Cavanaugh Macdonald
CONSULTING, LLC

The experience and dedication you deserve

NEBRASKA PUBLIC EMPLOYEES
RETIREMENT SYSTEMS

Experience Study
Study Period: Four Years Ending June 30, 2019 or
December 31, 2019

Date: December 21, 2020

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December 21, 2020

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 2019. For the Schools, Patrol, and Judges Plans, this is the period July 1, 2015 to June 30, 2019, while for the County and State Cash Balance Plans the period is January 1, 2016 through December 31, 2019. 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, 2021 and July 1, 2021 actuarial valuations.

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

We further certify that, in our opinion, the assumptions developed in this report satisfy Actuarial Standards of Practice, in particular, No. 27 (Selection of Economic Assumptions for Measuring Pension Obligations) and No. 35 (Selection of Demographic and Other Non-economic Assumptions for Measuring Pension Obligations). At the time this study was prepared, the world is in the midst of a pandemic. We have considered available information, but do not believe that there is yet sufficient data to influence the recommended assumptions which are intended to be long term estimates. We will continue to monitor the situation and advise the Board in the future of any adjustments that we believe would be appropriate.

In order to prepare the results in this study we have utilized appropriate actuarial models that were developed for this purpose. These models use assumptions about future contingent events along with recognized actuarial approaches to develop the needed results.

Board of Trustees
December 21, 2020
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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
Principal and Consulting Actuary

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

Introduction

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

The basic purpose of an experience study is to determine whether the actuarial assumptions currently in use 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 2019. For the School, Patrol, and Judges plans, this is the period July 1, 2015 to June 30, 2019, while for the County and State plans the period is January 1, 2016 through December 31, 2019. 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, 2021 and July 1, 2021 actuarial valuations.

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

Our Philosophy

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

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

returns closer to its prior level, we will not have overreacted, possibly causing volatility in the actuarial contribution rates.

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

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

Actuarial Methods

The basic actuarial methodologies used in the valuation process include the;
- actuarial cost method,
- asset valuation method and
- unfunded actuarial accrued liability (UAAL) amortization methodology.

The actuarial cost method and UAAL amortization method are set in statute, but we nonetheless review them to determine if there is reason to propose any legislative changes. We are not recommending a change to the actuarial cost method (individual Entry Age Normal) or the asset valuation method. However, we are making a recommendation for changes to the UAAL amortization methodology for the School, Patrol and Judges plans.

Given best practices in the industry and recent guidance from the Actuarial Standards Board, we recommend the current amortization period of 30 years for the School, Patrol and Judges Plans be shortened. While 30 years used to be a very common amortization period, more recently the trend has been to shorter periods. Given the State's desire to fund these plans largely with fixed contribution rates, **we recommend NPERS work to change the statutes to reduce the current 30-year amortization period for new bases for the School, Patrol and Judges Plans to 25 years.** An amortization period of 20 years would better conform to best practices in the industry but would introduce more volatility in the actuarial contribution rate and any additional state contributions. To implement the change in the amortization period with minimal financial impact on the short-term valuation results, we suggest the change be made prospectively and existing amortization bases remain on their current payment schedules. In addition, layered amortization can create some volatility or discontinuity in the actuarial 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 and offsetting existing UAAL amortization bases upon the recommendation of the actuary. We recommend the Board consider the advantages and disadvantages of such a change and then decide about whether to seek legislative change.

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 2008 followed by the rebound in many financial markets in the years following. Our goal is to try to find the emerging long-term trends in the midst of this volatility so that we can then apply reasonable assumptions.

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 a decrease in the inflation assumption from 2.75% to 2.35%. This change moves the assumption closer to recent inflation levels and closer to the levels expected by most economic forecasts.

With the change in inflation assumption, most of the other economic assumptions which build upon it are also impacted. In addition, we are also recommending several other changes to the set of economic assumptions including:

- Lowering the productivity assumption from 0.75% to 0.50% which results in a general wage growth assumption of 2.85%.
- Lowering the payroll growth assumption from 3.50% to 2.85%, consistent with the change in the general wage inflation.
- Lowering the real rate of return from 4.75% to 4.65%.
- Explicitly including the administrative expenses as part of the actuarial contribution rate instead of netting the expenses out of investment earnings.

The following table summarizes the current and proposed economic assumptions:

	Current Assumptions	Proposed Assumptions
Price Inflation	2.75%	2.35%
Investment Return	7.50%	7.00%
General Wage Growth	3.50%	2.85%
Payroll Growth	3.50%	2.85%
Cost-of-Living Adjustment (Tier 1)	2.25%	2.00%
Cash Balance Interest Credit Rate	6.25%	6.00%

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

In order to provide a smoother cost pattern, the proposed change to the inflation assumption of 40 basis points will be phased-in over four years. We believe the set of economic assumptions in each year complies with actuarial standards of practice.

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.

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

- **Mortality**: Changes to active, retiree, and disabled mortality tables based on the Pub-2010 Mortality Table. Specifically, for retiree mortality, we recommend the Pub-2010 General Employees Male Table (Above Median) and 95% of the Pub-2010 General Employees Female Table (Above Median), both male and female set back one year, with mortality improvements using 75% of the ultimate improvement rates in MP-2019.

- **Retirement**: Modifications to the early and normal retirement rates for the Schools Plan and adjusting retirement rates for members of the State and County plans.

- **Retirement Age for Deferred Vested Members**: We recommend changing the current assumption for Schools from age 62 to age 64.

- **Cash Balance Lump Sum Election:** Lowering the assumption of account balances paid in a lump sum at retirement from 70% to 50% for County members.

- **Termination of Employment:** Minor adjustments to the assumptions for School (Male and Female), State and County Plans.

Given the proposed changes to the investment return assumption, mortality assumption and cost-of-living adjustment assumption, the Board will need 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 suggested assumption changes was estimated by performing additional valuations using the January 1, 2020 or July 1, 2020 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 with a four-year phase-in of the decrease in the inflation assumption.

When this set of assumptions is actually used, in the January 1, 2021 or July 1, 2021 valuations, we expect the relative impact to be similar to the results shown here (as a percentage of the actuarial accrued liability

and normal cost). However, the actual impact may vary due to underlying changes that occur between valuation dates. Of particular note, the comparability may be affected by the actual investment return experience during the prior year.

The relative and net impact of the full four-year phase-in of both the recommended economic and demographic assumptions on each Plan's actuarial accrued liability is shown in the following graph:
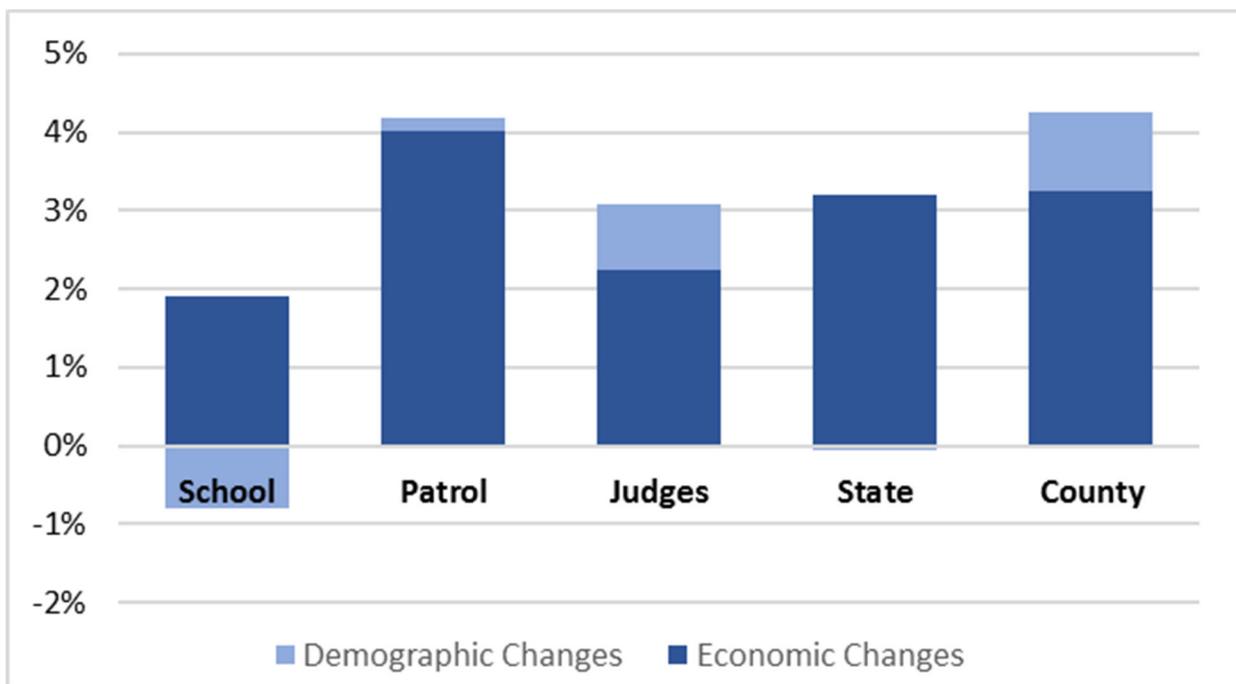
The following tables illustrate the expected impact over the next seven valuations under the current and proposed assumptions. The School, Patrol, and Judges tables also show the results if the future liability experience gains/losses and assumption changes are amortized over 25 rather than 30 years. Note that these results rely on the projection models prepared in conjunction with the most recent actuarial valuations and assume that all assumptions are met in future years. Actual results, especially the investment returns each year, will vary from those assumed and therefore the valuation results will also vary. These projections are shown for comparative purposes only.

JUDGES RETIREMENT SYSTEM

The following table illustrates the expected impact over the next seven valuations as described above.

| | Current Assumptions | Proposed Assumptions | |
	30-Year Amortization	30-Year Amortization	25-Year Amortization
UAAL			
2021	5,753,403	9,378,337	9,378,337
2022	8,197,572	12,848,000	12,823,558
2023	10,807,548	16,454,054	16,380,288
2024	13,044,077	19,588,466	19,434,664
2025	13,073,769	19,925,730	19,666,672
2026	12,998,080	19,925,286	19,547,687
2027	12,988,461	19,843,977	19,336,374
Funded Ratio			
2021	97.31%	95.69%	95.69%
2022	96.31%	94.32%	94.33%
2023	95.30%	92.99%	93.02%
2024	94.52%	91.93%	91.99%
2025	94.69%	92.03%	92.14%
2026	94.88%	92.25%	92.40%
2027	95.04%	92.49%	92.69%
Actuarial Rate			
2021	25.84%	27.00%	27.09%
2022	26.18%	27.75%	27.92%
2023	26.56%	28.54%	28.80%
2024	26.78%	29.19%	29.51%
2025	26.60%	29.07%	29.40%
2026	26.50%	28.96%	29.29%
2027	26.33%	28.78%	29.11%
Additional Appropriation			
2021	5.06%	6.41%	6.50%
2022	5.03%	6.76%	6.93%
2023	5.06%	7.13%	7.40%
2024	5.62%	8.05%	8.38%
2025	5.74%	8.19%	8.53%
2026	5.94%	8.35%	8.69%
2027	6.07%	8.43%	8.77%

STATE PATROL RETIREMENT SYSTEM

The following table illustrates the expected impact over the next seven valuations as described above.

	Current Assumptions	Proposed Assumptions	
	30-Year Amortization	30-Year Amortization	25-Year Amortization
UAAL			
2021	61,174,800	67,985,535	67,985,535
2022	65,654,775	75,940,225	75,890,942
2023	70,801,357	84,527,412	84,370,456
2024	74,566,069	96,895,420	96,558,262
2025	73,045,700	95,970,135	95,352,481
2026	71,384,740	94,409,805	93,479,252
2027	69,514,924	92,338,243	91,069,281
Funded Ratio			
2021	88.46%	87.33%	87.33%
2022	88.07%	86.42%	86.42%
2023	87.60%	85.47%	85.50%
2024	87.40%	84.10%	84.16%
2025	88.07%	84.73%	84.82%
2026	88.72%	85.42%	85.56%
2027	89.36%	86.14%	86.33%
Actuarial Rate			
2021	45.59%	47.45%	47.60%
2022	46.44%	49.30%	49.61%
2023	47.32%	51.19%	51.68%
2024	48.02%	53.87%	54.60%
2025	48.13%	54.21%	54.97%
2026	48.23%	54.46%	55.22%
2027	48.13%	54.41%	55.17%
Additional Appropriation			
2021	13.19%	15.05%	15.20%
2022	13.96%	16.82%	17.13%
2023	14.76%	18.63%	19.12%
2024	15.36%	21.21%	21.94%
2025	15.35%	21.43%	22.19%
2026	15.33%	21.56%	22.32%
2027	15.05%	21.33%	22.09%

SCHOOL RETIREMENT SYSTEM

The following table illustrates the expected impact over the next seven valuations as described above.

	Current Assumptions 30-Year Amortization	Proposed Assumptions 30-Year Amortization	25-Year Amortization
UAAL			
2021	1,091,348,521	1,004,347,039	1,004,347,039
2022	1,130,266,642	1,119,429,341	1,119,429,341
2023	1,179,046,315	1,251,494,008	1,251,494,008
2024	1,194,437,906	1,353,508,966	1,353,508,966
2025	1,069,282,913	1,273,600,400	1,273,600,400
2026	927,990,439	1,167,996,391	1,167,996,391
2027	769,158,677	1,040,143,642	1,040,143,642
Funded Ratio			
2021	92.40%	92.96%	92.96%
2022	92.44%	92.48%	92.48%
2023	92.42%	91.93%	91.93%
2024	92.61%	91.60%	91.60%
2025	93.62%	92.35%	92.35%
2026	94.65%	93.20%	93.20%
2027	95.72%	94.13%	94.13%
Actuarial Rate			
2021	17.92%	17.85%	17.81%
2022	18.07%	18.30%	18.30%
2023	18.24%	18.80%	18.85%
2024	18.36%	19.25%	19.34%
2025	18.14%	19.14%	19.22%
2026	17.93%	18.99%	19.06%
2027	17.70%	18.81%	18.87%
Contribution Shortfall/(Margin)			
2021	(3.74%)	(3.81%)	(3.85%)
2022	(3.59%)	(3.36%)	(3.36%)
2023	(3.42%)	(2.86%)	(2.81%)
2024	(3.30%)	(2.41%)	(2.32%)
2025	(3.52%)	(2.52%)	(2.44%)
2026	(3.73%)	(2.67%)	(2.60%)
2027	(3.96%)	(2.85%)	(2.79%)

STATE CASH BALANCE PLAN

The following table illustrates the expected impact over the next seven valuations as described above.

	Current Assumptions	Proposed Assumptions
UAAL		
2021	(93,753,262)	(71,394,540)
2022	(145,251,327)	(105,286,949)
2023	(174,395,359)	(112,916,903)
2024	(244,077,169)	(157,345,145)
2025	(283,144,808)	(181,320,870)
2026	(326,081,173)	(207,768,048)
2027	(373,216,690)	(238,001,571)
Funded Ratio		
2021	105.39%	104.06%
2022	108.03%	105.71%
2023	109.25%	105.85%
2024	112.43%	107.80%
2025	113.85%	108.65%
2026	115.31%	109.54%
2027	116.82%	110.53%
Actuarial Rate		
2021	9.27%	10.02%
2022	8.70%	9.73%
2023	8.44%	9.77%
2024	7.77%	9.43%
2025	7.47%	9.24%
2026	7.17%	9.05%
2027	6.86%	8.84%
Contribution Shortfall/(Margin)		
2021	(3.02%)	(2.27%)
2022	(3.58%)	(2.56%)
2023	(3.84%)	(2.52%)
2024	(4.52%)	(2.86%)
2025	(4.81%)	(3.04%)
2026	(5.12%)	(3.24%)
2027	(5.43%)	(3.45%)

COUNTY CASH BALANCE PLAN

The following table illustrates the expected impact over the next seven valuations as described above.

	Current Assumptions	Proposed Assumptions
UAAL		
2021	(32,085,677)	(18,425,595)
2022	(48,831,807)	(28,366,197)
2023	(59,124,229)	(30,420,688)
2024	(82,411,650)	(44,074,778)
2025	(96,078,405)	(51,333,847)
2026	(111,096,259)	(59,353,044)
2027	(127,580,202)	(68,555,114)
Funded Ratio		
2021	105.72%	103.21%
2022	108.32%	104.70%
2023	109.62%	104.78%
2024	112.82%	106.59%
2025	114.27%	107.35%
2026	115.76%	108.14%
2027	117.28%	109.01%
Actuarial Rate		
2021	9.08%	10.01%
2022	8.64%	9.83%
2023	8.42%	9.88%
2024	7.87%	9.63%
2025	7.62%	9.49%
2026	7.36%	9.35%
2027	7.09%	9.19%
Contribution Shortfall/(Margin)		
2021	(2.55%)	(1.62%)
2022	(2.99%)	(1.80%)
2023	(3.21%)	(1.75%)
2024	(3.76%)	(2.00%)
2025	(4.01%)	(2.14%)
2026	(4.27%)	(2.28%)
2027	(4.54%)	(2.44%)

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

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

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

If separate amortization bases are maintained, the UAAL is composed of multiple amortization bases, each with its own payment schedule and remaining amortization period. In each valuation, the unexpected change in the UAAL is established as a new amortization base over the appropriate amortization period beginning on that valuation date. The UAAL is then the sum of all of the outstanding amortization bases on the valuation date and the UAAL payment is the sum of all of the amortization payments on the existing amortization bases. This approach provides transparency in that the current UAAL is paid off over a fixed period of time and the remaining components of the UAAL are clearly identified 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. For all of the plans, a new base is created each year that includes all of the unanticipated changes in the UAAL for the year. These new bases are amortized in a consistent time frame and basis. Whenever a plan has a total UAAL of $0 or less (i.e. there is an actuarial surplus), all of the amortization bases are eliminated and the net surplus is amortized over 30 years.

While the current method, set by statute, is not unreasonable, we do note that over the last decade, the Government Finance Officers Association (GFOA) and the Conference of Consulting Actuaries (CCA) have published guidance on their opinion of "best practices" regarding public pension plan funding, including the length of the amortization period. Although these recommendations are not binding, they do point to an increased focus on developing amortization policies that are designed to pay down the UAAL in a meaningful way over a reasonable period. In particular, this guidance would encourage a more rapid amortization of the annual incremental pieces, paying them off in 15 to 20 years, particularly if the level percent of payroll methodology is being used.

The Actuarial Standards Board recently released a second exposure draft of *Actuarial Standard of Practice Number 4, Measuring Pension Obligations and Determining Pension Plan Costs* which 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,

most of the considerations outlined in ASOP 4 would lead us to recommend a shorter amortization period than the current 30 years for School, Patrol and Judges. For these three plans, 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 two experience studies has helped reduce the number of years of negative amortization and the resulting growth in the dollar amount of UAAL, but with an amortization period of 30 years the dollar amount of the UAAL is not expected to be lower than the initial amount for 18 years. 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, **we recommend NPERS work to change the statutes to reduce the current 30 year amortization period for new bases for the School, Patrol and Judges Plans to 25 years.** An amortization period of 20 years would conform better to best practices in the industry, but would also introduce more volatility in the actuarial contribution rate and, therefore, any additional state contributions. To implement the change in the amortization period with minimal financial impact on the short-term valuation results, we suggest the change be made prospectively to new amortization bases and existing amortization bases remain on their current payment schedules. 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 recommend the Board consider the advantages and disadvantages of such a change and then make a decision about whether to seek legislative change.

The following table illustrates the expected impact on contributions over the next seven valuations if future amortization bases for assumption changes and experience gains/losses are amortized over 25 rather than 30 years. Note that these results rely on the projection models prepared in conjunction with the most recent actuarial valuations and assume that all assumptions are met in future years. Actual results, especially the investment returns each year, will vary from those assumed and therefore the valuation results will also vary. These projections are shown for comparative purposes only.

Schools

| July 1 | Current: 30-Year Layers | | | 25-Year Layers | | | |
	Actuarial Rate	Statutory Rate	Shortfall / (Margin)	Actuarial Rate	Statutory Rate	Shortfall / (Margin)	Difference
2021	17.85%	21.66%	(3.81%)	17.81%	21.66%	(3.85%)	(0.04%)
2022	18.30%	21.66%	(3.36%)	18.30%	21.66%	(3.36%)	0.00%
2023	18.80%	21.66%	(2.86%)	18.85%	21.66%	(2.81%)	0.05%
2024	19.25%	21.66%	(2.41%)	19.34%	21.66%	(2.32%)	0.09%
2025	19.14%	21.66%	(2.52%)	19.22%	21.66%	(2.44%)	0.08%
2026	18.99%	21.66%	(2.67%)	19.06%	21.66%	(2.60%)	0.07%
2027	18.81%	21.66%	(2.85%)	18.87%	21.66%	(2.79%)	0.06%

State Patrol

| July 1 | Current: 30-Year Layers | | | 25-Year Layers | | | |
	Actuarial Rate	EE/ER Rate	Additional Appropriation	Actuarial Rate	EE/ER Rate	Additional Appropriation	Difference
2021	47.45%	32.40%	15.05%	47.60%	32.40%	15.20%	0.15%
2022	49.30%	32.48%	16.82%	49.61%	32.48%	17.13%	0.31%
2023	51.19%	32.56%	18.63%	51.68%	32.56%	19.12%	0.49%
2024	53.87%	32.66%	21.21%	54.60%	32.66%	21.94%	0.73%
2025	54.21%	32.78%	21.43%	54.97%	32.78%	22.19%	0.76%
2026	54.46%	32.90%	21.56%	55.22%	32.90%	22.32%	0.76%
2027	54.41%	33.08%	21.33%	55.17%	33.08%	22.09%	0.76%

Judges

| July 1 | Current: 30-Year Layers | | | 25-Year Layers | | | |
	Actuarial Rate	EE Rate + Court Fees	Additional Appropriation	Actuarial Rate	EE Rate + Court Fees	Additional Appropriation	Difference
2021	27.00%	20.59%	6.41%	27.09%	20.59%	6.50%	0.09%
2022	27.75%	20.99%	6.76%	27.92%	20.99%	6.93%	0.18%
2023	28.54%	21.41%	7.13%	28.80%	21.40%	7.40%	0.27%
2024	29.19%	21.14%	8.05%	29.51%	21.13%	8.38%	0.33%
2025	29.07%	20.88%	8.19%	29.40%	20.87%	8.53%	0.34%
2026	28.96%	20.61%	8.35%	29.29%	20.60%	8.69%	0.34%
2027	28.78%	20.35%	8.43%	29.11%	20.34%	8.77%	0.34%

Economic assumptions include price inflation, general wage increase (the across-the-board portion of salary increases), 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 both salary increases and investment return are influenced more by external forces which are difficult to accurately predict over the long term. The investment return and salary increase assumptions are generally selected on the basis of expectations in an inflation-free environment and then increased by the long-term expectation for price inflation.

Sources of data considered in the analysis and selection of the economic assumptions included:
- Historical observations of price and wage inflation statistics and investment returns.
- The 2020 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.

Note that some of these sources were published after the COVID-19 pandemic impacted the world economy and some were issued prior to the pandemic. In evaluating the forecasts, we considered the timing on the published information and the potential impact COVID-19 might have had on the forward-looking measurements.

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 Economic Assumptions for Measuring Pension Obligations*, provides actuaries with guidance regarding the selection of economic assumptions for measuring pension obligations. Because no one knows what the future holds, an actuary must use professional judgment to estimate possible future economic outcomes, based on a mixture of past experience, future expectations, and professional judgment. 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 economic assumptions to measure obligations under any defined benefit pension plan that is not a social insurance program (e.g., Social Security).

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

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

Recognizing that there is no correct answer, the standard calls for the actuary to select a "reasonable" economic assumption. For this purpose, an assumption is deemed reasonable if it has the following characteristics:

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

    b. it reflects the actuary's professional judgment;

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

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

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

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

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

The recent experience, and still developing impact, of COVID-19 is likely to influence both demographic experience and economic forecasts, at least in the short term. This report specifically excludes data for 2020 as we believe this experience is more short term in nature and we do not wish to distort the data used to develop recommended assumptions. We will continue to monitor the developments related to COVID-19 and their impact on pension plans over the next year or two and keep the Board advised of any changes we believe should be made.

The following table summarizes the current and proposed economic assumptions:

	Current Assumptions	Proposed Assumptions
Price Inflation	2.75%	2.35%
Real Rate of Return	4.75%	4.65%
Investment Return	7.50%	7.00%
Productivity	0.75%	0.50%
General Wage Growth	3.50%	2.85%
Payroll Growth	3.50%	2.85%
Cost-of-Living Adjustment (Tier 1)	2.25%	2.00%
Cash Balance Interest Credit Rate	6.25%	6.00%

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

In order to provide a smoother cost pattern, the proposed change to the inflation assumption of 40 basis points will be phased-in over four years. Our analysis indicates that phasing in the change in the inflation assumption does not have any negative implications on the funding the plans, as illustrated in the following graph.

Patrol - Funded Ratio

— 4-Year Phase In   — Immediate
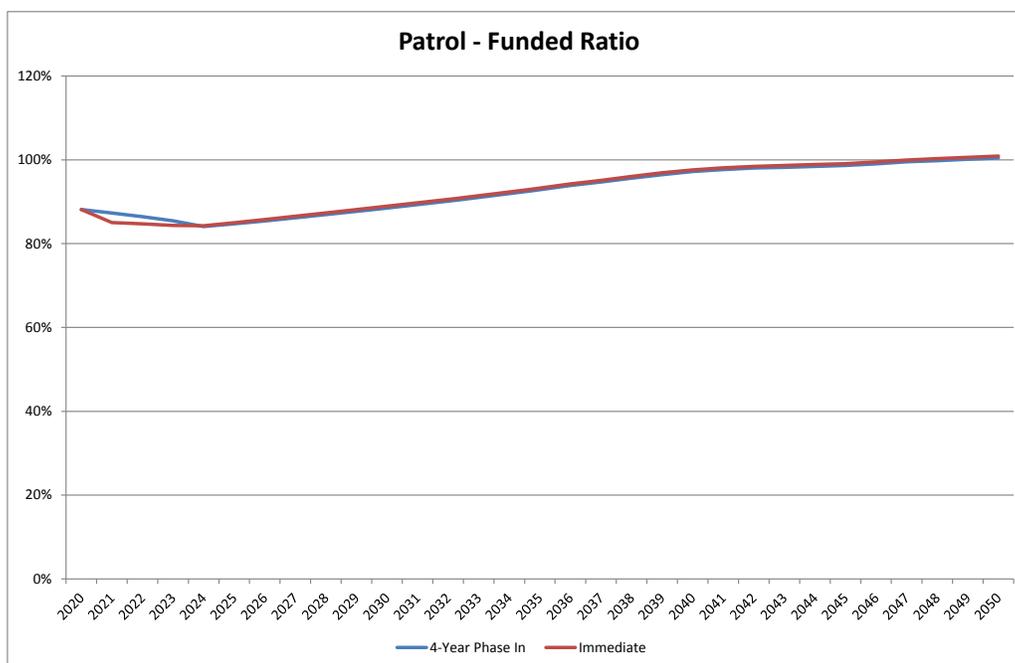
PRICE INFLATION

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 assumption, either directly or indirectly. The current assumption for price inflation, 2.75% per year, was reduced from 3.25% in 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 December 31, 2019.

Periods Ending December 2019	Annualized Rate of Inflation
Last 10 Years	1.75%
Last 15 Years	2.02%
Last 20 Years	2.14%
Last 25 Years	2.18%
Last 30 Years	2.44%
Since 1913 (first available year)	3.11%

Inflation has been low over most of these periods including about 2.2% over the last 25 years and 1.75% over the last 10 years.

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

Price Inflation
CPI-U
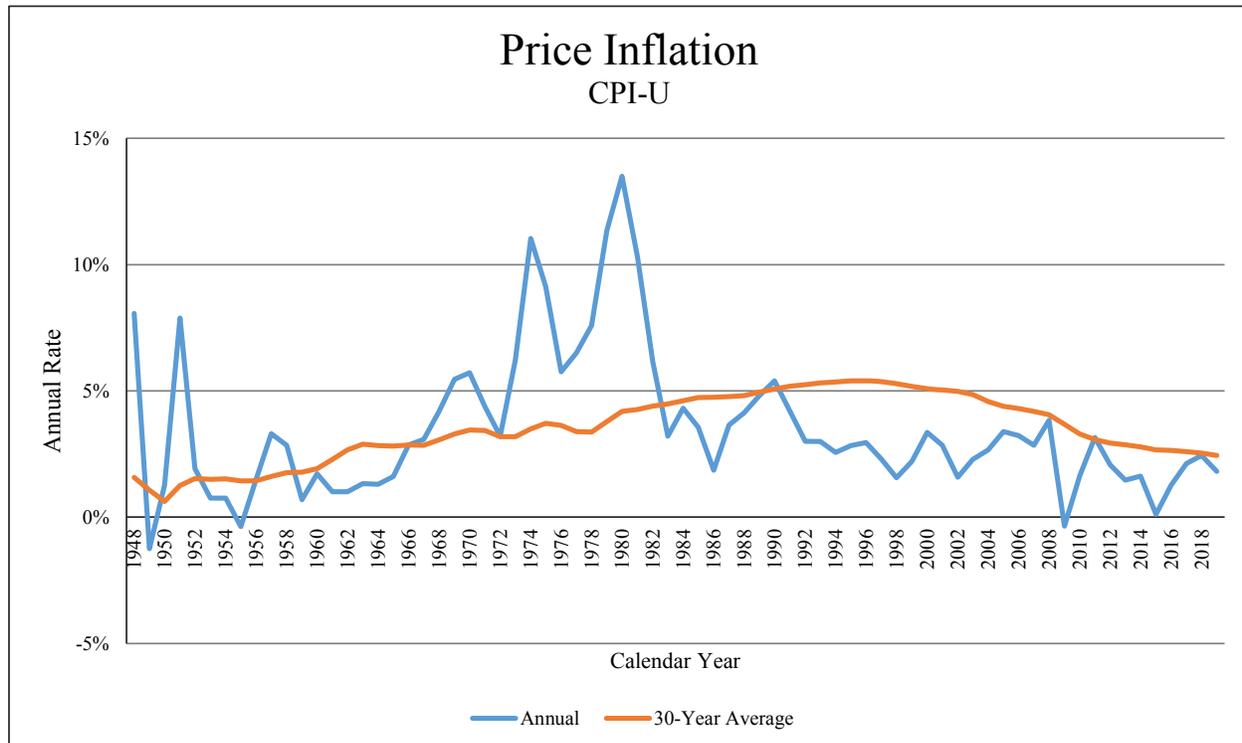
Historical averages are heavily dependent on the period selected. For example, the period of high inflation from 1973 to 1981 has a significant impact on the averages over periods which include these years. Over more recent periods (last 25 years), measured from December 31, 2019, the average annual rate of increase in the CPI-U has been much lower than the current assumption of 2.75%. Inflation has been under 2.50% for the last thirty years and under 2.00% for the last ten years.

