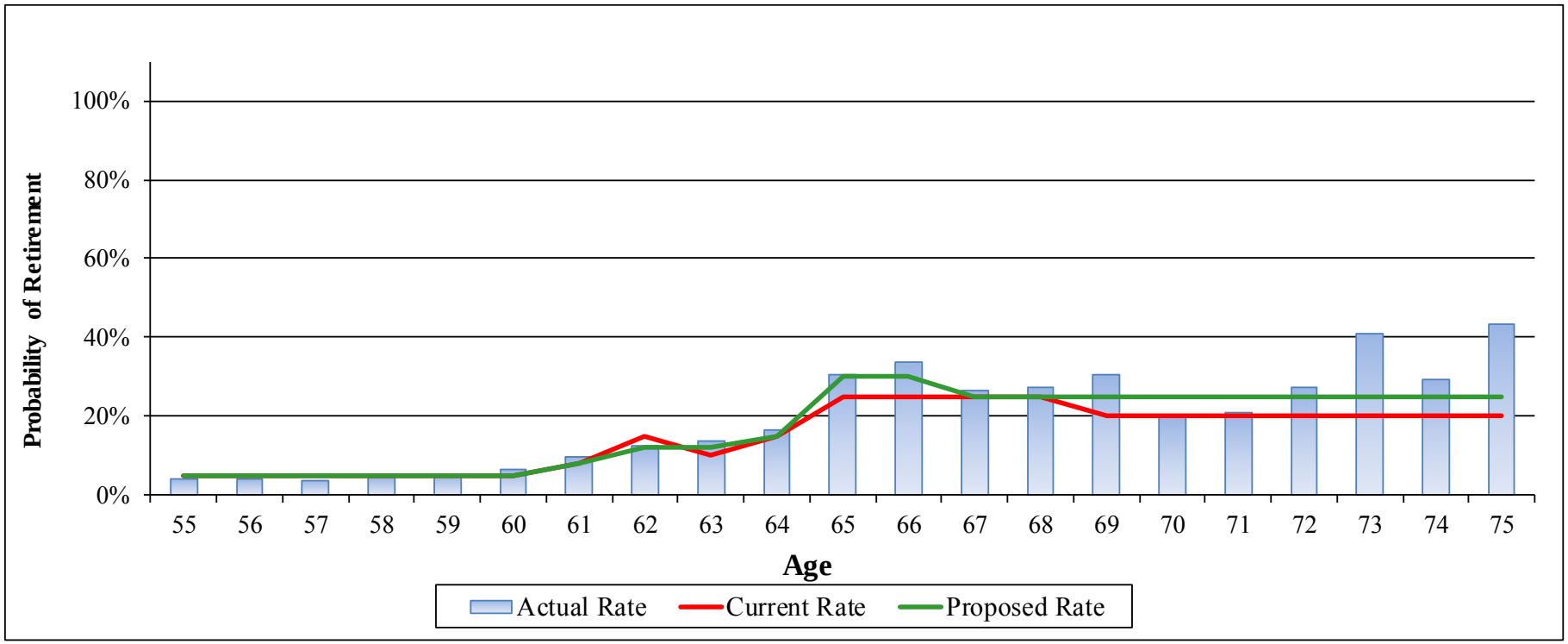
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-9

Retirement Rates

State - All Retirements



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,738	1,539	1,633
Actual/Expected		113%	106%

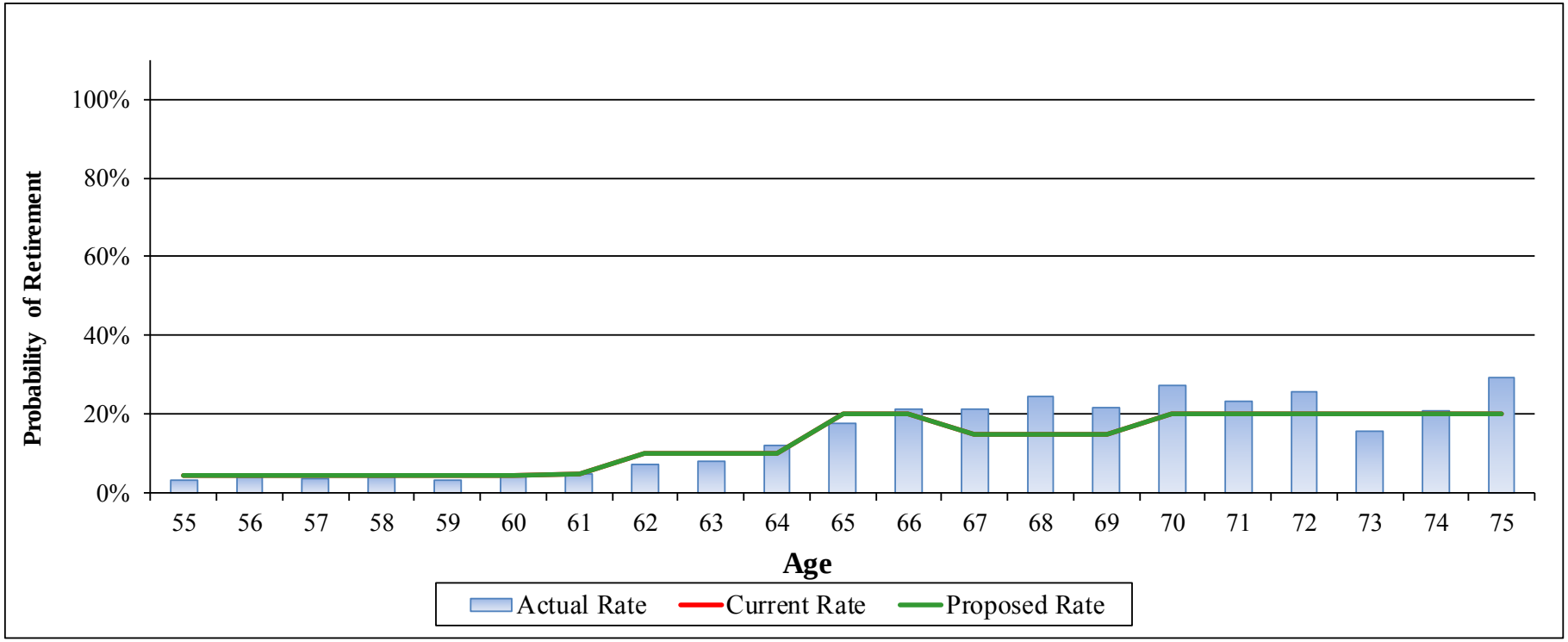
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-10

Retirement Rates

County - All Retirements



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	386	371	371
Actual/Expected		104%	104%

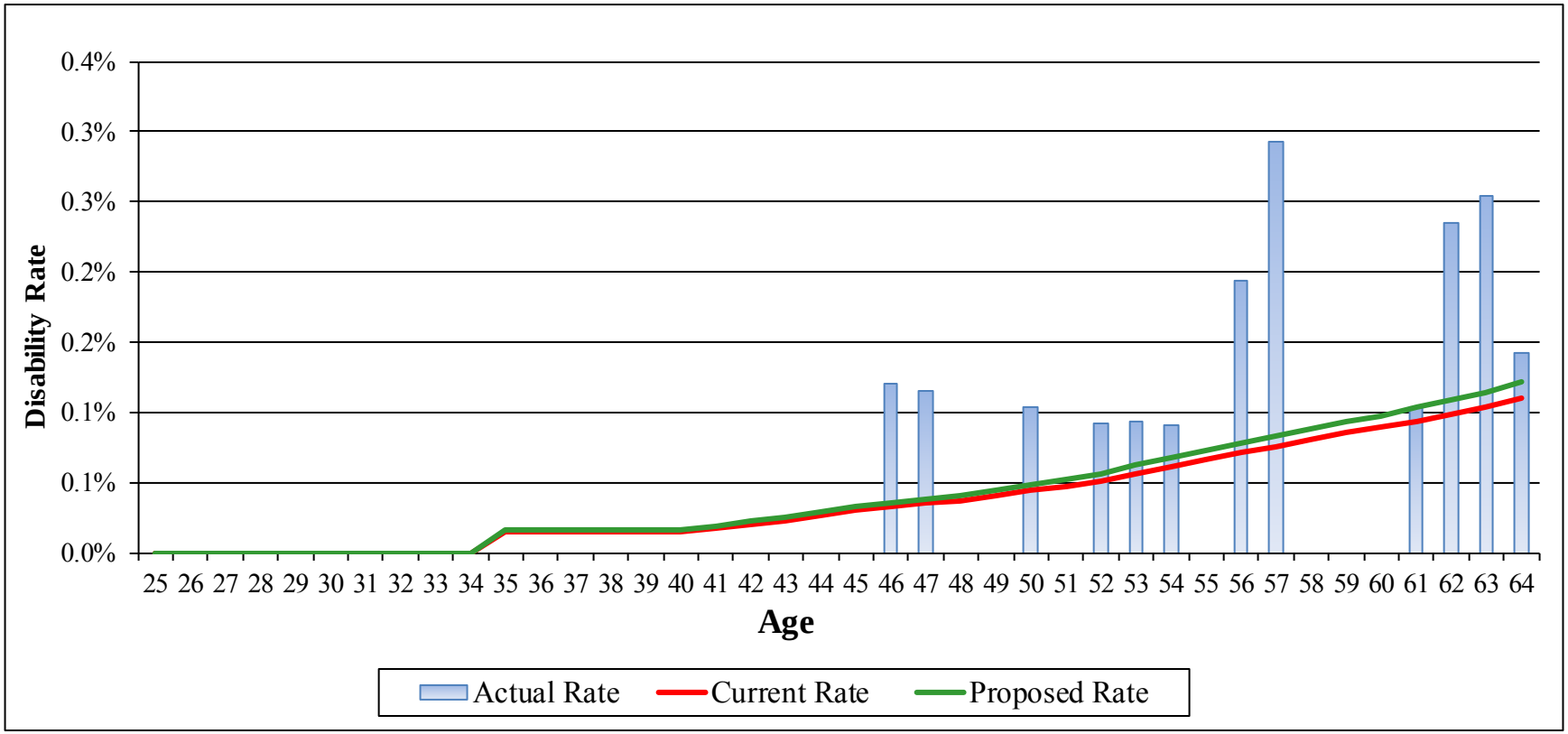
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-11

Rate of Disability

Schools - Male



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Total Count	17	14	15
Actual/Expected		121%	113%

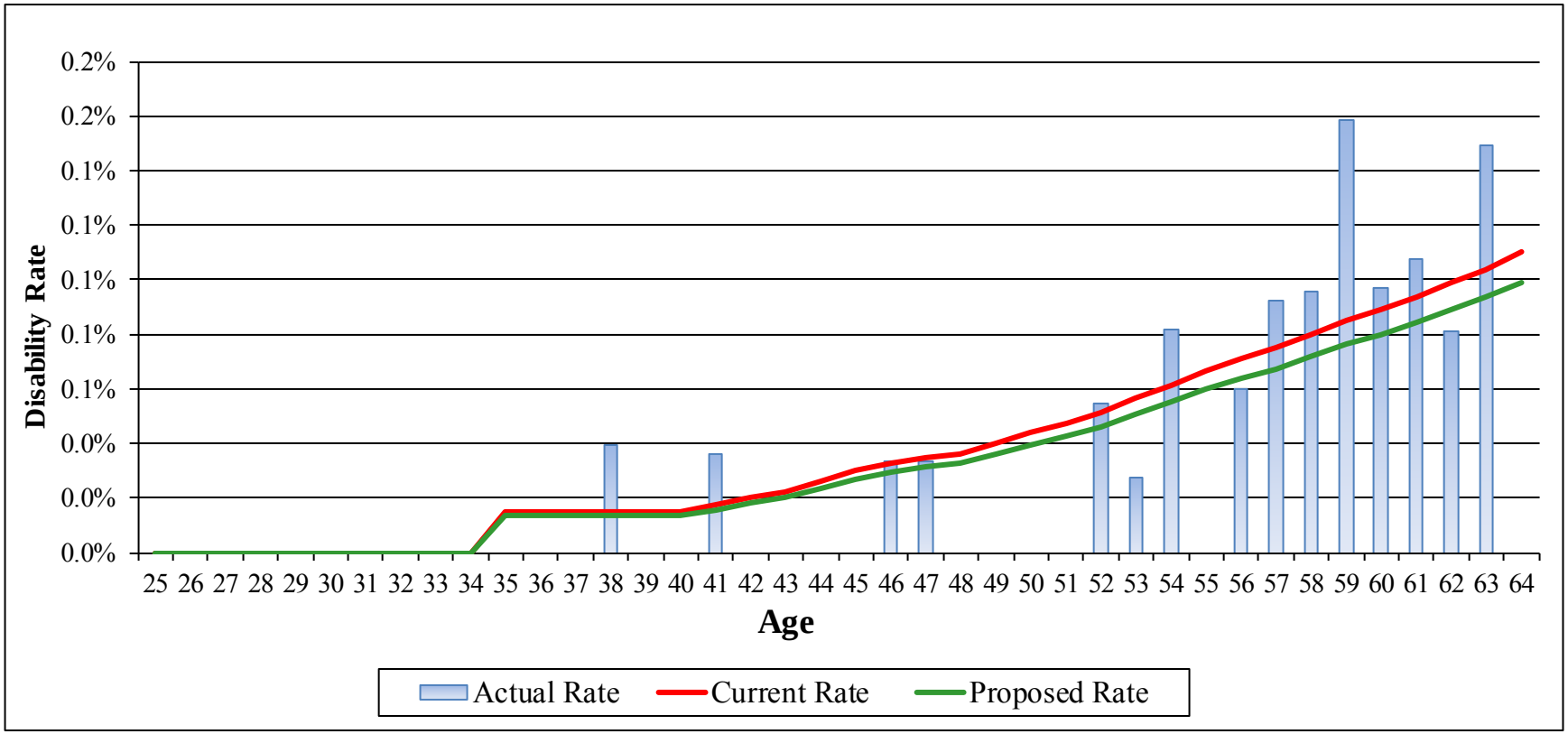
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-12

