NEBRASKA PUBLIC EMPLOYEES RETIREMENT SYSTEMS

Experience Study

Four Years Ending June 30, 2023 or December 31, 2023

Submitted: February 19, 2025

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CavMac
Actuarial Consulting Services

February 19, 2025

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 2023. For the Schools, Patrol, and Judges Plans, this is the period July 1, 2019 to June 30, 2023, while for the County and State Cash Balance Plans the period is January 1, 2020 through December 31, 2023. 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 January 1, 2025 and July 1, 2025 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. In particular, we have prepared the assumptions developed in this report in keeping with our understanding of Actuarial Standards of Practice No. 27 (Selection of Assumptions for Measuring Pension Obligations).

In order to prepare the results in this study we have utilized actuarial models that were developed for to measure liabilities and develop actuarial costs. These models include tools that we have produced and tested, along with commercially available valuation software that we have reviewed to confirm the appropriateness and accuracy of the output. In utilizing these models, we develop and use input parameters and assumptions about future contingent events along with recognized actuarial approaches to develop the needed results. Future actuarial results may differ significantly from the results in this report due to factors such as the following: Plan experience differing from that anticipated by the assumptions, changes to economic or demographic assumptions, end of an amortization period or changes to the plan provisions or applicable law.

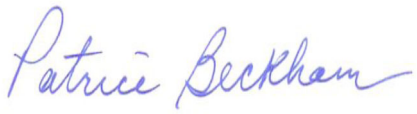
We are available to answer any questions on the material contained in the report, or to provide explanations or further details as may be appropriate. We are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein.

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

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 A. Beckham, FSA, EA, FCA, MAAA
Consulting Actuary

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

SECTION 1 – BOARD SUMMARY

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 align with the actual emerging experience of the plan and to review if there have been any changes in expectations of future plan 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 2023. For the School, Patrol, and Judges plans, this is the period July 1, 2019 to June 30, 2023, while for the County and State plans the period is January 1, 2020 through December 31, 2023. 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 January 1, 2025 and July 1, 2025 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 following:

- 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. We are not recommending a change to any of the current actuarial methods.

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 that occurred in 2020 followed by the rebound in the 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.

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 other economic forecasts, we are recommending the price inflation assumption remain 2.35%.

We are recommending changes to three of the economic assumptions used in the valuation process including:

- Increasing the productivity assumption from 0.50% to 0.60% which results in a general wage growth assumption of 2.95%.
- Lowering the real rate of return from 4.65% to 4.40% which results in the nominal investment return moving from 7.00% to 6.75%.
- Increasing the administrative expense component of the actuarial contribution rate for the Patrol, Judges and County Plans by 0.09%, 0.01% and 0.02% respectively.

The following table summarizes the current and proposed economic assumptions:

	Current Assumptions	Proposed Assumptions
Price Inflation	2.35%	2.35%
Investment Return	7.00%	6.75%
General Wage Growth	2.85%	2.95%
Payroll Growth	2.85%	2.85%
Cost-of-Living Adjustment (Tier 1)	2.00%	2.00%
Cash Balance Interest Credit Rate	6.00%	6.00%

Note: Cost-of-living assumption for other benefit tiers is 1.0% (both current and proposed).

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. 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. It's important to note that actual experience during this study period was impacted by the Covid pandemic. As a result, we are generally more cautious to propose changes to the demographic assumptions based on this experience.

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

- **Mortality**: No change
- **Retirement**: Modifications to the retirement rates for the School Plan, Judges Plan, the State Cash Balance Plan and the County Cash Balance Plan. Note these adjustments were minor.
- **Cash Balance Lump Sum Election:** Increasing the assumption of the percent of account balances paid in a lump sum at retirement from 50% to 55% for State Cash Balance members.
- **Termination of Employment:** Minor adjustments to the assumptions for School (Females) and County Plans.

Given the proposed changes to the investment return assumption, the Board may want to revisit the definition of actuarial equivalence being used to develop the actuarial factors for the five defined benefit plans.

Financial Impact

The financial impact of the recommended assumption changes was estimated by performing additional valuations using the January 1, 2024 or July 1, 2024 valuation data, as appropriate. The cost impact is illustrated in the tables on the following pages, using the recommended set of assumptions, as outlined in this report.

When this set of assumptions is actually used, in the January 1, 2025 or July 1, 2025 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 the underlying changes that occur before those valuation dates. Of particular note, the comparability may be affected by the actual investment return experience during the fiscal year prior to the valuation dates.

SCHOOLS RETIREMENT SYSTEM

	7/1/24 Valuation Baseline	Assumption Changes	Impact
Actuarial Accrued Liability ($M)	16,392	17,028	635
Actuarial Assets ($M)	16,377	16,377	0
Unfunded Actuarial Accrued Liability (UAAL) ($M)	15	650	635
Funded Ratio	99.9%	96.2%	-3.7%
Normal Cost Rate	13.02%	14.14%	1.12%
Administrative Expenses	0.16%	0.16%	0.00%
UAAL Amortization Rate	1.87%	3.45%	1.58%
Total Actuarial Rate	15.05%	17.75%	2.70%
Statutory Contribution Rate	21.66%	21.66%	0.00%
Contribution Shortfall/(Margin)	(6.61%)	(3.91%)	2.70%

Note: Numbers may not add due to rounding.

STATE PATROL RETIREMENT SYSTEM

	7/1/24 Valuation Baseline	Assumption Changes	Impact
Actuarial Accrued Liability ($M)	668.1	692.9	24.8
Actuarial Assets ($M)	568.8	568.8	0.0
Unfunded Actuarial Accrued Liability (UAAL) ($M)	99.3	124.1	24.8
Funded Ratio	85.1%	82.1%	-3.1%
Normal Cost Rate	30.12%	34.18%	4.06%
Administrative Expenses	0.26%	0.35%	0.09%
UAAL Amortization Rate	19.55%	22.83%	3.28%
Total Actuarial Rate	49.93%	57.36%	7.43%
Statutory Contribution Rate	34.00%	34.00%	0.00%
Contribution Shortfall/(Margin)	15.93%	23.36%	7.43%
Additional State Contribution	6.8	10.1	3.3

Note: Numbers may not add due to rounding.

JUDGES RETIREMENT SYSTEM

	7/1/24 Valuation Baseline	Assumption Changes	Impact
Actuarial Accrued Liability ($M)	246.7	252.0	5.3
Actuarial Assets ($M)	251.9	251.9	0.0
Unfunded Actuarial Accrued Liability (UAAL) ($M)	(5.2)	0.1	5.3
Funded Ratio	102.1%	99.9%	-2.2%
Normal Cost Rate	24.25%	25.05%	0.80%
Administrative Expenses	0.31%	0.32%	0.01%
UAAL Amortization Rate	(1.14%)	0.03%	1.17%
Total Actuarial Rate	23.42%	25.40%	1.98%
Member Contribution Rate	8.90%	8.90%	0.00%
Additional State Contribution	0.0	0.0	0.0

Note: Numbers may not add due to rounding.

STATE CASH BALANCE RETIREMENT SYSTEM

	1/1/24 Valuation Baseline	Assumption Changes	Impact
Actuarial Accrued Liability ($M)	2,214.9	2,274.0	59.1
Actuarial Assets ($M)	2,254.2	2,254.2	0.0
Unfunded Actuarial Accrued Liability (UAAL) ($M)	(39.3)	19.8	59.1
Funded Ratio	101.8%	99.1%	-2.7%
Normal Cost Rate	10.77%	11.11%	0.34%
Administrative Expenses	0.21%	0.21%	0.00%
UAAL Amortization Rate	(0.35%)	0.17%	0.52%
Total Actuarial Rate	10.63%	11.49%	0.86%
Statutory Contribution Rate	12.29%	12.29%	0.00%
Contribution Shortfall/(Margin)	(1.66%)	(0.80%)	0.86%

Note: Numbers may not add due to rounding.

COUNTY CASH BALANCE RETIREMENT SYSTEM

	1/1/24 Valuation Baseline	Assumption Changes	Impact
Actuarial Accrued Liability ($M)	751.1	769.1	18.1
Actuarial Assets ($M)	765.7	765.7	0.0
Unfunded Actuarial Accrued Liability (UAAL) ($M)	(14.6)	3.4	18.1
Funded Ratio	102.0%	99.6%	-2.4%
Normal Cost Rate	10.67%	10.94%	0.27%
Administrative Expenses	0.27%	0.29%	0.02%
UAAL Amortization Rate	(0.34%)	0.08%	0.42%
Total Actuarial Rate	10.60%	11.31%	0.71%
Statutory Contribution Rate	11.97%	11.97%	0.00%
Contribution Shortfall/(Margin)	(1.37%)	(0.66%)	0.71%

Note: Numbers may not add due to rounding.

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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 either 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 homeowner 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 in each valuation. 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 level dollar amounts. Legislation passed in the 2021 session changed the amortization period for new bases from 30 years to 25 years. 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.

The Actuarial Standards Board recently released a new version of *Actuarial Standard of Practice Number 4, Measuring Pension Obligations and Determining Pension Plan Costs* which for the first time includes guidance on the selection of an amortization method. It states that the actuary should select an amortization method for each amortization base that is expected to produce payments that fully amortize the amortization base within a reasonable time period or reduce the outstanding balance by a reasonable amount each year. The current version of ASOP 4 suggests the actuary consider the following in determining a reasonable time period or reasonable amortization amount:

a. whether the amortization period is open or closed;
b. Source of the amortization base;
c. anticipated pattern of amortization payments, including the length of time until payments exceed nominal interest on the outstanding balance;
d. whether the base is positive or negative;
e. duration of the actuarial accrued liability;
f. average remaining working lifetime of active members; and
g. funded status of the plan or period to insolvency.

Given the funding policy of the NPERS plans and the goal of funding with fixed contribution rates, an argument can be made for using an amortization period on the longer end of the reasonable range. However, for School, Patrol and Judges the UAAL is amortized as a level percentage of payroll which creates a pattern of contributions that is back-end loaded, i.e., payments are much higher in the latter part of the amortization period. This contribution pattern results in “negative amortization” wherein the dollar amount of the UAAL increases for several years because the dollar amount of the amortization payment is less than the interest on the UAAL. The period of time the plan experiences negative amortization is dependent on the investment return assumption and the payroll growth assumption. The reduction to both of these assumptions over the last few experience studies has helped reduce the number of years of negative amortization

and the resulting growth in the dollar amount of UAAL. With an amortization period of 25 years, the dollar amount of the UAAL is not expected to be lower than the initial amount for 6 years under current actuarial assumptions. Because the State and County plans use level-dollar amortization, they do not experience negative amortization. Each amortization payment includes some portion that reduces the dollar amount of the UAAL.

Given trends in the industry, guidance from the Government Finance Officers Association (GFOA), recent guidance from the Actuarial Standards Board about amortization periods, and the State's desire to fund these plans with fixed contribution rates, **the current amortization period for new bases of 25 years is reasonable.**

Under the layered amortization method, there are other considerations that can create volatility or discontinuity in contribution rates. These can be addressed by combining amortization bases or synchronizing the amortization periods to smooth out the UAAL contribution rate in future years. It is extremely difficult to write these discretionary decisions in statute. As a result, it would be ideal if the Legislature would delegate the authority to the PERB to make decisions on combining, offsetting, or synchronizing existing UAAL amortization bases. We also believe it would be ideal if the PERB had the authority to change the amortization period for future bases. We recommend the Board consider the advantages and disadvantages of such a change and then make a decision about whether to seek legislative change.

SECTION 3 – ECONOMIC ASSUMPTIONS

Economic assumptions include price inflation, general wage increase/wage inflation (the across-the-board portion of salary increases), cost-of-living adjustments, payroll growth, the long-term investment return, interest crediting rate for the Cash Balance Plans, salary increase for individual members, and the cost-of-living adjustment assumptions. Unlike demographic assumptions, economic assumptions do not lend themselves to analysis based solely upon internal historical patterns, because economic assumptions 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 2024 Social Security Trustees Report.
- Future expectations of the Nebraska Investment Council (NIC) and their consultant (Aon Consulting), along with the expectations of other investment consultants (Horizon Actuarial Survey).
- U. S. Department of the Treasury bond rates.
- Forecasts from various sources including the Congressional Budget Office, Federal Reserve Bank and the Survey of Professional Forecasters.
- Assumptions used by other large public retirement systems, based on the Public Fund Survey, published by the National Association of State Retirement Administrators.

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. Actuarial Standard of Practice (ASOP) No. 27, *Selection of Assumptions for Measuring Pension Obligations*, provides actuaries with guidance regarding the selection of 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. Our analysis of the expected rate of return, as well as all 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 all actuarial assumptions – both economic and demographic – 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 for selecting economic assumptions, 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.

ASOP 27 requires the actuary to select a "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 valuations to determine the obligations of the Nebraska retirement systems. In our opinion, the economic assumptions proposed in this report have been developed in accordance with ASOP No. 27.

SECTION 3 – ECONOMIC ASSUMPTIONS

The following table summarizes the current and proposed economic assumptions:

	Current Assumptions	Proposed Assumptions
Price Inflation	2.35%	2.35%
Real Rate of Return	4.65%	4.40%
Investment Return	7.00%	6.75%
Productivity	0.50%	0.60%
General Wage Growth	2.85%	2.95%
Payroll Growth	2.85%	2.85%
Cost-of-Living Adjustment (Tier 1)	2.00%	2.00%
Cash Balance Interest Credit Rate	6.00%	6.00%

Note: Cost-of-living assumption for other benefit tiers is 1.0% (both current and proposed).

PRICE INFLATION

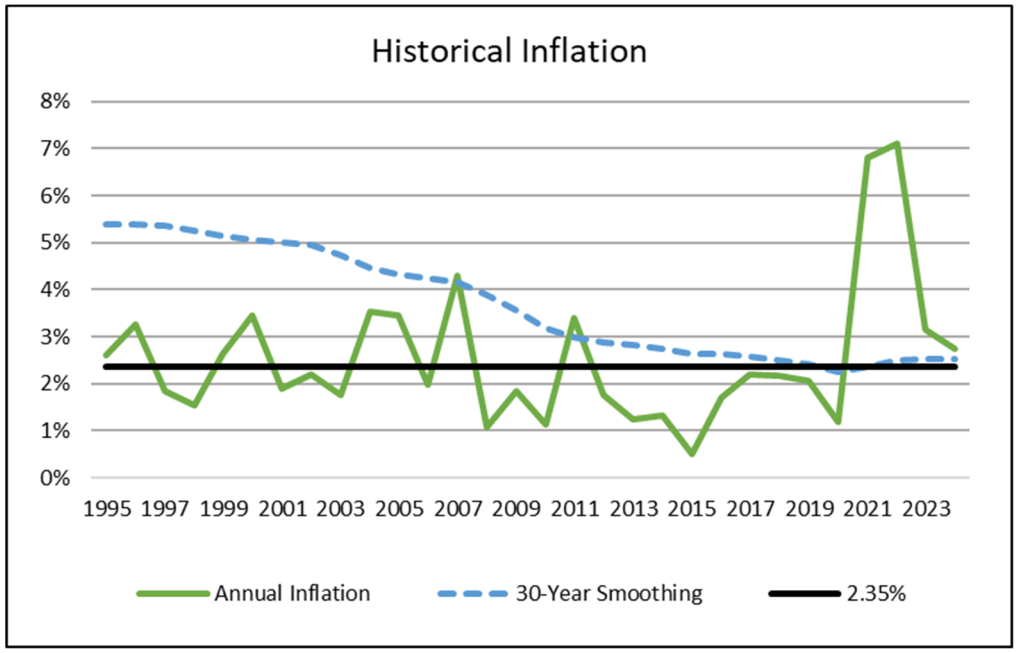
Use in the Valuation: Price inflation is typically measured by the annual increase in the Consumer Price Index (CPI). This assumption underlies most of the other economic assumptions, either directly or indirectly. The current assumption for price inflation, 2.35% per year, was reduced from 2.75% during the last experience study.

Future price inflation is used directly in developing the actuarial assumption for cost-of-living increases since they are based on the change in the Consumer Price Index (CPI). Inflation is used indirectly in the development of the assumptions for investment return, general wage increase, individual salary increases, payroll growth, and the interest crediting rate for the Cash Balance Plans. Under ASOP 27, the price inflation assumption must be consistent among all economic assumptions.

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 June 30, 2024.

Periods Ending June 30, 2024	Annualized Rate of Inflation
Last 10 Years	2.80%
Last 20 Years	2.55%
Last 30 Years	2.54%
Last 40 Years	2.81%
Last 50 Years	3.79%
Last 100 Years	2.96%

The following graph illustrates the historical annual change in price inflation, measured as of December 31, as well as the thirty-year rolling average.



Historical averages are heavily dependent on the period selected. For example, the period of high inflation from 1973 to 1981 has a significant impact on the averages over periods which include these years. Over more recent periods (last 25 years), measured through June 30, 2024, the average annual rate of increase in the CPI-U has been much lower, even after reflecting a spike in inflation during FY 2021 and FY 2022.

Forecasts of Inflation

For our purposes, the assumed inflation rate, and all economic assumptions, should be a forward-looking expectation of future experience. There are several sources to consider that offer expectations for future price inflation although many of these focus on a shorter timeframe than is used for pension funding. These sources are discussed below.

Investment Consultants

Based on Aon's second quarter 2024 capital market assumptions, the ten-year price inflation assumption is 2.2% and the thirty-year assumption is 2.3%. Using the 2024 Horizon Survey, based on data from the 41 consultants included in the survey for the short term (10 years) inflation assumptions, the resulting 25th to 75th percentile range was 2.0% to 2.8%, with a median of 2.4%. For the 26 consultants providing an inflation assumption for a longer period (20-30 years), the range was the same as the short-term inflation assumption. Note that these inflation expectations are consistent with Aon's inflation assumptions.

Bond Market Expectations

Additional information to consider in formulating this assumption is obtained from measuring the spread between the nominal yield on treasury securities (bonds) and the inflation indexed yield on TIPS of the same maturity. This is referred to as the "breakeven rate of inflation" and represents the bond market's expectation of inflation over the period to maturity. As of June 30, 2024, the difference for 30-year bonds implied inflation of 2.28% for the next thirty years. The implied inflation for 20-year bonds is higher at 2.45%. Market prices for treasuries and TIPS can change rapidly to reflect recent macroeconomic events as we have seen in the last few years.

Congressional Budget Office

The report of the Congressional Budget Office, *"The Budget and Economic Outlook: 2024 to 2034"*, reflects CBO's expectations of average annual price inflation of 2.30% for the CPI-U over the next ten years.

Survey of Professional Forecasters

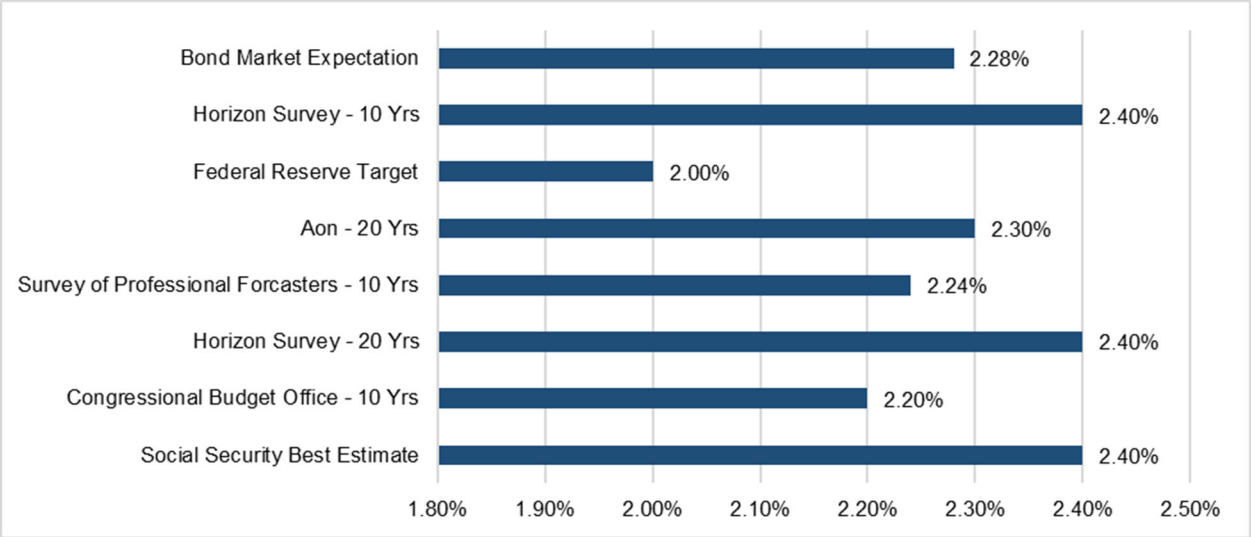
The Philadelphia Federal Reserve Bank conducts a quarterly survey of the Society of Professional Forecasters. Their forecast for the last quarter of 2024 was for inflation over the next ten years to average 2.2%.

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 (May 2024), the projected ultimate average annual increase in the CPI over the next 75 years was estimated to be 2.40%, under the intermediate (best estimate) cost assumption. The range of inflation assumptions used in the Social Security 75-year modeling, which includes low, intermediate and high-cost scenarios was 1.80% to 3.00%.

Comparison of Inflation Expectations

The following graph provides a comparison of the current levels of expected inflation.



Over the past three experience studies, the inflation assumption has been lowered significantly to its current level of 2.35%. Given the various forward-looking expectations for inflation discussed above, we are recommending the **current inflation assumption of 2.35% be retained.**

Consumer Price Inflation	
Current Assumption	2.35%
Recommended Assumption	2.35%

INVESTMENT RETURN

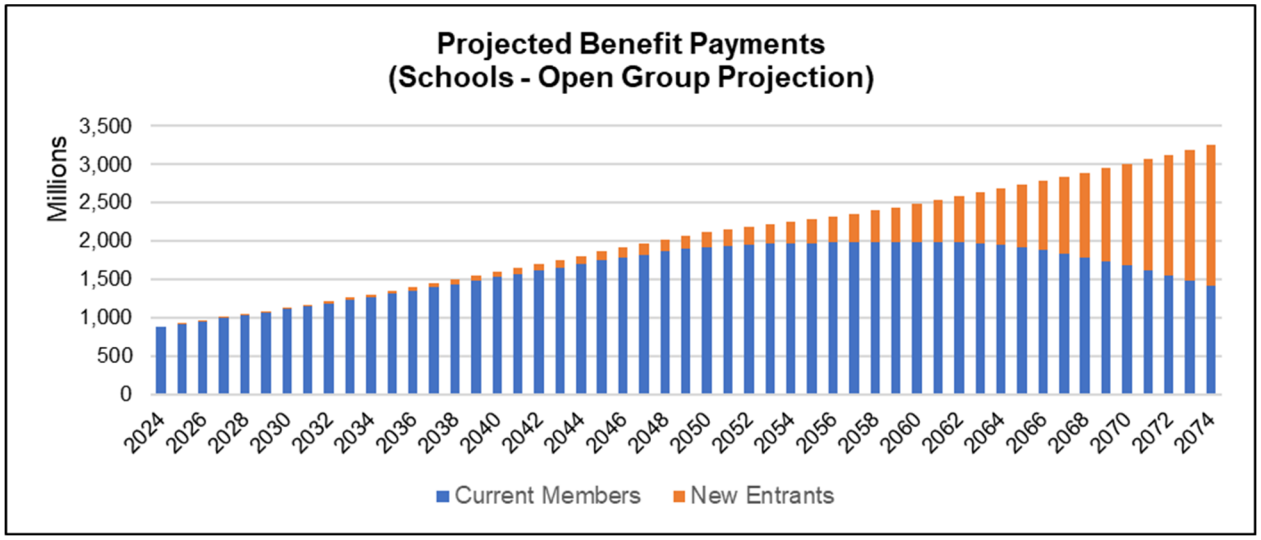
Use in the Valuation: The investment return assumption reflects the anticipated returns on the current and future assets. It is one of the primary determinants in the allocation of the expected cost of the System's benefits, providing a discount of the estimated future benefit payments to reflect the 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. For the State and County Cash Balance Plans, the investment return assumption is also part of the criteria for determining whether a dividend may be granted to members. If the annual interest credit rate (i.e., the Applicable Federal Mid-Term Rate plus 1.5%) exceeds the assumed rate of return, then no dividend may be granted to members.

The current investment return assumption was lowered from 7.50% to 7.00% in the last experience study with the change phased in over four years. The investment return assumption is net of investment-related expenses. This assumption is for the nominal rate of return and is composed of two components. The first component is price inflation (as previously discussed,

this assumption is currently 2.35%). Any excess return over price inflation is referred to as the real rate of return. The current assumption for the real rate of return, which is heavily driven by the system's asset allocation and capital market assumptions, is 4.65%. The investments are pooled for all five plans and based on one asset allocation so use of the same investment return assumption for all five plans is reasonable.

Long Term Perspective

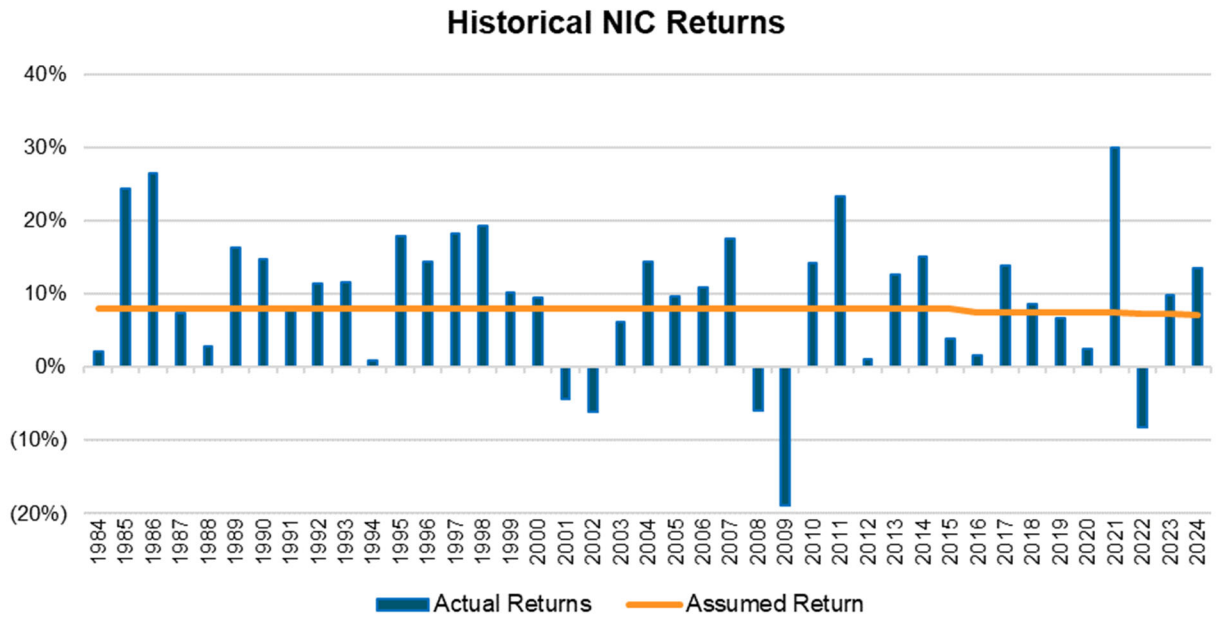
Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon in order to make prudent choices regarding how to invest the trust funds. For actuarial calculations, we typically 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, 2024.



NPERS Historical Returns

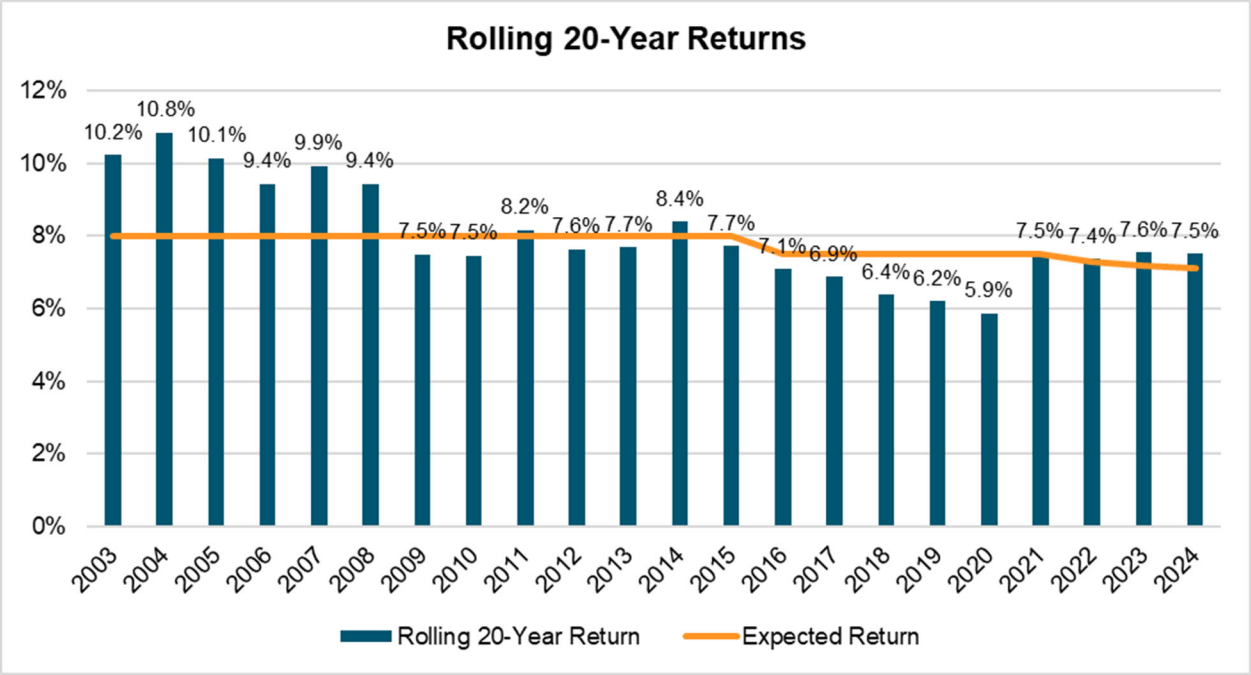
One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the timeframe used, especially if the year-to-year results vary widely. In addition, the asset allocation can also impact the investment returns so comparing results over long 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 (School Retirement System) for the last 41 years ending June 30, 2024.



Annualized Returns Through 6/30/24			
5-Year Return:	8.8%	20-Year Return:	7.5%
10-Year Return:	7.8%	30-Year Return:	8.2%

Another way to analyze historical data is to consider the compound return on the NIC's portfolio over longer periods like 20 years. As the graph below illustrates, 20-year rolling returns have been at or below the assumed rate of return for most years since the Great Recession. This trend has resulted in NPERS – along with many other statewide retirement systems – reducing their expected rate of return during recent experience studies.



Forward Looking Analysis

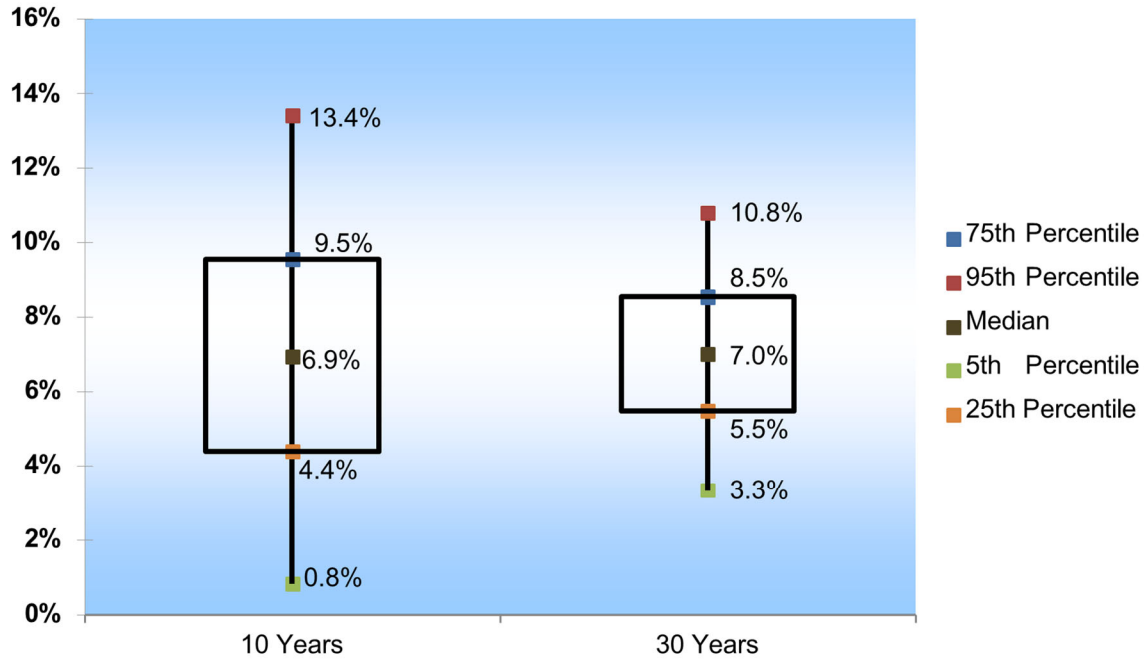
Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon so as to make prudent choices regarding how to invest the trust funds, i.e., asset allocation. For actuarial calculations, we typically consider very long periods of time as some current employees will be receiving benefit payments more than 60 years from now.

