Public Employees' Retirement Association of Colorado

Actuarial Experience Review

Analysis of Actuarial Experience During the Period January 1, 2020, through December 31, 2023

January 3, 2025 / Brad Ramirez, FSA, MAAA, EA / Matt Strom, FSA, MAAA, EA / Tanya Dybal, FSA, MAAA, EA

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January 3, 2025

Board of Trustees
Public Employees' Retirement Association of Colorado
1301 Pennsylvania Street
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Dear Trustees:

This report presents the results of the actuarial experience review of the demographic and economic experience of the Public Employees' Retirement Association of Colorado (PERA) for the four-year period January 1, 2020, to December 31, 2023.

All current actuarial assumptions and methods were reviewed as part of this study. This study is the basis for our recommendation of the actuarial methods and assumptions to be used beginning with the December 31, 2024, actuarial valuation for the PERA Division Trust Funds.

In preparing the results presented in this report, we have relied upon data provided by PERA regarding the membership census data and financial information. While the scope of our engagement did not call for us to perform an audit or independent verification of this information, we have reviewed it for reasonableness. The accuracy of the results presented in this report is dependent upon the accuracy and completeness of the underlying information.

This review recommends assumptions to be used in the valuation to measure PERA's financial condition as of a single date. Future actuarial measurements may differ significantly from the current measurements presented in this report due to other assumption sets. This report does not include an analysis of the potential range of such future measurements.

Segal valuation results and experience study analysis are based on proprietary actuarial modeling software. The actuarial valuation models generate a comprehensive set of liability and cost calculations that are presented to meet regulatory, legislative and client requirements. Deterministic cost projections are based on a proprietary forecasting model. Raw experience study analysis of actual and expected decrements are generated by a model, which is used to develop recommended assumption changes. Our Actuarial Technology and Systems unit, comprised of both actuaries and programmers, is responsible for the initial development and maintenance of these models. The models have a modular structure that allows for a high degree of accuracy, flexibility and user control. The client team programs the assumptions and the plan provisions, validates the models, and reviews test lives and results, under the supervision of the responsible actuaries.

It is important to note that this experience study analysis is based on census data and information through December 31, 2023. Market and demographic conditions may have changed significantly since this date. PERA's actuarial funded status does not reflect short term fluctuations in the market or plan demographics, but rather is based on asset and liability values on the last day of a plan year.

Our analysis was conducted in accordance with generally accepted actuarial principles as prescribed by the Actuarial Standards Board (ASB) and the American Academy of Actuaries. Additionally, the development of all assumptions contained herein is in accordance with ASB Actuarial Standard of Practice (ASOP) No. 27 (Selection of Economic Assumptions for Measuring Pension Obligations) and ASOP No. 35 (Selection of Demographic and Other Non-Economic Assumptions for Measuring Pension Obligations).

The undersigned are independent. They are Fellows of the Society of Actuaries, Enrolled Actuaries, and members of the American Academy of Actuaries and are experienced in performing experience studies for large public retirement systems. They meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein.

Sincerely,

Matthew Strom, FSA, MAAA, EA
Senior Vice President, Actuary

Brad Ramirez, FSA, MAAA, EA
Vice President, Actuary

Tanya Dybal, FSA, MAAA, EA
Vice President, Actuary

Table of Contents

I. Executive Summary

A. Introduction

Actuarial valuations of the Public Employees' Retirement Association of Colorado (PERA) five Division Trust Funds (State, School, Local Government, Judicial, and Denver Public Schools) are prepared annually to determine the actuarial contribution rate required to fund PERA on an actuarial reserve basis. Each actuarial valuation involves a projection of the benefits expected to be paid in the future to all members of PERA. The projection of expected future benefit payments is based on the characteristics of members as of the valuation date, the benefit provisions in effect on that date, and assumptions of future events and conditions.

The purpose of this report is to present the results of the actuarial methods and assumptions used in the actuarial valuation of the PERA Division Trust Funds. With the Board's approval of the recommendations in this report, these assumptions and methods would be used beginning with the December 31, 2024, actuarial valuation.

The assumptions used in actuarial valuations can be grouped in two categories: (1) economic assumptions – the assumed long-term rates of investment return, salary increases, and payroll growth, and (2) non-economic or demographic assumptions – the assumed rates of termination, disability, retirement, and mortality. Demographic assumptions are primarily selected on the basis of recent experience (although a change in plan design or the employment environment may suggest otherwise), while economic assumptions rely more on a long-term perspective of expected future trends.

To determine the probability of an event occurring, we examine the "decrements" and "exposures" of that event. Using termination from active employment, for example, we compare the number of employees who actually terminate in a certain age and/or service category (i.e., the number of "decrements") with those "who could have terminated" (i.e., the number of "exposures"). For example, if there were 500 active employees in the 20-24 age group at the beginning of the year and 50 of them terminate during the year, we would say the probability of termination in that age group is 50 ÷ 500 or 10%.

When setting the demographic assumptions (other than mortality), we typically develop proposed assumption rates by moving between the current assumption rate and the rate that the experience shows for that particular decrement. For example, if the probability of termination in the 20-24 age group is currently 8%, and the experience during the study period shows that 10% of eligible members actually terminated, we might propose adjusting the termination rate to 9%. We choose this methodology to smooth any changes in actual experience in case the experience during the study period is an anomaly.

For the demographic assumptions, we have reviewed the experience during the study period on a benefit-weighted basis. A member who is eligible to retire at any retirement age with a large pension may be more likely to retire than a member of the same age with a smaller benefit.

If actual experience exactly matches the expected experience, the actual annual cost of PERA will equal the annual cost determined by the actuarial valuation. However, this result is virtually never achieved, due to the long-term nature of the benefit projections and the numerous assumptions used in actuarial valuations. PERA recognizes actuarial gains or actuarial losses each year, reflecting the net difference between actual experience and anticipated experience. Determination of the funded status is updated in connection with each actuarial valuation to reflect the net gain or loss. A pattern of gains or losses with respect to one or more assumptions is often a basis for recommended changes to the assumptions. Each valuation measures the effectiveness of each assumption and allows for the monitoring of the assumptions.

Actuarial experience studies are undertaken periodically and serve as the basis for recommended changes in actuarial assumptions and methods. A change in assumptions is recommended when it is demonstrated that the current assumptions do not accurately reflect the current trend determined from analysis of the data or anticipated future trends based upon reasonable expectations. The data analyzed include actual experience for demographic assumptions and economic forecasts for economic assumptions. The Actuarial Standards Board (ASB) provides actuaries with standards of practice that provide guidance and recommendations on acceptable methods and techniques to be used in developing both economic and demographic assumptions. Specifically, these are the ASB Actuarial Standard of Practice (ASOP) No. 27 (“Selection of Economic Assumptions for Measuring Pension Obligations”) and ASOP No. 35 (“Selection of Demographic and Other Non-Economic Assumptions for Measuring Pension Obligations”).

Pursuant to Senate Bill 2018-200 (SB 18-200) and beginning January 1, 2020, the Local Government Division will have members under the "State Trooper" benefit structure. To mirror the language recently adopted within all PERA publications and communications, the term “State Trooper” has been changed to the broader term “Safety Officer”. Thus, all references and tables discussing/displaying proposed assumptions pertaining to "Safety Officers" will apply to both the State and Local Government Divisions.

This study reviews the actuarial experience of PERA for the four-year period beginning January 1, 2020, and ending December 31, 2023, compares this experience to the current actuarial assumptions, and recommends changes to the assumptions as necessary. Economic assumption recommendations were primarily developed based on inputs related to economic forecasts and capital market expectations.

A summary of the key points of our review and our recommendations follows.

B. Recommendations

The experience review provides an opportunity for the Board, staff, and actuary to consider how specific assumptions or methods affect the funding of PERA, including the funded status and the adequacy of contributions made by members and employers (as compared to the actuarially determined contribution). We have reviewed both economic and demographic experience of PERA as it relates to the expected actuarial experience based on the current plan assumptions. Included are recommendations for changes in assumptions that we believe will more accurately reflect the future experience of PERA.

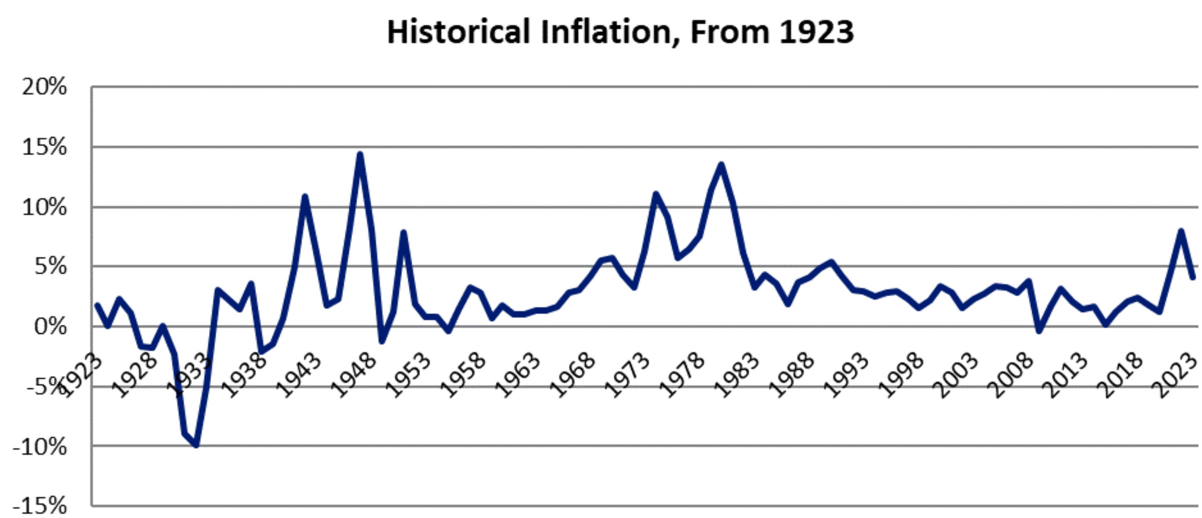
The detailed analysis of each individual assumption is discussed later in this report.

Economic Assumptions

Economic assumptions include inflation, investment rate of return (or discount rate), rate of individual salary increases, and payroll growth.

Inflation

Inflation broke from a pattern of relatively low levels from a historical perspective and resulted in rates that were the highest in the last 25 years, as shown in the graph below.



The current inflation assumption is 2.3% per annum. The outlook for inflation is closer to 2.4% over a 20-year time horizon according to the Horizon Survey of Capital Market Assumptions (2024 Edition), but below 2.4% based on other professional forecasters. Considering all sources of inflation expectations reviewed in our study, we recommend maintaining the current inflation assumption of 2.3%.

The other economic assumptions have an underlying inflationary component. The investment return assumption is comprised of inflation plus the real rate of return for each asset class. The assumed rates of individual salary increases are comprised of inflation, productivity, and merit and seniority increases. The payroll growth assumption is comprised of inflation and productivity.

Investment Return

PERA has averaged investment returns of 9.0% and 7.4% over the last 10 years and 20 years, respectively. The current assumption is 7.25%.

Based on PERA's target allocation and the 20-year composite Capital Market Assumptions provided in the Horizon Survey of Capital Market Assumptions (2024 Edition), the net expected real rate of investment return (net of investment expenses) is 5.15%, compared to the current assumption of 4.95%. Since we recommend that the inflation assumption be maintained at 2.30%, and the investment return assumption is the combination of expected inflation plus expected real rate of return, the 50th percentile expected return over the next 20 years is 7.45%. We recommend retaining the investment return assumption of 7.25%, which represents a 53% likelihood of achieving 7.25% over the long term.

Administrative Expenses

Based on feedback from PERA staff with respect to planned growth in the size of information technology personnel, we recommend increasing the administrative expense assumption from 0.40% of payroll to 0.45% of payroll.

Active Member Growth Assumption

The projection of PERA's funding over 50 years requires an assumption regarding future new entrants to PERA. Based upon our analysis as well as data included in the Colorado Department of Affairs State Demography Office – 2022 Population Summary, we recommend that the active member growth assumptions be adjusted as follows:

Division	Current Active Member Growth Assumption	Proposed Active Member Growth Assumption
State	0.25%	0.25%
School	1.00%	0.75%
Local Government	1.00%	0.50%
Judicial	0.25%	0.25%
DPS	1.00%	0.25%

Rates of Individual Salary Increases

We studied the merit and seniority increases (plus productivity) separately from inflation. The current salary scale assumptions are based on age for all divisions except Judicial, which is based on service. Analysis of the distribution of merit and seniority increases by years since date of hire during the study period shows that these increases were less than expected for the State Division (non-Safety Officers), Judicial Division, and Safety Officers. Actual increases were more than expected for the School Division, DPS Division, and Local Government Division (non-Safety Officers). Based on experience, we recommend appropriate increases and decreases to the merit and seniority portion of individual salary increases specific to each division (full rates in the appendix). The proposed salary increase assumptions represent approximately one-half of the actual salary increase above or below expected.

Payroll Growth Rate

The payroll growth rate is used for determining the effective amortization period and to determine the amortization payment of the unfunded actuarial accrued liability when the actuarially determined contribution rate is determined as a level percent-of-payroll. Based upon our analysis, we recommend maintaining the current payroll growth assumption of 3.00%.

Demographic Assumptions

The demographic assumptions include mortality, retirement, termination, disability incidence, percent married, and spouse age difference.

Mortality

Healthy Post-Retirement Mortality

Currently, PERA uses healthy post-retirement mortality rates based on the Pub-2010 series of mortality tables and the MP-2019 projection scale. For State and Local Government Division Trust Funds (members other than Safety Officers), the mortality table is the PubG-2010 Healthy Retiree table with adjustments for credibility and gender. For males, the adjustments are 94% of the rates prior to age 80 and 90% of the rates for ages 80 and older, with generational projection using scale MP-2019. For females, the adjustments are 87% of the rates prior to age 80 and 107% of the rates for ages 80 and older, with generational projection using scale MP-2019.

For the State and Local Government Divisions (Safety Officers), the post-retirement non-disabled retiree mortality table is the unadjusted PubS-2010 Healthy Retiree table, with generational projection using scale MP-2019.

For the School and DPS Divisions, the post-retirement non-disabled retiree mortality table is the PubT-2010 Healthy Retiree table with adjustments for credibility and gender. For males, the adjustments are 112% of the rates prior to age 80 and 94% of the rates for ages 80 and older, with generational projection using scale MP-2019. For females, the adjustments are 83% of the rates prior to age 80 and 106% of the rates for ages 80 and older, with generational projection using scale MP-2019.

For the Judicial Division, the post-retirement non-disabled retiree mortality table is the unadjusted PubG-2010(A) Above-Median Healthy Retiree table, with generational projection using scale MP-2019.

We recommend maintaining the base tables at the appropriate Pub-2010 mortality tables, with adjustments for PERA-specific experience where credible data exists. To reflect future improvements in mortality, we recommend updating the mortality projection scale to MP-2021[1]. The recommended healthy retiree base mortality tables are as follows:

- State and Local Government Divisions (Non-Safety Officers) – PubG-2010 Retired Lives Table for males using 90% of the rates for all ages. For females, the PubG-2010 Retired Lives Table using 85% of the rates prior to age 85 and 105% of the rates for ages 85 and older.
- State and Local Government Divisions (Safety Officers) – PubS-2010 Retired Lives Table.
- School and Denver Public Schools Divisions – PubT-2010 Retired Lives Table for males using 106% of the rates for all ages. For females, the PubT-2010 Retired Lives Table using 86% of the rates prior to age 85 and 115% of the rates for ages 85 and older.
- Judicial Division – PubG-2010 Above Median Retired Lives Table.

Beneficiary Mortality

For all divisions, the current post-retirement non-disabled beneficiary mortality table is the Pub-2010 Contingent Survivor table with adjustments for credibility and gender. For males, the adjustments are 97% of the rates for all ages, with generational projection using scale MP-2019. For females, the adjustments are 105% of the female rates for all ages, with generational projection using scale MP-2019.

Based upon our analysis, we recommend that the mortality table for healthy beneficiaries applicable to all divisions continue to be based on the Pub-2010 Contingent Survivor Tables. For males we recommended modifying the adjustment factor to use 92% of the rates for all ages. For females we recommended modifying the adjustment factor to use 100% of the rates for all ages. To reflect future improvements in mortality, we recommend updating the mortality projection scale to MP-2021.

Disabled Mortality

For all Divisions other than Safety Officers, the current disabled mortality rates are based upon the PubNS-2010 Disabled Retiree table using 99% of the rates for all ages with generational projection using scale MP-2019. For Safety Officers in the State and Local Government Divisions, the current disabled mortality rates are based upon the unadjusted PubS-2010 Disabled Retiree table with generational projection using scale MP-2019.

Experience for disabled annuitants has been fewer deaths than expected when compared to the current assumptions. We recommend that the mortality table for disability retirees applicable to all divisions (except Safety Officers) continue to be based on the Pub-2010 Non-Safety Disabled Lives Table; however, we recommend the adjustment factors for males and females be updated to using 95% of the rates for all ages. For Safety Officers within the State and Local Government Divisions, there was limited experience on which to base the assumption. We recommend that the mortality table for disability retirees applicable to Safety Officers continue to be based on the Pub-2010 Safety Disabled Lives Table for males and females. In order to reflect future improvements in mortality, we recommend updating the mortality projection scale to MP-2021.

[1] All references to the recommended mortality improvement projection scale MP-2021 are the 2024 adjusted Scale MP-2021.

Pre-Retirement Mortality

The current mortality assumptions for active members are based on the Pub-2010 series of mortality tables, with mortality improvement based on generational projection using scale MP-2019:

- PubG-2010 Employee Table for the State and Local Government Divisions (Non-Safety Officer)
- PubT-2010 Employee Table for the School and Denver Public Schools Divisions
- PubG-2010 Above Median Employee Table for the Judicial Division
- PubS-2010 Employee Table for the State and Local Government Divisions (Safety Officer)

Very few members die in active service and the liability associated with active deaths is a small percentage of the total liability. Since plan experience is insufficient to set the assumption, we recommend continued use of the current assumptions for active members and updating the generational projection scale to MP-2021.

Retirement

The eligibility criteria for retirement differs by division and date of hire. We have analyzed retirement experience on a benefit-weighted basis for the following groups:

- Eligible for a reduced benefit
- Eligible for an unreduced benefit in the first year only
- Eligible for an unreduced benefit in all other years

There is little retirement experience for the newer tiers (employees hired after July 1, 2005) to analyze. However, the retirement rates take into account each member's eligibility requirements.

For reduced benefits, there were fewer retirements than expected. We recommend modifications to rates at most ages across most divisions. Current reduced retirement rates for the Judicial Division and Safety Officers within the State and Local Government Divisions are unisex. There is not enough evidence in the recent experience to warrant a change to sex-distinct rates for either group at this time. Current rates associated with reduced retirement for the State and Local Government Divisions (Non-Safety Officer) are the same. Actual experience continues to be close enough that we recommend continuing to combine the exposures of these two groups to develop a single set of assumptions to apply to both. Current rates for the School and DPS Divisions (PERA Benefit Structure) are the same and we believe it is appropriate to continue in this manner. DPS Benefit Structure assumptions continue to be separate and unique to that structure.

For unreduced benefits in the first year of eligibility, in aggregate, there were more unreduced retirements than expected. We recommend modifications to rates at most ages across all divisions. Current unreduced retirement rates for the Judicial Division and Safety Officers within the State and Local Government Divisions are unisex. There is not enough evidence in the recent experience to warrant a change to sex-distinct rates for either group at this time. Current rates associated with unreduced retirement for the State and Local Government Divisions (Non-Safety Officer) are the same. Actual experience continues to be close enough that we recommend continuing to combine the exposures of these two groups to develop a single set of assumptions to apply to both. Current rates for the School and DPS Divisions (PERA Benefit Structure) are the same and we believe it is appropriate to continue in this manner. DPS Benefit Structure assumptions continue to be separate and unique to that structure.

We separately studied experience for members becoming eligible for unreduced retirement. In addition, we individually analyzed the experience during the first year that members were eligible for unreduced retirement. Typically, there is a higher tendency to retire upon attaining first eligibility for unreduced benefits and a few years thereafter. This was the case for several PERA divisions. In general, for members retiring with unreduced benefits in the legacy tiers, this increased tendency to retire at (or just after) first eligibility is already built into the retirement rate schedules. However, newer benefit tiers have later ages for retirement eligibility. Therefore, there was limited actual experience on which to recommend modifications to the current additional (referred to as “select”) rates of retirement for the first five years of eligibility for unreduced retirement to active members whose first eligibility for unreduced retirement is between age 55 and 64. Therefore we recommend retaining the current five-year select period adopted based on recommendations from the 2020 Experience Analysis.

Inactive vested retirements, for current inactive vested members in the PERA Benefit Structure who are assumed to leave their contributions in the plan in order to be eligible for a benefit at their retirement date are assumed to retire at first eligibility to retire with an unreduced pension benefit. Current inactive vested members in the DPS Benefit Structure who are assumed to leave their contributions in the plan in order to be eligible for a benefit at their retirement date are assumed to retire at age 65 with an unreduced pension benefit.

We reviewed actual retirement experience related to inactive vested members. Actual experience shows that some members retire earlier than the current assumption. Based on the experience over the most recent eight years we recommend adding rates of reduced retirement applicable to inactive members of State and Local Government Divisions (Non-Safety Officer), and School and DPS Divisions (PERA Benefit Structure).

Termination

The current assumption for termination uses Select and Ultimate Tables for the State Division (Non-Safety Officer), School and DPS Divisions (PERA Benefit Structure), and Local Government Division (Non-Safety Officer). Because all DPS Benefit Structure members have more than five years of service, the termination assumptions are based on age only. We have analyzed the ultimate period to determine if the select period should be extended or eliminated and recommend that the current select period be retained.

The current select termination rates are unisex and based on service. Based on our analysis, we recommend that the select termination rates be slightly decreased. There are no Select-period termination rates for Safety Officers; however, based on the experience data, we recommend adding a Select-period scale for this membership group.

The current ultimate termination assumptions are sex distinct and based on age. We recommend changes (primarily decreases) to the rates of termination.

Refunds of Contributions

For all but the Judicial Division, it is assumed that 35% of the vested members who terminate elect to withdraw their contributions and matching employer contributions while the remaining 65% elect to leave their contributions in the plan in order to be eligible for a benefit at their retirement date. For the Judicial Division, it is assumed that 100% of the vested members who terminate elect to leave their contributions in the plan in order to be eligible for a benefit at their retirement date. Current active members assumed to terminate service and leave their contribution in the plan in order to be eligible for a benefit at their retirement date are assumed to retire with a reduced benefit, if applicable, at an age based upon benefit structure, Non-Safety/Safety Officer, and/or service.

There is very little actual experience from the Judicial Division. We recommend maintaining the current 100% assumption for this group.

For all other divisions, we examined actual refund of contribution elections for members during the experience period. The observed election percentage during the experience period is around 29.4%. We recommend maintaining the current assumption of 35%.

Disability Retirement

The current disability rates are based on age and are unisex for all divisions. Rates are the highest for Safety Officers within the State and Local Government Divisions and are the lowest for the School and DPS Divisions (PERA Benefit Structure), and the Judicial Division. Aggregate experience for the period January 1, 2020, to December 31, 2023, resulted in net losses for PERA, although the Judicial Division had no disability retirements during the experience period, which resulted in actuarial gains.

As with the prior experience analysis, actual experience continues to be comparable between the State and Local Government Divisions (non-Safety Officers) and as such, are aggregated for purposes of developing revised combined assumptions. Similarly, since the School and DPS Divisions (PERA Benefit Structure), the Judicial Division, and members under the DPS Benefit Structure all have similar profiles for disability incidence, they are combined for purposes of developing revised combined assumptions.

Actual disability incidence over the experience period was less than assumed (except for the Judicial Division) and so, in general, reductions to rates were proposed.

Spouse Information

Spouse information assumptions affect the valuation and include the percentage of members married and the age difference of spouses. The current assumptions are:

- 100% of members are married (80% for members of the DPS Division Trust Fund)
- Male spouses are two years older than female spouses

- 100% of spouses are of the opposite gender

We have limited data on spouse information. However, the current assumptions are reasonable and consistent with assumptions used for similar plans. In addition, all optional forms of payment are actuarially equivalent, so these assumptions do not have a material effect on the valuation results. Therefore, we recommend no change to the current assumptions.

Summary of Actuarial Experience

For the four-year period under review, PERA has experienced both actuarial gains and actuarial losses. Investment returns on the market value of assets have averaged 7.8% and 7.7% over the last 10 and 20 years, respectively. Investment returns on the actuarial value of assets have averaged 9.0% and 7.4% over the last 10 and 20 years, respectively. Experience for all other assumptions has varied between producing gains and losses on a year-by-year basis over the study period, but net experience over the entire period has generally produced actuarial losses. A summary of the demographic historical gains and losses (dollars in millions) by division is shown beginning on the following page:

State Division
Demographic Gains/(Losses) 2020 to 2023

Decrement	Actuarial Valuation as of December 31			
	2023	2022	2021	2020
Age/Service Retirements	$ 5.7	$ (5.6)	$ (6.1)	$ (26.1)
Disability Retirements	(0.2)	(3.3)	(2.7)	(0.5)
Deaths	37.8	115.3	53.4	77.7
Withdrawals	(42.2)	43.7	(17.7)	(77.2)
Pay Increases	(175.9)	(154.0)	29.7	13.9
New Members	(132.7)	(143.6)	(77.2)	(63.6)
Other	(41.2)	105.8	(1.6)	55.9
Total	**(348.7)**	**(41.7)**	**(22.2)**	**(19.9)**
Actuarial Accrued Liability (AAL)	28,460.8	27,647.4	27,159.9	27,116.8
Total as a % of AAL	**-1.2%**	**-0.2%**	**-0.1%**	**-0.1%**

School Division
Demographic Gains/(Losses) 2020 to 2023

Decrement	Actuarial Valuation as of December 31			
	2023	2022	2021	2020
Age/Service Retirements	$ 4.8	$ (44.1)	$ (25.1)	$ (47.8)
Disability Retirements	(1.6)	(2.0)	(3.6)	(2.9)
Deaths	68.5	123.7	73.5	70.6
Withdrawals	(35.4)	(49.3)	(80.5)	(198.1)
Pay Increases	(512.1)	(222.1)	(236.1)	45.3
New Members	(145.0)	(170.6)	(116.4)	(70.1)
Other	(56.3)	(343.0)	(18.9)	(17.5)
Total	**(677.1)**	**(707.4)**	**(407.1)**	**(220.5)**
Actuarial Accrued Liability (AAL)	50,331.5	48,326.8	46,336.8	45,532.1
Total as a % of AAL	**-1.3%**	**-1.5%**	**-0.9%**	**-0.5%**

Local Government Division
Demographic Gains/(Losses) 2020 to 2023

Decrement	Actuarial Valuation as of December 31			
	2023	2022	2021	2020
Age/Service Retirements	$ (4.4)	$ (3.1)	$ (4.7)	$ (5.8)
Disability Retirements	(0.4)	-	(0.4)	(0.1)
Deaths	5.1	21.3	(7.5)	5.6
Withdrawals	(3.6)	23.3	(5.7)	(17.7)
Pay Increases	(50.5)	(67.7)	3.7	2.1
New Members	(21.4)	(31.1)	(22.4)	(14.1)
Other	(7.6)	33.0	(5.3)	19.3
Total	**(82.8)**	**(24.3)**	**(42.3)**	**(10.7)**
Actuarial Accrued Liability (AAL)	6,148.2	5,913.4	5,745.0	5,658.9
Total as a % of AAL	**-1.3%**	**-0.4%**	**-0.7%**	**-0.2%**

Judicial Division
Demographic Gains/(Losses) 2020 to 2023

Decrement	Actuarial Valuation as of December 31			
	2023	2022	2021	2020
Age/Service Retirements	$ (0.3)	$ (2.6)	$ (3.2)	$ (3.4)
Disability Retirements	0.1	0.1	0.1	0.1
Deaths	(1.4)	(0.5)	1.4	1.3
Withdrawals	0.5	(0.8)	-	(0.1)
Pay Increases	(0.1)	0.1	1.5	2.6
New Members	(4.4)	(7.0)	(5.3)	(4.0)
Other	(0.9)	(1.1)	(0.6)	0.6
Total	**(6.5)**	**(11.8)**	**(6.1)**	**(2.9)**
Actuarial Accrued Liability (AAL)	528.4	511.2	488.0	478.2
Total as a % of AAL	**-1.2%**	**-2.3%**	**-1.2%**	**-0.6%**

Denver Public Schools Division
Demographic Gains/(Losses) 2020 to 2023

Decrement	Actuarial Valuation as of December 31			
	2023	**2022**	**2021**	**2020**
Age/Service Retirements	$ (4.5)	$ (1.2)	$ (5.8)	$ (7.9)
Disability Retirements	0.4	(0.4)	-	(0.8)
Deaths	19.0	(3.2)	38.6	9.1
Withdrawals	41.4	57.3	(10.2)	(3.4)
Pay Increases	(53.3)	(10.7)	(6.0)	(39.1)
New Members	(58.6)	(47.8)	(44.9)	(24.7)
Other	(13.2)	8.3	(21.3)	20.4
Total	**(68.8)**	**2.3**	**(49.6)**	**(46.4)**
Actuarial Accrued Liability (AAL)	4,997.1	4,778.6	4,637.9	4,532.5
Total as a % of AAL	**-1.4%**	**0.0%**	**-1.1%**	**-1.0%**

Impact of Assumption Changes on Valuation Results

The following tables detail the impact of recommended assumption changes, using the December 31, 2023, actuarial valuation results for illustrative purposes. When the proposed set of assumptions is used in the December 31, 2024, valuations, the relative impact is expected to be similar to the results shown below (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. The comparability may also be affected by the actual investment return and demographic experience during the year.