Rate of Disability

Schools - Female



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Total Count	34	44	39
Actual/Expected		77%	87%

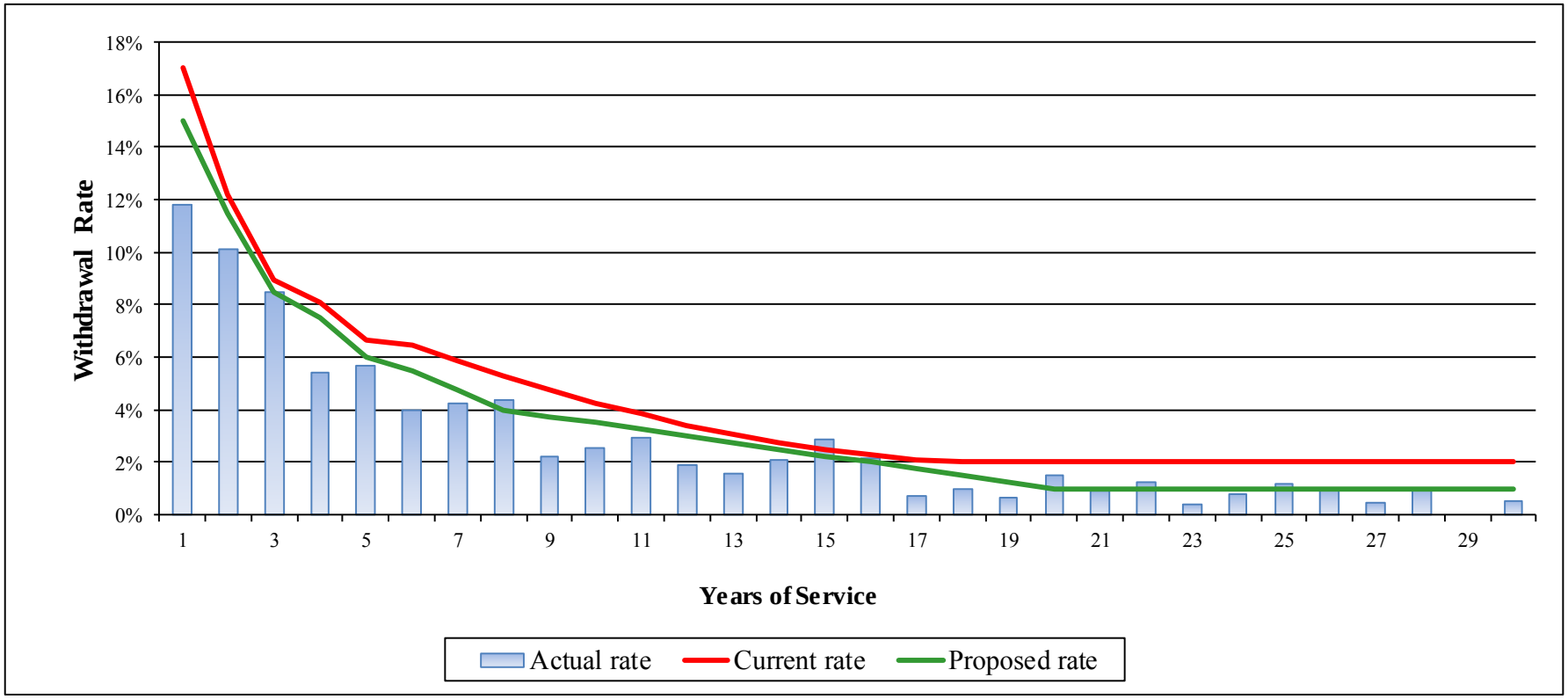
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-13

Rate of Termination of Employment

Schools - Male



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	350	561	424
Actual/Expected		62%	83%

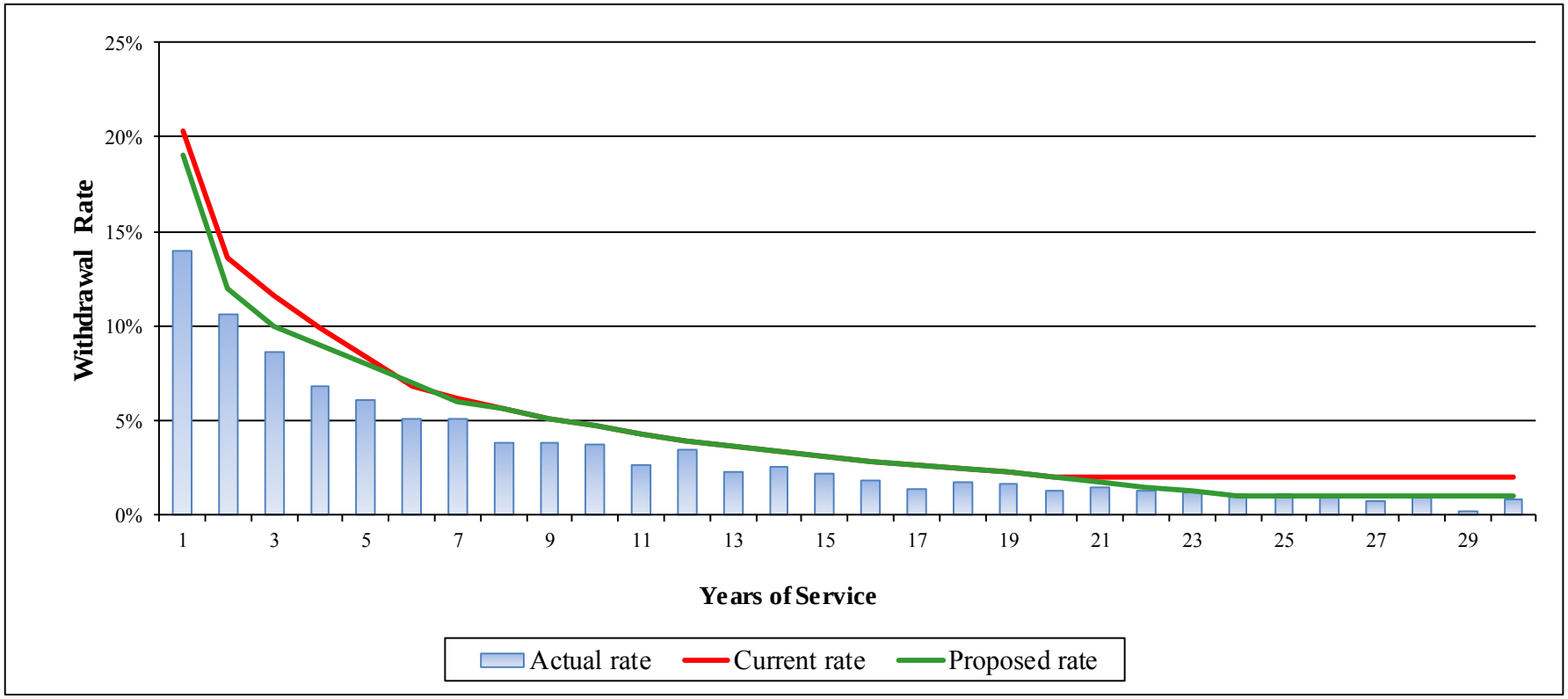
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-14

Rate of Termination of Employment

Schools - Female



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,034	1,512	1,368
Actual/Expected		68%	76%

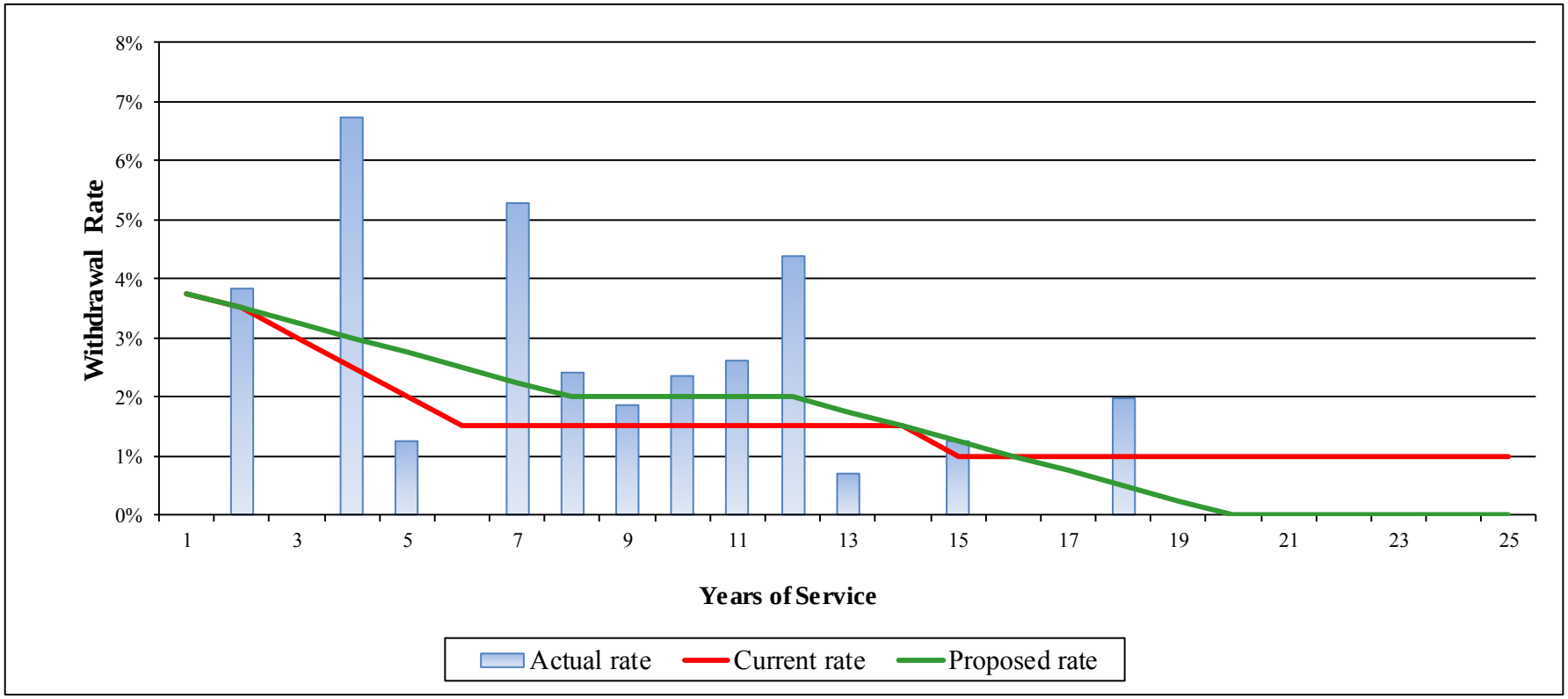
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-15

Rate of Termination of Employment

Patrol



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	13	14	13
Actual/Expected		95%	102%