We believe the most appropriate analysis to consider in setting the investment return assumption is to model the future expected returns, given the System's target asset allocation and forward-looking capital market assumptions. However, we are trained as actuaries and not as investment professionals. ASOP 27 provides that the actuary may rely on outside experts in setting economic assumptions. NPERS' assets are held and invested by the 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 for us to consider the results of Aon's work as one key factor in assessing expected future returns.

Our forward-looking analysis is based on the current target asset allocation for the system, as shown in the following table:

Asset Class	Long Term Policy Allocation
US Equities	24.0%
Non-US Equities	11.5%
Global Equities	22.0%
RS Fixed Income	10.0%
RR Fixed Income	20.0%
Private Equity	5.0%
Real Estate	7.5%
Total Fund	100.0%

The results in the following graph show the expected range of the compound average nominal returns over time, using Aon's 30-year forecast of capital market assumptions. **It is important to note that Aon's assumptions are as of June 30, 2024.** As the graph indicates, the median nominal return is 7.0%. While the range of potential results is very high over shorter periods, the range narrows considerably over time. Over a 30-year time span, the results indicate there is a 25% chance that returns will be below 5.5% and a 25% chance they will be above 8.5%. In other words, there is a 50% chance the compound return will be between 5.5% and 8.5%. This also means there is about a 50% chance of meeting the current assumed rate of return of 7.0%, based on Aon's assumptions.



Although it is interesting to consider the probability of reaching the nominal expected return, the investment return assumption is developed using the "building block" approach which considers both the price inflation and real return assumption individually. The current nominal assumed rate of return is composed of a price inflation assumption of 2.35% and a real rate of return of 4.65%. In Aon's 2024 capital market assumptions, the inflation assumption was 2.3% over the 30-year period, very close to the current assumption. Coupled with the 7.0% expected nominal return, it implies an expected real rate of return of 4.70%. While the investment consultant's expected return in this experience study is close to the current assumption, this has not always been the case. In the last experience study, Aon's expected return over the next 10 years was 5.7% and over the next 30 years, the expected return was 6.3%. The outlook for investment return tends to vary dramatically with the point in time at which it is measured and the economic conditions at that time. Given our long-term actuarial perspective, it is not uncommon for our recommendation to vary from the investment consultant's expected return over time.

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 (41 were included in the 2024 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 perform our analysis of the expected return using the median return for each asset class in the Horizon Survey as another factor to consider in setting the investment return assumption. The 20-year expected return, using the median capital market assumptions for each asset class, was 6.89%. Median inflation assumption in the Horizon Survey was 2.4%, resulting in an expected real rate of return of 4.49%. The expected real return, using both Aon's and Horizon's capital market assumptions is consistent and close to the current assumption. However, as pointed out earlier there tends to be significant variation in the expected return for the portfolio over time. The Nebraska retirement plans are well funded and are in a position to manage the impact of a lower investment return assumption. We believe it is prudent to lower the investment return assumption, thereby increasing the probability of meeting or exceeding the expected return. In turn, this should reduce the magnitude of future actuarial losses on investment experience and reduce the likelihood of increasing contribution rates.

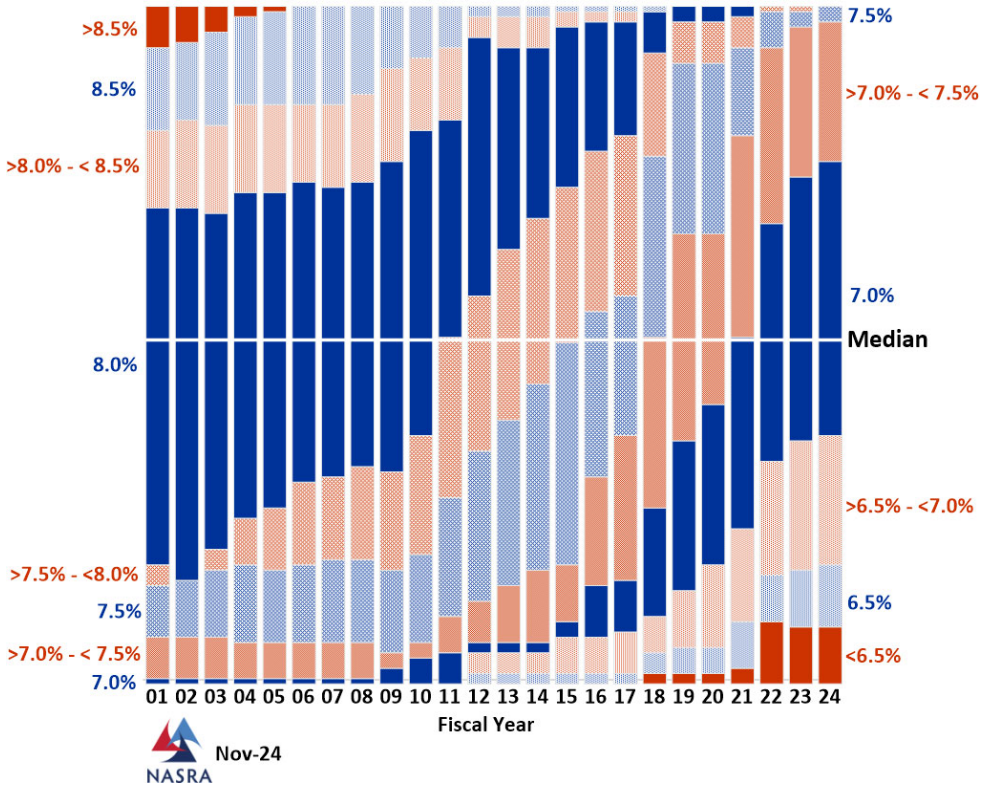
Given the uncertainty of capital market assumptions over a twenty to thirty-year period, we cannot rely too heavily on the current set of assumptions. In addition, most investment consultants update their capital market assumption at least annually, and most commonly each quarter, while an experience study is performed only every four years. Consequently, we are also hesitant to base our assumption solely on the most recent quarterly estimate from the investment consultants because the goal is to have consistency and stability in this assumption as much as possible.

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 and board risk perspective varies from system to system. The following graph shows the change in the distribution of the investment return assumption from fiscal year 2001 through 2024 for the 130+ 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.

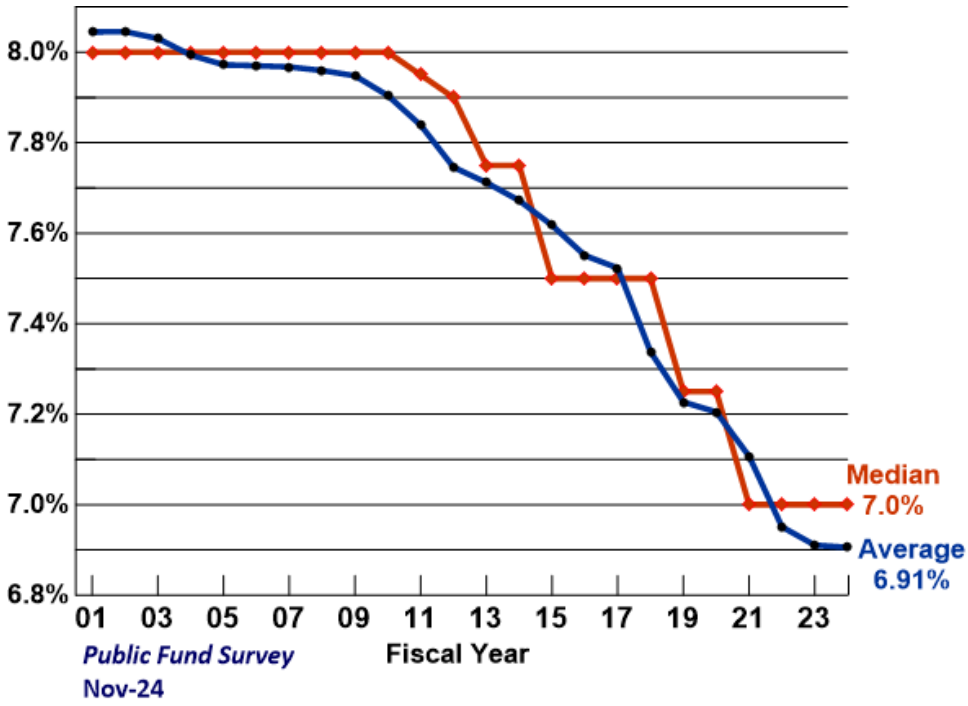
The trends observed in the data are far more valuable than the absolute return data. As the graph below indicates, the investment return assumptions used by public plans have decreased materially since FY 2011.

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



The graph illustrates how the median investment return assumption has declined from 8.0% in the first half of this period to 7.0%. NPERS' asset allocation is less aggressive than the typical public system in the NASRA survey so it is reasonable to expect NPERS' investment return assumption to be below the median in the Survey.

The following graph is based on the same data as the prior graph but shows only the median investment return assumption used by the systems in the Public Fund Survey



We might also note that the average real rate of return in the NASRA Survey is 4.41% compared to NPERS' current real return of 4.65% although asset allocations vary from one system to another, so the value of direct comparisons is somewhat limited.

INVESTMENT AND ADMINISTRATIVE EXPENSES

The NPERS trust fund pays expenses related to the administration of the System in addition to member benefits, so an assumption must be made about such expenses. Investment consulting firms, including Aon, typically issue reports that describe their capital market assumptions, which are net of investment-related expenses. Therefore, no direct adjustment to the expected return is necessary to account for investment-related expenses. Active management strategies are used by NPERS and many other retirement systems with the expectation that they will result in investment returns sufficiently above passive index funds to at least cover the increased investment fees. We have assumed that active management strategies would result in the same returns, net of investment expenses, as passive management strategies.

There is some variance of practice on how administrative expenses are handled in the valuation process. The two most common are:

- A separate component of the actuarial contribution rate.
- An offset or reduction to the assumed rate of return.

For NPERS, an explicit administrative expense charge is added to the normal cost rate as part of the actuarial required contribution rate. This amount is set in the experience study and remains level until it is reevaluated in the next study.

Over the four-year study period, actual expenses varied for each group. The Judges had one year of higher administrative expenses that skewed the four-year average and Patrol had two years of high expenses. In setting this assumption, we ignored the outlier years and based on recommendation on the remaining years of experience with the resulting recommendation:

Plan	Current Admin Rate	Actual Admin Rate	Recommended Admin Rate
School	0.16%	0.16%	0.16%
Patrol	0.26%	0.41%	0.35%
Judges	0.31%	0.36%	0.32%
State	0.21%	0.21%	0.21%
County	0.27%	0.29%	0.29%

Note that actual administrative expenses are directly assessed to each of the Plan trust funds so the recommended approach closely models the actual administrative practice.

Recommendation for Investment Return Assumption:

By actuarial standards we are required to maintain a long-term perspective in setting all assumptions, including the investment return assumption. Given the fluctuation in the expected returns from year to year, as demonstrated by the expected return varying from 6.3% in 2020 to 7.0% in 2024, and the importance of this assumption from a cost perspective, we believe it would be prudent to have some margin for adverse deviation. **Therefore, we recommend the investment return assumption be lowered from 7.00% to 6.75%, based on a 2.35% inflation assumption and a real rate of return of 4.40%.** Based on the Aon's current capital market assumptions, the lower investment return assumption of 6.75% increases the probability of meeting or exceeding the investment return assumption from 50% to 55%. As mentioned previously, lowering the investment return assumption could potentially impact future dividends for State and County members particularly if there is an increase in the Federal Mid-Term Rate.

Investment Return	
Current Assumption	7.00%
Recommended Assumption	6.75%

Furthermore, we recommend the administrative expense for each Plan continue to be included as a separate component of the actuarial required contribution rate.

COST OF LIVING ADJUSTMENTS

The final pay plans provide for an annual COLA based on actual inflation up to a maximum of 2.5% (Tier 1) or 1.0% (Tier 2, 3 and 4). For Tier 1, the current assumption is 2.0% (note the Purchasing Power Floor is not expected to apply for more than 75 years after retirement so no assumption is used to address the potentially higher COLA at that time). The assumption for Tiers 2, 3 and 4 is 1% for all years.

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 1.0%. It also means that most retirees will never reach the Purchasing Power Floor when a higher COLA might apply.

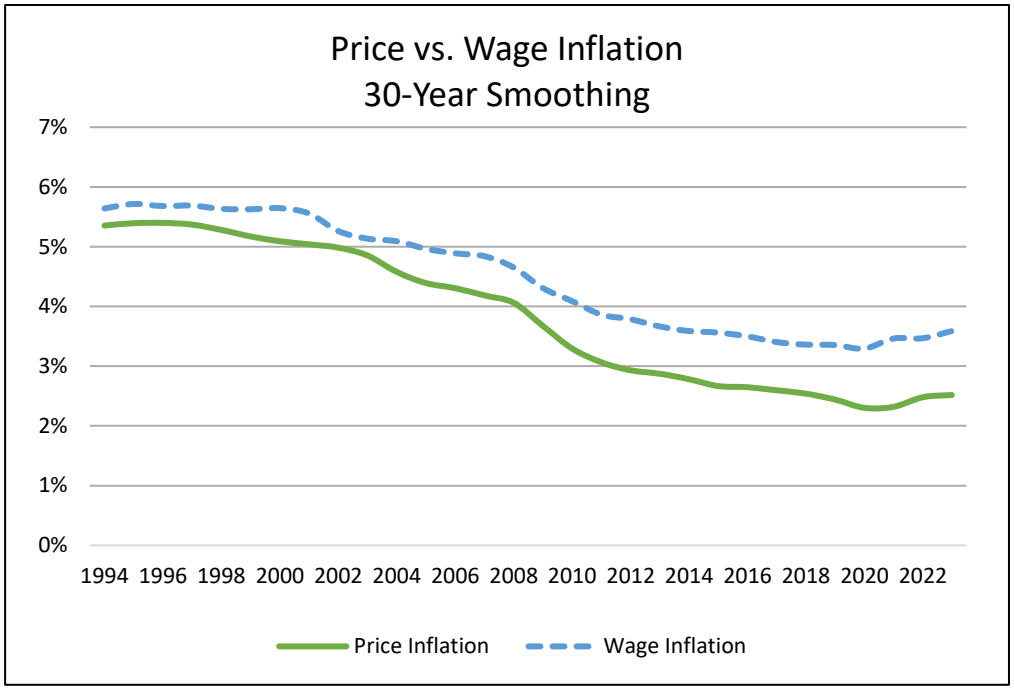
Using the actual COLA plan provisions, we examined the distribution of expected COLA's using the inflation assumption of 2.35% and a 1.00% standard deviation. This choice of standard deviation is intentionally on the low end of typical assumptions for the variability of inflation, but it was selected to provide some conservatism since it results in a higher COLA assumption. The resulting median COLA for Tier 1 members was 2.02%. Based on our analysis, **we recommend that the COLA assumption remain 2.00% for Tier 1 and 1.0% for Tiers 2 and later. The Purchasing Power Floor is not expected to apply for most members, so there is no assumption regarding its application.**

GENERAL WAGE INCREASE (GENERAL WAGE INFLATION)

Background: The general wage increase assumption represents the real wage growth over time in the general economy. Another way to think about this assumption is it anticipates how much the pay scales themselves will change from year to year. It does not necessarily indicate how much the pay increases received by individual members will be (the individual salary increase assumption) or how the total covered payroll may change (the payroll growth assumption).

General wage inflation can be thought of as the "across the board" rate of salary increases and is composed of the price inflation assumption combined with an assumption for the real rate of wage increase. In constructing the individual salary increase assumption, the general wage inflation assumption is further combined with an assumption for service-based salary increases (called a merit scale). The individual salary increase assumption is discussed later in this report. Given the current price inflation assumption of 2.35%, the current wage growth assumption of 2.85% implies an assumed real rate of wage increase or real wage growth assumption of 0.50%.

Historical Perspective: Historically, general wage inflation has nearly always exceeded price inflation, at least over longer periods of time. Since 1951, when the National Average Wage Index from the Social Security System began, wage inflation in the general economy has been around 1.0% higher than price inflation. In the last ten years, general wage inflation has also been about 1.0% higher than price inflation. 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 likely have some impact on NPERS members. In the shorter term, however, the wage growth of NPERS and the nation may be less correlated.



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, 2024 the annual increase in the National Average Wage Index under the intermediate cost assumption (best estimate) was 3.56%, 1.16% higher than the Social Security intermediate inflation assumption of 2.40% per year. The range of the assumed real wage inflation in the 2024 Trustees report was 0.53% to 1.74% per year with an intermediate assumption of 1.14%.

Historical across-the-board increases for State employees were available from calendar year 2003 through 2023. While the increase in some years was less than price inflation, there was some "catch up" in subsequent years where the actual increase granted exceeded price inflation. The average over the 20-year period reflected across the board increases that exceeded price inflation by about 0.56%.

We also looked at the increase in the average salary for School and County members over the last 20 years as a general indication of wage increases. The data for the School group indicated an increase in the average salary of 2.8% over the last 20 years (2003 through 2023). Over the same time period, price inflation was around 2.6% as well, indicating real wage growth over the period of about 0.2% (difference between the increase in average salary and price inflation). There have been more significant salary increases in recent years so it appears there is some catch up going on to compensate for prior increases that were lower than real wage inflation. For County members, the increase in the average salary was 3.8% over the last 20 years which indicates a real wage growth of about 1.2%. The number of active members in the County Plan is still growing as all new employees automatically become members of the Cash Balance Plan. It is likely the change in the composition of the active membership during this time period had an impact on the average salary increase for the group. There were also two years in the data for which the average salary increase was unusually high. Given the relatively short time span of the data and the high volatility of results, the credibility is somewhat limited. Therefore, we relied more heavily on the information observed in the other groups as a general indication of across-the-board wage increases for County employees in Nebraska.

Given the tight labor market and the increased likelihood of higher wage increases to catch up for high inflation post-Covid, it seem prudent to make some adjustment to the general wage increase. Based on data available and our professional judgment, **we recommend that the long-term assumed real wage increase assumption increase modestly from 0.50% to 0.60% per year. When coupled with the price inflation assumption of 2.35%, the resulting recommendation is for the general wage increase assumption to increase from 2.85% to 2.95%.**

PAYROLL GROWTH

The payment on the unfunded actuarial accrued liability is determined as a level percent of payroll for the School, Patrol and Judges. Therefore, those valuations require an assumption regarding future annual increases in covered payroll. The wage inflation assumption is most commonly used for this purpose. The current assumption of 2.85% is the same as the general wage increase/wage inflation assumption.

The current payroll growth assumption also reflects the assumption that there will be no future growth or decline in number of active members. With no assumed change in the size of the 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 or decrease in active membership for funding purposes.

We prefer to keep a small margin for adverse deviation in this assumption so we are recommending the payroll growth assumption, used to amortize the UAAL, remain 2.85%.

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 increase assumption of 2.95% (2.35% inflation and 0.60% real wage growth). Therefore, the merit scale will be added to the 2.95% general wage increase assumption to develop the total individual salary increase assumption.

Analysis of the merit salary scale is complicated by the fact that the 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.

For our first step, we compared individual salary increases using total reported salary for each valuation for all members active in two consecutive periods (e.g. 2020 and 2021, 2021 and 2022 etc.). Because each plan is composed of different types of jobs and possibly different employers, this analysis is performed by plan.

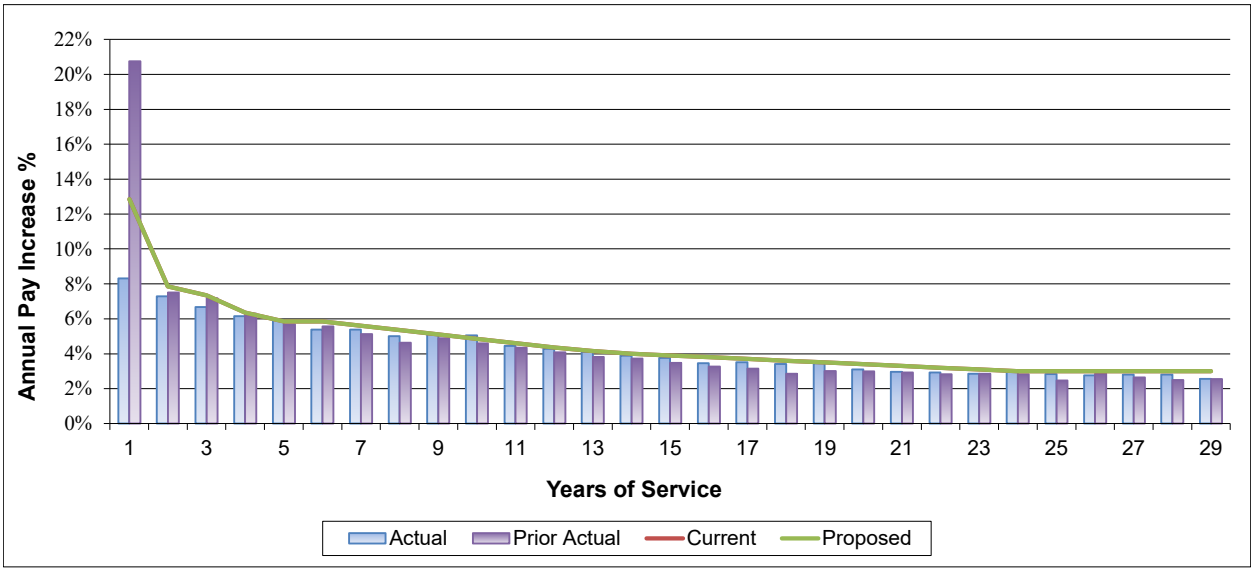
Schools

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

Average Increase in Salaries			
Year	**Actual**	**Expected**	**Difference**
2019-2020	4.01%	5.09%	(1.08%)
2020-2021	4.30%	5.07%	(0.77%)
2021-2022	4.59%	5.05%	(0.46%)
2022-2023	5.32%	5.10%	0.22%
All years	4.57%	5.08%	(0.51%)

In the last experience study, actual salary increases over the study period were 0.88% below expectations (4.28% actual versus 5.16% expected). As a result, we the PERB adopted lower assumed salary increases for members with more than three years of service. In the current experience study, actual salary increases are again lower than expected (4.57% actual versus 5.08% expected). However, much of the difference is attributable to members who one year of service or less. Members who have between 2 and 29 years of service make up the bulk of the Schools active liability and salary increases for this cohort match expectations much more closely (4.49% actual versus 4.70% expected). As shown in the graph below, the current assumption provides a good fit overall for observed experience. **Therefore, we recommend no changes to the individual salary increase assumption for Schools members**.

Total Salary Increases: Schools



Patrol

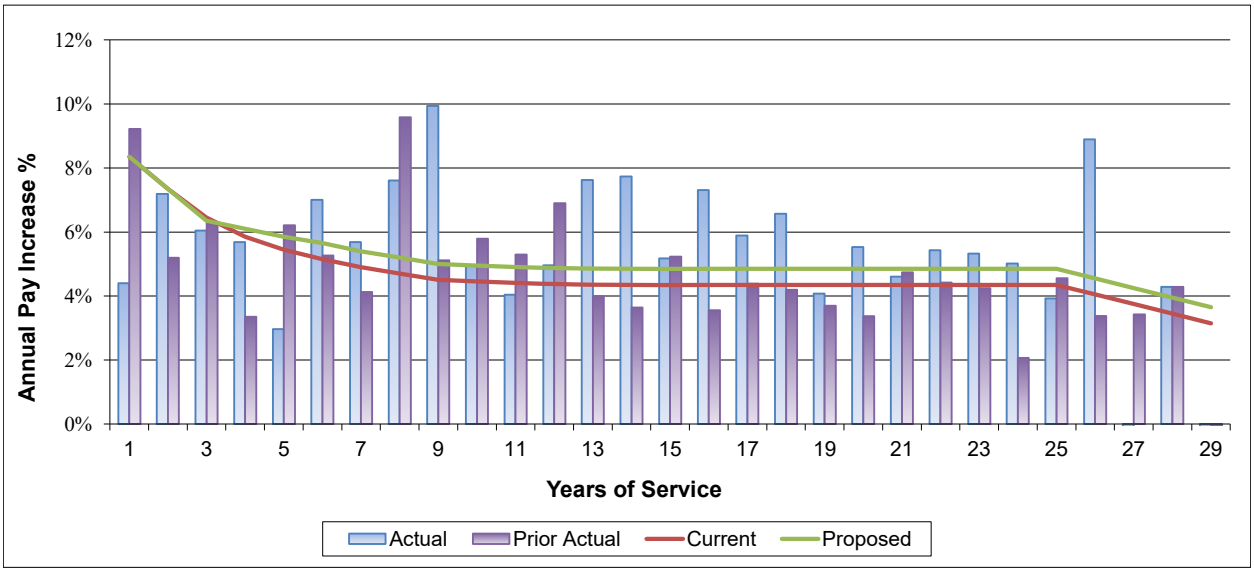
The following table contains a summary of the actual versus expected salary increases for Patrol members during the four-year study period:

Average Increase in Salaries			
Year	**Actual**	**Expected**	**Difference**
2019-2020	5.98%	4.81%	1.17%
2020-2021	5.61%	4.86%	0.75%
2021-2022	5.47%	4.94%	0.53%
2022-2023	26.69%	4.86%	21.83%
All years	11.11%	4.87%	6.24%

The experience study results were heavily impacted by the pay increases in the July 1, 2023 to June 30, 2025 labor contract between the State of Nebraska and the State Law Enforcement Bargaining Council (SLEBC). This comprehensive contract agreement included a 22.1% pay rate increase effective July 1, 2023 and another 5.0% pay rate increase effective July 1, 2024. Because of the magnitude of this increase, the data for the 2022-2023 fiscal year was excluded from our analysis, resulting in an actual salary increase of 5.69% compared to an expected increase of 4.86%.

Actual salary increases were 4.52% in the prior study period and 5.69% in the current study period. We have observed significant wage pressure for law enforcement personnel in recent years. Although it is uncertain whether the wage pressure will continue, we believe it is reasonable to increase the current assumption to anticipate some higher salary increases in the future. **We recommend increasing the salary increase assumption as shown in the graph below**. The recommended changes to the salary increase assumption move the expected increase from 4.86% to 5.29% and lower the A/E ratio from 117% to 108%.

Total Salary Increases: Patrol



Judges

The current salary increase assumption for the Judges plan is the general wage increase assumption of 2.85% plus a small merit component of 0.25% for a total salary increase assumption of 3.10%.

The salary of the Chief Justice and judges of the Supreme Court are set in statute and all other judges receive a percentage of that amount. The actual increase in judicial salaries over the last eleven years (July 1, 2014 through July 1, 2024) was 3.4%. This is close to the increase in the national average wage index indicating actual judicial salary increases are substantially keeping pace with the general economy. Given the importance of this assumption, we prefer to have some degree of conservatism. Therefore, we recommend retaining a small merit component to the individual salary increase assumption for Judges. **As a result, we recommend no changes to the salary increase assumption for Judges.**

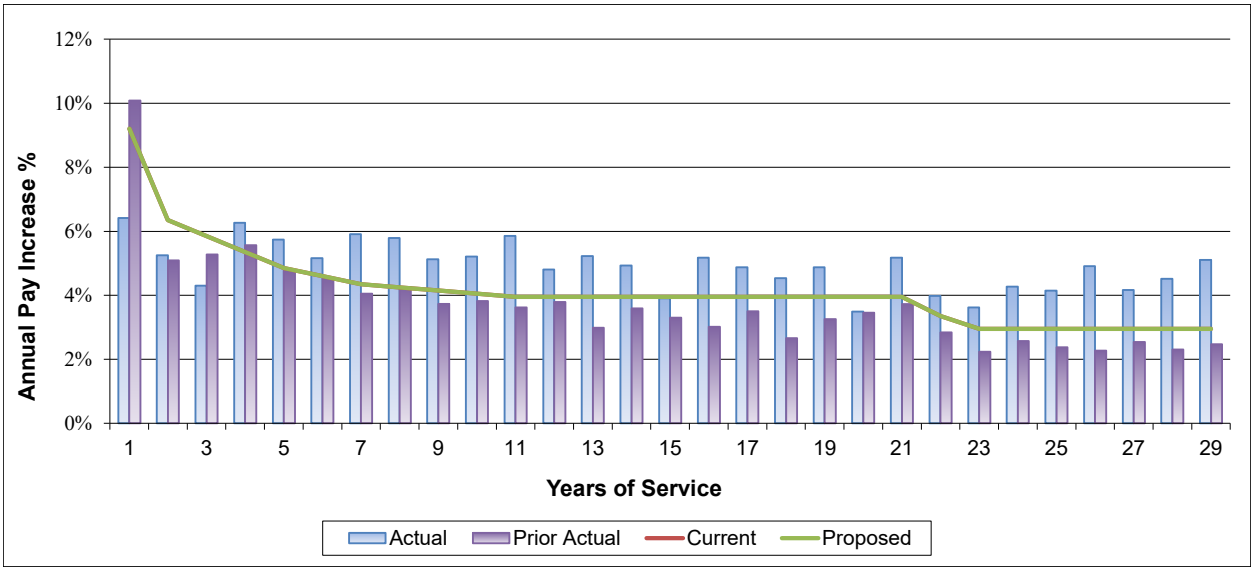
State Cash Balance

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

Average Increase in Salaries			
Year	**Actual**	**Expected**	**Difference**
2020	4.92%	5.43%	(0.51%)
2021	5.97%	5.34%	0.63%
2022	17.38%	5.71%	11.67%
2023	4.92%	5.74%	(0.82%)
All years	7.39%	5.55%	1.84%

The actual salary increases in the current study period were much higher than anticipated by the current assumption, 7.39% versus 5.55% expected. However, when analyzing the experience by year, it was obvious that 2022 was an outlier and should be excluded. Considering on the other three years in the study period, the aggregate salary increase was 5.25% compared to an expected increase of 5.52%. **Therefore, we recommend no change to the current salary increase assumption for the State Cash Balance Plan**.