I. Executive Summary

Change in Present Value of Future Benefits
($ in Millions)

Division	Before Changes	Reflecting Termination	Reflecting Termination, Retirement and Disability	Reflecting Termination, Retirement, Disability, and Mortality	Reflecting all Demographic Changes, Salary Scale, Payroll Growth and Admin. Expenses
State	$32,041.1	$31,844.1	$32,126.2	$32,036.3	$31,914.8
% Change		-0.6%	0.9%	-0.3%	-0.4%
Cumulative		-0.6%	0.3%	0.0%	-0.4%
School	57,557.2	57,826.7	58,429.1	57,756.1	59,286.9
% Change		0.5%	1.0%	-1.2%	2.7%
Cumulative		0.5%	1.5%	0.3%	3.0%
Local Gov't	6,963.8	6,939.5	7,014.7	6,994.0	7,123.4
% Change		-0.3%	1.1%	-0.3%	1.9%
Cumulative		-0.3%	0.7%	0.4%	2.3%
Judicial	623.0	623.0	622.9	617.1	601.4
% Change		0.0%	0.0%	-0.9%	-2.5%
Cumulative		0.0%	0.0%	-0.9%	-3.5%
DPS	6,010.5	6,023.3	6,102.6	6,034.2	6,270.4
% Change		0.2%	1.3%	-1.1%	3.9%
Cumulative		0.2%	1.5%	0.4%	4.3%

Change in Actuarial Accrued Liability
($ in Millions)

Division	Before Changes	Reflecting Termination	Reflecting Termination, Retirement and Disability	Reflecting Termination, Retirement, Disability, and Mortality	Reflecting all Demographic Changes, Salary Scale, Payroll Growth and Admin. Expenses
State	$28,460.8	$28,433.5	$28,489.0	$28,416.9	$28,344.8
% Change		-0.1%	0.2%	-0.3%	-0.3%
Cumulative		-0.1%	0.1%	-0.2%	-0.4%
School	50,331.5	50,316.5	50,430.9	49,829.0	50,349.5
% Change		0.0%	0.2%	-1.2%	1.0%
Cumulative		0.0%	0.2%	-1.0%	0.0%
Local Gov't	6,148.2	6,134.7	6,148.7	6,132.3	6,167.8
% Change		-0.2%	0.2%	-0.3%	0.6%
Cumulative		-0.2%	0.0%	-0.3%	0.3%
Judicial	528.4	528.4	531.0	526.3	520.0
% Change		0.0%	0.5%	-0.9%	-1.2%
Cumulative		0.0%	0.5%	-0.4%	-1.6%
DPS	4,997.1	4,995.1	5,006.0	4,947.2	5,035.1
% Change		0.0%	0.2%	-1.2%	1.8%
Cumulative		0.0%	0.2%	-1.0%	0.8%

I. Executive Summary

Change in Total Normal Cost Rate

Division	Before Changes	Reflecting Termination	Reflecting Termination, Retirement and Disability	Reflecting Termination, Retirement, Disability, and Mortality	Reflecting all Demographic Changes, Salary Scale, Payroll Growth and Admin. Expenses
State	12.99%	12.91%	13.48%	13.43%	13.37%
Delta		-0.08%	0.57%	-0.05%	-0.06%
Cumulative		-0.08%	0.49%	0.44%	0.38%
School	14.60%	14.93%	15.78%	15.65%	16.72%
Delta		0.33%	0.85%	-0.13%	1.07%
Cumulative		0.33%	1.18%	1.05%	2.12%
Local Gov't	12.89%	12.90%	13.57%	13.51%	14.31%
Delta		0.01%	0.67%	-0.06%	0.80%
Cumulative		0.01%	0.68%	0.62%	1.42%
Judicial	17.01%	17.01%	17.21%	17.03%	16.15%
Delta		0.00%	0.20%	-0.18%	-0.88%
Cumulative		0.00%	0.20%	0.02%	-0.86%
DPS	13.39%	13.72%	14.35%	14.23%	15.23%
Delta		0.33%	0.63%	-0.12%	1.00%
Cumulative		0.33%	0.96%	0.84%	1.84%

Change in Actuarially Determined Contribution Rate

Division	Before Changes	Reflecting Termination	Reflecting Termination, Retirement and Disability	Reflecting Termination, Retirement, Disability, and Mortality	Reflecting all Demographic Changes, Salary Scale, Payroll Growth and Admin. Expenses
State	18.78%	18.66%	19.32%	19.15%	18.99%
Delta		-0.12%	0.66%	-0.17%	-0.16%
Cumulative		-0.12%	0.54%	0.37%	0.21%
School	20.49%	20.80%	21.75%	21.08%	22.49%
Delta		0.31%	0.95%	-0.67%	1.41%
Cumulative		0.31%	1.26%	0.59%	2.00%
Local Gov't	8.22%	8.15%	8.91%	8.74%	9.75%
Delta		-0.07%	0.76%	-0.17%	1.01%
Cumulative		-0.07%	0.69%	0.52%	1.53%
Judicial	12.20%	12.20%	12.64%	12.03%	10.60%
Delta		0.00%	0.44%	-0.61%	-1.43%
Cumulative		0.00%	0.44%	-0.17%	-1.60%
DPS	6.08%	6.39%	7.09%	6.61%	8.12%
Delta		0.31%	0.70%	-0.48%	1.51%
Cumulative		0.31%	1.01%	0.53%	2.04%

I. Executive Summary

Change in Funded Percentage (AVA Basis)

Division	Before Changes	Reflecting Termination	Reflecting Termination, Retirement and Disability	Reflecting Termination, Retirement, Disability, and Mortality	Reflecting all Demographic Changes, Salary Scale, Payroll Growth and Admin. Expenses
State	66.24%	66.30%	66.17%	66.34%	66.51%
Delta		0.06%	-0.13%	0.17%	0.17%
Cumulative		0.06%	-0.07%	0.10%	0.27%
School	66.69%	66.71%	66.56%	67.36%	66.66%
Delta		0.02%	-0.15%	0.80%	-0.70%
Cumulative		0.02%	-0.13%	0.67%	-0.03%
Local Gov't	90.70%	90.90%	90.69%	90.93%	90.41%
Delta		0.20%	-0.21%	0.24%	-0.52%
Cumulative		0.20%	-0.01%	0.23%	-0.29%
Judicial	89.16%	89.16%	88.71%	89.51%	90.61%
Delta		0.00%	-0.45%	0.80%	1.10%
Cumulative		0.00%	-0.45%	0.35%	1.45%
DPS	89.58%	89.62%	89.42%	90.48%	88.90%
Delta		0.04%	-0.20%	1.06%	-1.58%
Cumulative		0.04%	-0.16%	0.90%	-0.68%

Change in Valuation Effective Amortization Period

Division	Before Changes	Reflecting Termination	Reflecting Termination, Retirement and Disability	Reflecting Termination, Retirement, Disability, and Mortality	Reflecting all Demographic Changes, Salary Scale, Payroll Growth and Admin. Expenses
State	18 years	18 years	19 years	19 years	18 years
Delta		+0 years	+1 year	+0 years	-1 year
Cumulative		+0 years	+1 year	+1 year	+0 years
School	23 years	24 years	26 years	24 years	28 years
Delta		+1 year	+2 years	-2 years	+4 years
Cumulative		+1 year	+3 years	+1 year	+5 years
Local Gov't	8 years	8 years	9 years	9 years	10 years
Delta		+0 years	+1 year	+0 years	+1 year
Cumulative		+0 years	+1 year	+1 year	+2 years
Judicial	5 years	5 years	6 years	5 years	4 years
Delta		+0 years	+1 year	-1 year	-1 year
Cumulative		+0 years	+1 year	+0 years	-1 year
DPS	6 years	7 years	7 years	6 years	8 years
Delta		+1 year	+0 years	-1 year	+2 years
Cumulative		+1 year	+1 year	+0 years	+2 years

I. Executive Summary

Change in Projected Number of Years Until 100% Funded Percentage (Based on Open Group Projections and Proposed Headcount Increase Assumptions)

Division	Before Changes	After all Demographic and Economic Changes
State Delta	23 years	23 years +0 years
School Delta	27 years	33 years +6 years
Local Gov't Delta	14 years	17 years +3 years
Judicial Delta	8 years	7 years -1 year
DPS Delta	9 years	11 years +2 years

II. Actuarial Methods

A. 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 administrative expenses. The actuarial valuation is the process used to determine the contribution rates.

The actuarial valuation does not directly affect the amount of benefits paid or the actual cost of those benefits. Over the life of the plan, actuaries cannot change the cost of the pension or health plan, regardless of the funding method used or the assumptions selected. However, the choice of actuarial methods and assumptions will affect the timing of contributions.

The valuation or determination of the present value of all future benefits to be paid by PERA reflects assumptions that reflect anticipated future experience. The choice of a funding method does not affect the determination of the present value of future benefits. Rather, the funding method determines the allocation of this value. The purpose of the funding method is to allocate the present value of future benefits into annual costs. In order to do this allocation, the funding method separates the present value into two components:

- The portion attributable to the past, which is called the **actuarial accrued liability**; and
- The portion attributable to the future, which is called the **present value of future normal costs**.

The portion of the present value of future normal costs that is allocated to the current year is called the **normal cost**. The difference between the actuarial accrued liability and the assets is called the **unfunded actuarial accrued liability**.

There are various actuarial cost methods, each of which has different characteristics. However, the Governmental Accounting Standards Board Statement Numbers 67 and 68 require that the Entry Age cost method be used for financial reporting. The Entry Age cost method is the most common funding method for public retirement systems and is the method currently used by PERA for financial reporting and funding.

Under the Entry Age cost method, the cost of each member's benefit is determined to be a level percentage of salary from date of hire to end of employment. The normal cost is the calculated level percentage multiplied by the member's annual salary. The present value of future normal cost is equal to the calculated level percentage multiplied by the present value of the member's assumed earnings for all future years, including the current year. The actuarial accrued liability is equal to the present value of future benefits minus the present value of future normal costs.

The annual contribution is equal to the normal cost plus, if necessary, the amortization of the unfunded actuarial accrued liability. The amortization is based upon the investment return assumption, the payroll growth assumption and the number of years over which the unfunded actuarial accrued liability is amortized.

Because the Entry Age cost method provides a stable contribution rate and is a reasonable allocation method, **we recommend that PERA continue the use of the Entry Age Normal actuarial cost method for the Division Trust Funds**.

B. Asset Valuation Method

PERA uses an "actuarial" value of assets for purposes of establishing the actuarially determined employer contributions. The current method smooths investment gains and losses for each fiscal year by recognizing these gains and losses evenly over a four-year period. This method does not impose a corridor, which would place a limit on the spread between actuarial value of assets (AVA) and market value of assets (MVA).

An essential part of the public sector budgeting process is that material budget items, including pension contributions, should have a level cost pattern from year to year to the extent possible. Recognizing investment gains and losses through a reasonable smoothing method is one way that plans limit the potential volatility that may result in fluctuations in contributions due to investment results.

The actuary's guide for determining the reasonableness of an asset smoothing method is Actuarial Standard of Practice (ASOP) No. 44. The two key principles that arise from ASOP 44 are that acceptable asset smoothing must create asset values that fall within a reasonable range around market value and that they are recognized in a reasonable period. In lieu of satisfying both of these principles, a smoothing method could satisfy the requirements if, in the actuary's professional judgment, the range around market value is sufficiently narrow or the differences are recognized in a sufficiently short period.

Segal has established an internal policy, which is consistent with others in the actuarial community, that four years is a sufficiently short period to constitute a reasonable asset smoothing method even if no corridor is used. **Therefore, we recommend the current asset valuation method be retained**.

C. Amortization of Unfunded Actuarial Accrued Liability

The actuarial accrued liability is the portion of the actuarial present value of future benefits that is not included in the present value of future normal costs. Therefore, the actuarial accrued liability represents the liability that theoretically should have been funded through the accumulation of prior normal costs. An unfunded actuarial accrued liability (UAAL) exists when the actuarial accrued liability exceeds the actuarial value of assets. The UAAL results from the following:

- Plan improvements that have not been completely funded;
- Experience that is less favorable than expected;
- Assumption changes that increase liabilities; and

- Contributions that are less than the actuarially determined contributions.

There are various methods that can be used to amortize the UAAL, each with a different payment stream. Each method has three characteristics:

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

Current PERA Amortization Method

The current amortization method used by the Division Trust Funds and as outlined in the Colorado PERA Defined Benefit Pension Plan Funding Policy is as follows:

- The existing UAAL on December 31, 2017, is amortized over 30 years.
- Any increase (or decrease) in the UAAL existing as of December 31, 2017, is amortized over the remaining period of the initial 30-year period from the date of the valuation.
- Annual future actuarial experience gains and losses are amortized over 30 years from the date of the valuation.
- Future assumption changes are amortized over 30 years from the date of the valuation.
- Future benefit enhancements/reductions over the number of years, as determined by the Board, to represent the anticipated duration of payment of the enhancement or, if a reduction, duration of the benefit to the plan. This determination will be based on the nature of the benefit change and the demographics of the membership group affected by the change, not to exceed 25 years from the date of the valuation.
- If any future annual actuarial valuation indicates a division has a negative UAAL, the actuarially determined contribution (ADC) is equal to the normal cost until the funded ratio equals or exceed 120%. At that time, the ADC shall be equal to the Normal Cost less an amount equal to 15-year amortization of the portion of the negative UAAL above the 120% funded ratio.

Because the current amortization method used by the Division Trust Funds will fund the existing UAAL over a set period, the method is reasonable, and we recommend it be retained.

D. Administrative Expense Assumption

The current administrative expense load added to the normal cost is 0.40% of payroll. Below is a table showing the amount of administrative expenses and payroll for the Division Trust Funds in aggregate over the past four years ($ in thousands).

As of December 31	Administrative Expense	Annual Reported Payroll	Percentage
2020	$39,377	$9,759,466	0.40%
2021	40,738	10,161,294	0.40%
2022	45,670	10,481,465	0.44%
2023	48,048	11,551,218	0.42%
Total	**$173,833**	**$41,953,443**	**0.41%**

Average administrative expenses over the past four years were 0.41% of total plan payroll, which is consistent with the current assumption. However, based on discussions with PERA staff, we understand management's plan for near-term growth in the size of information technology personnel. **Therefore, we recommend increasing the administrative expense assumption from 0.40% of payroll to 0.45% of payroll**.

E. Active Member Growth Assumption

The annual actuarial valuation provides a snapshot of PERA as of the valuation date. On an annual basis, actuarial projections are useful to assess trends and to generate expected actuarial metrics for each year in the projection period. The projection of PERA's funding levels over 50 years requires an assumption regarding future new entrants to PERA, as well as the actuarial assumptions that are used to estimate the timing of future events for current active members. As members are assumed to terminate service for any reason, they are replaced with a sufficient number of new entrants to increase the size of the active membership of each division in the future. The PERA Board is currently assuming the following active member growth rates:

Division	Active Member Growth Assumption
State	0.25%
School	1.00%
Local Government	1.00%
Judicial	0.25%
DPS	1.00%

II. Actuarial Methods

PERA active membership over the past 10 years is as follows:

As of December 31	State Division	School Division	Local Government Division	Judicial Division	DPS Division
2013	55,354	117,727	11,954	332	14,816
2014	55,300	119,618	12,084	334	15,414
2015	55,291	120,239	12,176	334	15,929
2016	55,725	121,945	12,736	335	15,950
2017	55,686	122,990	12,770	332	15,991
2018	55,511	126,333	13,260	332	16,148
2019	55,252	128,938	13,086	339	15,679
2020	53,643	119,421	12,757	344	14,693
2021	53,477	125,007	12,745	345	15,695
2022	50,892	128,057	12,103	340	15,254
2023	53,687	131,188	12,700	347	15,626
Current Active Growth Assumption	0.25%	1.00%	1.00%	0.25%	1.00%
Average Annual Increase over Last 10 Years	−0.31%	1.09%	0.61%	0.44%	0.53%
Average Annual Increase over Last Five Years	−0.67%	0.76%	−0.86%	0.89%	−0.66%

As the shown in the table above, over the last 10 years School and Judicial were the only divisions that exceeded the population growth assumption. Over the past five years, only the Judicial Division exceeded the population growth assumption.

Segal has reviewed the data included in the “Colorado Department of Affairs State Demography Office – 2022 Population Summary”. Below are some highlights from the Summary:

- Colorado's growth rate from 2021 to 2022 ranked 19th-highest among U.S. states and 12th in total change. This growth is comparable to that of 2021 and notably slower than the annual average of 74,000 and 1.4% during the previous decade, marking the slowest growth rate since the late 1980s.
- Between 2020 and 2030, Colorado's population is projected to increase by 600,000, a slower pace compared to the previous decade when the state grew by 745,000. The recent population growth in Colorado has been notably slower than the average annual growth observed in the last decade. Population growth is expected to hover just below 1% (50,000 annually) from 2025 to 2030.
- After 2030, population growth rates are expected to significantly slow due to a slowing economy, continued national decline in birth rates, an aging population, slowing labor force growth, and reduced international immigration.

II. Actuarial Methods

Based upon historical increases in active member population, the information included in the Colorado Department of Affairs State Demography Office – 2022 Population Summary, and discussions with PERA staff and the State Demography Office, we recommend that the active member growth assumption be adjusted as follows:

Division	Current Active Member Growth Assumption	Proposed Active Member Growth Assumption
State	0.25%	0.25%
School	1.00%	0.75%
Local Government	1.00%	0.50%
Judicial	0.25%	0.25%
DPS	1.00%	0.25%

III. Economic Assumptions

The economic assumptions have a significant impact on the development of plan liabilities. Changes to these assumptions can substantially alter the results determined by the actuary. The goal of an experience study is to produce a consistent set of economic assumptions that appropriately reflect expected future economic trends.

The primary economic assumptions that affect PERA's funding are:

- Inflation;
- Investment Rate of Return;
- Individual Salary Increases; and
- Payroll Growth

The Actuarial Standards Board has adopted ASOP No. 27 ("Selection of Economic Assumptions for Measuring Pension Obligations") to provide actuaries guidance in developing economic assumptions.

The inflation component is included in all economic assumptions, and therefore is key to developing a consistent set of actuarial assumptions. The investment rate of return assumption includes an inflation component and a real rate of return component. The components of the salary increase assumption are inflation, productivity, and merit and seniority increases. The components of the payroll growth assumption include inflation and productivity.

A. Inflation

In developing the recommendation for the assumed inflation component, actuarial standards of practice suggest the actuary review appropriate inflation data. This data may include consumer price indexes, the implicit price deflator, forecasts of inflation, and yields on government securities of various maturities. For this study, we referred to commonly referenced historical measures of inflation via the National Consumer Price Index for all urban consumers (CPI-U).

The table below shows that recent inflation experience has been significantly higher than longer-term averages.

Average Annual Change as of December 31, 2023	CPI-U
5-Year Average	4.07%
10-Year Average	2.79%
20-Year Average	2.58%
30-Year Average	2.51%

As can be seen in the table above, the average annual inflation rates have gradually increased over each shorter averaging period due to a relatively high inflationary period over the past several years. Historical trend is a less important consideration for the assumed rate of inflation, but assists in determining the reasonable bounds of expected inflation.

Since 2012, Horizon Actuarial Services, LLC has published survey results that summarize the capital market assumptions of various investment firms. Based on the survey results from the 2024 Edition of the Survey of Capital Market Assumptions, the average 10-year inflation assumption across 41 survey respondents was 2.42% and the average 20-year inflation assumption across a subset of 26 survey respondents that provided assumptions for 20 years was 2.44%.

The table below compares the 2024 Horizon Survey results to other sources.

Source	10-Year	20-Year	30-Year
Federal Reserve Bank of Philadelphia Third Quarter 2024 Survey of Professional Forecasters	2.30%		
Aon	2.30%		2.30%
Segal Marco Advisors	2.40%	2.40%	
2024 Horizon Survey of Capital Market Assumptions	2.42%	2.44%	

Next, we consider the measure of future inflation expectation; an indication of which is a market-based forecast. Treasury Inflation Protection Securities (TIPS) are government bonds, which, in addition to a fixed yield, add the actual percentage change in CPI to the principal value. Therefore, the spread between the TIPS and the Conventional Treasury note/bond of the same maturity is an indication of the market's forecast for inflation.

The following table compares the yields on US Treasury Bonds as of December 31, 2023, with and without inflation indexing.

US Treasury Bonds as of December 31, 2023	10-Year Yield	20-Year Yield	30-Year Yield
Non-Inflation Indexed	4.02%	4.32%	4.14%
Inflation Indexed	1.84%	1.90%	1.95%
Difference	2.18%	2.42%	2.19%

Because of the inflation protection, yields on TIPS are considerably lower than those of regular Treasury securities of similar maturities. As of December 31, 2023, 30-year Treasuries yielded 4.14% while 30-year TIPS yielded 1.95%. In order for 30-year TIPS to match the return of the conventional 30-year Treasury for a buy-and-hold income investor, inflation would have to measure 2.19% per year over the next 30 years. The market's expectation of inflation alone is not a definitive basis for an inflation assumption due to other factors that affect the yields of those securities but is useful as one indicator of future trend. In addition, it is also important to note that the market's view of inflation over 20 years is around 20 basis points greater than the 10-year horizon and around 20 basis points greater than the 30-year horizon.

We also referred to the 2024 report on the financial status of the Social Security program[2]. The projected average increase in price inflation over the next 75 years under the intermediate cost assumptions used in that report was 2.40%. The price inflation measure used in this report is the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W)[3]. Besides projecting the results under the intermediate cost assumptions using an inflation assumption of 2.40%, alternative projections were also made using a lower and a higher inflation assumption of 1.80% and 3.00%, respectively.

Lastly, the Philadelphia Federal Reserve Bank Survey of Professional Forecasters indicates inflation expectations for a 10-year period of 2.30%. The market's expectation for inflation over the next 20 years is approximately 20 basis points higher than the next 30-year period. This indicates a long-term expected trend towards moderately lower inflation levels than those projected over the next 20 years and those experienced recently. Considering all of this information, **we recommend maintaining the current inflation assumption of 2.30%**.

B. Investment Rate of Return

The investment rate of return is used to estimate annual investment return and to determine the present value of expected future plan payments. The selection of an investment return assumption considers capital market outlook, PERA's portfolio mix, and, to a lesser extent, historical returns.

The current investment return assumption is 7.25%, which is comprised of the following components:

- Inflation: 2.30%
- Real rate of return: 4.95%

The table below shows PERA's actual investment returns on a market value basis as well as an actuarial value basis.

Average Annual Return as of December 31, 2023	Market Value of Assets	Actuarial Value of Assets
Past 5 Years	10.0%	10.3%
Past 10 Years	7.8%	9.0%
Past 15 Years	9.2%	7.5%
Past 20 Years	7.7%	7.4%
Past 30 Years	8.2%	8.2%

[2] Source: Social Security Administration – The 2024 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds.

[3] The CPI-W is a more specialized index relative to CPI-U and seeks to track retail prices as they affect urban hourly wage earners and clerical workers. It encompasses about 32 percent of the United States' population and is a subset of the CPI-U group. The CPI-W places a slightly higher weight on food, apparel, transportation, and other goods and services. It places a slightly lower weight on housing, medical care, and recreation. The CPI-U is a more general index and seeks to track retail prices as they affect all urban consumers. It encompasses about 87 percent of the United States' population.

II. Economic Assumptions

The investment return on both the market value and actuarial value of assets basis has been above the 7.25% return in each period shown above. Historical trend is a less important consideration for the assumed rate of investment return, but is useful in determining the reasonable bounds of expected investment return.

In September 2024, Aon prepared a portfolio analysis of PERA's investments and determined that the current investment return assumption of 7.25% was achievable.

Segal based our analysis of the expected real rate of return on the Horizon Survey of Capital Market Assumptions (2024 Edition). This survey compiles and averages the capital market assumptions of 41 investment consultants (including Aon and Segal Marco Advisors). All investment consultants provided assumptions for a 10-year period and 26 respondents provided assumptions for 20-year periods. The expected arithmetic returns are used to determine the expected return by asset class. The 20-year expected geometric real rate of return was generated from the 50th percentile of 5,000 simulated portfolio return trials.

The real return assumptions for the asset classes and the portfolio's expected real return are shown below.

Horizon Study Asset Classes	Horizon Study 20-Year Annual Arithmetic Real Return	Target Allocation	Weighted Real Return
US Equity – Large Cap	5.81%	18.8%	1.09%
US Equity – Small/Mid Cap	7.06%	9.2%	0.65%
Non-US Equity – Developed	6.64%	17.1%	1.14%
Non-US Equity – Emerging	8.56%	5.9%	0.51%
US Corporate Bonds – Core	2.60%	23.0%	0.60%
Real Estate	4.94%	10.0%	0.49%
Infrastructure	6.12%	3.0%	0.18%
Private Equity	9.89%	10.0%	0.99%
Private Debt	6.65%	3.0%	0.20%
Total		**100.0%**	**5.85%**
Adjustment to Geometric			(0.70%)
Geometric Real Rate of Return			**5.15%**

Using the Fund's target asset allocation and the capital market assumptions provided in the 2024 Horizon Survey, the expected real return is 5.15%. This means that over a 20-year period, PERA is expected to earn an annual rate of return of at least 5.15% half of the time. Reflecting the proposed inflation assumption of 2.30% results in a nominal 50th percentile return of 7.45%. The current 7.25% assumption includes some provision for adverse experience, increasing the likelihood of meeting the expectation over a 20-year period to 53%. **Based on this analysis, we recommend retaining the investment return assumption of 7.25%**.

C. Salary Scale

The rate of individual salary increase is used to determine members' benefits provided by PERA. Generally, a member's salary will change over the long term in accordance with inflation, productivity, and merit and seniority scale. The actuary should review available compensation data when selecting this assumption, including employers' and school districts' current compensation practices and any anticipated changes, historical compensation increases and practices of the school districts and other employers in the same industry or geographic area, and historical national wage and productivity growth.

The estimated rate of individual salary increases consists of the following components:

- Inflation
- Productivity
- Merit and seniority increases

The inflation and productivity components are combined to produce the assumed rate of wage inflation (payroll growth). The productivity assumption is currently 0.7%. The inflation and productivity components represent the "across the board" average annual increase in salaries shown in the experience data. The merit component includes the additional increases in salary due to performance, seniority, promotions, etc.

Since merit and seniority increases are unique to each PERA division, it is appropriate to base this assumption on recent experience. We study the merit and seniority increases in combination with productivity and separately from inflation, which represents "non-inflation" increases in individual salaries.

The current salary scale assumption for each division (except the Judicial Division) is a table based on age. The historical compensation data, adjusted by inflation during the study period, was evaluated based on age and years since date of hire age. The strongest relationship for most divisions continues to be based on age. However, for the Judicial Division, experience continues to exhibit more correlation with members' years since date of hire.

The actual historical compensation data for the experience period (shown in the tables that follow) have been adjusted by approximately 4.1% to account for actual inflation during the study period. The expected salary increase rates have been adjusted by 2.3% to account for the current assumed rate of inflation. The proposed increase rates are based on ages (or years of service) as of the valuation date and do not reflect any underlying assumptions for inflation, while the proposed increase rates plus inflation reflect our proposed assumption for inflation of 2.30%.