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 2020 capital market assumptions, the ten-year price inflation assumption is 2.0% and the thirty-year assumption is 2.1%. Aon is expecting future inflation to remain around 2%, as targeted by the Federal Reserve.

Using the 2020 Horizon Survey, the range of inflation assumptions for the short term (10 years) based on data for 39 consultants included in the survey was 0.9% to 3.0% with a median of 2.0%. For the 18 consultants providing an inflation assumption for a longer period (20-30 years), the median assumption was 2.1% with a range of 1.7% to 3.0%. Note that the 25th to 75th percentile range for long term inflation was 2.0% to 2.2%. 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 December 31, 2019, the difference for 30-year bonds implied inflation of 1.81% for the next thirty years. Over the last few years, the bond market has been anticipating inflation of around 2.0% or less over 30 years, in line with the target inflation rate stated by the Federal Reserve. However, market prices for treasuries and TIPS can change rapidly to reflect recent macroeconomic events as we have seen in the months since the COVID-19 pandemic has spread in the United States.

Congressional Budget Office

The report of the Congressional Budget Office, *"The Budget and Economic Outlook: 2020 to 2030"*, reflects CBO's expectations of average annual price inflation of 2.38% 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 fourth quarter of 2019 was for inflation over the next ten years to average 2.20%. Given the current economic conditions, the most recently published survey indicates a lower expectation of around 2.0% for the next ten years.

Social Security Administration

Although many economists forecast lower inflation than the assumption used by most retirement plans, they are generally looking at a shorter time horizon than is appropriate for a pension valuation. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the most recent report (June 2020), 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%.

Peer System Comparison

While we do not recommend the selection of any assumption based on what other systems use, it does provide another set of relevant information to consider. The National Association of State Retirement Administrators (NASRA) Public Fund Survey collects information on the assumptions used by over 120 large retirement systems. The average inflation assumption in the most recent Public Fund Survey was 2.65% which compares to 3.75% back in the 2001 Survey. Note, however, that the most common assumption is 2.50%. It should be noted that there is a lag in this data as there is with any survey. Data for Systems that have recently conducted an experience study and made a change to this assumption is not captured in the survey data. Based on our knowledge, we believe the current average inflation assumption is 2.50% or lower. Some actuaries have questioned the reliability of the data in the survey for this assumption. Because we are not using it directly to set the inflation assumption for NPERS, we are not overly concerned about this claim. The real value of this data is it clearly illustrates the marked decline in the inflation assumption over the past two decades which is worth noting.

Comparison of Inflation Expectations

The following graph provides a comparison of the current levels of expected inflation.
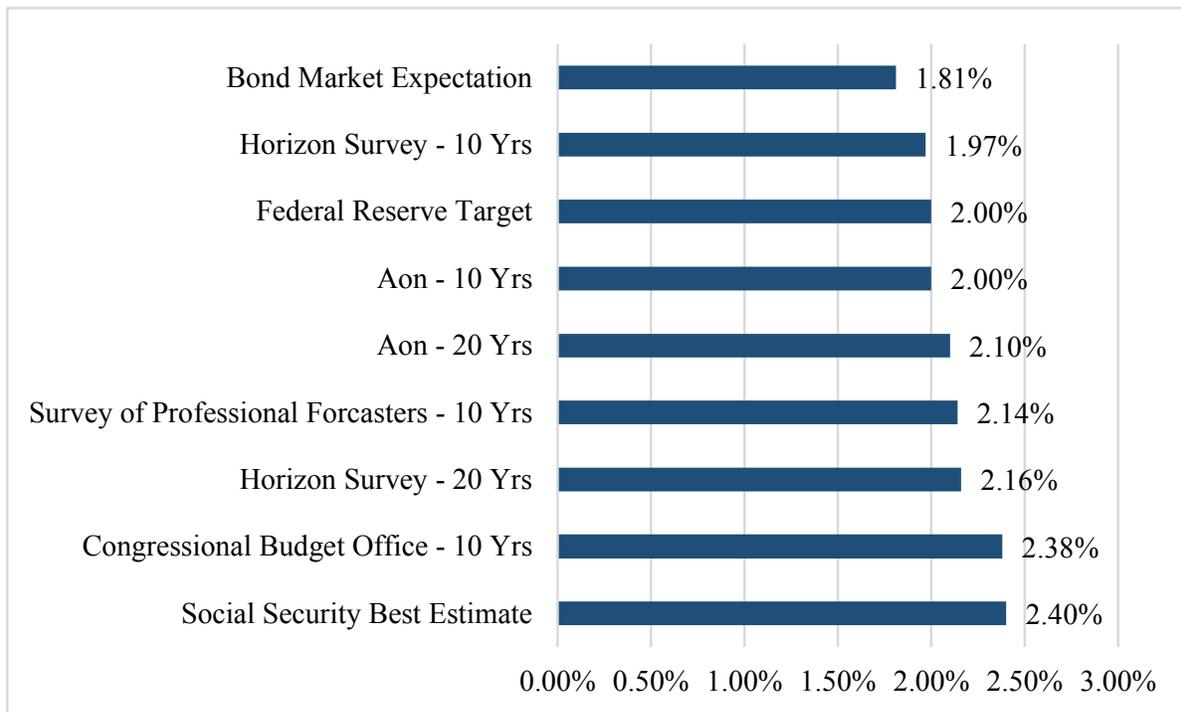
The lower inflation over the last 10, 20 and even 30 years, coupled with the low future inflation anticipated by the bond markets, investment consultants, and professional economic forecasters suggests the current inflation assumption of 2.75% is on the high end of the reasonable range. We are recommending the **inflation assumption be lowered to a rate of 2.35%. This change moves the assumption closer to recent inflation levels as well as closer to the levels expected by most economic forecasts.**

Consumer Price Inflation	
Current Assumption	2.75%
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.

The current investment return assumption is 7.50%. It should be noted that these assumptions are currently net of all investment-related expenses, as well as administrative expenses. This assumption is for the nominal rate of return and is composed of two components. The first component is price inflation (as previously discussed, this assumption is currently 2.75%). 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 4.75%. 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 <u>after</u> 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, 2019.
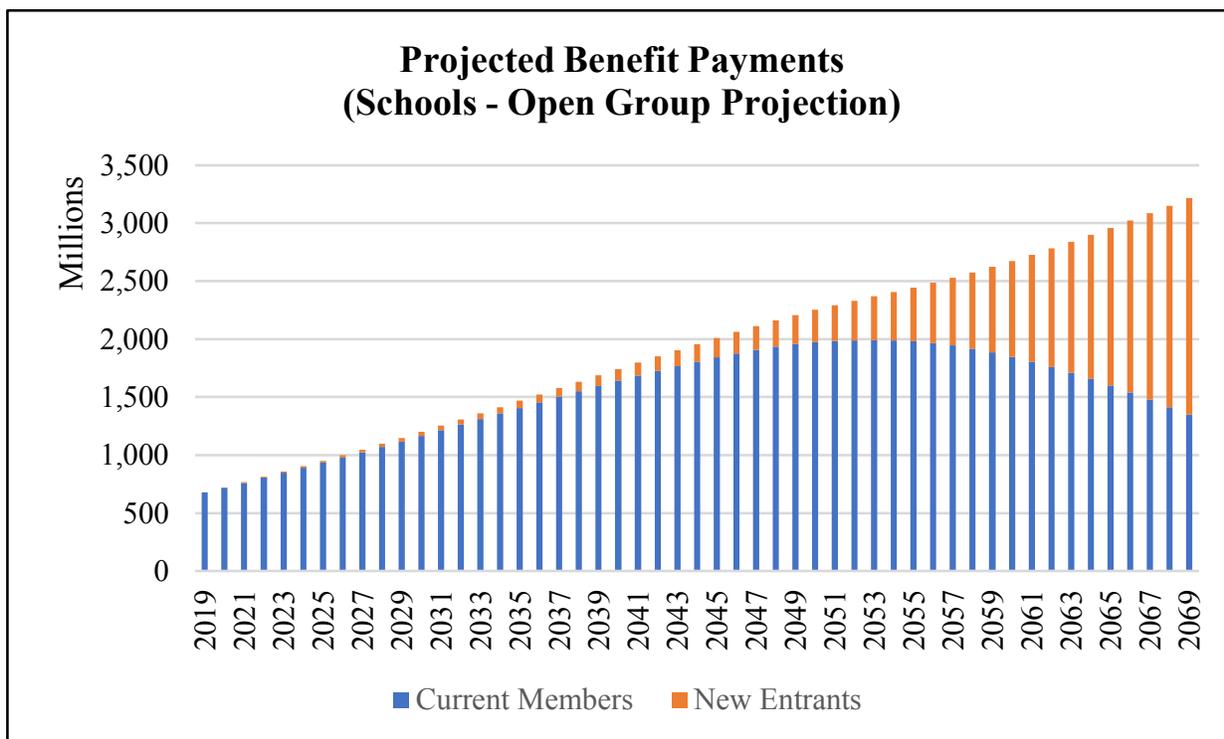
NPERS Historical Returns

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 36 years ending June 30, 2019. Despite significant volatility in the results from year to year, the actual geometric (compound) return was 9.9% for the last 10 years, 6.2% for the last 20 years, and 7.4% for the last 30 years.

Actual NIC Returns
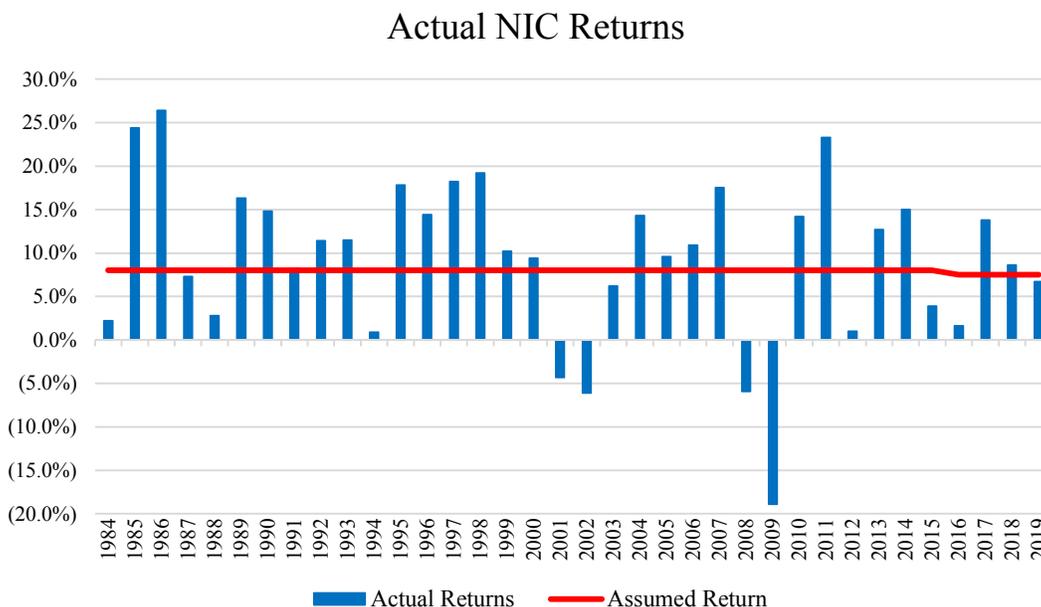
ANNUALIZED RETURNS through 6/30/19			
5-Year Return:	6.8%	20-Year Return:	6.2%
10-Year Return:	9.9%	30-Year Return:	8.3%

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, there is a definite downward trend.

Rolling 20-Year Returns
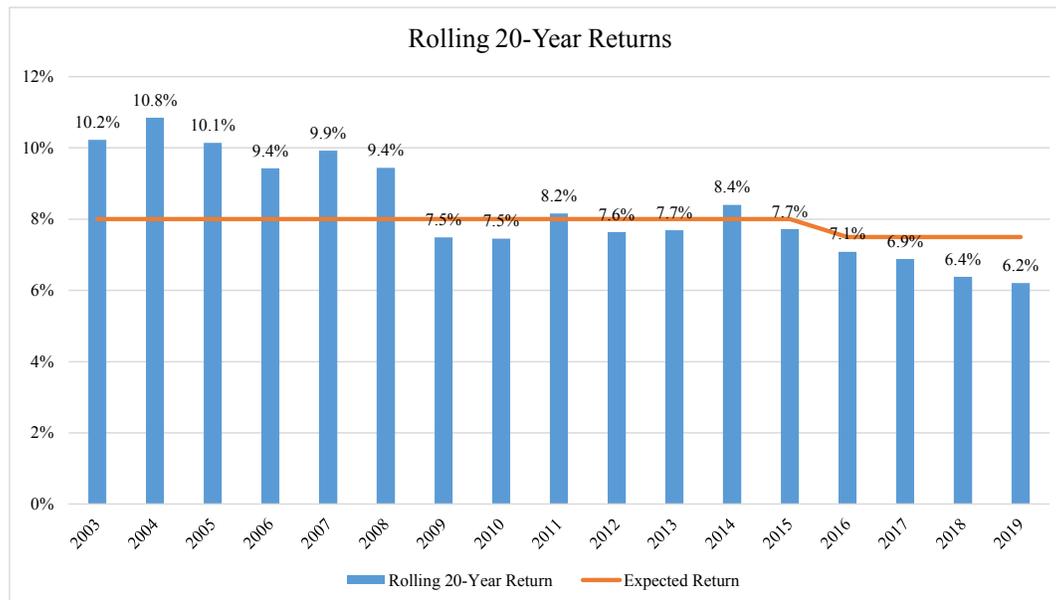
In addition, current expected long-term returns are much lower than those actually earned in the past, especially for the fixed income portion of the portfolio, reflecting a view of the capital markets that differs markedly from what has been experienced in the past.

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 65 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 Nebraska Investment Council (NIC) who relies on a variety of internal experts and external consultants to assist with investing the funds. As part of their duties, the NIC has its investment consultant, Aon, periodically perform asset-liability studies, along with comprehensive reviews of the expected return of the various asset classes in which the NPERS portfolio is invested. We believe it is appropriate for us to consider the results of Aon's work as one factor in assessing expected future returns.

We also recognize that there can be differences of opinion among investment professionals regarding future return expectations. Horizon Actuarial Services prepares an annual study in which they survey various investment advisors (39 were included in the 2020 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.

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	27.0%
Non-US Equities	11.5%
Global Equities	19.0%
Fixed Income	30.0%
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, 2020 and, therefore, reflect the impact of the pandemic.** As the graph indicates, the median nominal return is 6.3%. 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 5.2% and a 25% chance they will be above 7.4%. In other words, there is a 50% chance the compound return will be between 5.2% and 7.4%. This also means there is less than a 25% chance of meeting the current assumed rate of return of 7.5%, based on Aon's assumptions.

Estimated Range of Expected Future Nominal Rates of Return
Based on Aon's 30-Year Outlook
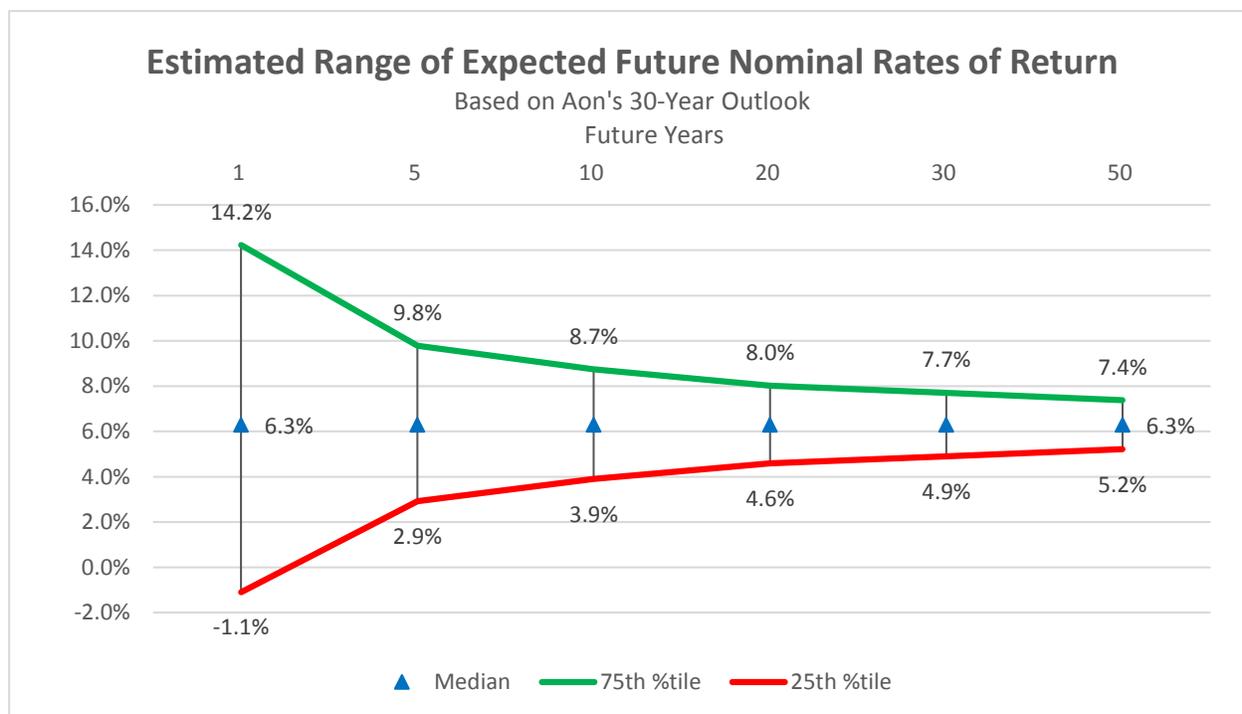
Although it is interesting to consider the probability of reaching the nominal expected return, the investment return assumption is developed using the "building block" approach which considers both the price inflation

and real return assumption individually. The current nominal assumed rate of return is composed of a price inflation assumption of 2.75% and a real rate of return of 4.75%.

Different firms use different approaches in setting capital market assumptions so we believe it is helpful to consider the assumptions and outlook of investment professionals other than the NIC's consultant. Using the 2020 Horizon Survey, we considered the range of capital market assumptions for the group of 39 investment firms who participated in the survey, which includes most major investment consultants. This provides another point of view from firms familiar with public plans. We believe there is value in considering both sets of capital market assumptions in our analysis.

Frequently investment consultants develop their expected return assumptions based on a timeframe of 5 to 10 years. Therefore, those assumptions may not necessarily be appropriate for the longer timeframe used by actuaries (30 to 50 years). Since both Aon and the Horizon Survey have developed longer term market return assumptions (30 and 20 years respectively), the expected returns from their assumptions are reasonably in line with the timeframe used by actuaries. Due to the timing of Aon's capital market assumptions provided to the NIC in 2020, the set of assumptions as of June 30, 2020 are not really comparable to the Horizon Survey assumptions because of the impact of the pandemic and actions taken by the Federal Reserve Bank. Therefore, both the 3/31/2020 and the 6/30/2020 assumptions are shown below for Aon. The following table summarizes our findings of the expected real returns:

Source	Nominal Return	Consultant's Inflation Assumption	Real Rate of Return
Aon (10 years) 6/30/2020	5.7%	2.0%	**3.7%**
Aon (10 years) 3/31/2020	6.3%	2.1%	**4.2%**
Horizon Survey (10 years) Q1 2020	6.07%	1.98%	**4.09%**
Horizon Survey (20 years) Q1 2020	6.97%	2.17%	**4.80%**
Aon (30 years) 3/31/2020	6.44%	2.10%	**4.34%**
Aon (30 years) 6/30/2020	6.3%	2.1%	**4.2%**

Given the uncertainty of capital market assumptions over a twenty to thirty-year period, the difference between Aon expected real return and the real return using the median assumption in the Horizon Survey is not material although Aon's expected real returns are somewhat lower.

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 2021 for the 125+ 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 over the last decade.

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

Distribution of Nominal Investment Return Assumptions, FY 01 to present

Public Fund Survey, NASRA July-20

Fiscal Year
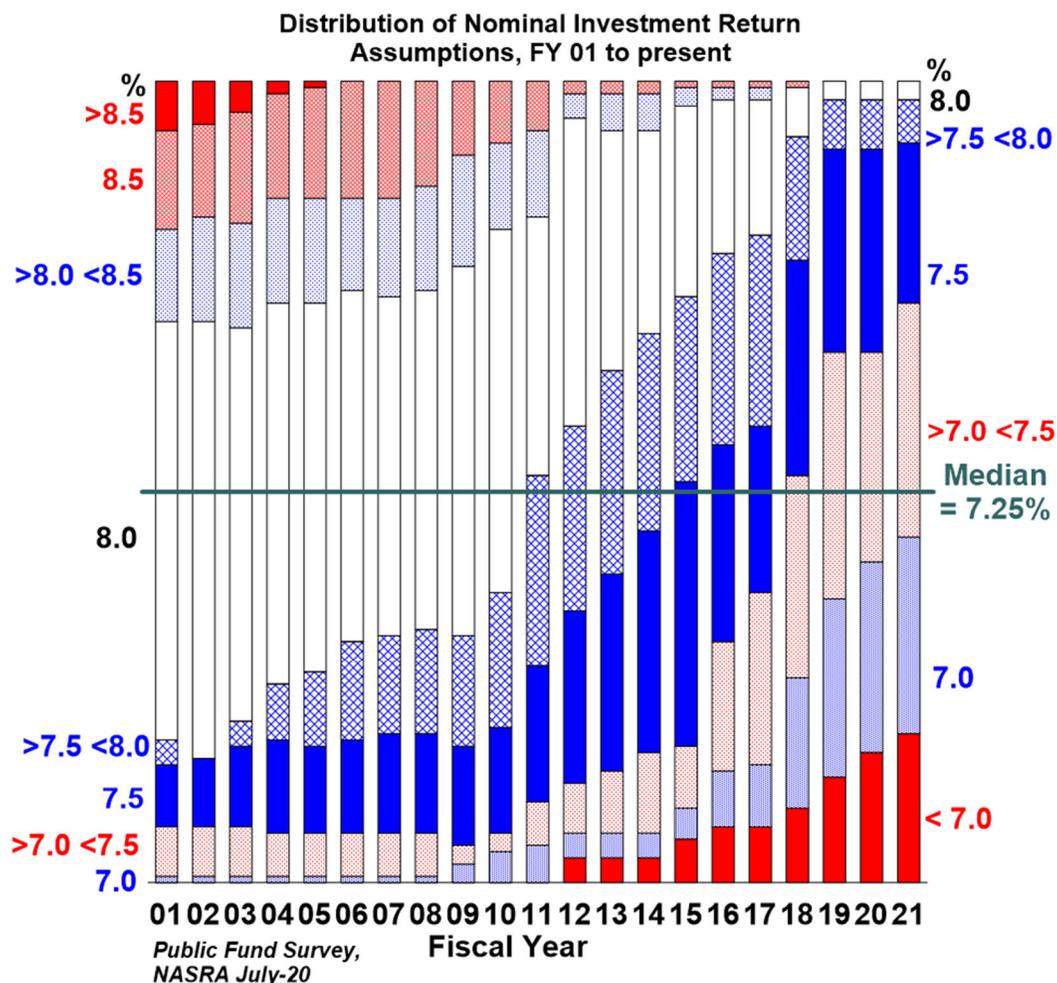
It is worth noting that the median investment return assumption when the last experience study was performed in 2016 was solidly 7.50% but dropped to 7.25% in 2018. The current distribution in July 2020 shows that while the median assumption remains 7.25%, it is moving closer to 7.00%. While 8.00% used to be the most common and the median assumption in the first half of this period (it was also NPERS' assumption), there are only 3 systems out of 130 currently using an 8.0% assumption.

The following graph is based on the same data as the prior graph, but shows only the distribution of the current investment return assumption used by the systems in the Public Fund Survey. Of the total, only 36 of 130, or 28%, use an assumption of 7.5% or higher.

Distribution of latest investment return assumptions

NASRA
July-20
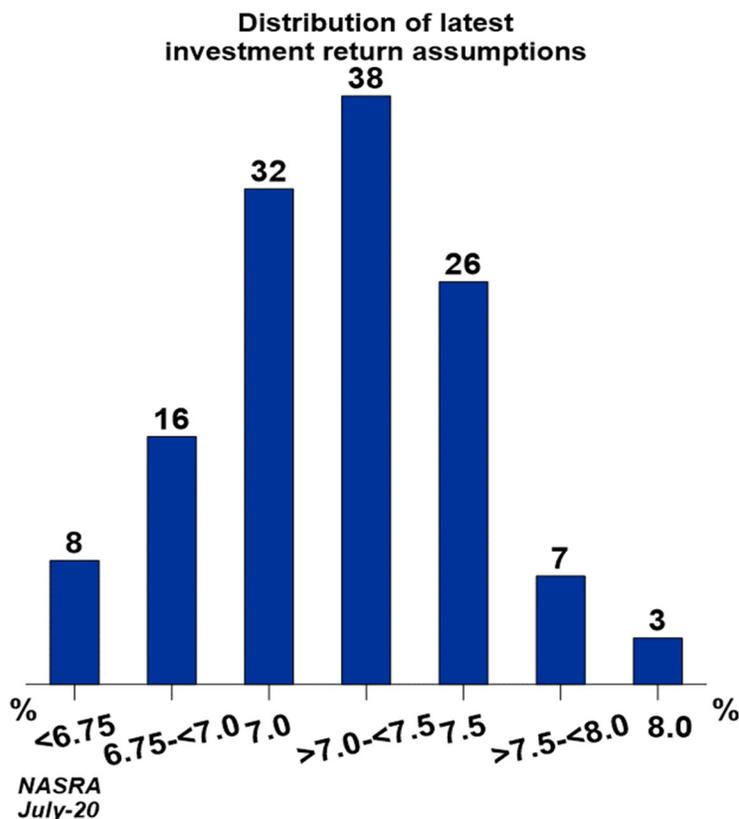
The last two graphs compare the distribution of nominal returns. However, as discussed earlier, the investment return assumption is composed of a price inflation assumption and a real rate of return assumption. The following graph compares the average of each component of the investment return over time. As can be observed, while the price inflation assumption has declined by 1.19% over this period, but the real rate of return has actually increased by 0.33%. We might also note that the average real rate of return is 4.54% compared to NPERS' current real return of 4.75% although asset allocations vary from one system to another so the value of direct comparisons is somewhat limited.
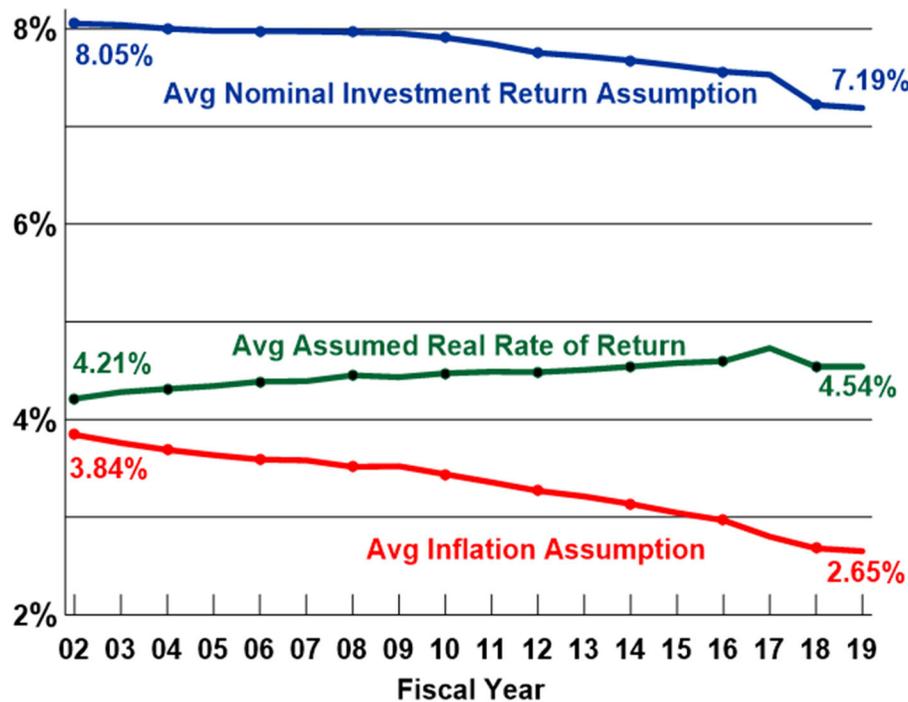
INVESTMENT AND ADMINISTRATIVE EXPENSES

The NPERS trust fund pays the administrative expenses 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, the past practice has been to set the investment return assumption as the net return after both investment and administrative expenses. Using this methodology, the investment return assumption is theoretically lowered to reflect the impact of paying administrative expenses from investment income. However, in practice the adjustment is typically quite small (about 4 to 5 basis points for NPERS). The investment return assumption tends to be rounded, so there has not necessarily been an explicit reduction to the investment return assumption for the payment of administrative expenses.