Total Salary Increases: State



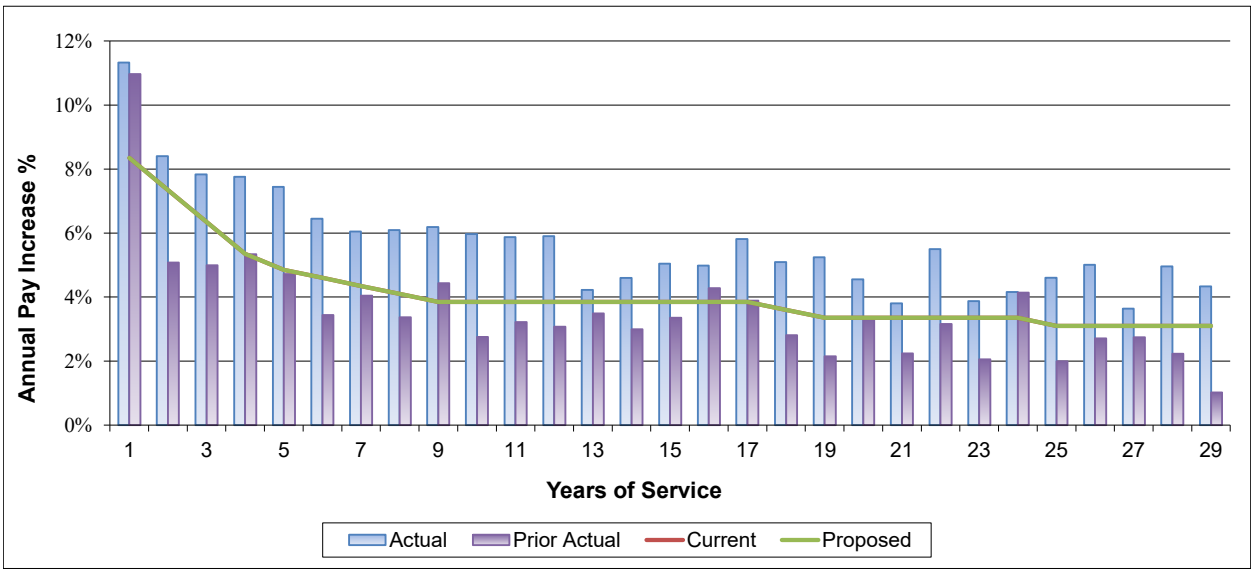
County Cash Balance

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**
2020	5.85%	5.26%	0.59%
2021	5.71%	5.21%	0.50%
2022	8.11%	5.23%	2.88%
2023	10.77%	5.37%	5.40%
All years	7.68%	5.27%	2.41%

In the last experience study, the actual salary increase over the study period was 4.54%. In the current experience study, actual salary increases were much higher than expected, but that was largely the result of an extremely high salary increase in 2022. If we consider the last eight years of experience, it allows for high and low increases to average and the actual increase is around 6.42%. This is still higher than the current assumption of 5.55%. However, given the extremely high salary increases in 2022, as well as the post-Covid economic conditions and the tight labor market, which we expect are temporary, we recommend retaining the current assumption. **Therefore, we recommend no change to the current salary increase assumption for the County Cash Balance Plan**.

Total Salary Increases: County



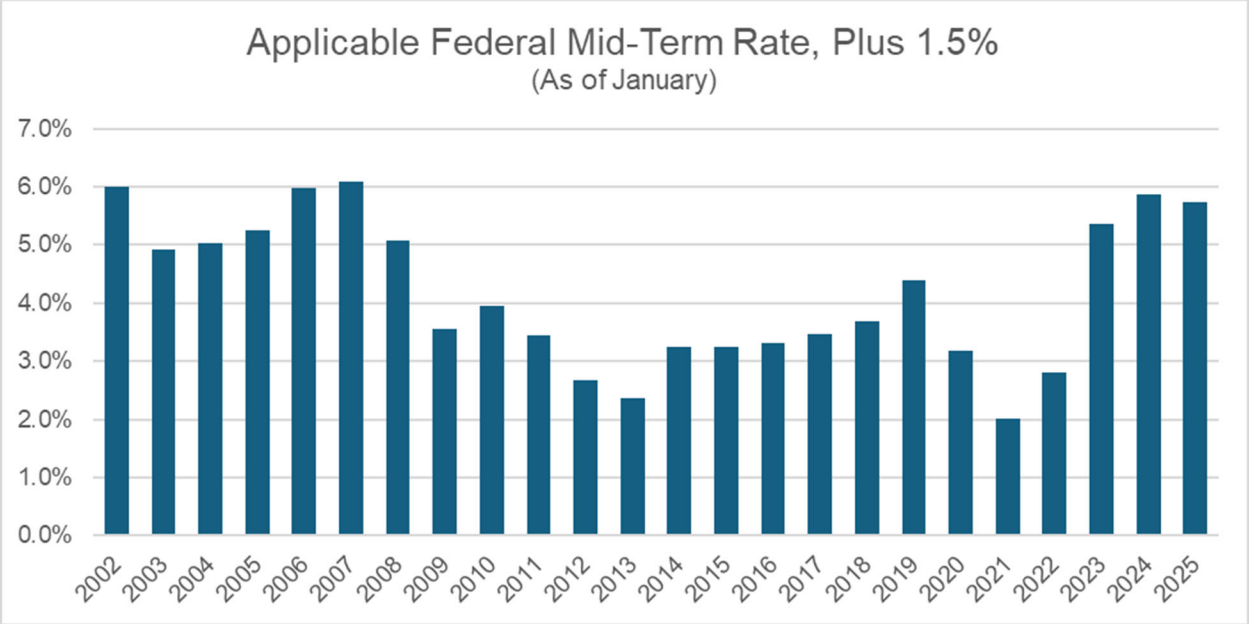
INTEREST CREDITS ON ACCOUNT BALANCES

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 economic conditions.

Cash Balance Interest Credits

The Cash Balance plans credit interest to the member accounts (for both the member and employer credits) and provides for the payment of dividends when certain conditions are met including a fully funded status. This interest crediting rate is set in statute as the greater of (1) 5% and (2) the applicable federal mid-term rate plus 1.5%.

The following graph shows the January applicable federal mid-term rate, plus 1.5%, since 2002. Between 2009 and 2022, the applicable federal mid-term rate has been very low and the 5% interest crediting rate minimum applied. However, since 2022 interest rates have increased and are now much closer to our current assumption. Looking forward, we believe the current assumption is still reasonable. **Therefore, we recommend the current assumption of 6.00% be retained.**



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. The current assumption is 2.50%, which provides for a small degree of conservatism. **We recommend no changes to the current assumption.**

SECTION 4 – DEMOGRAPHIC ASSUMPTIONS

As discussed earlier in this report, Actuarial Standard of Practice No. 27 (ASOP 27) provides guidance to actuaries regarding the selection of actuarial assumptions for measuring pension obligations. The standard states that 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.

When evaluating and selecting demographic assumptions, we consider:

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. We 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. We 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. We 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 and should not be anticipated to produce significant actuarial gains or losses.

ASOP 27 General Considerations and Application

Each individual demographic assumption should satisfy the criteria of ASOP 27. In selecting demographic assumptions, the actuary also considers: 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 27 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 27.

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, 2019 through June 30, 2023, or January 1, 2020 through December 31, 2023) 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.

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 the superior basis for setting 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 greater than stated.

Over the last few generations, rates of mortality have generally been declining, meaning people are 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.

The Society of Actuaries periodically publishes mortality tables derived from large, national studies. In recent years, they have tended to publish families of tables, allowing actuaries to select a table that is based on a subset of data most similar to that of the data the actuary is trying to value. In early 2019, the Society released a set of tables based solely on public plan data. This family of tables, called the Pub-2010 tables, includes tables based not only on the gender and status factors already noted, but also on the type of membership (teachers, public safety, and general government), as well as further breakdowns based on those members who were above or below the median benefit amounts. Because most other recent families of tables had excluded public sector data, the Pub-2010 tables were quite useful for valuing the benefits for public retirement systems like NPERS. A new set of mortality tables, based on public plan data, is expected to be released by the Society of Actuaries later in 2025.

Actuaries sometimes use various adjustments to these standard mortality tables in order to match the observed mortality rates of a specific retirement system. One of the most common adjustments is an age adjustment that can be either a “set back” or a “set forward”. A one-year age set back treats all members as if they were one year younger than they truly are when applying the rates in the mortality table. For example, 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. Another 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 necessary, actuaries may use both methods to develop an appropriate table to model the mortality of the specific plan population.

An important note in the examination of mortality is that there is a tendency for better mortality to be observed in the portion of the population with higher benefits than in the portion with lower benefits. Because the goal of an actuarial valuation is to model the expected benefit payments

to be provided by a system, actuaries will often analyze mortality experience on a benefit-weighted basis rather than simply considering headcounts (number of members dying). This benefit-weighted approach is typically used in the development of standard mortality tables, and so it makes sense to use a consistent basis to evaluate how a mortality table fits the actual experience of a group.

ASOP 27 requires the actuary to make a specific recommendation with respect to future improvements in mortality 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 the impact of Covid on mortality improvements has led to more uncertainty about the degree of improvement and how it might unfold. We believe it is prudent to anticipate that mortality will continue to improve to some degree in the future. Therefore, we believe it is appropriate to reflect some future mortality improvement as part of the mortality assumption.

The current, and our preferred approach, is referred to as generational mortality and it 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 2045 has a longer life expectancy than a member who turns age 65 in 2025. When using generational mortality, the A/E ratios for the observed experience are set near 100% as future mortality improvements will be reflected directly in the actuarial valuation process. NPERS moved to a generational approach for mortality in the 2016 experience study.

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 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. Given the size of the School group, the experience of that group drives any analysis performed on all plans combined.

Some additional discussion of the use of one mortality table is in order. Judges is a group which is expected to have a long-life expectancy so we would expect this group to exhibit mortality at least as good as that of the Schools membership. 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 better than average mortality and, therefore, 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 (plan years beginning in 2019 through 2022).

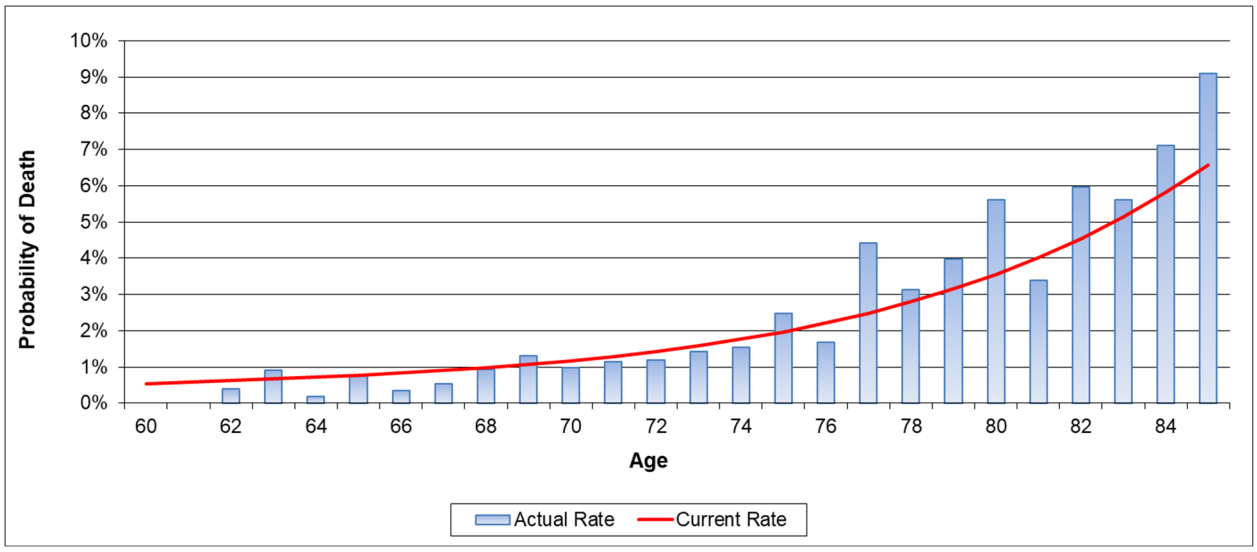
				A/E Ratio	
	Exposure	Actual	Expected	Count	Weighted
Year 1	7,404	168	141	119%	108%
Year 2	7,617	185	148	125%	108%
Year 3	7,776	220	155	142%	116%
Year 4	7,987	209	163	128%	99%
Total	**30,784**	**782**	**607**	**129%**	**107%**

Because the current table is a generational table (with mortality rates reflecting improvement each year), the A/E ratio should be around 100%. Although the A/E ratio on a count basis is well above 100%, the A/E ratio on a benefit-weighted basis is much lower (A/E ratio on count basis is 129% and on benefit-weighted basis is 107%).

Given the size of the group and the fact that Covid experience is included in the study period, A/E ratios above 100% are not unexpected. We prefer to wait until the next experience study before making a change to the mortality assumption. At that time, the new set of mortality tables for public plans will be published, along with an updated mortality improvement scale based on post-Covid mortality experience. The current assumption is reasonable, and we recommend it be retained. Therefore, the mortality assumption for males will remain the **General Members Male Table (Above Median), set back one year (treating a 65-year-old as having the mortality of a 64-year-old) and future mortality improvements modeled using Scale MP-2019.**

The graph of actual versus expected death rates, on a benefit-weighted basis, for ages 60 to 85 is shown on the following page.

Healthy Retiree Mortality - Males



Healthy Retiree Mortality- Females

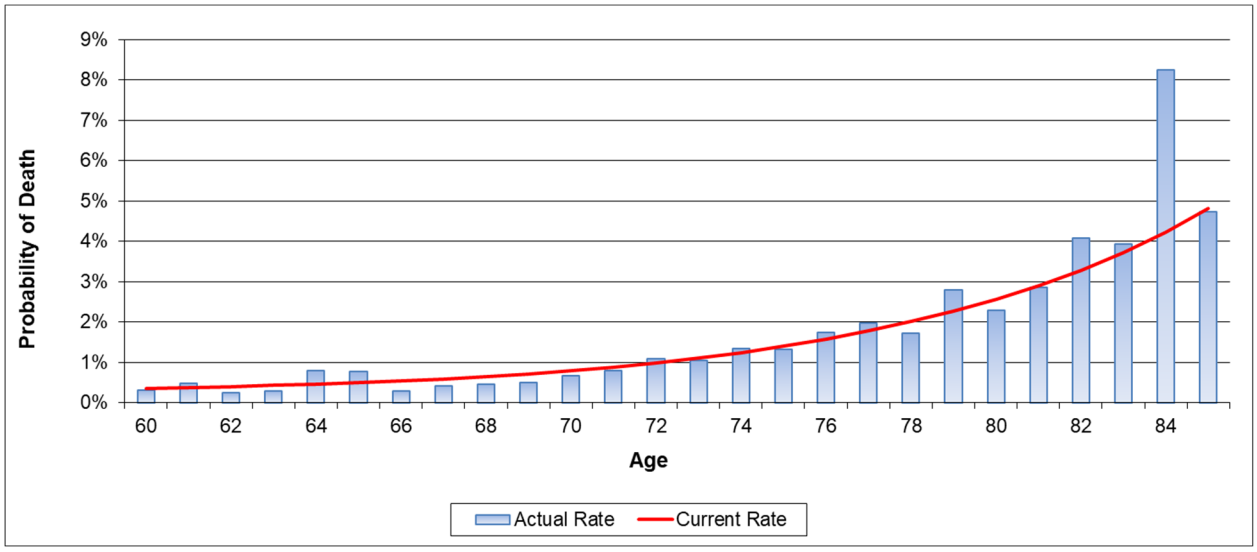
The following chart shows the exposures, actual deaths, and expected deaths for ages 60 to 85, along with the actual to expected ratio under the current assumption for each year in the experience study (plan years beginning in 2019 through 2022).

				A/E Ratio	
	Exposure	Actual	Expected	Count	Weighted
Year 1	16,150	228	202	113%	101%
Year 2	16,850	243	216	113%	113%
Year 3	17,424	279	229	122%	100%
Year 4	18,258	260	242	107%	97%
Total	**68,682**	**1,010**	**888**	**114%**	**102%**

As was the case for male retirees, the benefit-weighted A/E ratio on the current assumption is close to 100% (A/E ratio is 102%), indicating the current assumption is closely anticipating the amount of liability released as the result of the death of retired female members. Therefore, we recommend retaining **the General Members Female Table (Above Median), scaled by 95%, and then set back one year (treating a 65-year-old as having the mortality of a 64-year-old) and future mortality improvements modeled using Scale MP-2019.**

The graph of actual versus expected death rates, on a benefit-weighted basis, for ages 60 to 85 is shown below.

Healthy Retiree Mortality - Females



Healthy Retiree Mortality- Projected Improvement

The actual experience during the study period was a reasonable fit to expected deaths, based on the current mortality improvement scale. Therefore, **we propose retaining the current mortality improvement scale, the MP-2019 scale produced by the SOA, but with 75% of the ultimate improvement rates.**

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. Because we are retaining the current mortality assumption for annuitants, **we recommend also retaining the current mortality assumption for beneficiaries and joint annuitants, the Pub-2010 General Members Table (Above Median) Contingent Survivor mortality rates, with the same adjustments as proposed for retirees.**

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 annuitant mortality table. **Therefore, we recommend the current assumption, the Pub-2010 General Members Disabled Table without generational improvement, continue to be used.**

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 same set of mortality tables used for in-pay members, the Pub-2010 family of mortality tables. The specific assumptions are the **Pub-2010 Above Median General Members Employee Male Mortality Table set back one year and the Pub-2010 Above Median General Members Employee Female Mortality Table set back one year and further adjusted by multiplying by 95% for females (100% for males), respectively**.

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. Additionally, because it is a comparatively rare event, it is difficult to get meaningful analysis without a very large population. Further complicating the analysis is the fact that the way the Cash Balance provisions are administered results in active member deaths that cannot be distinguished from terminations of employment. As a result, our analysis was restricted to School, Patrol and Judges only which reduced the number of exposure and, therefore, the credibility of the results.

It is common practice to use the same set of tables for active mortality as is used for retiree mortality. The Pub-2010 family of tables has both annuitant tables (recommended earlier as the underlying table for retirees) and employee tables.

The following table shows that the proposed assumption provides a reasonable estimate of the observed experience. While the proposed A/E ratios are not as close to 100% as they usually are in setting the retiree mortality assumption, the limited number of observed deaths means that we assign more weight to the retiree assumption. In any case, this assumption has only a very minor impact upon the overall cost of the plan.

			Current Assumption	
Gender	Exposure	Actual	Expected	A/E Ratio
Males	41,332	54	49	110%
Females	125,883	68	79	86%

We recommend retaining the current assumptions, the Pub-2010 Above Median General Members Employee Male Mortality Table set back one-year and the Pub-2010 Above Median General Members Employee Female Mortality Table set back one-year and further adjusted by multiplying by 95% for females (100% for males). Future mortality improvements are based on the Scale MP-2019, as described earlier.

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SECTION 7 – RETIREMENT

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

The Nebraska Schools Plan currently contains four separate "tiers" of benefits. Tier membership is determined by the member's date of participation:

Benefit Tier	Participation Date
One	Prior to 7/1/2013
Two	On/after 7/1/2013 and prior to 7/1/2017
Three	On/after 7/1/2017 and prior to 7/1/2018
Four	On/after 7/1/2018

While there are differences in other aspects of the plan benefits, the retirement eligibility for Tiers One, Two and Three are the same. Members of these Tiers 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 creditable service is at least 85. Early (reduced) retirement is available to members who are at least age 60 with five years of creditable service. Although the retirement criteria for Tier Four School members is different than the other tiers, Tier Four was recently implemented so nearly all the experience during the study period is for Tier One through Three members. It will be many years before any credible retirement experience for Tier Four is available, so those retirement rates reflect an adjustment to the retirement rates for Tier 1 through Tier 3 based on differences in retirement eligibility. These adjustments are based on our professional judgment.

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 amount of the accrued benefit is reduced by an early retirement factor to reflect the longer expected 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 from age 55 to 79 during the study period for retirement is shown in the following table:

Retirement Experience (Tiers 1-3)					
				A/E Ratio	
	Exposures	Actual	Expected	Count	Weighted
Early retirement	8,486	365	651	56%	70%
Unreduced retirement	20,949	4,240	5,242	81%	111%

A more detailed discussion of our findings is included below.

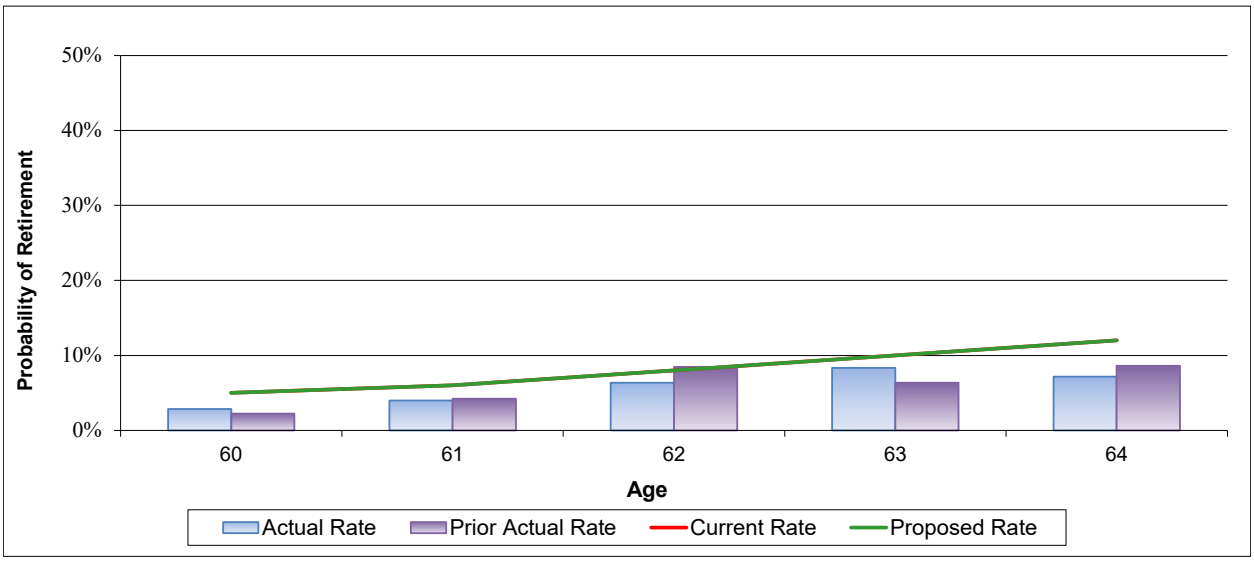
Early Retirement

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, 2019 to June 30, 2020	2,101	64	160	40%	48%
July 1, 2020 to June 30, 2021	2,160	86	165	52%	62%
July 1, 2021 to June 30, 2022	2,150	109	165	66%	84%
July 1, 2022 to June 30, 2023	2,075	106	161	66%	84%
Total	**8,486**	**365**	**651**	**56%**	**70%**

Overall, there were fewer early retirements than expected in the current study period (A/E ratio of 70% on a liability-weighted basis). In the last study period, the early retirement assumption was lowered with a resulting A/E ratio of 72%. Given the reduction in the early retirement rates in the prior study period, a relatively small number of both actual and expected early retirements, and the Covid pandemic occurring in the current study period, we prefer to be cautious and not make a change at this time. If actual experience is again below the expected in the next study, further reduction in the rates may be appropriate. **We recommend no change to the early retirement rates as shown in the graph below. The A/E ratio is 70% for the current study period.**

Early Retirement: Schools



Unreduced Retirement

The actual experience for unreduced retirement experience in this study period, on a count basis, was also lower than expected, as observed for early retirement. The following table summarizes the retirement experience for unreduced retirement for ages 55 to 79.

Unreduced Retirement Experience

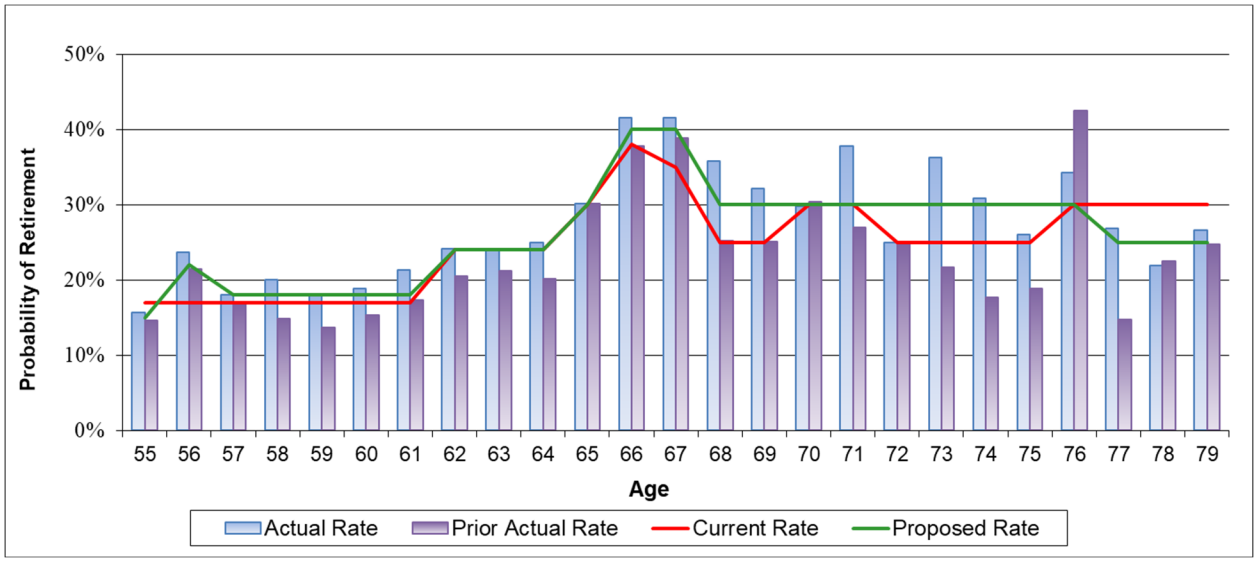
	Exposures	Actual	Expected	A/E Ratio Count	A/E Ratio Weighted
July 1, 2019 to June 30, 2020	5,374	1,050	1,338	78%	104%
July 1, 2020 to June 30, 2021	5,315	902	1,332	68%	87%
July 1, 2021 to June 30, 2022	5,342	1,363	1,339	102%	139%
July 1, 2022 to June 30, 2023	4,918	925	1,234	75%	111%
Total	**20,949**	**4,240**	**5,243**	**81%**	**111%**

As the A/E ratios in the table illustrate, the number of actual retirements was lower than expected in each of the four years in the study period with the exception of fiscal year 2022, with an overall A/E ratio of 81%. However, on a liability-weighted basis, the A/E ratio was over 100% indicating that retirement by members with higher liability was higher than the assumption compared to those with lower liability.

The current assumption, which was adopted in the last experience study and reflected an A/E ratio of 95%, indicated a relatively close match with the actual experience in the last study. Given the potential impact of the Covid-19 pandemic, we wish to be cautious in revising the current assumption, so the recommended assumption was developed considering the experience over

the last two studies. **Using the recommended assumption for unreduced retirement, shown in the following graph for ages 55 through 79 (green line), the A/E ratio is 76% on a count basis and 105% on a liability-weighted basis for the current study period.** While this assumption change does not materially change the A/E ratio (111% down to 105%), it does improve the fit of the assumption to actual experience.

Unreduced Retirement: School



State Patrol

Members of the State Patrol Plan may retire with an unreduced benefit upon meeting any of the following eligibility criteria:

- 30 or more years of service, regardless of age,
- Age 50 with 25 or more years of service, or
- Age 55 with 10 or more years of service.

Early (reduced) retirement is available to members who have at least 10 years of service and are at least age 50. Retirement is mandatory at age 60.

The State Patrol Plan also offers a Deferred Retirement Option Plan (DROP) for Tier 1 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 a "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. An important difference is that the benefit does not receive the annual cost-of-living adjustment during the DROP period. Contributions from both the member and the State cease when a member

enters DROP, so DROP election is generally comparable to retirement by the member (benefit payments commence, and contributions stop) from the Plan's funding perspective. Therefore, the analysis of retirement and DROP election are performed together and one assumption is developed to anticipate the combined experience of both events. Note that this group is more homogeneous and so the A/E ratios on a count basis are not significantly different than those on a liability-weighted basis. As a result, the count basis results are included here for our analysis.

Because Patrol members are typically hired before age 45, early retirement rates effectively only apply to those members who are between the ages of 50 to 55 who have not yet reached 25 years of service. The current assumption for early retirement was reduced from 3.0% to 1.0% at each age in the last experience study. This was based on the observed experience over the last eight years which reflected 2 early retirements out of exposure of 237. Typically, very few members retire under the early retirement provision in retirement systems that cover members of the State Patrol. In the current study period, there were six early retirements with 173 exposure. The resulting AE ratio was 300% (6/2). The small number of occurrences tends to create volatility in the results. It is also possible that the impact of the Covid pandemic and civil strife during part of the study period could have impacted retirement experience. Although the actual experience in this study period is very different from the prior two study periods, **we are recommending the current assumption be retained.** If the retirement patterns in the next study are consistent with those observed in this period, the assumption can be changed at that time.

The next group of individuals studied were eligible for unreduced retirement because they were at least age 55 with 10 years of service but had less than 25 years of service. There were 70 exposures for this group over the four-year study period, and 11 members retired (13 were expected to retire). The resulting AE ratio is 85%. The current assumption for members under age 60 is that 10% of those will retire each year and 100% will retire at the age 60, the mandatory retirement age. The number of exposures for this group is very small so the results in this study period are reasonable. **We recommend the current assumption be retained.** It should be noted that the limited number of exposures means this assumption has a limited cost impact.

Finally, the final assumption used in the valuation is for members who attain 25 years of service and are at least age 50. The benefit formula for State Patrol members is 3.0% times years of service times final average compensation, up to a maximum of 75% of final average compensation. This means that members reach the maximum benefit of 75% once they have 25 years of service. As a result, most members with 25 years of service either retire or enter DROP (if Tier 1) and this pattern has consistently been observed in the past. As discussed earlier, we are considering both retirement and entering DROP together since contributions stop with either occurrence. The current assumption reflects a 100% probability of retirement/DROP at age 50 with at least 25 years of service. During the current study period, there were 51 retirements out of total exposure of 62. Of the 51 retirements, 43 retired/elected DROP in the year of first eligibility and another 4 retired in the next year **Based on our professional judgment and the data available, we recommend the current assumption be retained.**

Judges

Under the Judges Plan, unreduced retirement is available at age 65, regardless of service. Early retirement is available from ages 55 to 64, 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. However, as the table below shows the early retirement provisions are not heavily utilized by the membership.

The following table summarizes the key results during the study period. Note that this is a very small group, so the actual experience has limited credibility.

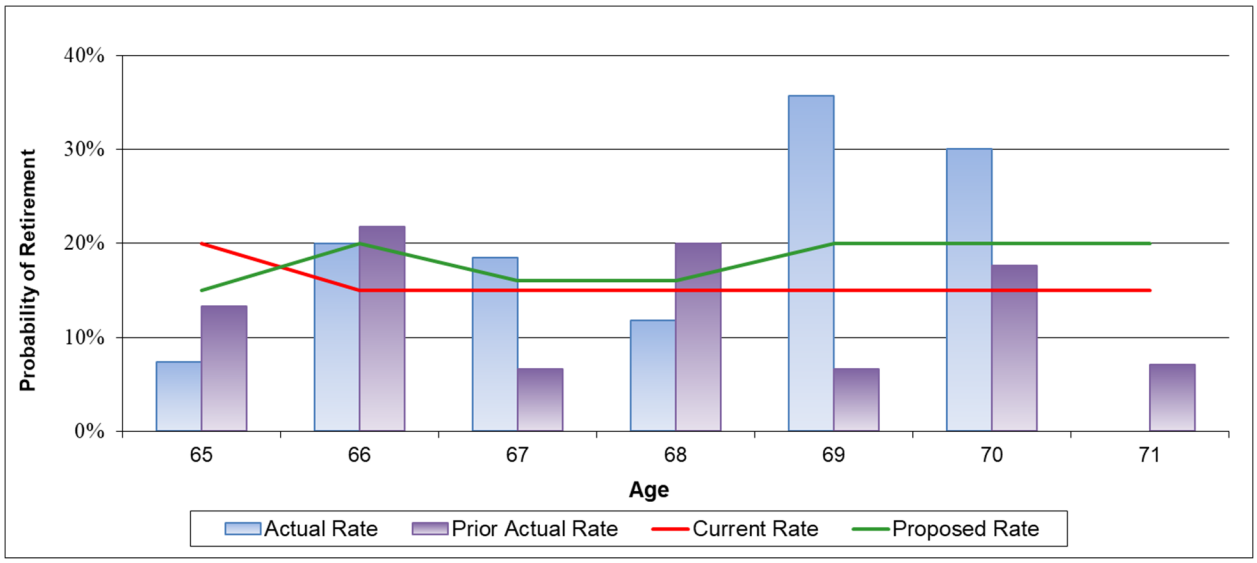
Retirement Experience					
				A/E Ratio	
	Exposures	Actual	Expected	Count	Weighted
Early	196	1	9	11%	18%
Unreduced	137	25	28	89%	94%
Total	**333**	**26**	**37**	**70%**	**81%**

The data above reflects the experience from age 55 to age 72, the age at which all members who are still actively working are assumed to retire (called certain retirement age). The weighted A/E ratio is higher than the count basis, indicating that the members retiring have, on average, more liability that those who do not. Since pay for judges is fairly uniform, this is likely due to judges with more service retiring at higher rates than those with lower years of service.