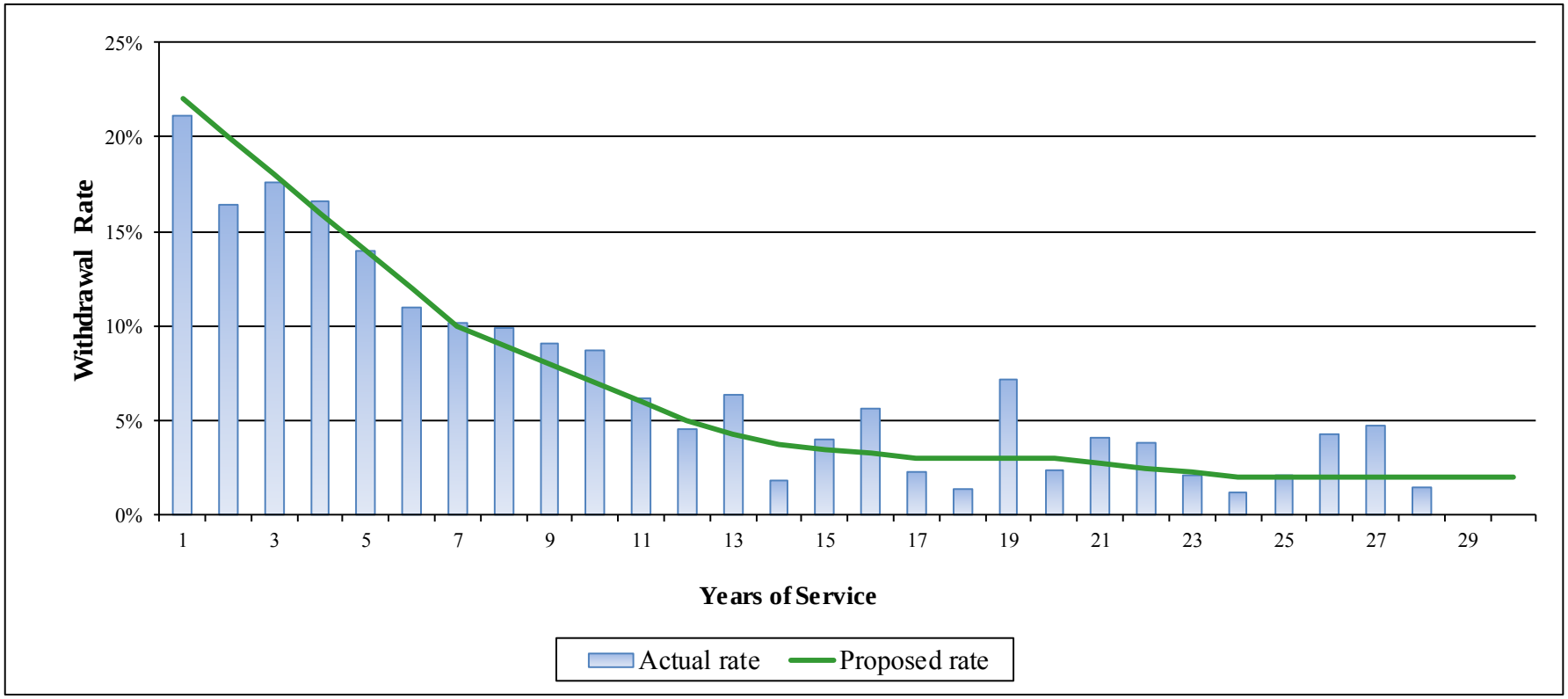
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-16

Rate of Termination of Employment

State



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	612		594
Actual/Expected		123%	103%

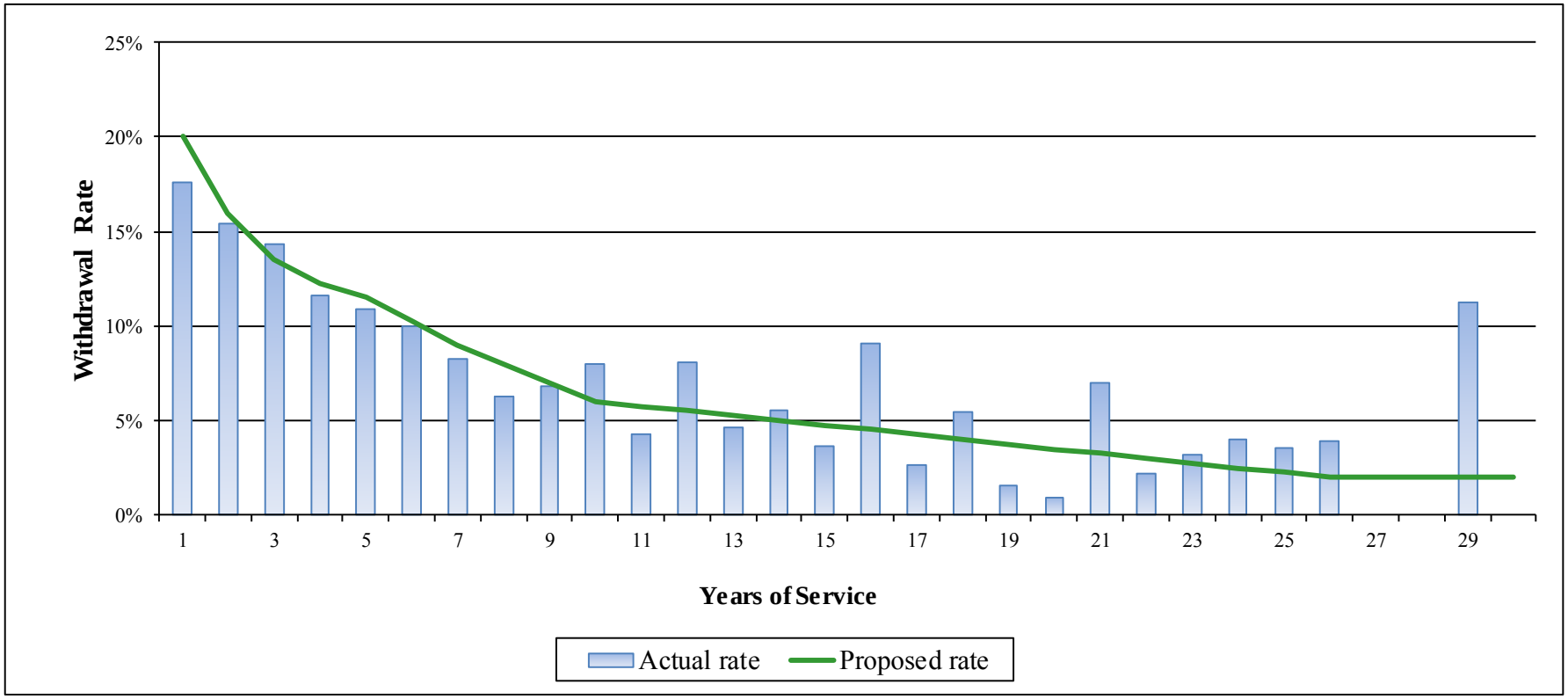
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-17

Rate of Termination of Employment

County



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	202		204
Actual/Expected		132%	99%

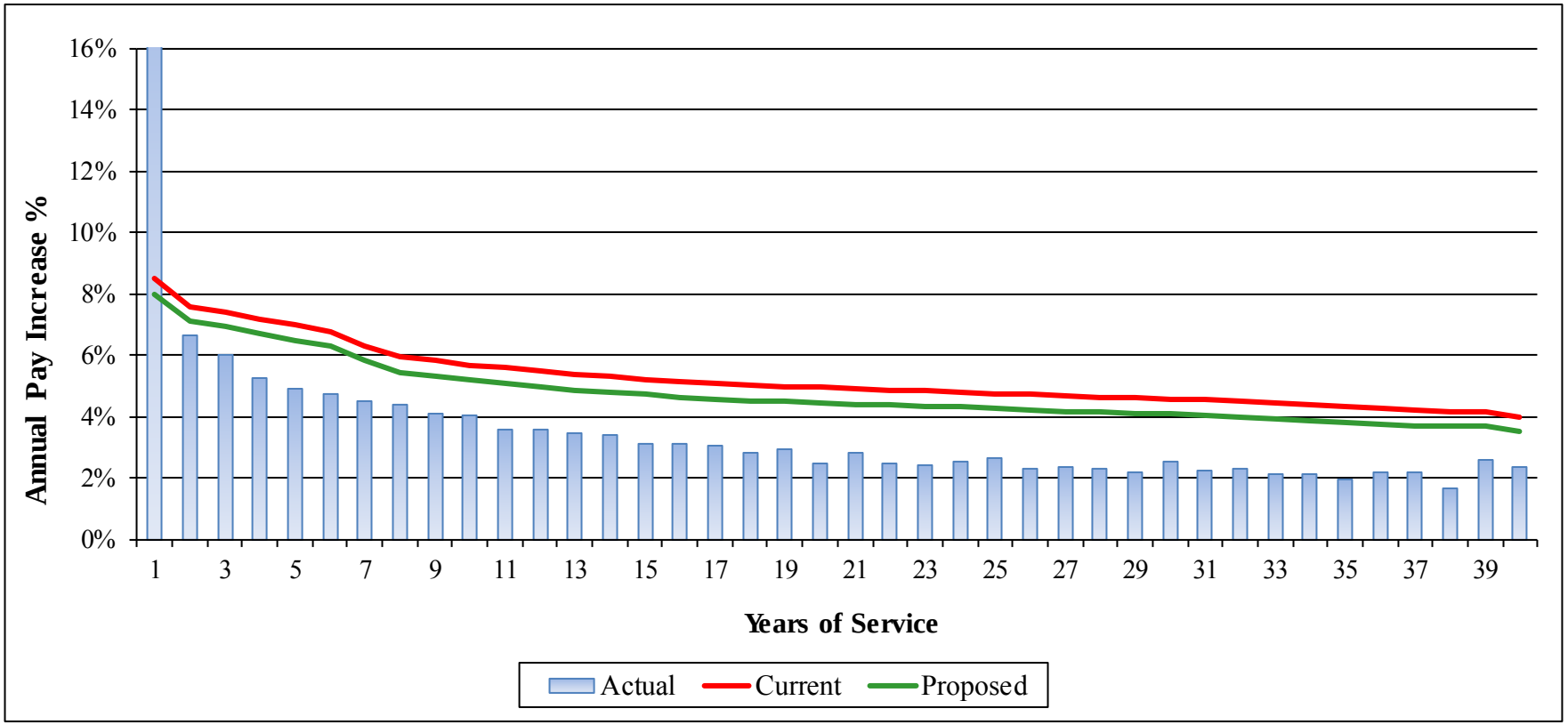
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-18

Total Salary Scale

Schools



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Average Increase	4.45%	5.77%	5.27%
Actual/Expected		77%	84%

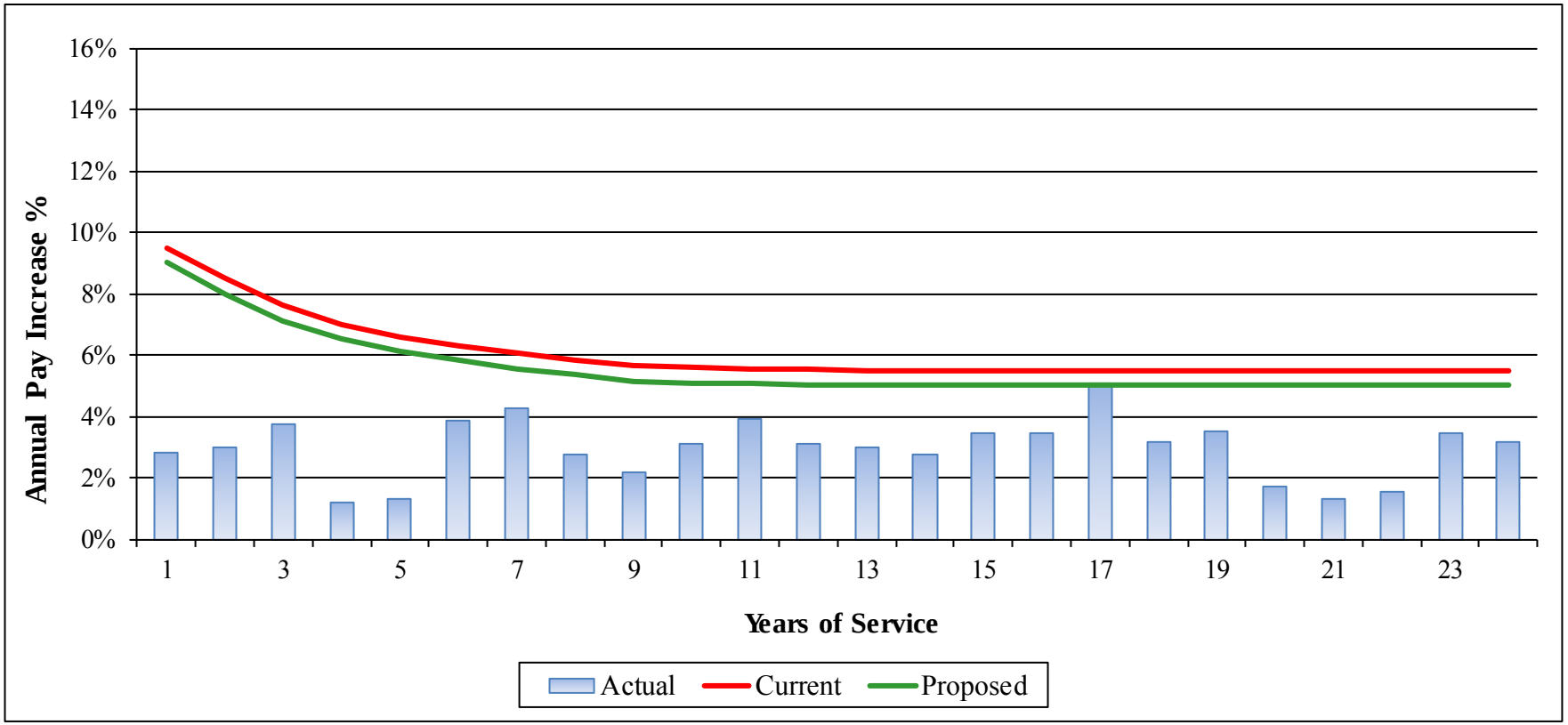
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-19