The current GASB accounting standards require administrative expenses to be separately accounted for in disclosure and, more importantly, in the projection of plan assets in future years to determine the discount rate used to calculate the Net Pension Liability. Therefore, technically, the expected long-term rate of return

for GASB purposes is net only of investment expenses – not both investment and administrative expenses. If this guidance was followed, as written, the discount rate used to calculate the GASB pension liability for NPERS would be slightly higher than the current 7.50% assumed rate of return. This could lead to some confusion or misunderstanding as to why a rate other than the assumed rate of return is being used so the 7.50% assumption has been used. Essentially, the impact of administrative expenses is reflected twice in the projection of plan assets into the future as administrative expenses are directly reflected and the 7.50% long term return assumption is net of administrative expenses. The use of 7.50% for the GASB long-term rate of return has not resulted in a depletion date so we do not believe this approach creates a problem although it could be argued that it does not technically comply with GASB requirements.

To be consistent with the GASB standards and avoid related complexities, we are recommending a change in the way administrative expenses are reflected in the funding valuation, i.e. an explicit administrative expense charge be added to the normal cost rate as part of the actuarial required contribution rate. Although this change is not required for funding purposes, it is more explicit than the current approach and provides more transparency. In addition, it permits the discount rate in the GASB accounting valuation to be developed on a consistent basis with the funding valuation (assuming assets are not projected to be depleted in the GASB projection of fiduciary net position) and removes any questions about the approach for GASB reporting.

The recommended approach includes a separate expense assumption, determined as a percent of aggregate covered payroll, to be included in the actuarial contribution rate each year. This amount is set in the experience study and remains level until it is reevaluated in the next study. If this approach had been used in the last actuarial valuations, the actuarial contribution rates for each group would have increased as follows:

Plan	Administrative Expenses	Covered Payroll	Contribution Rate
School	3,215,740	1,992,856,031	0.16%
Patrol	75,872	29,301,599	0.26%
Judges	71,663	23,215,585	0.31%
State	1,373,893	652,908,627	0.21%
County	755,388	275,574,640	0.27%

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. Therefore, we believe we must consider both the short-term and long-term expectations in setting this assumption. After reviewing the available information, **we recommend the investment return assumption be lowered from 7.50% to 7.00%, based on the 2.35% inflation assumption and a real rate of return of 4.65%. Furthermore, we recommend the administrative expense for each Plan be included as a separate component of the actuarial contribution rate.**

Investment Return	
Current Assumption	7.50%
Recommended Assumption	7.00%

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 2.25% (note the Purchasing Power Floor is not expected to apply until 59 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%. 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 2.03%. Based on our analysis, **we recommend that the COLA assumption be set at 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 2.75%, the current wage growth assumption of 3.50% implies an assumed real rate of wage increase or real wage growth assumption of 0.75%.

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 been about 0.60% 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, 2020 the annual increase in the National Average Wage Index under the intermediate cost assumption (best estimate) was 3.54%, 1.14% higher than the Social Security intermediate inflation assumption of 2.4% per year. The range of the assumed real wage inflation in the 2020 Trustees report was 0.52% to 1.76% per year.

Historical across-the-board increases for State employees were available from fiscal year 2004 through 2020. 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 17-year period reflected across the board increases that exceeded price inflation by about 0.45%.

We also looked at the increase in the average salary for School and County members over the last six or seven years (since Cavanaugh Macdonald became the system's actuary) as a general indication of wage increases. The data for the School group indicated an increase in the average salary of 2.0% over the last seven years (2012 through 2019). Over the same time period, price inflation was 1.6% indicating real wage growth over the period of about 0.40% (difference between the increase in average salary and price inflation). For County members, the increase in the average salary was 3.2% over the last six years which indicates a real wage growth of 1.6%. 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.

Compensation data gathered and compiled by the Bureau of Labor and Statistics also indicates that public employment is receiving larger increases in compensation than wages alone. In other words, benefits are

becoming a larger portion of total compensation. This trend supports the use of a lower general wage increase assumption for those in public employment compared to private employment.

Based on data available and our professional judgment, **we recommend that the long-term assumed real wage increase assumption be reduced from 0.75% to 0.50% per year. When coupled with the price inflation assumption of 2.35%, the resulting recommendation for the general wage increase assumption is 2.85%.**

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 3.50% 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 recommend the payroll growth assumption, used to amortize the UAAL, be lowered from 3.50% to 2.85%, reflecting the decrease in the general wage increase assumption.

Implementation of Recommended Economic Assumption Changes

The proposed changes to the economic assumptions have a significant impact on the funded status and actuarial contribution rate of each plan. In order to provide a smoother cost pattern and to provide sufficient time for the state to budget any increased contribution amounts, the proposed change to the inflation assumption could be phased in over four years. Particularly given the unknown impact of the Covid-19 pandemic on government revenues in the next few years, a phase-in approach seems to be prudent.

We believe the following sets of economic assumptions for the next four valuations would comply with actuarial standards of practice and systematically implement the set of recommended assumptions.

While the above sets of assumptions are reasonable in our professional judgment, there are additional sets of assumptions that could also be considered reasonable. These sets of assumptions have varying price inflation as well as real rates of return and varying general wage increase and payroll growth assumptions. As mentioned earlier, the selection of the price inflation assumption will impact many other assumptions, such as the cost of living adjustment, cash balance interest rate, the general wage increase and payroll growth assumption so no attempt to disclose the various combinations is included here.

	Current (2020 Valuations)	**2021 Valuations**	**2022 Valuations**	**2023 Valuations**	**2024 Valuations**
Inflation	2.75%	2.65%	2.55%	2.45%	2.35%
Real Return	4.75%	4.65%	4.65%	4.65%	4.65%
Investment Return	7.50%	7.30%	7.20%	7.10%	7.00%
COLA (Tier 1)	2.25%	2.15%	2.10%	2.05%	2.00%
Interest Credit*	6.25%	6.15%	6.10%	6.05%	6.00%
General Wage	3.50%	3.15%	3.05%	2.95%	2.85%
Payroll Growth	3.50%	3.15%	3.05%	2.95%	2.85%

* Applies to Cash Balance only

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 2.85% (2.35% inflation and 0.50% real wage growth). Therefore, the merit scale will be added to the 2.85% 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. 2016 and 2017, 2017 and 2018 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**
2015-16	4.36%	5.14%	(0.78%)
2016-17	4.61%	5.15%	(0.54%)
2017-18	4.01%	5.16%	(1.15%)
2018-19	4.12%	5.17%	(1.05%)
All years	4.28%	5.16%	(0.88%)

Since inflation is a component of the salary increase assumption, we would expect actual salary increases to be lower than the current assumption when actual price and wage inflation are lower than the assumption. During the study period, price inflation was around 2.0%, compared to the current assumption of 2.75%, and the increase in the national average wage index was 2.8% compared to the current assumption of 3.50%. The actual salary increases for members with more than 25 years of service (a proxy for actual general wage increases) was 2.7%, close to the increase in national wage data. This information suggests that we could expect actual wage increases reflected in our data to be around 0.70% to 0.80% lower than expected, simply as a function of the overall economy during this period. As noted in the table above, the actual increases were about 0.90% lower, relatively consistent with the difference in actual and assumed general wage increases so the current merit scale is a relatively good fit.
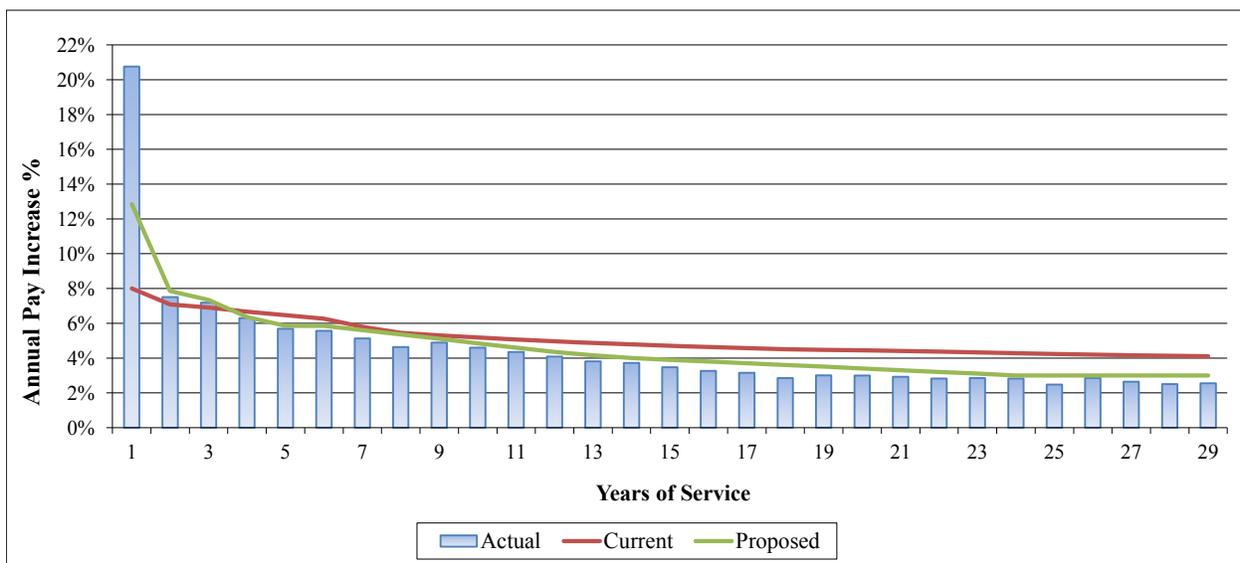
As a result of adjusting the general wage increase assumption from 3.50% to 2.85%, the individual salary increase assumption is lower and better matches the actual experience over this time period. In order to refine the assumption to reflect the actual experience, we are recommending some minor changes to the

merit scale to better fit the observed increases. These changes reduce the overall salary increase from 5.16% to 4.59%.

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
2015-16	3.80%	5.39%	(1.59%)
2016-17	6.11%	5.29%	0.82%
2017-18	4.65%	5.29%	(0.64%)
2018-19	3.63%	5.32%	(1.69%)
All years	4.52%	5.32%	(0.80%)

The difference in the actual versus expected salary increases for Patrol are similar to those observed for the School Plan. Actual increases were lower than those expected by the current assumption, but the difference was largely due to the lower price and wage inflation during the study period. Therefore, the current merit salary scale is a reasonable fit and we recommend it be retained. The green line in the graph below reflects the current merit scale with the proposed general wage increase assumption of 2.85%. The decrease in the overall assumed salary increase from 5.32% to 4.67%, is due to the reduction in the general wage increase assumption.
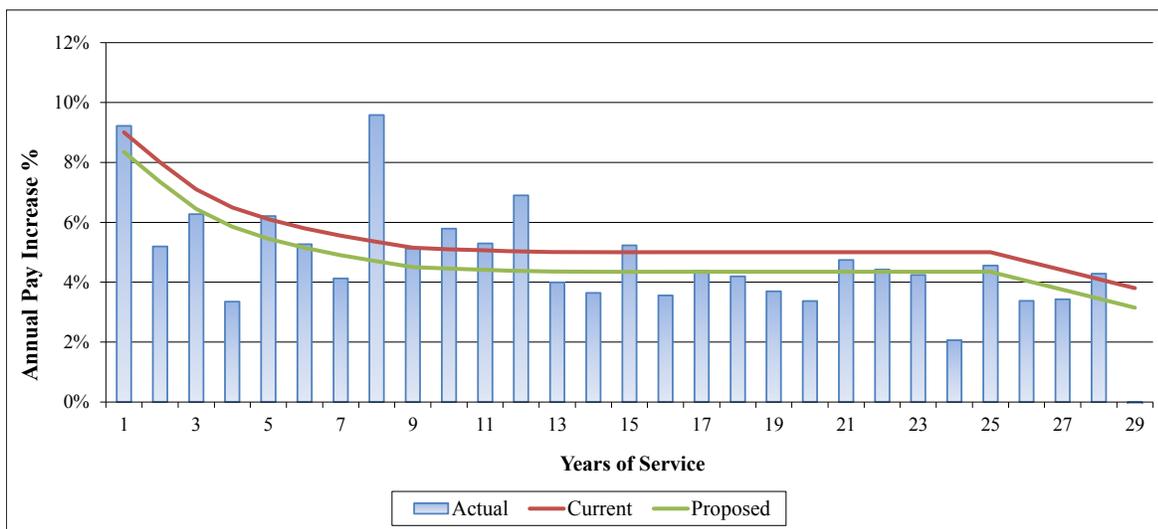

Judges

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
2015-16	3.58%	3.50%	0.08%
2016-17	4.16%	3.50%	0.66%
2017-18	0.76%	3.50%	(2.74%)
2018-19	0.96%	3.50%	(2.54%)
All years	2.32%	3.50%	(1.18%)

The current salary increase assumption for the Judges plan is the general wage increase assumption of 3.50%, i.e., no merit component. This reflects the fact that there is little promotional opportunity within the judicial system. The total salary increases over the period of 2.32% were about 1.18% lower than the assumed increase of 3.50%.

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. Based on data supplied by NPERS staff, the actual increase in judicial salaries over the last eleven years (July 1, 2009 through July 1, 2020) was 2.7%. 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 decrease in the general wage increase assumption, we prefer to have some small degree of conservatism in this assumption. Therefore, we are recommending the addition of a small merit component to the individual salary increase assumption for Judges equal to 0.25%. The result is a level individual salary increase assumption of 3.10% 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
2016	4.60%	4.20%	0.40%
2017	4.38%	4.14%	0.24%
2018	3.37%	4.16%	(0.79%)
2019	5.74%	4.15%	1.59%
All years	4.54%	4.16%	0.38%

In the last study period, we observed actual salary increases of 4.88% compared to expected increases of 4.43%. We were hesitant to change the salary scale at that time because we only had four years of data (we had not performed the prior experience study). A similar trend has occurred in the current experience study. Therefore, we believe it is appropriate to make changes to the individual salary increase assumption for State members. As already discussed earlier in this report, we recommended the price inflation assumption be lowered to 2.35% and the general wage increase assumption be lowered to 2.85% (meaning a productivity assumption of 0.50%). Note that these changes will lower the current individual salary increase assumption by 0.65% if the merit salary scale is not adjusted, resulting in an even larger difference

in actual versus expected salary increases. Such a result is not reasonable, so we are recommending an adjustment to the merit scale, as described below.

We studied the actual salary increases for calendar years 2016 through 2019 for members with at least 25 years of service. The resulting increase was 2.5% which we used as an estimate for the general wage increase for the state of Nebraska employees. The difference between the actual salary increase and 2.5% was then considered to be the actual merit increase for state employees. When comparing this result to the current merit scale we observed that the actual merit increases were much larger than the current merit scale so we believe some adjustment at this time is appropriate. We adjusted the merit salary scale to reasonably fit the actual experience, using the 2.5% general wage increase actually observed during the study period, and then replaced the 2.5% general wage increase with our recommended general wage increase assumption of 2.85%. These changes increased the overall expected salary increase from 4.16% to 4.85%. The result is the recommended total individual salary increase assumption for State members shown in the following graph.
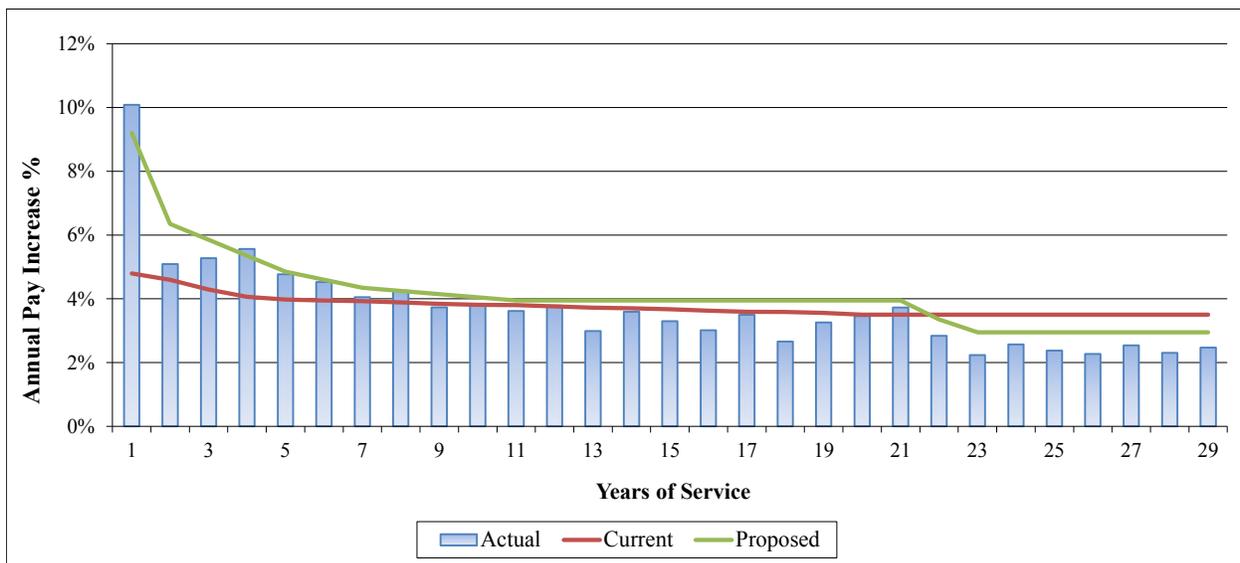
County Cash Balance

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**
2016	4.93%	4.70%	0.23%
2017	3.41%	4.60%	(1.19%)
2018	4.86%	4.58%	0.28%
2019	4.44%	4.59%	(0.15%)
All years	4.41%	4.62%	(0.21%)

In the last experience study, the actual salary increase over the study period was 4.79% and the expected increase was 4.79%. However, actual wage inflation was lower than the assumption (3.50%) so our expectation was that actual salary increases would be lower than assumed. Because we only had four years of data and had not performed the prior experience study, we were not comfortable making a material change to the assumption. In the current experience study, actual salary increases were slightly lower than expected, but actual wage inflation during the study period was far lower than assumed (3.50%). As we already discussed, we recommended the general wage increase assumption be lowered to 2.85% (2.35% price inflation and a productivity assumption of 0.50%). Given the observed salary experience over the study period, we are recommending a change to the merit scale so the total of the general wage inflation and merit scale more closely model actual experience.

We studied the actual salary increases for calendar years 2016 through 2019 for members with at least 25 years of service and observed increases of 2.4% which we used as an estimate for the general wage increase. The difference between the actual salary increase and 2.4% was then considered to be the actual merit increase for county members. We adjusted the merit salary scale to reasonably fit the actual experience, using the 2.4% general wage increase actually observed during the study period and then replaced the 2.4% general wage increase with our recommended general wage increase assumption of 2.85%. These changes increased the overall expected salary increase from 4.62% to 4.83%. The result is the recommended total individual salary increase assumption for County members (shown in the following graph).
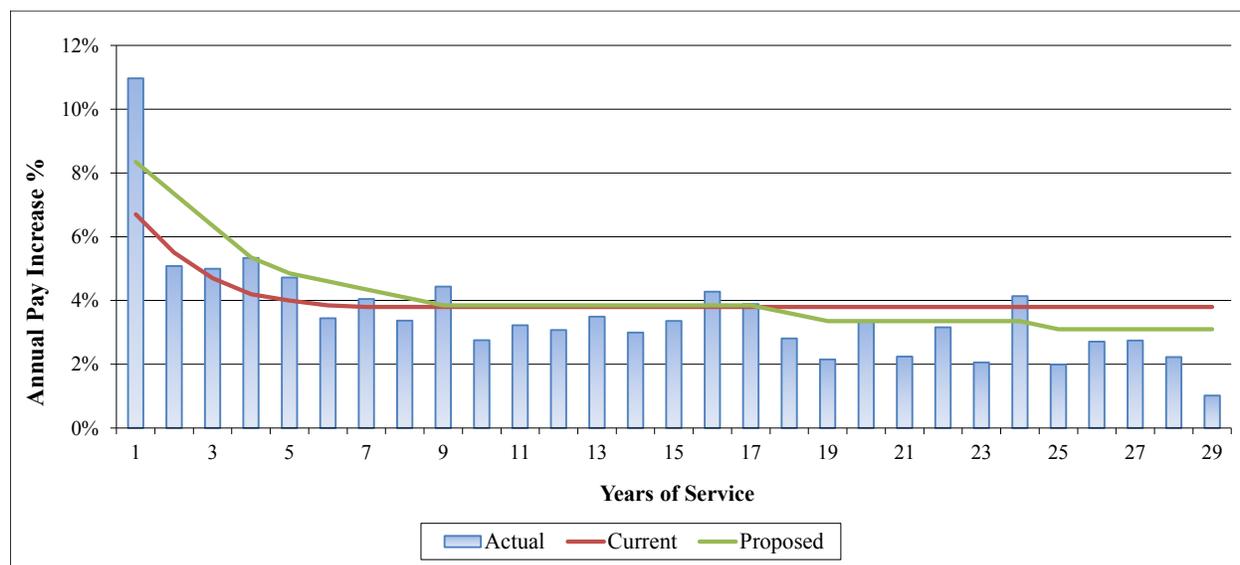
INTEREST CREDITS ON ACCOUNT BALANCES

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 federal mid-term rate for the last twenty years. Over the last ten years, the federal mid-term rate has been very low and the 5% interest crediting rate has applied. However, for purposes of setting this assumption a long-term view is appropriate.
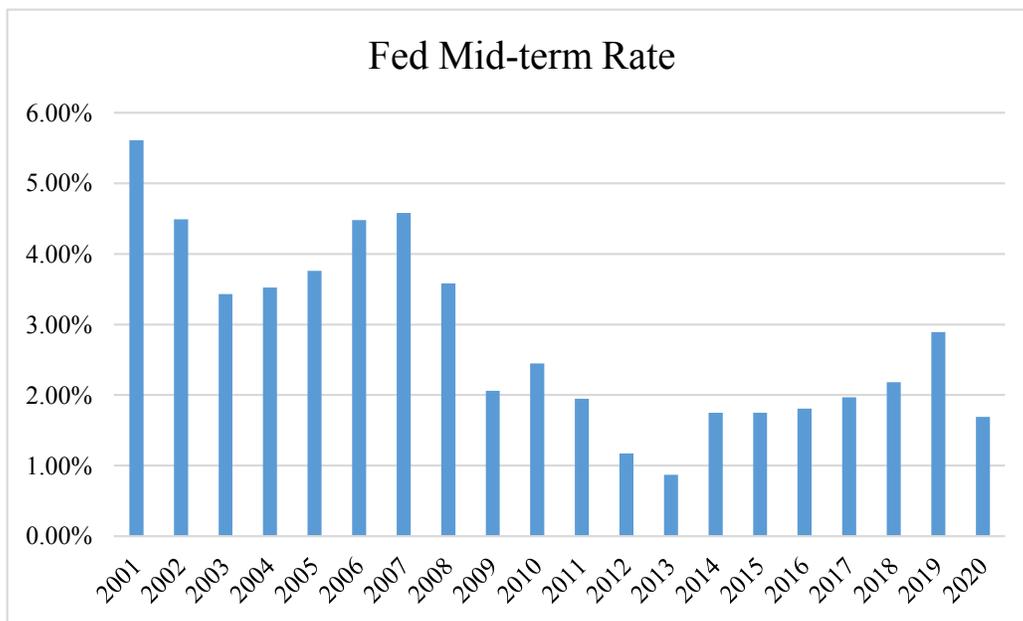
Historically, actual interest credits and dividends have been about 1% lower than the actual return. Over the longer term, we expect bond rates to increase which could be expected to increase the federal mid-term rate. In addition, because this assumption is significant in estimating future plan benefits, we believe it is appropriate to include some degree of conservatism. **Therefore, we recommend the assumption be lowered from 6.25% to 6.00%.**

Defined Benefit Interest Credits

The Defined Benefit plans also credit interest to the member contribution accounts although the cost impact is far less significant than the Cash Balance Plans. This interest crediting rate is set by the PERB rather than set in statute and has been set equal to the one-year U.S. Treasury rate in practice. Long term, this rate should be approximately equal to expected inflation. **We recommend using 2.50% for this rate to provide a small degree of conservatism.**

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

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

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

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

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

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

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

ASOP 35 General Considerations and Application

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

Overview of Analysis

The purpose of a study of demographic experience is to compare what actually happened to the individual members of the System during the study period (July 1, 2015 through June 30, 2019, or January 1, 2016 through December 31, 2019) 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 been declining, meaning people are generally living longer. Furthermore, the experience of large, public retirement systems that include school employees indicate that school groups, and teachers in particular, continue to exhibit better mortality than the average working population.

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

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 are expected to be quite useful for valuing the benefits for public retirement systems like NPERS.

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 35 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 there are different opinions about future expectations. We believe it is prudent to anticipate that the trend will continue to some degree in the

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

There are two widely used ways to reflect future improvements in mortality:
   (1) Static table with "margin"
   (2) Generational mortality

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

Another approach, referred to as generational mortality, directly anticipates future improvements in mortality by using a different set of mortality rates for each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain "built-in" mortality improvements, e.g., a member who turns age 65 in 2040 has a longer life expectancy than a member who turns age 65 in 2020. When using generational mortality, the A/E ratios for the observed experience are set near 100% as future mortality improvements will be reflected directly in the actuarial valuation process. NPERS moved to a generational approach for mortality in the last 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. One option would be to study the mortality experience for the Schools plan alone and then use standard tables, based on professional judgment, to set the assumptions for the other four plans. However, in keeping with NPERS' tradition of using a common mortality table for all five plans, we have instead combined the data for all five plans and performed the mortality study on an aggregate basis. To improve the credibility of our analysis, we also considered the four years of data from the prior study.

Some additional discussion of the use of a common mortality table is in order. Judges generally exhibit mortality that is as good, if not better than, 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.

	Exposure	Actual	Expected	A/E Ratio	
				Count	Weighted
Year 1	6,765	139	110	126%	120%
Year 2	7,042	144	114	126%	119%
Year 3	7,265	156	119	131%	111%
Year 4	7,488	158	124	127%	119%
Total	**28,560**	**597**	**467**	**128%**	**117%**
Total (last 8 years)	**52,546**	**1,041**	**858**	**121%**	**108%**

The actual experience indicates that the current assumption for male retirees is predicting too few deaths, i.e., the A/E ratio is more than 100%. Because the current table is a generational table (with mortality rates reflecting improvement each year), we prefer the A/E ratio be around 100%. Further, the A/E ratio, when experience is weighted based on benefit amounts, is well over 100%. This indicates that the amount of liability being released as a result of retiree deaths is not being accurately anticipated by the current assumption.

Our observation of the most recent four years compared to the last eight years is that this is consistent with the national trend that has been observed by actuaries in which the actual mortality improvement did not increase as expected. When we selected the recommended projection scale in 2015, we were concerned that the standard Society of Actuaries projection scale (named MP-2015) was too optimistic and so we developed a variant of that scale that reflected lower ultimate improvement. As it turns out, the short-term improvement of MP-2015 (which was blended into our recommended improvement scale) was also stronger than what actually occurred, i.e. actual improvements between 2015 and 2019 were less than anticipated by Scale MP-2015.

In selecting a new mortality table to consider, we looked to the Pub-2010 family of tables as published by the Society of Actuaries (SOA) in January of 2019. **We found that the General Members Table (Above Median) projected to the study years with Scale MP-2019, and then set back one year (treating a 65-year old as having the mortality of a 64-year old) provided a good fit to the observed data so we are recommending this assumption for male retiree mortality.** The comparison for ages 60 to 85 is shown below.
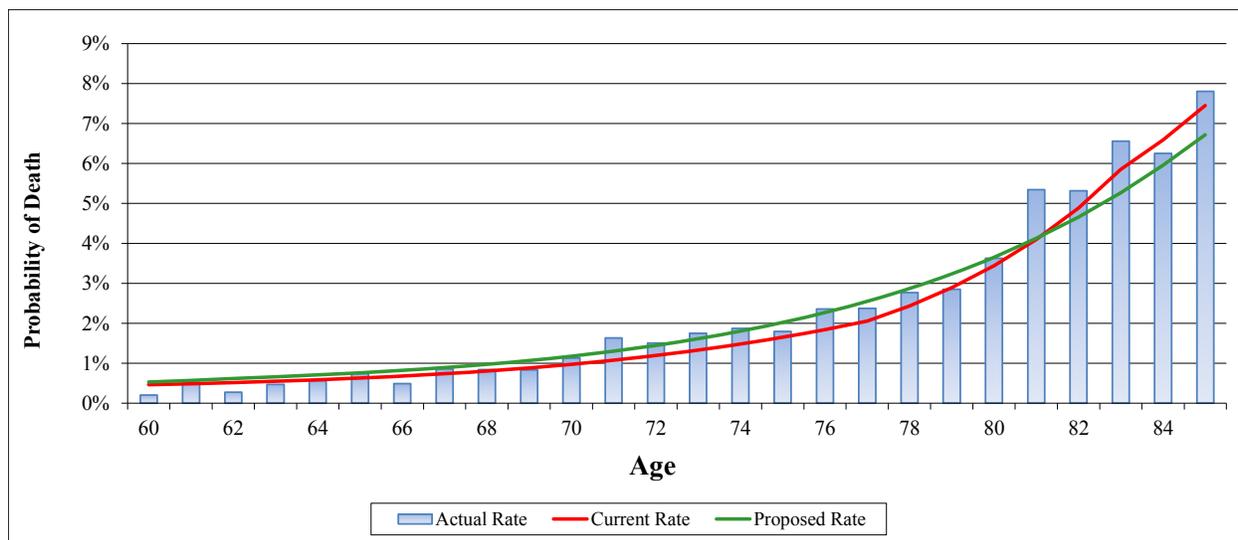
Healthy Retiree Mortality- Females

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.