Unless otherwise stated, proposed non-inflationary increases have been developed based on weighting the current assumption (i.e., historical experience) by one-half and recent experience by one-half. After adjusting for actual inflation, non-inflationary salary increases observed in the first two years of the study period were much lower than expected while increases in the two most-recent years of the study period were much greater than expected. However, we view all four years together as a payroll cycle, which can be relied on for establishing a recommended assumption basis without further adjustments.

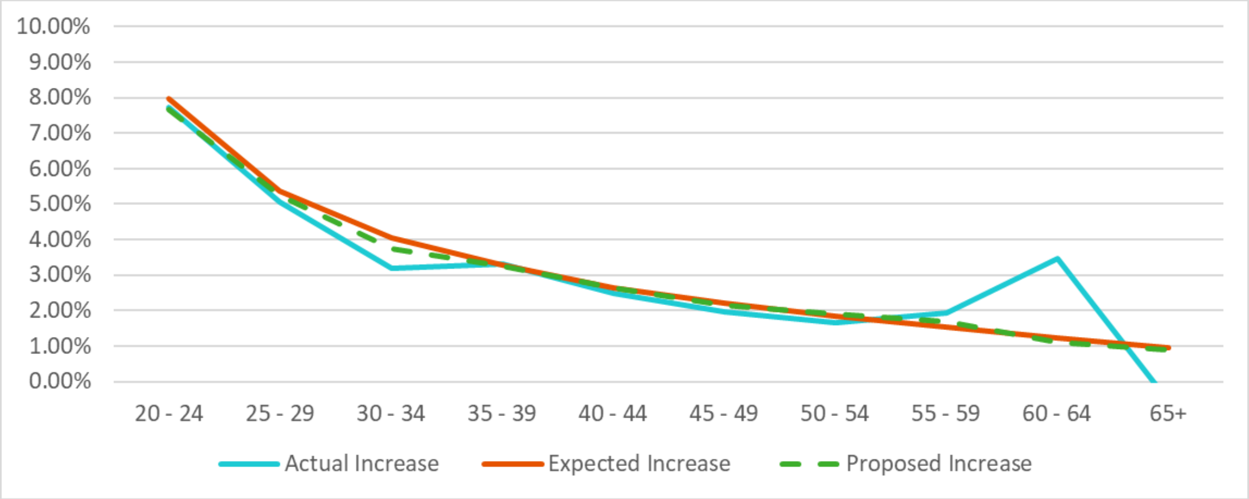
II. Economic Assumptions

The following tables show the actual salary increase experience compared to the current and proposed assumptions. Experience has been adjusted to remove actual inflation over the experience period, which averaged approximately 4.1%.

State and Local Government Divisions (Safety Officers)

Age	Prior Year Salaries (in $000s)	Actual Salaries[4] (in $000s)	Actual Salary Increase	Expected Salary Increases (in $000s)	Expected Salary Increase Rate	Proposed Salary Increase Rate
20 – 24	13,779	14,845	7.74%	14,878	7.97%	7.67%
25 – 29	43,613	45,823	5.07%	45,959	5.38%	5.25%
30 – 34	56,293	58,082	3.18%	58,574	4.05%	3.74%
35 – 39	75,751	78,258	3.31%	78,234	3.28%	3.24%
40 – 44	62,642	64,202	2.49%	64,288	2.63%	2.63%
45 – 49	67,009	68,334	1.98%	68,485	2.20%	2.14%
50 – 54	41,281	41,964	1.65%	42,041	1.84%	1.91%
55 – 59	12,408	12,647	1.93%	12,599	1.54%	1.69%
60 – 64	4,475	4,630	3.46%	4,529	1.21%	1.10%
65 +	1,820	1,810	−0.56%	1,838	0.95%	0.90%
Total	**379,073**	**390,595**	**3.04%**	**391,425**	**3.26%**	**3.18%**

State and Local Government Divisions (Safety Officers)

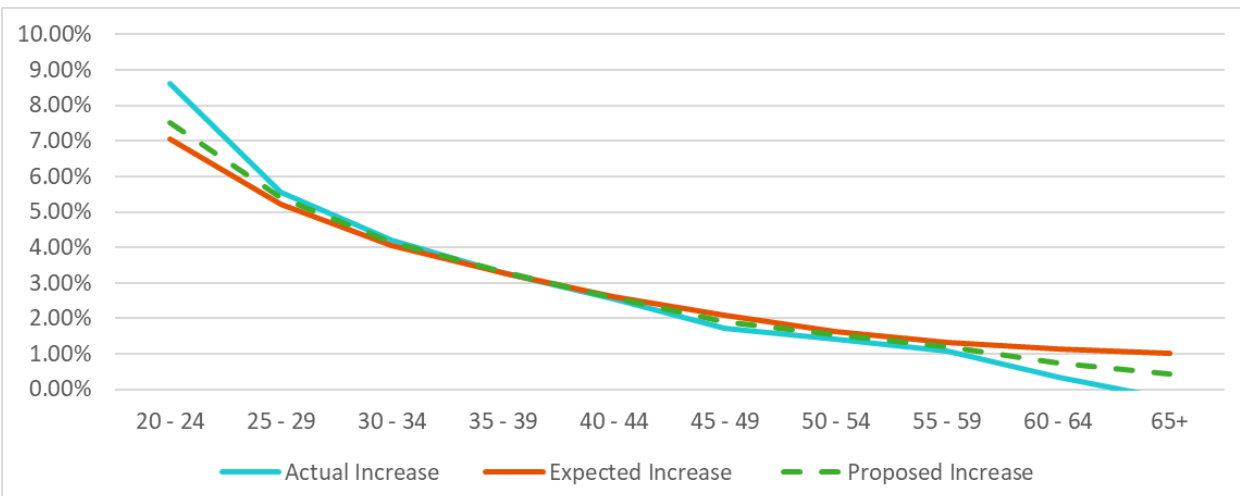


[4] Adjusted for actual average inflation of approximately 4.1% during the experience period.

State Division (Non-Safety Officer)

Age	Prior Year Salaries (in $000s)	Actual Salaries[5] (in $000s)	Actual Salary Increase	Expected Salary Increases (in $000s)	Expected Salary Increase Rate	Proposed Salary Increase Rate
20 – 24	107,514	116,783	8.62%	115,107	7.06%	7.51%
25 – 29	532,738	562,299	5.55%	560,547	5.22%	5.40%
30 – 34	948,691	988,428	4.19%	986,971	4.04%	4.13%
35 – 39	1,235,158	1,275,615	3.28%	1,275,789	3.29%	3.31%
40 – 44	1,485,608	1,523,507	2.55%	1,524,350	2.61%	2.59%
45 – 49	1,506,749	1,532,859	1.73%	1,538,283	2.09%	1.91%
50 – 54	1,524,342	1,545,701	1.40%	1,549,164	1.63%	1.53%
55 – 59	1,235,475	1,248,911	1.09%	1,251,836	1.32%	1.19%
60 – 64	825,229	828,015	0.34%	834,512	1.12%	0.74%
65 +	351,207	350,205	−0.29%	354,720	1.00%	0.44%
Total	**9,752,712**	**9,972,323**	**2.25%**	**9,991,279**	**2.45%**	**2.36%**

State Division (Non-Safety Officer)



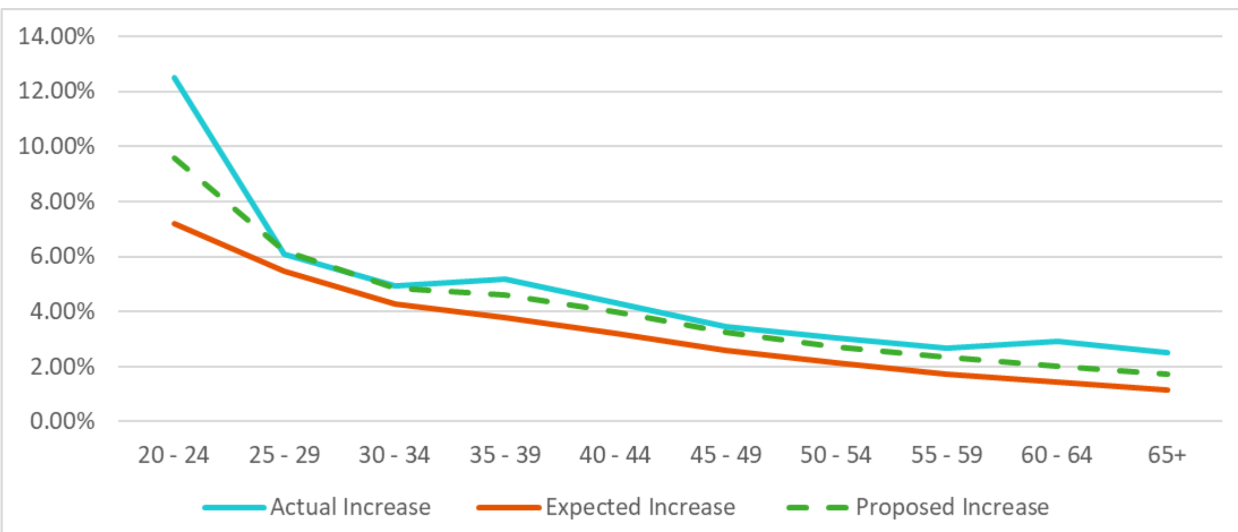
[5] Adjusted for actual average inflation of approximately 4.1% during the experience period.

II. Economic Assumptions

School Division

Age	Prior Year Salaries (in $000s)	Actual Salaries[6] (in $000s)	Actual Salary Increase	Expected Salary Increases (in $000s)	Expected Salary Increase Rate	Proposed Salary Increase Rate
20 – 24	309,878	348,632	12.51%	332,204	7.20%	9.60%
25 – 29	1,223,709	1,297,952	6.07%	1,290,415	5.45%	6.20%
30 – 34	1,775,367	1,862,954	4.93%	1,851,117	4.27%	4.83%
35 – 39	2,352,254	2,473,945	5.17%	2,441,328	3.79%	4.61%
40 – 44	3,083,201	3,216,860	4.34%	3,181,586	3.19%	3.97%
45 – 49	3,185,030	3,294,790	3.45%	3,267,738	2.60%	3.24%
50 – 54	2,893,563	2,981,197	3.03%	2,954,790	2.12%	2.72%
55 – 59	1,945,942	1,997,943	2.67%	1,979,626	1.73%	2.33%
60 – 64	1,033,047	1,063,276	2.93%	1,047,761	1.42%	2.02%
65 +	354,275	363,129	2.50%	358,320	1.14%	1.74%
Total	**18,156,267**	**18,900,676**	**4.10%**	**18,704,885**	**3.02%**	**3.72%**

School Division



In the prior experience study, recommended salary increase rates were set at two-thirds of the then-current assumption and one-third of 2016-2019 actual experience. Actual increases during the prior experience study period were materially higher than the legacy experience and caution was exercised in recommending a much higher assumption until more experience emerged. Actual experience between 2020-2023 was more consistent with the 2016-2019 experience and so **recommended rates for the School Division in this study are one-third of the current assumption and two-thirds of the 2020-2023 actual experience**.

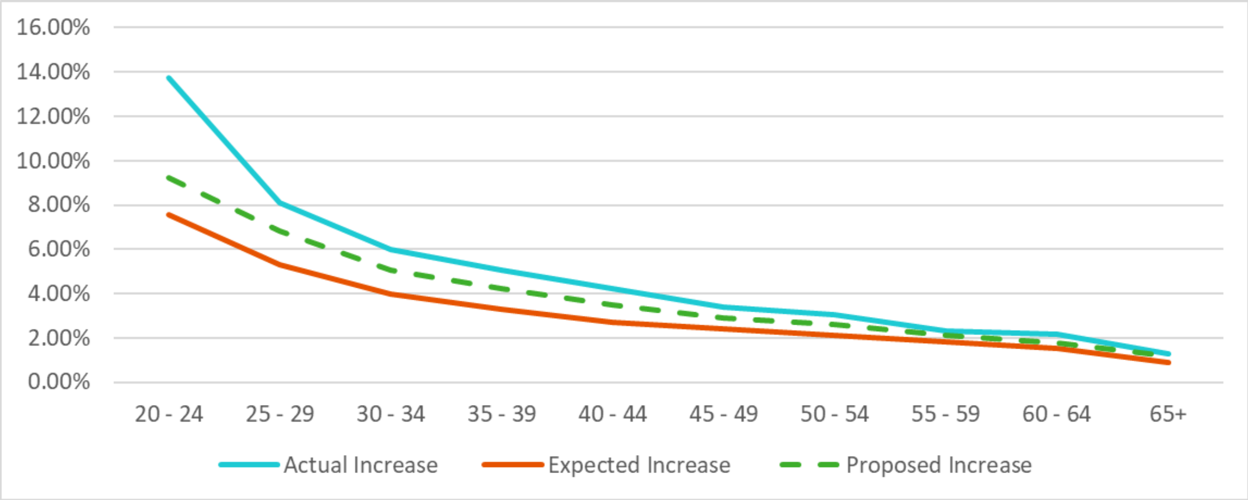
[6] Adjusted for actual average inflation of approximately 4.1% during the experience period.

II. Economic Assumptions

Local Government Division (Non-Safety Officer)

Age	Prior Year Salaries (in $000s)	Actual Salaries[7] (in $000s)	Actual Salary Increase	Expected Salary Increases (in $000s)	Expected Salary Increase Rate	Proposed Salary Increase Rate
20 – 24	31,335	35,648	13.76%	33,701	7.55%	9.85%
25 – 29	127,061	137,368	8.11%	133,809	5.31%	6.81%
30 – 34	235,717	249,867	6.00%	245,130	3.99%	5.07%
35 – 39	280,458	294,600	5.04%	289,697	3.29%	4.21%
40 – 44	349,043	363,744	4.21%	358,514	2.71%	3.51%
45 – 49	374,128	386,749	3.37%	383,093	2.40%	2.92%
50 – 54	357,082	367,971	3.05%	364,601	2.11%	2.59%
55 – 59	305,600	312,615	2.30%	311,117	1.81%	2.13%
60 – 64	186,980	190,990	2.14%	189,799	1.51%	1.79%
65 +	56,676	57,411	1.30%	57,227	0.88%	1.20%
Total	**2,304,081**	**2,396,962**	**4.03%**	**2,366,689**	**2.72%**	**3.40%**

Local Government Division (Non-Safety Officer)

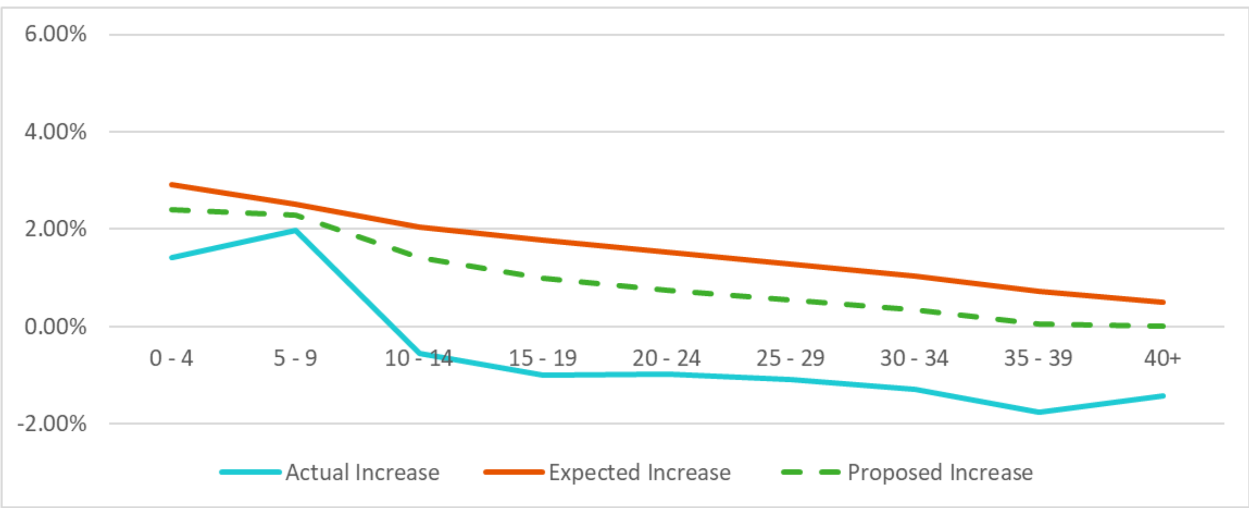


[7] Adjusted for actual average inflation of approximately 4.1% during the experience period.

Judicial Division

Years of Service	Prior Year Salaries (in $000s)	Actual Salaries[8] (in $000s)	Actual Salary Increase	Expected Salary Increases (in $000s)	Expected Salary Increase Rate	Proposed Salary Increase Rate
0 – 4	41,678	42,265	1.41%	42,897	2.92%	2.40%
5 – 9	42,225	43,061	1.98%	43,285	2.51%	2.28%
10 – 14	45,897	45,642	−0.56%	46,831	2.03%	1.43%
15 – 19	35,830	35,475	−0.99%	36,470	1.79%	0.99%
20 – 24	16,330	16,169	−0.98%	16,580	1.53%	0.75%
25 – 29	9,492	9,390	−1.08%	9,614	1.28%	0.54%
30 – 34	5,131	5,065	−1.30%	5,185	1.04%	0.34%
35 – 39	631	620	−1.77%	636	0.73%	0.06%
65 +	716	706	−1.42%	719	0.50%	0.00%
Total	**197,930**	**198,392**	**0.23%**	**202,216**	**2.17%**	**1.60%**

Judicial Division



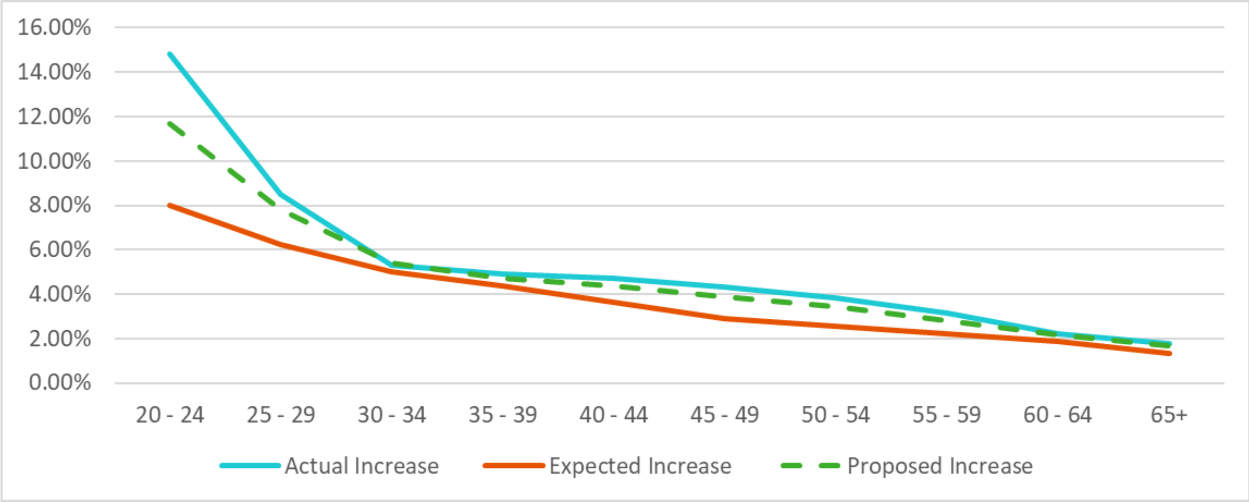
Actual non-inflationary salary increases for the Judicial Division averaged slightly above 0% during the experience period. The **recommended rates were set by taking two-thirds of the current assumption and one-third of recent actual experience.**

[8] Adjusted for actual average inflation of approximately 4.1% during the experience period.

Denver Public Schools Division

Age	Prior Year Salaries (in $000s)	Actual Salaries[9] (in $000s)	Actual Salary Increase	Expected Salary Increases (in $000s)	Expected Salary Increase Rate	Proposed Salary Increase Rate
20 – 24	48,115	55,240	14.81%	51,960	7.99%	11.69%
25 – 29	259,239	281,302	8.51%	275,397	6.23%	7.82%
30 – 34	419,923	442,142	5.29%	440,960	5.01%	5.42%
35 – 39	484,073	507,793	4.90%	505,132	4.35%	4.71%
40 – 44	376,284	393,994	4.71%	389,945	3.63%	4.39%
45 – 49	344,068	358,996	4.34%	354,117	2.92%	3.90%
50 – 54	281,000	291,757	3.83%	288,126	2.54%	3.42%
55 – 59	193,947	200,074	3.16%	198,199	2.19%	2.80%
60 – 64	106,455	108,836	2.24%	108,421	1.85%	2.16%
65 +	43,868	44,639	1.76%	44,450	1.33%	1.67%
Total	**2,556,973**	**2,684,772**	**5.00%**	**2,656,707**	**3.90%**	**4.67%**

Denver Public Schools Division



In the prior experience study, recommended salary increase rates were set at two-thirds of the then-current assumption and one-third of 2016-2019 actual experience. Actual increases during the prior experience study period were materially higher than the legacy experience and caution was exercised in recommending a much higher assumption until more experience emerged. Actual experience between 2020-2023 was more consistent with the 2016-2019 experience and so **recommended rates for the DPS Division in this study are one-third of the current assumption and two-thirds of the 2020-2023 actual experience**.

[9] Adjusted for actual average inflation of approximately 4.1% during the experience period.

D. Payroll Growth (Wage Inflation)

The rate of individual salary increase is used to determine members' benefits provided by PERA. Generally, a member's salary will change over the long term in accordance with inflation, productivity, and merit and seniority scale. The actuary should review available compensation data when selecting this assumption, including employers' and school districts' current compensation practices and any anticipated changes, historical compensation increases and practices of the school districts and other employers in the same industry or geographic area, and historical national wage and productivity growth.

Component	Current Assumption
Inflation	2.30%
Productivity	0.70%
Total	3.00%

The Social Security Administration publishes data on wage growth in the United States. A comparison of wage inflation with price inflation over various periods is shown in the table below. The difference between wage inflation and price inflation is the measure of the real rate of wage inflation.

Productivity can be measured as the excess of the increase in the National Average Wage over inflation. As of December 2023:

Period	General Wage Growth	Price Inflation (CPI-U)	Productivity
2013 – 2023 (10 years)	4.03%	2.79%	1.24%
2008 – 2023 (15 years)	3.23%	2.55%	0.68%
2003 – 2023 (20 years)	3.41%	2.58%	0.83%

Productivity over the prior 10-year period of 1.24% is much higher as compared to productivity over the prior 15- and 20-year periods of 0.68% and 0.83%, respectively. However, the most-recent 10-year period includes the impact of the dynamic that the pandemic had on employment/wages as well as a period of extraordinarily high price inflation (which wage increases reacted to).

A lower payroll growth assumption is more conservative. To the extent that actual payroll increases were more than 3.00%, more dollars have gone toward paying off the unfunded liability than anticipated and future amortization payments are lower. If actual payroll increases were less than 3.00%, fewer dollars have gone toward paying off the unfunded liability than anticipated and future amortization payments are higher.

II. Economic Assumptions

The following table summarizes PERA's historical payroll and active population growth:

Year Ended December 31	Total Payroll ($ in millions)	Number of Active Members
2023	$11,551.2	213,548
2018	9,121.9	211,584
2013	7,530.2	200,183

The average increase in covered payroll and active members is shown below:

Period	Increase in Total Payroll	Increase in Active Members
5-year average	4.8%	0.2%
10-year average	4.4%	0.6%

The following table summarizes the components of the current and recommended payroll growth assumption; **our recommendation represents no change from the current assumptions**:

Component	Current	Recommended
Inflation	2.3%	2.3%
Productivity	0.7%	0.7%
Total	3.0%	3.0%

IV. Demographic Assumptions

The demographic assumptions used to value PERA reflect the expected occurrences of various events among PERA members. The assumptions should reflect specific characteristics of PERA and produce reasonable results. A reasonable assumption is one that is expected to model the contingency being measured and not expected to produce significant gains and losses. The types of demographic assumptions used to measure pension obligations include, but are not limited to the following:

- Mortality;
- Retirement;
- Termination;
- Disability incidence; and
- Other assumptions such as percent married and age difference between spouses.

The Actuarial Standards Board (ASB) has adopted Actuarial Standard of Practice No. 35 (ASOP 35, "Selection of Demographic and Other Non-economic Assumptions for Measuring Pension Obligations") to provide actuaries guidance in developing demographic assumptions. The standard recommends the actuary follow a general process for selecting demographic assumptions. The first step of the general procedure is to identify the types of assumptions to use. The actuary should consider relevant plan provisions that will affect timing and value of any potential benefit payments, all contingencies that give rise to benefits or loss of benefits and the characteristics of the covered group. The next step is to identify the relevant assumption universe. The assumption universe may include prior experience studies or general studies of trends relevant to the type of demographic assumption in addition to plan experience to the extent that it is credible. The third step is to consider the assumption format. The format may include different tables for different segments of the covered population (i.e., different termination rate tables for males/females). The final step is to select the specific assumption and evaluate the reasonableness of each assumption. The specific experience of the Plan should be incorporated but not given undue weight to past experience if recent experience is attributable to a phenomenon that is unlikely to continue. For example, if recent rates of termination were due to a one-time reduction in workforce it may be unreasonable to assume that such rates will continue.

A. Mortality Rates

One of the most significant actuarial assumptions is the probability of death, which drives expectations of annuitant longevity and, therefore, the duration of pension payments. The mortality assumption takes the form of a mortality table that contains for each age in the table a probability of a person dying between that age and the next. PERA currently uses three types of mortality tables for its members: post-retirement mortality, disabled mortality, and pre-retirement mortality.

In 2019, the Society of Actuaries (SOA) published a series of mortality tables derived from public plan experience, referred to as Pub-2010. The published mortality tables are based on three broad categories: teachers, public safety, and general employees. In addition, the study concluded that surviving annuitants demonstrated worse mortality than the primary annuitants. As a result, separate contingent survivor tables were developed.

We analyzed the experience by weighting the probability of death with each annuitant's pension benefit amount. This methodology takes into consideration the correlation between the annuitant mortality and the level of benefit.

In 2008, the SOA published an article recommending that mortality assumptions include an adjustment for credibility. Under this approach, the number of actual deaths in a sub-group needed for "full credibility" is 1,082. Full credibility in this context means 90% confidence that the actual experience will be within 5% of the expected value. Partial credibility can be assigned where actual deaths in a group or sub-group are less than 1,082. Partially credible results can be blended with an appropriate, unadjusted published base table. In some instances we combine male and female experience of a particular group to improve credibility. While in these instances we show the results of the analysis in this report using male and female experience combined, the actual proposed tables to be used in the actuarial valuations will rely on sex distinct mortality tables with the same adjustment applied to each gender.

When reviewing the actual experience under each of the four categories below, we compared actual experience with the current mortality table and with the applicable Pub-2010 mortality table. We recommend continuing to use the base tables to the applicable Pub-2010 mortality tables, with updated adjustments, where appropriate, for PERA-specific experience where credible data exists. We also recommend the continued use of the Pub-2010 Contingent Survivor Mortality Table.

To reflect future improvements in mortality, we recommend updating the mortality projection scale to 2024 Adjusted Scale MP-2021.

Adjusting For Pandemic-related Mortality

The experience study period of calendar years 2020 through 2023 intersects with the timing of the global COVID-19 pandemic. The pandemic created a level of "excess mortality" for a period that we must evaluate in this experience study. In general, to use all mortality data from the experience study as-is with no adjustment – and then fit that data to a recommended mortality assumption – would inherently assume that a pandemic-level event would occur every four years and as a result the level of mortality would be higher than typical pre-pandemic levels.