Total Salary Scale

Patrol



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Average Increase	2.93%	5.79%	5.29%
Actual/Expected		51%	55%

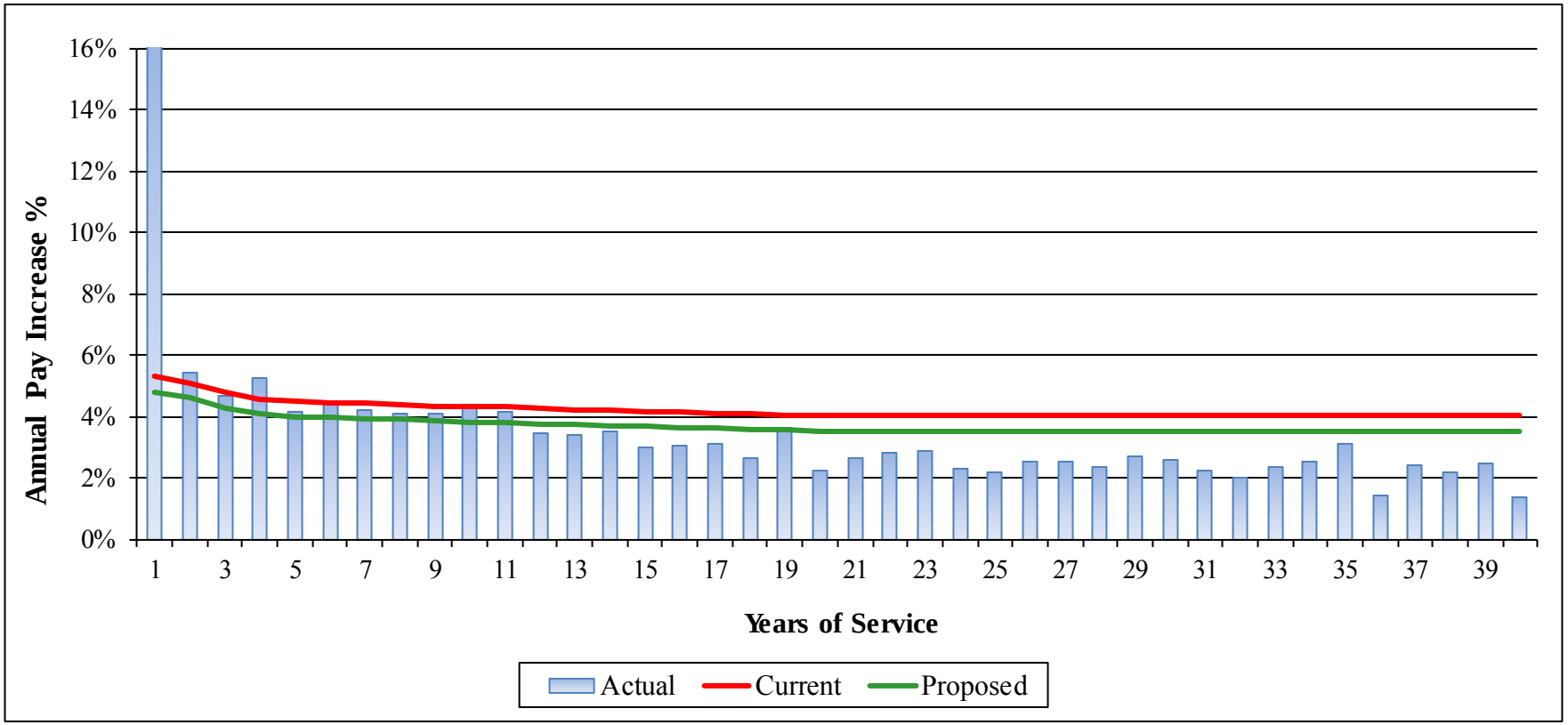
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-20

Total Salary Scale

State



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Average Increase	4.88%	4.43%	3.93%
Actual/Expected		110%	124%

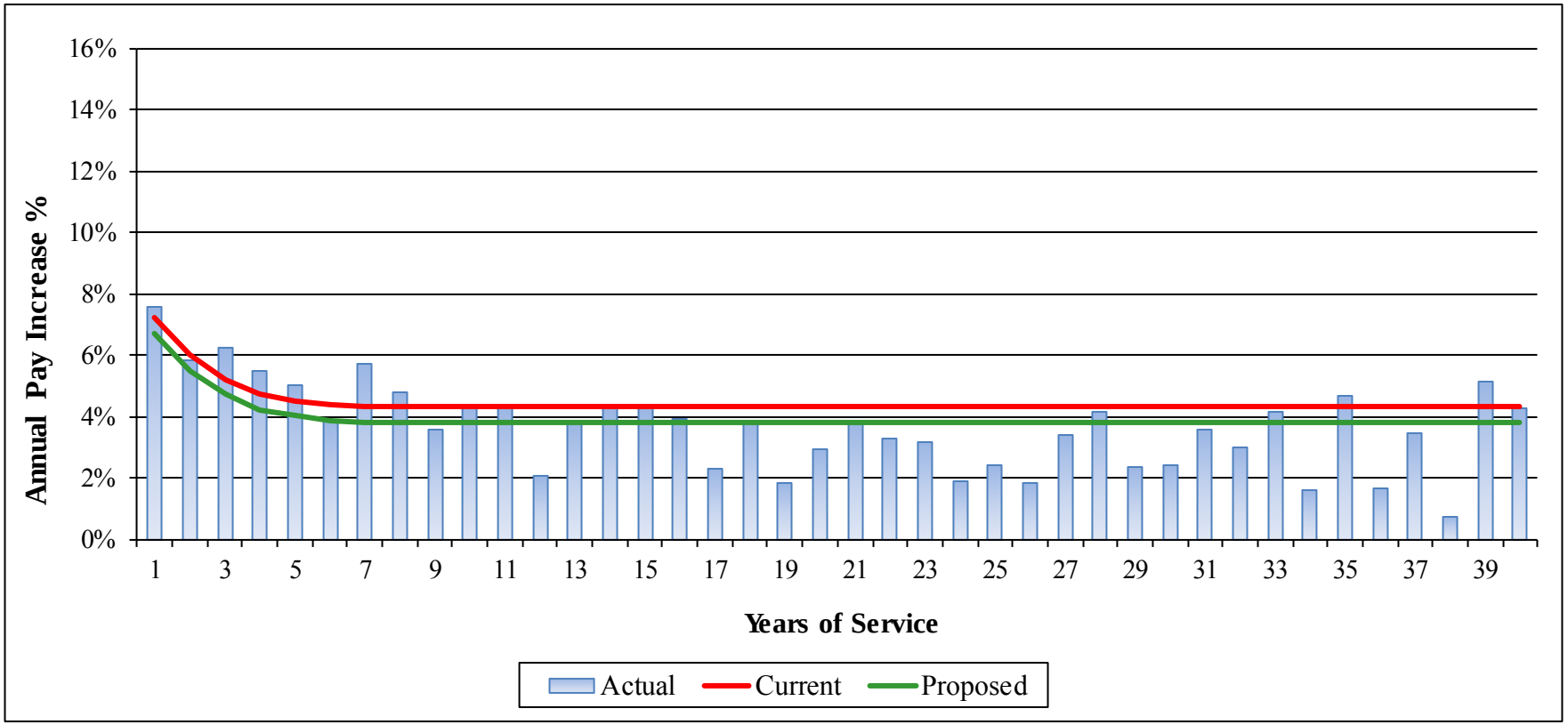
Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit C-21

Total Salary Scale

County



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Average Increase	4.63%	4.79%	4.29%
Actual/Expected		97%	108%

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Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-1

Probability of Death - Healthy Retirees

Males

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	23.9	-	0.000%	0.1	0.260%	0.1	0.352%
56	64.1	0.1	0.207%	0.2	0.296%	0.2	0.374%
57	83.8	1.5	1.838%	0.3	0.338%	0.3	0.398%
58	111.2	0.7	0.667%	0.4	0.389%	0.5	0.419%
59	133.1	1.2	0.876%	0.6	0.449%	0.6	0.442%
60	172.7	0.3	0.191%	0.9	0.505%	0.8	0.467%
61	218.0	1.3	0.583%	1.2	0.568%	1.1	0.496%
62	261.9	1.2	0.457%	1.7	0.654%	1.4	0.529%
63	308.8	1.4	0.446%	2.3	0.739%	1.7	0.566%
64	342.2	2.4	0.715%	2.9	0.853%	2.1	0.607%
65	370.4	2.5	0.679%	3.6	0.962%	2.4	0.655%
66	379.6	1.3	0.349%	4.1	1.081%	2.7	0.710%
67	385.9	3.7	0.967%	4.8	1.234%	3.0	0.774%
68	358.6	1.3	0.367%	4.9	1.370%	3.0	0.848%
69	329.8	1.2	0.371%	4.9	1.477%	3.1	0.933%
70	315.2	3.5	1.107%	5.1	1.616%	3.3	1.032%
71	272.4	4.1	1.520%	4.7	1.728%	3.1	1.145%
72	238.4	3.9	1.639%	4.5	1.889%	3.0	1.273%
73	221.2	4.3	1.951%	4.6	2.074%	3.1	1.417%
74	194.1	2.2	1.143%	4.4	2.272%	3.1	1.578%
75	178.9	3.5	1.984%	4.4	2.479%	3.1	1.758%
76	170.7	4.4	2.560%	4.7	2.768%	3.3	1.959%
77	139.3	3.1	2.209%	4.2	3.039%	3.0	2.184%
78	126.8	3.6	2.857%	4.4	3.432%	3.3	2.588%
79	109.1	2.2	1.995%	4.3	3.897%	3.3	3.070%
80	95.4	3.1	3.223%	4.2	4.428%	3.5	3.647%
81	84.8	4.7	5.507%	4.3	5.023%	3.7	4.340%
82	74.2	3.3	4.386%	4.2	5.675%	3.8	5.177%
83	65.3	4.4	6.772%	4.2	6.381%	4.0	6.187%
84	57.3	3.2	5.656%	4.0	6.970%	4.0	6.974%
85	51.2	3.1	5.959%	4.0	7.732%	4.0	7.875%
86	48.3	3.3	6.814%	4.1	8.390%	4.3	8.901%
87	40.2	2.7	6.691%	3.7	9.128%	4.0	10.070%
88	30.1	2.9	9.574%	3.1	10.194%	3.4	11.392%
89	22.6	4.1	18.221%	2.6	11.429%	2.9	12.886%
90	15.5	2.9	18.687%	1.9	12.552%	2.3	14.566%
91	10.7	1.1	10.106%	1.5	14.059%	1.8	16.452%
92	8.6	2.0	23.523%	1.3	15.376%	1.6	18.569%
93	5.5	1.0	17.616%	0.9	17.114%	1.1	20.853%
94	3.8	1.0	25.492%	0.7	18.626%	0.9	23.271%
95	2.5	0.2	9.806%	0.5	20.251%	0.7	25.796%
96	2.1	0.9	41.868%	0.5	22.399%	0.6	28.422%
97	0.9	0.3	29.340%	0.2	24.116%	0.3	31.151%
98	0.5	-	0.000%	0.1	25.775%	0.2	33.968%
99	0.4	0.0	7.045%	0.1	27.935%	0.1	36.898%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-2