				A/E Ratio	
	Exposure	**Actual**	**Expected**	**Count**	**Weighted**
Year 1	13,391	176	153	115%	94%
Year 2	14,244	192	160	120%	117%
Year 3	14,928	207	167	124%	123%
Year 4	15,653	199	175	114%	109%
Total	**58,216**	**774**	**655**	**118%**	**111%**
Total (last 8 years)	**103,650**	**1,349**	**1,199**	**112%**	**105%**

The experience for the female retirees substantially mirrors the male experience. Using the same approach as was used for males, **we found that the General Members Table (Above Median) projected to the study years with Scale MP-2019, scaled by 95%, and then set back one year (treating a 65-year old as having the mortality of a 64-year old) provided a good fit to the observed data so we are recommending this assumption for female retiree mortality.**

The comparison for ages 60 to 85 is shown below.
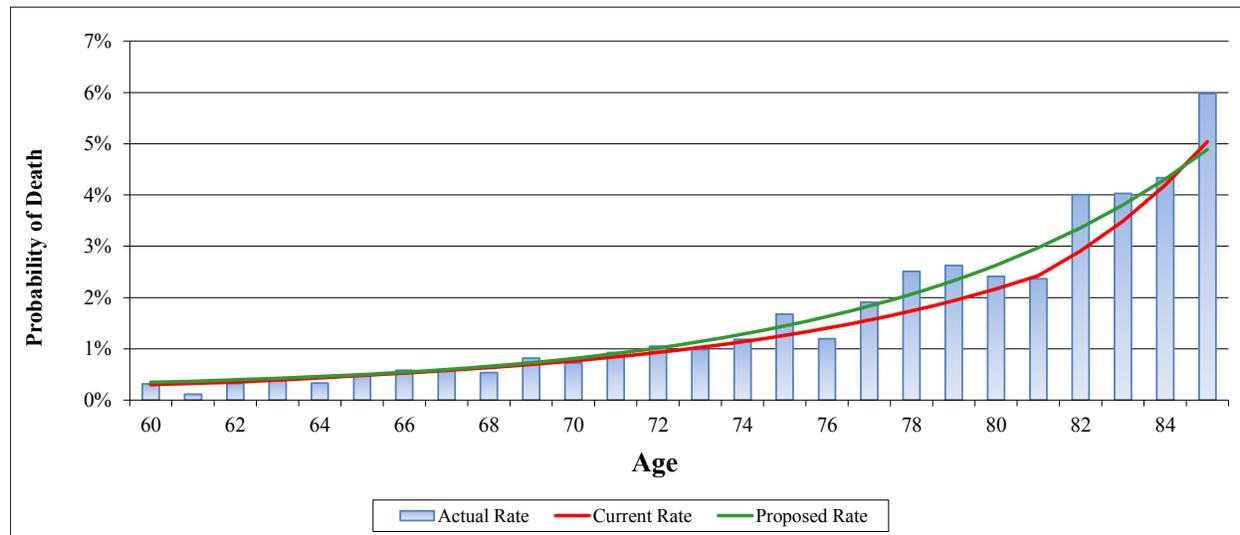
Healthy Retiree Mortality- Projected Improvement

For both males and females, **we propose that improvements from 2019 forward be modeled by a mortality improvement scale that is constructed in the same manner as the MP-2019 scale produced by the SOA, but with 75% of the ultimate improvement rates.** For comparison, the current scale uses 50% of the ultimate improvement rates from the MP-2015 scale. Because of the changes in the near-term improvement rates in MP-2019 vs. MP-2015, we believe that the higher ultimate rates are more appropriate.

It should be noted that as we prepare this analysis, the world is in the midst of a pandemic. At this time, we do not believe there is sufficient data to warrant reflecting any change in mortality. It is very probable that the next valuation or two may have more deaths than expected, but this could be followed by a period of fewer than expected if the current deaths from COVID-19 are significantly from groups who would have had higher than expected death rates in the short term. Because there are significant unknowns at this time, we believe it appropriate to utilize the data from the study period to help guide our long-term expectations. We will, of course, review the observed death rates each year as part of the valuation and make any needed recommendations to NPERS.

Beneficiaries

The mortality of beneficiaries applies to the survivors of members who receive a joint and survivor option. There are fewer members receiving benefits under the joint and survivor options which can produce more volatility in the observed mortality rates. Based on the limited data, **we recommend using the Pub-2010 General Members Table (Above Median) Contingent Survivor mortality rates, with the same adjustments as proposed for retirees, be used for beneficiaries.**

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. **We recommend the Pub-2010 General Members Disabled Table be used without generational improvement.**

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 RP-2014 Tables. The specific assumption is the RP-2014 Employee White Collar Male Mortality Table multiplied by 100% and the RP-2014 Employee White Collar Female Mortality Table multiplied by 55% for males and females, respectively.

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 from a study of this size. 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. Since the retiree mortality is based on the Pub-2010 Above Median General Members Healthy Annuitant Tables with adjustments, we propose starting with those tables for the active mortality assumption and then adjusting as needed. **Based on this approach, we recommend using 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).**

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 we usually are in setting an assumption, the limited number of observed deaths means that we assign more weight to using the retiree assumption. In any case, this assumption has only a very minor impact upon the overall cost of the plan.

| Gender | Exposure | Actual | Current Assumption | | Proposed Assumption |
			Expected	A/E Ratio	A/E Ratio
Males	40,364	43	52	83%	90%
Females	121,255	62	55	113%	76%

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

Schools

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 just recently implemented so 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 are set 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 80 during the study period for retirement is shown in the following table:

Retirement Experience					
				A/E Ratio	
	Exposures	Actual	Expected	Count	Weighted
Early retirement	8,065	401	958	42%	45%
Unreduced retirement	21,346	3,865	5,255	74%	92%

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, 2015 to June 30, 2016	1,988	139	236	59%	64%
July 1, 2016 to June 30, 2017	1,989	88	236	37%	41%
July 1, 2017 to June 30, 2018	2,012	93	240	39%	39%
July 1, 2018 to June 30, 2019	2,076	81	246	33%	39%
Total	**8,065**	**401**	**958**	**42%**	**45%**

Overall, there were far fewer early retirements than expected during the study period (A/E ratio of 45% on a liability-weighted basis) and fewer than observed in the last study period when the A/E ratio on the current assumption was 85%. Given the dramatic difference in results from the prior study period and the relatively small number of both actual and expected early retirements, we believe it is prudent to be cautious in making adjustment to the current assumptions to reflect the recent experience. **Based on the combined experience of the last two study periods, we recommend lowering the early retirement rates as shown in the graph below with a resulting A/E ratio of 72% for the current study period and 101% for the last two study periods combined.**
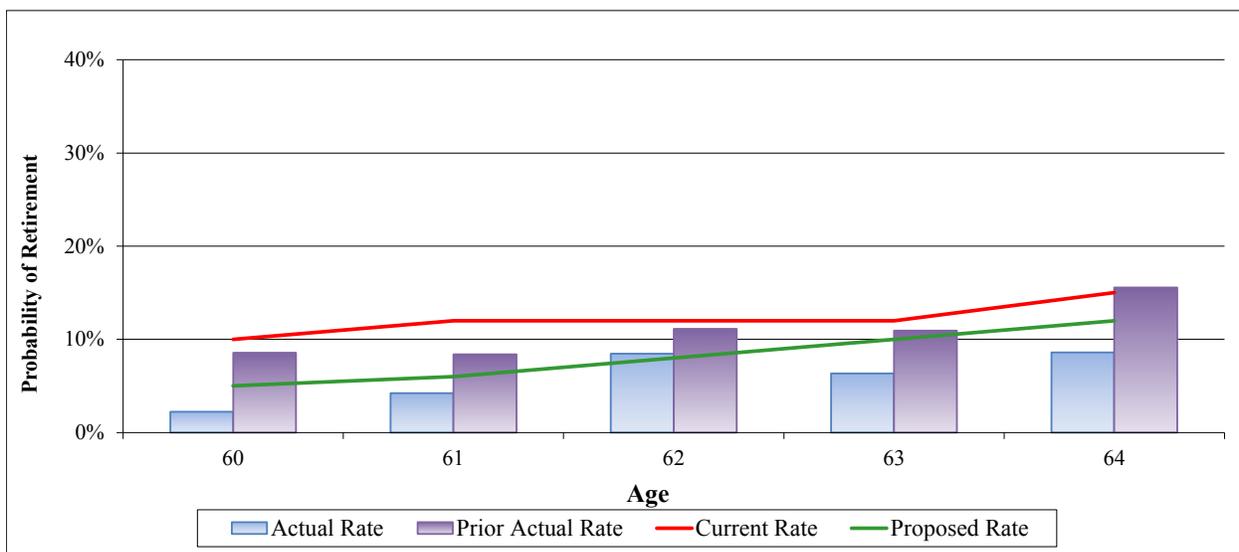
Unreduced Retirement

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 80.

				A/E Ratio	
Unreduced Retirement Experience					
	Exposures	**Actual**	**Expected**	**Count**	**Weighted**
July 1, 2015 to June 30, 2016	5,423	1,074	1,333	81%	100%
July 1, 2016 to June 30, 2017	5,318	878	1,304	67%	81%
July 1, 2017 to June 30, 2018	5,311	989	1,306	76%	94%
July 1, 2018 to June 30, 2019	5,294	924	1,312	70%	92%
Total	**21,346**	**3,865**	**5,255**	**74%**	**92%**

As the A/E ratios in the table illustrate, the number of actual retirements was consistently lower than expected in each of the four years in the study period. However, on a liability-weighted basis, the A/E ratio was much closer to 100% indicating that retirement by members with higher liability was closer to the assumption than those with lower liability.

The current assumption, which was adopted in the last experience study and reflected an A/E ratio of 102%, indicated a close match with the actual experience in the last study. We wish to be cautious in revising the current assumption, so the recommended assumption was developed using 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 95% on a liability-weighted basis for the current study period and 100% for the last two study periods.** While this assumption change does not materially change the A/E ratio, it does improve the fit of the assumption to actual experience.
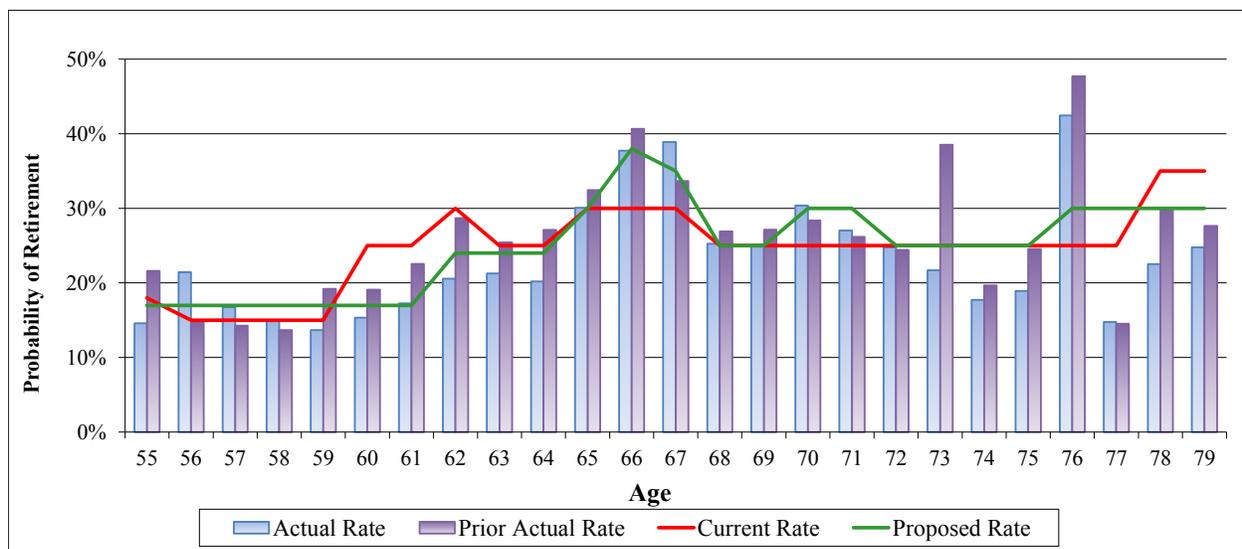
State Patrol

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 are at least age 50. Retirement is mandatory at age 60.

The State Patrol Plan also offers a Deferred Retirement Option Plan (DROP) that allows members who are age 50 with 25 years of service to apply for retirement benefits, but then remain in active employment up to five years (but not beyond age 60) during which time the retirement benefit payments are accumulated in 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 has the same impact as retirement (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 age 50 to 55 who have not yet reached 25 years of service. The current assumption for early retirement is low, i.e., 3.0% at each age. During the study period, there were 143 exposures for early retirement and one member elected early retirement, an effective rate of approximately 0.7%. This is consistent with observed behavior in the prior study period when there were 94 exposures and one member elected early retirement, a rate of approximately 1%. Based on the actual experience in the last 8 years, very few members elect to retire under the early retirement provision. This is similar to the experience we have observed in other retirement systems that cover members of the State Patrol. Therefore, we believe a reduction to the early retirement rates is appropriate. **We recommend reducing the early retirement assumption from 3.0% at each age to 1.0% at each age.**

The next group of individuals studied were eligible for unreduced retirement because they were at least 55 with 10 years of service but had less than 25 years of service. There were only 51 exposures for this group over the four-year study period, and only 6 members retired (9 were expected to retire). 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 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 last part of the 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 and this pattern has consistently been observed in the past. As discussed earlier, we are considering both retirement and entering DROP together since they affect

the funding of the retirement plan essentially the same way. The current assumption reflects a 100% probability of retirement/DROP at age 50 with at least 25 years of service. The results for the current study are shown below:
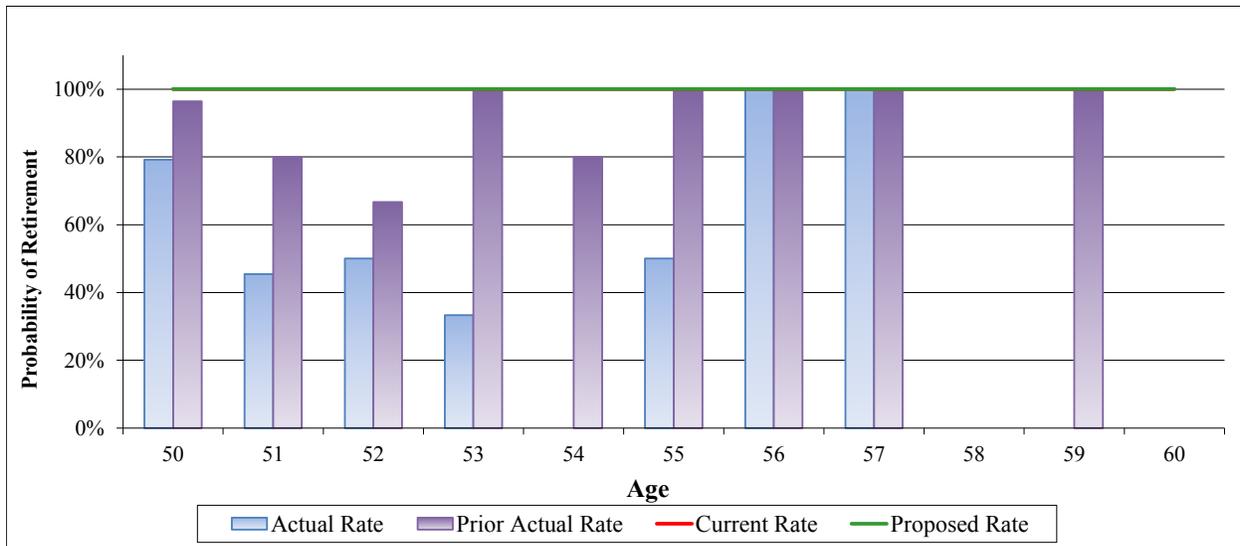
In the prior experience study, 51 of 55 eligible members retired/elected DROP once they had 25 years of service and 3 of the remaining 4 retired the following year. At first glance, the experience in the current study period appears to be quite different with 34 actual retirements versus 54 expected for an A/E ratio of 63%. However, after additional review the results in the current study period are not significantly different. It is important to note that this is a relatively small group as evidenced by the fact there were only 54 exposure over a four-year period, an average of about 13 per year. Each year, the number of exposure and retirements are determined and then summed for the total results for the entire study period. Therefore, if a member is eligible to retire during the entire four-year period but does not actually retire, he is included as an exposure each year (and would represent four exposures over the study period). During the current study period, the total exposure was 54. Of that number, there were three members who delayed retirement (one member for the entire four-year study period and two members who delayed for three years each). Consequently, these three members were counted as an exposure a total of 10 times. **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, again without any minimum service requirement. It should be noted that the early retirement reduction for ages 62 to 64 is subsidized by using factors that produce less reduction than would be required for full actuarial equivalence. 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	416	0	13	0%	0%
Unreduced	129	22	31	71%	77%
Total	**545**	**22**	**44**	**50%**	**60%**

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 were no retirements by members below age 65. While there are typically a few retirements before age 65, the number is normally quite small and typically occur between 60 and 64. The retirement rates are already low for ages 55 to 61 (3% or less). **Given the experience over the last two study periods, we recommend the early retirement rates be lowered to 1.5% at ages 55 through 63 but remain 15% for age 64.**

The following graph shows the actual and expected retirement rates for unreduced retirement benefits at age 65 through 71 for the current and prior four-year study period:
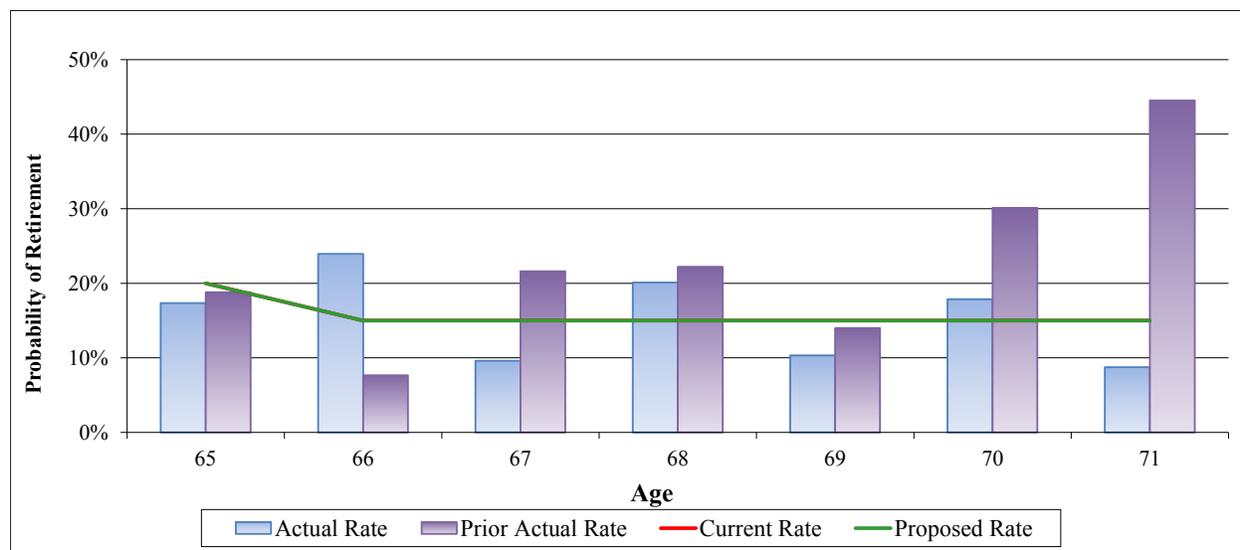
The current assumption for ages 65 and older is a reasonable fit to the actual experience in the current study period given the size of the group (A/E ratio of 100% for ages 65 through 71 on a liability-weighted basis). The results appear less reasonable (A/E ratio of 77%) if the ultimate age is extended to age 72, the assumed certain retirement age. Because all members age 72 (10 over the period) are assumed to retire, but only four actually retired, inclusion of age 72 tends to skew the results. Therefore, we prefer to base our recommendation on the results for ages 65 through 71. **Based on our professional judgment and the available data for the last two experience studies, we are recommending no change to the retirement rates for ages 65 and beyond.**

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 2016 through 2019). 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					
				A/E Ratio	
Calendar Year	**Exposures**	**Actual**	**Expected**	**Count**	**Weighted**
2016	4,130	471	480	98%	85%
2017	4,127	600	488	123%	110%
2018	3,958	564	472	119%	107%
2019	3,844	504	461	109%	88%
Total	**16,059**	**2,139**	**1,901**	**113%**	**98%**

As can be noted in the graph below, the current assumption was a relatively good fit at most ages. We are recommending minor adjustments at to improve the fit of the assumption to actual experience. The experience is also consistent with the change to age 66 for full Social Security Retirement Age. The proposed assumption moves the weighted A/E ratio from 98% to 101% on a liability-weighted basis.

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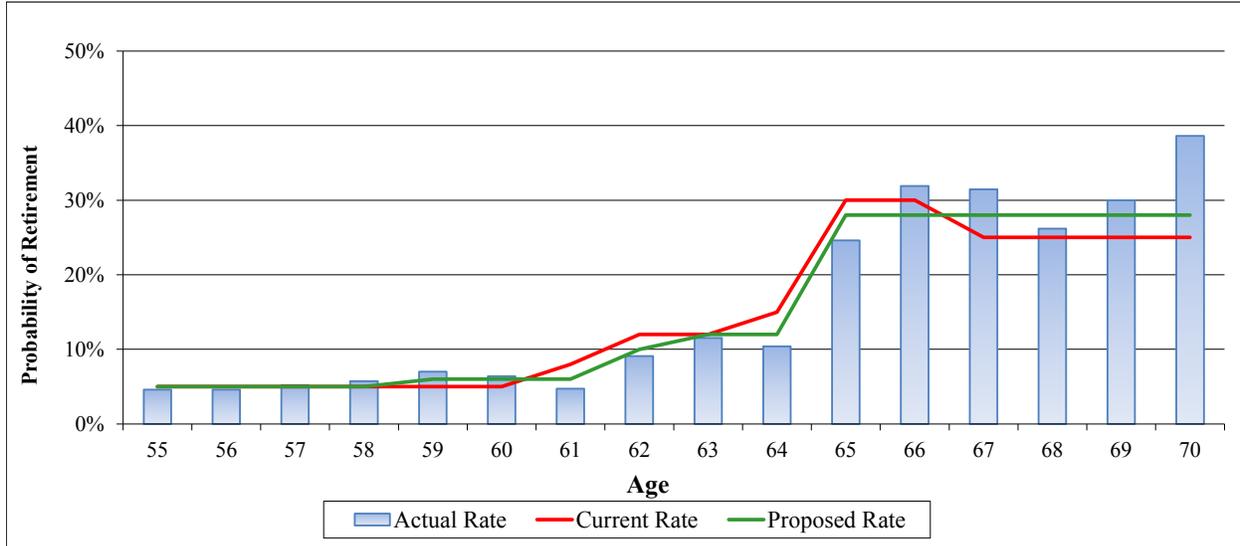
County Cash Balance

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**
2016	2,363	187	212	88%	95%
2017	2,428	271	221	123%	99%
2018	2,405	249	222	112%	94%
2019	2,396	318	221	144%	127%
Total	**9,592**	**1,025**	**876**	**117%**	**104%**

Although the underlined number of members retiring during the current study period was much higher than expected, the actual experience was close to that expected on a liability-weighted basis. Since the assumption was developed using the liability-weighted results in the prior experience study this is not unexpected. Overall, the current assumption is reasonable fit but there is room for some small improvement. In the last study, we considered raising the retirement rates for ages 67 to 69 based on the liability-weighted results, but retained the current rates because the experience, on a count basis, was very close to the assumed 15% rate. In this study, **we have again observed higher retirement rates on a weighted basis at ages 67 through 69 so we are recommending those retirement rates be increased from 15% to 20%.** The resulting A/E ratio, using the proposed assumption (shown below), is 98%.
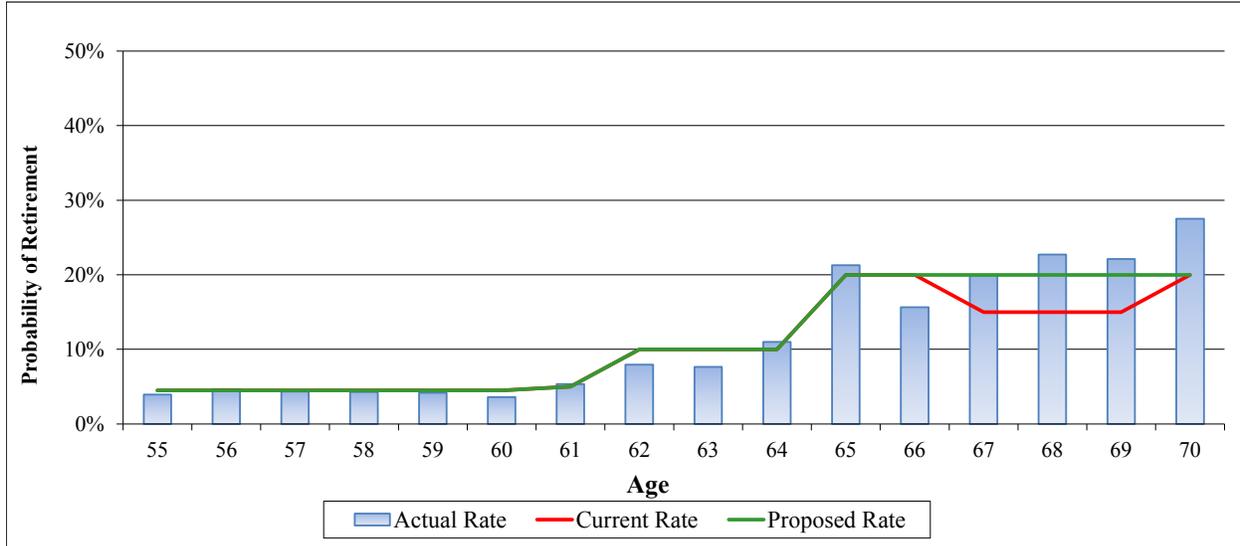
Cash Balance Lump Sum/Annuity Election Rate

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 the State Plan is that 50% of the account balances will be paid as a lump sum and 50% will be paid as monthly benefits (annuitized). For the County Plan, 60% of the account balances are assumed to be paid as a lump sum and 40% of the account balances will be paid as monthly benefits.

As the result of the current interest rate environment, the cost of annuities sold by insurance companies are currently much more expensive than the statutory conversion basis (i.e. lower monthly benefit for the same account balance). In addition, given the recent market volatility during the COVID-19 pandemic, new retirees may also value the fact that an annuity provides steady income as well as providing protection against longevity risk, i.e., outliving one's money. Thus, 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	30%	50%
State	44%	53%

The current 50% assumption seems reasonable for the State Cash Balance Plan and we propose retaining it. However, for the County Cash Balance Plan we recommend increasing the percentage of account balances paid as annuities from 40% to 50%. 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 changes to the investment return assumption and the mortality assumption in this experience study, we believe it is appropriate 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, this form 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

A gender-neutral mortality assumption is needed to comply with legal requirements. In addition, the mortality tables used in the valuation are "generational" meaning that the probabilities of death decrease slightly in each future year, which would result in different life expectancies each year and a change to the actuarial equivalent factors, if used. Rather than update actuarial factors each year, it is common practice to project the mortality rates to a specific year in the future and then use that single set of mortality rates for actuarial equivalent purposes.

Our approach in this study is consistent with the last experience study. To determine the unisex blend of male and female mortality rates for the School and Judges plans, the male/female split of liability for those members nearing retirement was studied. We further examined the actual election patterns for optional forms of payment by gender to determine if any adjustment was needed to reflect different utilization of joint and survivor benefits. For the Cash Balance Plans, we reviewed the male/female split of recently annuitized account balances, focusing on only those who were in the cash balance plan (excluding those in the defined contribution plan). The opposite gender blend is used for the mortality assumption of the joint annuitant.

The following mortality assumptions are recommended **if** the Board wishes to adopt a new mortality assumption for the definition of "actuarial equivalent":

- 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 the School and Judges Plans, while the State and County Cash Balance Plans 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). Effective with the January 1, 2018 valuations, the investment return assumption was going to change to 7.50%. If this assumption had also been used to determine actuarial equivalent benefit amounts, it would have resulted in a lower benefit for someone retiring in 2018 compared to a person with identical data (age and account balance) who retired in 2017. As a result, the PERB voted to maintain the 7.75% interest rate for members hired prior to January 1, 2018. The continued use of the 7.75% interest rate assumption for this group provides consistent benefit calculations before and after January 1, 2018 and avoids any potential reduction in accrued benefits that might occur if a lower interest rate assumption were used.

With the recommended changes to the investment return assumption and mortality assumption, the Board must evaluate whether to change the definition of "actuarial equivalence" for Cash Balance Plan members. The following graphs compare the resulting benefit amounts, based on converting a $350,000 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 (7.75% interest and 1994 Group Annuity Mortality Table

blended 50% Male/50% Female) and an alternate definition based on the recommended valuation assumptions (7% interest and 1994 Group Annuity Mortality Table blended 50% Male/50% Female).