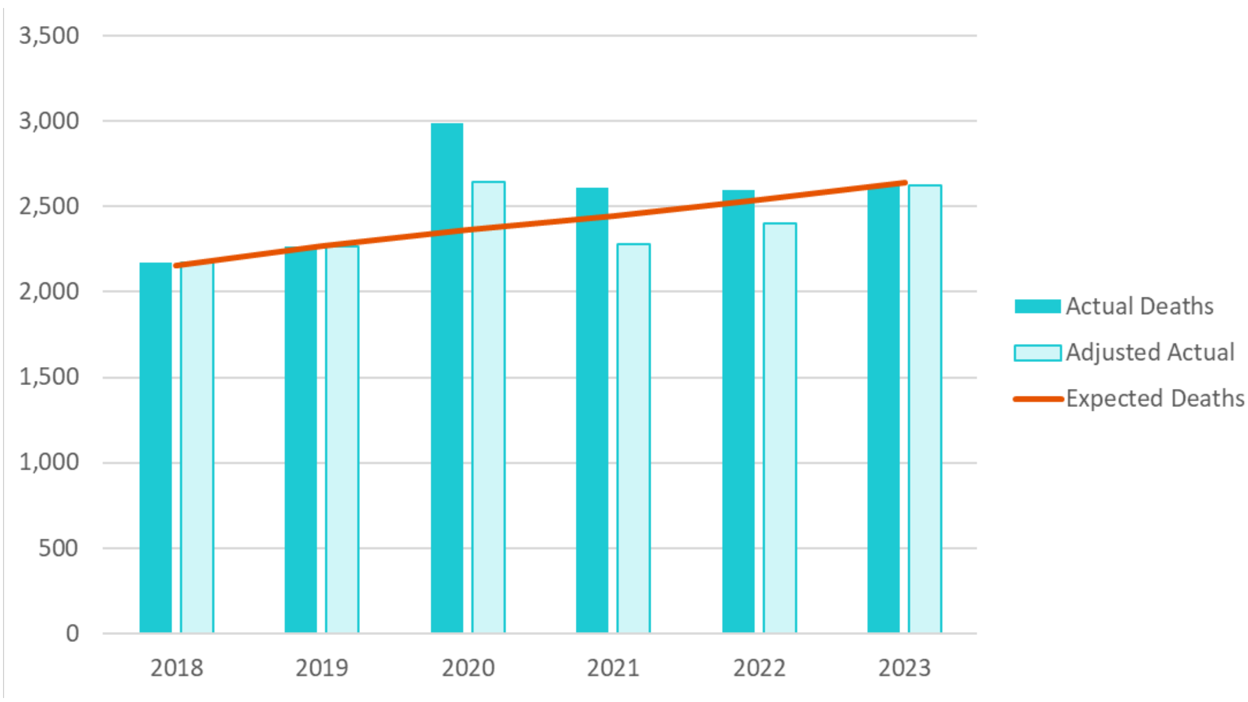
There are several approaches available to manage the mortality experience in this study to avoid developing an assumption that overstates future mortality. The two options we evaluated in detail for purposes of this experience study were 1) using publicly available information regarding excess mortality to adjust the PERA experience; and 2) ignoring the periods of mortality experience data that were impacted by the pandemic and back-fill with data from the prior experience study.

Given that this report is a study of experience over the past four years, the inertia is to utilize this experience to the extent possible. Various outlets (e.g., the US Center for Disease Control) collected data on excess mortality experienced during the height of the COVID-19 pandemic. We have used this data to generate adjustment factors to apply to the observed mortality experience of PERA over the experience period. Specifically, we developed adjustment factors based on excess mortality observed in Colorado for males and females between ages 50-84 and 85+. For purposes of our study (and based on available data), we developed and applied adjustment factors for calendar years 2020-2023, with the factor for calendar 2020 reflecting approximately 9 ½ months of excess mortality. The adjustment factors developed and applied to the data are as follows:

Year	Males 50-84	Males 85+	Females 50-84	Females 85+
2020	88.3%	85.9%	90.2%	87.9%
2021	84.5%	88.7%	86.4%	91.1%
2022	92.0%	91.4%	92.8%	93.1%

Where excess mortality started to spike by the middle of March 2020, the 88.3% factor above for males in Colorado between the ages of 50-84 in 2020 represents an "annualized" adjustment for an effective level of excess mortality of approximately 117% for this cohort from Late March 2020 through December 2020. The 84.5% factor for the same cohort in 2021 represents an effective level of excess mortality of approximately 118%.

The following charts illustrates the level of expected, actual and "adjusted actual" mortality over the prior six calendar years. Expected deaths are estimated based on the current mortality assumptions; all values have been adjusted from the benefit-weighted tables to show comparable values on a headcount basis for illustrative purposes.



Adjusted actual deaths for 2020 are still greater than expected while adjusted actual deaths for 2021 and 2022 fall under the expected line. In aggregate from 2020 through 2023, total adjusted actual deaths are within 0.5% of expected.

IV. Demographic Assumptions

Without relying on any adjustments to the data, but excluding calendar years 2020 and 2021, total actual deaths for the four calendar years 2018-2019 and 2022-2023 are within 0.6% of expected. Given that either approach will yield a similar outcome, we have based our analysis on the 2020-2023 experience data and applying the adjustments for 2020-2022 as outlined. **Data related to actual mortality during the experience period shown throughout the rest of this section reflects these adjustments**.

Post-Retirement Healthy Mortality

The mortality experience among retirees determines the durations over which retirement benefits are paid. Lower mortality rates mean longer benefit payment periods and, therefore, higher benefit costs.

Currently, PERA uses healthy post-retirement mortality rates based on the Pub-2010 series of mortality tables and the MP-2019 projection scale. For State and Local Government Division Trust Funds (members other than Safety Officers), the post-retirement non-disabled retiree mortality table is the PubG-2010 Healthy Retiree table with adjustments for credibility and gender. For males, the adjustments are 94% of the rates prior to age 80 and 90% of the rates for ages 80 and older, with generational projection using scale MP-2019. For females, the adjustments are 87% of the rates prior to age 80 and 107% of the rates for ages 80 and older, with generational projection using scale MP-2019.

For the State and Local Government Divisions (Safety Officers), the post-retirement non-disabled retiree mortality table is the unadjusted PubS-2010 Healthy Retiree table, with generational projection using scale MP-2019.

For the School and DPS Divisions, the post-retirement non-disabled retiree mortality table is the PubT-2010 Healthy Retiree table with adjustments for credibility and gender. For males, the adjustments are 112% of the rates prior to age 80 and 94% of the rates for ages 80 and older, with generational projection using scale MP-2019. For females, the adjustments are 83% of the rates prior to age 80 and 106% of the rates for ages 80 and older, with generational projection using scale MP-2019.

For the Judicial Division, the post-retirement non-disabled retiree mortality table is the unadjusted PubG-2010(A) Above-Median Healthy Retiree table, with generational projection using scale MP-2019.

State and Local Government Divisions (Non-Safety Officer)

The experience during the study period shows that, for males, more members in pay status have died (based on adjusted data) than expected; adjusted experience for females was in line with expected. However, on a benefit-weighted basis, the adjusted-actual amount of benefits released due to mortality was 101% of expected for males and 97% for females. When compared to the unadjusted PubG-2010 mortality tables, we continue to see a difference in mortality rates between newer and older retirees (age 85 was selected as the bifurcation point) in the experience for females, where the adjusted-actual amount of benefits released due to mortality prior to age 85 is 84% of expected based on that table yet the adjusted-actual amount of benefits released for ages 85 and later is 106% of expected. Experience for males is comparable for newer and older retirees and so a single adjustment applied to the entire base table is recommended.

IV. Demographic Assumptions

During the experience study period and after applying the adjustments for excess mortality, there were 1,774 female deaths and 2,180 male deaths, broken out as follows:

Age	Female Deaths	Female Credibility	Male Deaths	Male Credibility	Total Deaths	Total Credibility
<85	1,004	96.3%	1,468	100.0%	2,472	n/a
85+	770	84.4%	712	81.1%	1,482	n/a
Total	**1,774**	**n/a**	**2,180**	**100.0%**	**3,954**	**n/a**

We used these credibility adjustments to develop the recommended mortality assumption on a sex-distinct basis for rates before and after age 85 for females and all ages for males. The following table provides a summary of mortality experience (on the basis of annual benefits, in thousands) for annuitants by gender for the study period:

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Female	**3,305,753**	**53,479**	**55,274**	**97%**
<85	3,134,512	32,838	35,034	94%
85+	171,241	20,641	20,240	102%
Male	**3,748,195**	**93,622**	**92,626**	**101%**
<85	3,487,265	63,272	62,939	101%
85+	260,931	30,350	29,687	102%
Total	**7,053,949**	**147,101**	**147,900**	**99%**

The total adjusted amount of benefits released due to healthy post-retirement mortality among the retiree population was $147,101,000. Applying the State and Local Government Divisions (Non-Safety Officers) exposures to the unadjusted PubG-2010 Retiree Table results in $162,767,000 in benefits released due to mortality, for an aggregate actual-to-proposed ratio of 90%. Applying credibility-weighted adjustments by gender and age (pre and post age 85) results in a better fit of the published table to this group's own experience, as shown in the following table (on the basis of annual benefits, in thousands):

Gender	Actual Deaths	Unadjusted PubG-2010 Deaths	Ratio of Actual to Unadjusted	Credibility Applied to Actual	Credibility Weighted Deaths	Ratio of Actual to Weighted
Female	**53,479**	**58,469**	**91%**		**53,515**	**100%**
<85	32,838	39,064	84%	96.3%	33,068	99%
85+	20,641	19,406	106%	84.4%	20,447	101%
Male	**93,622**	**104,298**	**90%**	**100.0%**	**93,622**	**100%**
<85	63,272	70,058	90%			
85+	30,350	34,240	89%			
Total	**147,101**	**162,767**	**90%**		**147,137**	**100%**

The adjustments applied to the mortality rates are calculated using Ratio of Actual to Unadjusted and Credibility Applied to Actual. For example, for females below age 85, the adjustment is 85% = (84% x 96.3% +100% x 3.7%).

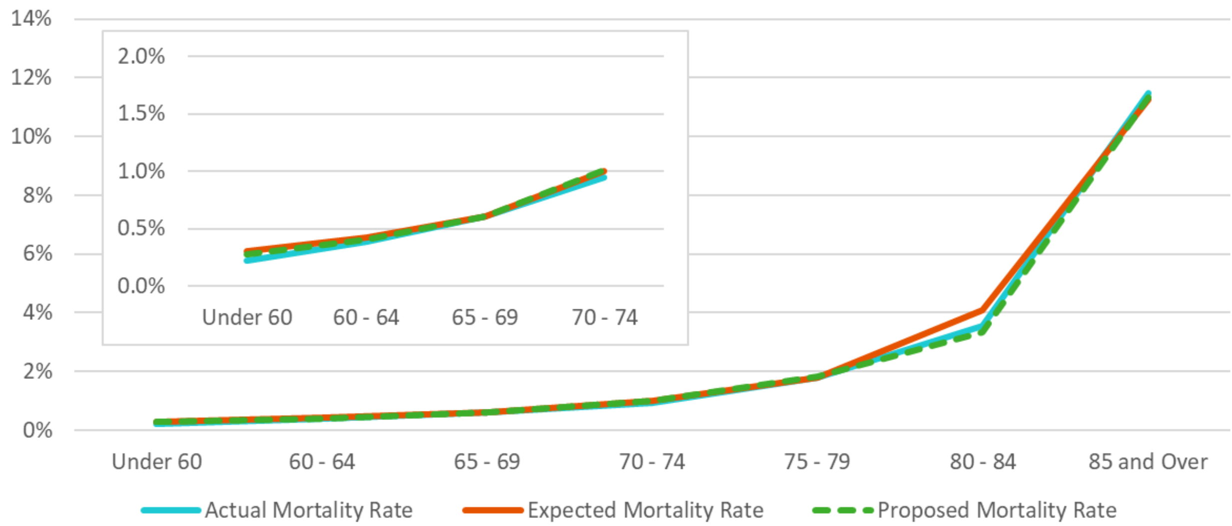
IV. Demographic Assumptions

The credibility weightings as outlined above applied to the State and Local Government Divisions (Non-Safety Officer) exposures would result in $147,137,000 in benefits released due to mortality, for an aggregate actual-to-weighted rate of 100%. Therefore, we recommend continued use of the PubG-2010 Retired Lives Table for healthy retirees applicable to the State and Local Government Divisions (Non-Safety Officers). For males, we recommend using 90% of the rates for all ages. For females, we recommend using 85% of the rates prior to age 85 and 105% of the rates for ages 85 and older. In aggregate, this assumption would result in $148,629,000 in benefits released due to mortality and is close to the number of credibility-weighted deaths during the study period. To reflect future improvements in mortality, we recommend updating the mortality projection scale to MP-2021.

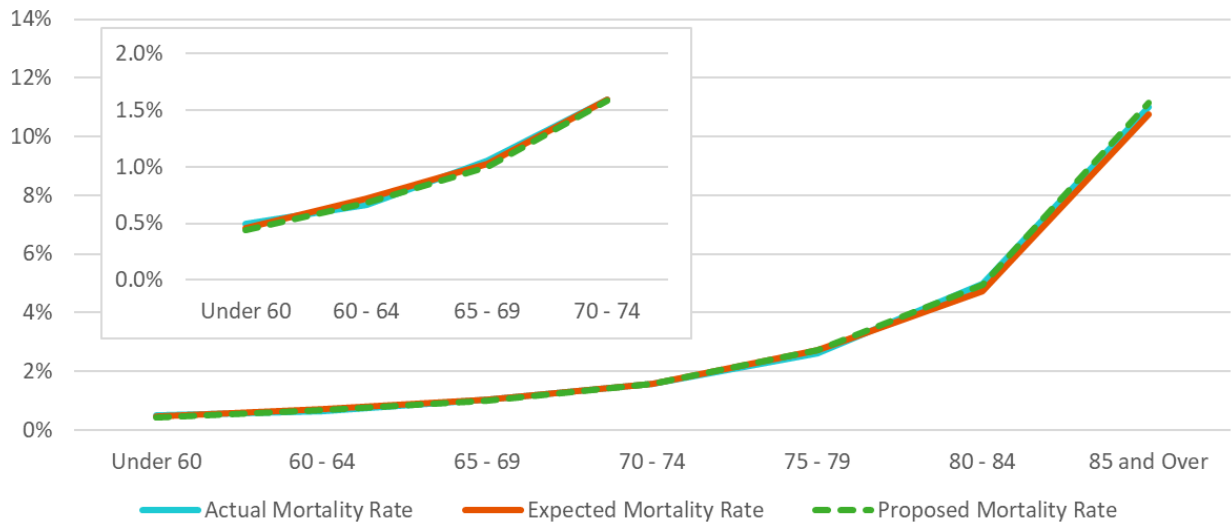
IV. Demographic Assumptions

The following graphs show the actual mortality rate, expected mortality rate, and proposed mortality rate by female and male.

Actual Versus Proposed Experience, Benefit-Weighted Basis
Healthy Retiree Mortality – **Female**
State and Local Government Divisions (Non-Safety Officer)



Actual Versus Proposed Experience, Benefit-Weighted Basis
Healthy Retiree Mortality – **Male**
State and Local Government Divisions (Non-Safety Officer)



IV. Demographic Assumptions

State and Local Government Divisions (Safety Officer)

Safety Officers within the State and Local Government Divisions retiree population is limited for the four-year experience period and there were only 49 actual deaths. Due to this insufficient experience for the Safety Officer subgroup, we recommend continuing to use the unadjusted PubS-2010 Retired Lives Tables for males and females. To reflect future improvements in mortality, we recommend updating the mortality projection scale to MP-2021.

School and DPS Divisions

The experience during the study period shows that, for both males and females, more members in pay status have died (based on adjusted data) than expected. On a benefit-weighted basis, the adjusted-actual amount of benefits released due to mortality was 109% of expected for males and 104% for females. When compared to the unadjusted PubT-2010 mortality tables, we continue to see a difference in mortality rates between newer and older retirees (age 85 was selected as the bifurcation point) in the experience for females, where the adjusted-actual amount of benefits released due to mortality prior to age 85 is 86% of expected based on that table yet the adjusted-actual amount of benefits released for ages 85 and later is 115% of expected. Experience for males is comparable for newer and older retirees and so we recommend a single adjustment applied to the entire base table.

During the experience study period and after applying the adjustments for excess mortality, there were 3,718 female deaths and 2,196 male deaths, broken out as follows:

Age	Female Deaths	Female Credibility	Male Deaths	Male Credibility	Total Deaths	Total Credibility
<85	1,947	100.0%	1,344	100.0%	3,291	n/a
85+	1,771	100.0%	852	88.7%	2,623	n/a
Total	**3,718**	**n/a**	**2,196**	**n/a**	**5,914**	**n/a**

We used these credibility adjustments to develop the recommended mortality assumption on a sex-distinct basis for rates before and after age 85 for females and all ages for males. The following table provides a summary of mortality experience (on the basis of annual benefits, in thousands) for annuitants by gender for the study period:

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Female	**7,387,633**	**114,191**	**110,069**	**104%**
<85	6,934,419	63,482	64,551	98%
85+	453,214	50,709	45,518	111%
Male	**3,347,758**	**87,973**	**80,594**	**109%**
<85	3,058,827	52,876	50,766	104%
85+	288,931	35,097	29,828	118%
Total	**10,735,391**	**202,164**	**190,663**	**106%**

IV. Demographic Assumptions

The total adjusted amount of benefits released due to healthy post-retirement mortality among the retiree population was $202,164,000. Applying the School and DPS Divisions exposures to the unadjusted PubT-2010 Retiree Table results in $200,572,000 in benefits released due to mortality, for an aggregate actual-to-proposed ratio of 101%; however, for females the ratio is 97% while for males the ratio is 106%. Applying credibility-weighted adjustments by gender and age (pre and post age 85) results in a better fit of the published table to this group's own experience, as shown in the following table (on the basis of annual benefits, in thousands):

Gender	Actual Deaths	Unadjusted PubT-2010 Deaths	Ratio of Actual to Unadjusted	Credibility Applied to Actual	Credibility Weighted Deaths	Ratio of Actual to Weighted
Female	**114,191**	**117,918**	**97%**		**114,191**	**100%**
<85	63,482	73,865	86%	100.0%	63,482	100%
85+	50,709	44,053	115%	100.0%	50,709	100%
Male	**87,973**	**82,654**	**106%**	**100.0%**	**87,973**	**99%**
<85	52,876	49,710	106%			
85+	35,097	32,944	107%			
Total	**202,164**	**200,572**	**101%**		**202,164**	**100%**

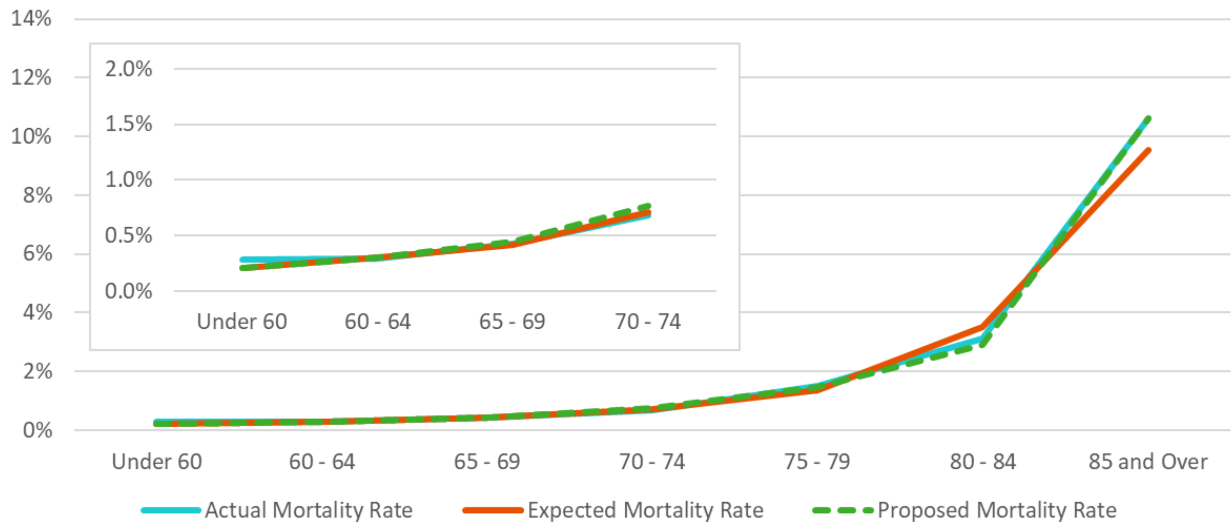
The adjustments applied to the mortality rates are calculated using Ratio of Actual to Unadjusted and Credibility Applied to Actual. For example, for females below age 85, the adjustment is 86% = (86% x 100.0% +100% x 0.0%).

The credibility weightings as outlined above applied to the School and DPS Division exposures would result in $202,855,000 in benefits released due to mortality, for an aggregate actual-to-weighted rate of 100%. Therefore, we recommend continued use of the PubT-2010 Retired Lives Table for healthy retirees applicable to the School and DPS Divisions. For males, we recommend using 106% of the rates for all ages. For females, we recommend using 86% of the rates prior to age 85 and 115% of the rates for ages 85 and older. In aggregate, this assumption would result in $202,849,000 in benefits released due to mortality and is close to the number of credibility-weighted deaths during the study period. To reflect future improvements in mortality, we recommend updating the mortality projection scale to MP-2021.

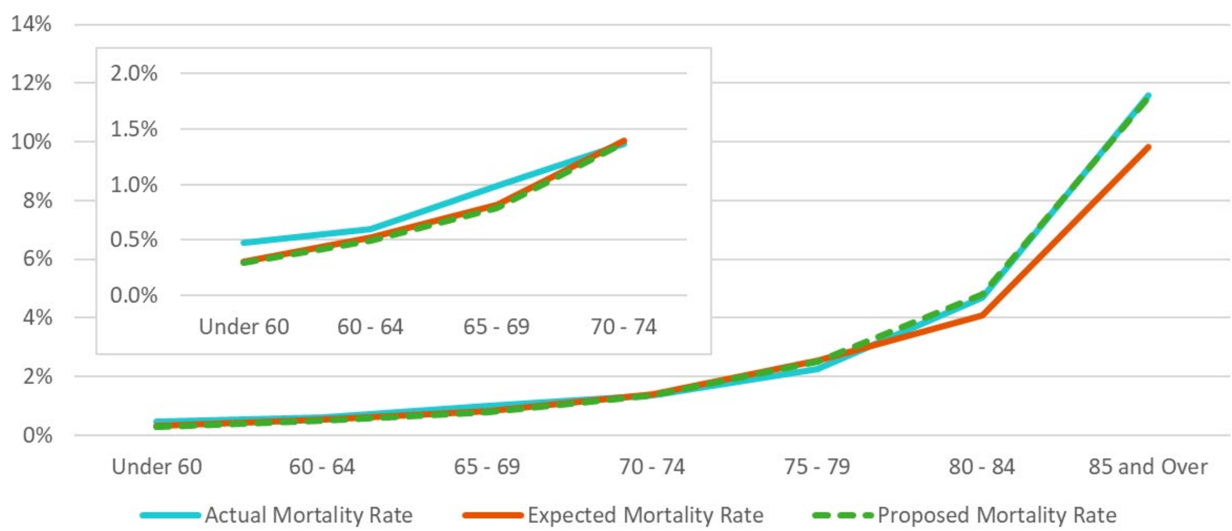
IV. Demographic Assumptions

The following graphs show the actual mortality rate, expected mortality rate, and proposed mortality rate by female and male.

Actual Versus Proposed Experience, Benefit-Weighted Basis
Healthy Retiree Mortality – **Female**
School and DPS Divisions



Actual Versus Proposed Experience, Benefit-Weighted Basis
Healthy Retiree Mortality – **Male**
School and DPS Divisions



IV. Demographic Assumptions

Judicial Division

Because of the size of the annuitant population of the Judicial Division, the experience was combined for males and females. The experience during the study period shows that fewer members in pay status have died (based on adjusted data) than expected. On a benefit-weighted basis, the adjusted-actual amount of benefits released due to mortality was 60% of expected. Since the vast majority of retirees in this group have annuities greater than the average of those in the PubG-2010 dataset, we believe that the PubG-2010 Above Median mortality table continues to represent the appropriate base table.

During the experience study period and after applying the adjustments for excess mortality, there were 4 female deaths and 21 male deaths, broken out as follows:

Age	Female Deaths	Female Credibility	Male Deaths	Male Credibility	Total Deaths	Total Credibility
Total	4	n/a	21	n/a	25	n/a

Given the relatively low credibility of the Judicial Division subgroup, we have not attempted to blend this group's actual experience with the unadjusted PubG-2010 Above Median tables. The following table provides a summary of mortality experience (on the basis of annual benefits, in thousands) for annuitants by gender for the study period:

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Total	107,611	1,538	2,572	60%

The total amount of benefits released due to healthy post-retirement mortality among the retiree population was $1,538,000. Applying the Judicial Division exposures to the unadjusted PubG-2010 Above Median Retiree Table results in $2,586,000 in benefits released due to mortality, for an aggregate actual-to-proposed ratio of 59%.

Gender	Actual Deaths	Unadjusted PubG-2010 (A) Deaths	Ratio of Actual to Unadjusted	Credibility Applied to Actual	Credibility Weighted Deaths	Ratio of Actual to Weighted
Total	1,538	2,586	59%	0.0%	2,586	59%

We recommend continued use of the PubG-2010 Above Median Retired Lives Table for healthy retirees applicable to the Judicial Division for males and females. To reflect future improvements in mortality, we recommend updating the mortality projection scale to MP-2021.

Beneficiary Mortality

For all Divisions, the post-retirement non-disabled beneficiary mortality table is the Pub-2010 Contingent Survivor table with adjustments for credibility and gender. For males, the adjustments are 97% of the rates for all ages, with generational projection using scale MP-2019. For females, the adjustments are 105% of the female rates for all ages, with generational projection using scale MP-2019.

Based upon our analysis, we recommend that one set of mortality tables continue to be used for all divisions combined.

All Divisions

The beneficiary experience during the study period shows that the number of members that have died (based on adjusted data) is comparable to expected. On a benefit-weighted basis, the adjusted-actual amount of benefits released due to mortality was slightly lower than expected. For females, on a benefit-weighted basis, the adjusted-actual number of deaths was 96% of expected. For males, on a benefit-weighted basis, the adjusted-actual number of deaths was 91% of expected. We believe that the Pub-2010 Contingent Survivor mortality table continues to represent the appropriate base table.

During the experience study period and after applying the adjustments for excess mortality, there were 1,719 female deaths and 481 male deaths, broken out as follows:

Age	Female Deaths	Female Credibility	Male Deaths	Male Credibility	Total Deaths	Total Credibility
Total	**1,719**	**100.0%**	**481**	**66.7%**	**2,200**	**n/a**

We used these credibility adjustments to develop the recommended mortality assumption on a sex-distinct basis. The following table provides a summary of mortality experience (on the basis of annual benefits, in thousands) for annuitants by gender for the study period:

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Female	**1,061,089**	**52,283**	**54,383**	**96%**
Male	**236,913**	**9,183**	**10,088**	**91%**
Total	**1,298,002**	**61,466**	**64,471**	**95%**

The total adjusted amount of benefits released due to healthy post-retirement mortality among the beneficiary population was $61,466,000. Applying the PERA beneficiary exposures to the unadjusted Pub-2010 Contingent Survivor Table results in $62,584,000 in benefits released due to mortality, for an aggregate actual-to-proposed ratio of 98%.

IV. Demographic Assumptions

Applying credibility-weighted adjustments by gender results in a better fit of the published table to this group's own experience, as shown in the following table:

Gender	Actual Deaths	Unadjusted Pub-2010 Contingent Survivor Deaths	Ratio of Actual to Unadjusted	Credibility Applied to Actual	Credibility Weighted Deaths	Ratio of Actual to Weighted
Female	**52,283**	**52,096**	**100%**	**100.0%**	**52,283**	**100%**
Male	**9,183**	**10,488**	**88%**	**66.7%**	**9,617**	**95%**
Total	**61,466**	**62,584**	**98%**		**61,900**	**99%**

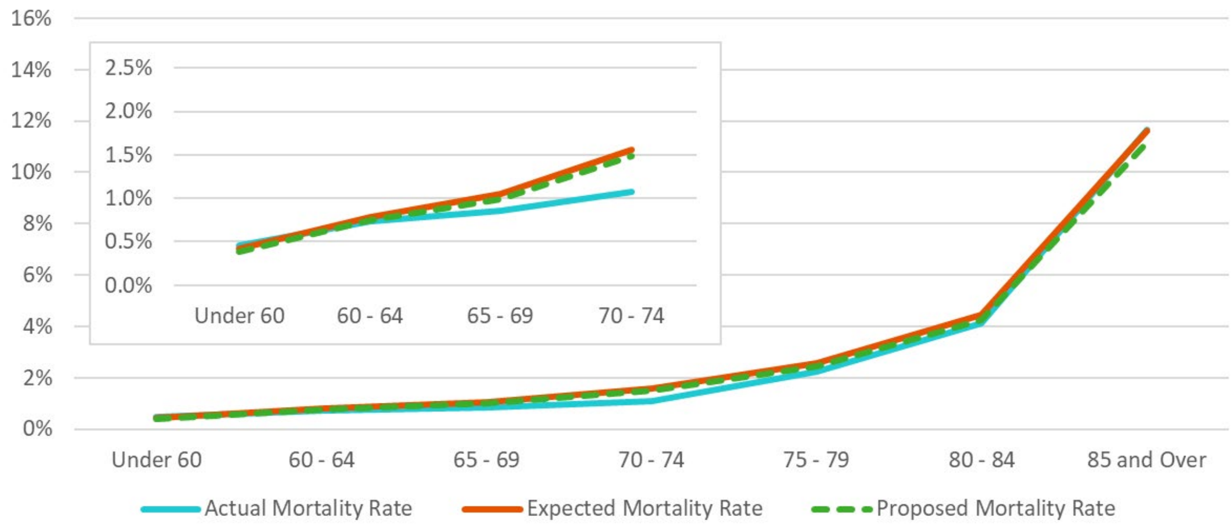
The adjustments applied to the mortality rates are calculated using Ratio of Actual to Unadjusted and Credibility Applied to Actual. For example, for males, the adjustment is 92% = (88% x 66.7% +100% x 33.3%).