In the current study period, there was only one retirement by a member below age 65. While there are typically a few retirements before age 65, they typically occur between ages 60 and 64. The retirement rates are already low for ages 55 to 61 (1.5%). **Given the experience over the last two study periods, we recommend the early retirement rates be lowered from 1.5% to 1.0% at ages 55 through 59, from 3.0% to 1.0% at ages 60 to 63, and from 15% to 7% at age 64.**

The following graph shows the actual and expected retirement rates for unreduced retirement benefits at ages 65 through 71 for the current and prior four-year study period:

Normal Retirement: Judges



The A/E ratio using the current assumption for ages 65 to 71 was 121% on a liability-weighted basis, indicating some adjustment to the assumption might be appropriate. **Based on our professional judgment, we are recommending modifying retirement rates as shown in the graph above.** The impact of the proposed changes to the Judges retirement assumption is an A/E ratio of 109%.

State Cash Balance

The State Cash Balance Plan does not have any specific eligibility requirements for retirement, other than being vested. Because of the prevalence of age 55 as the earliest retirement age in the Schools and Judges plans as well as society in general, 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 actuarially equivalent annuity. There is no distinction between early and unreduced retirement since the benefit amount is based on the account balance at the benefit commencement date and the member's age. In other words, the benefit amount automatically adjusts for earlier commencement, i.e., 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 four-year study period (calendar years 2020 through 2023). The number of active members

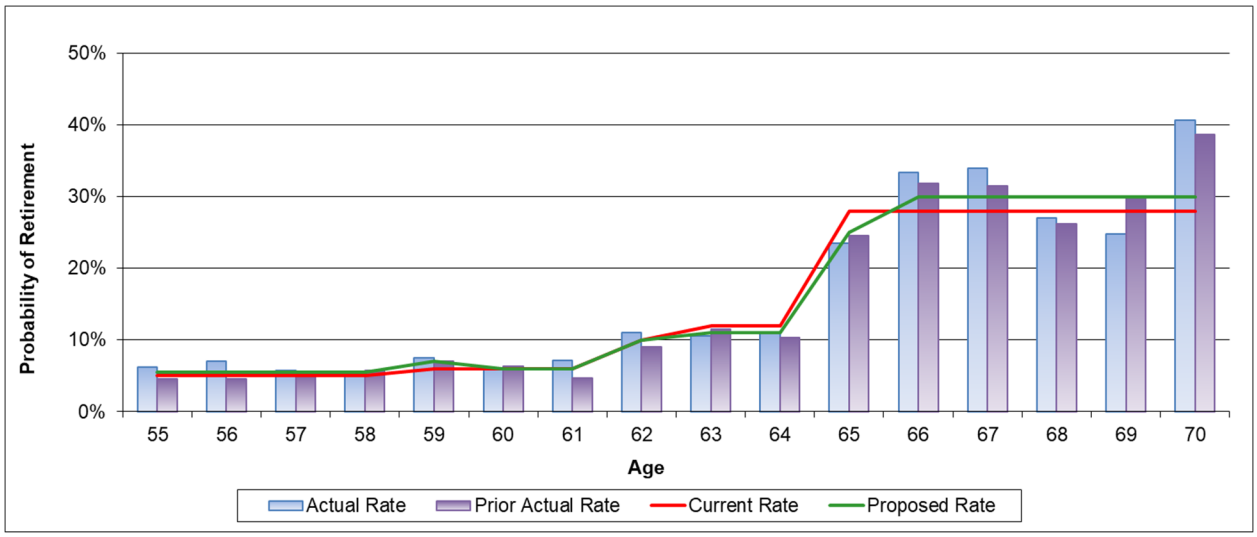
eligible to retire drops significantly after age 70 even though retirement rates continue to apply to age 80. Therefore, the focus of our analysis for the retirement assumption was ages 55 through 70. The detailed information for that age range is supplied in the following table:

Retirement Experience

Calendar Year	Exposures	Actual	Expected	A/E Ratio	
				Count	Weighted
2020	3,849	540	451	120%	104%
2021	3,778	585	446	131%	109%
2022	3,594	548	433	127%	114%
2023	3,585	453	432	105%	96%
Total	**14,806**	**2,126**	**1,762**	**121%**	**106%**

Actual retirement rates were higher than the current assumption at most ages. In the prior experience study, the A/E ratio was 101% on a liability-weighted basis. Given the current study period included years where the Covid pandemic impacted behavior, we prefer to be cautious in recommending any adjustments. Therefore, the proposed assumption only moves the weighted A/E ratio from 106% to 104%, partially recognizing the observed experience in the current study period. **We recommend minor changes to the current assumption, as shown below, recognizing consistent patterns in both the current and prior study.**

Retirement: State



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 at ages 55 through 70 for the four-year study period:

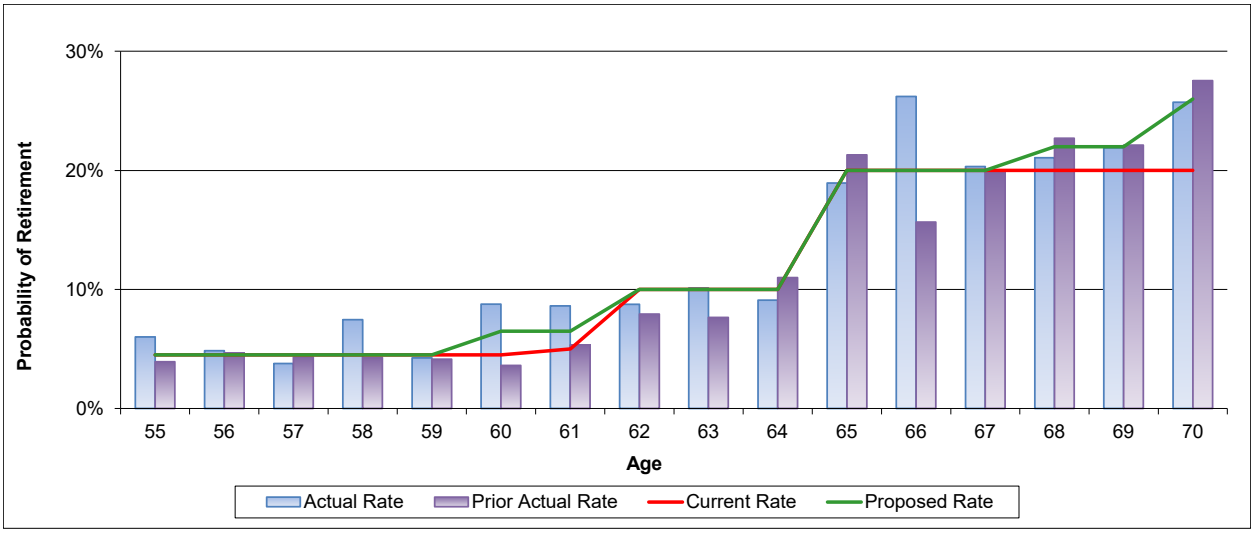
Retirement Experience

				A/E Ratio	
Calendar Year	**Exposures**	**Actual**	**Expected**	**Count**	**Weighted**
2020	2,439	260	245	106%	75%
2021	2,417	294	246	120%	126%
2022	2,343	323	242	133%	124%
2023	2,270	302	232	130%	122%
Total	**9,469**	**1,179**	**965**	**122%**	**112%**

The A/E ratios were above 100% in all years of the current study period on a count basis and above 100% on a liability-weighted basis for three of the four years. The retirement rates were increased at ages 67 to 69 in the prior experience study, based on the liability-weighted results, with a resulting A/E ratio of 98%. We prefer to be cautious in adjusting the retirement rates, given the study period included years of the Covid pandemic as well as the post-pandemic period. **We**

recommend minor changes to the current assumption, as shown below, to partially recognize the actual experience. The resulting A/E ratio, using the proposed assumption, is 106%, reflecting only part of the actual experience in this study period.

Retirement: County



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, an annuity based on the value of the account balance, or a combination of the two. The current assumption for both the State and County Plans is that 50% of the account balances will be paid as a lump sum and 50% will be paid as monthly benefits (annuitized).

As the result of the current interest rate environment, the cost of annuities sold by insurance companies are currently less expensive than in the recent past although still more expensive than the statutory conversion basis (i.e. lower monthly benefit for the same account balance). The election of annuities is partially a function of economic conditions (recent and expected) along with plan design. In addition, as account balances in the two plans increase over time there may be more members electing to receive some portion of the benefit as an annuity.

For purposes of our analysis on a count basis, a member who took any portion of their benefit as an annuity was counted as electing an annuity. The relevant question for actuarial purposes is what percentage of account balances are annuitized versus paid out as lump sums. Therefore, we analyzed the portion of the account values at retirement that were paid as a lump sum versus paid as an annuity in order to evaluate the current assumption. The results are as follows:

Annuitization Rate Experience Proportion Electing Annuity Benefit		
	Count Basis	**Account Balance Weighted**
County	68%	49%
State	72%	62%

In the last experience study, the weighted lump sum election was 50% for the County Cash Balance Plan and 53% for the State Cash Balance Plan. **Based on both the prior and current study period results, we believe the current assumption for the County Cash Balance Plan is reasonable and we recommend retaining it. However, for the State Cash Balance Plan we recommend increasing the percentage of account balances paid as annuities from 50% to 55%.** We will continue to monitor this assumption in anticipation that trends may change as the plans mature and account balances become more substantial.

DEFINITION OF ACTUARIAL EQUIVALENCE FOR FACTORS

Given we are recommending a change to the investment return assumption in this experience study, the Board may want to consider updating the definition of actuarial equivalence for members of the School and Judges Systems hired on or after July 1, 2017. Reflecting the changes now will result in a smaller adjustment to the resulting benefit amounts compared to waiting until a later date when the assumption changes are more significant and reduce the amount of any gains/losses from members electing a different form of payment at retirement. Given the direct implication that changing the definition of actuarial equivalence will have on the benefit amounts for Cash Balance Plan members and the fact that this authority was delegated to the PERB by the Legislature, we do not believe it is appropriate for us to make a specific recommendation, but rather to point out the implications of the options available to the PERB.

Prior to legislation passed in the 2017 Session (LB 415), the definition of “actuarial equivalent” was defined in statute for all five of the retirement systems administered by the Nebraska Public Retirement System (NPERS), as summarized in the following table:

	Interest Rate	Mortality Table	Male/Female Blend
School	8.0%	1994 Group Annuity Table	25%/75%
State Patrol	8.0%	1994 Group Annuity Table	75%/25%
Judges	8.0%	1994 Group Annuity Table	75%/25%
State Cash Balance	Valuation interest rate	1994 Group Annuity Table	50%/50%
County Cash Balance	Valuation interest rate	1994 Group Annuity Table	50%/50%

For the three traditional defined benefit plans (School, State Patrol, and Judges), the definition of actuarial equivalence only affects the amount of benefit received if a member elects to receive payment under an optional form of benefit. The benefit formula (Final Average Salary * Years of Service * Multiplier) determines the amount of the benefit payable under the normal form of payment. For School, for example, the normal form of payment is a five-years certain and life annuity. Optional forms are based on this benefit amount multiplied by an optional form factor.

However, for the State and County Cash Balance Plans, the definition of actuarial equivalent has a more direct impact on all non-lump sum benefit amounts, including the normal form. Regardless of the form of payment elected, the benefit amount in a cash balance plan is calculated by dividing the account balance (a lump sum value) by the appropriate annuity factor. A change in the definition of actuarial equivalence changes the annuity factor and, therefore, the corresponding monthly benefit amount for all forms of monthly income.

Legislative Bill 415 from the 2017 Session changed the actuarial equivalent basis for current and future members of the retirement plans as follows:

	Before LB 415	After LB 415
School and Judges	Set in statute	Set by PERB
State and County	Mortality in statute, interest rate assumption set by PERB	Both interest and mortality assumption set by PERB

Note: For School and Judges the Change Date was July 1, 2017 and for State and County the Change Date was January 1, 2018.

The actuarial equivalent basis that was previously in statute for members of the School and Judges Plans who were hired before July 1, 2017 remains in place. (Patrol members do not have any optional benefit forms and so are not discussed.) However, the PERB now determines the assumptions for actuarial equivalence for optional forms of payment for members hired after June 30, 2017 in the School and Judges Plans. Similarly, the PERB has the authority to determine the actuarial equivalent basis (both mortality and interest rate assumptions) for members of the Cash Balance Plans hired after December 31, 2017. For members of the State and County Cash Balance Plans, the mortality assumption used for actuarial equivalence for members hired prior to January 1, 2018 is protected in statute, but the PERB sets the interest rate assumption for that group.

There are three primary assumptions that create the actuarial equivalent basis for the actuarial factors:

(1) Mortality assumption,
(2) interest rate (investment return assumption),
(3) cost of living adjustment (if the adjustment is variable).

Recommended Mortality Assumption for Actuarial Equivalent Basis

Given we are not recommending a change to the mortality assumption in the valuation, we recommend no change to the mortality assumption used for the definition of actuarial equivalence for Schools and Judges. The current mortality assumptions will be retained:

- Schools: Valuation mortality table, projected to 2040 using NPERS mortality projection scale, with a 30% male/70% female blend.
- Judges: Valuation mortality table, projected to 2040 using NPERS mortality projection scale, with a 75% male/25% female blend.
- Patrol (if needed): Valuation mortality table, projected to 2040 using NPERS mortality projection scale, with a 100% male/0% female blend.
- State: Valuation mortality table, projected to 2040 using NPERS mortality projection scale, with a 55% male/45% female blend.
- County: Valuation mortality table, projected to 2040 using NPERS mortality projection scale, with a 55% male/45% female blend.

COLA Assumption for Actuarial Equivalent Basis

The plan provisions in statute provide for an automatic 1% COLA (not to exceed CPI) for School and Judges members who are hired on or after July 1, 2017, while State and County Cash Balance Plan members receive a COLA only if they elect a form of payment with a COLA. For funding purposes, the full 1% COLA is assumed for the School and Judges Plans. While the Judges Plan has a provision for an additional discretionary COLA when certain funding-related

criteria is met, there is no specific adjustment made to the COLA funding assumption. Therefore, we would not recommend reflecting it in the actuarial equivalence for Judges.

For the Cash Balance Plans, the COLA option selected by the member should be directly reflected in the development of the annuity factor since this is a fixed COLA, not subject to any other considerations.

BENEFIT IMPLICATIONS FOR CASH BALANCE PLANS

Cash Balance Members Hired Before January 1, 2018

Prior to the 2017 legislative session, the account balances for State and County Cash Balance members were converted to monthly benefit amounts using a 50% male/50% female blend of the GAM 1994 Mortality Table with the valuation interest rate (7.75% at that time). Although the investment return assumption has been lowered since 2017, the PERB voted to maintain the 7.75% interest rate for members hired prior to January 1, 2018.

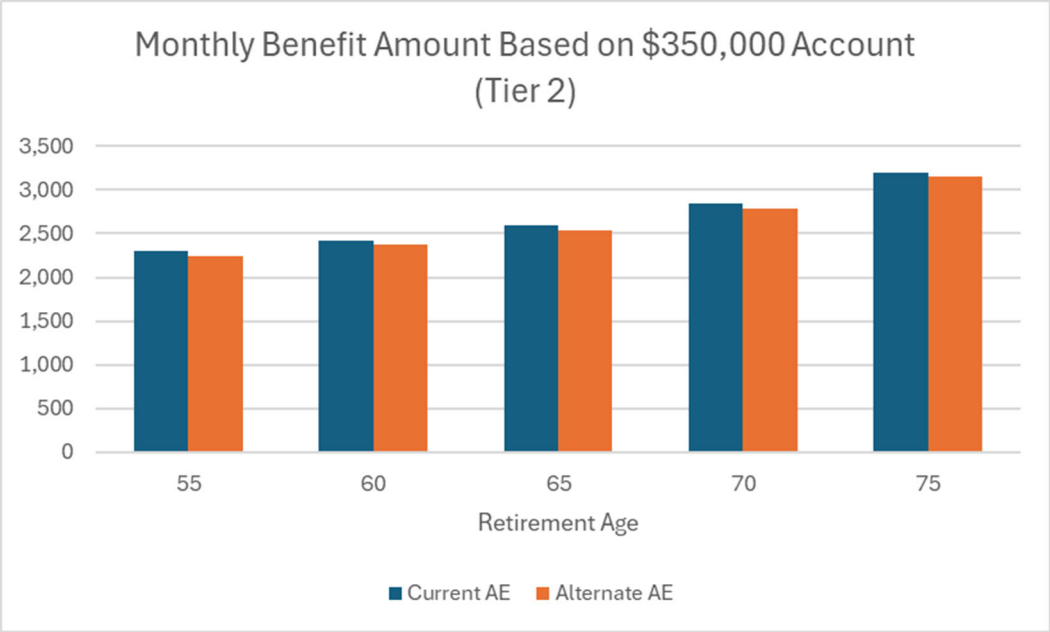
Cash Balance Members Hired After December 31, 2017

The PERB sets both the interest rate and mortality assumption used to define actuarial equivalence for this group. The current actuarial equivalence basis for this group is based on the valuation assumptions, with the necessary adjustment to reflect unisex mortality:

- 7.00% interest and the valuation mortality table, projected to 2040 using NPERS mortality projection scale, with a 55% male/45% female blend.

Setting "actuarial equivalence" based on the valuation assumptions tends to minimize the financial impact of gains or losses arising from members electing a different form of payment than assumed. However, when the definition of actuarial equivalence changes for the Cash Balance Plans it has a direct impact on the amount of monthly benefits received by members so additional discussion for this group is appropriate.

With the proposed decrease in the investment return assumption from 7.00% to 6.75%, the monthly benefit amounts will be lower if the Board adopts the use of valuation assumptions for the definition of actuarial equivalence. The following graphs compare the resulting benefit amounts, based on converting a $350,000 hypothetical account balance to a five years certain and life annuity, at sample retirement ages of 55, 60, 65, 70 and 75, under the current definition of actuarial equivalence and an alternate definition reflecting the lower investment return assumption of 6.75%.



Age:	55	60	65	70	75
Alternate AE	2,248	2,369	2,540	2,789	3,152
Current AE	2,306	2,425	2,595	2,842	3,203
Alternate/Current	97.5%	97.7%	97.9%	98.1%	98.4%

The reduction in benefits range from 1.6% to 2.5% over the age range shown. Given the direct implication that this decision will have on the benefit amounts for plan members, we do not believe it is appropriate for us to make a specific recommendation, but rather to point out the implications of the change to the PERB. While changing to a definition of actuarial equivalence that is consistent with valuation assumptions will lower actuarial liabilities, it will do so by reducing the actual benefits paid to members. This decision has important benefit policy implications for the Cash Balance Plan members which require the PERB to evaluate the situation and make an appropriate decision.

School and Judges: Investment Return (Interest Rate) Assumption for Actuarial Equivalent Basis

For members of the School and Judges Plan who became members on/after July 1, 2017, the PERB may want to consider using an interest rate of 6.75%, consistent with the investment return assumption. For these plans, the optional form factors are calculated by dividing the annuity factor for the normal form of payment by the annuity factor for the optional form of payment. Because the change in the underlying actuarial assumptions impacts both annuity factors, the cost impact is somewhat mitigated. For the key retirement ages of 60 to 70, the new interest rate assumption has very little impact on the optional form factors (<0.5% difference).

State Service Annuity

Based on state statutes, NPERS transfers the actuarial accrued liability to OSERS for members who retire from OSERS and are entitled to a service annuity from the state of Nebraska. Therefore, the valuation assumptions are appropriate for use in this calculation. For this calculation, a mortality assumption and investment return assumption are needed since the member has already retired. We recommend the investment return assumption used in the valuation be used for this purpose. The valuation assumptions use generational mortality which would require a different table each year. To simplify the calculation process and eliminate the need to update factors every year, we recommend the valuation mortality assumptions (gender-specific) be projected to 2045 with the mortality projection scale used in the valuation. This assumption would be used until re-evaluated in the next experience study.

Assumed Commencement Date for Deferred Annuity

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 inactive vested School members, the current assumption is that those who choose the deferred annuity will elect to start benefits at age 64. A review of the actual retirements by terminated vested School members during the study period indicated the average retirement age was 64.5, same as the prior experience study. Given there is an early retirement reduction applied to benefits commencing before age 65 (unless meeting the Rule of 85), the behavior observed is consistent with reasonable expectations. **Therefore, we recommend the current assumed benefit commencement age of 64 for terminated vested School members remain unchanged.**

For Patrol members, it is assumed terminated vested members will commence benefit payments at age 55. For Judges, the assumed benefit commencement age for vested inactive members is age 63. There is insufficient data for both the Patrol and Judges Plans to provide any credible results. However, we believe the current assumption is reasonable, based on our professional judgment, and **we recommend it be maintained.**

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. Therefore, no specific assumption for benefit commencement is necessary in the valuation.

Equal Retirement Benefit Fund (ERBF) Valuations

The current assumption is that 40% of account balances for members subject to the ERBF conversion rules will be paid as monthly income (annuity option). Because of the current interest

rate environment and the associated impact on annuity amounts for members in the Defined Contribution Plan, we believe the current assumption is reasonable. **We recommend maintaining the 40% assumption for the portion of account balances for Cash balance Plan members subject to the ERBF conversion rules.**

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 (which has minor cost implications), while Patrol and Judges have normal payment forms that continue to the spouse upon the member's death (which has a more significant cost impact).

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

Age of Beneficiary

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 School plan, and three years older in the Patrol and Judges plans. There is insufficient data to assess this assumption, particularly for Patrol and Judges, but we did review recent retirees who were covered by a joint and survivor benefit. For the School Plan, males were 1.4 years older, on average, and for the Patrol Plan the age difference was also 1.4 years. For Judges Plan, males were 3.4 years older. **We believe the current assumption is reasonable and recommend that it be retained.**

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SECTION 8 – DISABILITY

Another ancillary benefit the System provides 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 utilize a disability assumption. The occurrence of disability in the Judges Plan is quite rare, and because many judges would be eligible for retirement at the time of disability, the cost to the Plan of a disability would be minor. Therefore, a specific assumption is not used.

The State and County Cash Balance Plans provide a disability benefit that is equal to the termination or retirement benefit (although the taxable nature of the annuity is different). Because the benefit amount does not differ whether the benefit is paid for termination or disability, 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, the occurrence of a disability is included in the termination and retirement 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 liability-weighted results is frequently distorted by lower salaries in the year leading up to a disability as the member typically first uses leave from work to manage medical issues.

Schools

The disability assumption is a sex-specific assumption based on the meaningful differences observed in the data for males and females. The table below indicates the actual and expected disability experience during the current study period and the resulting A/E Ratios.

	Exposure	Actual	Expected	A/E Ratio
Males	37,750	10	15	67%
Females	119,354	20	38	53%
Total	157,104	30	53	57%

The A/E ratio for males in the current study was 67%, consistent with the A/E ratio of 73% in the last study. For females, the A/E ratio in the current study is 53%, consistent with the A/E ratio of 55% in the prior study. However, in the 2016 experience study, the A/E ratios were much higher (113% for males and 87% for females). It is not unusual to observe considerable volatility in the A/E ratios for disability due to the relatively small number of occurrences. For males, the difference in actual and expected disabilities was five members over a four-year period. Even for females the difference in actual and expected counts is about four members per year. Based on our professional judgment and the observed experience in the last two studies, **we recommend the current assumptions be retained.**

Patrol

During the four-year study period, there were three Patrol disabilities compared with five expected. In the prior study, there were three disabilities with five expected. Given the very small numbers involved and the actual experience, we do not see a compelling reason to change the assumption. **We recommend the current assumption be retained.**

SECTION 9 – TERMINATION OF EMPLOYMENT (WITHDRAWAL)

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 service level. 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 termination of employment for reasons other than death, retirement, or disability. Because the types of jobs and employee characteristics vary significantly among 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 and used in the valuation process.

Schools

As mentioned above, gender-distinct termination rates are used for the School Retirement System. The rates are service based, with employees with lower years of service exhibiting higher incidences of termination than the rates for employees with more years of service. A summary of the experience in the current study period for durations 1 through 25 is displayed in the following tables:

Termination Experience - Males

				A/E Ratio	
	Exposures	Actual	Expected	Count	Weighted
July 1, 2019 to June 30, 2020	7,781	533	490	109%	91%
July 1, 2020 to June 30, 2021	7,864	510	500	102%	78%
July 1, 2021 to June 30, 2022	7,896	588	495	119%	109%
July 1, 2022 to June 30, 2023	7,933	646	503	128%	113%
Total	**31,474**	**2,277**	**1,988**	**115%**	**98%**

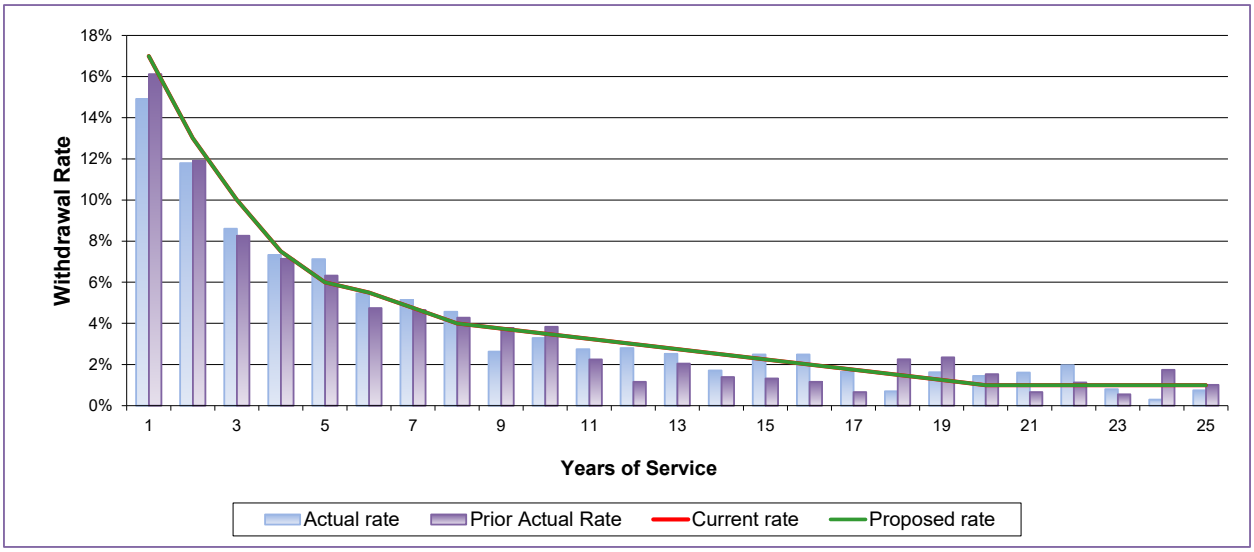
Termination Experience - Females

				A/E Ratio	
	Exposures	Actual	Expected	Count	Weighted
July 1, 2019 to June 30, 2020	25,548	2,162	1,956	111%	79%
July 1, 2020 to June 30, 2021	26,006	2,226	2,003	111%	74%
July 1, 2021 to June 30, 2022	26,003	2,410	1,940	124%	87%
July 1, 2022 to June 30, 2023	26,456	2,834	2,016	141%	113%
Total	**104,013**	**9,632**	**7,915**	**122%**	**89%**

As is evident from the charts, the current assumptions are estimating the liability associated with terminations more closely than the number of terminations. Given that the current assumptions were developed using the liability-weighted experience in the prior study, this result is to be expected. Essentially, the terminations are occurring more often among members with lower salaries relative to higher salaried members. There are undoubtedly multiple factors that might 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 probably proportionately lower than the headcount reduction.

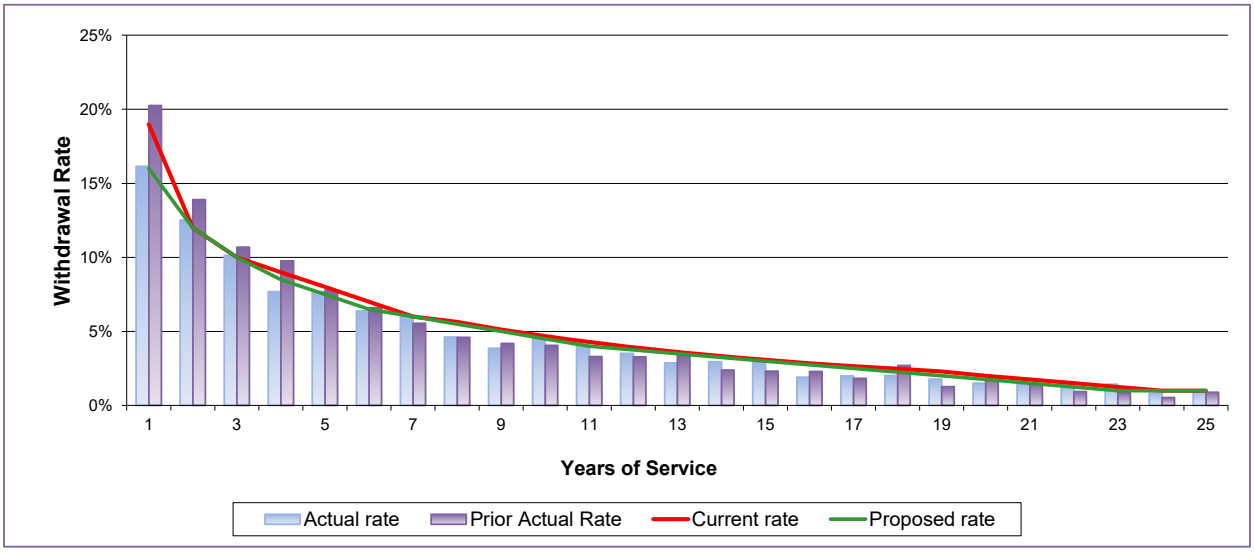
As a result of our analysis, we are proposing no change to the termination rates for males.

Termination of Employment: Schools – Males



For the female rates, the A/E ratio was 92% on a weighted basis in the prior study and 89% in the current study period. **We recommend the current termination assumption for females be modified as shown in the following graph, reflecting partial recognition of the actual experience in the current and prior study periods.** The resulting A/E ratio is 94% using the proposed assumption.

Termination of Employment: Schools - Females



Patrol

Termination of employment in the Patrol plan is very low and termination rates apply only in the first twenty years of employment (the assumption is service based). There were 32 terminations during the current four-year study period compared to 22 expected (resulting in an A/E ratio of 146% on a count basis and 168% on a liability-weighted basis. The number of terminations is higher when compared to the results of the prior study period in which there were 26 terminations compared to 23 expected (A/E ratio of 113% on count basis but 161% on a liability-weighted basis). However, as we noted in the prior study, the high A/E ratio on a liability-weighted basis was skewed due to a few high-service members terminating. As a result, we did not recommend any change to the termination rates at that time. Similarly, the liability-weighted A/E ratio for the current study period is skewed by a relatively small number of members terminating with 14 and 15 years of service. In our experience, public safety workers rarely terminate with so many years of service and we are hesitant to increase termination rates beyond 10 years of service. It is also reasonable to believe that significant pay increases for State Patrol members in recent years will affect termination behavior in the future by encouraging retention.

After taking these relevant factors into consideration, **we recommend the current assumption be retained.** We will continue to closely monitor this behavior in future studies to determine if change is appropriate.

Judges

Termination of employment for judges is a rare event, so no assumption is used in the valuation. During the study period, no terminations were observed. We believe it is reasonable to continue using an assumption that there is no termination of employment.