Tier 1
Monthly Benefit Amount on $350,000 Account
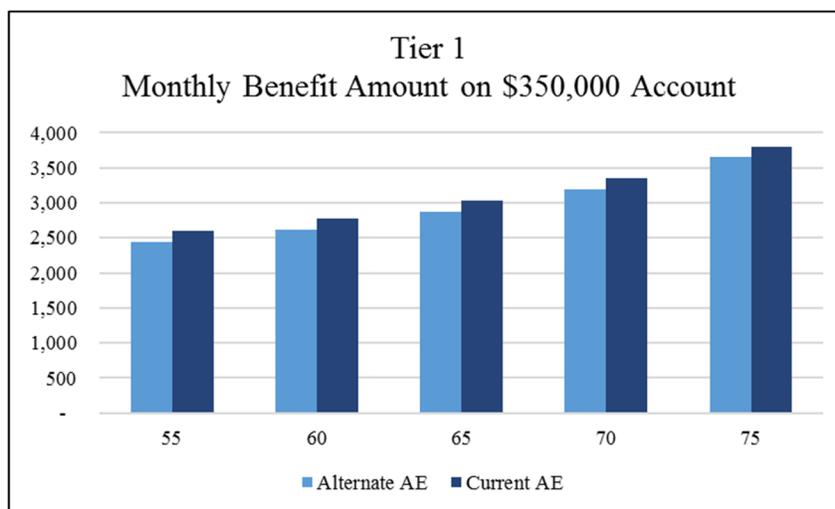
Tier 1: Monthly Benefit Amount on $350,000 Account					
Age	55	60	65	70	75
Alternate AE	2,436	2,619	2,866	3,194	3,649
Current AE	2,605	2,784	3,027	3,350	3,800
Alternate/Current	93.5%	94.1%	94.7%	95.3%	96.0%

As the table illustrates, lowering the interest rate from 7.75% to 7.00% has a significant impact on the amount of monthly benefit the members will receive. The reduction at age 55 is about 6.5% while the reduction at age 75 is about 4.0%. This situation is similar to that occurring after the last experience study when the investment return assumption was lowered to 7.50%. At that time the Board voted to maintain the 7.75% interest rate to provide consistent benefits for members in subsequent years. Given the benefit policy implications of these decisions, we do not believe it is appropriate for us to make a specific recommendation but rather to make the Board aware of the implications of their choices.

If the PERB decides to maintain the use of the current 7.75% interest rate for actuarial equivalence for this group, benefits will not be reduced. As a result, the liability for this group will be higher than if the definition of actuarial equivalence was based on 7.00%. As we stated in the last experience study, this approach is reasonable and defensible at the current time given the Plans' strong funded status. However, the Board should be aware that an adjustment to the interest rate assumption for this group could be necessary in the future if the Plan's funding warrants such action. As the investment return assumption continues to decline, this is more likely to become a potential consideration.

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:
- 7.50% interest and the valuation mortality table, projected to 2035 using NPERS mortality projection scale, with a 55% male/45% female blend.

This approach tends to minimize the financial impact of gains or losses arising from members electing a different form of payment than assumed. However, as noted above when the definition of actuarial equivalence changes for the Cash Balance Plans it has a material impact on the amount of monthly benefits received by members so additional discussion is appropriate.

With the decrease in the investment return assumption from 7.50% to 7.00% and the change to the mortality assumption, the monthly benefit amounts will be lower if the Board adopts the use of valuation assumptions for the definition. The following graphs compare the resulting benefit amounts, based on converting a $350,000 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 based on the recommended valuation assumptions (7% interest and valuation mortality assumption, projected to 2040 with 75% of the ultimate scale in MP-2019, with a 55% males/45% female blend).

Tier 2
Monthly Benefit Amount on $350,000 Account

Tier 2: Monthly Benefit Amount on $350,000 Account
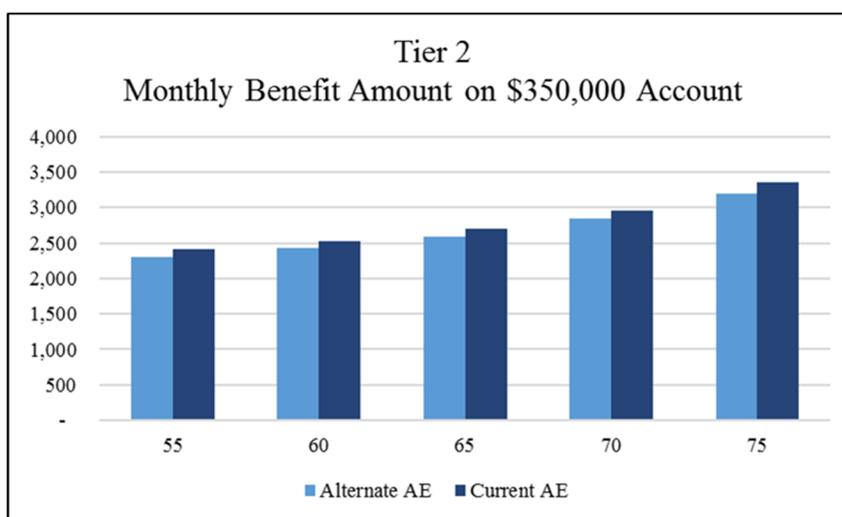
Age	55	60	65	70	75
Alternate AE	2,306	2,425	2,595	2,842	3,203
Current AE	2,411	2,526	2,696	2,952	3,348
Alternate/Current	95.6%	96.0%	96.3%	96.3%	95.7%

The reduction in benefits range from 3.7% to 4.4% 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 options available 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 implications for the benefits of Cash Balance Plan members and we defer to the PERB to ultimately 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 we recommend the interest rate of 7.00% be used for the next four years, essentially ignoring the phase in of the reduction in 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.

Given we are recommending changes to the investment return assumption, the mortality assumption, and the COLA assumption for members with a maximum COLA of 2.50% in this experience study, we believe it is appropriate to update the definition of actuarial equivalence for members of the School and Judges Systems hired after June 30, 2017. For the key retirement ages of 60 to 70, the new interest and mortality assumptions produce optional form factors that range from 99% to 101% of the current factors. Reflecting the changes now will result in smaller adjustments to the resulting benefit amounts compared to waiting until a later date when the assumption changes are more significant.

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 2040 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 62. This assumption was just recently introduced in the valuation process once NPERS was able to provide the benefit amounts for terminated vested members. A review of the actual retirements by terminated vested School members during the study period indicated the average retirement age was 64. 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. **We recommend the benefit commencement age assumption for terminated vested School members be changed from age 62 to age 64.**

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 25% of account balances for members subject to the ERBF conversion rules will be paid as monthly income (annuity option). Because of the current low interest rate environment and the associated impact on annuity amounts for members in the Defined Contribution Plan, we believe the current assumption is reasonable. However, we have observed a steady or slightly increasing percentage of Cash Balance Plan members electing annuity benefits. Therefore, **we recommend increasing the assumed portion of account balances for Cash balance Plan members subject to the ERBF conversion rules from 25% to 40%** to help minimize adverse experience.

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 Schools plan is quite small and the use of 100% marriage assumption for the Patrol and Judges plans means the survivor provisions are valued conservatively. **We believe the current assumptions are reasonable in our professional judgment and should be retained.**

Age of 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 Schools plan, and three years older for in the Patrol and Judges plans. There is insufficient data to assess this assumption, but we did review recent retirees who were covered by a joint and survivor benefit. For the School Plan, males were 1.5 years older, on average, and for the Patrol Plan the age difference was 2.5 years. For Judges Plan, males were 3 years older. **We believe the current assumption is reasonable and recommend that it be retained.**

One of the types of benefits 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 was changed from a unisex assumption to a gender-specific assumption in the last experience study based on the meaningful differences observed in the data. 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	36,976	11	15	73%
Females	115,697	21	38	55%
Total	152,673	32	53	60%

The A/E ratio for males in the current study was 73%, but it was 113% in the prior study and the A/E ratio for females in the current study is 55%, but it was 87% in the prior study. It is not unusual to observe considerable volatility in the A/E ratios for disability due to the relatively small number of occurrences. Based on our professional judgment and the observed experience in the last two studies, **we recommend the current assumptions be retained.**

Patrol

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

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Not all active members on the valuation date are expected to continue working until retirement. Therefore, a termination of employment assumption is used to anticipate the probability that a member will leave covered employment at any given 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 mention 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, 2015 to June 30, 2016	7,397	478	443	108%	90%
July 1, 2016 to June 30, 2017	7,552	502	454	111%	86%
July 1, 2017 to June 30, 2018	7,641	515	453	114%	88%
July 1, 2018 to June 30, 2019	7,766	550	459	120%	107%
Total	**30,355**	**2,045**	**1,809**	**113%**	**93%**

Termination Experience - Females					
				A/E Ratio	
	Exposures	Actual	Expected	Count	Weighted
July 1, 2015 to June 30, 2016	24,130	2,129	1,825	117%	97%
July 1, 2016 to June 30, 2017	24,571	2,116	1,886	112%	87%
July 1, 2017 to June 30, 2018	24,910	2,156	1,901	113%	89%
July 1, 2018 to June 30, 2019	25,173	2,271	1,917	118%	96%
Total	**98,784**	**8,672**	**7,530**	**115%**	**92%**

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 minor changes to the termination rates for males at the shorter durations, and no change to the termination assumption for females. For the male rates shown below, our proposed rates (in green) move the count A/E ratio from 113% to 104% and the weighted A/E ratio from 93% 90%. For the female rates, the A/E ratio on a count basis was 115%, but 92% on a weighted basis. We recommend the current termination assumption for females be retained.

Termination of Employment – Males
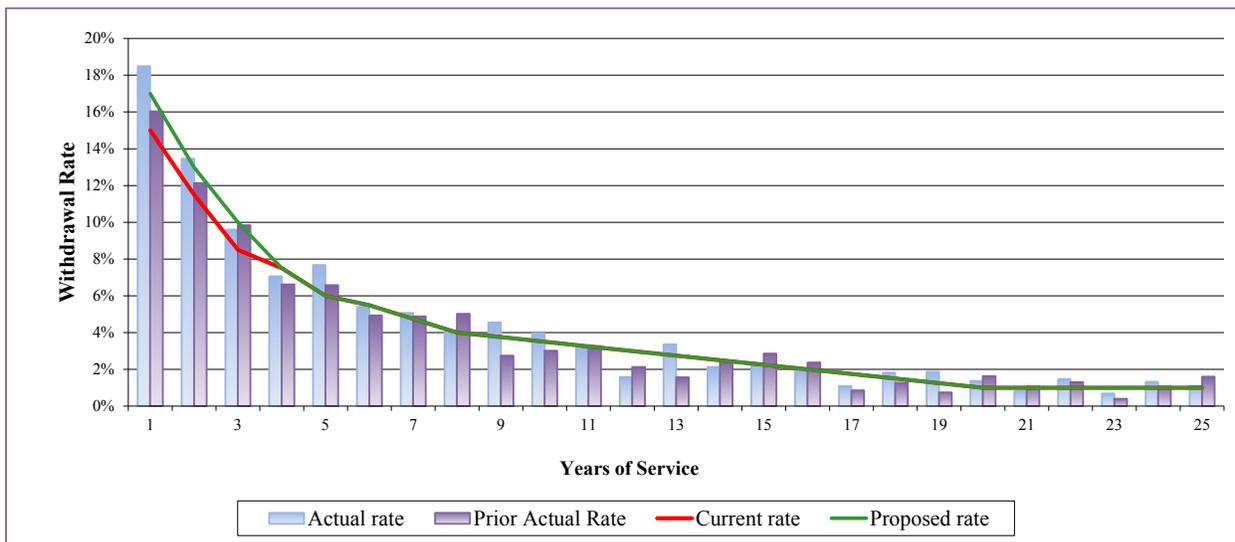
Termination of Employment - Females
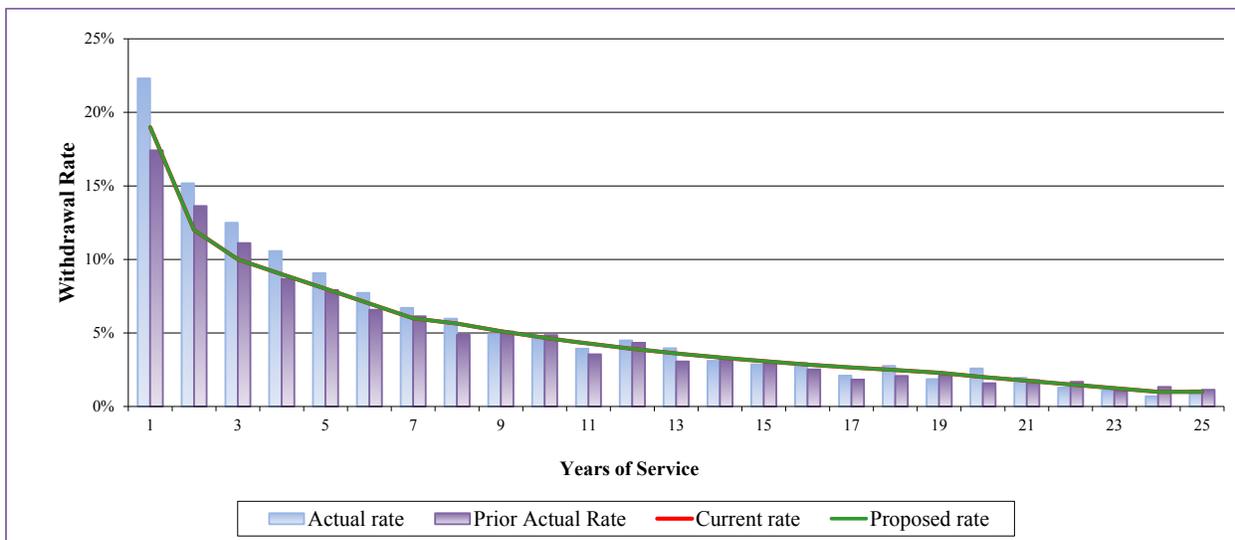
Patrol

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 just 26 terminations during the current four-year study period compared to 23 expected (resulting in an A/E ratio of 113% on a count basis and 161% on a liability-weighted basis). The number of terminations is consistent with the results of the prior study period in which there were 27 terminations compared to 23 expected (A/E ratio of 120% on count basis but 95% on a liability-weighted basis).

Due to the small number of terminations (six to seven per year), it is not surprising the data does not indicate a strong pattern. We also analyzed the results by age to determine if that provided any greater insight, but it was also inconclusive. The A/E Ratio on a count basis was 113%, but the difference between actual and expected experience was only three terminations over a four-year period. The high A/E Ratio of 161% on a weighted basis is due to terminations by 4 members with more than 15 years of service (unusual experience for this group). Given the small size of the group, some volatility in the results from one study period to another is not unexpected. Based on our professional judgment as well as the experience in the last two studies, **we recommend the current assumption be retained.**

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	
	Exposures	**Actual**	**Expected**	**Count**	**Weighted**
July 1, 2015 to June 30, 2016	7,860	1,050	1,108	95%	98%
July 1, 2016 to June 30, 2017	8,218	1,424	1,165	122%	120%
July 1, 2017 to June 30, 2018	7,909	1,219	1,086	112%	118%
July 1, 2018 to June 30, 2019	8,148	1,190	1,125	106%	103%
Total	**32,135**	**4,883**	**4,484**	**109%**	**110%**

We considered separate rates for males and females but did not find the difference to be significant enough to justify distinct assumptions. However, future experience studies should continue to study this assumption by gender to ensure differences do not unfold over time.

The results shown in the graph below show the current and proposed rates, based on the results of the last two experience studies. The recommended changes are intended to partially reflect the higher termination experience in the current study, so the resulting A/E ratio is 107% on a count basis, down from 109% (down from 110% to 106% on a liability-weighted basis).
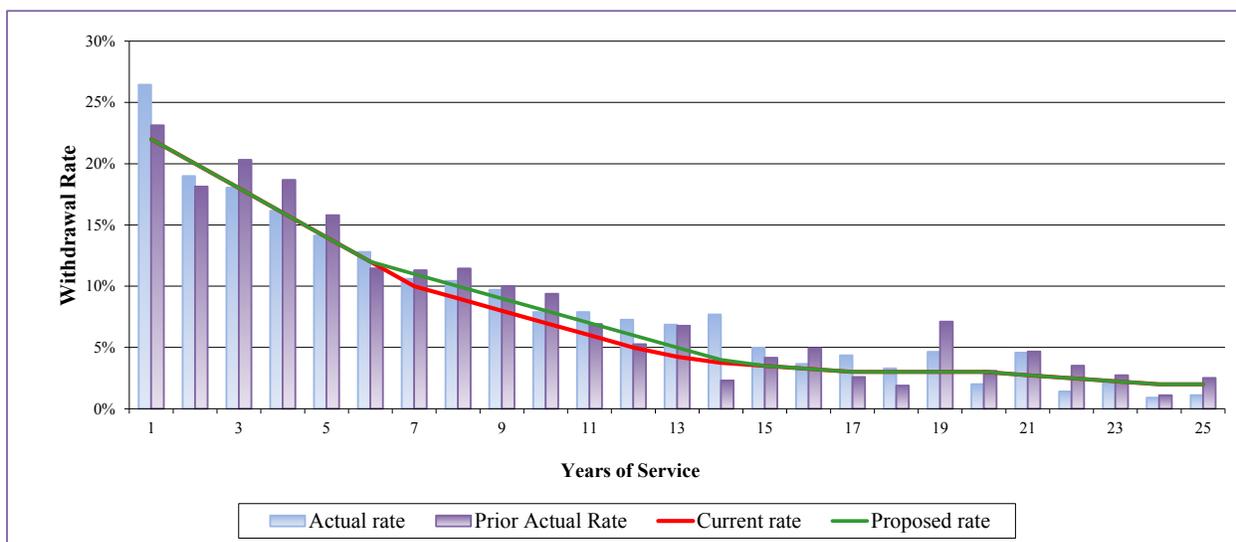
County Cash Balance

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	
	Exposures	Actual	Expected	Count	Weighted
July 1, 2015 to June 30, 2016	3,398	369	408	90%	92%
July 1, 2016 to June 30, 2017	3,617	513	437	117%	123%
July 1, 2017 to June 30, 2018	3,655	538	431	125%	112%
July 1, 2018 to June 30, 2019	3,569	577	410	141%	151%
Total	**14,239**	**1,997**	**1,686**	**118%**	**121%**

The results shown in the graph below show the current and proposed rates, based on the results of the last two experience studies. The recommended changes are intended to partially reflect the higher termination experience in the current study so the resulting A/E ratio is 113% on a count basis, down from 118% (down from 121% to 114% on a liability-weighted basis).
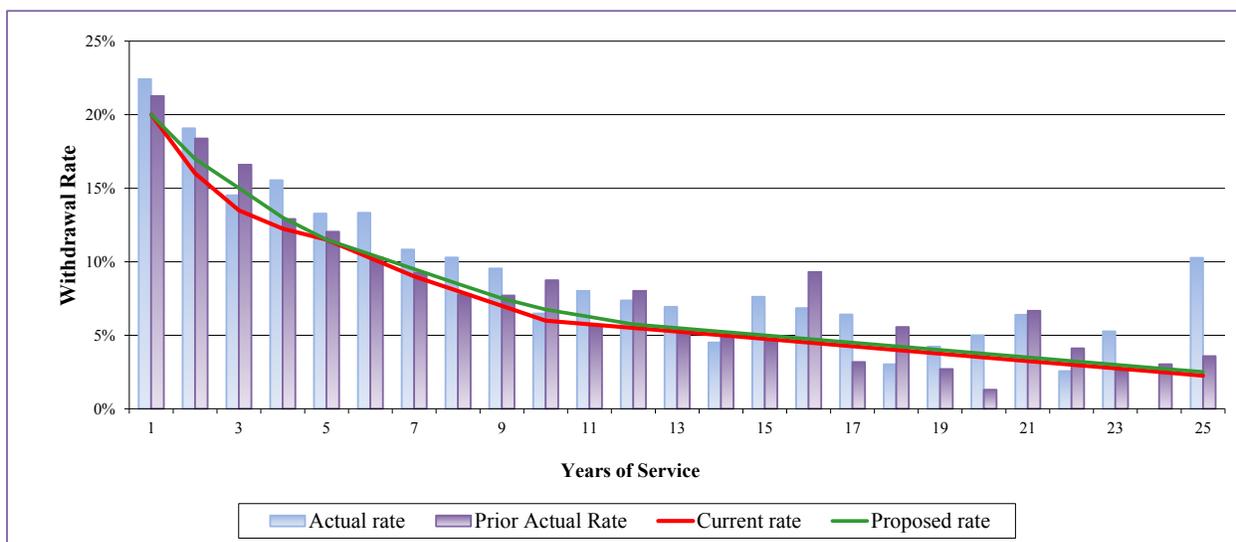
ELECTION OF A DEFERRED ANNUITY/REFUND

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

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

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

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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 30-year amortization bases, each with their own individual payment schedules. 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.

B.   **VALUATION PROCEDURES**

Data Procedures

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

Active members who are missing a date of birth on their record are assumed to have been hired at age 35.

Members who are missing a gender are assumed to be female.

Other Valuation Procedures

The compensation amounts used in the projection of benefits and liabilities for active members were prior plan year compensations. Salary increases are assumed to apply to annual amounts.

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

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

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

ECONOMIC ASSUMPTIONS

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

2. Inflation   2.75% per annum, compounded annually

3. Payroll Growth   3.50% per annum

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

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

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

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

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

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

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

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

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

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

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

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

ECONOMIC ASSUMPTIONS

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

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

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	18%
56-59	15
60-61	25
62	30
63-64	25
65-67	30
68-77	25
78-79	35
80	100

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

2. Termination

Rates vary by service.
Sample rates are as follows:

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

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.

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

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

3. Administrative Expense

Investment return is assumed to be net of investment and administrative expenses.

4. Commencement age for deferred vested benefit

Age 62

5. Cost of Living Adjustment

Service annuity – None

Formula annuity – 2.25% 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.

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

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

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	3% at each age
Unreduced	Age 55 Service: 10 years	10% at each age
Unreduced (Eligible for DROP)	Age 50 Service: 25 years	100% at each age
Unreduced (Mandatory)	Age 60	100% at each age

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   Investment return is assumed to be net of investment and administrative expenses.

5. Cost of living adjustments   2.25% per annum, compounded annually for Tier 1 members. 1.00% per annum, compounded annually for Tier 2 members.

6. DROP participation   All members elect the DROP at the earliest possible date and remain in the DROP for 4 years or to age 60, if earlier.

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

ECONOMIC ASSUMPTIONS

1. Salary Increases   Salaries are assumed to increase 3.50% each year.

DEMOGRAPHIC ASSUMPTIONS

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

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

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   7.50%

    b. Mortality   RP-2014 White Collar Table for Employees, set back two years, scaled (males: under 80, 1.008; over 80, 1.449; females: under 85, 0.924; over 85, 1.5855; geometrically blended), projected to 2035 with a Society of Actuaries (SOA) projection scale tool 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   Investment return is assumed to be net of investment and administrative expenses.

5. Cost of Living Adjustment   2.25% 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   6.25% per annum, compounded annually
   Balance Accounts

2. Annuitization Rate of Member &   7.75% per annum, compounded annually, for members
   Employer Accumulated Balances   hired before January 1, 2018 (set statutorily)

3. Salary Scale   Rates vary by service. Rates are as follows:

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

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

   a. 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

2. Retirement

Rates vary by retirement age after 5 years of service.
Rates are as follows:

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

3. Termination

Rates vary by service. Rates are as follows:

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

4. Disability

None

OTHER ASSUMPTIONS

1. Payment Assumptions

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

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

*Five-year certain and life annuity

2. Cost of Living Adjustment

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

ECONOMIC ASSUMPTIONS

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

2. Annuitization Rate of Member &   7.75% per annum, compounded annually, for members
   Employer Accumulated Balances   hired before January 1, 2018 (set statutorily)

3. Salary Scale   Rates vary by service. Rates are as follows:

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

DEMOGRAPHIC ASSUMPTIONS

1. Mortality

   a. Mortality for Annuitization of   1994 Group Annuity Mortality Table, with 50% Male, 50%
   Employee and Employer Cash   Female blending, for members hired before January 1, 2018
   Balance Accounts   (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

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%
65-66	20.0%
67-69	15.0%
70-79	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	6.00
15	4.75
20	3.50
25	2.25
26+	2.00

4. Disability

None

OTHER ASSUMPTIONS

1. Payment Assumptions

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

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

*Five-year certain and life annuity

2. Cost of Living Adjustment

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

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.

B. **VALUATION PROCEDURES**

Data Procedures

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

Active members who are missing a date of birth on their record are assumed to have been hired at age 35.

Members who are missing a gender are assumed to be female.

Other Valuation Procedures

The compensation amounts used in the projection of benefits and liabilities for active members were prior plan year compensations. Salary increases are assumed to apply to annual amounts.

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

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

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

The PERB has decided to phase in the inflation assumption over the next four valuation cycles. Due to using the building block approach for developing economic assumption, the change in inflation affects a number of other economic assumptions. The table below shows the change in economic assumptions during the next few valuations.

	Current (2020 Valuations)	2021 Valuations	2022 Valuations	2023 Valuations	2024 Valuations
Inflation	2.75%	2.65%	2.55%	2.45%	2.35%
Real Return	4.75%	4.65%	4.65%	4.65%	4.65%
Investment Return	7.50%	7.30%	7.20%	7.10%	7.00%
COLA (Tier 1)	2.25%	2.15%	2.10%	2.05%	2.00%
Cash Balance Interest Credit	6.25%	6.15%	6.10%	6.05%	6.00%
General Wage	3.50%	3.15%	3.05%	2.95%	2.85%
Payroll Growth	3.50%	3.15%	3.05%	2.95%	2.85%

Note that the assumptions listed below are the ultimate assumptions that will be used in the 2024 valuation.

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 for males, 95% of female rates for females), 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 for males, 95% of female rates for females), 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) Survivor Mortality Table (100% of male rates for males, 95% of female rates for females), 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 General Members Disabled Mortality Table (static table).

e. 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					
	Scale (2020)		**Scale (2030)**		**Scale (2040)**	
Sample 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.

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

3. Administrative Expense — 0.18% of payroll

4. Commencement age for deferred vested benefit — Age 64

5. 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.

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. 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+	0.0

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   0.18% of payroll

5. Commencement age for   Age 55
deferred vested benefit

6. Cost of living adjustments   2.00% per annum, compounded annually for Tier 1 members.
(COLA)   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.

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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. Marital Status

      a. Percent married   100% married

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

3. Administrative Expense   0.18% of payroll

4. 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.

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

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

2. Retirement

   Rates vary by retirement age after 5 years of service. Rates are as follows:

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. 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 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.