The credibility weightings as outlined above applied to the PERA beneficiary exposures would result in $61,900,000 in benefits released due to mortality, for an aggregate actual-to-weighted rate of 99%. Therefore, we recommend continued use of the Pub-2010 Contingent Survivor Table for healthy beneficiaries applicable to all divisions. For males, we recommend using 92% of the rates for all ages. For females, we recommend using 100% of the rates for all ages. In aggregate, this assumption would result in $61,745,000 in benefits released due to mortality and is close to the number of credibility-weighted deaths during the study period. To reflect future improvements in mortality, we recommend updating the mortality projection scale to MP-2021.

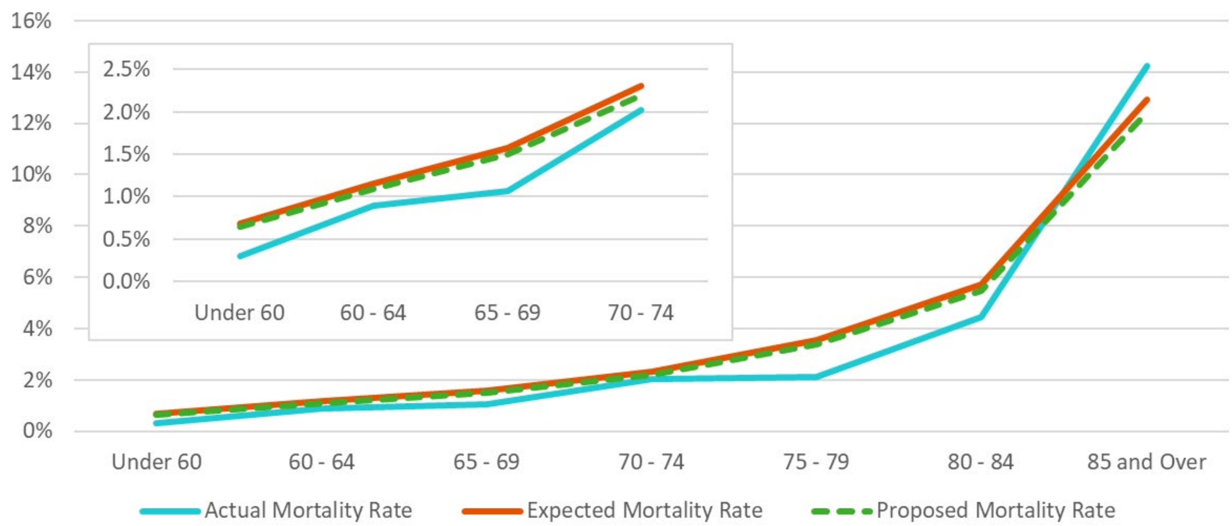
IV. Demographic Assumptions

The following graphs show the actual mortality rate, expected mortality rate, and proposed mortality rate by female and male.

Actual Versus Proposed Experience, Benefit-Weighted Basis
Healthy Beneficiary Mortality – **Female**
All Divisions



Actual Versus Proposed Experience, Benefit-Weighted Basis
Healthy Beneficiary Mortality – **Male**
All Divisions



Disabled Mortality

For all divisions (except Safety Officers), the current mortality table for disabled lives is the Pub-2010 Non-Safety Disabled Lives Table for males and females using 99% of the rates for all ages. For Safety Officers within the State and Local Government divisions, the mortality table for disability retirees is the Pub-2010 Safety Disabled Lives Table for males and females. In order to reflect future improvements in mortality, rates are projected on a generational basis using the MP-2019 projection scale.

Based upon our analysis, we continue to recommend that one set of mortality tables be used for all divisions combined, with a separate assumption used for Safety Officers.

All Divisions (Except Safety Officers)

Experience for disabled annuitants (based on adjusted data) has been below the current assumptions, as the ratio of actual to expected deaths on a benefit-weighted basis is 94% for females and 96% for males for all divisions. We believe that the Pub-2010 Non-Safety Disabled Lives mortality table continues to represent the appropriate base table.

During the experience study period and after applying the adjustments for excess mortality, there were 457 female deaths and 392 male deaths, broken out as follows:

Age	Female Deaths	Female Credibility	Male Deaths	Male Credibility	Total Deaths	Total Credibility
Total	457	n/a	392	n/a	849	88.5%

To improve the overall credibility of the group, we developed the credibility adjustment used to develop the recommended mortality assumption on a unisex basis. The following table provides a summary of mortality experience (on the basis of annual benefits, in thousands) for disabled annuitants in total for the study period:

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Total	520,966	20,961	22,058	95%

The total adjusted amount of benefits released due to mortality among the disability retiree population was $20,961,000. Applying the PERA disability retiree exposures to the unadjusted Pub-2010 Non-Safety Disabled Retiree Table results in $22,320,000 in benefits released due to mortality, for an aggregate actual-to-proposed ratio of 94%. Applying the credibility-weighted adjustment results in a better fit of the published table to this group's own experience, as shown in the following table (on the basis of annual benefits, in thousands):

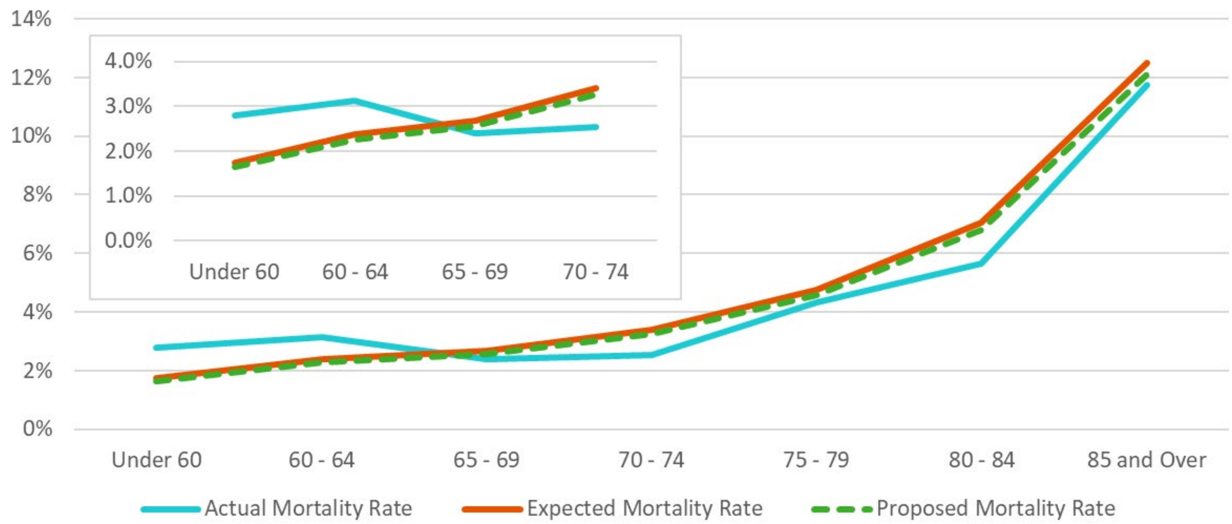
Gender	Actual Deaths	Unadjusted Pub-2010 Non-Safety Disabled Deaths	Ratio of Actual to Unadjusted	Credibility Applied to Actual	Credibility Weighted Deaths	Ratio of Actual to Weighted
Total	20,961	22,320	94%	88.5%	21,117	99%

The adjustments applied to the mortality rates are calculated using Ratio of Actual to Unadjusted and Credibility Applied to Actual. For example, the adjustment is 95% = (94% x 88.5% +100% x 11.5%).

IV. Demographic Assumptions

We recommend continued use of the Pub-2010 Non-Safety Disabled Lives Table for disability retirees applicable to all divisions (except Safety Officers). For males and females, we recommend using 95% of the rates for all ages. In order to reflect future improvements in mortality, we recommend updating the mortality projection scale to MP-2021. The following graphs show the actual mortality rate, expected mortality rate, and proposed mortality rate for Non-Safety Officers on a unisex basis.

Actual Versus Proposed Experience, Benefit-Weighted Basis
Disabled Retiree Mortality – **Unisex**
All Divisions (Except Safety Officers)



State and Local Government Divisions (Safety Officers)

For Safety Officers within the State and Local Government divisions, the ratio of adjusted-actual to expected deaths on a benefit-weighted basis is 132% for females and males combined. However, there was limited experience on which to base the recommended assumption (five adjusted-actual deaths). We recommend that the mortality table for disability retirees applicable to Safety Officers (in either the State or Local Government Division) continue to be the Pub-2010 Safety Disabled Lives Table for males and females. To reflect future improvements in mortality, we recommend updating the mortality projection scale to MP-2021.

Pre-Retirement Mortality

First, in combination with withdrawal and disability rates, the pre-retirement mortality table enables the actuary to estimate the number of individuals who will eventually be eligible for a service retirement benefit, and thereby estimate the liability for those individuals. In addition, the death of a member before retirement may result in a benefit payable to a beneficiary, and the liability for these benefits must be taken into account in the valuation.

IV. Demographic Assumptions

The following base tables are used for pre-retirement mortality; in each case a generational projection is applied using Scale MP-2019:

- PubG-2010 Employee Table for the State and Local Government Divisions (Non-Safety Officers)
- PubS-2010 Employee Table for the State and Local Government Divisions (Safety Officers)
- PubT-2010 Employee Table for the School and Denver Public Schools Divisions
- PubG-2010 Above Median Employee Table for the Judicial Division

Very few members die in active service and the liability associated with active deaths is a small percentage of the total liability. Since plan experience is insufficient to set the assumption, we recommend continued use of the above-mentioned base tables. To reflect future improvements in mortality, we recommend updating the mortality projection scale to MP-2021. The following table provides a summary of pre-retirement mortality experience (on the basis of annual benefits, in thousands) by division/grouping and gender for the study period:

State and Local Government Divisions (Non-Safety Officers)

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Female	2,434,536	8,914	3,143	284%
Male	2,265,464	10,381	4,851	214%
Total	**4,700,000**	**19,295**	**7,994**	**241%**

State and Local Government Divisions (Safety Officers)

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Female	14,756	0	11	0%
Male	117,416	72	135	53%
Total	**132,172**	**72**	**146**	**49%**

School and DPS Divisions

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Female	6,021,119	11,709	5,734	204%
Male	2,281,228	6,907	3,390	204%
Total	**8,302,347**	**18,616**	**9,124**	**204%**

Judicial Division

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Female	30,151	17	41	41%
Male	47,421	3	139	2%
Total	**77,572**	**20**	**180**	**11%**

B. Retirement Rates

Active Retirement

The eligibility criteria for retirement differs by division and date of hire. The age and service requirements – in addition to age 65 with 5 years of Service Credit and age 65 with 60 payroll postings – to be eligible for an **unreduced retirement benefit** are outlined below.

Members, except State Troopers, hired before July 1, 2005, who have 5 or more years of service credit as of January 1, 2011:

Age	Service Credit (Years)
50	30
55	Age + Service = 80 or more
60	20

Members, except State Troopers, hired on or after July 1, 2005, but before January 1, 2007, and who have 5 or more years of service credit as of January 1, 2011:

Age	Service Credit (Years)
Any	35
55	Age + Service = 80 or more
60	20

Members, except State Troopers, hired on or after July 1, 2007, but before January 1, 2011, regardless of service credit as of January 1, 2011, and those hired before January 1, 2011, who have less than 5 years of service credit:

Age	Service Credit (Years)
Any	35
55	30
55	Age + Service = 85 or more
60	25

Members, except State Troopers, hired on or after January 1, 2011, but before January 1, 2017, and members, except State Troopers, hired on or after January 1, 2017, but before January 1, 2020, whose last 10 years of service credit are in either the School or DPS Division:

Age	Service Credit (Years)
Any	35
58	Age + Service = 88 or more

Members, except State Troopers, hired on or after January 1, 2017, but before January 1, 2020, whose last 10 years of service credit are not in either the School or DPS Divisions:

Age	Service Credit (Years)
Any	35
60	Age + Service = 90 or more

IV. Demographic Assumptions

Members, except State Troopers, hired on or after January 1, 2020:

Age	Service Credit (Years)
Any	35
64	Age + Service = 94 or more

State Troopers hired before January 1, 2020:

Age	Service Credit (Years)
Any	30
50	25
55	20
60	Age + Service = 80 or more

State Troopers hired on or after January 1, 2020:

Age	Service Credit (Years)
Any	35
55	25
55	Age + Service = 80 or more

The age and service requirements – in addition to age 60 with 5 years of Service Credit – to be eligible for a **reduced retirement benefit** are outlined below.

Members, except State Troopers, hired before January 1, 2020:

Age	Service Credit (Years)
50	25
55	20

Members, except State Troopers, hired on or after January 1, 2020:

Age	Service Credit (Years)
55	25

State Troopers hired before January 1, 2020:

Age	Service Credit (Years)
50	20

State Troopers hired on or after January 1, 2020:

Age	Service Credit (Years)
55	20

We have analyzed retirement experience for the following groups:

- Eligible for a reduced benefit
- Eligible for an unreduced benefit in the first year only
- Eligible for an unreduced benefit in all other years

IV. Demographic Assumptions

There is little retirement experience for the newer tiers (those hired after July 1, 2005) to analyze. However, the retirement rates take into account each member's eligibility requirements. Where possible, we have made modifications to certain age/service combinations to reflect our best estimate of emerging retirement experience under the newer tiers.

Reduced Retirement Benefit

The experience showed that, in aggregate, there were fewer reduced retirements than expected. We recommend modifications to rates at most ages across most divisions. Current reduced retirement rates for the Judicial Division and Safety Officers within the State and Local Government Divisions are unisex. There is not enough evidence in the recent experience to warrant a change to sex-distinct rates for either group at this time. Current rates associated with reduced retirement for the State and Local Government Divisions (Non-Safety Officer) are the same. Actual experience continues to be close enough that we recommend continuing to combine the exposures of these two groups to develop a single set of assumptions to apply to both. Current rates for the School and DPS Divisions (PERA Benefit Structure) are the same and we believe it is appropriate to continue in this manner.

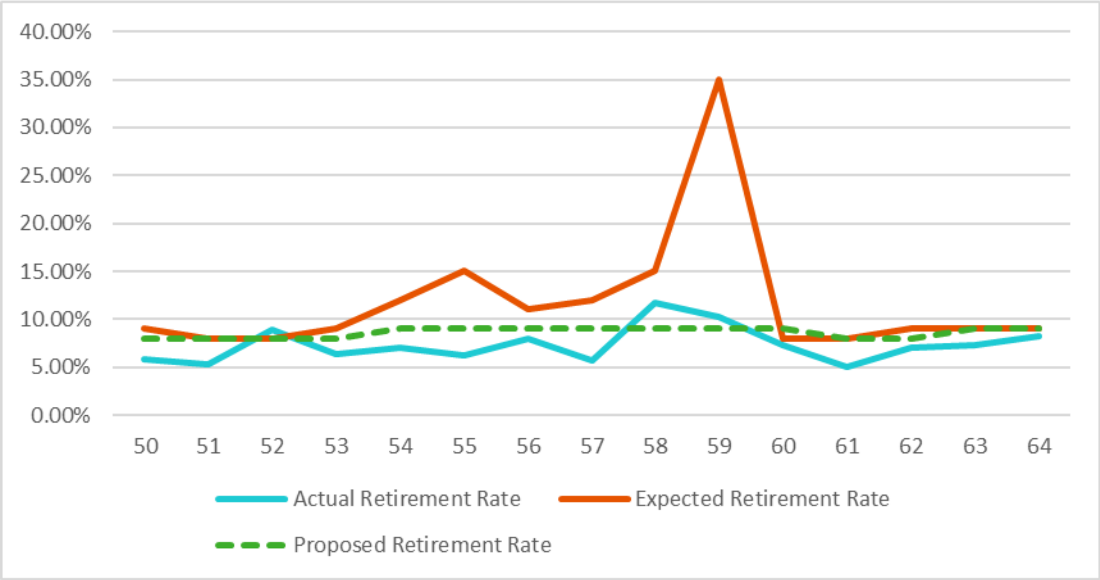
IV. Demographic Assumptions

The following tables and graphs show the actual reduced retirement experience compared to the current and proposed assumptions:

State and Local Government Divisions (Non-Safety Officers)
Reduced Retirements – **Females**

Age	Exposures	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
50	8,187	5.77%	9.0%	64%	8.0%	72%
51	17,816	5.27%	8.0%	66%	8.0%	66%
52	19,585	8.93%	8.0%	112%	8.0%	112%
53	20,284	6.31%	9.0%	70%	8.0%	79%
54	19,064	7.02%	12.0%	59%	9.0%	78%
55	25,536	6.17%	15.0%	41%	9.0%	69%
56	17,736	7.90%	11.0%	72%	9.0%	88%
57	15,466	5.74%	12.0%	48%	9.0%	64%
58	11,594	11.77%	15.0%	78%	9.0%	131%
59	8,081	10.30%	35.0%	29%	9.0%	114%
60	19,602	7.31%	8.0%	91%	9.0%	81%
61	29,819	5.08%	8.0%	64%	8.0%	64%
62	24,035	6.98%	9.0%	78%	8.0%	87%
63	20,253	7.32%	9.0%	81%	9.0%	81%
64	16,530	8.21%	9.0%	91%	9.0%	91%
Total	273,587	7.22%	10.77%	67%	8.56%	84%

Actual Versus Proposed Experience, Benefit-Weighted Basis
Reduced Retirements – **Females**



State and Local Government Divisions (Non-Safety Officers)
Reduced Retirements – **Males**

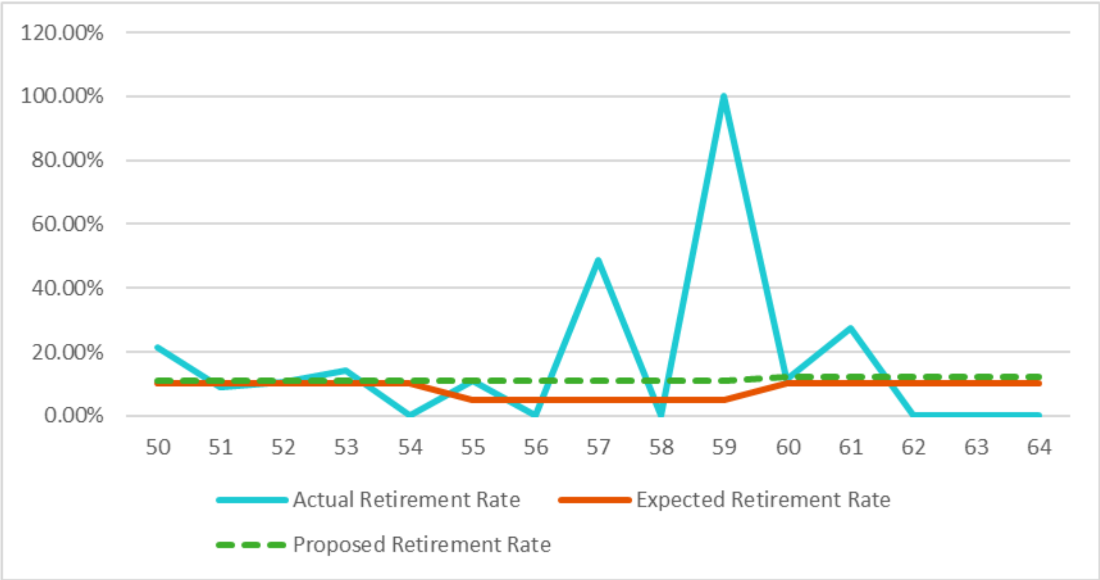
Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
50	9,523	11.92%	9.5%	125%	8.5%	140%
51	18,471	6.03%	11.0%	55%	8.5%	71%
52	19,473	8.21%	11.0%	75%	9.0%	91%
53	20,111	8.32%	12.0%	69%	9.0%	92%
54	19,473	7.65%	12.0%	64%	9.0%	85%
55	23,304	9.68%	12.0%	81%	10.0%	97%
56	16,817	6.70%	9.5%	71%	9.0%	74%
57	12,884	4.78%	15.0%	32%	9.0%	53%
58	11,296	10.47%	15.0%	70%	9.0%	116%
59	7,310	12.01%	35.0%	34%	9.0%	133%
60	17,601	7.47%	7.5%	100%	9.0%	83%
61	24,940	4.41%	7.5%	59%	8.0%	55%
62	21,147	7.90%	7.5%	105%	8.0%	99%
63	18,190	8.43%	7.5%	112%	8.0%	105%
64	15,453	5.42%	7.5%	72%	8.0%	68%
Total	255,994	7.77%	10.82%	72%	8.72%	89%

Actual Versus Proposed Experience, Benefit-Weighted Basis
Reduced Retirements – **Males**

State and Local Government Divisions (Safety Officers)
Reduced Retirements – **Unisex**

Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
50	2,581	21.45%	10.0%	215%	11.0%	195%
51	1,771	9.16%	10.0%	92%	11.0%	83%
52	1,815	10.70%	10.0%	107%	11.0%	97%
53	1,541	14.23%	10.0%	142%	11.0%	129%
54	1,197	0.00%	10.0%	0%	11.0%	0%
55	1,180	11.03%	5.0%	221%	11.0%	100%
56	0	0.00%	5.0%	0%	11.0%	0%
57	100	48.84%	5.0%	977%	11.0%	444%
58	0	0.00%	5.0%	0%	11.0%	0%
59	39	100.00%	5.0%	2000%	11.0%	909%
60	132	11.32%	10.0%	113%	12.0%	94%
61	341	27.39%	10.0%	274%	12.0%	228%
62	103	0.00%	10.0%	0%	12.0%	0%
63	126	0.00%	10.0%	0%	12.0%	0%
64	76	0.00%	10.0%	0%	12.0%	0%
Total	11,001	13.23%	9.40%	141%	11.07%	120%

Actual Versus Proposed Experience, Benefit-Weighted Basis
Reduced Retirements – **Unisex**



IV. Demographic Assumptions

School and DPS Divisions (PERA Benefit Structure)
Reduced Retirements – **Females**

Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
50	26,878	7.22%	7.0%	103%	7.0%	103%
51	62,464	5.06%	7.0%	72%	7.0%	72%
52	69,441	7.02%	8.0%	88%	7.0%	100%
53	65,729	8.61%	10.0%	86%	8.0%	108%
54	58,726	10.34%	14.0%	74%	10.0%	103%
55	63,863	10.77%	12.0%	90%	10.5%	103%
56	44,731	8.46%	12.0%	71%	10.5%	81%
57	37,710	9.47%	12.0%	79%	10.5%	90%
58	29,238	11.53%	16.0%	72%	10.5%	110%
59	21,888	15.17%	34.0%	45%	10.5%	144%
60	38,409	12.05%	9.0%	134%	12.0%	100%
61	51,084	7.14%	9.0%	79%	10.0%	71%
62	38,956	7.84%	10.0%	78%	10.0%	78%
63	28,960	7.59%	10.0%	76%	10.0%	76%
64	20,641	9.96%	10.0%	100%	10.0%	100%
Total	658,718	8.86%	11.11%	80%	9.34%	95%

Actual Versus Proposed Experience, Benefit-Weighted Basis
Reduced Retirements – **Females**

School and DPS Divisions (PERA Benefit Structure)
Reduced Retirements – **Males**

Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
50	13,582	6.49%	8.0%	81%	7.0%	93%
51	28,789	4.82%	8.0%	60%	7.0%	69%
52	32,778	5.23%	9.0%	58%	7.0%	75%
53	33,402	5.80%	9.0%	64%	7.0%	83%
54	30,406	9.92%	12.0%	83%	9.0%	110%
55	31,932	9.12%	9.0%	101%	9.0%	101%
56	17,593	6.36%	9.0%	71%	9.0%	71%
57	12,730	6.82%	9.0%	76%	9.0%	76%
58	8,329	4.78%	12.0%	40%	9.0%	53%
59	5,841	12.12%	24.0%	51%	9.0%	135%
60	13,679	9.71%	8.0%	121%	10.0%	97%
61	17,541	6.51%	9.0%	72%	9.5%	69%
62	14,642	6.43%	10.0%	64%	9.5%	68%
63	11,809	5.91%	10.0%	59%	9.5%	62%
64	10,073	10.03%	10.0%	100%	9.5%	106%
Total	283,126	7.08%	9.65%	73%	8.38%	85%

Actual Versus Proposed Experience, Benefit-Weighted Basis
Reduced Retirements – **Males**

All Divisions (DPS Benefit Structure)
Reduced Retirements – **Females**

Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
50	703	4.66%	5.0%	93%	6.0%	78%
51	2,335	7.74%	7.0%	111%	6.0%	129%
52	2,448	1.22%	10.0%	12%	6.0%	20%
53	3,548	1.30%	10.0%	13%	6.0%	22%
54	4,662	9.81%	10.0%	98%	10.0%	98%
55	7,056	11.57%	10.0%	116%	10.0%	116%
56	5,783	5.30%	10.0%	53%	10.0%	53%
57	5,676	7.55%	10.0%	76%	9.0%	84%
58	4,744	8.33%	10.0%	83%	9.0%	93%
59	5,152	9.45%	14.0%	68%	12.0%	79%
60	4,920	7.97%	17.0%	47%	12.0%	66%
61	5,728	4.57%	17.0%	27%	12.0%	38%
62	5,168	9.12%	17.0%	54%	12.0%	76%
63	4,066	7.94%	17.0%	47%	12.0%	66%
64	3,901	9.33%	17.0%	55%	12.0%	78%
Total	65,890	7.58%	12.68%	60%	10.17%	75%

Actual Versus Proposed Experience, Benefit-Weighted Basis
Reduced Retirements – **Females**

All Divisions (DPS Benefit Structure)
Reduced Retirements – **Males**

Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
50	605	0.00%	8.0%	0%	6.0%	0%
51	1,044	0.00%	8.0%	0%	6.0%	0%
52	1,119	0.00%	8.0%	0%	6.0%	0%
53	1,215	3.85%	10.0%	39%	6.0%	64%
54	1,414	6.50%	10.0%	65%	6.0%	108%
55	3,043	12.60%	10.0%	126%	11.0%	115%
56	2,893	3.73%	10.0%	37%	8.0%	47%
57	3,025	3.43%	10.0%	34%	8.0%	43%
58	2,697	1.94%	10.0%	19%	8.0%	24%
59	2,118	10.24%	15.0%	68%	8.0%	128%
60	2,200	11.80%	15.0%	79%	12.0%	98%
61	2,266	3.69%	16.0%	23%	12.0%	31%
62	1,955	5.88%	16.0%	37%	12.0%	49%
63	1,804	8.67%	16.0%	54%	12.0%	72%
64	1,638	9.84%	16.0%	62%	12.0%	82%
Total	29,035	6.13%	12.14%	50%	9.30%	66%

Actual Versus Proposed Experience, Benefit-Weighted Basis
Reduced Retirements – **Males**

IV. Demographic Assumptions

Unreduced Retirement Benefit

The experience showed that, in aggregate, there were more unreduced retirements than expected. We recommend modifications to rates at most ages across all divisions. Current unreduced retirement rates for the Judicial Division and Safety Officers within the State and Local Government Divisions are unisex. There is not enough evidence in the recent experience to warrant a change to sex-distinct rates for either group at this time. Current rates associated with unreduced retirement for the State and Local Government Divisions (Non-Safety Officer) are the same. Actual experience continues to be close enough that we recommend continuing to combine the exposures of these two groups to develop a single set of assumptions to apply to both. Current rates for the School and DPS Divisions (PERA Benefit Structure) are the same and we believe it is appropriate to continue in this manner.

In addition to retirement experience for all members eligible for unreduced retirement, we separately studied members during the first year they were eligible for unreduced retirement. Typically, there is a higher tendency to retire upon attaining first eligibility for unreduced benefits and a few years thereafter. This was the case for several PERA divisions. In general, for members retiring with unreduced benefits in the legacy tiers, this increased tendency to retire at (or just after) first eligibility is already built into the retirement rate schedules. However, newer benefit tiers have later ages for retirement eligibility. Therefore, there was limited actual experience on which to recommend modifications to the current additional rates of retirement for the first five years of eligibility for unreduced retirement to active members whose first eligibility for unreduced retirement is between age 55 and 64.