State Cash Balance

The current assumption used in the valuation of the State Cash Balance Plan is a service-based assumption with the probability of termination varying with the member's years of service. The actual and expected experience in the study period is summarized in the table below:

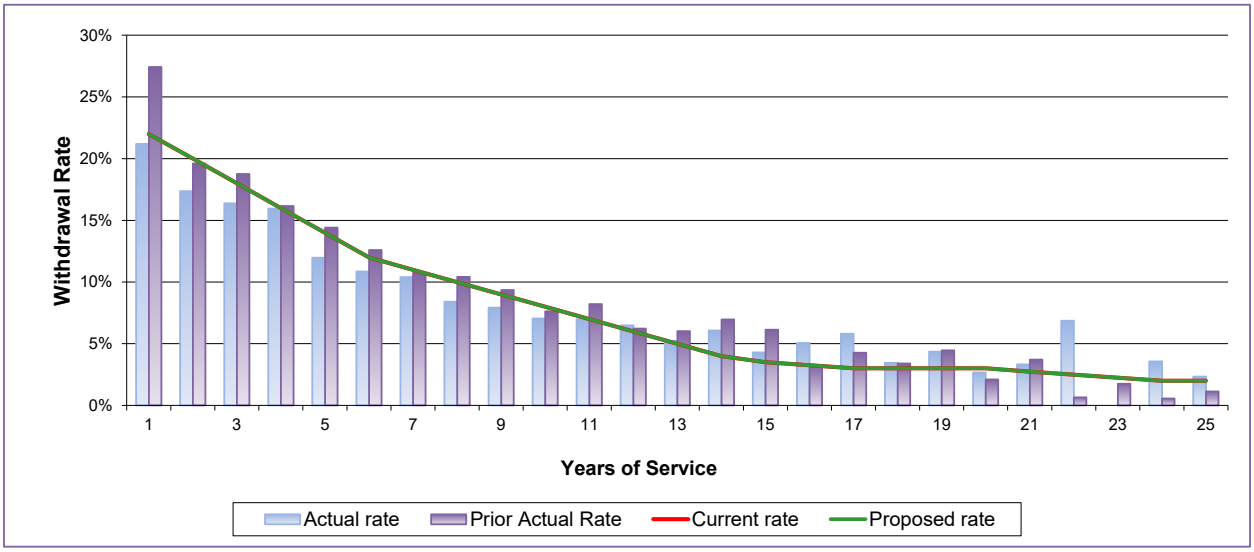
Termination Experience

				A/E Ratio	
Calendar Year	**Exposures**	**Actual**	**Expected**	**Count**	**Weighted**
2020	8,543	1,114	1,194	93%	83%
2021	9,052	1,567	1,265	124%	116%
2022	8,896	1,471	1,210	122%	114%
2023	9,232	1,139	1,277	89%	86%
Total	**35,723**	**5,291**	**4,946**	**107%**	**100%**

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 sex to ensure differences do not unfold over time. As shown in the table above, the A/E ratio on a count basis is 107% under the current assumption and 100% on a liability-weighted basis. **As a result of our analysis, we are proposing no change to the termination rates for State Cash Balance members.**

The results shown in the following graph show the current rates, based on the results of the last two experience studies.

Termination of Employment: State



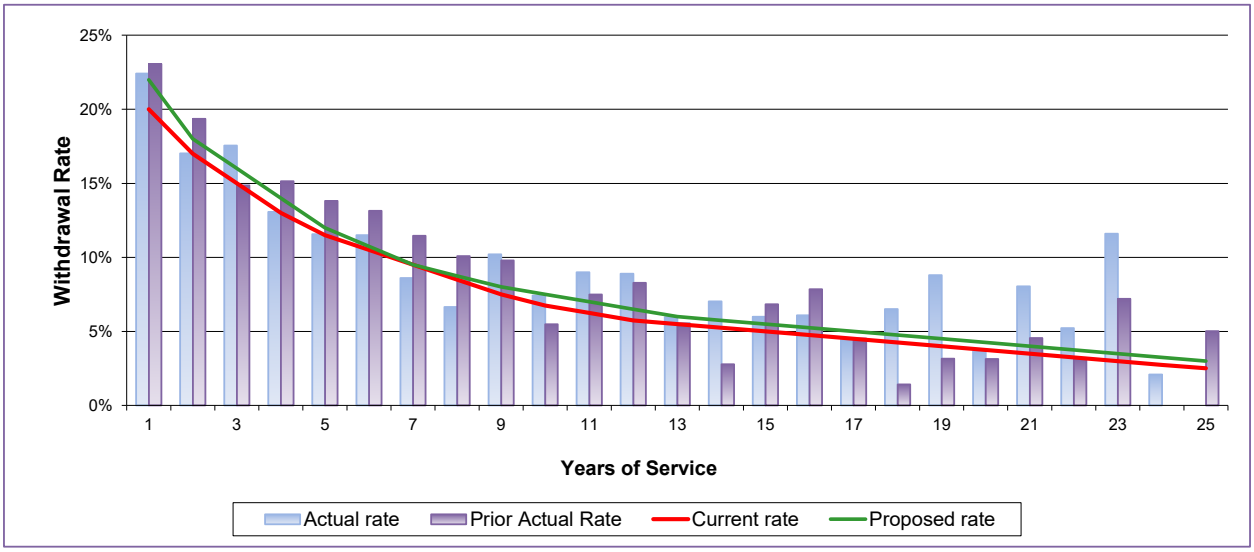
County Cash Balance

The current assumption for the County Cash Balance Plan is a service-based assumption with the probability of termination varying with the member's years of service. The actual and expected experience in the study period is summarized in the table below:

Termination Experience					
				A/E Ratio	
Calendar Year	Exposures	Actual	Expected	Count	Weighted
2020	3,673	503	452	111%	92%
2021	3,781	518	460	112%	101%
2022	3,880	620	466	133%	139%
2023	3,846	580	462	126%	127%
Total	**15,180**	**2,221**	**1,840**	**121%**	**116%**

The A/E ratio on a liability-weighted basis in the current study period was 116%, consistent with the A/E ratio in the prior study using the current assumption which was 114%. In six of the last eight years, the A/E ratio has been well above 100%. Therefore, **we are recommending changes to the current assumption that are intended to partially reflect the higher termination experience in the current and prior study.** The resulting A/E ratio is 113% on a count basis and 108% on a liability-weighted basis. The current and proposed rates are shown in the following graph:

Termination of Employment: County



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 upon termination, 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.**

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. 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.

The unfunded actuarial accrued liability is amortized using the "layered" approach. The unfunded actuarial accrued liability as of July 1, 2006 was the initial or legacy amortization base, amortized over a closed 30-year period. Changes in the unfunded actuarial accrued liability due to assumption changes or actuarial experience gains/losses are amortized over separate 25-year amortization bases, each with their own individual payment schedules, beginning June 30, 2021 and after for School, Patrol and Judges. If the UAAL

is less than or equal to zero, then all prior bases shall be considered fully funded and the UAAL shall be amortized over a 30-year period as of the actuarial valuation date. The UAAL amortization payment schedules are determined using the level percent of payroll methodology, where payments escalate annually with the assumed increase in payroll growth.

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.

   The return to be spread is the difference between (1) the actual investment return on market value of assets and (2) the expected return of actuarial value of assets. Effective July 1, 2000, the expected return on actuarial value of assets includes interest on the previous year's unrecognized return.

APPENDIX A – CURRENT ACTUARIAL ASSUMPTIONS (ALL PLANS)

ECONOMIC ASSUMPTIONS

1. Investment Return	7.00% per annum, compounded annually, net of investment expenses
2. Inflation	2.35% per annum, compounded annually
3. Payroll Growth	2.85% per annum
4. Investment on Employee Contributions	2.50% per annum compounded annually
5. Increase in Compensation And Benefit Limits	2.35% per annum on the 401(a)(17) compensation limit and 415 benefit limit

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

a. Healthy lives - Active members	Pub-2010 General Members (Above Median) Employee Mortality Table (100% of male rates, 95% of female rates), both male and female rates set back one year, projected generationally using MP-2019 modified to 75% of the ultimate rates.
b. Healthy lives – Retired members	Pub-2010 General Members (Above Median) Retiree Mortality Table (100% of male rates, 95% of female rates), both male and female rates set back one year, projected generationally using MP-2019 modified to 75% of the ultimate rates.
c. Healthy lives – Beneficiaries	Pub-2010 General Members (Above Median) Contingent Survivor Mortality Table (100% of male rates, 95% of female rates), both male and female rates set back one year, projected generationally using MP-2019 modified to 75% of the ultimate rates.
d. Disabled lives	Pub-2010 Non-Safety Disabled Retiree Mortality Table (static table).

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

	Pre-retirement Mortality	
	Mortality Rate (Base Rates)	
Sample Age	Males	Females
20	0.04%	0.01%
30	0.04	0.01
40	0.07	0.03
50	0.11	0.06
60	0.27	0.16

	Post-retirement Mortality	
	Mortality Rate (Base Rates)	
Sample Age	Males	Females
50	0.11%	0.06%
60	0.53	0.35
70	1.17	0.80
80	3.60	2.60
90	11.73	9.07

	Projection Scale – Post-retirement Mortality					
Sample	Scale (2020)		Scale (2030)		Scale (2040)	
Age	Males	Females	Males	Females	Males	Females
50	0.0004	0.0030	0.0026	0.0036	0.0075	0.0075
60	0.0004	-0.0041	0.0063	0.0069	0.0075	0.0075
70	0.0017	0.0052	0.0069	0.0063	0.0075	0.0075
80	0.0067	0.0061	0.0066	0.0070	0.0075	0.0075
90	0.0048	0.0032	0.0067	0.0067	0.0069	0.0069

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

Sample Age	Males	Females
30	0.35%	0.26%
40	0.65	0.63
50	1.61	1.48
60	2.50	1.96
70	3.90	2.86
80	7.35	6.01

ECONOMIC ASSUMPTIONS

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

	Rates by Service			
Years	Inflation	Productivity	Merit	Total
1	2.35%	0.50%	10.00%	12.85%
2	2.35	0.50	5.00	7.85
3	2.35	0.50	4.50	7.35
4	2.35	0.50	3.50	6.35
5	2.35	0.50	3.00	5.85
6	2.35	0.50	3.00	5.85
7	2.35	0.50	2.75	5.60
8	2.35	0.50	2.50	5.35
9	2.35	0.50	2.25	5.10
10	2.35	0.50	2.00	4.85
11	2.35	0.50	1.75	4.60
12	2.35	0.50	1.50	4.35
13	2.35	0.50	1.30	4.15
14	2.35	0.50	1.15	4.00
15	2.35	0.50	1.05	3.90
16	2.35	0.50	0.95	3.80
17	2.35	0.50	0.85	3.70
18	2.35	0.50	0.75	3.60
19	2.35	0.50	0.65	3.50
20	2.35	0.50	0.55	3.40
21	2.35	0.50	0.45	3.30
22	2.35	0.50	0.35	3.20
23	2.35	0.50	0.25	3.10
24-39	2.35	0.50	0.15	3.00
40+	2.35	0.50	0.00	2.85

DEMOGRAPHIC ASSUMPTIONS

1. Retirement

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

Retirement Rates When Eligible for Unreduced Benefits	
Age	Rate
<62	17%
62	24
63	24
64	24
65	30
66	38
67	35
68	25
69	25
70	30
71	30
72	25
73	25
74	25
75	25
76	30
77	30
78	30
79	30
80	100

Retirement Rates When Eligible for Reduced Benefits	
Age	Rate
60	5%
61	6
62	8
63	10
64	12

2. Termination

Rates vary by service. Sample rates are as follows:

Rates by Service		
Years	Male	Female
<1	27.5%	31.7%
1	17.0	19.0
5	6.0	8.0
10	3.5	4.7
15	2.3	3.1
20	1.0	2.0
25+	1.0	1.0

3. Disability

Rates vary by age. Sample rates are as follows:

Age	Male	Female
Under 35	0.00%	0.00%
35	0.02	0.01
40	0.02	0.01
45	0.03	0.03
50	0.05	0.04
55	0.07	0.06
60	0.10	0.08

OTHER ASSUMPTIONS

1. Form of Payment

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

Members who terminated vested are assumed to take a refund of contributions if it is more valuable than their deferred benefit.

For members who die with between 5 and 20 years of service before reaching age 65, their surviving spouse is assumed to take the lump sum benefit if it is more valuable than the annuity.

For inactive vested members who die with between 5 and 20 years of service before reaching age 65, their surviving spouse is assumed to take the lump sum benefit.

2. Actuarial Equivalence Basis for Members Hired after July 1, 2017	
a. Interest	7.00%
b. Mortality	Pub-2010 General Members (Above Median) Retiree Mortality Table (100% of male rates, 95% of female rates), both male and female rates set back one year, projected to 2040 using MP-2019 modified to 75% of the ultimate rates using a 30% male, 70% female blend.
3. Marital Status	
a. Percent married	85% married
b. Spouse's age	Females assumed to be two years younger than males.
4. Administrative Expense	0.16% of payroll
5. Commencement Age for Deferred Vested Benefit	Age 64
6. Cost of Living Adjustment	Service annuity – none Formula annuity – 2.00% per annum, compounded annually, for members hired before January 1, 2013. 1.00% per annum, compounded annually, for members hired on or after January 1, 2013.
7. 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.

ECONOMIC ASSUMPTIONS

1. Salary Increase

Rates vary by service. Sample rates are as follows:

	Rates by Service			
Years	Inflation	Productivity	Merit	Total
1	2.35%	0.50%	5.50%	8.35%
2	2.35	0.50	4.50	7.35
3	2.35	0.50	3.60	6.45
4	2.35	0.50	3.00	5.85
5	2.35	0.50	2.60	5.45
6	2.35	0.50	2.30	5.15
7	2.35	0.50	2.05	4.90
8	2.35	0.50	1.85	4.70
9	2.35	0.50	1.65	4.50
10	2.35	0.50	1.60	4.45
11	2.35	0.50	1.56	4.41
12	2.35	0.50	1.53	4.38
13-25	2.35	0.50	1.50	4.35
26	2.35	0.50	1.20	4.05
27	2.35	0.50	0.90	3.75
28	2.35	0.50	0.60	3.45
29	2.35	0.50	0.30	3.15
30	2.35	0.50	0.00	2.85

DEMOGRAPHIC ASSUMPTIONS

1. 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	1% 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

2. 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+	0.00

3. Disability

Rates vary by age. Sample rates are as follows:

Rates by Age	
Age	Rate
25	0.08%
30	0.10
35	0.13
40	0.20
45	0.31
50	0.52
55	0.91
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

0.26% of payroll

5. Commencement Age for Deferred Vested Benefit

Age 55

6. Cost of living adjustments (COLA)

2.00% per annum, compounded annually for Tier 1 members.

1.00% per annum, compounded annually for Tier 2 members.

7. DROP participation for COLA valuation

All members elect the DROP at the earliest possible date and remain in the DROP for 4 years or to age 60, if earlier. No COLA is received during DROP.

8. 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.

APPENDIX A-3 – CURRENT ACTUARIAL ASSUMPTIONS – JUDGES

ECONOMIC ASSUMPTIONS

1. Salary Increases — Salaries are assumed to increase 3.10% each year.

DEMOGRAPHIC ASSUMPTIONS

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

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

2. Termination — None

3. Disability — None

OTHER ASSUMPTIONS

1. Form of Payment — Modified Cash Refund Annuity for members hired prior to July 1, 2004 and not electing the 50% Joint & Survivor Benefit. A 50% Joint & Survivor Benefit for members electing this provision, and new members hired on or 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.

   For members hired on or after July 1, 2017, the Public Employee Retirement Board sets the actuarial assumptions used to determine the benefit amounts payable under optional forms of payment, with guidance from the System's actuary.

2. Actuarial Equivalence Basis for Members Hired after July 1, 2017
   a. Interest — 7.00%
   b. Mortality — Pub-2010 General Members (Above Median) Retiree Mortality Table (100% of male rates, 95% of female rates), both male and female rates set back one year, projected to

	2040 using MP-2019 modified to 75% of the ultimate rates using a 75% male, 25% female blend.
3. Marital Status	
a. Percent married	100% married
b. Spouse's age	Females assumed to be three years younger than males.
4. Administrative Expense	0.31% of payroll
5. Cost of Living Adjustment	2.00% per annum, compounded annually for members hired before July 1, 2015.
	1.00% per annum for members hired on or after July 1, 2015.
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.

ECONOMIC ASSUMPTIONS

1. Interest Crediting Rate on Cash Balance Accounts

   6.00% per annum, compounded annually

2. Annuitization Rate of Member & Employer Accumulated Balances

   The Board has statutory some authority to adopt the mortality tables and the interest rate used in the actuarial basis used for annutization of member balances. A different basis will apply to those hired before January 1, 2018 and after December 31, 2017. For valuation purposes, the most recent basis adopted by the Board will be used.

3. Salary Scale

   Rates vary by service. Rates are as follows:

	Rates by Service			
Years	Inflation	Productivity	Merit	Total
1	2.35%	0.50%	6.35%	9.20%
2	2.35	0.50	3.50	6.35
3	2.35	0.50	3.00	5.85
4	2.35	0.50	2.50	5.35
5	2.35	0.50	2.00	4.85
6	2.35	0.50	1.75	4.60
7	2.35	0.50	1.50	4.35
8	2.35	0.50	1.40	4.25
9	2.35	0.50	1.30	4.15
10	2.35	0.50	1.20	4.05
11-21	2.35	0.50	1.10	3.95
22	2.35	0.50	0.50	3.35
23-29	2.35	0.50	0.10	2.95
30+	2.35	0.50	0.00	2.85

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

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

1994 Group Annuity Mortality Table, with 50% Male, 50% Female blending for members hired before January 1, 2018 (set statutorily)

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

Retiree mortality table, projected to 2040, with 55% Male, 45% Female blending for members hired after January 1, 2018.

Sample Age	Mortality Rate	Life Expectancy (Years)
55	0.27%	32.3
60	0.40	27.7
65	0.58	23.3
70	0.89	19.1
75	1.51	15.1
80	2.71	11.4

2. Retirement

Age	Annual Rates
55-58	5.0%
59-61	6.0
62	10.0
63	12.0
64	12.0
65-79	28.0
80	100.0

3. Termination

Rates vary by service. Rates are as follows:

Service	Rate
<1	30.0%
1	22.0
5	14.0
10	8.0
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. Administrative Expense

0.21% of payroll

3. 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. Interest Crediting Rate on Cash Balance Accounts

6.00% per annum, compounded annually

2. Annuitization Rate of Member & Employer Accumulated Balances

The Board has statutory some authority to adopt the mortality tables and the interest rate used in the actuarial basis used for annuitization of member balances. A different basis will apply to those hired before January 1, 2018 and after December 31, 2017. For valuation purposes, the most recent basis adopted by the Board will be used.

5. Salary Scale

Rates vary by service. Rates are as follows:

	Rates by Service			
Years	Inflation	Productivity	Merit	Total
0	2.35%	0.50%	6.50%	9.35%
1	2.35	0.50	5.50	8.35
2	2.35	0.50	4.50	7.35
3	2.35	0.50	3.50	6.35
4	2.35	0.50	2.50	5.35
5	2.35	0.50	2.00	4.85
6	2.35	0.50	1.75	4.60
7	2.35	0.50	1.50	4.35
8	2.35	0.50	1.25	4.10
9-17	2.35	0.50	1.00	3.85
18	2.35	0.50	0.75	3.60
19-24	2.35	0.50	0.50	3.35
25-35	2.35	0.50	0.25	3.10
36+	2.35	0.50	0.00	2.85

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

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

1994 Group Annuity Mortality Table, with 50% Male, 50% Female blending for members hired before January 1, 2018 (set statutorily)

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

Retiree mortality table, projected to 2040, with 55% Male, 45% Female blending for members hired after January 1, 2018.

Sample Age	Mortality Rate	Life Expectancy (Years)
55	0.27%	32.3
60	0.40	27.7
65	0.58	23.3
70	0.89	19.1
75	1.51	15.1
80	2.71	11.4

2. Retirement

Rates vary by retirement age. Rates are as follows:

Age	Annual Rates
55-60	4.5%
61	5.0%
62-64	10.0%
65-79	20.0%
80	100.0%

3. Termination

Rates vary by service. Rates are as follows:

Service	Rate
<1	25.00%
1	20.00
5	11.50
10	6.75
15	5.00
20	3.75
25	2.50
26+	2.00

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. Administrative Expense

0.27% of payroll

3. Cost of Living Adjustment

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

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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. 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.

The unfunded actuarial accrued liability is amortized using the "layered" approach. The unfunded actuarial accrued liability as of July 1, 2006 was the initial or legacy amortization base, amortized over a closed 30-year period. Changes in the unfunded actuarial accrued liability due to assumption changes or actuarial experience gains/losses are amortized over separate 25-year amortization bases, each with their own individual payment schedules, beginning June 30, 2021 and after for School, Patrol and Judges. If the UAAL

is less than or equal to zero, then all prior bases shall be considered fully funded and the UAAL shall be amortized over a 30-year period as of the actuarial valuation date. The UAAL amortization payment schedules are determined using the level percent of payroll methodology, where payments escalate annually with the assumed increase in payroll growth.

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.

   The return to be spread is the difference between (1) the actual investment return on market value of assets and (2) the expected return of actuarial value of assets. Effective July 1, 2000, the expected return on actuarial value of assets includes interest on the previous year's unrecognized return.

APPENDIX B – PROPOSED ACTUARIAL ASSUMPTIONS (ALL PLANS)

ECONOMIC ASSUMPTIONS

1. Investment Return	6.75% per annum, compounded annually, net of investment expenses
2. Inflation	2.35% per annum, compounded annually
3. Payroll Growth	2.85% per annum
4. Investment on Employee Contributions	2.50% per annum compounded annually
5. Increase in Compensation And Benefit Limits	2.35% per annum on the 401(a)(17) compensation limit and 415 benefit limit

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

a. Healthy lives - Active members	Pub-2010 General Members (Above Median) Employee Mortality Table (100% of male rates, 95% of female rates), both male and female rates set back one year, projected generationally using MP-2019 modified to 75% of the ultimate rates.
b. Healthy lives – Retired members	Pub-2010 General Members (Above Median) Retiree Mortality Table (100% of male rates, 95% of female rates), both male and female rates set back one year, projected generationally using MP-2019 modified to 75% of the ultimate rates.
c. Healthy lives – Beneficiaries	Pub-2010 General Members (Above Median) Contingent Survivor Mortality Table (100% of male rates, 95% of female rates), both male and female rates set back one year, projected generationally using MP-2019 modified to 75% of the ultimate rates.
d. Disabled lives	Pub-2010 Non-Safety Disabled Retiree Mortality Table (static table).

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

	Pre-retirement Mortality	
	Mortality Rate (Base Rates)	
Sample Age	Males	Females
20	0.04%	0.01%
30	0.04	0.01
40	0.07	0.03
50	0.11	0.06
60	0.27	0.16

	Post-retirement Mortality	
	Mortality Rate (Base Rates)	
Sample Age	Males	Females
50	0.11%	0.06%
60	0.53	0.35
70	1.17	0.80
80	3.60	2.60
90	11.73	9.07

	Projection Scale – Post-retirement Mortality					
Sample	Scale (2020)		Scale (2030)		Scale (2040)	
Age	Males	Females	Males	Females	Males	Females
50	0.0004	0.0030	0.0026	0.0036	0.0075	0.0075
60	0.0004	-0.0041	0.0063	0.0069	0.0075	0.0075
70	0.0017	0.0052	0.0069	0.0063	0.0075	0.0075
80	0.0067	0.0061	0.0066	0.0070	0.0075	0.0075
90	0.0048	0.0032	0.0067	0.0067	0.0069	0.0069

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

Sample Age	Males	Females
30	0.35%	0.26%
40	0.65	0.63
50	1.61	1.48
60	2.50	1.96
70	3.90	2.86
80	7.35	6.01

ECONOMIC ASSUMPTIONS

1. Salary Increases

Rates vary by service. Sample rates are as follows:

	Rates by Service			
Years	Inflation	Productivity	Merit	Total
1	2.35%	0.60%	10.00%	12.95%
2	2.35	0.60	5.00	7.95
3	2.35	0.60	4.50	7.45
4	2.35	0.60	3.50	6.45
5	2.35	0.60	3.00	5.95
6	2.35	0.60	3.00	5.95
7	2.35	0.60	2.75	5.70
8	2.35	0.60	2.50	5.45
9	2.35	0.60	2.25	5.20
10	2.35	0.60	2.00	4.95
11	2.35	0.60	1.75	4.70
12	2.35	0.60	1.50	4.45
13	2.35	0.60	1.30	4.25
14	2.35	0.60	1.15	4.10
15	2.35	0.60	1.05	4.00
16	2.35	0.60	0.95	3.90
17	2.35	0.60	0.85	3.80
18	2.35	0.60	0.75	3.70
19	2.35	0.60	0.65	3.60
20	2.35	0.60	0.55	3.50
21	2.35	0.60	0.45	3.40
22	2.35	0.60	0.35	3.30
23	2.35	0.60	0.25	3.20
24-39	2.35	0.60	0.15	3.10
40+	2.35	0.60	0.00	2.95

DEMOGRAPHIC ASSUMPTIONS

1. Retirement

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

Retirement Rates When Eligible for Unreduced Benefits	
Age	Rate
55	15%
56	22
57-61	18
62-64	24
65	30
66-67	40
68-76	30
77-79	25
80	100

Retirement Rates When Eligible for Reduced Benefits	
Age	Rate
60	5%
61	6
62	8
63	10
64	12

2. Termination

Rates vary by service. Sample rates are as follows:

Rates by Service		
Years	Male	Female
<1	27.5%	31.7%
1	17.0	16.0
5	6.0	7.5
10	3.5	4.5
15	2.3	3.0
20	1.0	1.8
25+	1.0	1.0

3. Disability

Rates vary by age. Sample rates are as follows:

Age	Male	Female
Under 35	0.00%	0.00%
35	0.02	0.01
40	0.02	0.01
45	0.03	0.03
50	0.05	0.04
55	0.07	0.06
60	0.10	0.08

OTHER ASSUMPTIONS

1. Form of Payment

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

Members who terminated vested are assumed to take a refund of contributions if it is more valuable than their deferred benefit.

For members who die with between 5 and 20 years of service before reaching age 65, their surviving spouse is assumed to take the lump sum benefit if it is more valuable than the annuity.

For inactive vested members who die with between 5 and 20 years of service before reaching age 65, their surviving spouse is assumed to take the lump sum benefit.

2. Actuarial Equivalence Basis for Members Hired after July 1, 2017
   a. Interest
   b. Mortality

6.75%
Pub-2010 General Members (Above Median) Retiree Mortality Table (100% of male rates, 95% of female rates), both male and female rates set back one year, projected to 2040 using MP-2019 modified to 75% of the ultimate rates using a 30% male, 70% female blend.

3. Marital Status
   a. Percent married
   b. Spouse's age

85% married
Females assumed to be two years younger than males.

4. Administrative Expense	0.16% of payroll
5. Commencement Age for Deferred Vested Benefit	Age 64
6. Cost of Living Adjustment	Service annuity – none Formula annuity – 2.00% per annum, compounded annually, for members hired before January 1, 2013. 1.00% per annum, compounded annually, for members hired on or after January 1, 2013.
7. 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.

ECONOMIC ASSUMPTIONS

1. Salary Increase

Rates vary by service. Sample rates are as follows:

	Rates by Service			
Years	Inflation	Productivity	Merit	Total
1	2.35%	0.60%	5.50%	8.45%
2	2.35	0.60	4.50	7.45
3	2.35	0.60	3.50	6.45
4	2.35	0.60	3.25	6.20
5	2.35	0.60	3.00	5.95
6	2.35	0.60	2.80	5.75
7	2.35	0.60	2.55	5.50
8	2.35	0.60	2.35	5.30
9	2.35	0.60	2.15	5.10
10	2.35	0.60	2.10	5.05
11	2.35	0.60	2.06	5.01
12	2.35	0.60	2.03	4.98
13-25	2.35	0.60	2.00	4.95
26	2.35	0.60	1.70	4.65
27	2.35	0.60	1.40	4.35
28	2.35	0.60	1.10	4.05
29	2.35	0.60	0.80	3.75
30	2.35	0.60	0.00	2.95

DEMOGRAPHIC ASSUMPTIONS

1. 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	1% 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

2. 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+	0.00

3. Disability

Rates vary by age. Sample rates are as follows:

Rates by Age	
Age	Rate
25	0.08%
30	0.10
35	0.13
40	0.20
45	0.31
50	0.52
55	0.91
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

0.35% of payroll

5. Commencement Age for Deferred Vested Benefit

Age 55

6. Cost of living adjustments (COLA)

2.00% per annum, compounded annually for Tier 1 members.

1.00% per annum, compounded annually for Tier 2 members.

7. DROP participation for COLA valuation

All members elect the DROP at the earliest possible date and remain in the DROP for 4 years or to age 60, if earlier. No COLA is received during DROP.

8. 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.

APPENDIX B-3 – PROPOSED ACTUARIAL ASSUMPTIONS – JUDGES

ECONOMIC ASSUMPTIONS

1. Salary Increases — Salaries are assumed to increase 3.20% each year.

DEMOGRAPHIC ASSUMPTIONS

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

Rates by Age	
Age	Rate
55-63	1.0%
64	7.0
65	15.0
66	20.0
67-68	16.0
69-71	20.0
72	100.0

2. Termination — None

3. Disability — None

OTHER ASSUMPTIONS

1. Form of Payment — Modified Cash Refund Annuity for members hired prior to July 1, 2004 and not electing the 50% Joint & Survivor Benefit. A 50% Joint & Survivor Benefit for members electing this provision, and new members hired on or 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.

For members hired on or after July 1, 2017, the Public Employee Retirement Board sets the actuarial assumptions used to determine the benefit amounts payable under optional forms of payment, with guidance from the System's actuary.

2. Actuarial Equivalence Basis for Members Hired after July 1, 2017	
a. Interest	6.75%
b. Mortality	Pub-2010 General Members (Above Median) Retiree Mortality Table (100% of male rates, 95% of female rates), both male and female rates set back one year, projected to 2040 using MP-2019 modified to 75% of the ultimate rates using a 75% male, 25% female blend.
3. Marital Status	
a. Percent married	100% married
b. Spouse's age	Females assumed to be three years younger than males.
4. Administrative Expense	0.32% of payroll
5. Cost of Living Adjustment	2.00% per annum, compounded annually for members hired before July 1, 2015. 1.00% per annum for members hired on or after July 1, 2015.
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.

ECONOMIC ASSUMPTIONS

1. Interest Crediting Rate on Cash Balance Accounts

   6.00% per annum, compounded annually

2. Annuitization Rate of Member & Employer Accumulated Balances

   The Board has statutory some authority to adopt the mortality tables and the interest rate used in the actuarial basis used for annutization of member balances. A different basis will apply to those hired before January 1, 2018 and after December 31, 2017. For valuation purposes, the most recent basis adopted by the Board will be used.

3. Salary Scale

   Rates vary by service. Rates are as follows:

	Rates by Service			
Years	Inflation	Productivity	Merit	Total
1	2.35%	0.60%	6.35%	9.30%
2	2.35	0.60	3.50	6.45
3	2.35	0.60	3.00	5.95
4	2.35	0.60	2.50	5.45
5	2.35	0.60	2.00	4.95
6	2.35	0.60	1.75	4.70
7	2.35	0.60	1.50	4.45
8	2.35	0.60	1.40	4.35
9	2.35	0.60	1.30	4.25
10	2.35	0.60	1.20	4.15
11-21	2.35	0.60	1.10	4.05
22	2.35	0.60	0.50	3.45
23-29	2.35	0.60	0.10	3.05
30+	2.35	0.60	0.00	2.95

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

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

1994 Group Annuity Mortality Table, with 50% Male, 50% Female blending for members hired before January 1, 2018 (set statutorily)

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

Retiree mortality table, projected to 2040, with 55% Male, 45% Female blending for members hired after January 1, 2018.