Probability of Death - Healthy Retirees

Females

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	19.3	-	0.000%	0.0	0.169%	0.0	0.224%
56	67.9	-	0.000%	0.0	0.194%	0.2	0.237%
57	103.7	0.1	0.115%	0.0	0.226%	0.3	0.251%
58	138.2	0.9	0.663%	0.0	0.263%	0.4	0.267%
59	182.7	0.6	0.307%	0.0	0.302%	0.5	0.286%
60	261.4	1.4	0.517%	0.0	0.348%	0.8	0.308%
61	346.4	0.4	0.105%	0.0	0.400%	1.2	0.333%
62	427.9	1.0	0.235%	0.0	0.458%	1.6	0.362%
63	506.7	2.4	0.470%	0.0	0.525%	2.1	0.408%
64	527.0	1.7	0.326%	0.0	0.601%	2.4	0.456%
65	529.0	3.4	0.646%	0.0	0.686%	2.7	0.506%
66	503.3	3.0	0.598%	0.0	0.777%	2.8	0.560%
67	447.2	3.2	0.708%	0.0	0.873%	2.8	0.617%
68	392.2	2.5	0.641%	0.0	0.969%	2.7	0.679%
69	353.4	1.7	0.469%	0.0	1.059%	2.6	0.746%
70	322.3	3.4	1.062%	0.0	1.144%	2.6	0.820%
71	290.0	1.2	0.422%	0.0	1.236%	2.6	0.902%
72	257.4	3.6	1.384%	0.0	1.318%	2.6	0.994%
73	219.9	1.9	0.877%	0.0	1.455%	2.4	1.097%
74	207.1	1.2	0.587%	0.0	1.583%	2.5	1.213%
75	198.5	2.9	1.484%	0.0	1.759%	2.7	1.342%
76	183.5	1.5	0.813%	0.0	1.917%	2.7	1.488%
77	170.6	3.0	1.755%	0.0	2.139%	2.8	1.652%
78	150.5	3.6	2.391%	0.0	2.448%	2.8	1.836%
79	130.9	2.7	2.090%	0.0	2.738%	2.7	2.045%
80	117.4	2.6	2.255%	0.0	3.051%	2.7	2.281%
81	109.9	3.2	2.912%	0.0	3.399%	2.8	2.548%
82	104.2	3.2	3.051%	0.0	3.792%	3.2	3.049%
83	98.8	2.7	2.777%	0.0	4.241%	3.6	3.656%
84	91.4	3.6	3.982%	0.0	4.733%	4.0	4.390%
85	78.2	5.7	7.318%	0.0	5.262%	4.1	5.279%
86	62.7	3.8	6.119%	0.0	5.970%	4.0	6.357%
87	50.5	3.9	7.756%	0.0	6.782%	3.9	7.666%
88	39.7	4.2	10.641%	0.0	7.724%	3.7	9.253%
89	35.9	3.3	9.283%	0.0	8.625%	4.0	11.179%
90	33.4	3.4	10.173%	0.0	9.820%	4.2	12.628%
91	29.6	4.2	14.185%	0.0	10.916%	4.2	14.268%
92	24.0	4.0	16.626%	0.0	12.088%	3.9	16.120%
93	19.2	3.0	15.374%	0.0	13.329%	3.5	18.159%
94	14.7	2.6	17.782%	0.0	14.951%	3.0	20.369%
95	10.3	2.3	22.616%	0.0	16.365%	2.3	22.744%
96	6.9	1.4	19.544%	0.0	17.855%	1.7	25.278%
97	5.3	1.1	20.778%	0.0	19.420%	1.5	27.971%
98	3.1	1.3	42.204%	0.0	21.509%	1.0	30.805%
99	2.0	0.4	19.057%	0.0	23.277%	0.7	33.796%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-2

Probability of Death - Healthy Retirees

Females (Static)

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	19.3	-	0.000%	0.0	0.169%	0.0	0.218%
56	67.9	-	0.000%	0.1	0.194%	0.2	0.232%
57	103.7	0.1	0.115%	0.2	0.226%	0.3	0.246%
58	138.2	0.9	0.663%	0.4	0.263%	0.4	0.259%
59	182.7	0.6	0.307%	0.6	0.302%	0.5	0.272%
60	261.4	1.4	0.517%	0.9	0.348%	0.7	0.286%
61	346.4	0.4	0.105%	1.4	0.400%	1.1	0.311%
62	427.9	1.0	0.235%	2.0	0.458%	1.4	0.335%
63	506.7	2.4	0.470%	2.7	0.525%	1.8	0.362%
64	527.0	1.7	0.326%	3.2	0.601%	2.1	0.391%
65	529.0	3.4	0.646%	3.6	0.686%	2.2	0.423%
66	503.3	3.0	0.598%	3.9	0.777%	2.3	0.462%
67	447.2	3.2	0.708%	3.9	0.873%	2.3	0.506%
68	392.2	2.5	0.641%	3.8	0.969%	2.2	0.557%
69	353.4	1.7	0.469%	3.7	1.059%	2.2	0.615%
70	322.3	3.4	1.062%	3.7	1.144%	2.2	0.682%
71	290.0	1.2	0.422%	3.6	1.236%	2.2	0.757%
72	257.4	3.6	1.384%	3.4	1.318%	2.2	0.842%
73	219.9	1.9	0.877%	3.2	1.455%	2.1	0.938%
74	207.1	1.2	0.587%	3.3	1.583%	2.2	1.046%
75	198.5	2.9	1.484%	3.5	1.759%	2.3	1.168%
76	183.5	1.5	0.813%	3.5	1.917%	2.4	1.309%
77	170.6	3.0	1.755%	3.6	2.139%	2.6	1.519%
78	150.5	3.6	2.391%	3.7	2.448%	2.7	1.765%
79	130.9	2.7	2.090%	3.6	2.738%	2.7	2.052%
80	117.4	2.6	2.255%	3.6	3.051%	2.8	2.390%
81	109.9	3.2	2.912%	3.7	3.399%	3.1	2.784%
82	104.2	3.2	3.051%	4.0	3.792%	3.4	3.245%
83	98.8	2.7	2.777%	4.2	4.241%	3.7	3.779%
84	91.4	3.6	3.982%	4.3	4.733%	4.0	4.406%
85	78.2	5.7	7.318%	4.1	5.262%	3.9	4.960%
86	62.7	3.8	6.119%	3.7	5.970%	3.5	5.589%
87	50.5	3.9	7.756%	3.4	6.782%	3.2	6.289%
88	39.7	4.2	10.641%	3.1	7.724%	2.8	7.079%
89	35.9	3.3	9.283%	3.1	8.625%	2.9	7.969%
90	33.4	3.4	10.173%	3.3	9.820%	3.0	8.970%
91	29.6	4.2	14.185%	3.2	10.916%	3.0	10.068%
92	24.0	4.0	16.626%	2.9	12.088%	2.7	11.266%
93	19.2	3.0	15.374%	2.6	13.329%	2.4	12.548%
94	14.7	2.6	17.782%	2.2	14.951%	2.1	13.930%
95	10.3	2.3	22.616%	1.7	16.365%	1.6	15.414%
96	6.9	1.4	19.544%	1.2	17.855%	1.2	17.121%
97	5.3	1.1	20.778%	1.0	19.420%	1.0	18.967%
98	3.1	1.3	42.204%	0.7	21.509%	0.7	20.912%
99	2.0	0.4	19.057%	0.5	23.277%	0.5	23.001%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-3

Probability of Death - Active Lives

Males

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
20	52	-	0.000%	0.0	0.014%	0.0	0.029%
21	57	-	0.000%	0.0	0.015%	0.0	0.032%
22	118	-	0.000%	0.0	0.016%	0.0	0.035%
23	231	-	0.000%	0.0	0.017%	0.1	0.037%
24	438	-	0.000%	0.1	0.019%	0.2	0.037%
25	606	1	0.165%	0.1	0.021%	0.2	0.035%
26	715	-	0.000%	0.2	0.024%	0.2	0.033%
27	788	-	0.000%	0.2	0.028%	0.3	0.032%
28	842	-	0.000%	0.3	0.030%	0.3	0.032%
29	874	-	0.000%	0.3	0.032%	0.3	0.032%
30	889	-	0.000%	0.3	0.035%	0.3	0.032%
31	936	-	0.000%	0.3	0.037%	0.3	0.033%
32	953	-	0.000%	0.4	0.038%	0.3	0.034%
33	924	-	0.000%	0.4	0.039%	0.3	0.035%
34	893	-	0.000%	0.4	0.040%	0.3	0.036%
35	855	-	0.000%	0.3	0.040%	0.3	0.037%
36	888	-	0.000%	0.4	0.040%	0.3	0.038%
37	906	-	0.000%	0.4	0.040%	0.4	0.039%
38	915	1	0.109%	0.4	0.042%	0.4	0.041%
39	886	-	0.000%	0.4	0.043%	0.4	0.042%
40	889	-	0.000%	0.4	0.045%	0.4	0.045%
41	932	-	0.000%	0.4	0.047%	0.4	0.048%
42	950	-	0.000%	0.5	0.050%	0.5	0.052%
43	961	1	0.104%	0.5	0.052%	0.5	0.057%
44	981	-	0.000%	0.5	0.055%	0.6	0.063%
45	899	-	0.000%	0.5	0.057%	0.6	0.070%
46	906	3	0.331%	0.5	0.060%	0.7	0.078%
47	932	1	0.107%	0.6	0.063%	0.8	0.088%
48	934	-	0.000%	0.6	0.067%	0.9	0.098%
49	1,014	1	0.099%	0.7	0.072%	1.1	0.109%
50	1,027	-	0.000%	0.8	0.077%	1.2	0.121%
51	1,075	2	0.186%	0.9	0.083%	1.4	0.134%
52	1,116	2	0.179%	1.0	0.089%	1.7	0.149%
53	1,100	3	0.273%	1.1	0.097%	1.8	0.164%
54	1,123	2	0.178%	1.2	0.107%	2.0	0.180%
55	1,117	2	0.179%	1.3	0.117%	2.2	0.198%
56	1,060	3	0.283%	1.4	0.132%	2.3	0.218%
57	1,054	2	0.190%	1.6	0.149%	2.5	0.241%
58	1,084	4	0.369%	1.9	0.171%	2.9	0.267%
59	1,053	-	0.000%	2.1	0.198%	3.1	0.297%
60	988	6	0.607%	2.2	0.225%	3.3	0.331%
61	992	4	0.403%	2.5	0.256%	3.7	0.370%
62	874	7	0.801%	2.6	0.298%	3.6	0.415%
63	808	5	0.619%	2.7	0.340%	3.8	0.465%
64	731	6	0.821%	2.9	0.393%	3.8	0.523%
65	605	3	0.496%	2.7	0.443%	3.6	0.587%

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-4

Probability of Death - Active Lives

Females

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
20	121	-	0.000%	0.0	0.007%	0.0	0.008%
21	173	-	0.000%	0.0	0.007%	0.0	0.008%
22	287	-	0.000%	0.0	0.007%	0.0	0.008%
23	797	-	0.000%	0.1	0.007%	0.1	0.008%
24	1,568	-	0.000%	0.1	0.007%	0.1	0.008%
25	2,079	-	0.000%	0.2	0.007%	0.2	0.008%
26	2,313	1	0.043%	0.2	0.007%	0.2	0.008%
27	2,405	-	0.000%	0.2	0.008%	0.2	0.009%
28	2,416	1	0.041%	0.2	0.008%	0.2	0.009%
29	2,481	-	0.000%	0.2	0.008%	0.2	0.010%
30	2,515	1	0.040%	0.2	0.009%	0.3	0.010%
31	2,504	1	0.040%	0.2	0.010%	0.3	0.011%
32	2,508	-	0.000%	0.3	0.011%	0.3	0.011%
33	2,438	-	0.000%	0.3	0.012%	0.3	0.012%
34	2,412	-	0.000%	0.3	0.012%	0.3	0.013%
35	2,442	2	0.082%	0.3	0.013%	0.3	0.013%
36	2,485	-	0.000%	0.3	0.013%	0.3	0.014%
37	2,556	1	0.039%	0.4	0.014%	0.4	0.015%
38	2,550	-	0.000%	0.4	0.015%	0.4	0.016%
39	2,640	1	0.038%	0.4	0.016%	0.5	0.017%
40	2,724	-	0.000%	0.5	0.017%	0.5	0.019%
41	2,777	1	0.036%	0.5	0.018%	0.6	0.021%
42	2,894	-	0.000%	0.6	0.020%	0.7	0.023%
43	2,997	-	0.000%	0.6	0.021%	0.8	0.025%
44	3,000	-	0.000%	0.7	0.022%	0.8	0.028%
45	3,014	-	0.000%	0.7	0.023%	0.9	0.031%
46	2,976	1	0.034%	0.7	0.023%	1.0	0.035%
47	2,984	3	0.101%	0.7	0.024%	1.2	0.039%
48	3,071	1	0.033%	0.8	0.026%	1.3	0.043%
49	3,202	1	0.031%	0.9	0.028%	1.5	0.047%
50	3,452	-	0.000%	1.0	0.030%	1.8	0.052%
51	3,616	2	0.055%	1.2	0.034%	2.0	0.057%
52	3,686	1	0.027%	1.4	0.037%	2.3	0.062%
53	3,679	2	0.054%	1.6	0.043%	2.5	0.067%
54	3,678	2	0.054%	1.8	0.048%	2.7	0.072%
55	3,570	3	0.084%	2.0	0.055%	2.8	0.078%
56	3,366	3	0.089%	2.1	0.063%	2.8	0.084%
57	3,253	4	0.123%	2.4	0.075%	3.0	0.091%
58	3,148	3	0.095%	2.8	0.088%	3.1	0.098%
59	3,167	5	0.158%	3.3	0.104%	3.4	0.106%
60	3,096	5	0.161%	3.8	0.122%	3.6	0.115%
61	2,804	6	0.214%	4.0	0.143%	3.5	0.124%
62	2,467	1	0.041%	4.1	0.168%	3.3	0.135%
63	2,012	2	0.099%	4.0	0.197%	3.0	0.147%
64	1,657	2	0.121%	3.8	0.228%	2.7	0.160%
65	1,276	1	0.078%	3.3	0.260%	2.2	0.175%