5. Salary Scale

   Rates vary by service. 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	3.50	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

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. 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
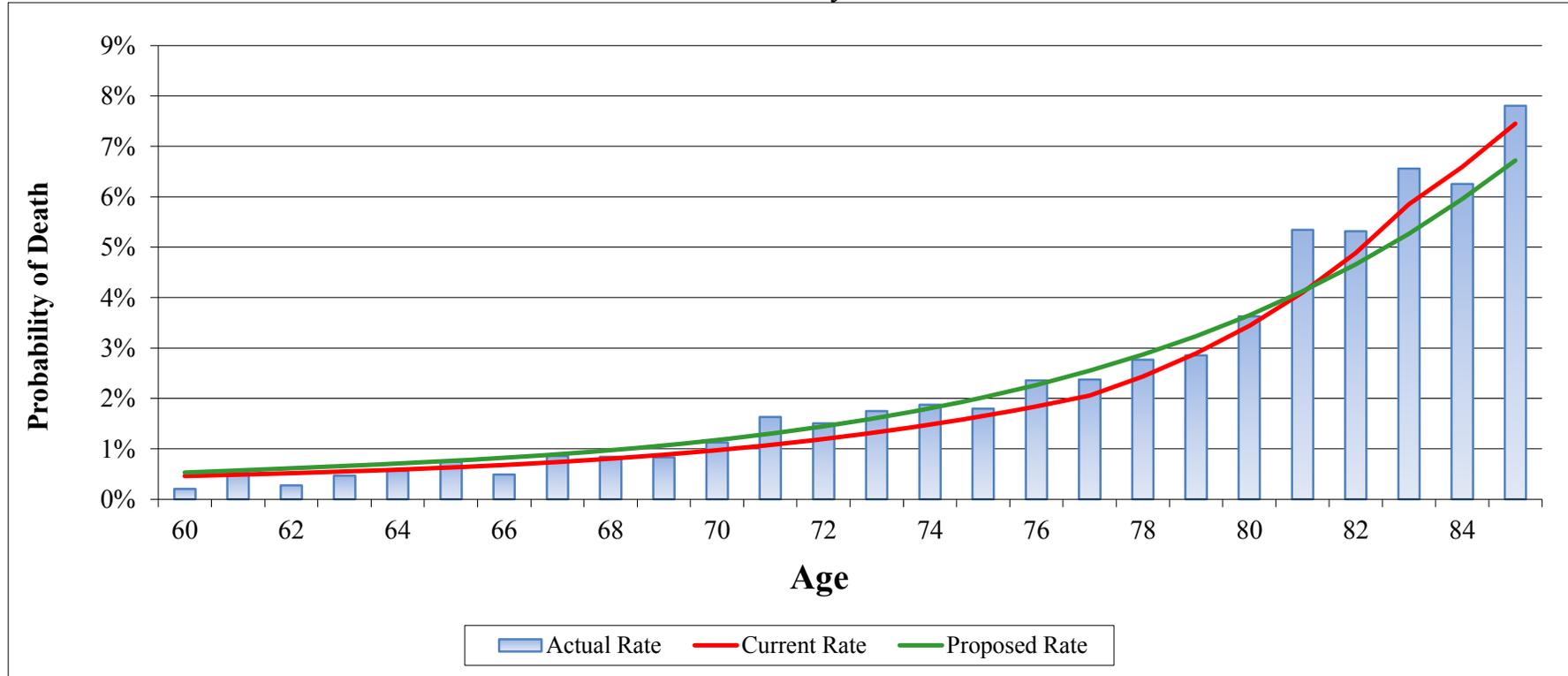
Current Study	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,215,916	1,036,384	1,159,790
Actual/Expected		117%	105%

Current + Prior Study	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,948,965	1,803,103	1,987,780
Actual/Expected		108%	98%

EXHIBIT C-2
Retiree Mortality – Females
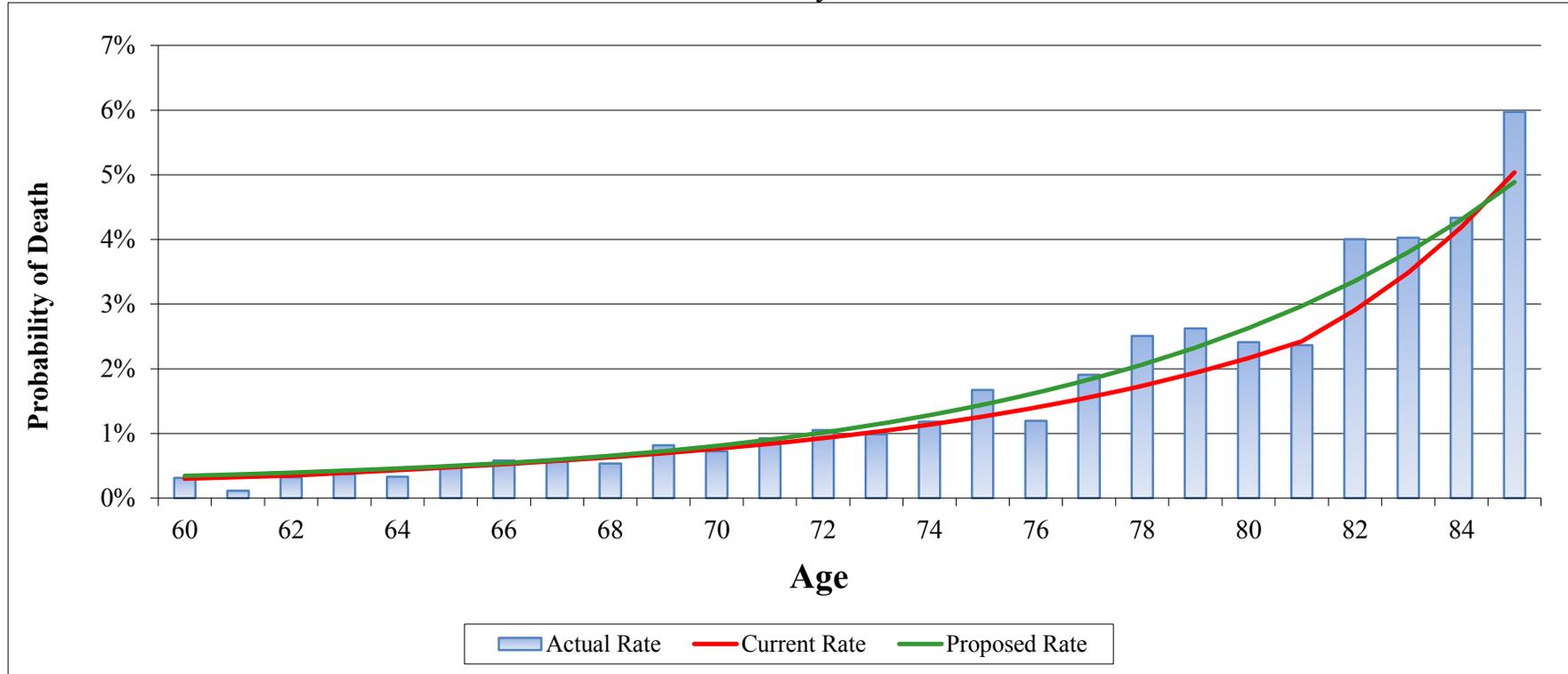
Current Study	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,067,358	959,109	1,050,949
Actual/Expected		111%	102%

Current + Prior Study	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,735,725	1,646,731	1,776,068
Actual/Expected		105%	98%

EXHIBIT C-3
Retirement – Schools (Early)
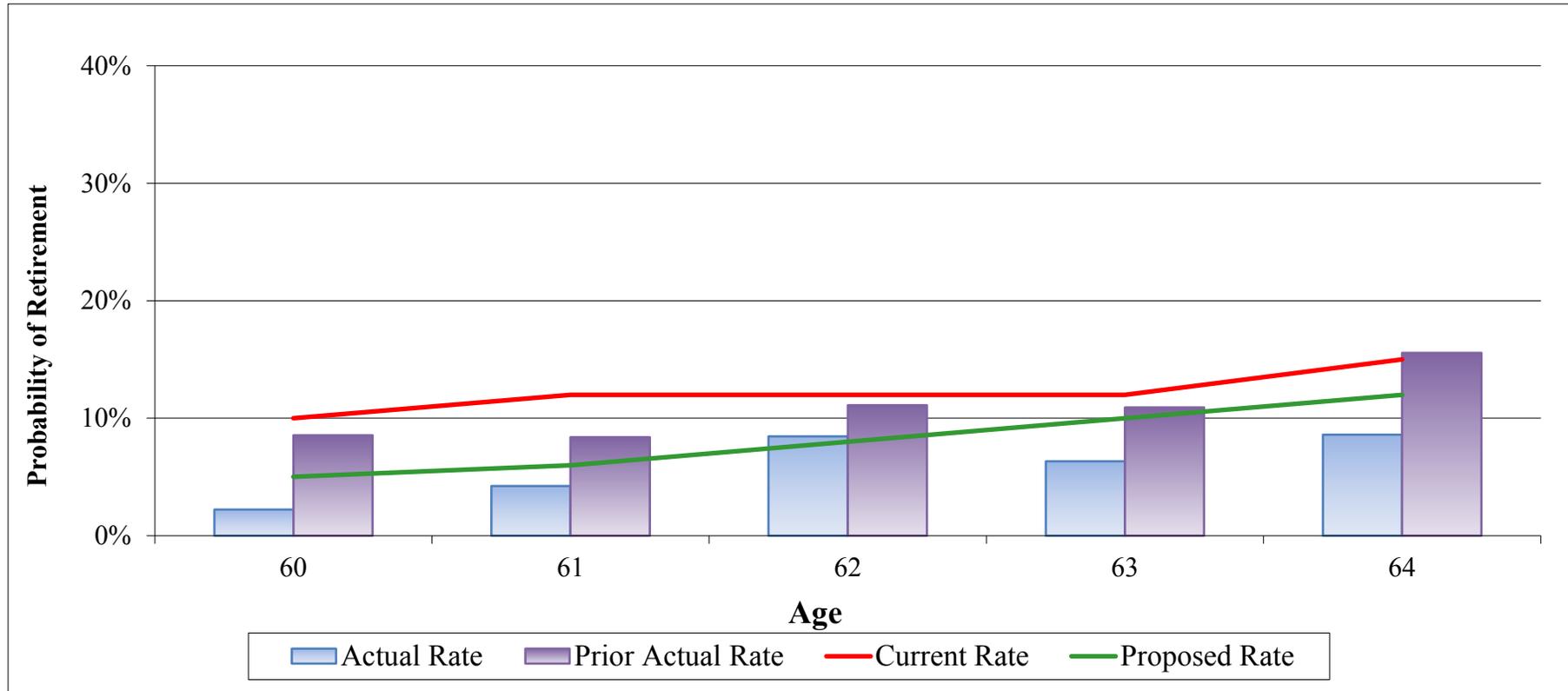
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	234	517	326
Actual/Expected		45%	72%

EXHIBIT C-4
Retirement – Schools (Unreduced)
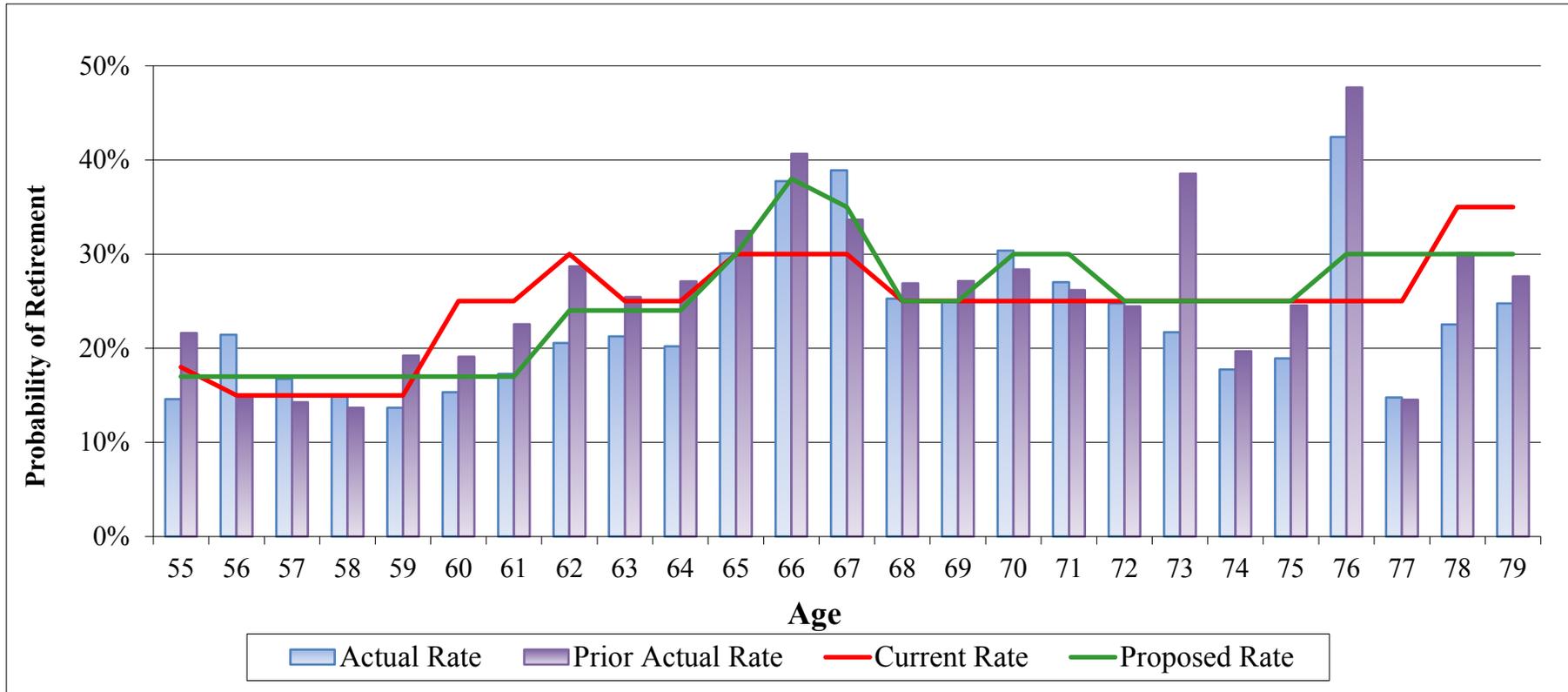
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	6,222	6,751	6,540
Actual/Expected		92%	95%

EXHIBIT C-5
Retirement – Patrol (DROP after 25 Years)
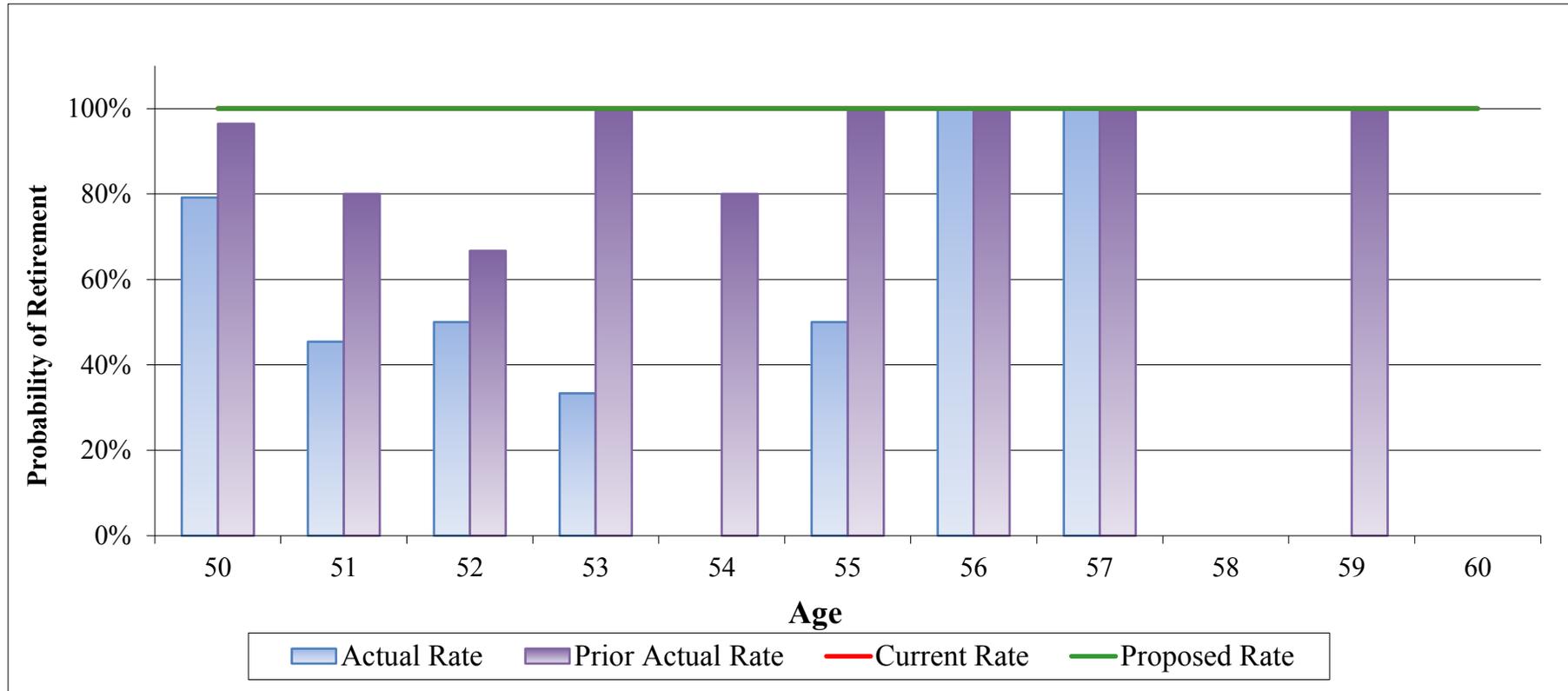
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Total Count	34	54	54
Actual/Expected		63%	63%

EXHIBIT C-6
Retirement – Judges
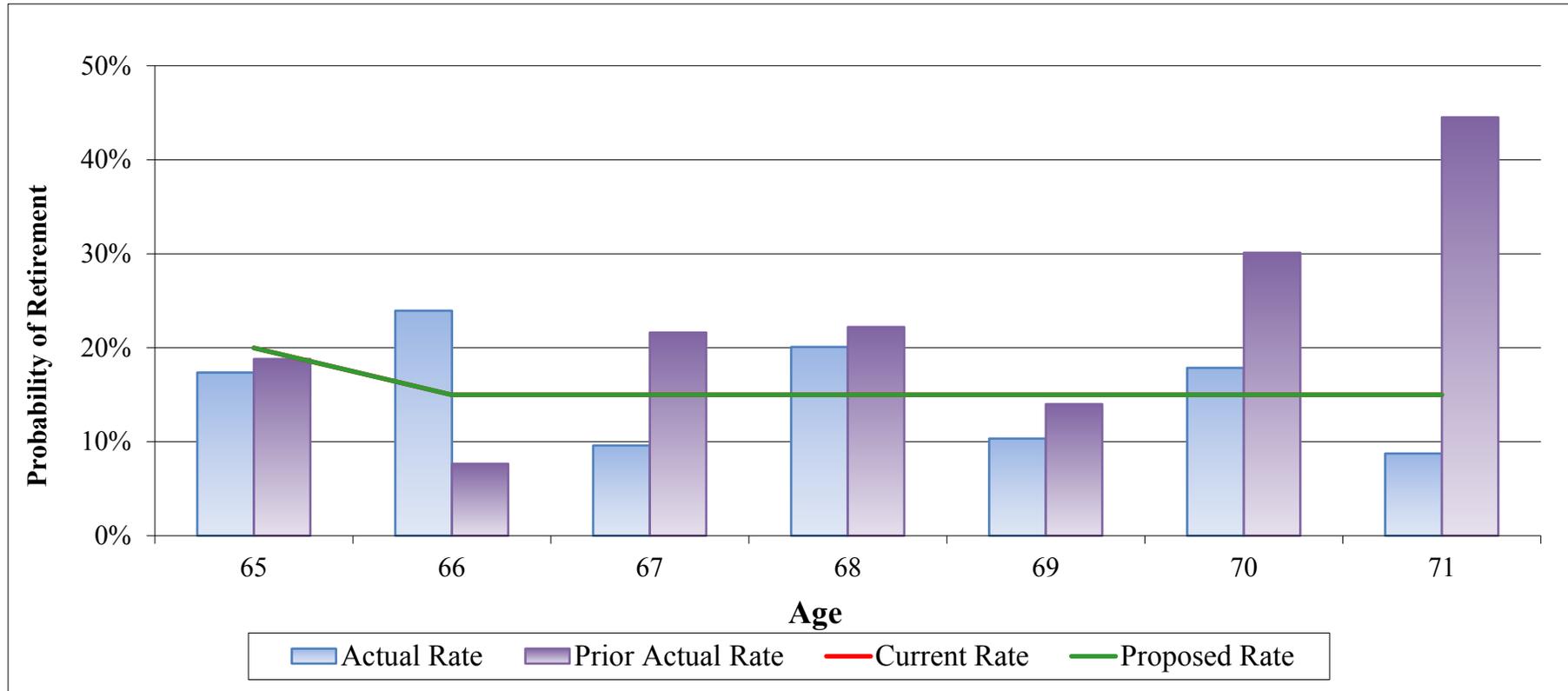
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	67	68	68
Actual/Expected		100%	100%

EXHIBIT C-7
Retirement – State
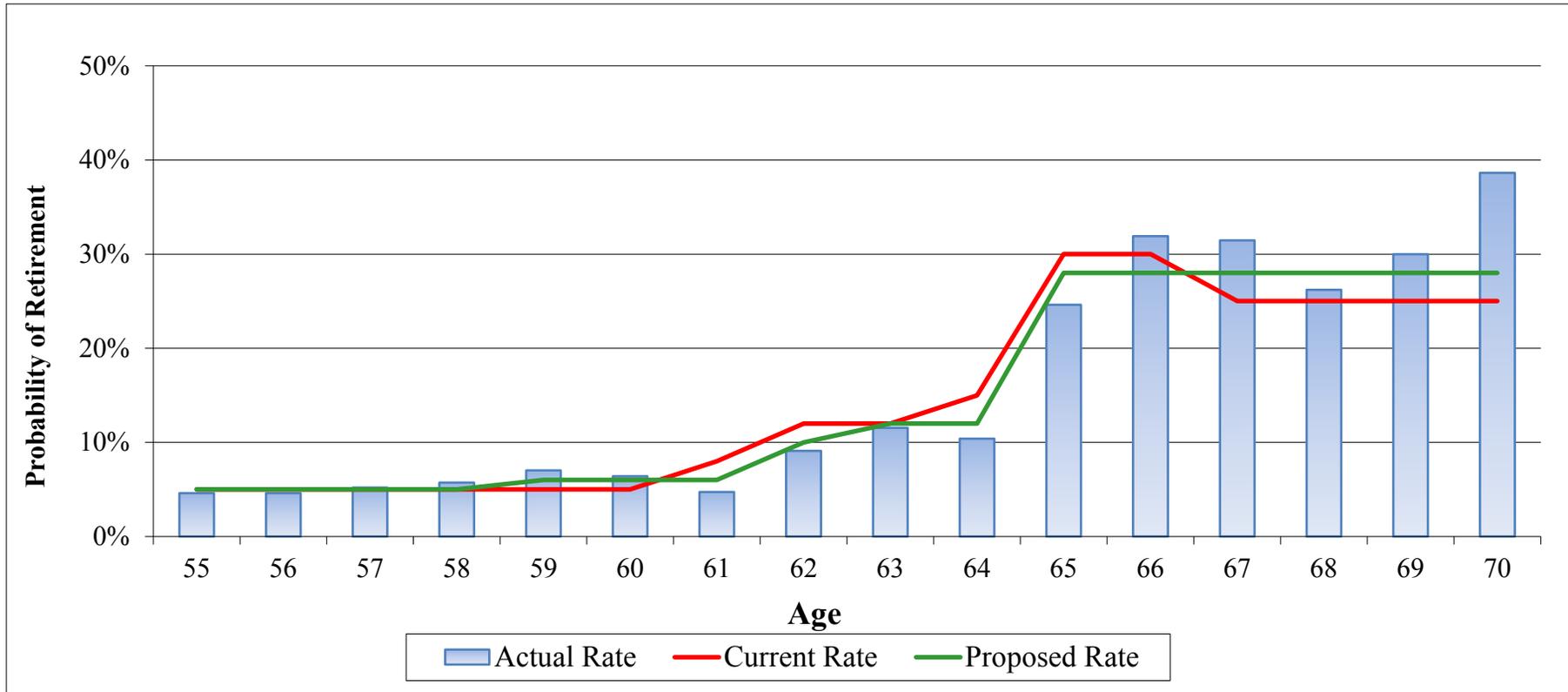
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,925	1,968	1,913
Actual/Expected		98%	101%

EXHIBIT C-8
Retirement – County
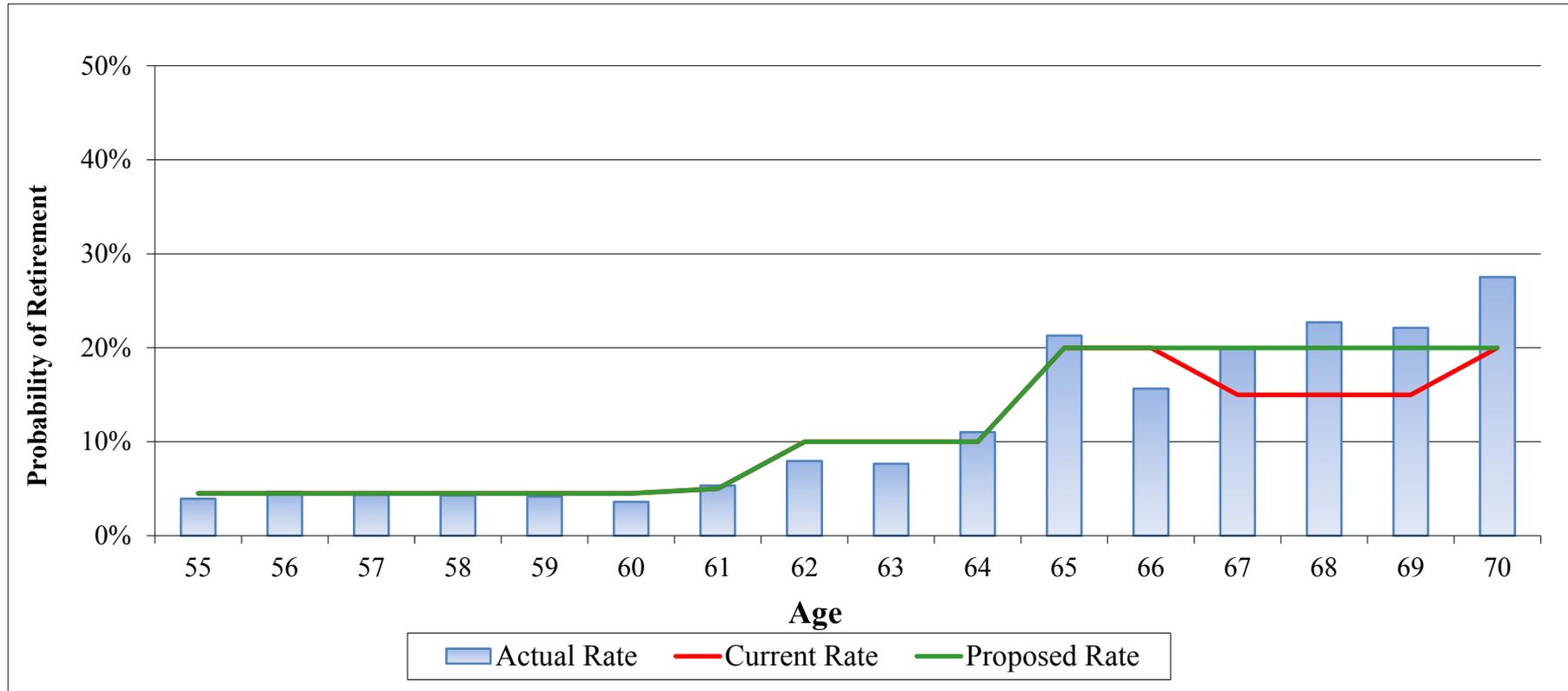
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	534	514	546
Actual/Expected		104%	98%

EXHIBIT C-9
Termination of Employment – Schools (Males)
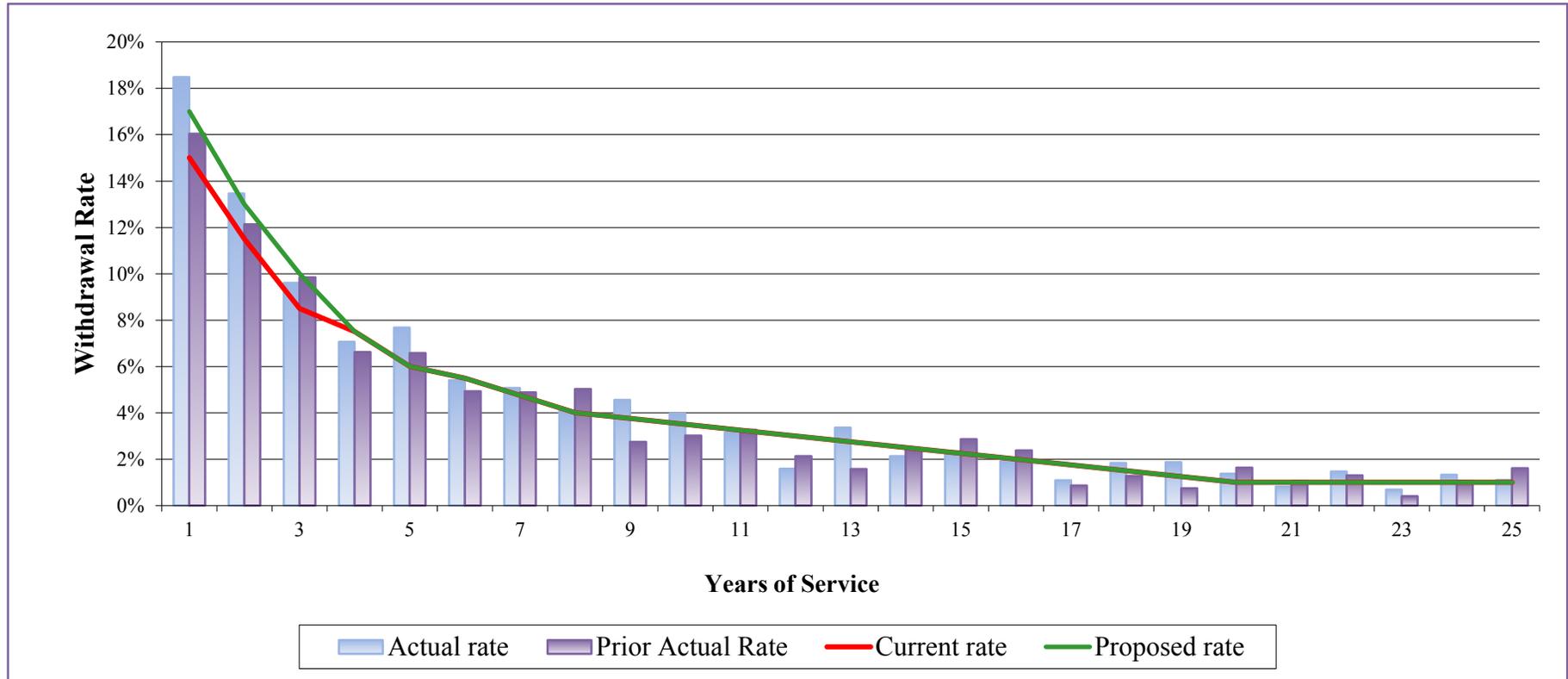
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Total Count	2,045	1,809	1,958
Actual/Expected		113%	104%

EXHIBIT C-10
Termination of Employment – Schools (Females)
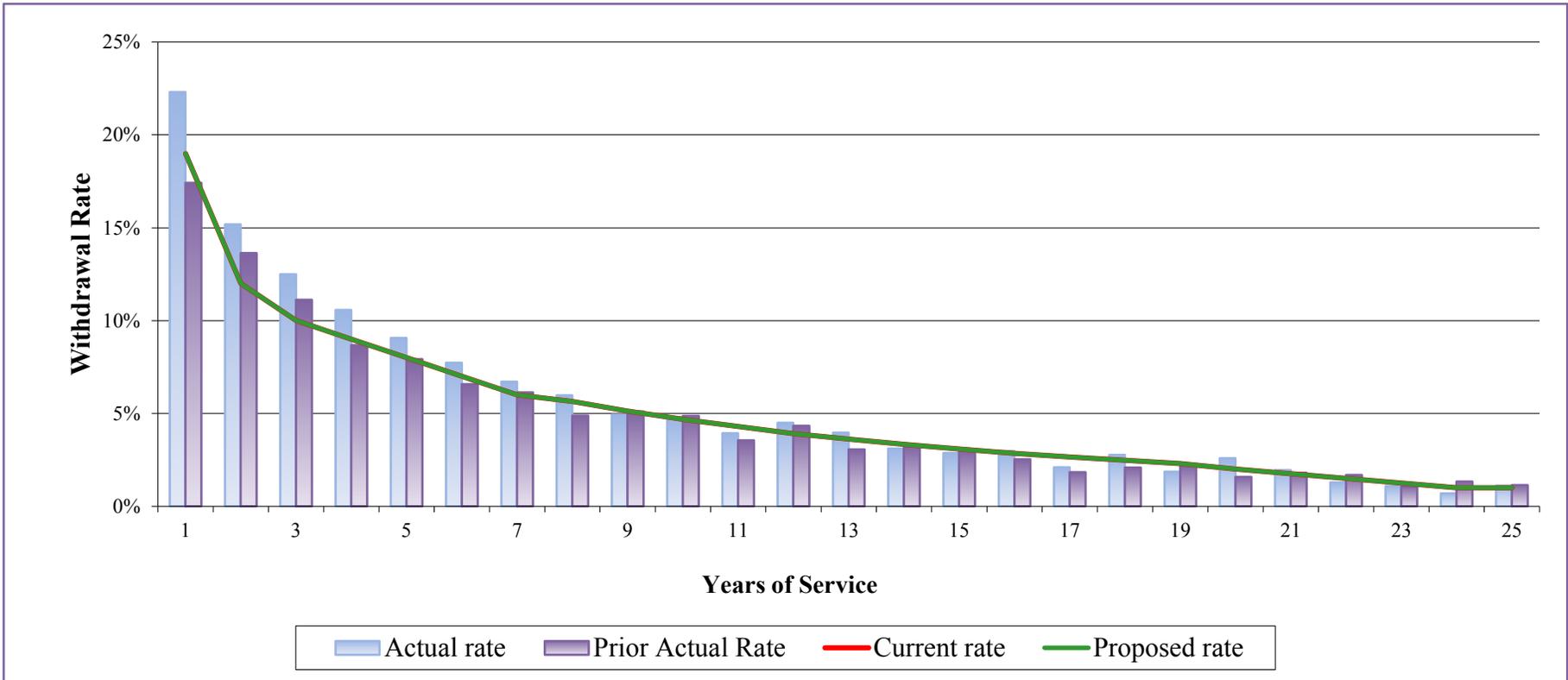
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Total Count	8,672	7,530	7,530
Actual/Expected		115%	115%