Sample Age	Mortality Rate	Life Expectancy (Years)
55	0.27%	32.3
60	0.40	27.7
65	0.58	23.3
70	0.89	19.1
75	1.51	15.1
80	2.71	11.4

2. Retirement

Age	Annual Rates
55-58	5.5%
59	7.0
60-61	6.0
62	10.0
63-64	11.0
65	25.0
66-79	30.0
80	100.0

3. Termination

Rates vary by service. Rates are as follows:

Service	Rate
<1	30.0%
1	22.0
5	14.0
10	8.0
15	3.5
20	3.0
25+	2.0

4. Disability

None

OTHER ASSUMPTIONS

1. Payment Assumptions

As shown in the table below, 55% of all members eligible for retirement are assumed to be paid in the form of an annuity and the other 45% 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	45% Lump Sum / 55% Annuity*
Vested	Lump Sum
Non-vested	Lump Sum
Disability	Lump Sum
Death	Lump Sum

*Five-year certain and life annuity.

2. Administrative Expense

0.21% of payroll

3. 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. Interest Crediting Rate on Cash Balance Accounts

6.00% per annum, compounded annually

2. Annuitization Rate of Member & Employer Accumulated Balances

The Board has statutory some authority to adopt the mortality tables and the interest rate used in the actuarial basis used for annuitization of member balances. A different basis will apply to those hired before January 1, 2018 and after December 31, 2017. For valuation purposes, the most recent basis adopted by the Board will be used.

5. Salary Scale

Rates vary by service. Rates are as follows:

	Rates by Service			
Years	Inflation	Productivity	Merit	Total
0	2.35%	0.60%	6.50%	9.45%
1	2.35	0.60	5.50	8.45
2	2.35	0.60	4.50	7.45
3	2.35	0.60	3.50	6.45
4	2.35	0.60	2.50	5.45
5	2.35	0.60	2.00	4.95
6	2.35	0.60	1.75	4.70
7	2.35	0.60	1.50	4.45
8	2.35	0.60	1.25	4.20
9-17	2.35	0.60	1.00	3.95
18	2.35	0.60	0.75	3.70
19-24	2.35	0.60	0.50	3.45
25-35	2.35	0.60	0.25	3.20
36+	2.35	0.60	0.00	2.95

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

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

1994 Group Annuity Mortality Table, with 50% Male, 50% Female blending for members hired before January 1, 2018 (set statutorily)

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

Retiree mortality table, projected to 2040, with 55% Male, 45% Female blending for members hired after January 1, 2018.

Sample Age	Mortality Rate	Life Expectancy (Years)
55	0.27%	32.3
60	0.40	27.7
65	0.58	23.3
70	0.89	19.1
75	1.51	15.1
80	2.71	11.4

2. Retirement

Rates vary by retirement age. Rates are as follows:

Age	Annual Rates
55-59	4.5%
60-61	6.5%
62-64	10.0%
65-67	20.0%
68-69	22.0%
70-71	26.0%
72-79	20.0%
80	100.0%

3. Termination

Rates vary by service. Rates are as follows:

Service	Rate
<1	25.00%
1	22.00
5	12.00
10	7.50
15	5.50
20	4.25
25	3.00
26+	2.00

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. Administrative Expense

0.29% of payroll

3. Cost of Living Adjustment

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

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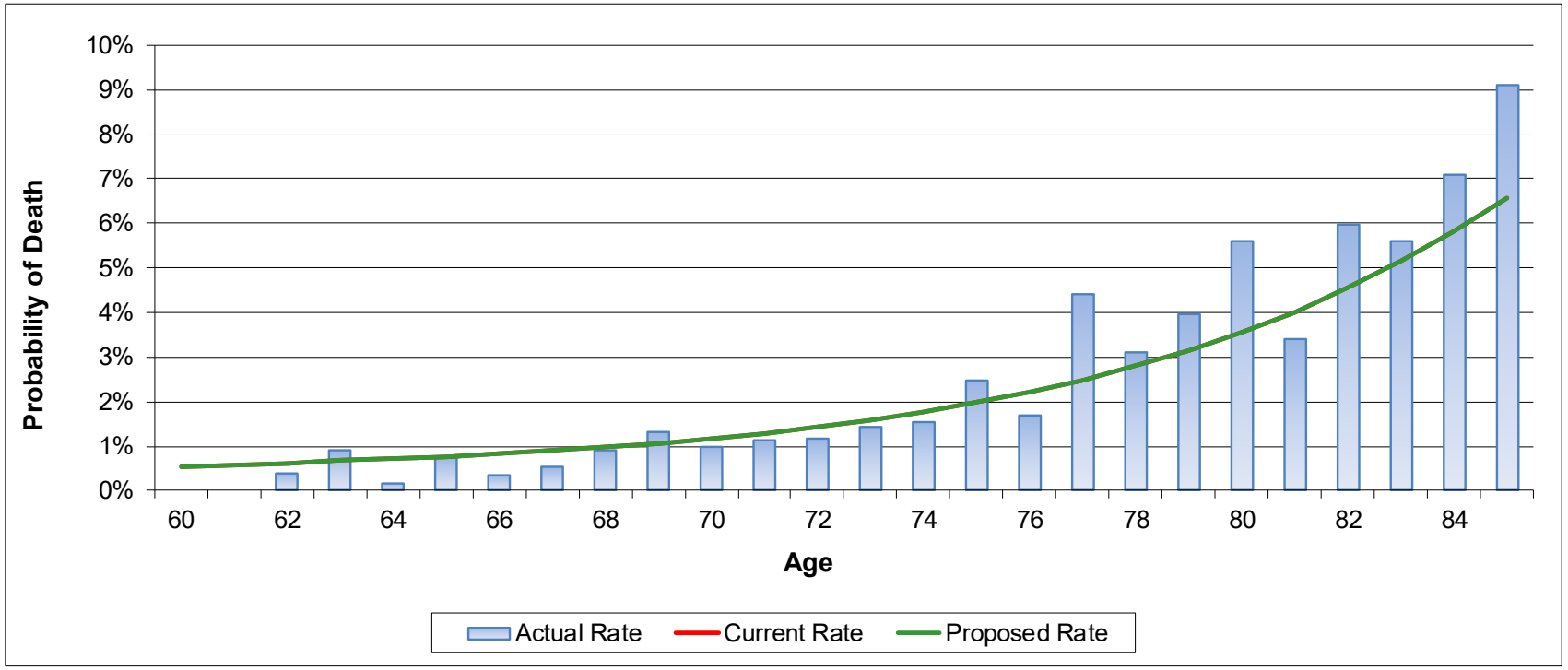
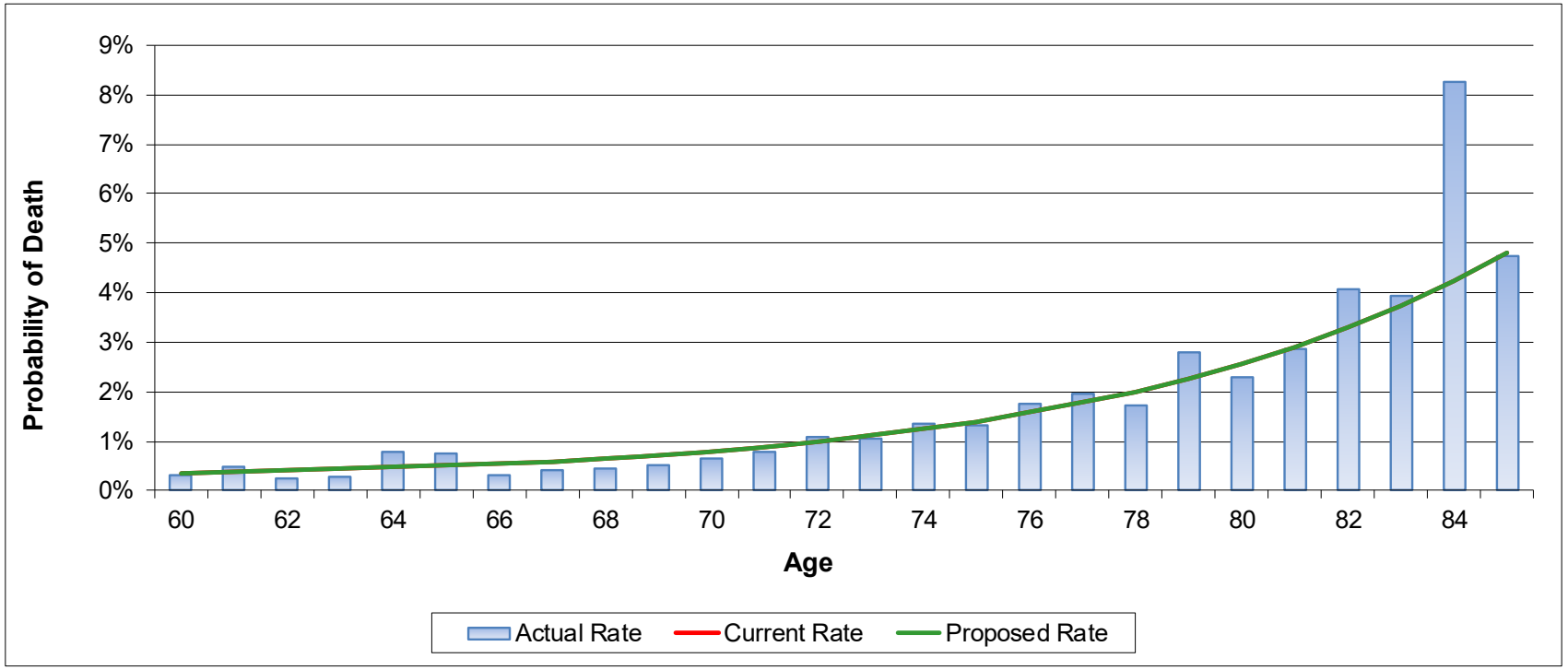
EXHIBIT C-1
Retiree Mortality – Males



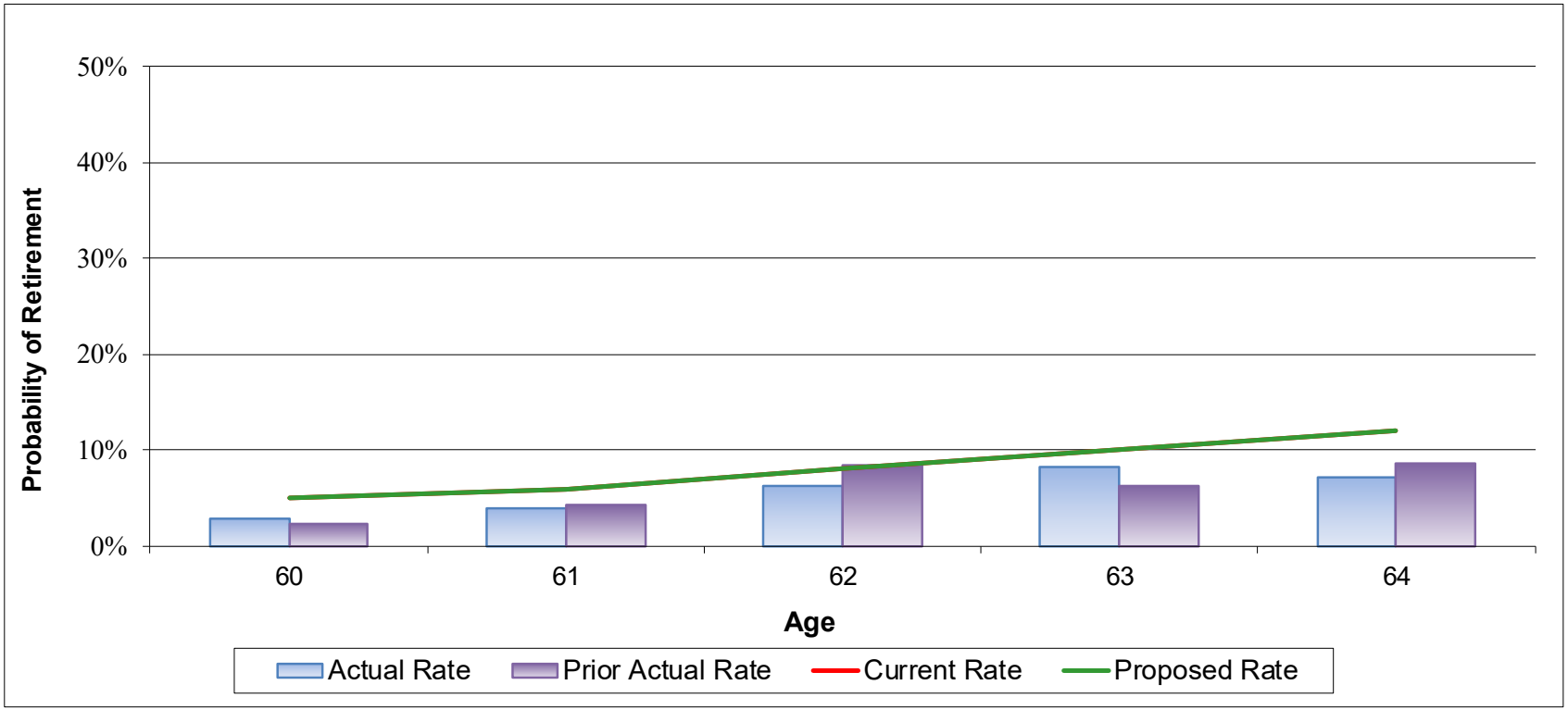
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,630,785	1,517,718	1,517,718
Actual/Expected		107%	107%

EXHIBIT C-2
Retiree Mortality – Females



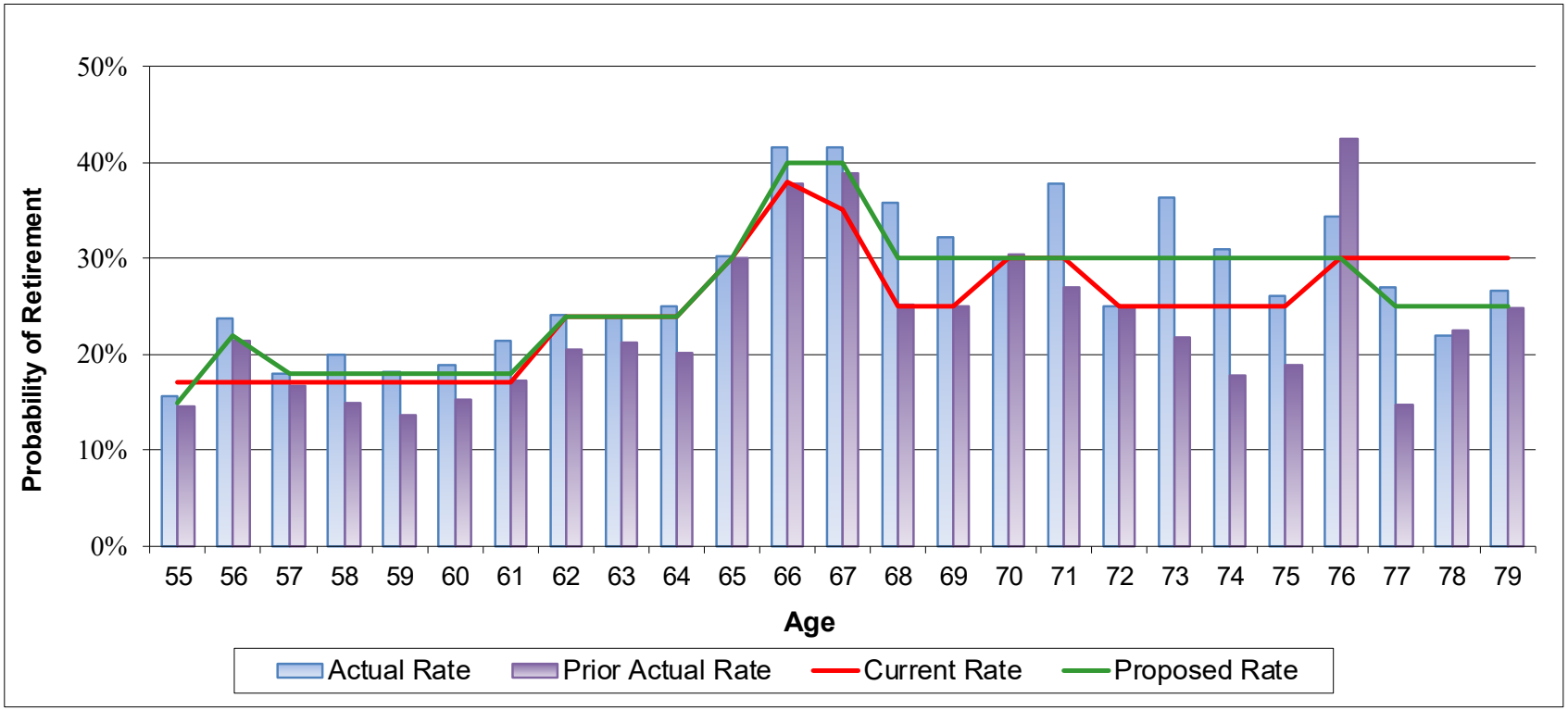
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,544,788	1,509,569	1,509,569
Actual/Expected		102%	102%

EXHIBIT C-3
Retirement – Schools (Early)



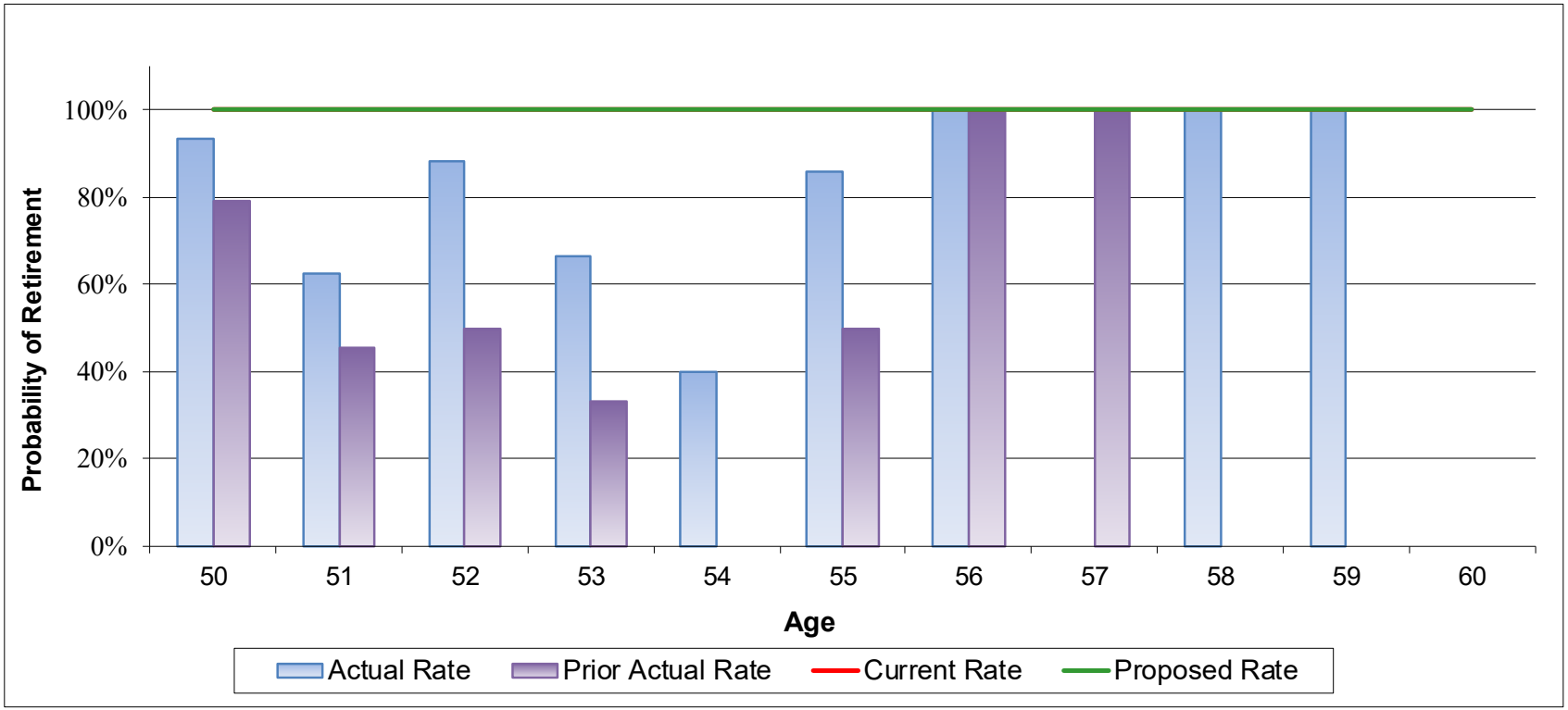
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	253	363	363
Actual/Expected		70%	70%

EXHIBIT C-4
Retirement – Schools (Unreduced)



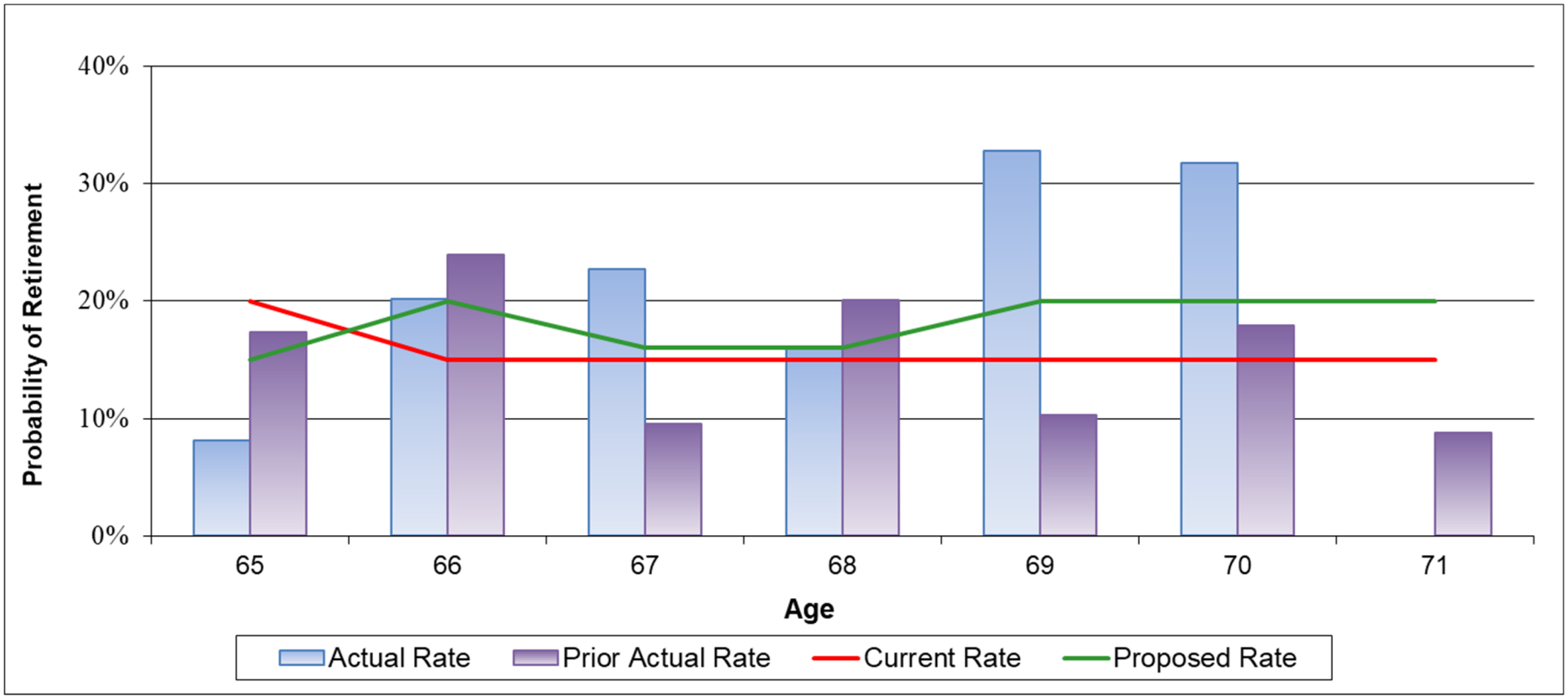
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	7,281	6,586	6,937
Actual/Expected		111%	105%

EXHIBIT C-5
Retirement – Patrol (DROP after 25 Years)



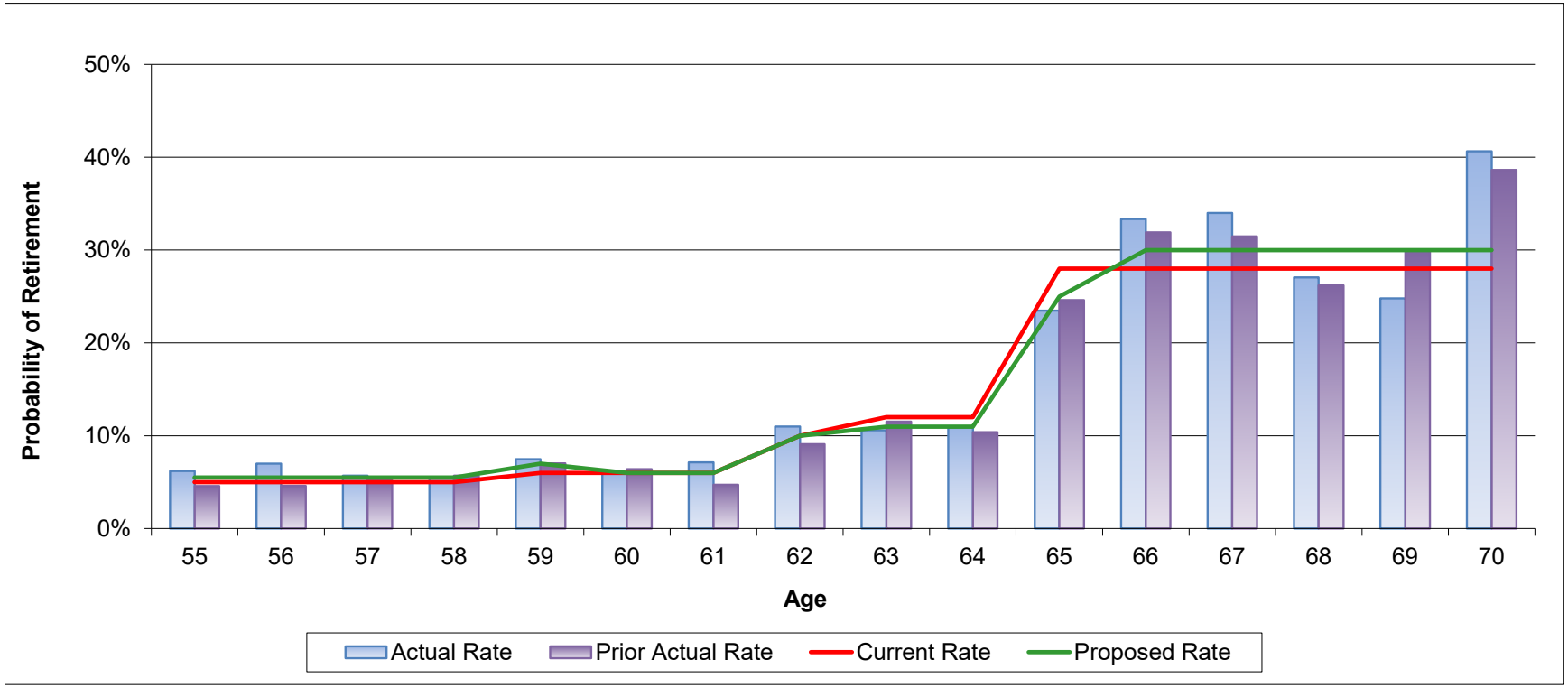
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Total Count	51	62	62
Actual/Expected		82%	82%

EXHIBIT C-6
Retirement – Judges (Unreduced)



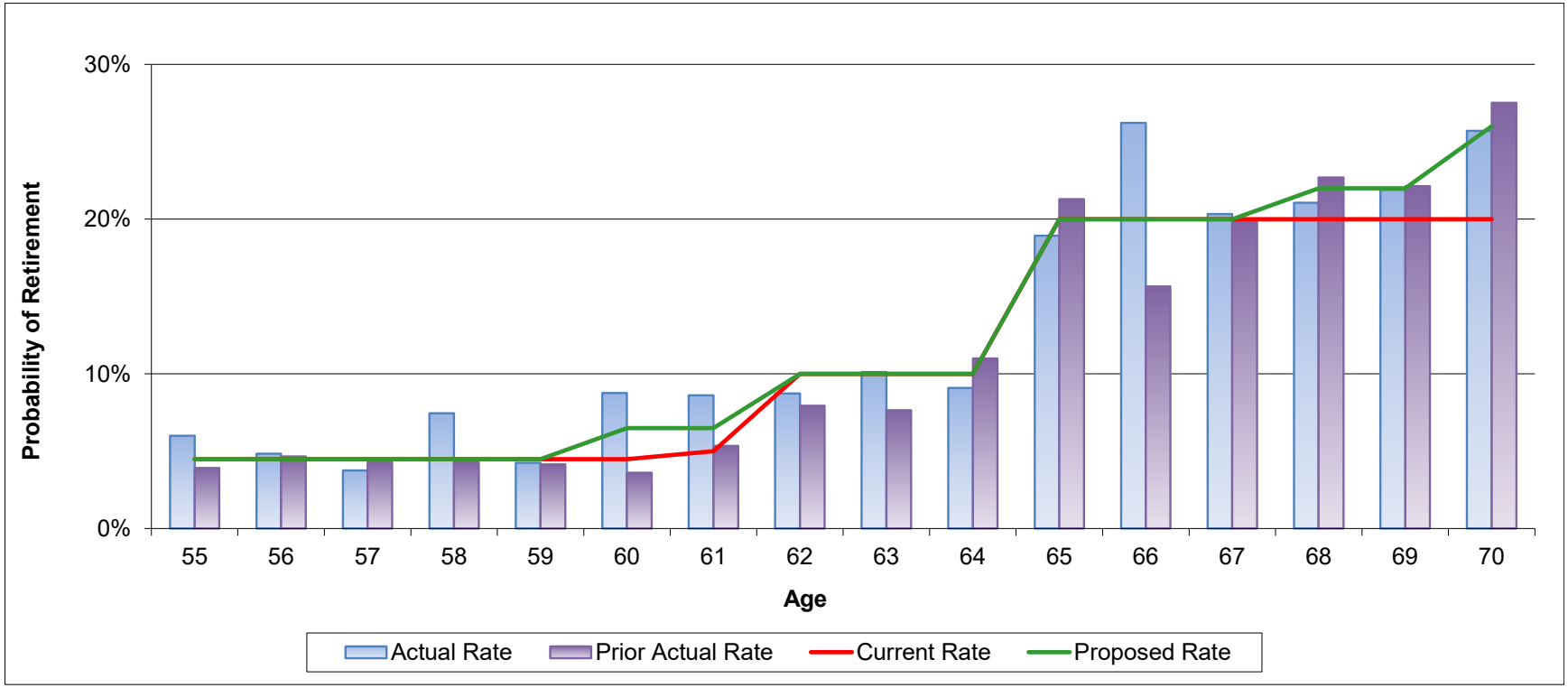
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	78	64	72
Actual/Expected		121%	109%