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-5

Retirement Rates

Schools - Early Retirement

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
60	1,150.0	98.3	8.544%	115.0	10.000%	115.0	10.000%
61	905.7	76.0	8.389%	108.7	12.000%	108.7	12.000%
62	670.5	74.5	11.108%	100.6	15.000%	80.5	12.000%
63	492.5	53.8	10.917%	59.1	12.000%	59.1	12.000%
64	199.6	31.0	15.543%	35.9	18.000%	29.9	15.000%
	3,418.3	333.5	9.756%	419.3	12.266%	393.2	11.502%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-6

Retirement Rates

Schools - Unreduced Retirement

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	2,316.4	500.5	21.606%	579.1	25.000%	417.0	18.000%
56	2,205.8	325.7	14.764%	441.2	20.000%	330.9	15.000%
57	2,306.1	328.8	14.256%	461.2	20.000%	345.9	15.000%
58	2,426.3	332.2	13.692%	485.3	20.000%	363.9	15.000%
59	2,629.5	505.2	19.212%	525.9	20.000%	394.4	15.000%
60	2,597.5	495.9	19.092%	649.4	25.000%	649.4	25.000%
61	2,629.7	593.5	22.568%	657.4	25.000%	657.4	25.000%
62	2,367.9	679.7	28.706%	710.4	30.000%	710.4	30.000%
63	1,937.3	492.9	25.441%	484.3	25.000%	484.3	25.000%
64	1,745.5	473.3	27.115%	436.4	25.000%	436.4	25.000%
65	1,412.4	458.6	32.466%	423.7	30.000%	423.7	30.000%
66	931.6	378.9	40.670%	232.9	25.000%	279.5	30.000%
67	512.9	172.7	33.665%	102.6	20.000%	153.9	30.000%
68	350.3	94.2	26.895%	70.1	20.000%	87.6	25.000%
69	271.3	73.6	27.139%	54.3	20.000%	67.8	25.000%
70	192.0	54.5	28.374%	38.4	20.000%	48.0	25.000%
71	130.3	34.1	26.167%	26.1	20.000%	32.6	25.000%
72	89.8	21.9	24.450%	18.0	20.000%	22.4	25.000%
73	69.3	26.7	38.544%	13.9	20.000%	17.3	25.000%
74	45.7	9.0	19.670%	11.4	25.000%	11.4	25.000%
75	34.3	8.4	24.570%	8.6	25.000%	8.6	25.000%
	27,201.9	6,060.2	22.279%	6,430.3	23.639%	5,942.8	21.847%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-7

Retirement Rates

Patrol - Retirement/DROP after 25 Years

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
50	59.2	56.3	94.988%	59.2	100.000%	59.2	100.000%
51	9.0	6.8	75.009%	9.0	100.000%	9.0	100.000%
52	6.6	4.4	66.581%	6.6	100.000%	6.6	100.000%
53	9.0	9.0	100.000%	9.0	100.000%	9.0	100.000%
54	9.8	7.9	80.291%	9.8	100.000%	9.8	100.000%
55	8.9	8.9	100.000%	8.9	100.000%	8.9	100.000%
56	4.0	4.0	100.000%	4.0	100.000%	4.0	100.000%
57	1.5	1.5	100.000%	1.5	100.000%	1.5	100.000%
58	-	-	0.000%	-	100.000%	-	100.000%
59	2.1	2.1	100.000%	2.1	100.000%	2.1	100.000%
60	-	-	0.000%	-	100.000%	-	100.000%
	110.1	100.8	91.495%	110.1	100.000%	110.1	100.000%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-8

Retirement Rates

Judges - All Retirements

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	19.6	-	0.000%	0.3	1.500%	0.3	1.500%
56	31.1	-	0.000%	0.5	1.500%	0.5	1.500%
57	37.1	-	0.000%	0.6	1.500%	0.6	1.500%
58	48.5	2.3	4.690%	0.7	1.500%	0.7	1.500%
59	71.1	-	0.000%	1.1	1.500%	1.1	1.500%
60	63.5	2.4	3.741%	1.9	3.000%	1.9	3.000%
61	70.0	1.6	2.350%	2.1	3.000%	2.1	3.000%
62	69.9	2.8	4.044%	7.0	10.000%	4.9	7.000%
63	62.5	1.5	2.457%	6.2	10.000%	4.4	7.000%
64	77.5	15.2	19.666%	7.7	10.000%	11.6	15.000%
65	73.0	13.7	18.809%	14.6	20.000%	14.6	20.000%
66	69.5	5.3	7.662%	7.0	10.000%	10.4	15.000%
67	73.8	16.0	21.626%	7.4	10.000%	11.1	15.000%
68	55.1	12.2	22.207%	5.5	10.000%	8.3	15.000%
69	35.6	5.0	13.997%	3.6	10.000%	5.3	15.000%
70	15.9	4.8	30.107%	2.4	15.000%	2.4	15.000%
71	10.1	4.5	44.509%	1.5	15.000%	1.5	15.000%
72	5.4	-	0.000%	5.4	100.000%	5.4	100.000%
	889.4	87.4	9.831%	75.4	8.478%	87.0	9.782%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-9

Retirement Rates

State - All Retirements

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	814.7	33.9	4.165%	40.7	5.000%	40.7	5.000%
56	897.2	36.9	4.117%	44.9	5.000%	44.9	5.000%
57	967.7	35.5	3.672%	48.4	5.000%	48.4	5.000%
58	1,055.1	46.0	4.358%	52.8	5.000%	52.8	5.000%
59	1,128.6	54.0	4.781%	56.4	5.000%	56.4	5.000%
60	1,182.9	78.2	6.614%	59.1	5.000%	59.1	5.000%
61	1,225.0	121.7	9.932%	98.0	8.000%	98.0	8.000%
62	1,219.1	154.9	12.710%	182.9	15.000%	146.3	12.000%
63	1,144.5	158.4	13.844%	114.4	10.000%	137.3	12.000%
64	1,024.4	167.4	16.345%	153.7	15.000%	153.7	15.000%
65	890.5	270.8	30.413%	222.6	25.000%	267.2	30.000%
66	623.3	211.4	33.915%	155.8	25.000%	187.0	30.000%
67	417.4	111.6	26.732%	104.3	25.000%	104.3	25.000%
68	310.0	84.4	27.216%	77.5	25.000%	77.5	25.000%
69	202.4	62.1	30.701%	40.5	20.000%	50.6	25.000%
70	143.6	28.6	19.928%	28.7	20.000%	35.9	25.000%
71	117.6	24.5	20.849%	23.5	20.000%	29.4	25.000%
72	78.7	21.5	27.346%	15.7	20.000%	19.7	25.000%
73	42.8	17.5	40.929%	8.6	20.000%	10.7	25.000%
74	26.8	7.9	29.546%	5.4	20.000%	6.7	25.000%
75	24.4	10.6	43.515%	4.9	20.000%	6.1	25.000%
	13,536.5	1,738.1	12.840%	1,538.8	11.368%	1,632.6	12.061%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-10

Retirement Rates

County - All Retirements

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	251.5	8.8	3.496%	11.3	4.500%	11.3	4.500%
56	272.9	11.6	4.249%	12.3	4.500%	12.3	4.500%
57	302.7	11.1	3.667%	13.6	4.500%	13.6	4.500%
58	316.6	12.9	4.086%	14.2	4.500%	14.2	4.500%
59	329.3	11.1	3.380%	14.8	4.500%	14.8	4.500%
60	316.0	15.7	4.981%	14.2	4.500%	14.2	4.500%
61	328.8	16.0	4.861%	16.4	5.000%	16.4	5.000%
62	312.2	23.1	7.406%	31.2	10.000%	31.2	10.000%
63	307.9	24.9	8.095%	30.8	10.000%	30.8	10.000%
64	265.4	32.1	12.106%	26.5	10.000%	26.5	10.000%
65	223.3	39.8	17.810%	44.7	20.000%	44.7	20.000%
66	179.5	38.6	21.504%	35.9	20.000%	35.9	20.000%
67	134.6	28.9	21.439%	20.2	15.000%	20.2	15.000%
68	112.8	27.5	24.372%	16.9	15.000%	16.9	15.000%
69	86.6	18.7	21.619%	13.0	15.000%	13.0	15.000%
70	71.6	19.6	27.428%	14.3	20.000%	14.3	20.000%
71	58.0	13.6	23.431%	11.6	20.000%	11.6	20.000%
72	42.7	11.0	25.722%	8.5	20.000%	8.5	20.000%
73	40.2	6.3	15.643%	8.0	20.000%	8.0	20.000%
74	34.4	7.2	20.926%	6.9	20.000%	6.9	20.000%
75	26.2	7.7	29.302%	5.2	20.000%	5.2	20.000%
	4,013.2	386.3	9.625%	370.8	9.239%	370.8	9.239%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-11

Rate of Disability

Schools - Male

Age	Exposure	Actual Disabilities	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
25	596	-	0.000%	-	0.000%	-	0.000%
26	701	-	0.000%	-	0.000%	-	0.000%
27	767	-	0.000%	-	0.000%	-	0.000%
28	813	-	0.000%	-	0.000%	-	0.000%
29	840	-	0.000%	-	0.000%	-	0.000%
30	852	-	0.000%	-	0.000%	-	0.000%
31	892	-	0.000%	-	0.000%	-	0.000%
32	905	-	0.000%	-	0.000%	-	0.000%
33	880	-	0.000%	-	0.000%	-	0.000%
34	838	-	0.000%	-	0.000%	-	0.000%
35	791	-	0.000%	0.1	0.015%	0.1	0.017%
36	823	-	0.000%	0.1	0.015%	0.1	0.017%
37	832	-	0.000%	0.1	0.015%	0.1	0.017%
38	845	-	0.000%	0.1	0.015%	0.1	0.017%
39	818	-	0.000%	0.1	0.015%	0.1	0.017%
40	814	-	0.000%	0.1	0.015%	0.1	0.017%
41	858	-	0.000%	0.2	0.018%	0.2	0.019%
42	870	-	0.000%	0.2	0.020%	0.2	0.022%
43	879	-	0.000%	0.2	0.023%	0.2	0.025%
44	905	-	0.000%	0.2	0.026%	0.3	0.029%
45	820	-	0.000%	0.2	0.030%	0.3	0.033%
46	834	1	0.120%	0.3	0.033%	0.3	0.036%
47	867	1	0.115%	0.3	0.035%	0.3	0.039%
48	861	-	0.000%	0.3	0.036%	0.3	0.040%
49	947	-	0.000%	0.4	0.040%	0.4	0.044%
50	968	1	0.103%	0.4	0.044%	0.5	0.048%
51	1,046	-	0.000%	0.5	0.048%	0.5	0.052%
52	1,089	1	0.092%	0.6	0.051%	0.6	0.056%
53	1,069	1	0.094%	0.6	0.056%	0.7	0.062%
54	1,096	1	0.091%	0.7	0.061%	0.7	0.067%
55	1,089	-	0.000%	0.7	0.066%	0.8	0.073%
56	1,033	2	0.194%	0.7	0.071%	0.8	0.078%
57	1,025	3	0.293%	0.8	0.075%	0.8	0.083%
58	1,051	-	0.000%	0.8	0.080%	0.9	0.088%
59	1,014	-	0.000%	0.9	0.085%	0.9	0.094%
60	959	-	0.000%	0.9	0.089%	0.9	0.098%
61	964	1	0.104%	0.9	0.094%	1.0	0.103%
62	850	2	0.235%	0.8	0.099%	0.9	0.109%
63	788	2	0.254%	0.8	0.104%	0.9	0.114%
64	704	1	0.142%	0.8	0.110%	0.9	0.121%
	35,593	17	0.048%	13.9	0.039%	15.3	0.043%