EXHIBIT C-11
Termination of Employment – Patrol
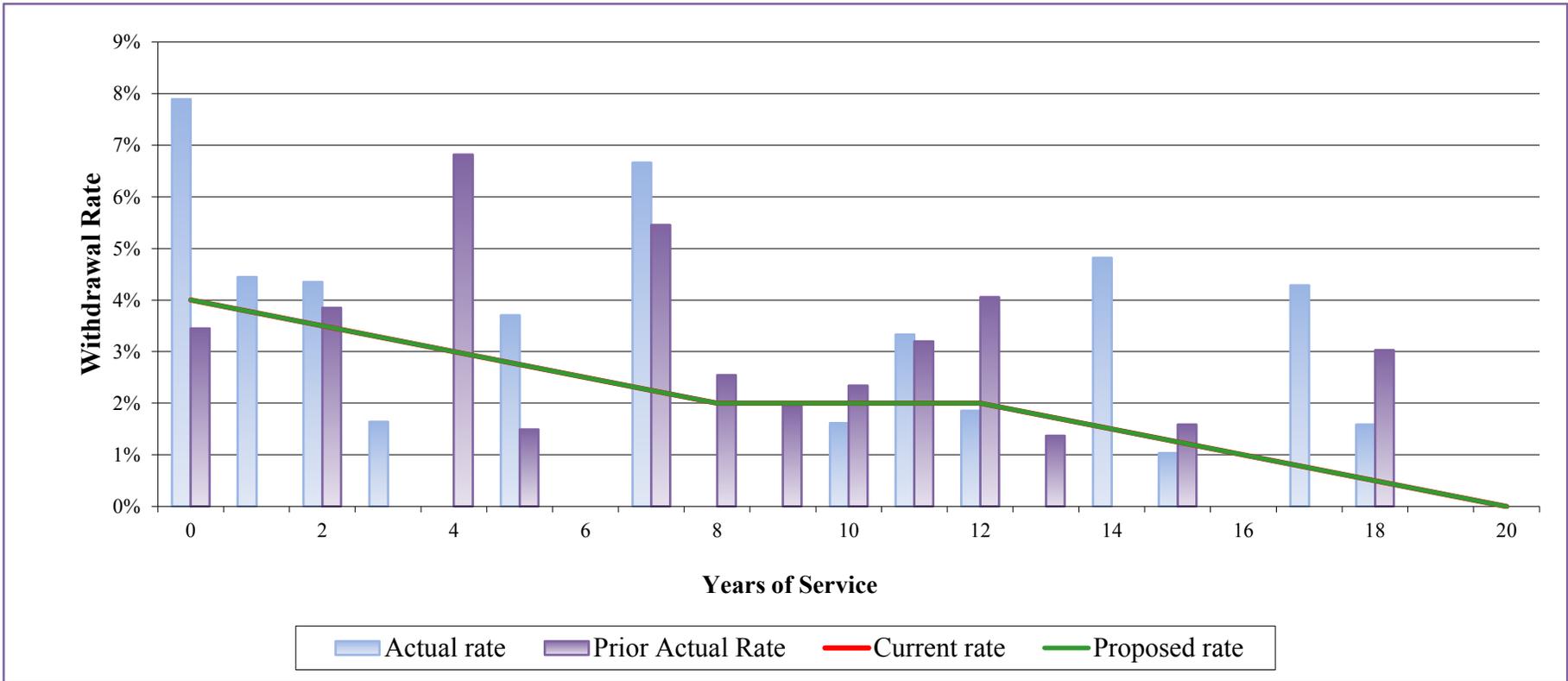
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Total Count	26	23	23
Actual/Expected		113%	113%

EXHIBIT C-12
Termination of Employment – State
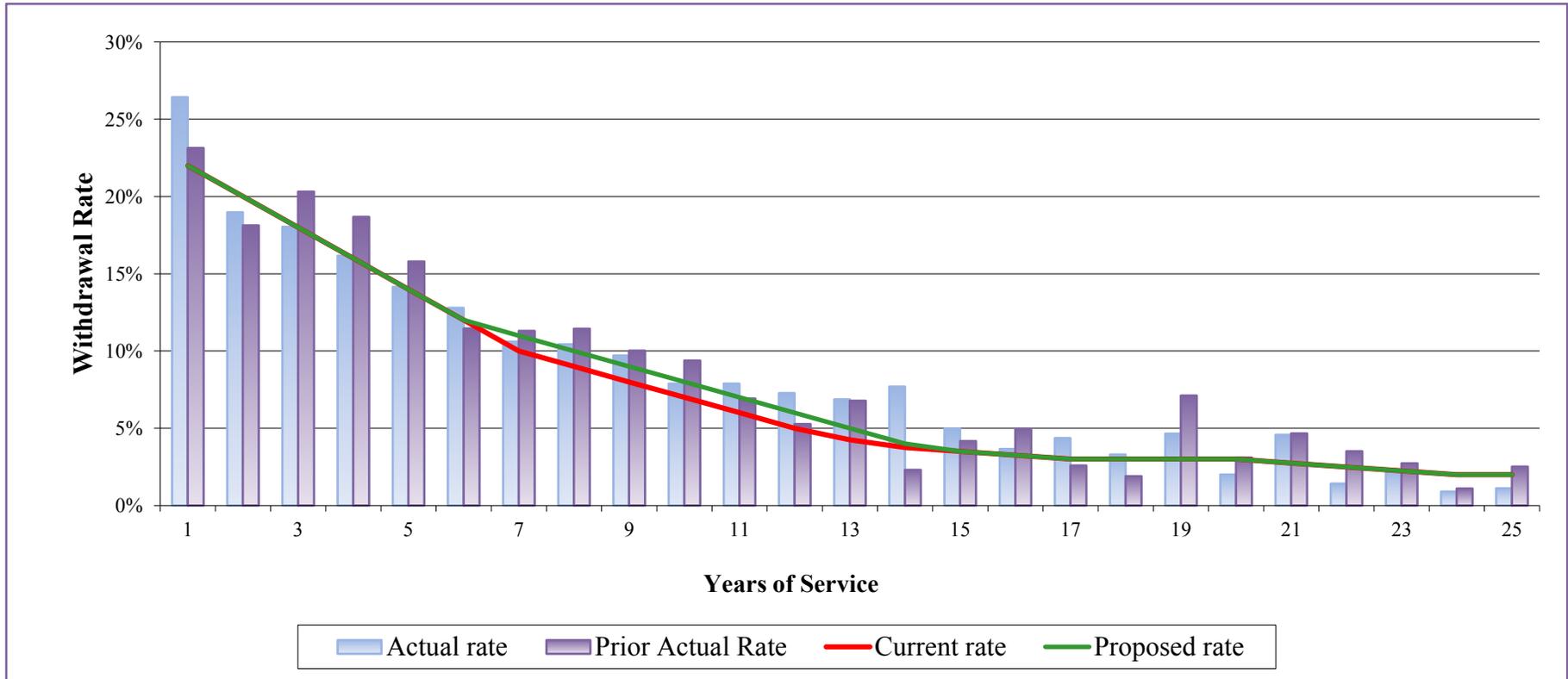
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Total Count	4,883	4,484	4,569
Actual/Expected		109%	107%

EXHIBIT C-13
Termination of Employment – County
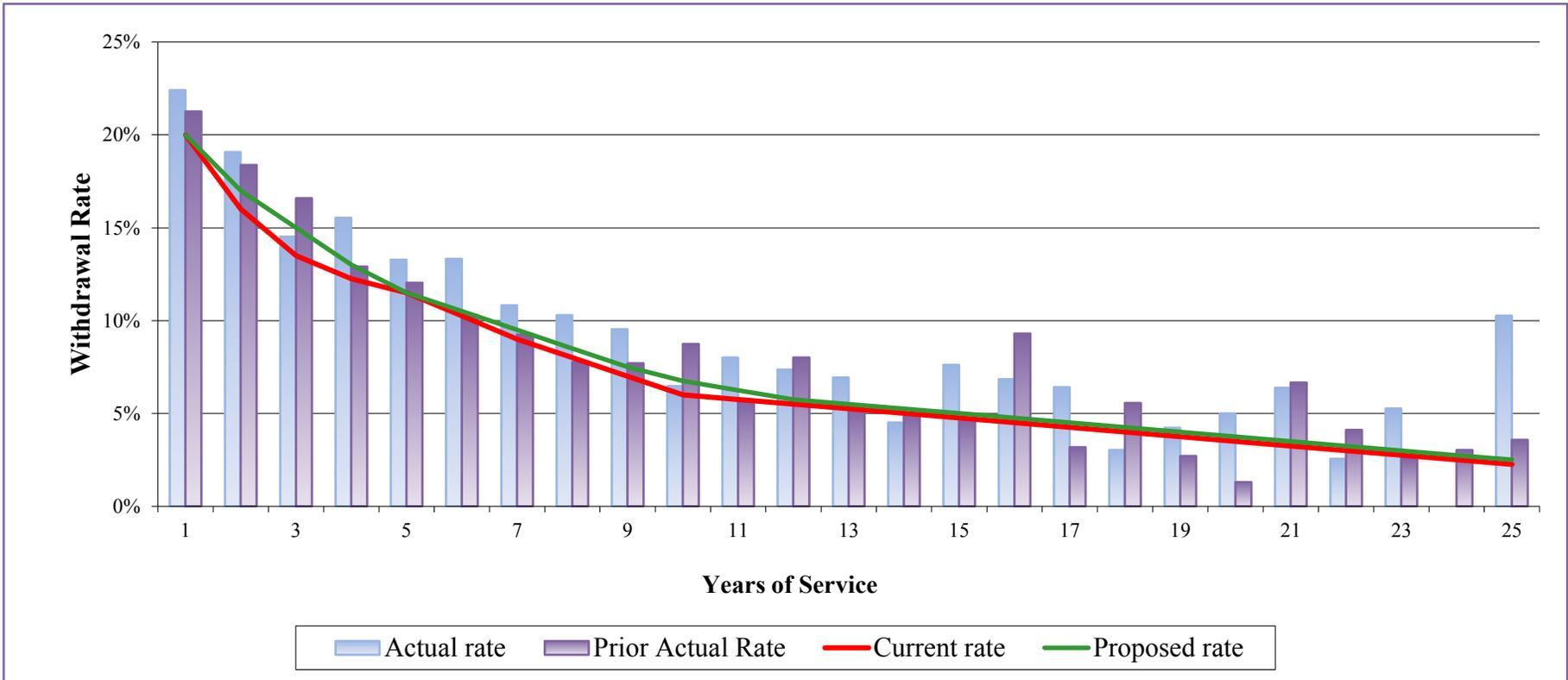
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Total Count	1,997	1,686	1,762
Actual/Expected		118%	113%

EXHIBIT C-14
Salary Scale – Schools
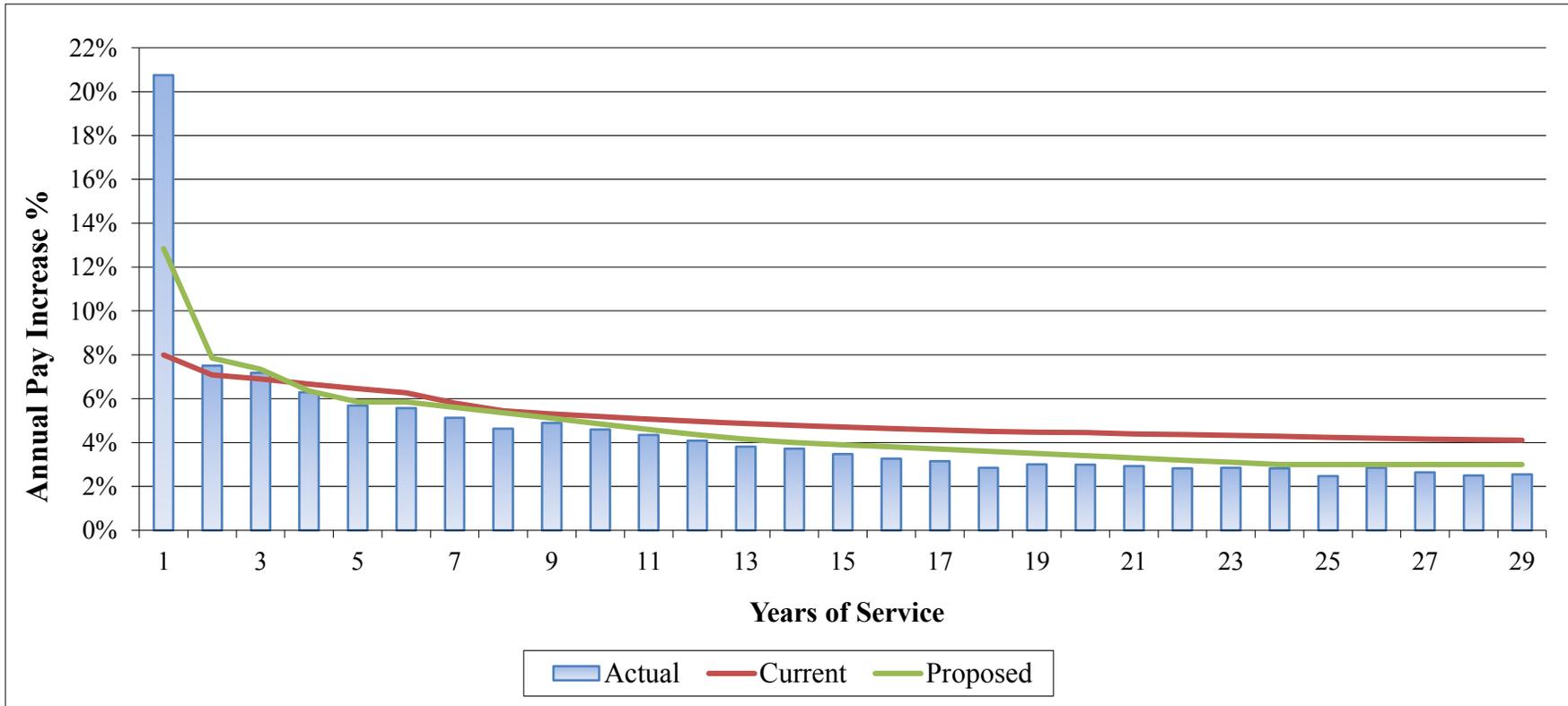
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Average Increase	4.28%	5.16%	4.59%
Actual/Expected		83%	93%

EXHIBIT C-15
Salary Scale – Patrol
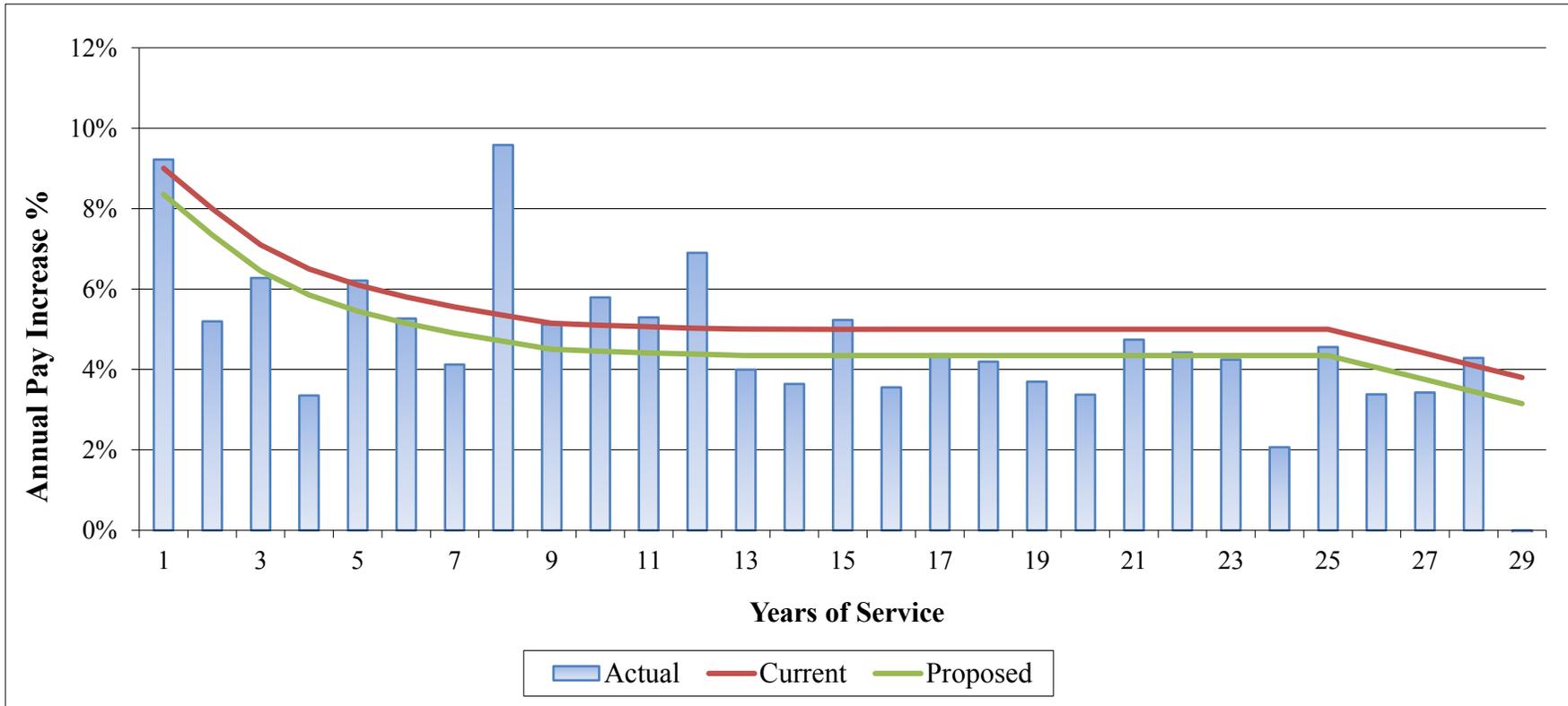
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Average Increase	4.52%	5.32%	4.67%
Actual/Expected		85%	97%

EXHIBIT C-16
Salary Scale – State
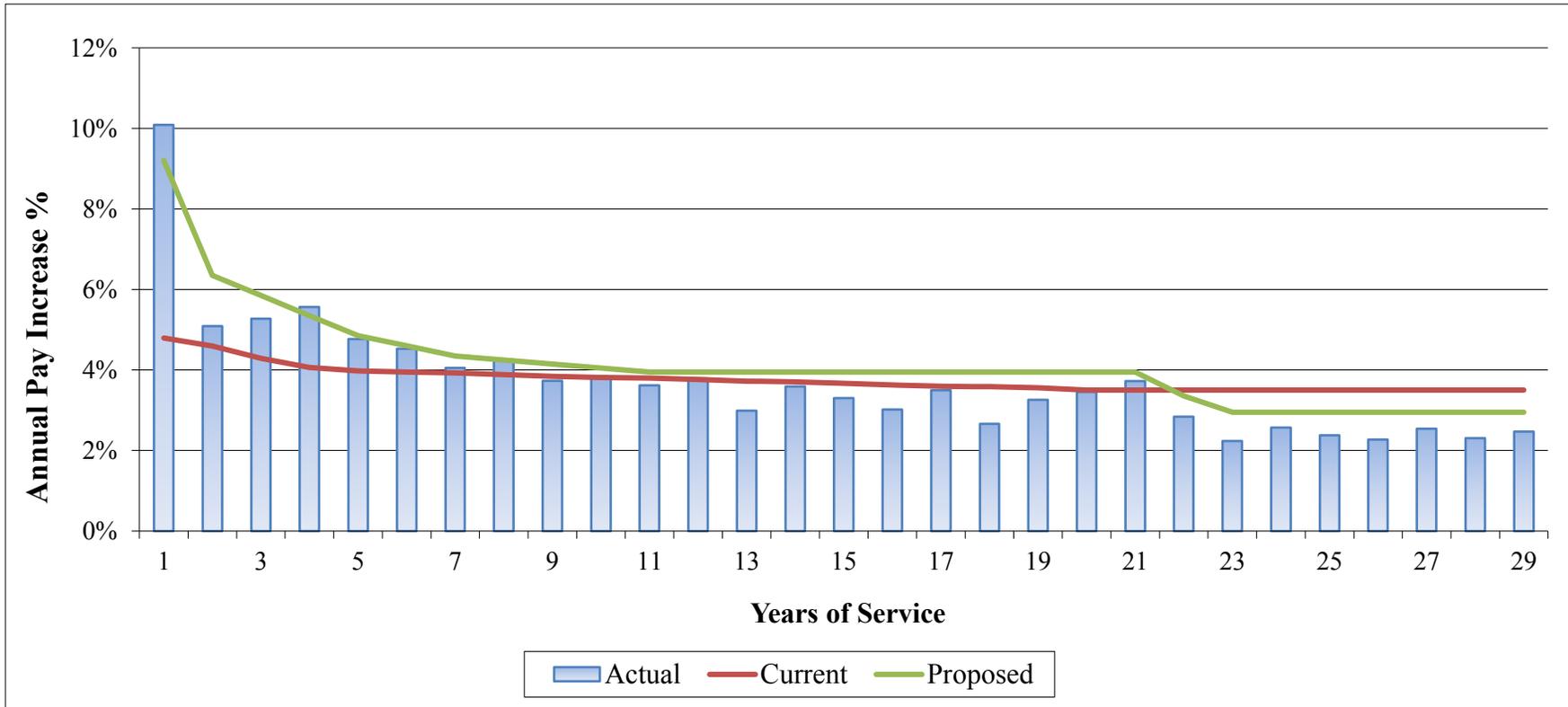
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Average Increase	4.54%	4.16%	4.85%
Actual/Expected		109%	93%

EXHIBIT C-17
Salary Scale – County
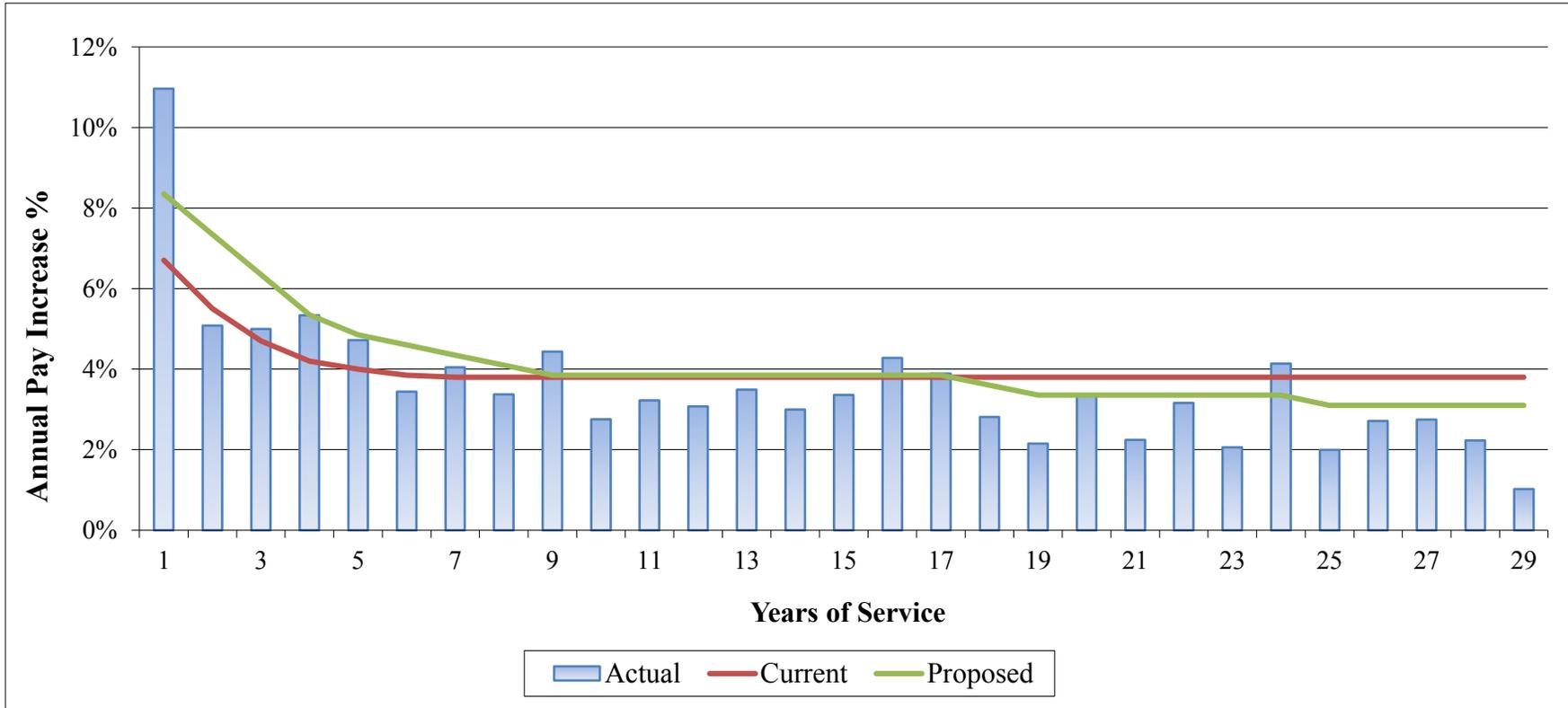
	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Average Increase	4.41%	4.62%	4.83%
Actual/Expected		95%	91%

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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	1,425,150	3,184	0.223%	6,568.1	0.461%	7,551.0	0.530%
61	1,689,865	7,466	0.442%	8,271.4	0.489%	9,653.1	0.571%
62	2,083,756	962	0.046%	10,843.6	0.520%	12,809.5	0.615%
63	2,493,989	12,343	0.495%	13,826.4	0.554%	16,445.2	0.659%
64	2,891,659	11,232	0.388%	17,132.5	0.592%	20,447.1	0.707%
65	3,568,489	29,081	0.815%	22,668.0	0.635%	27,106.5	0.760%
66	4,106,134	25,452	0.620%	28,104.7	0.684%	33,626.3	0.819%
67	4,593,431	35,197	0.766%	34,075.2	0.742%	40,841.4	0.889%
68	4,840,623	58,088	1.200%	39,167.1	0.809%	47,010.7	0.971%
69	4,830,603	55,673	1.153%	42,867.0	0.887%	51,528.2	1.067%
70	4,647,252	52,884	1.138%	45,447.9	0.978%	54,712.8	1.177%
71	4,542,582	77,127	1.698%	49,233.9	1.084%	59,292.6	1.305%
72	4,058,380	57,917	1.427%	48,855.5	1.204%	58,882.2	1.451%
73	3,650,386	59,327	1.625%	48,904.5	1.340%	59,061.5	1.618%
74	3,338,206	76,712	2.298%	49,774.4	1.491%	60,356.9	1.808%
75	2,814,950	47,208	1.677%	46,793.4	1.662%	57,057.7	2.027%
76	2,456,739	54,592	2.222%	45,468.7	1.851%	55,854.1	2.274%
77	2,238,692	55,399	2.475%	46,299.6	2.068%	57,267.6	2.558%
78	1,930,017	52,299	2.710%	47,325.3	2.452%	55,586.0	2.880%
79	1,778,202	60,149	3.383%	51,767.1	2.911%	57,711.9	3.246%
80	1,643,420	63,546	3.867%	56,795.5	3.456%	60,111.4	3.658%
81	1,339,391	70,226	5.243%	55,191.4	4.121%	55,364.6	4.134%
82	1,155,246	68,353	5.917%	56,747.2	4.912%	53,933.2	4.669%
83	987,830	63,428	6.421%	58,063.6	5.878%	52,142.5	5.278%
84	820,897	54,766	6.671%	54,456.5	6.634%	48,978.0	5.966%
85	689,924	63,305	9.176%	51,734.8	7.499%	46,458.5	6.734%
	70,615,810	1,215,916	1.722%	1,036,383.6	1.468%	1,159,790.4	1.642%