EXHIBIT C-7
Retirement – State



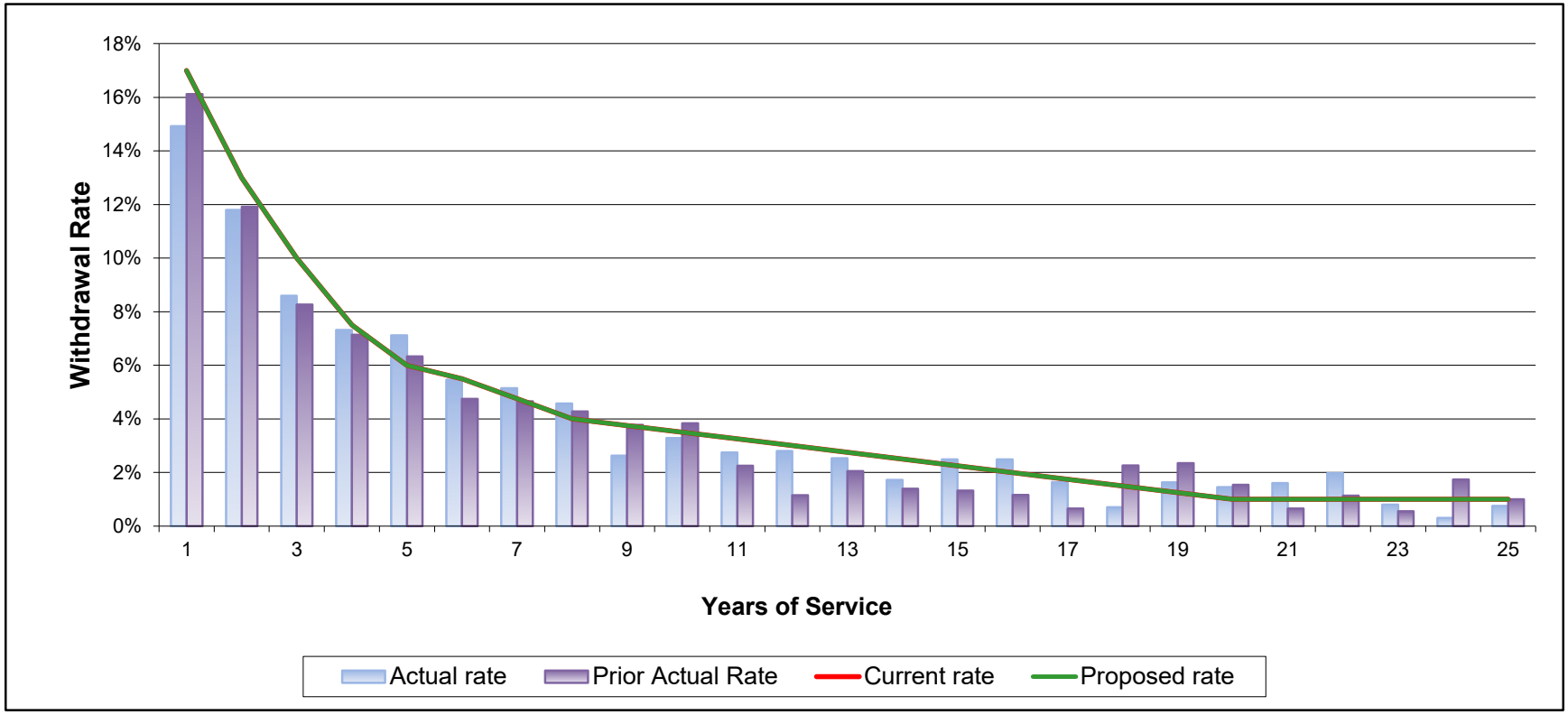
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,948	1,845	1,869
Actual/Expected		106%	104%

EXHIBIT C-8
Retirement – County



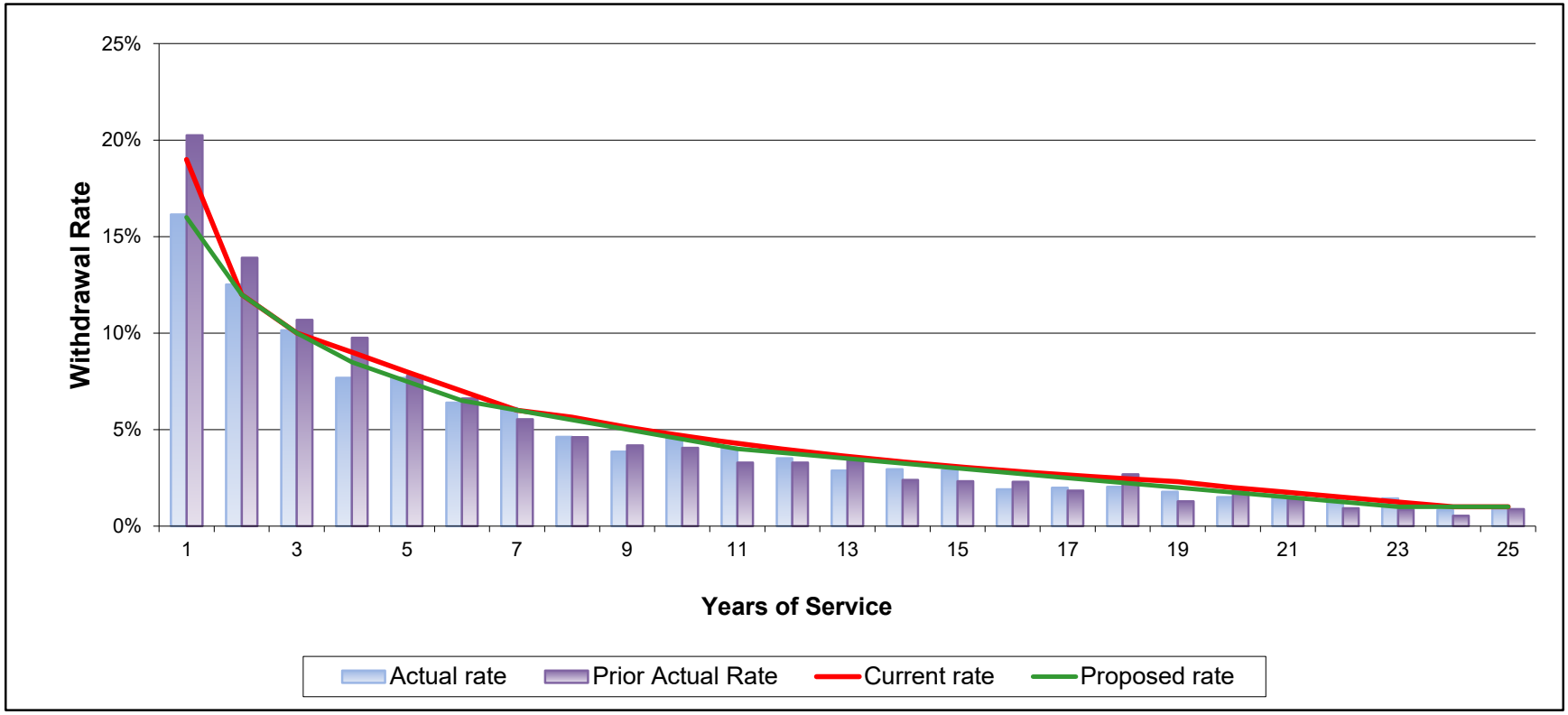
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	710	632	667
Actual/Expected		112%	106%

EXHIBIT C-9
Termination of Employment – Schools (Males)



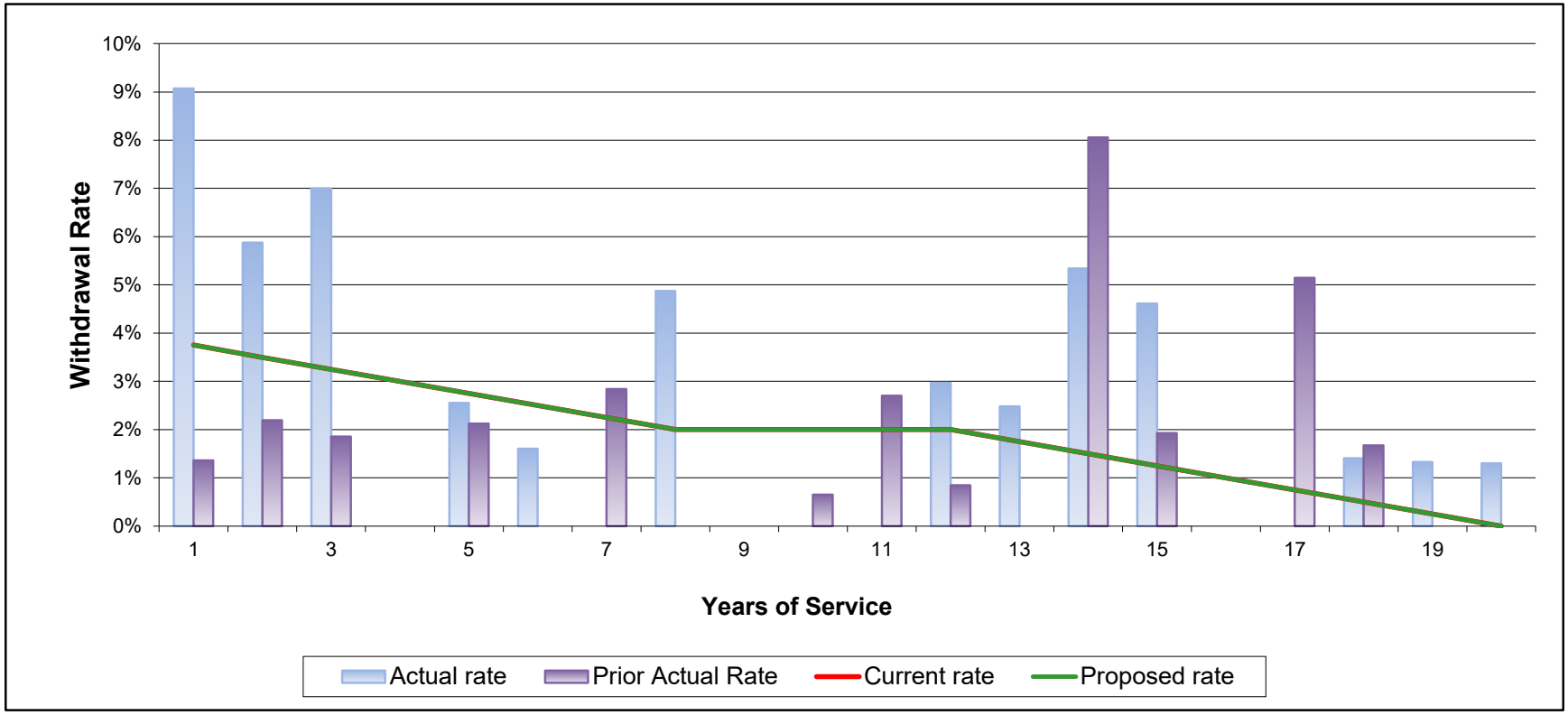
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	516	527	527
Actual/Expected		98%	98%

EXHIBIT C-10
Termination of Employment – Schools (Females)



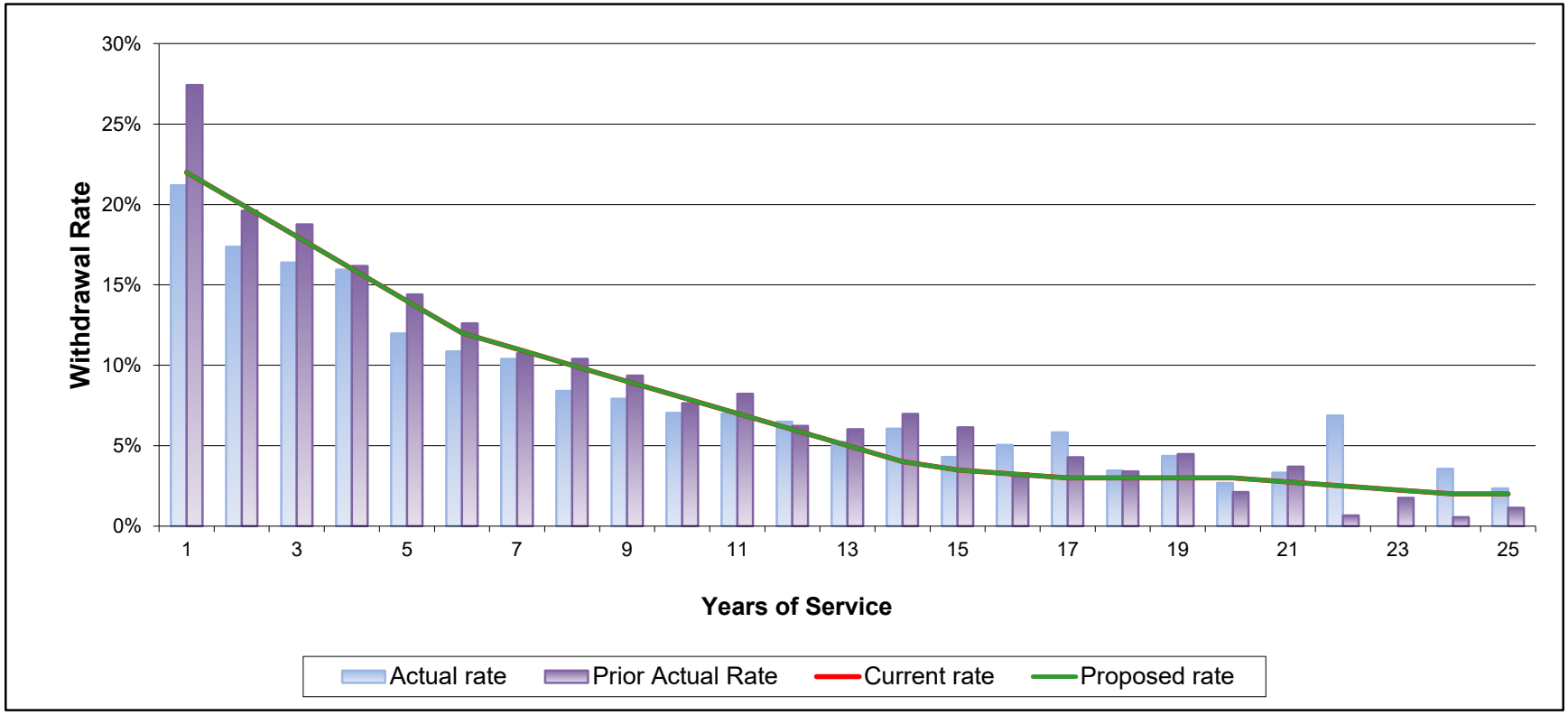
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,576	1,775	1,676
Actual/Expected		89%	94%

EXHIBIT C-11
Termination of Employment – Patrol



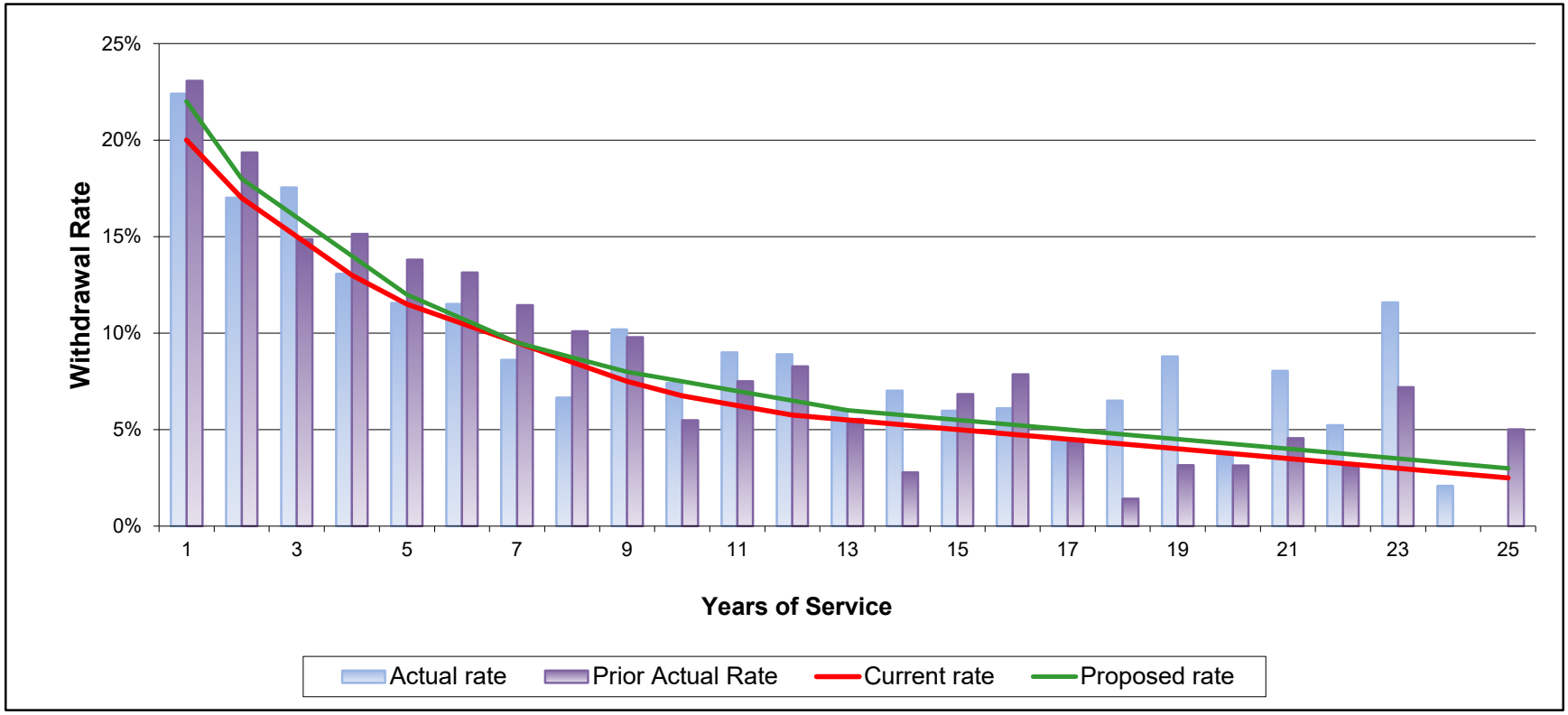
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	16	9	9
Actual/Expected		168%	168%

EXHIBIT C-12
Termination of Employment – State



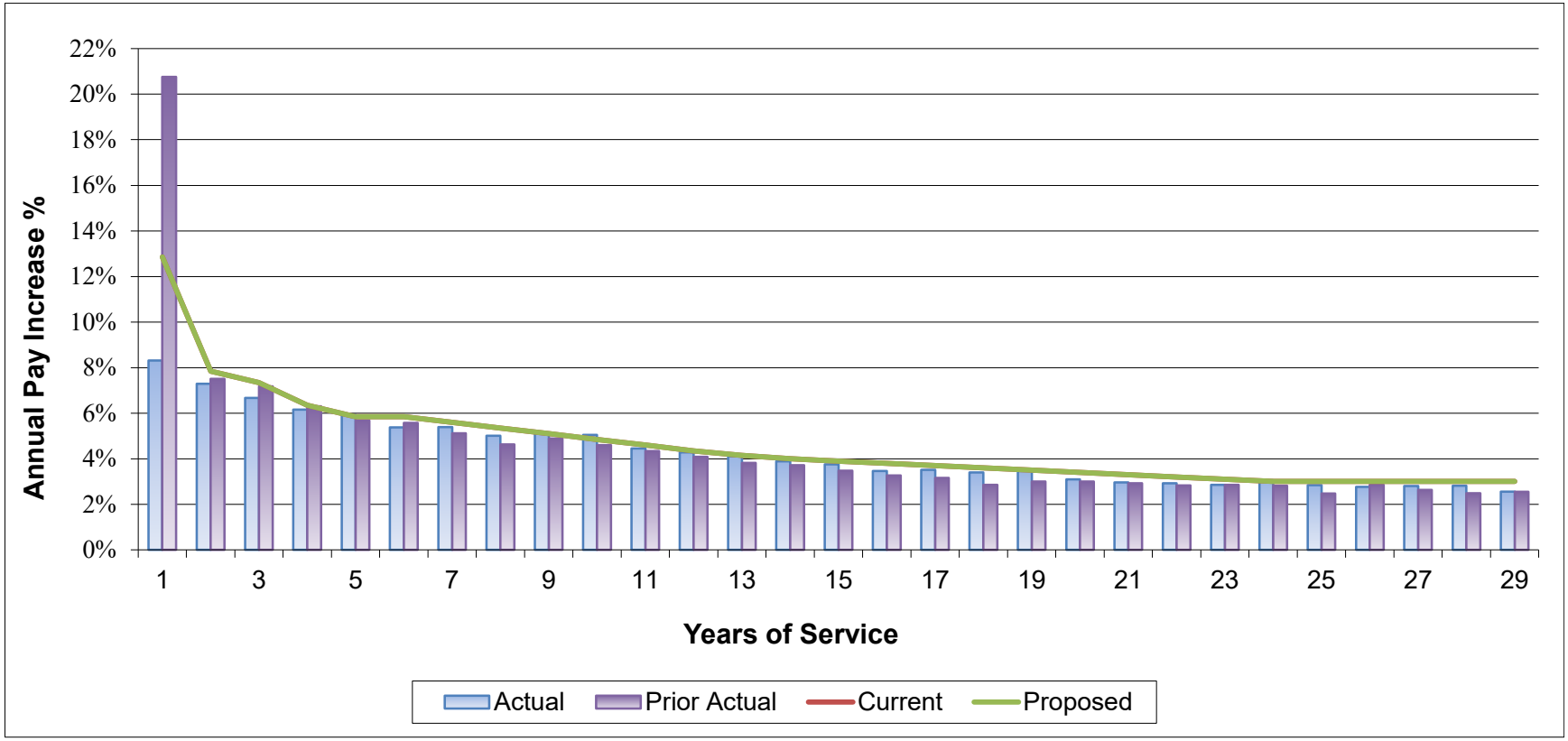
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,020	1,025	1,025
Actual/Expected		100%	100%

EXHIBIT C-13
Termination of Employment – County



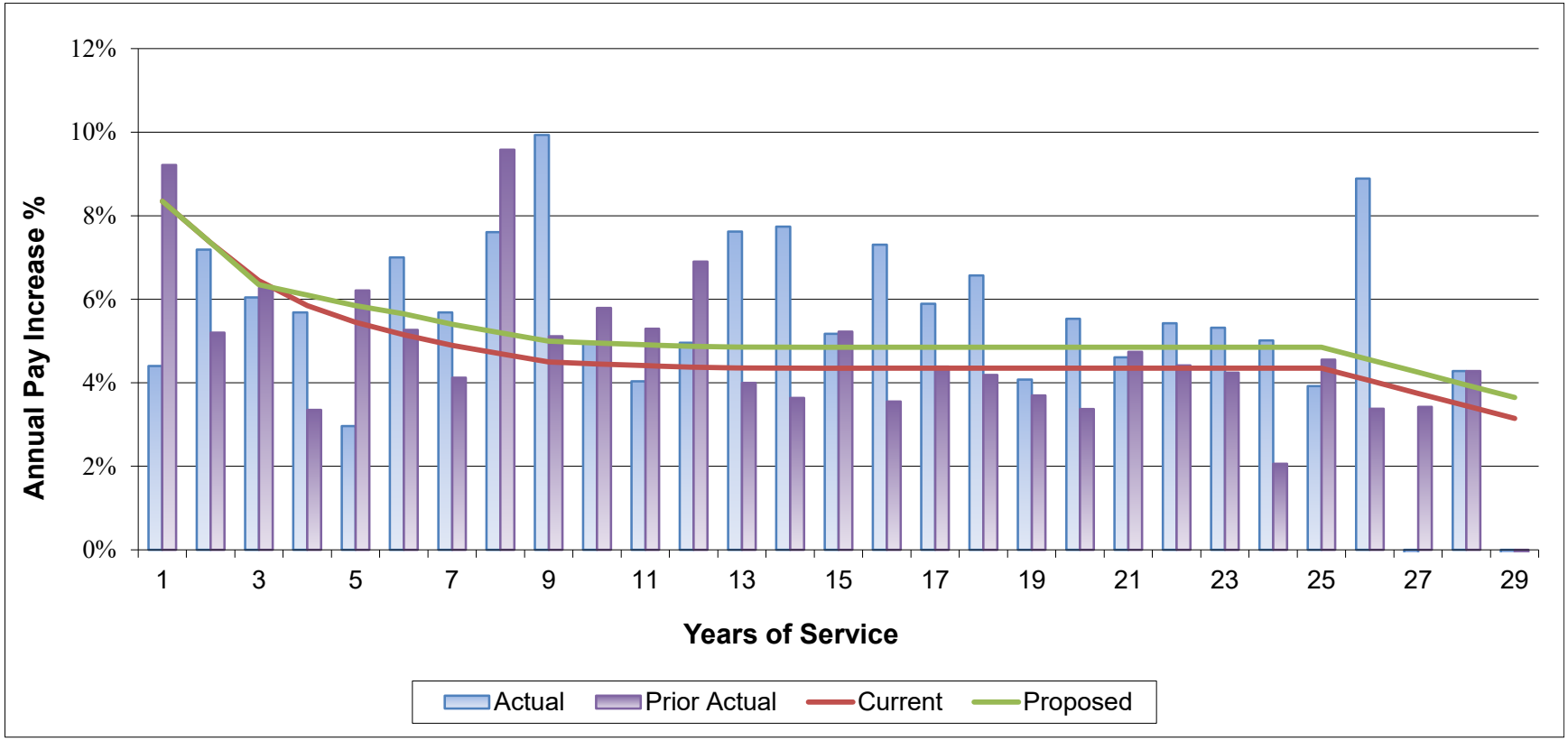
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	425	366	394
Actual/Expected		116%	108%

EXHIBIT C-14
Salary Scale – Schools



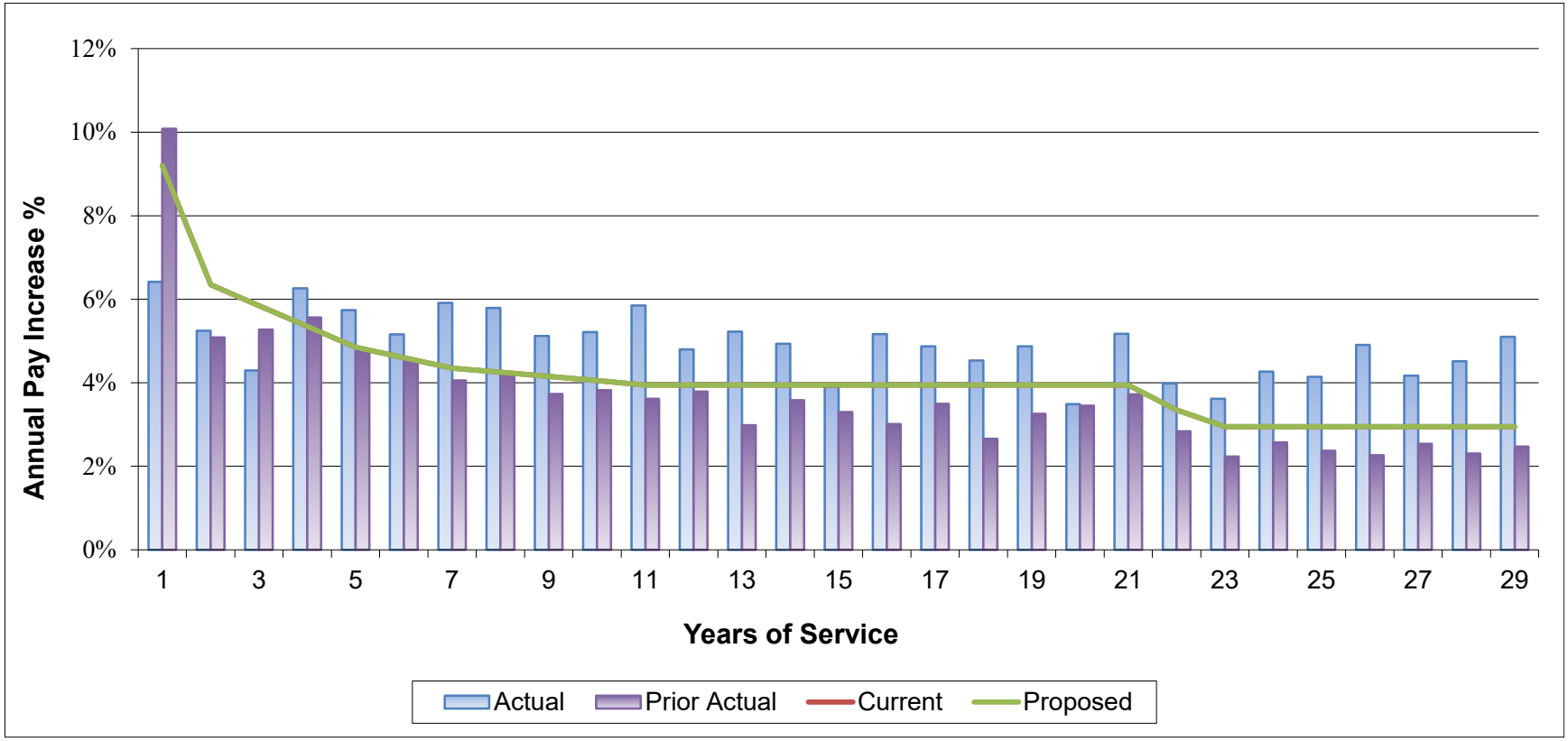
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Average Increase	4.70%	5.15%	5.15%
Actual/Expected		91%	91%

EXHIBIT C-15
Salary Scale – Patrol



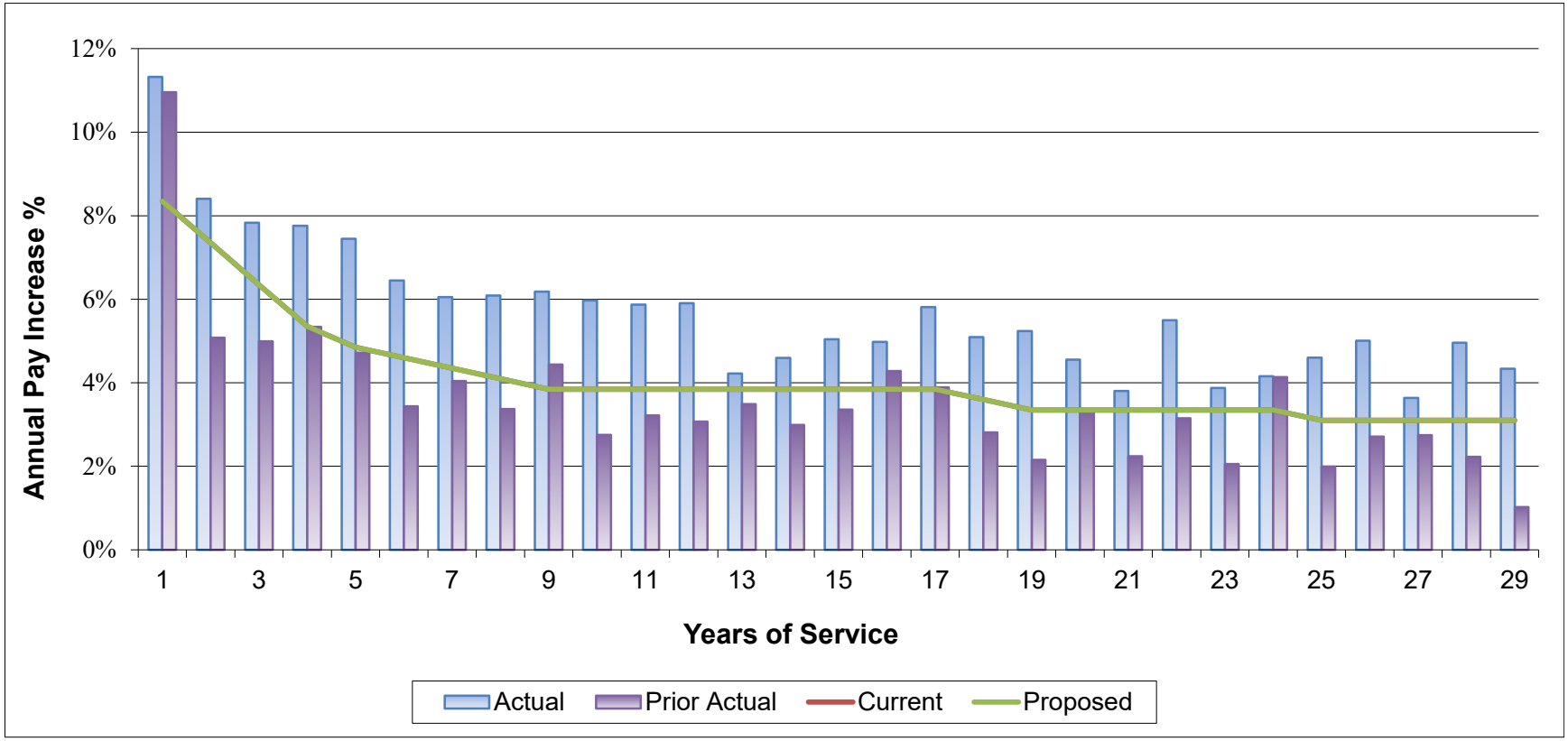
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Average Increase	5.69%	4.86%	5.29%
Actual/Expected		117%	108%