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-12

Rate of Disability

Schools - Female

Age	Exposure	Actual Disabilities	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
25	2,078	-	0.000%	-	0.000%	-	0.000%
26	2,312	-	0.000%	-	0.000%	-	0.000%
27	2,403	-	0.000%	-	0.000%	-	0.000%
28	2,413	-	0.000%	-	0.000%	-	0.000%
29	2,477	-	0.000%	-	0.000%	-	0.000%
30	2,510	-	0.000%	-	0.000%	-	0.000%
31	2,502	-	0.000%	-	0.000%	-	0.000%
32	2,506	-	0.000%	-	0.000%	-	0.000%
33	2,437	-	0.000%	-	0.000%	-	0.000%
34	2,410	-	0.000%	-	0.000%	-	0.000%
35	2,438	-	0.000%	0.4	0.015%	0.3	0.014%
36	2,482	-	0.000%	0.4	0.015%	0.3	0.014%
37	2,553	-	0.000%	0.4	0.015%	0.3	0.014%
38	2,545	1	0.039%	0.4	0.015%	0.3	0.014%
39	2,636	-	0.000%	0.4	0.015%	0.4	0.014%
40	2,718	-	0.000%	0.4	0.015%	0.4	0.014%
41	2,773	1	0.036%	0.5	0.018%	0.4	0.016%
42	2,891	-	0.000%	0.6	0.020%	0.5	0.018%
43	2,989	-	0.000%	0.7	0.023%	0.6	0.020%
44	2,991	-	0.000%	0.8	0.026%	0.7	0.024%
45	3,007	-	0.000%	0.9	0.030%	0.8	0.027%
46	2,968	1	0.034%	1.0	0.033%	0.9	0.029%
47	2,982	1	0.034%	1.0	0.035%	0.9	0.032%
48	3,066	-	0.000%	1.1	0.036%	1.0	0.033%
49	3,196	-	0.000%	1.3	0.040%	1.2	0.036%
50	3,445	-	0.000%	1.5	0.044%	1.4	0.039%
51	3,608	-	0.000%	1.7	0.048%	1.5	0.043%
52	3,679	2	0.054%	1.9	0.051%	1.7	0.046%
53	3,673	1	0.027%	2.1	0.056%	1.9	0.051%
54	3,670	3	0.082%	2.2	0.061%	2.0	0.055%
55	3,564	-	0.000%	2.4	0.066%	2.1	0.060%
56	3,357	2	0.060%	2.4	0.071%	2.2	0.064%
57	3,243	3	0.093%	2.4	0.075%	2.2	0.068%
58	3,138	3	0.096%	2.5	0.080%	2.3	0.072%
59	3,156	5	0.158%	2.7	0.085%	2.4	0.077%
60	3,089	3	0.097%	2.7	0.089%	2.5	0.080%
61	2,797	3	0.107%	2.6	0.094%	2.4	0.084%
62	2,462	2	0.081%	2.4	0.099%	2.2	0.089%
63	2,006	3	0.150%	2.1	0.104%	1.9	0.093%
64	1,652	-	0.000%	1.8	0.110%	1.6	0.099%
	112,822	34	0.030%	43.6	0.039%	39.3	0.035%

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-13

Rate of Termination of Employment

Schools - Male

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	85.3	10.1	11.819%	14.5	17.011%	12.8	15.000%
2	172.7	17.4	10.093%	21.1	12.197%	19.9	11.500%
3	240.6	20.4	8.467%	21.6	8.960%	20.4	8.500%
4	286.5	15.5	5.425%	23.2	8.096%	21.5	7.500%
5	355.9	20.2	5.665%	23.7	6.663%	21.4	6.000%
6	415.9	16.5	3.971%	26.9	6.478%	22.9	5.500%
7	456.6	19.5	4.274%	26.8	5.880%	21.7	4.750%
8	489.9	21.4	4.376%	26.0	5.315%	19.6	4.000%
9	509.9	11.5	2.258%	24.3	4.757%	19.1	3.750%
10	557.5	14.4	2.575%	23.7	4.256%	19.5	3.500%
11	628.3	18.4	2.930%	24.1	3.835%	20.4	3.250%
12	681.1	12.8	1.879%	23.3	3.415%	20.4	3.000%
13	747.2	11.6	1.555%	22.9	3.063%	20.5	2.750%
14	753.9	15.9	2.114%	20.9	2.767%	18.8	2.500%
15	744.5	21.5	2.894%	18.7	2.517%	16.8	2.250%
16	769.5	16.7	2.173%	17.6	2.283%	15.4	2.000%
17	770.3	5.8	0.753%	16.1	2.084%	13.5	1.750%
18	851.0	8.6	1.005%	17.0	2.000%	12.8	1.500%
19	870.2	5.6	0.646%	17.4	2.000%	10.9	1.250%
20	846.8	12.5	1.478%	16.9	2.000%	8.5	1.000%
21	815.8	7.3	0.900%	16.3	2.000%	8.2	1.000%
22	815.6	9.9	1.218%	16.3	2.000%	8.2	1.000%
23	765.8	3.1	0.400%	15.3	2.000%	7.7	1.000%
24	762.8	6.0	0.790%	15.3	2.000%	7.6	1.000%
25	756.1	8.8	1.166%	15.1	2.000%	7.6	1.000%
26	749.0	7.5	1.000%	15.0	2.000%	7.5	1.000%
27	663.0	3.2	0.483%	13.3	2.000%	6.6	1.000%
28	560.1	5.5	0.978%	11.2	2.000%	5.6	1.000%
29	468.4	-	0.000%	9.4	2.000%	4.7	1.000%
30	364.0	2.0	0.541%	7.3	2.000%	3.6	1.000%
	17,954.2	349.8	1.948%	561.1	3.125%	423.9	2.361%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-14

Rate of Termination of Employment

Schools - Female

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	200.3	27.9	13.945%	40.6	20.283%	38.1	19.000%
2	411.6	43.8	10.650%	56.1	13.633%	49.4	12.000%
3	609.2	52.7	8.650%	70.6	11.589%	60.9	10.000%
4	782.0	53.1	6.791%	77.3	9.891%	70.4	9.000%
5	979.2	59.4	6.067%	82.1	8.380%	78.3	8.000%
6	1,138.1	57.8	5.074%	77.2	6.780%	79.7	7.000%
7	1,233.8	62.4	5.059%	76.0	6.161%	74.0	6.000%
8	1,285.9	49.4	3.842%	72.4	5.634%	72.4	5.634%
9	1,332.4	51.1	3.833%	68.4	5.130%	68.4	5.130%
10	1,415.4	53.0	3.745%	66.2	4.679%	66.2	4.679%
11	1,604.0	42.4	2.646%	68.8	4.292%	68.8	4.292%
12	1,808.2	63.2	3.494%	70.8	3.917%	70.8	3.917%
13	1,934.2	43.7	2.260%	69.9	3.613%	69.9	3.613%
14	1,926.2	48.3	2.509%	64.2	3.333%	64.2	3.333%
15	1,828.5	40.1	2.195%	56.4	3.082%	56.4	3.082%
16	1,710.3	32.0	1.868%	48.8	2.854%	48.8	2.854%
17	1,717.7	23.4	1.362%	45.6	2.653%	45.6	2.653%
18	1,718.3	29.9	1.739%	42.4	2.471%	42.4	2.471%
19	1,727.8	28.7	1.662%	39.8	2.302%	39.8	2.302%
20	1,798.9	22.7	1.265%	36.0	2.000%	36.0	2.000%
21	1,797.5	26.6	1.478%	36.0	2.000%	31.5	1.750%
22	1,770.0	22.8	1.290%	35.4	2.000%	26.5	1.500%
23	1,786.0	21.0	1.175%	35.7	2.000%	22.3	1.250%
24	1,712.2	18.8	1.097%	34.2	2.000%	17.1	1.000%
25	1,511.3	17.2	1.135%	30.2	2.000%	15.1	1.000%
26	1,441.0	13.0	0.903%	28.8	2.000%	14.4	1.000%
27	1,262.5	9.5	0.752%	25.3	2.000%	12.6	1.000%
28	1,118.2	10.9	0.974%	22.4	2.000%	11.2	1.000%
29	902.5	1.8	0.198%	18.0	2.000%	9.0	1.000%
30	817.3	7.0	0.853%	16.3	2.000%	8.2	1.000%
	41,280.5	1,033.7	2.504%	1,512.0	3.663%	1,368.5	3.315%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-15

Rate of Termination of Employment

Patrol

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	1.3	-	0.000%	0.1	3.750%	0.1	3.750%
2	2.5	0.1	3.821%	0.1	3.500%	0.1	3.500%
3	4.9	-	0.000%	0.1	3.000%	0.2	3.250%
4	8.6	0.6	6.720%	0.2	2.500%	0.3	3.000%
5	17.0	0.2	1.248%	0.3	2.000%	0.5	2.750%
6	20.0	-	0.000%	0.3	1.500%	0.5	2.500%
7	20.7	1.1	5.285%	0.3	1.500%	0.5	2.250%
8	55.2	1.3	2.397%	0.8	1.500%	1.1	2.000%
9	54.4	1.0	1.853%	0.8	1.500%	1.1	2.000%
10	77.6	1.8	2.355%	1.2	1.500%	1.6	2.000%
11	85.3	2.2	2.615%	1.3	1.500%	1.7	2.000%
12	56.3	2.5	4.367%	0.8	1.500%	1.1	2.000%
13	61.4	0.4	0.691%	0.9	1.500%	1.1	1.750%
14	58.9	-	0.000%	0.9	1.500%	0.9	1.500%
15	63.2	0.8	1.237%	0.6	1.000%	0.8	1.250%
16	57.8	-	0.000%	0.6	1.000%	0.6	1.000%
17	54.3	-	0.000%	0.5	1.000%	0.4	0.750%
18	42.3	0.8	1.981%	0.4	1.000%	0.2	0.500%
19	25.0	-	0.000%	0.3	1.000%	0.1	0.250%
20	51.5	-	0.000%	0.5	1.000%	-	0.000%
21	46.1	-	0.000%	0.5	1.000%	-	0.000%
22	69.2	-	0.000%	0.7	1.000%	-	0.000%
23	62.0	-	0.000%	0.6	1.000%	-	0.000%
24	33.2	-	0.000%	0.3	1.000%	-	0.000%
25	26.8	-	0.000%	0.3	1.000%	-	0.000%
	1,055.7	12.9	1.219%	13.5	1.279%	12.6	1.191%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-16

Rate of Termination of Employment

State

Duration	Exposure	Actual Terminations	Actual Rate	Proposed Expected	Proposed Rate
1	151.5	32.0	21.115%	33.3	22.000%
2	237.0	38.9	16.412%	47.4	20.000%
3	294.3	51.8	17.591%	53.0	18.000%
4	322.1	53.4	16.592%	51.5	16.000%
5	475.9	66.4	13.954%	66.6	14.000%
6	518.4	56.9	10.986%	62.2	12.000%
7	530.9	53.8	10.129%	53.1	10.000%
8	542.9	53.8	9.905%	48.9	9.000%
9	417.9	37.9	9.067%	33.4	8.000%
10	376.2	32.7	8.695%	26.3	7.000%
11	339.3	20.8	6.133%	20.4	6.000%
12	289.0	13.1	4.536%	14.5	5.000%
13	200.3	12.7	6.315%	8.5	4.250%
14	168.6	3.1	1.823%	6.3	3.750%
15	167.3	6.8	4.042%	5.9	3.500%
16	164.8	9.3	5.645%	5.4	3.250%
17	182.8	4.1	2.251%	5.5	3.000%
18	180.0	2.5	1.412%	5.4	3.000%
19	184.4	13.1	7.127%	5.5	3.000%
20	214.7	5.1	2.364%	6.4	3.000%
21	241.9	9.9	4.081%	6.7	2.750%
22	274.6	10.6	3.842%	6.9	2.500%
23	296.2	6.2	2.078%	6.7	2.250%
24	227.2	2.8	1.216%	4.5	2.000%
25	156.4	3.2	2.067%	3.1	2.000%
26	125.4	5.3	4.262%	2.5	2.000%
27	103.7	4.9	4.764%	2.1	2.000%
28	76.6	1.1	1.481%	1.5	2.000%
29	22.7	-	0.000%	0.5	2.000%
30	0.3	-	0.000%	0.0	2.000%
	7,483.5	612.2	8.181%	593.9	7.937%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Data Summary D-17

Rate of Termination of Employment

County

Duration	Exposure	Actual Terminations	Actual Rate	Proposed Expected	Proposed Rate
1	50.8	9.0	17.614%	10.2	20.000%
2	82.7	12.7	15.386%	13.2	16.000%
3	107.8	15.4	14.292%	14.6	13.500%
4	156.3	18.1	11.602%	19.1	12.250%
5	198.7	21.7	10.917%	22.9	11.500%
6	230.3	23.1	10.016%	23.6	10.250%
7	174.6	14.4	8.257%	15.7	9.000%
8	222.7	14.0	6.292%	17.8	8.000%
9	155.6	10.6	6.789%	10.9	7.000%
10	113.3	9.1	7.990%	6.8	6.000%
11	125.0	5.3	4.276%	7.2	5.750%
12	91.2	7.4	8.087%	5.0	5.500%
13	83.3	3.9	4.644%	4.4	5.250%
14	71.4	4.0	5.544%	3.6	5.000%
15	57.8	2.1	3.659%	2.7	4.750%
16	63.5	5.8	9.096%	2.9	4.500%
17	44.9	1.2	2.611%	1.9	4.250%
18	57.3	3.1	5.420%	2.3	4.000%
19	51.8	0.8	1.552%	1.9	3.750%
20	66.6	0.6	0.886%	2.3	3.500%
21	77.5	5.4	6.985%	2.5	3.250%
22	78.9	1.7	2.152%	2.4	3.000%
23	83.9	2.7	3.185%	2.3	2.750%
24	75.5	3.0	3.965%	1.9	2.500%
25	62.9	2.2	3.545%	1.4	2.250%
26	85.2	3.3	3.908%	1.7	2.000%
27	65.2	-	0.000%	1.3	2.000%
28	39.4	-	0.000%	0.8	2.000%
29	15.1	1.7	11.228%	0.3	2.000%
30	-	-	0.000%	-	2.000%
	2,789.1	202.2	7.248%	203.6	7.299%