Year of Eligibility	State and Local Government Female	State and Local Government Male	Safety Officer Unisex	School and DPS Divisions Female	School and DPS Divisions Male
1st year	20%	30%	20%	28%	28%
2nd year	9%	13%	0%	10%	4%
3rd year	9%	13%	0%	10%	4%
4th year	9%	13%	0%	10%	4%
5th year	9%	13%	0%	10%	4%

These rates are additive to the rates included in the following schedules of proposed unreduced retirement rates. For example, a proposed rate of 25% at age 55 for females in the State Division would become 45% if this were the member’s first year of eligibility, the proposed rate of 20% at age 56 for females would be 29% in their second year of eligibility, etc.

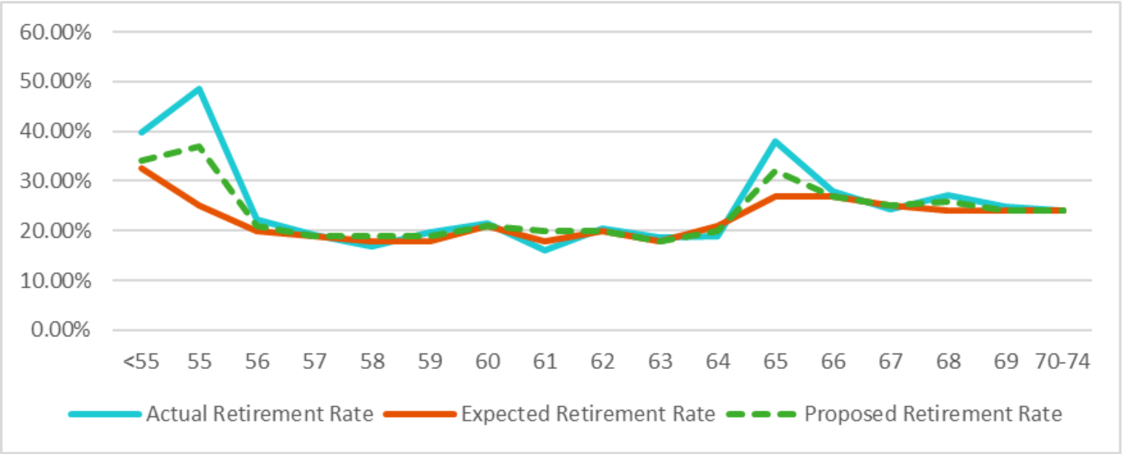
IV. Demographic Assumptions

The following tables and graphs show the actual unreduced retirement experience compared to the current and proposed assumptions:

State and Local Government Divisions (Non-Safety Officers) Unreduced Retirements – **Females**

Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
< 55	28,695	39.73%	32.5%	83%	34.1%	117%
55	12,557	48.56%	25.0%	139%	37.0%	131%
56	24,334	22.31%	20.0%	66%	21.0%	106%
57	26,650	19.10%	19.0%	68%	19.0%	101%
58	28,443	16.85%	18.0%	56%	19.0%	89%
59	32,583	19.60%	18.0%	78%	19.0%	103%
60	34,521	21.62%	21.0%	108%	21.0%	103%
61	33,648	16.01%	18.0%	84%	20.0%	80%
62	35,767	20.37%	20.0%	113%	20.0%	102%
63	34,767	18.77%	18.0%	104%	18.0%	104%
64	33,932	18.94%	21.0%	90%	20.0%	95%
65	33,933	37.97%	27.0%	211%	32.0%	119%
66	33,204	27.81%	27.0%	139%	27.0%	103%
67	25,328	24.44%	25.0%	136%	25.0%	98%
68	18,904	27.15%	24.0%	129%	26.0%	104%
69	14,338	24.95%	24.0%	92%	24.0%	104%
70 – 74	36,371	24.08%	24.0%	89%	24.0%	100%
Total	487,974	24.31%	22.21%	109%	23.28%	104%

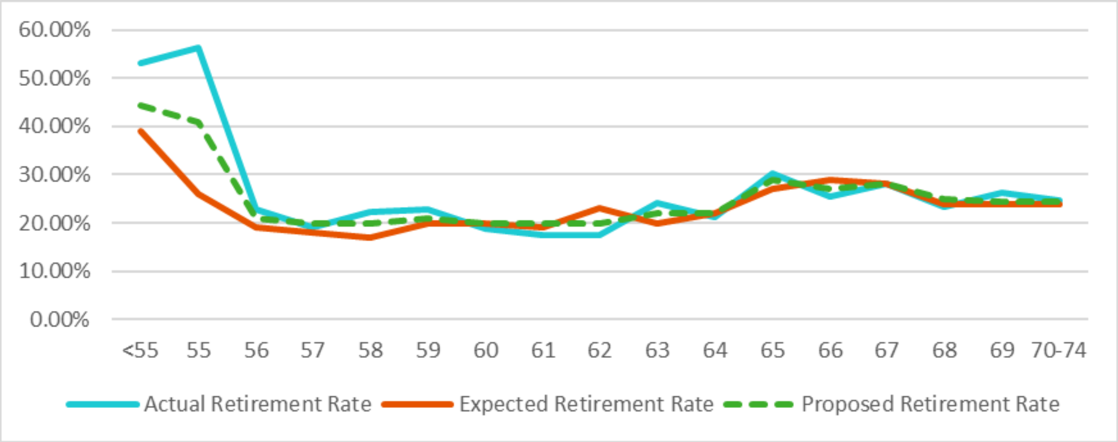
Actual Versus Proposed Experience, Benefit-Weighted Basis Unreduced Retirements – **Females**



State and Local Government Divisions (Non-Safety Officers)
Unreduced Retirements – **Males**

Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
< 55	22,510	53.05%	39.1%	136%	44.3%	120%
55	12,011	56.25%	26.0%	216%	41.0%	137%
56	21,933	22.75%	19.0%	120%	21.0%	108%
57	24,524	18.99%	18.0%	106%	20.0%	95%
58	27,908	22.36%	17.0%	132%	20.0%	112%
59	31,258	22.80%	20.0%	114%	21.0%	109%
60	34,046	18.80%	20.0%	94%	20.0%	94%
61	35,149	17.53%	19.0%	92%	20.0%	88%
62	33,970	17.50%	23.0%	76%	20.0%	87%
63	34,340	24.22%	20.0%	121%	22.0%	110%
64	30,814	21.17%	22.0%	96%	22.0%	96%
65	30,064	30.31%	27.0%	112%	29.0%	105%
66	31,772	25.49%	29.0%	88%	27.0%	94%
67	24,179	28.02%	28.0%	100%	28.0%	100%
68	17,332	23.22%	24.0%	97%	25.0%	93%
69	14,094	26.25%	24.0%	109%	24.5%	107%
70 – 74	35,489	24.78%	24.0%	103%	24.5%	101%
Total	461,392	25.67%	23.11%	111%	24.29%	106%

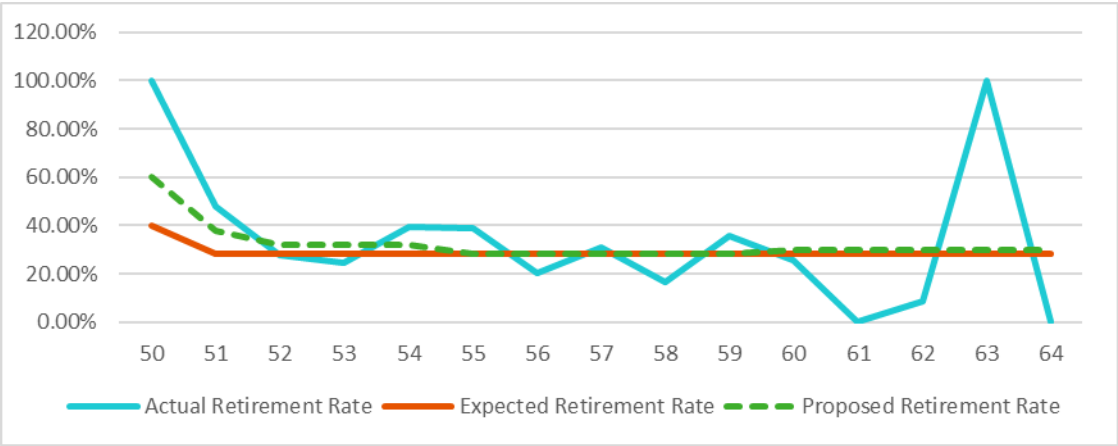
Actual Versus Proposed Experience, Benefit-Weighted Basis
Unreduced Retirements – **Males**



State and Local Government Divisions (Safety Officers)
Unreduced Retirements – **Unisex**

Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
50	1,864	100.00%	40.0%	250%	60.0%	167%
51	3,023	47.66%	28.0%	170%	38.0%	125%
52	1,830	27.85%	28.0%	99%	32.0%	87%
53	1,657	24.32%	28.0%	87%	32.0%	76%
54	1,684	39.14%	28.0%	140%	32.0%	122%
55	1,940	38.70%	28.0%	138%	28.0%	138%
56	2,463	20.06%	28.0%	72%	28.0%	72%
57	1,909	30.96%	28.0%	111%	28.0%	111%
58	1,132	16.26%	28.0%	58%	28.0%	58%
59	664	35.66%	28.0%	127%	28.0%	127%
60	362	25.58%	28.0%	91%	30.0%	85%
61	95	0.00%	28.0%	0%	30.0%	0%
62	513	8.62%	28.0%	31%	30.0%	29%
63	376	100.00%	28.0%	357%	30.0%	333%
64	275	0.00%	28.0%	0%	30.0%	0%
Total	19,786	38.64%	29.13%	133%	33.75%	114%

Actual Versus Proposed Experience, Benefit-Weighted Basis
Unreduced Retirements – **Unisex**



School and DPS Divisions (PERA Benefit Structure)
Unreduced Retirements – **Females**

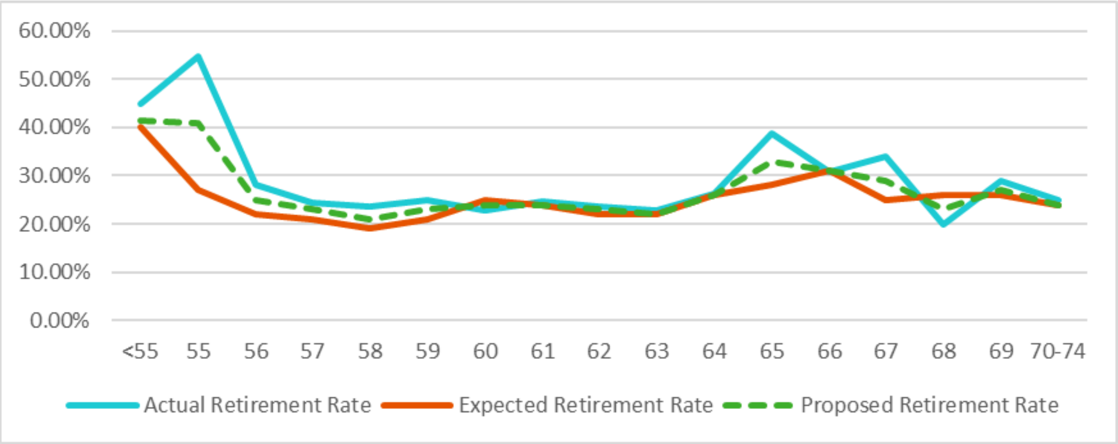
Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
< 55	44,726	45.31%	38.3%	118%	40.7%	111%
55	27,613	54.10%	28.0%	193%	41.0%	132%
56	54,056	26.29%	24.0%	110%	25.0%	105%
57	57,102	26.16%	23.0%	114%	25.0%	105%
58	61,074	23.70%	22.0%	108%	23.0%	103%
59	67,157	24.03%	22.0%	109%	23.0%	104%
60	69,758	25.98%	24.0%	108%	25.0%	104%
61	66,146	25.91%	23.0%	113%	24.0%	108%
62	65,570	24.24%	26.0%	93%	25.0%	97%
63	62,802	24.20%	24.0%	101%	24.0%	101%
64	57,464	23.98%	24.0%	100%	24.0%	100%
65	52,255	40.67%	31.0%	131%	36.0%	113%
66	44,151	32.49%	29.0%	112%	31.0%	105%
67	31,334	29.66%	26.0%	114%	28.0%	106%
68	22,833	30.53%	25.0%	122%	28.0%	109%
69	15,698	27.04%	25.0%	108%	26.0%	104%
70 – 74	36,421	26.44%	24.6%	107%	25.7%	103%
Total	836,158	28.76%	25.45%	113%	27.08%	106%

Actual Versus Proposed Experience, Benefit-Weighted Basis
Unreduced Retirements – **Females**

School and DPS Divisions (PERA Benefit Structure)
Unreduced Retirements – **Males**

Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
< 55	23,134	44.84%	40.0%	112%	41.4%	108%
55	13,166	54.61%	27.0%	202%	41.0%	133%
56	30,924	28.25%	22.0%	128%	25.0%	113%
57	29,258	24.44%	21.0%	116%	23.0%	106%
58	31,071	23.48%	19.0%	124%	21.0%	112%
59	29,852	24.99%	21.0%	119%	23.0%	109%
60	28,068	22.75%	25.0%	91%	24.0%	95%
61	26,598	24.62%	24.0%	103%	24.0%	103%
62	23,768	23.66%	22.0%	108%	23.0%	103%
63	20,840	22.83%	22.0%	104%	22.0%	104%
64	18,242	26.26%	26.0%	101%	26.0%	101%
65	16,230	38.71%	28.0%	138%	33.0%	117%
66	16,354	30.89%	31.0%	100%	31.0%	100%
67	11,794	33.93%	25.0%	136%	29.0%	117%
68	8,277	19.79%	26.0%	76%	23.0%	86%
69	7,126	28.84%	26.0%	111%	27.0%	107%
70 – 74	17,588	24.88%	24.0%	104%	24.0%	104%
Total	352,290	28.31%	24.60%	115%	26.29%	108%

Actual Versus Proposed Experience, Benefit-Weighted Basis
Unreduced Retirements – **Males**



All Divisions (DPS Benefit Structure)
Unreduced Retirements – **Females**

Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
< 55	818	33.39%	30.4%	110%	30.4%	110%
55	1,206	47.20%	34.0%	139%	41.0%	115%
56	4,089	23.65%	24.0%	99%	24.0%	99%
57	4,180	25.23%	25.0%	101%	25.0%	101%
58	3,524	21.76%	20.0%	109%	21.0%	104%
59	3,119	22.34%	28.0%	80%	25.0%	89%
60	3,400	21.14%	25.0%	85%	23.0%	92%
61	2,696	34.91%	28.0%	125%	31.0%	113%
62	2,192	34.71%	30.0%	116%	31.0%	112%
63	2,039	23.91%	31.0%	77%	31.0%	77%
64	2,053	20.13%	42.0%	48%	31.0%	65%
65	3,139	51.19%	38.0%	135%	45.0%	114%
66	4,422	39.71%	35.0%	113%	35.0%	113%
67	3,124	39.20%	32.0%	123%	35.0%	112%
68	1,854	48.38%	27.0%	179%	35.0%	138%
69	1,266	15.59%	29.0%	54%	35.0%	45%
70 – 74	3,481	30.11%	29.3%	103%	30.0%	100%
Total	46,603	30.86%	29.29%	105%	30.14%	102%

Actual Versus Proposed Experience, Benefit-Weighted Basis
Unreduced Retirements – **Females**

All Divisions (DPS Benefit Structure)
Unreduced Retirements – **Males**

Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
< 55	756	40.95%	31.9%	128%	35.3%	116%
55	810	74.63%	30.0%	249%	30.0%	249%
56	1,843	34.03%	20.0%	170%	27.0%	126%
57	1,638	28.01%	26.0%	108%	27.0%	104%
58	1,981	23.10%	22.0%	105%	36.0%	64%
59	1,542	58.58%	26.0%	225%	36.0%	163%
60	1,373	39.37%	26.0%	151%	33.0%	119%
61	1,001	34.10%	18.0%	189%	26.0%	131%
62	992	36.57%	27.0%	135%	32.0%	114%
63	1,003	28.10%	40.0%	70%	34.0%	83%
64	881	28.24%	24.0%	118%	26.0%	109%
65	865	41.51%	38.0%	109%	40.0%	104%
66	1,716	18.38%	30.0%	61%	28.0%	66%
67	1,673	26.67%	30.0%	89%	28.0%	95%
68	1,277	24.10%	30.0%	80%	28.0%	86%
69	820	35.49%	30.0%	118%	28.0%	127%
70 – 74	958	55.45%	30.0%	185%	43.1%	129%
Total	21,130	34.96%	27.43%	127%	31.30%	112%

Actual Versus Proposed Experience, Benefit-Weighted Basis
Unreduced Retirements – **Males**

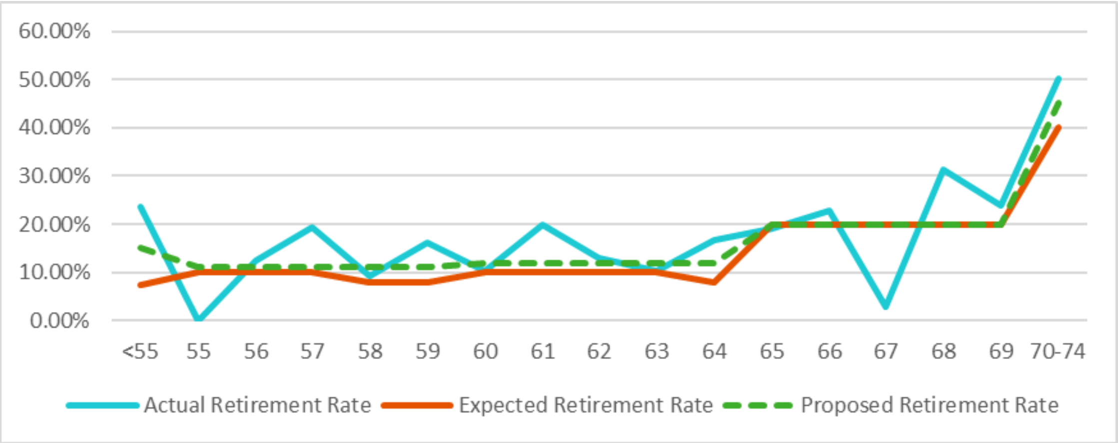
IV. Demographic Assumptions

The following table and graph shows the actual retirement experience compared to the current and proposed assumptions for the Judicial Division:

Judicial Division
All Retirements – **Unisex**

Age	Exposures (Benefits, in 000's)	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
<55	1,040	23.55%	7.3%	323%	15.0%	157%
55	1,147	0.00%	10.0%	0%	11.0%	0%
56	1,503	12.45%	10.0%	125%	11.0%	113%
57	1,606	19.32%	10.0%	193%	11.0%	176%
58	2,041	9.32%	8.0%	117%	11.0%	85%
59	2,251	16.11%	8.0%	201%	11.0%	146%
60	3,528	10.31%	10.0%	103%	12.0%	86%
61	3,718	19.78%	10.0%	198%	12.0%	165%
62	3,028	13.06%	10.0%	131%	12.0%	109%
63	2,773	10.34%	10.0%	103%	12.0%	86%
64	2,360	16.80%	8.0%	210%	12.0%	140%
65	2,270	19.14%	20.0%	96%	20.0%	96%
66	1,842	22.91%	20.0%	115%	20.0%	115%
67	1,921	2.85%	20.0%	14%	20.0%	14%
68	2,179	31.24%	20.0%	156%	20.0%	156%
69	2,076	23.95%	20.0%	120%	20.0%	120%
70 - 74	4,100	50.13%	40.0%	125%	45.0%	111%
Total	39,385	19.34%	15.33%	126%	17.39%	111%

Actual Versus Proposed Experience, Benefit-Weighted Basis
All Retirements – **Unisex**



Inactive Vested Retirement

The current assumption is that 100% of inactive members who terminated employer with less than five years of service elect to withdraw their contributions. Current inactive members in the PERA Benefit Structure who are assumed to leave their contributions in the plan in order to be eligible for a benefit at their retirement date are assumed to retire at first eligibility for an unreduced pension benefit. Current inactive members in the DPS Benefit Structure who are assumed to leave their contributions in the plan in order to be eligible for a benefit at their retirement date are assumed to retire at age 65 with an unreduced pension benefit.

We reviewed actual experience related to inactive vested members. Actual experience shows that some members retire earlier than the current assumption. Based on the experience over the most recent eight years we recommend adding the following rates of reduced retirement applicable to inactive members of State and Local Government Divisions (Non-Safety Officer), and School and DPS Divisions (PERA Benefit Structure):

Reduced Inactive Vested Retirements – **Unisex**

Division	Exposures (Benefits, in 000's)	Actual Retirements	Actual Retirement Rate	Proposed Retirement Rate
State and Local Government (Non-Safety Officers)	134,906	27,299	20.2%	20.0%
School and DPS PERA	146,264	26,138	17.9%	18.0%

C. Termination

The termination rates used in annual actuarial valuations project the percentage of employees at each age or service duration that will terminate membership before retirement. These rates take account of possible terminations for all causes other than retirement, death, or disability. They include both voluntary and involuntary withdrawals from service.

Terminations before retirement give rise to some benefit rights but may also involve the forfeiture of a portion of previously accrued benefits. Forfeitures resulting from turnover are anticipated in advance and help finance benefits that become payable to other members.

The termination experience studied includes all terminations of active employment for members not vested at termination (since such members are not eligible for other benefits, termination of employment will, most likely, result in a withdrawal of employee contributions), and terminations of membership for members who were vested and either withdrew their contributions or are eligible for future benefits. Rehired members offset these terminations in order to determine the net terminations for each year.

The current assumption for termination uses Select and Ultimate Tables for the State Division (Non-Safety Officer), School and DPS Divisions (PERA Benefit Structure), and Local Government Division (Non-Safety Officer). Because all DPS Benefit Structure members have more than five years of service, the termination assumptions are based on age only. We have analyzed the ultimate period to determine if the select period should be extended or eliminated and recommend that the current select period be retained. There are no Select-period termination rates for Safety Officers; however, based on the experience data, we recommend adding a Select-period scale. Proposed rates of termination have been developed based on weighting the current assumption (i.e., historical experience) by one-half and recent experience by one-half.

IV. Demographic Assumptions

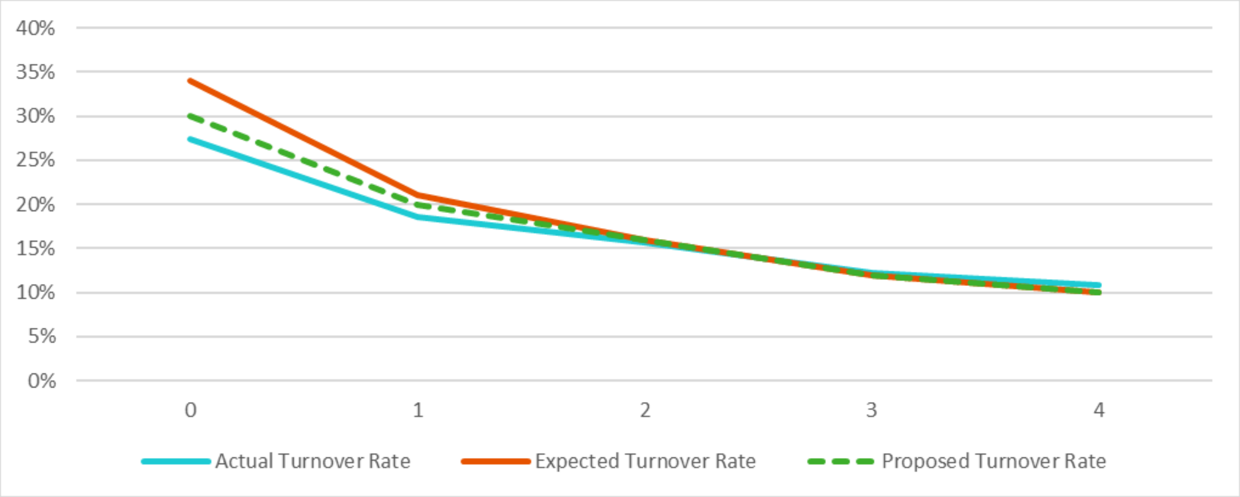
Select Termination Rates

The current select termination rates are unisex. Based on our analysis, we recommend that unisex rates continue to be applied and that some of the select termination rates be slightly decreased. The following tables provide a summary of select termination rates by division for the study period:

State and Local Government Divisions (Non-Safety Officers)
0 to 5 Years From Hire – **Unisex**

Years from Hire	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
0	37,171	27.41%	34.00%	81%	30.00%	91%
1	24,543	18.56%	21.00%	88%	20.00%	93%
2	19,587	15.63%	16.00%	98%	16.00%	98%
3	17,317	12.29%	12.00%	102%	12.00%	102%
4	14,444	10.86%	10.00%	109%	10.00%	109%
Total	113,062	19.02%	21.62%	88%	20.09%	95%

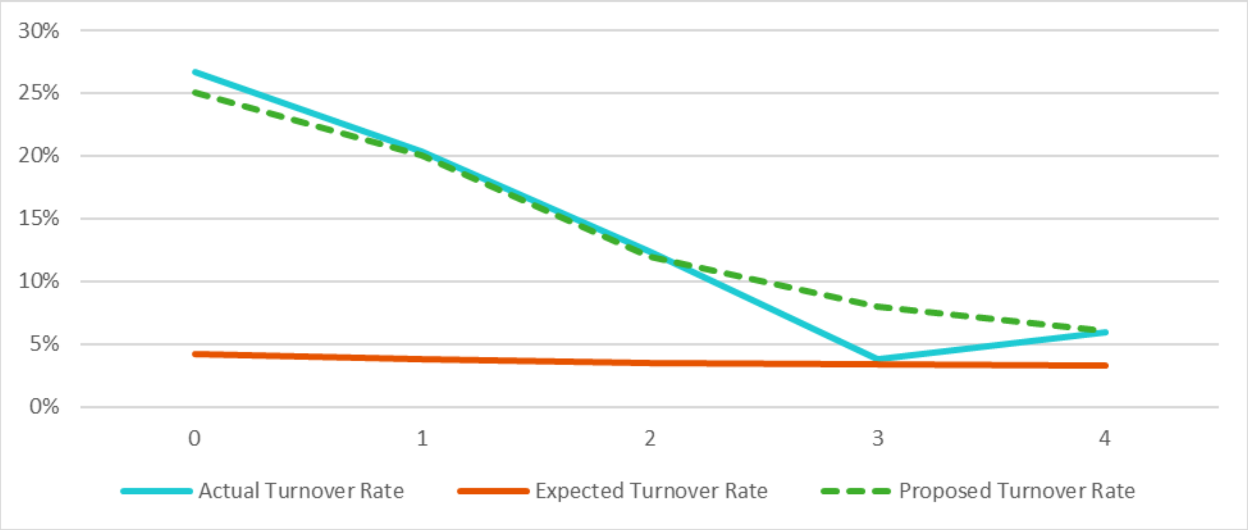
Actual Versus Proposed Experience, Headcount Basis
Select Period Termination – **Unisex**



State and Local Government Divisions (Safety Officers)
0 to 5 Years From Hire – **Unisex**

Years from Hire	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
0	1,780	26.69%	4.22%	632%	25.00%	107%
1	988	20.34%	3.82%	533%	20.00%	102%
2	477	12.37%	3.52%	351%	12.00%	103%
3	237	3.80%	3.43%	111%	8.00%	47%
4	219	5.94%	3.29%	180%	6.00%	99%
Total	3,701	20.45%	3.92%	522%	19.78%	103%

Actual Versus Proposed Experience, Headcount Basis
Select Period Termination – **Unisex**