EXHIBIT C-16
Salary Scale – State



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Average Increase	5.33%	5.17%	5.17%
Actual/Expected		103%	103%

EXHIBIT C-17
Salary Scale – County



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Average Increase	6.76%	4.98%	4.98%
Actual/Expected		136%	136%

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EXHIBIT D-1
Retiree Mortality – Males

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
60	1,358,366	-	0.000%	7,217.7	0.531%	7,217.7	0.531%
61	1,558,359	-	0.000%	8,968.5	0.576%	8,968.5	0.576%
62	1,830,727	7,256	0.396%	11,382.1	0.622%	11,382.1	0.622%
63	2,194,886	19,787	0.901%	14,680.2	0.669%	14,680.2	0.669%
64	2,532,912	4,328	0.171%	18,199.1	0.719%	18,199.1	0.719%
65	2,820,208	21,483	0.762%	21,745.1	0.771%	21,745.1	0.771%
66	3,480,291	12,185	0.350%	28,866.3	0.829%	28,866.3	0.829%
67	4,027,700	21,687	0.538%	36,122.6	0.897%	36,122.6	0.897%
68	4,337,748	40,065	0.924%	42,292.8	0.975%	42,292.8	0.975%
69	4,758,328	62,345	1.310%	50,676.5	1.065%	50,676.5	1.065%
70	4,907,425	47,620	0.970%	57,364.5	1.169%	57,364.5	1.169%
71	5,131,166	58,063	1.132%	66,115.8	1.289%	66,115.8	1.289%
72	5,263,934	62,321	1.184%	75,028.8	1.425%	75,028.8	1.425%
73	5,158,256	72,877	1.413%	81,626.3	1.582%	81,626.3	1.582%
74	4,825,497	74,406	1.542%	85,067.9	1.763%	85,067.9	1.763%
75	4,487,013	110,711	2.467%	88,431.7	1.971%	88,431.7	1.971%
76	3,975,096	66,577	1.675%	87,767.7	2.208%	87,767.7	2.208%
77	3,553,026	156,551	4.406%	88,116.1	2.480%	88,116.1	2.480%
78	3,160,013	98,649	3.122%	88,210.5	2.791%	88,210.5	2.791%
79	2,663,225	105,783	3.972%	83,807.5	3.147%	83,807.5	3.147%
80	2,243,291	125,748	5.606%	79,666.1	3.551%	79,666.1	3.551%
81	2,039,126	69,196	3.393%	81,847.8	4.014%	81,847.8	4.014%
82	1,746,535	104,039	5.957%	79,314.5	4.541%	79,314.5	4.541%
83	1,549,463	86,834	5.604%	79,610.6	5.138%	79,610.6	5.138%
84	1,420,818	100,939	7.104%	82,570.0	5.811%	82,570.0	5.811%
85	1,112,615	101,333	9.108%	73,021.6	6.563%	73,021.6	6.563%
	82,136,021	1,630,785	1.985%	1,517,718.4	1.848%	1,517,718.4	1.848%

Weighted results for current study

EXHIBIT D-2
Retiree Mortality – Females

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
60	2,362,284	7,326	0.310%	8,345.2	0.353%	8,345.2	0.353%
61	3,158,779	14,869	0.471%	11,903.3	0.377%	11,903.3	0.377%
62	3,856,058	9,440	0.245%	15,528.9	0.403%	15,528.9	0.403%
63	4,602,792	12,959	0.282%	19,919.0	0.433%	19,919.0	0.433%
64	5,066,004	40,367	0.797%	23,605.5	0.466%	23,605.5	0.466%
65	5,830,426	44,573	0.764%	29,398.5	0.504%	29,398.5	0.504%
66	7,059,147	21,187	0.300%	38,599.3	0.547%	38,599.3	0.547%
67	8,229,243	34,151	0.415%	49,020.2	0.596%	49,020.2	0.596%
68	9,058,392	41,396	0.457%	59,055.4	0.652%	59,055.4	0.652%
69	9,552,174	47,755	0.500%	68,512.3	0.717%	68,512.3	0.717%
70	9,632,870	64,188	0.666%	76,456.2	0.794%	76,456.2	0.794%
71	9,422,929	74,222	0.788%	83,173.0	0.883%	83,173.0	0.883%
72	8,738,330	95,575	1.094%	86,115.9	0.985%	86,115.9	0.985%
73	7,794,117	80,998	1.039%	86,108.4	1.105%	86,108.4	1.105%
74	6,721,917	89,927	1.338%	83,442.0	1.241%	83,442.0	1.241%
75	5,486,311	73,025	1.331%	76,657.2	1.397%	76,657.2	1.397%
76	4,630,547	80,571	1.740%	72,960.4	1.576%	72,960.4	1.576%
77	4,049,132	79,636	1.967%	71,990.9	1.778%	71,990.9	1.778%
78	3,531,904	60,982	1.727%	70,896.2	2.007%	70,896.2	2.007%
79	3,065,027	85,610	2.793%	69,516.9	2.268%	69,516.9	2.268%
80	2,642,816	60,411	2.286%	67,797.7	2.565%	67,797.7	2.565%
81	2,235,179	63,948	2.861%	64,898.2	2.903%	64,898.2	2.903%
82	2,034,298	82,912	4.076%	66,929.9	3.290%	66,929.9	3.290%
83	1,878,224	73,889	3.934%	70,075.9	3.731%	70,075.9	3.731%
84	1,674,862	138,143	8.248%	70,931.2	4.235%	70,931.2	4.235%
85	1,408,756	66,727	4.737%	67,731.7	4.808%	67,731.7	4.808%
	133,722,521	1,544,788	1.155%	1,509,569.2	1.129%	1,509,569.2	1.129%

Weighted results for current study

EXHIBIT D-3
Retirement – Schools (Early)

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
60	1,410	40	2.837%	70.5	5.000%	70.5	5.000%
61	1,230	49	3.992%	73.8	6.000%	73.8	6.000%
62	1,019	65	6.342%	81.5	8.000%	81.5	8.000%
63	722	60	8.337%	72.2	10.000%	72.2	10.000%
64	540	39	7.170%	64.8	12.000%	64.8	12.000%
	4,922	253	5.134%	362.9	7.373%	362.9	7.373%

EXHIBIT D-4
Retirement – Schools (Unreduced)

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	2,078	326	15.687%	353.3	17.000%	311.7	15.000%
56	2,200	521	23.687%	374.0	17.000%	484.0	22.000%
57	2,123	383	18.054%	360.9	17.000%	382.2	18.000%
58	2,250	450	20.014%	382.6	17.000%	405.1	18.000%
59	2,282	414	18.134%	387.9	17.000%	410.7	18.000%
60	2,386	451	18.915%	405.6	17.000%	429.4	18.000%
61	2,456	524	21.347%	417.5	17.000%	442.1	18.000%
62	2,342	565	24.132%	562.0	24.000%	562.0	24.000%
63	2,211	528	23.862%	530.7	24.000%	530.7	24.000%
64	2,001	499	24.954%	480.3	24.000%	480.3	24.000%
65	2,148	648	30.167%	644.5	30.000%	644.5	30.000%
66	1,659	689	41.531%	630.4	38.000%	663.6	40.000%
67	1,054	438	41.498%	369.0	35.000%	421.8	40.000%
68	686	246	35.831%	171.5	25.000%	205.8	30.000%
69	506	163	32.114%	126.6	25.000%	151.9	30.000%
70	376	112	29.856%	112.8	30.000%	112.8	30.000%
71	309	117	37.748%	92.8	30.000%	92.8	30.000%
72	196	49	24.965%	49.0	25.000%	58.8	30.000%
73	163	59	36.308%	40.7	25.000%	48.8	30.000%
74	110	34	30.865%	27.4	25.000%	32.9	30.000%
75	71	19	25.993%	17.8	25.000%	21.4	30.000%
76	61	21	34.280%	18.4	30.000%	18.4	30.000%
77	48	13	26.915%	14.4	30.000%	12.0	25.000%
78	32	7	21.873%	9.7	30.000%	8.1	25.000%
79	22	6	26.614%	6.5	30.000%	5.4	25.000%
	29,772	7,281	24.458%	6,586.3	22.123%	6,937.1	23.301%

EXHIBIT D-5
Retirement – Patrol (DROP after 25 Years)

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
50	15	14	93.333%	15.0	100.000%	15.0	100.000%
51	8	5	62.500%	8.0	100.000%	8.0	100.000%
52	17	15	88.235%	17.0	100.000%	17.0	100.000%
53	3	2	66.667%	3.0	100.000%	3.0	100.000%
54	5	2	40.000%	5.0	100.000%	5.0	100.000%
55	7	6	85.714%	7.0	100.000%	7.0	100.000%
56	3	3	100.000%	3.0	100.000%	3.0	100.000%
57	-	-	0.000%	-	100.000%	-	100.000%
58	3	3	100.000%	3.0	100.000%	3.0	100.000%
59	1	1	100.000%	1.0	100.000%	1.0	100.000%
60	-	-	0.000%	-	100.000%	-	100.000%
	62	51	82.258%	62.0	100.000%	62.0	100.000%

EXHIBIT D-6
Retirement – Judges (Unreduced)

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
65	75	6	8.146%	15.0	20.000%	11.3	15.000%
66	89	18	20.157%	13.3	15.000%	17.7	20.000%
67	85	19	22.671%	12.7	15.000%	13.6	16.000%
68	52	8	16.083%	7.8	15.000%	8.3	16.000%
69	44	14	32.804%	6.5	15.000%	8.7	20.000%
70	38	12	31.724%	5.7	15.000%	7.7	20.000%
71	21	-	0.000%	3.2	15.000%	4.3	20.000%
	404	78	19.324%	64.4	15.931%	71.6	17.714%

EXHIBIT D-7
Retirement – State

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	610	38	6.207%	30.5	5.000%	33.5	5.500%
56	662	46	6.993%	33.1	5.000%	36.4	5.500%
57	765	44	5.725%	38.2	5.000%	42.1	5.500%
58	872	48	5.501%	43.6	5.000%	47.9	5.500%
59	954	71	7.464%	57.2	6.000%	66.8	7.000%
60	1,001	61	6.083%	60.0	6.000%	60.0	6.000%
61	1,072	77	7.136%	64.3	6.000%	64.3	6.000%
62	1,111	122	10.989%	111.1	10.000%	111.1	10.000%
63	1,136	120	10.594%	136.3	12.000%	124.9	11.000%
64	1,142	124	10.898%	137.0	12.000%	125.6	11.000%
65	1,157	272	23.491%	323.8	28.000%	289.1	25.000%
66	997	332	33.343%	279.2	28.000%	299.1	30.000%
67	707	240	34.016%	198.0	28.000%	212.1	30.000%
68	509	138	27.065%	142.4	28.000%	152.6	30.000%
69	383	95	24.811%	107.2	28.000%	114.9	30.000%
70	295	120	40.644%	82.5	28.000%	88.4	30.000%
	13,370	1,948	14.572%	1,844.5	13.796%	1,869.0	13.978%

EXHIBIT D-8
Retirement – County

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	284	17	6.003%	12.8	4.500%	12.8	4.500%
56	309	15	4.848%	13.9	4.500%	13.9	4.500%
57	339	13	3.765%	15.3	4.500%	15.3	4.500%
58	387	29	7.462%	17.4	4.500%	17.4	4.500%
59	418	18	4.253%	18.8	4.500%	18.8	4.500%
60	443	39	8.767%	19.9	4.500%	28.8	6.500%
61	463	40	8.614%	23.1	5.000%	30.1	6.500%
62	470	41	8.739%	47.0	10.000%	47.0	10.000%
63	455	46	10.127%	45.5	10.000%	45.5	10.000%
64	470	43	9.094%	47.0	10.000%	47.0	10.000%
65	486	92	18.936%	97.3	20.000%	97.3	20.000%
66	419	110	26.224%	83.7	20.000%	83.7	20.000%
67	310	63	20.337%	62.1	20.000%	62.1	20.000%
68	247	52	21.061%	49.4	20.000%	54.3	22.000%
69	215	47	21.890%	43.0	20.000%	47.3	22.000%
70	177	46	25.716%	35.5	20.000%	46.1	26.000%
	5,893	710	12.045%	631.7	10.720%	667.4	11.326%

EXHIBIT D-9
Termination of Employment – Schools (Males)

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	122	18	14.914%	20.8	17.000%	20.8	17.000%
2	223	26	11.797%	29.0	13.000%	29.0	13.000%
3	312	27	8.598%	31.2	10.000%	31.2	10.000%
4	375	27	7.321%	28.2	7.500%	28.2	7.500%
5	448	32	7.121%	26.9	6.000%	26.9	6.000%
6	540	30	5.467%	29.7	5.500%	29.7	5.500%
7	630	32	5.143%	29.9	4.750%	29.9	4.750%
8	656	30	4.569%	26.2	4.000%	26.2	4.000%
9	694	18	2.625%	26.0	3.750%	26.0	3.750%
10	702	23	3.292%	24.6	3.500%	24.6	3.500%
11	749	21	2.748%	24.3	3.250%	24.3	3.250%
12	813	23	2.801%	24.4	3.000%	24.4	3.000%
13	914	23	2.525%	25.1	2.750%	25.1	2.750%
14	980	17	1.719%	24.5	2.500%	24.5	2.500%
15	1,003	25	2.492%	22.6	2.250%	22.6	2.250%
16	991	25	2.490%	19.8	2.000%	19.8	2.000%
17	980	16	1.638%	17.1	1.750%	17.1	1.750%
18	993	7	0.702%	14.9	1.500%	14.9	1.500%
19	1,081	18	1.628%	13.5	1.250%	13.5	1.250%
20	1,108	16	1.451%	11.1	1.000%	11.1	1.000%
21	1,177	19	1.607%	11.8	1.000%	11.8	1.000%
22	1,163	23	1.968%	11.6	1.000%	11.6	1.000%
23	1,113	9	0.803%	11.1	1.000%	11.1	1.000%
24	1,144	3	0.303%	11.4	1.000%	11.4	1.000%
25	1,125	8	0.750%	11.2	1.000%	11.2	1.000%
	20,035	516	2.577%	527.1	2.631%	527.1	2.631%

EXHIBIT D-10
Termination of Employment – Schools (Females)

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	332	54	16.146%	63.0	19.000%	53.1	16.000%
2	597	75	12.523%	71.6	12.000%	71.6	12.000%
3	862	87	10.150%	86.2	10.000%	86.2	10.000%
4	1,060	82	7.686%	95.4	9.000%	90.1	8.500%
5	1,239	95	7.683%	99.1	8.000%	92.9	7.500%
6	1,441	92	6.388%	100.9	7.000%	93.7	6.500%
7	1,571	96	6.111%	94.3	6.000%	94.3	6.000%
8	1,665	77	4.616%	93.8	5.634%	91.6	5.500%
9	1,743	67	3.856%	89.4	5.130%	87.2	5.000%
10	1,869	86	4.575%	87.5	4.679%	84.1	4.500%
11	2,058	84	4.067%	88.3	4.292%	82.3	4.000%
12	2,267	80	3.516%	88.8	3.917%	85.0	3.750%
13	2,461	71	2.878%	88.9	3.613%	86.1	3.500%
14	2,610	77	2.952%	87.0	3.333%	84.8	3.250%
15	2,570	75	2.901%	79.2	3.082%	77.1	3.000%
16	2,478	47	1.907%	70.7	2.854%	68.2	2.750%
17	2,390	48	1.992%	63.4	2.653%	59.7	2.500%
18	2,383	48	2.025%	58.9	2.471%	53.6	2.250%
19	2,447	44	1.779%	56.3	2.302%	48.9	2.000%
20	2,618	40	1.511%	52.4	2.000%	45.8	1.750%
21	2,704	41	1.504%	47.3	1.750%	40.6	1.500%
22	2,602	39	1.492%	39.0	1.500%	32.5	1.250%
23	2,473	35	1.431%	30.9	1.250%	24.7	1.000%
24	2,206	18	0.834%	22.1	1.000%	22.1	1.000%
25	2,018	21	1.024%	20.2	1.000%	20.2	1.000%
	48,666	1,576	3.239%	1,774.7	3.647%	1,676.5	3.445%

EXHIBIT D-11
Termination of Employment – Patrol

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	5	0	9.068%	0.2	3.750%	0.2	3.750%
2	9	1	5.876%	0.3	3.500%	0.3	3.500%
3	12	1	7.005%	0.4	3.250%	0.4	3.250%
4	19	-	0.000%	0.6	3.000%	0.6	3.000%
5	26	1	2.552%	0.7	2.750%	0.7	2.750%
6	24	0	1.603%	0.6	2.500%	0.6	2.500%
7	26	-	0.000%	0.6	2.250%	0.6	2.250%
8	16	1	4.876%	0.3	2.000%	0.3	2.000%
9	15	-	0.000%	0.3	2.000%	0.3	2.000%
10	19	-	0.000%	0.4	2.000%	0.4	2.000%
11	12	-	0.000%	0.2	2.000%	0.2	2.000%
12	28	1	2.970%	0.6	2.000%	0.6	2.000%
13	32	1	2.478%	0.6	1.750%	0.6	1.750%
14	55	3	5.338%	0.8	1.500%	0.8	1.500%
15	59	3	4.612%	0.7	1.250%	0.7	1.250%
16	60	-	0.000%	0.6	1.000%	0.6	1.000%
17	99	-	0.000%	0.7	0.750%	0.7	0.750%
18	101	1	1.405%	0.5	0.500%	0.5	0.500%
19	131	2	1.328%	0.3	0.250%	0.3	0.250%
20	145	2	1.297%	-	0.000%	-	0.000%
	893	16	1.780%	9.5	1.059%	9.5	1.059%

EXHIBIT D-12
Termination of Employment – State

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	277	59	21.189%	61.0	22.000%	61.0	22.000%
2	406	71	17.370%	81.2	20.000%	81.2	20.000%
3	514	84	16.379%	92.6	18.000%	92.6	18.000%
4	591	94	15.945%	94.6	16.000%	94.6	16.000%
5	634	76	11.975%	88.7	14.000%	88.7	14.000%
6	669	73	10.867%	80.3	12.000%	80.3	12.000%
7	735	76	10.393%	80.9	11.000%	80.9	11.000%
8	714	60	8.411%	71.4	10.000%	71.4	10.000%
9	703	56	7.930%	63.2	9.000%	63.2	9.000%
10	648	46	7.040%	51.8	8.000%	51.8	8.000%
11	613	43	6.999%	42.9	7.000%	42.9	7.000%
12	572	37	6.502%	34.3	6.000%	34.3	6.000%
13	700	37	5.237%	35.0	5.000%	35.0	5.000%
14	743	45	6.061%	29.7	4.000%	29.7	4.000%
15	741	32	4.293%	25.9	3.500%	25.9	3.500%
16	703	36	5.054%	22.8	3.250%	22.8	3.250%
17	513	30	5.829%	15.4	3.000%	15.4	3.000%
18	466	16	3.454%	14.0	3.000%	14.0	3.000%
19	404	18	4.364%	12.1	3.000%	12.1	3.000%
20	319	9	2.680%	9.6	3.000%	9.6	3.000%
21	230	8	3.319%	6.3	2.750%	6.3	2.750%
22	157	11	6.872%	3.9	2.500%	3.9	2.500%
23	145	-	0.000%	3.3	2.250%	3.3	2.250%
24	114	4	3.572%	2.3	2.000%	2.3	2.000%
25	91	2	2.336%	1.8	2.000%	1.8	2.000%
	12,402	1,020	8.226%	1,025.2	8.266%	1,025.2	8.266%

EXHIBIT D-13
Termination of Employment – County

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	93	21	22.413%	18.6	20.000%	20.4	22.000%
2	144	24	17.027%	24.4	17.000%	25.9	18.000%
3	176	31	17.554%	26.4	15.000%	28.2	16.000%
4	207	27	13.078%	27.0	13.000%	29.0	14.000%
5	234	27	11.564%	26.9	11.500%	28.1	12.000%
6	265	31	11.508%	27.9	10.500%	28.5	10.750%
7	279	24	8.605%	26.5	9.500%	26.5	9.500%
8	279	19	6.658%	23.7	8.500%	24.4	8.750%
9	271	28	10.196%	20.4	7.500%	21.7	8.000%
10	253	19	7.418%	17.1	6.750%	19.0	7.500%
11	259	23	8.997%	16.2	6.250%	18.1	7.000%
12	259	23	8.899%	14.9	5.750%	16.8	6.500%
13	301	18	5.975%	16.6	5.500%	18.1	6.000%
14	304	21	7.022%	16.0	5.250%	17.5	5.750%
15	292	17	5.982%	14.6	5.000%	16.1	5.500%
16	287	18	6.099%	13.6	4.750%	15.1	5.250%
17	223	10	4.447%	10.0	4.500%	11.1	5.000%
18	164	11	6.500%	7.0	4.250%	7.8	4.750%
19	136	12	8.795%	5.4	4.000%	6.1	4.500%
20	102	4	3.665%	3.8	3.750%	4.3	4.250%
21	77	6	8.048%	2.7	3.500%	3.1	4.000%
22	73	4	5.225%	2.4	3.250%	2.7	3.750%
23	62	7	11.592%	1.9	3.000%	2.2	3.500%
24	42	1	2.090%	1.2	2.750%	1.4	3.250%
25	45	-	0.000%	1.1	2.500%	1.4	3.000%
	4,828	425	8.802%	366.2	7.583%	393.5	8.150%

EXHIBIT D-14
Salary Scale – Schools

Duration	Initial Salary (Millions)	Subsequent Salary (Millions)	Actual Rate	Current Expected (Millions)	Current Rate	Proposed Expected (Millions)	Proposed Rate
1	394.4	427.2	8.3%	445.0	12.9%	445.0	12.9%
2	370.3	397.3	7.3%	399.4	7.9%	399.4	7.9%
3	363.8	388.1	6.7%	390.6	7.4%	390.6	7.4%
4	355.4	377.2	6.2%	377.9	6.4%	377.9	6.4%
5	336.9	356.9	5.9%	356.6	5.9%	356.6	5.9%
6	333.3	351.3	5.4%	352.8	5.9%	352.8	5.9%
7	316.8	333.9	5.4%	334.6	5.6%	334.6	5.6%
8	296.6	311.5	5.0%	312.5	5.4%	312.5	5.4%
9	280.0	294.3	5.1%	294.3	5.1%	294.3	5.1%
10	265.4	278.8	5.0%	278.3	4.9%	278.3	4.9%
11	264.9	276.7	4.5%	277.1	4.6%	277.1	4.6%
12	268.9	280.4	4.3%	280.6	4.4%	280.6	4.4%
13	274.5	285.8	4.1%	285.9	4.2%	285.9	4.2%
14	272.0	282.5	3.9%	282.9	4.0%	282.9	4.0%
15	255.6	265.1	3.8%	265.5	3.9%	265.5	3.9%
16	237.0	245.2	3.5%	246.0	3.8%	246.0	3.8%
17	219.7	227.4	3.5%	227.8	3.7%	227.8	3.7%
18	209.8	217.0	3.4%	217.4	3.6%	217.4	3.6%
19	211.0	218.3	3.5%	218.4	3.5%	218.4	3.5%
20	214.1	220.8	3.1%	221.4	3.4%	221.4	3.4%
21	213.2	219.5	3.0%	220.2	3.3%	220.2	3.3%
22	197.0	202.8	2.9%	203.3	3.2%	203.3	3.2%
23	179.0	184.1	2.8%	184.6	3.1%	184.6	3.1%
24	161.4	166.3	3.1%	166.2	3.0%	166.2	3.0%
25	147.0	151.2	2.8%	151.4	3.0%	151.4	3.0%
26	137.6	141.4	2.8%	141.8	3.0%	141.8	3.0%
27	127.9	131.5	2.8%	131.8	3.0%	131.8	3.0%
28	117.9	121.3	2.8%	121.5	3.0%	121.5	3.0%
29	101.5	104.1	2.6%	104.6	3.0%	104.6	3.0%
	7,123.2	7,458.0	4.7%	7,490.4	5.2%	7,490.4	5.2%

EXHIBIT D-15
Salary Scale – Patrol

Duration	Initial Salary (Millions)	Subsequent Salary (Millions)	Actual Rate	Current Expected (Millions)	Current Rate	Proposed Expected (Millions)	Proposed Rate
1	3.3	3.5	4.4%	3.6	8.4%	3.6	8.4%
2	2.8	2.9	7.2%	3.0	7.4%	3.0	7.4%
3	2.9	3.1	6.0%	3.1	6.5%	3.1	6.4%
4	4.0	4.2	5.7%	4.2	5.9%	4.2	6.1%
5	3.8	3.9	3.0%	4.0	5.5%	4.1	5.9%
6	2.8	3.0	7.0%	2.9	5.2%	2.9	5.7%
7	1.8	2.0	5.7%	1.9	4.9%	1.9	5.4%
8	0.9	0.9	7.6%	0.9	4.7%	0.9	5.2%
9	1.7	1.9	9.9%	1.8	4.5%	1.8	5.0%
10	0.9	0.9	5.0%	0.9	4.5%	0.9	5.0%
11	1.1	1.1	4.0%	1.1	4.4%	1.1	4.9%
12	1.5	1.6	5.0%	1.6	4.4%	1.6	4.9%
13	2.6	2.8	7.6%	2.8	4.4%	2.8	4.9%
14	3.8	4.1	7.7%	4.0	4.4%	4.0	4.9%
15	2.7	2.8	5.2%	2.8	4.4%	2.8	4.9%
16	3.0	3.3	7.3%	3.2	4.4%	3.2	4.9%
17	5.7	6.1	5.9%	6.0	4.4%	6.0	4.9%
18	7.1	7.6	6.6%	7.4	4.4%	7.4	4.9%
19	7.8	8.1	4.1%	8.1	4.4%	8.1	4.9%
20	5.5	5.9	5.5%	5.8	4.4%	5.8	4.9%
21	5.0	5.2	4.6%	5.2	4.4%	5.2	4.9%
22	3.9	4.1	5.4%	4.0	4.4%	4.1	4.9%
23	2.6	2.7	5.3%	2.7	4.4%	2.7	4.9%
24	3.2	3.4	5.0%	3.3	4.4%	3.3	4.9%
25	0.7	0.7	3.9%	0.7	4.4%	0.7	4.9%
26	0.4	0.4	8.9%	0.4	4.1%	0.4	4.6%
27	-	-	-100.0%	-	3.8%	-	4.3%
28	0.1	0.1	4.3%	0.1	3.5%	0.1	4.0%
29	-	-	-100.0%	-	3.2%	-	3.7%
	81.6	86.2	5.7%	85.6	4.9%	85.9	5.3%

EXHIBIT D-16
Salary Scale – State

Duration	Initial Salary (Millions)	Subsequent Salary (Millions)	Actual Rate	Current Expected (Millions)	Current Rate	Proposed Expected (Millions)	Proposed Rate
1	205.5	218.7	6.4%	224.4	9.2%	224.4	9.2%
2	148.1	155.8	5.2%	157.5	6.4%	157.5	6.4%
3	129.1	134.6	4.3%	136.6	5.9%	136.6	5.9%
4	114.4	121.6	6.3%	120.5	5.4%	120.5	5.4%
5	111.0	117.3	5.7%	116.3	4.9%	116.3	4.9%
6	91.6	96.4	5.2%	95.9	4.6%	95.9	4.6%
7	91.3	96.7	5.9%	95.3	4.4%	95.3	4.4%
8	79.5	84.1	5.8%	82.8	4.3%	82.8	4.3%
9	71.2	74.8	5.1%	74.2	4.2%	74.2	4.2%
10	56.9	59.8	5.2%	59.2	4.1%	59.2	4.1%
11	53.6	56.7	5.9%	55.7	4.0%	55.7	4.0%
12	49.9	52.3	4.8%	51.9	4.0%	51.9	4.0%
13	57.0	59.9	5.2%	59.2	4.0%	59.2	4.0%
14	55.9	58.7	4.9%	58.1	4.0%	58.1	4.0%
15	43.0	44.6	3.9%	44.6	4.0%	44.6	4.0%
16	50.6	53.2	5.2%	52.6	4.0%	52.6	4.0%
17	33.7	35.3	4.9%	35.0	4.0%	35.0	4.0%
18	30.0	31.4	4.5%	31.2	4.0%	31.2	4.0%
19	26.3	27.6	4.9%	27.3	4.0%	27.3	4.0%
20	20.4	21.1	3.5%	21.2	4.0%	21.2	4.0%
21	17.5	18.5	5.2%	18.2	4.0%	18.2	4.0%
22	11.9	12.3	4.0%	12.3	3.4%	12.3	3.4%
23	13.0	13.5	3.6%	13.4	3.0%	13.4	3.0%
24	11.0	11.5	4.3%	11.3	3.0%	11.3	3.0%
25	9.8	10.2	4.1%	10.1	3.0%	10.1	3.0%
26	11.7	12.2	4.9%	12.0	3.0%	12.0	3.0%
27	10.2	10.6	4.2%	10.5	3.0%	10.5	3.0%
28	11.6	12.1	4.5%	11.9	3.0%	11.9	3.0%
29	12.7	13.3	5.1%	13.0	3.0%	13.0	3.0%
	1,628.0	1,714.9	5.3%	1,712.3	5.2%	1,712.3	5.2%

EXHIBIT D-17
Salary Scale – County

Duration	Initial Salary (Millions)	Subsequent Salary (Millions)	Actual Rate	Current Expected (Millions)	Current Rate	Proposed Expected (Millions)	Proposed Rate
1	66.3	73.8	11.3%	71.9	8.4%	71.9	8.4%
2	57.0	61.8	8.4%	61.2	7.4%	61.2	7.4%
3	48.7	52.5	7.8%	51.8	6.4%	51.8	6.4%
4	41.3	44.5	7.8%	43.5	5.4%	43.5	5.4%
5	42.7	45.9	7.4%	44.8	4.9%	44.8	4.9%
6	41.6	44.3	6.4%	43.5	4.6%	43.5	4.6%
7	38.4	40.7	6.0%	40.1	4.4%	40.1	4.4%
8	32.2	34.2	6.1%	33.5	4.1%	33.5	4.1%
9	29.6	31.5	6.2%	30.8	3.9%	30.8	3.9%
10	25.8	27.3	6.0%	26.8	3.9%	26.8	3.9%
11	23.9	25.3	5.9%	24.8	3.9%	24.8	3.9%
12	23.2	24.6	5.9%	24.1	3.9%	24.1	3.9%
13	29.4	30.6	4.2%	30.5	3.9%	30.5	3.9%
14	28.4	29.7	4.6%	29.5	3.9%	29.5	3.9%
15	24.4	25.6	5.0%	25.3	3.9%	25.3	3.9%
16	18.7	19.6	5.0%	19.4	3.9%	19.4	3.9%
17	16.5	17.4	5.8%	17.1	3.9%	17.1	3.9%
18	12.9	13.6	5.1%	13.4	3.6%	13.4	3.6%
19	9.7	10.2	5.2%	10.0	3.4%	10.0	3.4%
20	7.4	7.7	4.6%	7.6	3.4%	7.6	3.4%
21	7.1	7.4	3.8%	7.4	3.4%	7.4	3.4%
22	5.6	5.9	5.5%	5.8	3.4%	5.8	3.4%
23	4.2	4.3	3.9%	4.3	3.4%	4.3	3.4%
24	3.9	4.1	4.2%	4.1	3.4%	4.1	3.4%
25	4.1	4.3	4.6%	4.3	3.1%	4.3	3.1%
26	4.0	4.2	5.0%	4.1	3.1%	4.1	3.1%
27	3.9	4.0	3.6%	4.0	3.1%	4.0	3.1%
28	4.2	4.4	5.0%	4.3	3.1%	4.3	3.1%
29	4.7	4.9	4.3%	4.9	3.1%	4.9	3.1%
	659.7	704.3	6.8%	692.6	5.0%	692.6	5.0%