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	2,378,502	2,306	0.097%	7,221.2	0.304%	8,194.6	0.345%
61	2,971,158	3,846	0.129%	9,682.4	0.326%	10,894.2	0.367%
62	3,661,180	15,837	0.433%	12,867.8	0.351%	14,337.0	0.392%
63	4,845,734	13,054	0.269%	19,030.8	0.393%	20,431.1	0.422%
64	5,886,615	19,885	0.338%	25,652.0	0.436%	26,865.2	0.456%
65	6,836,449	25,919	0.379%	32,872.6	0.481%	34,003.7	0.497%
66	7,877,662	45,109	0.573%	41,631.3	0.528%	42,838.9	0.544%
67	8,211,732	40,295	0.491%	47,656.1	0.580%	49,043.1	0.597%
68	7,828,367	37,759	0.482%	49,819.8	0.636%	51,573.4	0.659%
69	7,141,323	71,020	0.994%	49,836.0	0.698%	52,129.3	0.730%
70	6,251,312	34,497	0.552%	47,906.7	0.766%	50,789.0	0.812%
71	5,246,935	63,218	1.205%	44,333.5	0.845%	47,643.7	0.908%
72	4,463,671	38,535	0.863%	41,690.6	0.934%	45,452.7	1.018%
73	3,977,410	41,635	1.047%	41,110.2	1.034%	45,519.3	1.144%
74	3,526,694	54,168	1.536%	40,329.4	1.144%	45,363.2	1.286%
75	3,072,167	55,215	1.797%	38,943.1	1.268%	44,450.2	1.447%
76	2,658,662	38,758	1.458%	37,459.5	1.409%	43,346.8	1.630%
77	2,292,760	46,362	2.022%	35,974.7	1.569%	42,136.4	1.838%
78	2,115,864	54,953	2.597%	37,001.4	1.749%	43,819.5	2.071%
79	1,990,493	59,307	2.980%	38,853.7	1.952%	46,479.3	2.335%
80	1,803,967	45,415	2.518%	39,333.1	2.180%	47,532.6	2.635%
81	1,626,975	32,574	2.002%	39,650.0	2.437%	48,397.8	2.975%
82	1,431,697	67,299	4.701%	41,785.2	2.919%	48,145.0	3.363%
83	1,222,496	61,659	5.044%	42,839.4	3.504%	46,546.6	3.808%
84	1,074,880	49,843	4.637%	45,270.0	4.212%	46,378.1	4.315%
85	994,274	48,890	4.917%	50,358.2	5.065%	48,638.1	4.892%
	101,388,978	1,067,358	1.053%	959,108.6	0.946%	1,050,948.9	1.037%

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	1,276	28	2.232%	127.6	10.000%	63.8	5.000%
61	1,056	45	4.222%	126.7	12.000%	63.3	6.000%
62	873	74	8.461%	104.7	12.000%	69.8	8.000%
63	657	42	6.333%	78.9	12.000%	65.7	10.000%
64	528	45	8.599%	79.2	15.000%	63.4	12.000%
	4,390	234	5.329%	517.1	11.780%	326.1	7.428%

EXHIBIT D-4
Retirement – Schools (Unreduced)

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	1,891	276	14.593%	340.4	18.000%	321.5	17.000%
56	2,272	487	21.454%	340.8	15.000%	386.2	17.000%
57	2,345	393	16.748%	351.8	15.000%	398.7	17.000%
58	2,408	358	14.868%	361.2	15.000%	409.4	17.000%
59	2,486	340	13.678%	372.9	15.000%	422.6	17.000%
60	2,531	388	15.322%	632.8	25.000%	430.3	17.000%
61	2,450	423	17.280%	612.6	25.000%	416.6	17.000%
62	2,396	493	20.561%	718.8	30.000%	575.1	24.000%
63	2,187	465	21.263%	546.7	25.000%	524.9	24.000%
64	1,945	393	20.217%	486.3	25.000%	466.9	24.000%
65	2,181	656	30.093%	654.4	30.000%	654.4	30.000%
66	1,537	580	37.740%	461.2	30.000%	584.2	38.000%
67	1,016	395	38.903%	304.8	30.000%	355.6	35.000%
68	646	163	25.269%	161.4	25.000%	161.4	25.000%
69	482	121	25.071%	120.5	25.000%	120.5	25.000%
70	327	100	30.384%	81.9	25.000%	98.2	30.000%
71	211	57	27.018%	52.7	25.000%	63.3	30.000%
72	161	40	24.760%	40.4	25.000%	40.4	25.000%
73	127	28	21.712%	31.7	25.000%	31.7	25.000%
74	94	17	17.730%	23.6	25.000%	23.6	25.000%
75	72	14	18.910%	18.1	25.000%	18.1	25.000%
76	47	20	42.466%	11.6	25.000%	14.0	30.000%
77	29	4	14.760%	7.3	25.000%	8.8	30.000%
78	27	6	22.541%	9.6	35.000%	8.2	30.000%
79	19	5	24.776%	6.7	35.000%	5.8	30.000%
80	12	2	14.831%	12.3	100.000%	12.3	100.000%
	29,904	6,224	20.813%	6,762.9	22.615%	6,552.7	21.913%

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

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
50	24	19	79.167%	24.0	100.000%	24.0	100.000%
51	11	5	45.455%	11.0	100.000%	11.0	100.000%
52	6	3	50.000%	6.0	100.000%	6.0	100.000%
53	3	1	33.333%	3.0	100.000%	3.0	100.000%
54	2	-	0.000%	2.0	100.000%	2.0	100.000%
55	2	1	50.000%	2.0	100.000%	2.0	100.000%
56	1	1	100.000%	1.0	100.000%	1.0	100.000%
57	4	4	100.000%	4.0	100.000%	4.0	100.000%
58	1	-	0.000%	1.0	100.000%	1.0	100.000%
59	-	-	0.000%	-	100.000%	-	100.000%
60	-	-	0.000%	-	100.000%	-	100.000%
	54	34	62.963%	54.0	100.000%	54.0	100.000%

EXHIBIT D-6
Retirement – Judges

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
65	89	15	17.344%	17.8	20.000%	17.8	20.000%
66	70	17	23.950%	10.5	15.000%	10.5	15.000%
67	53	5	9.584%	7.9	15.000%	7.9	15.000%
68	50	10	20.076%	7.5	15.000%	7.5	15.000%
69	51	5	10.319%	7.7	15.000%	7.7	15.000%
70	59	11	17.869%	8.8	15.000%	8.8	15.000%
71	49	4	8.758%	7.4	15.000%	7.4	15.000%
	421	67	16.014%	67.6	16.059%	67.6	16.059%

EXHIBIT D-7
Retirement – State

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	737	34	4.592%	36.9	5.000%	36.9	5.000%
56	825	38	4.600%	41.3	5.000%	41.3	5.000%
57	919	48	5.189%	45.9	5.000%	45.9	5.000%
58	970	55	5.705%	48.5	5.000%	48.5	5.000%
59	1,071	75	7.024%	53.6	5.000%	64.3	6.000%
60	1,136	73	6.399%	56.8	5.000%	68.2	6.000%
61	1,205	57	4.720%	96.4	8.000%	72.3	6.000%
62	1,313	120	9.105%	157.5	12.000%	131.3	10.000%
63	1,278	147	11.528%	153.3	12.000%	153.3	12.000%
64	1,241	129	10.384%	186.2	15.000%	149.0	12.000%
65	1,201	296	24.619%	360.2	30.000%	336.1	28.000%
66	935	298	31.909%	280.6	30.000%	261.9	28.000%
67	644	203	31.462%	161.0	25.000%	180.3	28.000%
68	491	129	26.200%	122.8	25.000%	137.5	28.000%
69	386	116	30.000%	96.6	25.000%	108.2	28.000%
70	281	109	38.634%	70.2	25.000%	78.7	28.000%
	14,633	1,925	13.155%	1,967.6	13.447%	1,913.5	13.076%

EXHIBIT D-8
Retirement – County

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	310	12	3.928%	14.0	4.500%	14.0	4.500%
56	329	15	4.672%	14.8	4.500%	14.8	4.500%
57	366	16	4.323%	16.5	4.500%	16.5	4.500%
58	372	16	4.280%	16.7	4.500%	16.7	4.500%
59	374	16	4.148%	16.8	4.500%	16.8	4.500%
60	422	15	3.617%	19.0	4.500%	19.0	4.500%
61	453	24	5.341%	22.6	5.000%	22.6	5.000%
62	464	37	7.938%	46.4	10.000%	46.4	10.000%
63	440	34	7.654%	44.0	10.000%	44.0	10.000%
64	411	45	10.996%	41.1	10.000%	41.1	10.000%
65	379	81	21.300%	75.8	20.000%	75.8	20.000%
66	319	50	15.663%	63.8	20.000%	63.8	20.000%
67	271	54	19.946%	40.6	15.000%	54.1	20.000%
68	216	49	22.708%	32.4	15.000%	43.3	20.000%
69	163	36	22.130%	24.5	15.000%	32.7	20.000%
70	124	34	27.535%	24.8	20.000%	24.8	20.000%
	5,412	534	9.867%	513.8	9.494%	546.3	10.094%

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

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	3,424	633	18.487%	513.6	15.000%	582.1	17.000%
2	2,868	386	13.459%	329.8	11.500%	372.8	13.000%
3	2,489	239	9.602%	211.6	8.500%	248.9	10.000%
4	1,984	140	7.056%	148.8	7.500%	148.8	7.500%
5	1,707	131	7.674%	102.4	6.000%	102.4	6.000%
6	1,443	78	5.405%	79.4	5.500%	79.4	5.500%
7	1,321	67	5.072%	62.7	4.750%	62.7	4.750%
8	1,320	54	4.091%	52.8	4.000%	52.8	4.000%
9	1,274	58	4.553%	47.8	3.750%	47.8	3.750%
10	1,210	48	3.967%	42.4	3.500%	42.4	3.500%
11	1,112	35	3.147%	36.1	3.250%	36.1	3.250%
12	1,013	16	1.579%	30.4	3.000%	30.4	3.000%
13	922	31	3.362%	25.4	2.750%	25.4	2.750%
14	845	18	2.130%	21.1	2.500%	21.1	2.500%
15	853	20	2.345%	19.2	2.250%	19.2	2.250%
16	837	16	1.912%	16.7	2.000%	16.7	2.000%
17	824	9	1.092%	14.4	1.750%	14.4	1.750%
18	762	14	1.837%	11.4	1.500%	11.4	1.500%
19	696	13	1.868%	8.7	1.250%	8.7	1.250%
20	656	9	1.372%	6.6	1.000%	6.6	1.000%
21	616	5	0.812%	6.2	1.000%	6.2	1.000%
22	616	9	1.461%	6.2	1.000%	6.2	1.000%
23	578	4	0.692%	5.8	1.000%	5.8	1.000%
24	530	7	1.321%	5.3	1.000%	5.3	1.000%
25	455	5	1.099%	4.6	1.000%	4.6	1.000%
	30,355	2,045	6.737%	1,809.2	5.960%	1,958.1	6.451%

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

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	12,009	2,679	22.308%	2,281.7	19.000%	2,281.7	19.000%
2	9,547	1,450	15.188%	1,145.6	12.000%	1,145.6	12.000%
3	8,007	1,000	12.489%	800.7	10.000%	800.7	10.000%
4	6,494	687	10.579%	584.5	9.000%	584.5	9.000%
5	5,523	501	9.071%	441.8	8.000%	441.8	8.000%
6	4,898	379	7.738%	342.9	7.000%	342.9	7.000%
7	4,734	318	6.717%	284.0	6.000%	284.0	6.000%
8	4,565	273	5.980%	257.2	5.634%	257.2	5.634%
9	4,442	219	4.930%	227.9	5.130%	227.9	5.130%
10	4,219	203	4.812%	197.4	4.679%	197.4	4.679%
11	3,786	149	3.936%	162.5	4.292%	162.5	4.292%
12	3,361	151	4.493%	131.6	3.917%	131.6	3.917%
13	3,025	120	3.967%	109.3	3.613%	109.3	3.613%
14	2,805	87	3.102%	93.5	3.333%	93.5	3.333%
15	2,752	79	2.871%	84.8	3.082%	84.8	3.082%
16	2,760	82	2.971%	78.8	2.854%	78.8	2.854%
17	2,675	56	2.093%	71.0	2.653%	71.0	2.653%
18	2,385	66	2.767%	58.9	2.471%	58.9	2.471%
19	2,092	39	1.864%	48.2	2.302%	48.2	2.302%
20	1,814	47	2.591%	36.3	2.000%	36.3	2.000%
21	1,588	31	1.952%	27.8	1.750%	27.8	1.750%
22	1,475	19	1.288%	22.1	1.500%	22.1	1.500%
23	1,373	15	1.092%	17.2	1.250%	17.2	1.250%
24	1,285	9	0.700%	12.9	1.000%	12.9	1.000%
25	1,170	13	1.111%	11.7	1.000%	11.7	1.000%
	98,784	8,672	8.779%	7,530.2	7.623%	7,530.2	7.623%

EXHIBIT D-11
Termination of Employment – Patrol

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
0	38	3	7.895%	1.5	4.000%	1.5	4.000%
1	90	4	4.444%	3.4	3.750%	3.4	3.750%
2	69	3	4.348%	2.4	3.500%	2.4	3.500%
3	61	1	1.639%	2.0	3.250%	2.0	3.250%
4	30	-	0.000%	0.9	3.000%	0.9	3.000%
5	27	1	3.704%	0.7	2.750%	0.7	2.750%
6	27	-	0.000%	0.7	2.500%	0.7	2.500%
7	15	1	6.667%	0.3	2.250%	0.3	2.250%
8	36	-	0.000%	0.7	2.000%	0.7	2.000%
9	41	-	0.000%	0.8	2.000%	0.8	2.000%
10	62	1	1.613%	1.2	2.000%	1.2	2.000%
11	60	2	3.333%	1.2	2.000%	1.2	2.000%
12	54	1	1.852%	1.1	2.000%	1.1	2.000%
13	90	-	0.000%	1.6	1.750%	1.6	1.750%
14	83	4	4.819%	1.2	1.500%	1.2	1.500%
15	97	1	1.031%	1.2	1.250%	1.2	1.250%
16	105	-	0.000%	1.1	1.000%	1.1	1.000%
17	70	3	4.286%	0.5	0.750%	0.5	0.750%
18	63	1	1.587%	0.3	0.500%	0.3	0.500%
19	51	-	0.000%	0.1	0.250%	0.1	0.250%
20	41	-	0.000%	-	0.000%	-	0.000%
	1,210	26	2.149%	23.1	1.906%	23.1	1.906%

EXHIBIT D-12
Termination of Employment – State

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	5,602	1,481	26.437%	1,232.4	22.000%	1,232.4	22.000%
2	4,217	801	18.995%	843.4	20.000%	843.4	20.000%
3	3,630	655	18.044%	653.4	18.000%	653.4	18.000%
4	2,976	481	16.163%	476.2	16.000%	476.2	16.000%
5	2,391	338	14.136%	334.7	14.000%	334.7	14.000%
6	1,838	235	12.786%	220.6	12.000%	220.6	12.000%
7	1,509	160	10.603%	150.9	10.000%	166.0	11.000%
8	1,303	136	10.437%	117.3	9.000%	130.3	10.000%
9	1,421	138	9.711%	113.7	8.000%	127.9	9.000%
10	1,330	105	7.895%	93.1	7.000%	106.4	8.000%
11	1,202	95	7.903%	72.1	6.000%	84.1	7.000%
12	1,045	76	7.273%	52.3	5.000%	62.7	6.000%
13	743	51	6.864%	31.6	4.250%	37.2	5.000%
14	637	49	7.692%	23.9	3.750%	25.5	4.000%
15	502	25	4.980%	17.6	3.500%	17.6	3.500%
16	383	14	3.655%	12.4	3.250%	12.4	3.250%
17	275	12	4.364%	8.3	3.000%	8.3	3.000%
18	182	6	3.297%	5.5	3.000%	5.5	3.000%
19	172	8	4.651%	5.2	3.000%	5.2	3.000%
20	149	3	2.013%	4.5	3.000%	4.5	3.000%
21	153	7	4.575%	4.2	2.750%	4.2	2.750%
22	141	2	1.418%	3.5	2.500%	3.5	2.500%
23	134	3	2.239%	3.0	2.250%	3.0	2.250%
24	111	1	0.901%	2.2	2.000%	2.2	2.000%
25	89	1	1.124%	1.8	2.000%	1.8	2.000%
	32,135	4,883	15.195%	4,483.6	13.952%	4,568.9	14.218%

EXHIBIT D-13
Termination of Employment – County

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	2,449	549	22.417%	489.8	20.000%	489.8	20.000%
2	1,887	360	19.078%	301.9	16.000%	320.8	17.000%
3	1,494	217	14.525%	201.7	13.500%	224.1	15.000%
4	1,293	201	15.545%	158.4	12.250%	168.1	13.000%
5	1,032	137	13.275%	118.7	11.500%	118.7	11.500%
6	841	112	13.317%	86.2	10.250%	88.3	10.500%
7	721	78	10.818%	64.9	9.000%	68.5	9.500%
8	680	70	10.294%	54.4	8.000%	57.8	8.500%
9	692	66	9.538%	48.4	7.000%	51.9	7.500%
10	617	40	6.483%	37.0	6.000%	41.6	6.750%
11	549	44	8.015%	31.6	5.750%	34.3	6.250%
12	475	35	7.368%	26.1	5.500%	27.3	5.750%
13	346	24	6.936%	18.2	5.250%	19.0	5.500%
14	266	12	4.511%	13.3	5.000%	14.0	5.250%
15	210	16	7.619%	10.0	4.750%	10.5	5.000%
16	146	10	6.849%	6.6	4.500%	6.9	4.750%
17	109	7	6.422%	4.6	4.250%	4.9	4.500%
18	99	3	3.030%	4.0	4.000%	4.2	4.250%
19	71	3	4.225%	2.7	3.750%	2.8	4.000%
20	60	3	5.000%	2.1	3.500%	2.3	3.750%
21	47	3	6.383%	1.5	3.250%	1.6	3.500%
22	39	1	2.564%	1.2	3.000%	1.3	3.250%
23	38	2	5.263%	1.0	2.750%	1.1	3.000%
24	39	-	0.000%	1.0	2.500%	1.1	2.750%
25	39	4	10.256%	0.9	2.250%	1.0	2.500%
	14,239	1,997	14.025%	1,686.1	11.841%	1,762.0	12.374%

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	29.9	36.1	20.76%	32.3	8.00%	33.7	12.85%
2	351.1	377.5	7.51%	376.0	7.08%	378.7	7.85%
3	340.1	364.5	7.18%	363.5	6.90%	365.1	7.35%
4	324.4	344.8	6.30%	346.0	6.67%	345.0	6.35%
5	298.4	315.3	5.69%	317.6	6.46%	315.8	5.85%
6	277.0	292.4	5.57%	294.4	6.27%	293.2	5.85%
7	260.5	273.9	5.12%	275.7	5.80%	275.1	5.60%
8	259.8	271.9	4.63%	274.0	5.44%	273.7	5.35%
9	264.4	277.3	4.89%	278.4	5.30%	277.8	5.10%
10	269.9	282.3	4.60%	283.8	5.18%	283.0	4.85%
11	265.5	277.0	4.35%	278.9	5.07%	277.7	4.60%
12	251.1	261.3	4.08%	263.5	4.96%	262.0	4.35%
13	232.8	241.7	3.82%	244.1	4.86%	242.5	4.15%
14	216.9	224.9	3.72%	227.3	4.78%	225.6	4.00%
15	210.4	217.7	3.47%	220.3	4.71%	218.6	3.90%
16	213.4	220.4	3.27%	223.3	4.62%	221.5	3.80%
17	220.6	227.6	3.15%	230.7	4.57%	228.8	3.70%
18	222.0	228.3	2.85%	232.0	4.51%	230.0	3.60%
19	206.7	212.9	3.00%	215.9	4.47%	213.9	3.50%
20	190.1	195.8	3.00%	198.6	4.45%	196.6	3.40%
21	172.5	177.5	2.92%	180.0	4.39%	178.1	3.30%
22	161.0	165.5	2.83%	168.0	4.36%	166.1	3.20%
23	156.6	161.0	2.85%	163.3	4.33%	161.4	3.10%
24	149.3	153.5	2.82%	155.7	4.29%	153.7	3.00%
25	143.2	146.8	2.47%	149.3	4.24%	147.5	3.00%
26	134.2	138.0	2.85%	139.9	4.20%	138.2	3.00%
27	124.0	127.3	2.64%	129.2	4.16%	127.8	3.00%
28	114.4	117.3	2.49%	119.2	4.13%	117.9	3.00%
29	104.5	107.2	2.55%	108.8	4.10%	107.7	3.00%
30	94.8	97.3	2.64%	98.7	4.07%	97.7	3.00%
31	84.3	86.5	2.60%	87.7	4.03%	86.8	3.00%
32	73.7	75.5	2.45%	76.6	3.98%	75.9	3.00%
33	64.3	66.1	2.68%	66.9	3.92%	66.3	3.00%
34	49.5	50.8	2.53%	51.4	3.87%	51.0	3.00%
35	44.3	45.5	2.64%	46.0	3.82%	45.7	3.00%
36	39.5	40.6	2.66%	41.0	3.76%	40.7	3.00%
37	35.5	36.4	2.49%	36.9	3.70%	36.6	3.00%
38	31.6	32.6	3.11%	32.7	3.66%	32.5	3.00%
39	25.7	26.3	2.43%	26.6	3.66%	26.4	3.00%
40	19.9	20.3	2.13%	20.6	3.50%	20.4	2.85%
	6,727.8	7,015.6	4.28%	7,074.7	5.16%	7,036.8	4.59%

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	1.6	1.7	9.22%	1.7	9.00%	1.7	8.35%
2	4.4	4.6	5.20%	4.8	8.00%	4.7	7.35%
3	3.4	3.7	6.28%	3.7	7.10%	3.7	6.45%
4	3.2	3.3	3.35%	3.4	6.50%	3.4	5.85%
5	1.6	1.7	6.21%	1.7	6.10%	1.7	5.45%
6	1.4	1.5	5.27%	1.5	5.80%	1.5	5.15%
7	1.6	1.6	4.12%	1.6	5.55%	1.6	4.90%
8	0.8	0.9	9.58%	0.8	5.35%	0.8	4.70%
9	2.1	2.2	5.12%	2.2	5.15%	2.2	4.50%
10	2.3	2.5	5.79%	2.4	5.10%	2.4	4.45%
11	3.6	3.8	5.29%	3.8	5.06%	3.8	4.41%
12	3.6	3.9	6.90%	3.8	5.03%	3.8	4.38%
13	3.6	3.7	4.00%	3.8	5.00%	3.8	4.35%
14	6.8	7.1	3.64%	7.2	5.00%	7.1	4.35%
15	6.5	6.8	5.23%	6.8	5.00%	6.8	4.35%
16	8.4	8.7	3.55%	8.8	5.00%	8.7	4.35%
17	9.2	9.6	4.39%	9.7	5.00%	9.6	4.35%
18	6.0	6.3	4.19%	6.3	5.00%	6.3	4.35%
19	5.7	5.9	3.69%	6.0	5.00%	6.0	4.35%
20	4.7	4.9	3.37%	5.0	5.00%	4.9	4.35%
21	4.0	4.1	4.74%	4.2	5.00%	4.1	4.35%
22	4.7	4.9	4.42%	4.9	5.00%	4.9	4.35%
23	3.7	3.8	4.24%	3.9	5.00%	3.8	4.35%
24	3.0	3.1	2.06%	3.2	5.00%	3.2	4.35%
25	2.2	2.3	4.55%	2.3	5.00%	2.3	4.35%
26	1.2	1.3	3.38%	1.3	4.70%	1.3	4.05%
27	1.3	1.3	3.43%	1.3	4.40%	1.3	3.75%
28	1.1	1.2	4.28%	1.2	4.10%	1.2	3.45%
29	0.4	0.4	-1.70%	0.4	3.80%	0.4	3.15%
30	0.3	0.3	10.72%	0.3	3.50%	0.3	2.85%
31	0.2	0.2	8.87%	0.2	3.50%	0.2	2.85%
	102.8	107.4	4.52%	108.3	5.32%	107.6	4.67%

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	183.1	201.5	10.08%	191.8	4.79%	199.9	9.20%
2	163.8	172.1	5.09%	171.3	4.60%	174.2	6.35%
3	146.6	154.4	5.27%	152.9	4.29%	155.2	5.85%
4	129.1	136.3	5.56%	134.3	4.06%	136.0	5.35%
5	110.4	115.6	4.77%	114.8	3.98%	115.7	4.85%
6	90.4	94.5	4.53%	93.9	3.95%	94.5	4.60%
7	80.6	83.8	4.05%	83.7	3.93%	84.1	4.35%
8	71.7	74.8	4.26%	74.5	3.89%	74.8	4.25%
9	81.7	84.8	3.73%	84.9	3.84%	85.1	4.15%
10	80.1	83.2	3.82%	83.2	3.81%	83.4	4.05%
11	75.8	78.6	3.62%	78.7	3.80%	78.8	3.95%
12	70.5	73.2	3.79%	73.1	3.76%	73.3	3.95%
13	51.3	52.9	2.99%	53.2	3.72%	53.4	3.95%
14	45.9	47.5	3.59%	47.6	3.70%	47.7	3.95%
15	39.3	40.6	3.30%	40.8	3.67%	40.9	3.95%
16	33.2	34.2	3.02%	34.4	3.63%	34.5	3.95%
17	27.0	28.0	3.50%	28.0	3.60%	28.1	3.95%
18	20.4	21.0	2.66%	21.2	3.59%	21.2	3.95%
19	19.1	19.7	3.26%	19.8	3.56%	19.9	3.95%
20	17.1	17.7	3.45%	17.7	3.50%	17.8	3.95%
21	17.5	18.1	3.73%	18.1	3.50%	18.2	3.95%
22	17.5	18.0	2.84%	18.2	3.50%	18.1	3.35%
23	17.1	17.5	2.24%	17.7	3.50%	17.6	2.95%
24	19.2	19.6	2.57%	19.8	3.50%	19.7	2.95%
25	20.8	21.3	2.37%	21.6	3.50%	21.4	2.95%
26	22.8	23.3	2.27%	23.5	3.50%	23.4	2.95%
27	24.7	25.3	2.54%	25.5	3.50%	25.4	2.95%
28	25.6	26.2	2.31%	26.5	3.50%	26.3	2.95%
29	26.6	27.3	2.47%	27.6	3.50%	27.4	2.95%
30	27.4	28.1	2.50%	28.3	3.50%	28.2	2.85%
31	26.5	27.3	2.69%	27.5	3.50%	27.3	2.85%
32	27.4	28.0	2.07%	28.4	3.50%	28.2	2.85%
33	23.4	24.0	2.32%	24.2	3.50%	24.1	2.85%
34	19.2	19.6	2.35%	19.8	3.50%	19.7	2.85%
35	14.6	14.9	2.30%	15.1	3.50%	15.0	2.85%
36	7.9	8.0	1.75%	8.2	3.50%	8.1	2.85%
37	6.0	6.2	3.29%	6.2	3.50%	6.1	2.85%
38	4.9	5.0	0.93%	5.1	3.50%	5.0	2.85%
39	2.9	2.9	2.06%	3.0	3.50%	3.0	2.85%
40	2.0	2.1	2.14%	2.1	3.50%	2.1	2.85%
	1,891.0	1,976.8	4.54%	1,966.1	3.97%	1,982.8	4.85%

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	71.8	79.6	10.96%	76.6	6.70%	77.8	8.35%
2	66.2	69.6	5.08%	69.9	5.50%	71.1	7.35%
3	59.7	62.7	5.00%	62.6	4.70%	63.5	6.35%
4	54.6	57.6	5.34%	56.9	4.20%	57.6	5.35%
5	48.1	50.4	4.72%	50.0	4.00%	50.4	4.85%
6	42.6	44.0	3.44%	44.2	3.85%	44.5	4.60%
7	38.9	40.5	4.04%	40.4	3.80%	40.6	4.35%
8	38.1	39.3	3.37%	39.5	3.80%	39.6	4.10%
9	41.9	43.8	4.44%	43.5	3.80%	43.5	3.85%
10	42.4	43.6	2.76%	44.0	3.80%	44.0	3.85%
11	39.2	40.4	3.22%	40.7	3.80%	40.7	3.85%
12	35.8	36.9	3.07%	37.2	3.80%	37.2	3.85%
13	26.9	27.9	3.49%	28.0	3.80%	28.0	3.85%
14	22.1	22.8	2.99%	22.9	3.80%	22.9	3.85%
15	18.5	19.1	3.36%	19.2	3.80%	19.2	3.85%
16	14.2	14.8	4.28%	14.7	3.80%	14.7	3.85%
17	11.6	12.0	3.89%	12.0	3.80%	12.0	3.85%
18	10.7	11.0	2.81%	11.1	3.80%	11.1	3.60%
19	8.1	8.3	2.15%	8.4	3.80%	8.4	3.35%
20	6.7	6.9	3.35%	6.9	3.80%	6.9	3.35%
21	6.5	6.7	2.24%	6.8	3.80%	6.7	3.35%
22	6.5	6.7	3.16%	6.8	3.80%	6.7	3.35%
23	6.5	6.6	2.06%	6.7	3.80%	6.7	3.35%
24	6.9	7.2	4.14%	7.2	3.80%	7.1	3.35%
25	7.5	7.6	1.99%	7.8	3.80%	7.7	3.10%
26	8.3	8.6	2.71%	8.7	3.80%	8.6	3.10%
27	8.9	9.1	2.75%	9.2	3.80%	9.2	3.10%
28	8.6	8.8	2.23%	8.9	3.80%	8.9	3.10%
29	11.4	11.5	1.02%	11.8	3.80%	11.7	3.10%
30	10.7	11.1	3.80%	11.1	3.80%	11.0	3.10%
31	10.2	10.4	1.87%	10.6	3.80%	10.5	3.10%
32	8.1	8.4	2.82%	8.4	3.80%	8.4	3.10%
33	4.5	4.6	2.76%	4.6	3.80%	4.6	3.10%
34	3.4	3.5	2.01%	3.5	3.80%	3.5	3.10%
35	3.0	3.1	2.35%	3.1	3.80%	3.1	3.10%
36	2.6	2.7	2.75%	2.7	3.80%	2.7	2.85%
37	2.2	2.2	2.89%	2.3	3.80%	2.2	2.85%
38	1.9	1.9	1.19%	1.9	3.80%	1.9	2.85%
39	1.3	1.2	-2.03%	1.3	3.80%	1.3	2.85%
40	0.6	0.6	4.24%	0.6	3.80%	0.6	2.85%
	817.6	853.7	4.41%	852.8	4.30%	857.1	4.83%