Weighted results

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit D-18

Total Salary Scale

Schools

Duration	Initial Salary (Millions)	Subsequent Salary (Millions)	Actual Rate	Current Expected (Millions)	Current Rate	Proposed Expected (Millions)	Proposed Rate
1	253.4	307.8	21.47%	274.9	8.50%	273.6	8.00%
2	267.6	285.4	6.66%	287.9	7.58%	286.5	7.08%
3	266.0	281.9	5.99%	285.7	7.40%	284.3	6.90%
4	270.9	285.1	5.23%	290.4	7.17%	289.0	6.67%
5	273.0	286.4	4.88%	292.0	6.96%	290.7	6.46%
6	266.3	278.8	4.72%	284.3	6.77%	283.0	6.27%
7	248.8	260.0	4.52%	264.4	6.30%	263.2	5.80%
8	231.1	241.2	4.36%	244.8	5.94%	243.7	5.44%
9	214.3	223.0	4.09%	226.7	5.80%	225.6	5.30%
10	206.1	214.4	4.05%	217.8	5.68%	216.8	5.18%
11	213.9	221.5	3.55%	225.8	5.57%	224.8	5.07%
12	218.8	226.6	3.54%	230.8	5.46%	229.7	4.96%
13	221.0	228.6	3.46%	232.8	5.36%	231.7	4.86%
14	206.6	213.6	3.41%	217.5	5.28%	216.4	4.78%
15	186.8	192.6	3.11%	196.5	5.21%	195.6	4.71%
16	170.9	176.2	3.11%	179.7	5.12%	178.8	4.62%
17	163.0	168.0	3.06%	171.2	5.07%	170.4	4.57%
18	161.5	166.1	2.81%	169.6	5.01%	168.8	4.51%
19	157.2	161.8	2.90%	165.0	4.97%	164.2	4.47%
20	154.9	158.7	2.44%	162.6	4.95%	161.8	4.45%
21	149.5	153.8	2.83%	156.8	4.89%	156.1	4.39%
22	142.2	145.7	2.48%	149.1	4.86%	148.4	4.36%
23	135.1	138.3	2.40%	141.6	4.83%	140.9	4.33%
24	125.3	128.4	2.52%	131.3	4.79%	130.7	4.29%
25	115.7	118.8	2.61%	121.2	4.74%	120.6	4.24%
26	111.3	113.9	2.29%	116.6	4.70%	116.0	4.20%
27	102.9	105.3	2.33%	107.7	4.66%	107.2	4.16%
28	94.3	96.5	2.31%	98.6	4.63%	98.2	4.13%
29	86.6	88.5	2.18%	90.6	4.60%	90.2	4.10%
30	78.6	80.6	2.50%	82.2	4.57%	81.8	4.07%
31	74.8	76.5	2.23%	78.2	4.53%	77.8	4.03%
32	70.1	71.7	2.31%	73.2	4.48%	72.9	3.98%
33	63.3	64.6	2.10%	66.1	4.42%	65.8	3.92%
34	52.8	53.9	2.13%	55.1	4.37%	54.8	3.87%
35	42.7	43.6	1.95%	44.6	4.32%	44.4	3.82%
36	35.6	36.4	2.18%	37.2	4.26%	37.0	3.76%
37	28.4	29.0	2.20%	29.5	4.20%	29.4	3.70%
38	22.1	22.5	1.65%	23.0	4.16%	22.9	3.66%
39	17.5	17.9	2.55%	18.2	4.16%	18.1	3.66%
40	11.7	12.0	2.35%	12.2	4.00%	12.1	3.50%
	5,912.5	6,175.4	4.45%	6,253.4	5.77%	6,223.9	5.27%

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit D-19

Total Salary Scale

Patrol

Duration	Initial Salary (Millions)	Subsequent Salary (Millions)	Actual Rate	Current Expected (Millions)	Current Rate	Proposed Expected (Millions)	Proposed Rate
1	1.3	1.4	2.80%	1.5	9.50%	1.5	9.00%
2	1.2	1.2	2.99%	1.3	8.50%	1.3	8.00%
3	1.6	1.7	3.74%	1.8	7.60%	1.8	7.10%
4	2.0	2.0	1.17%	2.1	7.00%	2.1	6.50%
5	3.3	3.4	1.28%	3.6	6.60%	3.6	6.10%
6	3.3	3.4	3.83%	3.5	6.30%	3.5	5.80%
7	2.8	2.9	4.25%	3.0	6.05%	3.0	5.55%
8	6.7	6.9	2.76%	7.1	5.85%	7.1	5.35%
9	6.6	6.7	2.15%	6.9	5.65%	6.9	5.15%
10	8.2	8.5	3.10%	8.7	5.60%	8.6	5.10%
11	8.6	9.0	3.91%	9.1	5.56%	9.1	5.06%
12	4.8	4.9	3.09%	5.1	5.53%	5.0	5.03%
13	4.9	5.1	3.00%	5.2	5.50%	5.2	5.00%
14	4.5	4.6	2.73%	4.7	5.50%	4.7	5.00%
15	4.5	4.6	3.43%	4.7	5.50%	4.7	5.00%
16	3.7	3.9	3.43%	3.9	5.50%	3.9	5.00%
17	3.5	3.7	5.05%	3.7	5.50%	3.7	5.00%
18	2.6	2.7	3.19%	2.7	5.50%	2.7	5.00%
19	2.0	2.1	3.48%	2.1	5.50%	2.1	5.00%
20	3.4	3.4	1.74%	3.6	5.50%	3.6	5.00%
21	3.4	3.4	1.29%	3.5	5.50%	3.5	5.00%
22	4.5	4.6	1.52%	4.8	5.50%	4.8	5.00%
23	5.0	5.2	3.43%	5.3	5.50%	5.3	5.00%
24	1.6	1.6	3.15%	1.7	5.50%	1.7	5.00%
25	1.3	1.3	0.97%	1.3	5.50%	1.3	5.00%
	95.5	98.3	2.93%	101.0	5.79%	100.5	5.29%

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit D-20

Total Salary Scale

State

Duration	Initial Salary (Millions)	Subsequent Salary (Millions)	Actual Rate	Current Expected (Millions)	Current Rate	Proposed Expected (Millions)	Proposed Rate
1	138.1	160.7	16.38%	145.4	5.29%	144.7	4.79%
2	118.1	124.5	5.41%	124.2	5.10%	123.6	4.60%
3	100.0	104.7	4.69%	104.8	4.79%	104.3	4.29%
4	84.9	89.3	5.22%	88.8	4.56%	88.3	4.06%
5	105.1	109.5	4.17%	109.8	4.48%	109.3	3.98%
6	102.0	106.5	4.46%	106.5	4.45%	106.0	3.95%
7	92.3	96.2	4.21%	96.4	4.43%	95.9	3.93%
8	84.8	88.3	4.07%	88.6	4.39%	88.1	3.89%
9	60.6	63.1	4.08%	63.2	4.34%	62.9	3.84%
10	51.7	53.9	4.38%	53.9	4.31%	53.6	3.81%
11	44.8	46.7	4.13%	46.7	4.30%	46.5	3.80%
12	38.0	39.3	3.45%	39.6	4.26%	39.4	3.76%
13	26.9	27.8	3.37%	28.0	4.22%	27.9	3.72%
14	22.9	23.7	3.53%	23.9	4.20%	23.8	3.70%
15	21.3	21.9	2.99%	22.2	4.17%	22.1	3.67%
16	19.0	19.5	3.02%	19.7	4.13%	19.6	3.63%
17	20.5	21.2	3.11%	21.4	4.10%	21.3	3.60%
18	18.9	19.4	2.61%	19.6	4.09%	19.5	3.59%
19	18.1	18.8	3.64%	18.8	4.06%	18.8	3.56%
20	21.5	22.0	2.22%	22.4	4.00%	22.3	3.50%
21	24.7	25.3	2.64%	25.7	4.00%	25.6	3.50%
22	25.6	26.3	2.78%	26.6	4.00%	26.5	3.50%
23	27.7	28.4	2.88%	28.8	4.00%	28.6	3.50%
24	28.8	29.4	2.29%	29.9	4.00%	29.8	3.50%
25	30.0	30.7	2.16%	31.2	4.00%	31.1	3.50%
26	30.5	31.3	2.52%	31.7	4.00%	31.6	3.50%
27	30.6	31.4	2.51%	31.8	4.00%	31.7	3.50%
28	33.2	34.0	2.36%	34.6	4.00%	34.4	3.50%
29	32.6	33.4	2.68%	33.9	4.00%	33.7	3.50%
30	28.6	29.3	2.59%	29.7	4.00%	29.6	3.50%
31	26.0	26.6	2.24%	27.1	4.00%	26.9	3.50%
32	19.4	19.8	1.98%	20.2	4.00%	20.1	3.50%
33	17.0	17.4	2.35%	17.7	4.00%	17.6	3.50%
34	11.9	12.2	2.52%	12.4	4.00%	12.4	3.50%
35	9.2	9.5	3.12%	9.6	4.00%	9.5	3.50%
36	5.7	5.8	1.40%	5.9	4.00%	5.9	3.50%
37	4.3	4.5	2.42%	4.5	4.00%	4.5	3.50%
38	1.8	1.8	2.19%	1.9	4.00%	1.9	3.50%
39	1.2	1.2	2.44%	1.2	4.00%	1.2	3.50%
40	0.9	0.9	1.36%	1.0	4.00%	0.9	3.50%
	1,579.3	1,656.4	4.88%	1,649.3	4.43%	1,641.4	3.93%

Nebraska Public Employees Retirement System

Experience Study 2011-2015

Exhibit D-21

Total Salary Scale

County

Duration	Initial Salary (Millions)	Subsequent Salary (Millions)	Actual Rate	Current Expected (Millions)	Current Rate	Proposed Expected (Millions)	Proposed Rate
1	53.5	57.5	7.59%	57.3	7.20%	57.1	6.70%
2	46.5	49.2	5.82%	49.3	6.00%	49.0	5.50%
3	41.5	44.1	6.20%	43.7	5.20%	43.5	4.70%
4	46.6	49.1	5.47%	48.7	4.70%	48.5	4.20%
5	50.5	53.0	5.03%	52.8	4.50%	52.5	4.00%
6	50.4	52.4	3.86%	52.6	4.35%	52.4	3.85%
7	35.1	37.1	5.73%	36.6	4.30%	36.5	3.80%
8	38.5	40.3	4.75%	40.1	4.30%	39.9	3.80%
9	25.8	26.8	3.59%	27.0	4.30%	26.8	3.80%
10	18.4	19.2	4.33%	19.2	4.30%	19.1	3.80%
11	17.9	18.7	4.29%	18.7	4.30%	18.6	3.80%
12	13.6	13.9	2.03%	14.2	4.30%	14.2	3.80%
13	11.4	11.9	3.78%	11.9	4.30%	11.9	3.80%
14	9.7	10.1	4.26%	10.1	4.30%	10.1	3.80%
15	8.0	8.4	4.24%	8.4	4.30%	8.4	3.80%
16	8.5	8.8	3.89%	8.9	4.30%	8.8	3.80%
17	6.4	6.5	2.27%	6.6	4.30%	6.6	3.80%
18	7.5	7.8	3.77%	7.8	4.30%	7.8	3.80%
19	6.9	7.0	1.85%	7.2	4.30%	7.2	3.80%
20	8.9	9.2	2.90%	9.3	4.30%	9.3	3.80%
21	10.2	10.6	3.87%	10.6	4.30%	10.6	3.80%
22	9.6	9.9	3.25%	10.0	4.30%	10.0	3.80%
23	11.2	11.5	3.14%	11.7	4.30%	11.6	3.80%
24	10.0	10.2	1.87%	10.5	4.30%	10.4	3.80%
25	12.2	12.5	2.42%	12.7	4.30%	12.6	3.80%
26	15.9	16.2	1.82%	16.6	4.30%	16.5	3.80%
27	7.4	7.6	3.39%	7.7	4.30%	7.6	3.80%
28	8.1	8.5	4.15%	8.5	4.30%	8.4	3.80%
29	4.7	4.8	2.32%	4.9	4.30%	4.9	3.80%
30	3.6	3.7	2.43%	3.7	4.30%	3.7	3.80%
31	4.8	5.0	3.57%	5.0	4.30%	5.0	3.80%
32	3.3	3.4	2.99%	3.5	4.30%	3.5	3.80%
33	3.5	3.6	4.17%	3.7	4.30%	3.6	3.80%
34	1.7	1.7	1.57%	1.8	4.30%	1.8	3.80%
35	1.8	1.9	4.65%	1.9	4.30%	1.9	3.80%
36	0.9	0.9	1.66%	0.9	4.30%	0.9	3.80%
37	1.0	1.1	3.44%	1.1	4.30%	1.1	3.80%
38	0.3	0.3	0.71%	0.3	4.30%	0.3	3.80%
39	0.6	0.6	5.14%	0.6	4.30%	0.6	3.80%
40	0.2	0.2	4.23%	0.2	4.30%	0.2	3.80%
	616.6	645.2	4.63%	646.2	4.79%	643.1	4.29%