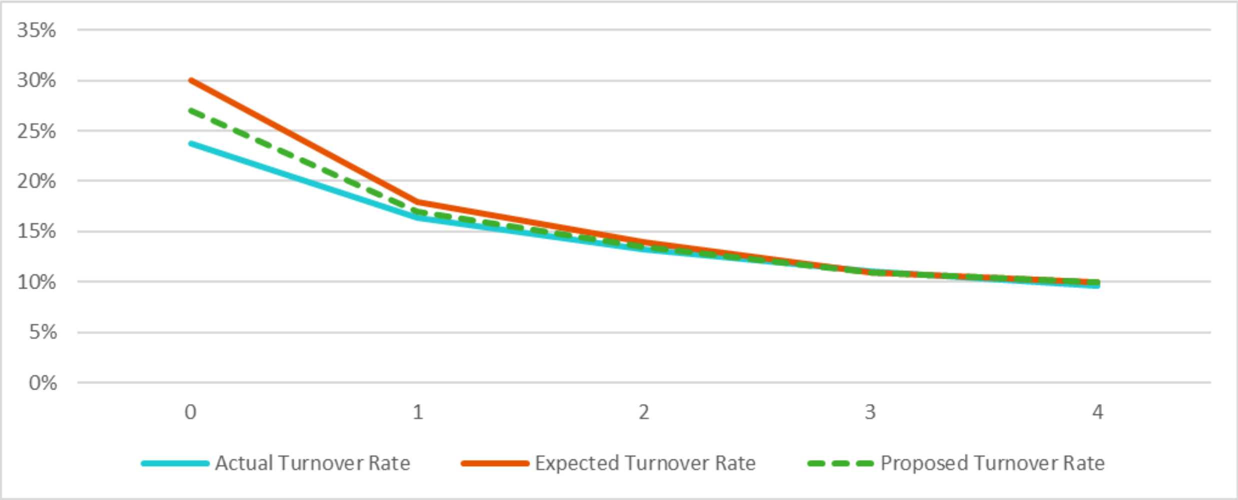


IV. Demographic Assumptions

School Division
0 to 5 Years From Hire – **Unisex**

Years from Hire	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
0	74,999	23.77%	30.00%	79%	27.00%	88%
1	48,513	16.32%	18.00%	91%	17.00%	96%
2	36,770	13.24%	14.00%	95%	13.50%	98%
3	31,440	11.01%	11.00%	100%	11.00%	100%
4	26,706	9.66%	10.00%	97%	10.00%	97%
Total	218,428	16.78%	19.46%	86%	18.12%	93%

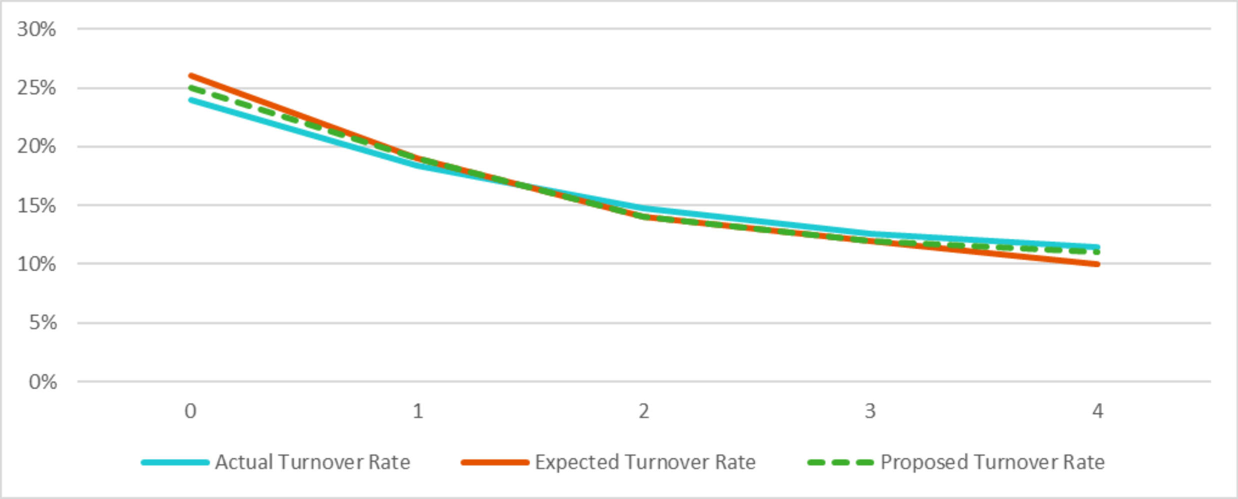
Actual Versus Proposed Experience, Headcount Basis
Select Period Termination – **Unisex**



DPS Division (PERA Benefit Structure)
0 to 5 Years From Hire – **Unisex**

Years from Hire	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
0	8,470	23.98%	26.00%	92%	25.00%	96%
1	6,471	18.37%	19.00%	97%	19.00%	97%
2	5,098	14.71%	14.00%	105%	14.00%	105%
3	4,682	12.56%	12.00%	105%	12.00%	105%
4	4,157	11.40%	10.00%	114%	11.00%	104%
Total	28,878	17.43%	17.74%	98%	17.59%	99%

Actual Versus Proposed Experience, Headcount Basis
Select Period Termination – **Unisex**



IV. Demographic Assumptions

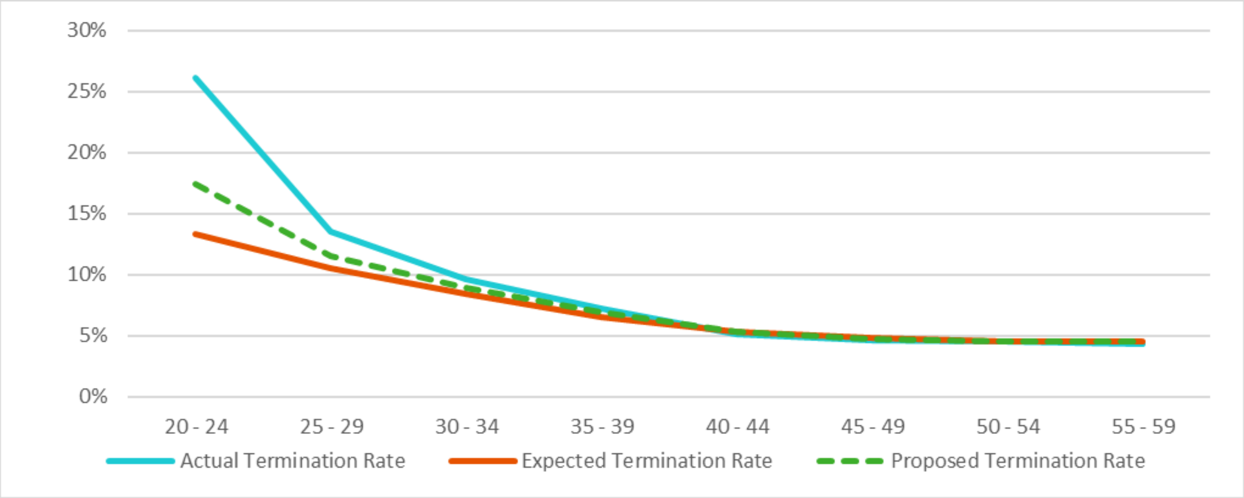
Ultimate Termination Rates

The current ultimate termination assumptions are sex-distinct and based on age. We recommend at least some minor changes – both increases and decreases – to the rates of termination in most cases (with the exception of the Judicial Division, which remain unchanged). The following tables and graphs show the actual, expected, and proposed termination rates based on age and gender:

State and Local Government Divisions (Non-Safety Officers)
More Than 5 Years From Hire – **Females**

Age	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
20 – 24	23	26.09%	13.29%	196%	17.42%	150%
25 – 29	1,094	13.53%	10.49%	129%	11.48%	118%
30 – 34	5,239	9.66%	8.39%	115%	8.93%	108%
35 – 39	8,413	7.20%	6.55%	110%	6.89%	105%
40 – 44	10,642	5.10%	5.33%	96%	5.33%	96%
45 – 49	11,419	4.65%	4.77%	97%	4.73%	98%
50 – 54	10,831	4.51%	4.53%	100%	4.52%	100%
55 – 59	7,879	4.28%	4.50%	95%	4.50%	95%
Total	55,540	5.70%	5.52%	103%	5.63%	101%

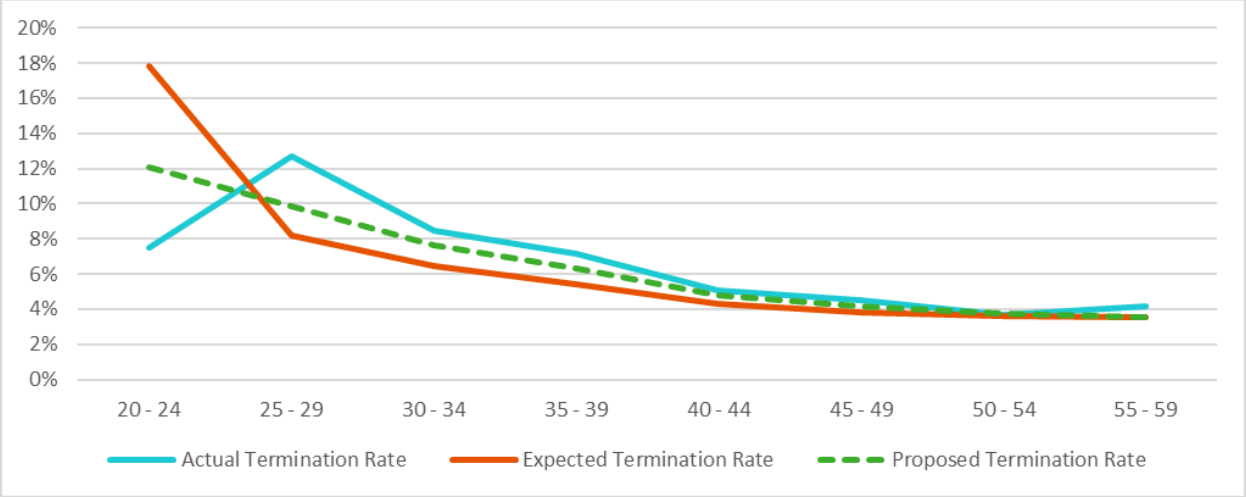
Actual Versus Proposed Experience, Headcount Basis
Ultimate Termination – **Females**



State and Local Government Divisions (Non-Safety Officers)
More Than 5 Years From Hire – **Males**

Age	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
20 – 24	40	7.50%	17.83%	42%	12.10%	62%
25 – 29	1,003	12.66%	8.19%	155%	9.83%	129%
30 – 34	4,176	8.45%	6.48%	130%	7.62%	111%
35 – 39	7,244	7.15%	5.44%	131%	6.29%	114%
40 – 44	9,650	5.06%	4.31%	117%	4.81%	105%
45 – 49	10,304	4.54%	3.79%	120%	4.19%	108%
50 – 54	9,526	3.68%	3.61%	102%	3.74%	99%
55 – 59	6,108	4.14%	3.51%	118%	3.52%	118%
Total	48,051	5.33%	4.41%	121%	4.88%	109%

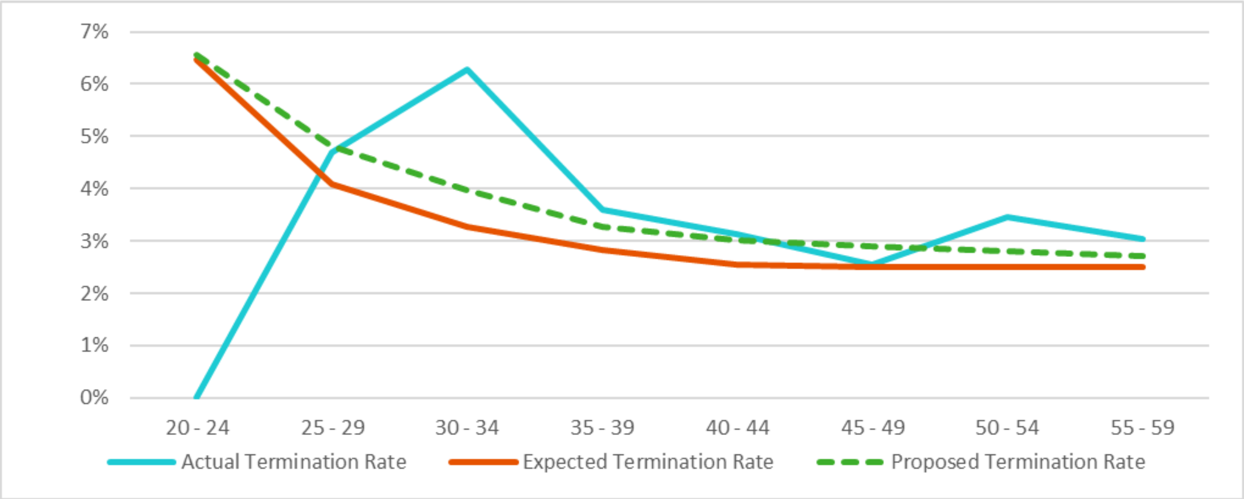
Actual Versus Proposed Experience, Headcount Basis
Ultimate Termination – **Males**



State and Local Government Divisions (Safety Officers)
All Years of Service – **Unisex**

Age	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
20 – 24	0	0.00%	6.47%	0%	6.56%	0%
25 – 29	64	4.69%	4.08%	115%	4.82%	97%
30 – 34	319	6.27%	3.27%	191%	3.97%	158%
35 – 39	557	3.59%	2.82%	127%	3.27%	110%
40 – 44	577	3.12%	2.54%	123%	3.02%	103%
45 – 49	591	2.54%	2.50%	102%	2.90%	88%
50 – 54	203	3.45%	2.50%	138%	2.80%	123%
55 – 59	66	3.03%	2.50%	121%	2.70%	112%
Total	2,377	3.58%	2.73%	131%	3.20%	112%

Actual Versus Proposed Experience, Headcount Basis
Termination – **Unisex**

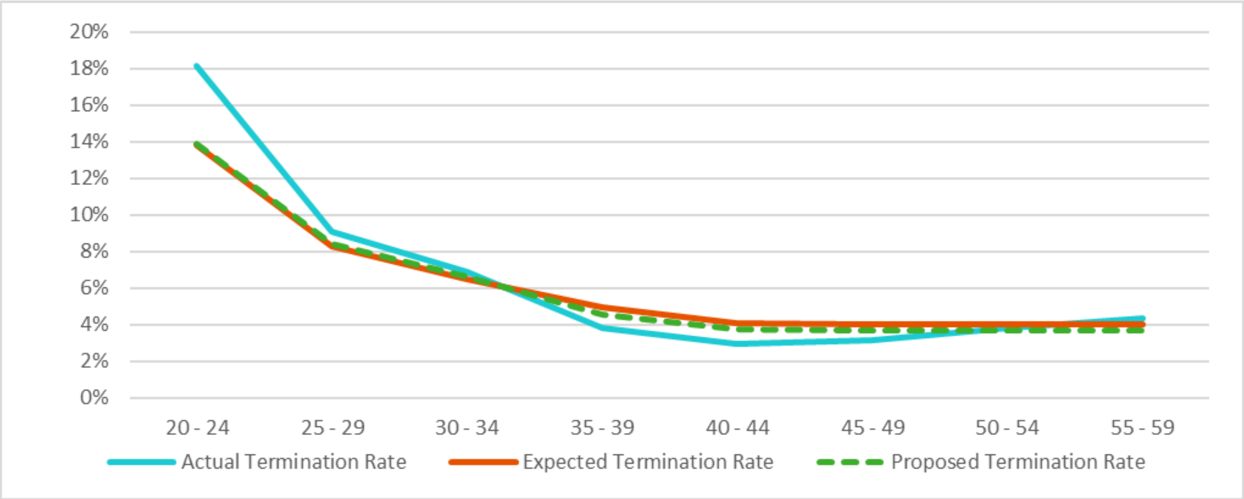


IV. Demographic Assumptions

School Division
More Than 5 Years From Hire – **Females**

Age	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
20 – 24	149	18.12%	13.83%	131%	13.87%	131%
25 – 29	4,521	9.09%	8.28%	110%	8.40%	108%
30 – 34	17,397	6.91%	6.49%	106%	6.59%	105%
35 – 39	24,521	3.82%	4.92%	78%	4.56%	84%
40 – 44	32,156	2.96%	4.10%	72%	3.77%	78%
45 – 49	35,307	3.18%	4.00%	80%	3.70%	86%
50 – 54	31,394	3.80%	4.00%	95%	3.70%	103%
55 – 59	19,684	4.32%	4.00%	108%	3.70%	117%
Total	165,129	4.05%	4.54%	89%	4.29%	95%

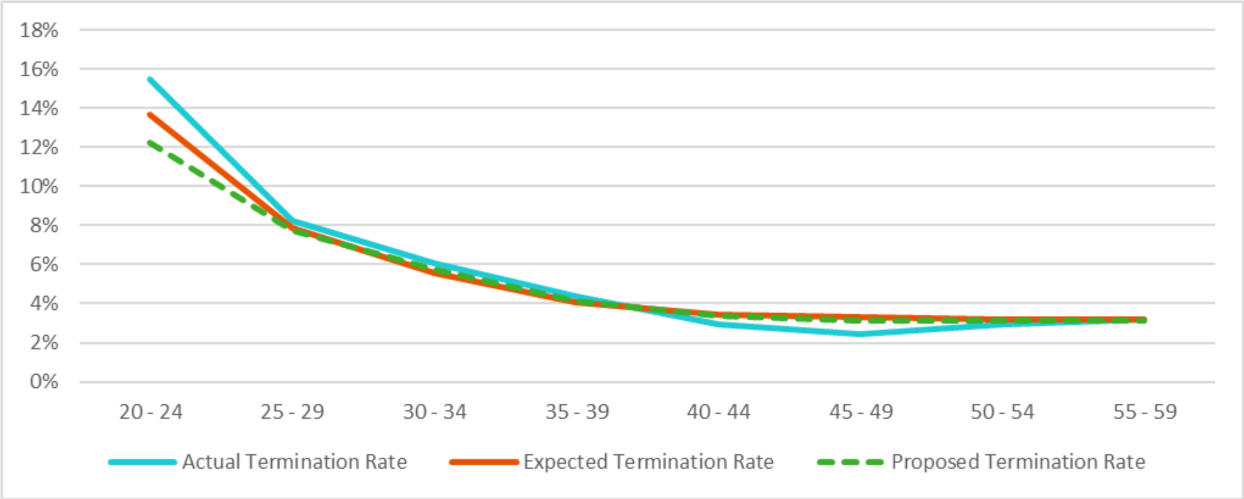
Actual Versus Proposed Experience, Headcount Basis
Ultimate Termination – **Females**



School Division
More Than 5 Years From Hire – **Males**

Age	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
20 – 24	84	15.48%	13.70%	113%	12.26%	126%
25 – 29	1,514	8.26%	7.87%	105%	7.77%	106%
30 – 34	5,529	6.06%	5.54%	109%	5.75%	105%
35 – 39	8,070	4.37%	4.09%	107%	4.12%	106%
40 – 44	10,267	2.96%	3.46%	86%	3.35%	88%
45 – 49	11,065	2.46%	3.30%	74%	3.12%	79%
50 – 54	8,258	2.94%	3.22%	91%	3.10%	95%
55 – 59	4,784	3.20%	3.20%	100%	3.10%	103%
Total	49,571	3.63%	3.85%	94%	3.78%	96%

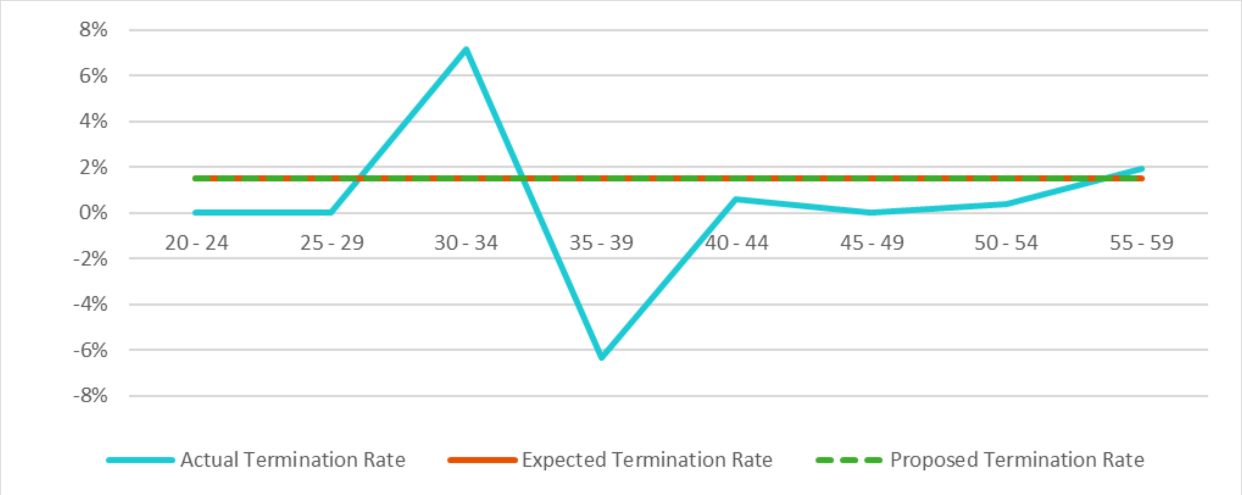
Actual Versus Proposed Experience, Headcount Basis
Ultimate Termination – **Males**



Judicial Division
All Years of Service – **Unisex**

Age	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
20 – 24	0	0.00%	1.50%	0%	1.50%	0%
25 – 29	0	0.00%	1.50%	0%	1.50%	0%
30 – 34	14	7.14%	1.50%	476%	1.50%	476%
35 – 39	63	-6.35%	1.50%	-401%	1.50%	-401%
40 – 44	163	0.61%	1.50%	41%	1.50%	41%
45 – 49	206	0.00%	1.50%	0%	1.50%	0%
50 – 54	269	0.37%	1.50%	25%	1.50%	25%
55 – 59	205	1.95%	1.50%	131%	1.50%	131%
Total	920	0.33%	1.50%	22%	1.50%	22%

Actual Versus Proposed Experience, Headcount Basis
Termination – **Unisex**

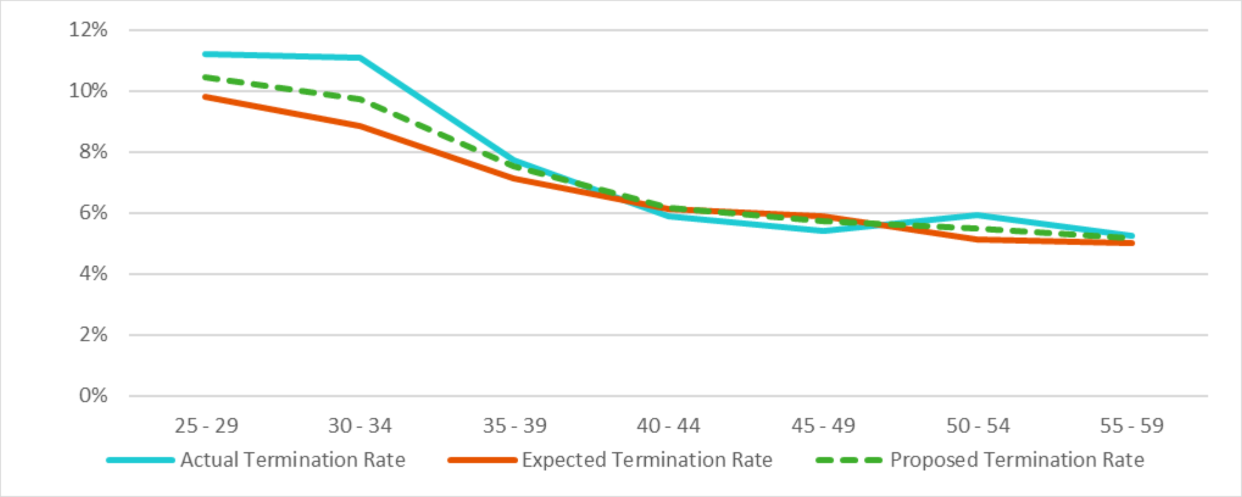


Actual turnover studied in the experience data is net of rehires. Due to the relatively low actual experience in the Judicial Division, there were more rehires than terminations between age 35 and 39, which resulted in a “negative” actual termination rate. Given the low level of experience, we recommend no change in the termination rates for the Judicial Division.

DPS Division (PERA Benefit Structure)
More Than 5 Years From Hire – **Females**

Age	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
25 – 29	804	11.19%	9.82%	114%	10.43%	107%
30 – 34	3,418	11.09%	8.83%	126%	9.72%	114%
35 – 39	3,454	7.73%	7.13%	108%	7.54%	103%
40 – 44	2,476	5.90%	6.13%	96%	6.16%	96%
45 – 49	1,991	5.42%	5.88%	92%	5.72%	95%
50 – 54	1,683	5.94%	5.14%	116%	5.47%	109%
55 – 59	1,085	5.25%	5.00%	105%	5.16%	102%
Total	14,911	7.69%	6.95%	111%	7.32%	105%

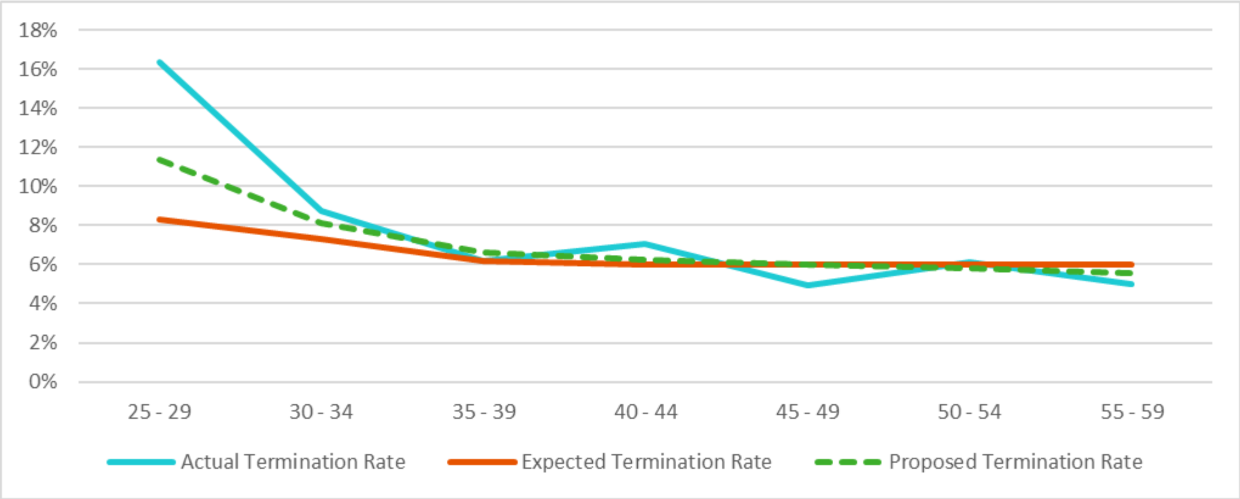
Actual Versus Proposed Experience, Headcount Basis
Ultimate Termination – **Females**



DPS Division (PERA Benefit Structure)
More Than 5 Years From Hire – **Males**

Age	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
25 – 29	245	16.33%	8.30%	197%	11.41%	143%
30 – 34	892	8.74%	7.31%	120%	8.13%	108%
35 – 39	1,395	6.16%	6.15%	100%	6.61%	93%
40 – 44	1,046	7.07%	6.00%	118%	6.23%	114%
45 – 49	689	4.93%	6.00%	82%	6.01%	82%
50 – 54	524	6.11%	6.00%	102%	5.79%	106%
55 – 59	400	5.00%	6.00%	83%	5.54%	90%
Total	5,191	7.01%	6.38%	110%	6.77%	104%

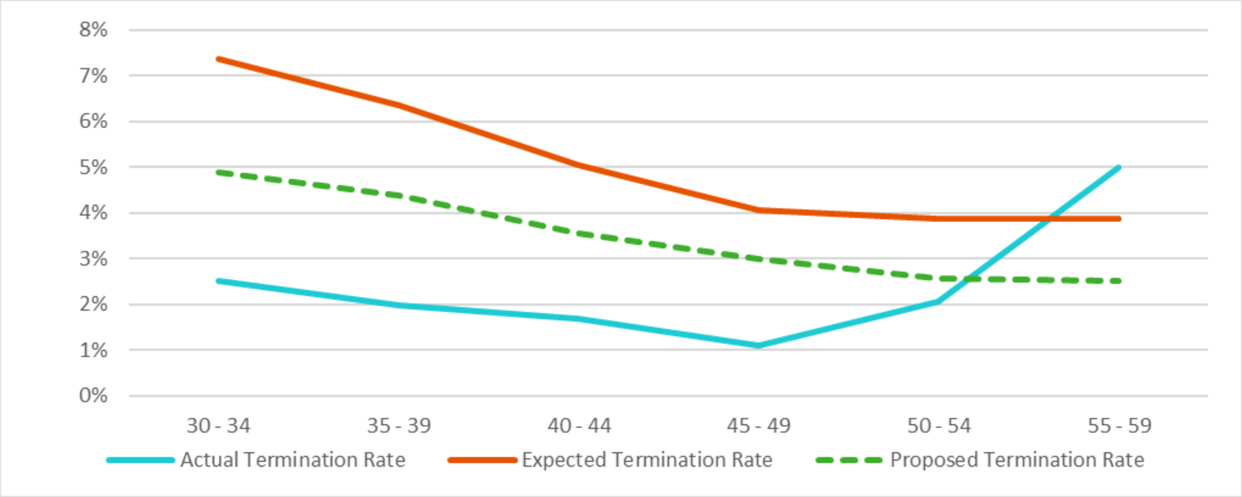
Actual Versus Proposed Experience, Headcount Basis
Ultimate Termination – **Males**



All Divisions (DPS Benefit Structure)
All Years of Service – **Females**

Age	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
30 – 34	120	2.50%	7.36%	34%	4.89%	51%
35 – 39	1,064	1.97%	6.36%	31%	4.38%	45%
40 – 44	1,651	1.70%	5.03%	34%	3.55%	48%
45 – 49	1,900	1.11%	4.05%	27%	3.00%	37%
50 – 54	1,550	2.06%	3.88%	53%	2.57%	80%
55 – 59	421	4.99%	3.87%	129%	2.50%	200%
Total	6,706	1.88%	4.67%	40%	3.26%	58%

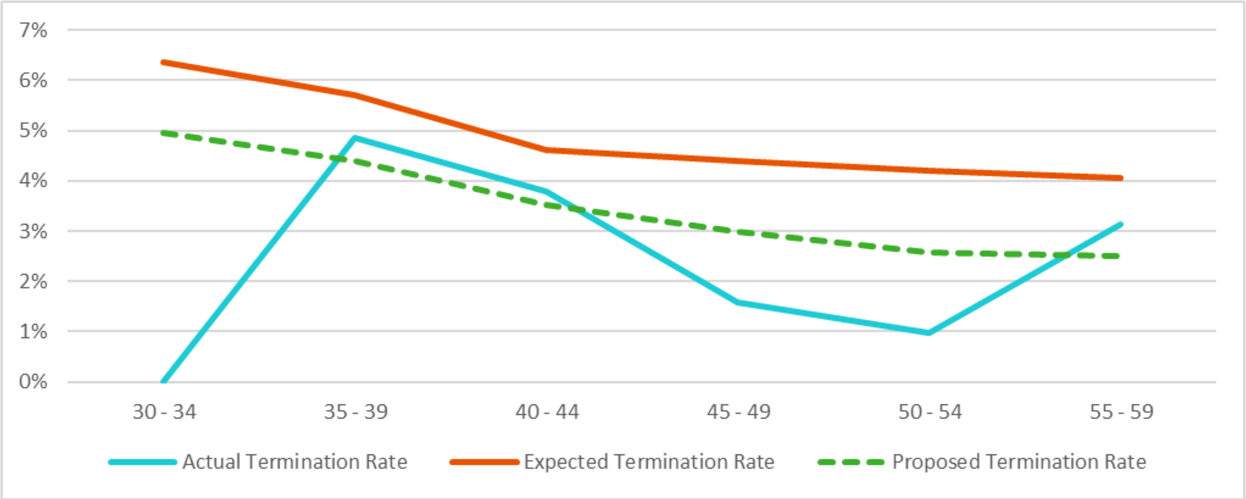
Actual Versus Proposed Experience, Headcount Basis
Termination – **Females**



All Divisions (DPS Benefit Structure)
All Years of Service – **Males**

Age	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
30 – 34	60	0.00%	6.35%	0%	4.95%	0%
35 – 39	309	4.85%	5.69%	85%	4.41%	110%
40 – 44	501	3.79%	4.61%	82%	3.52%	108%
45 – 49	698	1.58%	4.39%	36%	3.00%	53%
50 – 54	515	0.97%	4.20%	23%	2.57%	38%
55 – 59	160	3.13%	4.04%	77%	2.50%	125%
Total	2,243	2.45%	4.60%	53%	3.23%	76%

Actual Versus Proposed Experience, Headcount Basis
Termination – **Males**



The proposed rates for DPS Benefit Structure male rates are identical to the proposed female rates, effectively establishing a unisex termination rate basis.

Refunds of Contributions

For all but the Judicial Division, the current assumption is that 35% of the vested members who terminate elect to withdraw their contributions and matching employer contributions while the remaining 65% elect to leave their contributions in the plan in order to be eligible for a benefit at their retirement date. For Judicial Division members, the current assumption is that 100% of the vested members who terminate elect to leave their contribution in in the plan in order to be eligible for a benefit at their retirement date. Current active members who are assumed to terminate service and leave their contributions in the Plan in order to be eligible for a benefit at their retirement date are assumed to retire with a reduced benefit, if applicable, at an age based upon benefit structure, Non-Trooper/Trooper, and/or service.

There is very little actual experience from the Judicial Division. **We recommend maintaining the current 100% assumption for this group**.

For all other divisions, we examined actual refund of contribution elections for members during the experience period. The observed election percentage during the experience period is around 29.4%. **We recommend maintaining the current assumption of 35%**.

D. Disability Retirement

Disability incidence rates function in the same way as retirement rate tables. The rate at each age indicates the probability of becoming disabled before the next age. Disability rates add liability for the value of disability benefits, but lessen the value of retirement benefits ultimately payable, since anyone who becomes disabled is not projected to receive retirement benefits other than the disability benefit.

The current disability rates are based on age and are unisex for all divisions. Rates are the highest for Safety Officers within the State and Local Government Divisions and are the lowest for the School and DPS Divisions (PERA Benefit Structure). Aggregate experience for the period January 1, 2020, to December 31, 2023, resulted in net losses for PERA, although the Judicial Division had no disability retirements during the experience period, which resulted in actuarial gains.

Actual experience is comparable between the State and Local Government Divisions (non-Safety Officers) and they have been aggregated for purposes of developing a proposed assumption. Similarly, since the School and DPS Divisions (PERA Benefit Structure), the Judicial Division, and members under the DPS Benefit Structure all have similar profiles for disability incidence, they were combined for purposes of developing a proposed assumption.

Actual disability incidence over the experience period was less than assumed (except for the Judicial Division) and so, in general, reductions to rates were proposed.

State and Local Government Divisions (Non-Safety Officers)
All Ages Less Than 65 – **Unisex**

Age	Exposures (Benefits, in 000's)	Actual Disability Rate	Expected Disability Rate	Ratio of Actual to Expected	Proposed Disability Rate	Ratio of Actual to Proposed
Total	3,731,297	0.084%	0.144%	58%	0.115%	73%

Based on the experience, **we recommend decreases to rates of about 20%, on average**.

State and Local Government Divisions (Safety Officers)
All Ages Less Than 65 – **Unisex**

Age	Exposures (Benefits, in 000's)	Actual Disability Rate	Expected Disability Rate	Ratio of Actual to Expected	Proposed Disability Rate	Ratio of Actual to Proposed
Total	122,403	0.128%	0.214%	60%	0.178%	72%

Based on the experience, **we recommend decreases to rates of about 19%, on average**.

School, Judicial and DPS Divisions
All Ages Less Than 65 – **Unisex**

Age	Exposures (Benefits, in 000's)	Actual Disability Rate	Expected Disability Rate	Ratio of Actual to Expected	Proposed Disability Rate	Ratio of Actual to Proposed
Total	7,198,575	0.048%	0.086%	56%	0.067%	72%

Based on the experience, **we recommend decreases to rates of about 22%, on average**.

E. Spouse Information

Spouse information assumptions that affect the valuation include the percentage of members married and the age difference of spouses. The current assumptions are:

- 100% of active members (80% for DPS Division) are married
- Male spouses are two years older than female spouses
- 100% of spouses are of the opposite gender

We have limited data on marital status and spouse information. However, the current assumptions are reasonable and consistent with assumptions used for similar plans. In addition, all optional forms of payment are actuarially equivalent, so these assumptions do not have a material effect on the valuation results. Therefore, **we recommend no changes to the current assumptions**.

V. Appendix

Appendix A: Proposed Salary Scale

State Division (Non-Safety Officers)

Age	Current	Proposed	Age	Current	Proposed
20	10.90%	13.30%	44	4.70%	4.60%
21	10.40	13.30	45	4.60	4.50
22	9.90	10.10	46	4.50	4.30
23	9.40	9.60	47	4.40	4.20
24	8.90	9.10	48	4.30	4.10
25	8.50	8.70	49	4.20	4.00
26	8.00	8.20	50	4.10	4.00
27	7.50	7.70	51	4.00	3.90
28	7.30	7.40	52	3.90	3.80
29	7.00	7.20	53	3.80	3.70
30	6.80	6.90	54	3.80	3.70
31	6.50	6.70	55	3.70	3.60
32	6.30	6.40	56	3.70	3.60
33	6.20	6.20	57	3.60	3.50
34	6.00	6.10	58	3.60	3.40
35	5.90	5.90	59	3.50	3.30
36	5.70	5.80	60	3.50	3.20
37	5.60	5.60	61	3.40	3.10
38	5.50	5.50	62	3.40	3.00
39	5.30	5.30	63	3.40	2.90
40	5.20	5.20	64	3.40	2.90
41	5.00	5.00	65	3.30	2.80
42	4.90	4.90	66	3.30	2.80
43	4.80	4.80	67 & over	3.30	2.70

Proposed Salary Scale

State and Local Government Divisions (Safety Officers)

Age	Current	Proposed	Age	Current	Proposed
20	12.40%	16.30%	44	4.70%	4.70%
21	11.70	16.30	45	4.70	4.60
22	11.00	10.20	46	4.60	4.50
23	10.30	9.70	47	4.50	4.40
24	9.60	9.10	48	4.40	4.40
25	8.90	8.60	49	4.30	4.30
26	8.20	8.00	50	4.30	4.30
27	7.50	7.50	51	4.20	4.20
28	7.30	7.20	52	4.10	4.20
29	7.00	6.90	53	4.00	4.20
30	6.80	6.50	54	4.00	4.10
31	6.50	6.20	55	3.90	4.10
32	6.30	5.90	56	3.90	4.00
33	6.20	5.80	57	3.80	4.00
34	6.00	5.80	58	3.70	3.90
35	5.90	5.70	59	3.70	3.70
36	5.70	5.70	60	3.60	3.60
37	5.60	5.60	61	3.60	3.40
38	5.50	5.50	62	3.50	3.30
39	5.30	5.30	63	3.40	3.30
40	5.20	5.20	64	3.40	3.30
41	5.00	5.00	65	3.30	3.20
42	4.90	4.90	66	3.30	3.20
43	4.80	4.80	67 & over	3.20	3.20

V. Appendix

Proposed Salary Scale

School Division

Age	Current	Proposed	Age	Current	Proposed
20	11.00%	13.40%	44	5.30%	6.00%
21	10.50	13.40	45	5.10	5.80
22	10.00	13.10	46	5.00	5.70
23	9.50	12.10	47	4.90	5.50
24	9.10	11.10	48	4.80	5.40
25	8.60	10.20	49	4.70	5.30
26	8.20	9.20	50	4.60	5.20
27	7.70	8.20	51	4.50	5.10
28	7.50	8.00	52	4.40	5.00
29	7.20	7.70	53	4.30	4.90
30	7.00	7.50	54	4.20	4.80
31	6.70	7.20	55	4.20	4.80
32	6.50	7.00	56	4.10	4.70
33	6.40	7.00	57	4.00	4.60
34	6.30	7.00	58	3.90	4.50
35	6.30	7.00	59	3.90	4.50
36	6.20	7.00	60	3.80	4.40
37	6.10	7.00	61	3.80	4.40
38	6.00	6.90	62	3.70	4.30
39	5.90	6.70	63	3.60	4.20
40	5.70	6.60	64	3.60	4.20
41	5.60	6.40	65	3.50	4.10
42	5.50	6.30	66	3.50	4.10
43	5.40	6.10	67 & over	3.40	4.00

Proposed Salary Scale

Local Government Division (Non-Safety Officers)

Age	Current	Proposed	Age	Current	Proposed
20	11.30%	13.00%	44	4.90%	5.60%
21	10.80	13.00	45	4.80	5.40
22	10.30	13.00	46	4.80	5.30
23	9.80	12.20	47	4.70	5.20
24	9.20	11.40	48	4.60	5.10
25	8.70	10.60	49	4.60	5.10
26	8.10	9.80	50	4.50	5.00
27	7.60	9.00	51	4.50	5.00
28	7.30	8.70	52	4.40	4.90
29	7.00	8.30	53	4.30	4.80
30	6.80	8.00	54	4.30	4.70
31	6.50	7.60	55	4.20	4.60
32	6.20	7.30	56	4.20	4.50
33	6.10	7.10	57	4.10	4.40
34	6.00	7.00	58	4.00	4.30
35	5.80	6.80	59	4.00	4.30
36	5.70	6.70	60	3.90	4.20
37	5.60	6.50	61	3.90	4.20
38	5.50	6.40	62	3.80	4.10
39	5.40	6.20	63	3.70	4.00
40	5.20	6.10	64	3.60	3.80
41	5.10	5.90	65	3.40	3.70
42	5.00	5.80	66	3.30	3.50
43	4.90	5.70	67 & over	3.20	3.40

Proposed Salary Scale

Judicial Division

Service	Current	Proposed	Service	Current	Proposed
0	5.30%	4.70%	21	3.90%	3.00%
1	5.30	4.70	22	3.80	3.00
2	5.30	4.70	23	3.80	3.00
3	5.20	4.70	24	3.70	2.90
4	5.10	4.70	25	3.70	2.90
5	5.00	4.60	26	3.60	2.80
6	4.90	4.60	27	3.60	2.80
7	4.80	4.60	28	3.50	2.80
8	4.70	4.40	29	3.50	2.72
9	4.60	4.20	30	3.40	2.68
10	4.50	3.90	31	3.40	2.60
11	4.40	3.70	32	3.30	2.60
12	4.30	3.50	33	3.30	2.50
13	4.30	3.40	34	3.20	2.50
14	4.20	3.40	35	3.20	2.40
15	4.20	3.30	36	3.10	2.40
16	4.10	3.30	37	3.10	2.30
17	4.10	3.20	38	3.00	2.30
18	4.00	3.20	39	2.90	2.30
19	4.00	3.10	40	2.80	2.30
20	3.90	3.10	41 & over	2.80	2.30

Proposed Salary Scale

Denver Public Schools Division

Age	Current	Proposed	Age	Current	Proposed
20	11.50%	16.80%	44	5.60%	6.50%
21	11.10	16.80	45	5.50	6.40
22	10.70	14.90	46	5.30	6.30
23	10.30	13.90	47	5.20	6.20
24	9.90	13.00	48	5.10	6.10
25	9.40	12.00	49	5.00	6.00
26	9.00	11.10	50	5.00	5.90
27	8.60	10.10	51	4.90	5.80
28	8.30	9.60	52	4.80	5.70
29	8.00	9.10	53	4.70	5.60
30	7.80	8.50	54	4.70	5.50
31	7.50	8.00	55	4.60	5.30
32	7.20	7.50	56	4.60	5.20
33	7.10	7.40	57	4.50	5.10
34	7.00	7.30	58	4.40	5.00
35	6.90	7.20	59	4.30	4.80
36	6.80	7.10	60	4.30	4.70
37	6.70	7.00	61	4.20	4.50
38	6.50	6.90	62	4.10	4.40
39	6.40	6.90	63	4.00	4.30
40	6.20	6.80	64	4.00	4.20
41	6.10	6.80	65	3.90	4.10
42	5.90	6.70	66	3.90	4.00
43	5.80	6.60	67 & over	3.80	3.90

Appendix B: Proposed Retirement Rates

State and Local Government Divisions (Non-Safety Officers)
Reduced Retirements

Age	Current Females	Proposed Females	Current Males	Proposed Males
50	9.0%	8.0%	9.5%	8.5%
51	8.0	8.0	11.0	8.5
52	8.0	8.0	11.0	9.0
53	9.0	8.0	12.0	9.0
54	12.0	9.0	12.0	9.0
55	15.0	9.0	12.0	10.0
56	11.0	9.0	9.5	9.0
57	12.0	9.0	15.0	9.0
58	15.0	9.0	15.0	9.0
59	35.0	9.0	35.0	9.0
60	8.0	9.0	7.5	9.0
61	8.0	8.0	7.5	8.0
62	9.0	8.0	7.5	8.0
63	9.0	9.0	7.5	8.0
64	9.0	9.0	7.5	8.0

State and Local Government Divisions (Non-Safety Officers)
Unreduced Retirements

Age	Current Females	Proposed Females	Current Males	Proposed Males
50	48.0%	60.0%	56.0%	60.0%
51	35.0	30.0	43.0	57.0
52	34.0	33.0	38.0	47.0
53	28.0	31.0	34.0	36.0
54	30.0	33.0	33.0	33.0
55	25.0	37.0	26.0	41.0
56	20.0	21.0	19.0	21.0
57	19.0	19.0	18.0	20.0
58	18.0	19.0	17.0	20.0
59	18.0	19.0	20.0	21.0
60	21.0	21.0	20.0	20.0
61	18.0	20.0	19.0	20.0
62	20.0	20.0	23.0	20.0
63	18.0	18.0	20.0	22.0
64	21.0	20.0	22.0	22.0
65	27.0	32.0	27.0	29.0
66	27.0	27.0	29.0	27.0
67	25.0	25.0	28.0	28.0
68	24.0	26.0	24.0	25.0
69	24.0	24.0	24.0	24.5
70	24.0	24.0	24.0	24.5
71	24.0	24.0	24.0	24.5
72	24.0	24.0	24.0	24.5
73	24.0	24.0	24.0	24.5
74	24.0	24.0	24.0	24.5
75 & over	100.0	100.0	100.0	100.0

Additional increase in rates during the first 5 years of unreduced retirement at ages 55-64

Year of Eligibility	Female	Male
1st year	20%	30%
2nd year	9%	13%
3rd year	9%	13%
4th year	9%	13%
5th year	9%	13%

State and Local Government Divisions (Safety Officers) Reduced and Unretirements - **Unisex**

Age	Current Reduced	Proposed Reduced	Current Unreduced	Proposed Unreduced
50	10.0%	11.0%	40.0%	60.0%
51	10.0	11.0	28.0	38.0
52	10.0	11.0	28.0	32.0
53	10.0	11.0	28.0	32.0
54	10.0	11.0	28.0	32.0
55	5.0	11.0	28.0	28.0
56	5.0	11.0	28.0	28.0
57	5.0	11.0	28.0	28.0
58	5.0	11.0	28.0	28.0
59	5.0	11.0	28.0	28.0
60	10.0	12.0	28.0	30.0
61	10.0	12.0	28.0	30.0
62	10.0	12.0	28.0	30.0
63	10.0	12.0	28.0	30.0
64	10.0	12.0	28.0	30.0
65			100.0	100.0%

Additional increase in rates during the first 5 years of unreduced retirement at ages 55-64

Year of Eligibility	Unisex
1st year	20%
2nd year	0%
3rd year	0%
4th year	0%
5th year	0%

V. Appendix

School and DPS Divisions (PERA Benefit Structure)
Reduced Retirements

Age	Current Females	Proposed Females	Current Males	Proposed Males
50	7.0%	7.0%	8.0%	7.0%
51	7.0	7.0	8.0	7.0
52	8.0	7.0	9.0	7.0
53	10.0	8.0	9.0	7.0
54	14.0	10.0	12.0	9.0
55	12.0	10.5	9.0	9.0
56	12.0	10.5	9.0	9.0
57	12.0	10.5	9.0	9.0
58	16.0	10.5	12.0	9.0
59	34.0	10.5	24.0	9.0
60	9.0	12.0	8.0	10.0
61	9.0	10.0	9.0	9.5
62	10.0	10.0	10.0	9.5
63	10.0	10.0	10.0	9.5
64	10.0	10.0	10.0	9.5

V. Appendix

School and DPS Divisions (PERA Benefit Structure)
Unreduced Retirements

Age	Current Females	Proposed Females	Current Males	Proposed Males
50	55.0%	60.0%	52.0%	60.0%
51	45.0	43.0	43.0	45.0
52	41.0	43.0	41.0	38.0
53	37.0	41.0	39.0	42.0
54	34.0	36.0	37.0	38.0
55	28.0	41.0	27.0	41.0
56	24.0	25.0	22.0	25.0
57	23.0	25.0	21.0	23.0
58	22.0	23.0	19.0	21.0
59	22.0	23.0	21.0	23.0
60	24.0	25.0	25.0	24.0
61	23.0	24.0	24.0	24.0
62	26.0	25.0	22.0	23.0
63	24.0	24.0	22.0	22.0
64	24.0	24.0	26.0	26.0
65	31.0	36.0	28.0	33.0
66	29.0	31.0	31.0	31.0
67	26.0	28.0	25.0	29.0
68	25.0	28.0	26.0	23.0
69	25.0	26.0	26.0	27.0
70	28.0	27.0	24.0	24.0
71	23.0	25.0	24.0	24.0
72	23.0	25.0	24.0	24.0
73	23.0	25.0	24.0	24.0
74	23.0	25.0	24.0	24.0
75 & over	100.0	100.0	100.0	100.0

Additional increase in rates during the first 5 years of unreduced retirement at ages 55-64

Year of Eligibility	Female	Male
1st year	28%	28%
2nd year	10%	4%
3rd year	10%	4%
4th year	10%	4%
5th year	10%	4%

V. Appendix

Judicial Division

Reduced and Unreduced Retirements – **Unisex**

Age	Current Reduced	Proposed Reduced	Current Unreduced	Proposed Unreduced
50	6.0%	15.0%	6.0%	15.0%
51	6.0	15.0	6.0	15.0
52	6.0	15.0	6.0	15.0
53	6.0	15.0	6.0	15.0
54	10.0	15.0	10.0	15.0
55	10.0	11.0	10.0	11.0
56	10.0	11.0	10.0	11.0
57	10.0	11.0	10.0	11.0
58	8.0	11.0	8.0	11.0
59	8.0	11.0	8.0	11.0
60	10.0	12.0	10.0	12.0
61	10.0	12.0	10.0	12.0
62	10.0	12.0	10.0	12.0
63	10.0	12.0	10.0	12.0
64	8.0	12.0	8.0	12.0
65			20.0	20.0
66			20.0	20.0
67			20.0	20.0
68			20.0	20.0
69			20.0	20.0
70			40.0	45.0
71			40.0	45.0
72			40.0	45.0
73			40.0	45.0
74			40.0	45.0
75 & over			100.0	100.0

V. Appendix

All Divisions (DPS Benefit Structure)
Reduced Retirements

Age	Current Females	Proposed Females	Current Males	Proposed Males
50	5.0%	6.0%	8.0%	6.0%
51	7.0	6.0	8.0	6.0
52	10.0	6.0	8.0	6.0
53	10.0	6.0	10.0	6.0
54	10.0	10.0	10.0	6.0
55	10.0	10.0	10.0	11.0
56	10.0	10.0	10.0	8.0
57	10.0	9.0	10.0	8.0
58	10.0	9.0	10.0	8.0
59	14.0	12.0	15.0	8.0
60	17.0	12.0	15.0	12.0
61	17.0	12.0	16.0	12.0
62	17.0	12.0	16.0	12.0
63	17.0	12.0	16.0	12.0
64	17.0	12.0	16.0	12.0

All Divisions (DPS Benefit Structure)
Unreduced Retirements

Age	Current Females	Proposed Females	Current Males	Proposed Males
50	40.0%	40.0%	35.0%	60.0%
51	40.0	40.0	35.0	33.0
52	30.0	30.0	30.0	38.0
53	30.0	30.0	30.0	30.0
54	30.0	30.0	25.0	25.0
55	34.0	41.0	30.0	30.0
56	24.0	24.0	20.0	27.0
57	25.0	25.0	26.0	27.0
58	20.0	21.0	22.0	36.0
59	28.0	25.0	26.0	36.0
60	25.0	23.0	26.0	33.0
61	28.0	31.0	18.0	26.0
62	30.0	31.0	27.0	32.0
63	31.0	31.0	40.0	34.0
64	42.0	31.0	24.0	26.0
65	38.0	45.0	38.0	40.0
66	35.0	35.0	30.0	28.0
67	32.0	35.0	30.0	28.0
68	27.0	35.0	30.0	28.0
69	29.0	35.0	30.0	28.0
70	28.0	30.0	30.0	46.0
71	30.0	30.0	30.0	40.0
72	30.0	30.0	30.0	40.0
73	30.0	30.0	30.0	40.0
74	30.0	30.0	30.0	40.0
75 & over	100.0	100.0	100.0	100.0

Appendix C: Proposed Termination Rates

State and Local Government Divisions (Non-Safety Officers)
Select Termination Rates – Unisex

Service	Current	Proposed
0	34.00%	30.00%
1	21.00	20.00%
2	16.00	16.00%
3	12.00	12.00%
4	10.00	10.00%

State and Local Government Divisions (Safety Officers)
Select Termination Rates – Unisex

Service	Proposed
0	25.00%
1	20.00%
2	12.00%
3	8.00%
4	6.00%

School Division
Select Termination Rates – Unisex

Service	Current	Proposed
0	30.00%	27.00%
1	18.00%	17.00%
2	14.00%	13.50%
3	11.00%	11.00%
4	10.00%	10.00%

DPS Division (PERA Benefit Structure)
Select Termination Rates – Unisex

Service	Current	Proposed
0	26.00%	25.00%
1	19.00%	19.00%
2	14.00%	14.00%
3	12.00%	12.00%
4	10.00%	11.00%

V. Appendix

State and Local Government Divisions (Non-Safety Officers)
Ultimate Termination Rates

Age	Current Females	Proposed Females	Current Males	Proposed Males
20	16.45%	21.90%	30.00%	20.70%
21	15.35	20.80	26.00	16.70
22	14.25	19.70	22.00	12.70
23	13.60	18.20	19.20	12.20
24	12.95	16.60	16.40	11.80
25	12.30	15.10	13.60	11.30
26	11.65	13.50	10.80	10.90
27	11.00	12.00	8.00	10.40
28	10.50	11.40	7.70	9.80
29	10.00	10.80	7.40	9.20
30	9.50	10.20	7.10	8.70
31	9.00	9.60	6.80	8.10
32	8.50	9.00	6.50	7.50
33	8.10	8.60	6.30	7.30
34	7.70	8.20	6.10	7.10
35	7.30	7.70	5.90	6.80
36	6.90	7.30	5.70	6.60
37	6.50	6.90	5.50	6.40
38	6.25	6.60	5.25	6.10
39	6.00	6.20	5.00	5.70
40	5.75	5.90	4.75	5.40
41	5.50	5.50	4.50	5.00
42	5.25	5.20	4.25	4.70
43	5.15	5.10	4.15	4.60
44	5.05	5.00	4.05	4.50
45	4.95	4.90	3.95	4.40
46	4.85	4.80	3.85	4.30
47	4.75	4.70	3.75	4.20
48	4.70	4.70	3.72	4.10
49	4.65	4.60	3.69	4.00
50	4.60	4.60	3.66	3.90
51	4.55	4.50	3.63	3.80
52	4.50	4.50	3.60	3.70
53	4.50	4.50	3.58	3.66
54	4.50	4.50	3.56	3.60
55	4.50	4.50	3.54	3.60
56	4.50	4.50	3.52	3.50
57 & over	4.50	4.50	3.50	3.50

State and Local Government Divisions (Safety Officers)
Ultimate Termination Rates - Unisex

Age	Current	Proposed
20	7.30%	7.30%
21	6.90	6.90
22	6.50	6.50
23	6.05	6.20
24	5.60	5.90
25	5.15	5.60
26	4.70	5.30
27	4.25	5.00
28	4.05	4.80
29	3.85	4.60
30	3.65	4.40
31	3.45	4.20
32	3.25	4.00
33	3.16	3.80
34	3.07	3.70
35	2.98	3.50
36	2.89	3.40
37	2.80	3.20
38	2.74	3.20
39	2.68	3.10
40	2.62	3.10
41	2.56	3.00
42	2.50	3.00
43	2.50	3.00
44	2.50	3.00
45	2.50	2.90
46	2.50	2.90
47	2.50	2.90
48	2.50	2.90
49	2.50	2.90
50	2.50	2.80
51	2.50	2.80
52	2.50	2.80
53	2.50	2.80
54	2.50	2.80
55	2.50	2.70
56	2.50	2.70
57 & over	2.50	2.70

V. Appendix

School Division
Ultimate Termination Rates

Age	Current Females	Proposed Females	Current Males	Proposed Males
20	17.00%	17.00%	20.00%	18.00%
21	16.50	16.50	18.00	16.00
22	16.00	16.00	16.00	14.00
23	14.52	14.50	14.42	12.80
24	13.04	13.10	12.84	11.60
25	11.56	11.60	11.26	10.40
26	10.08	10.20	9.68	9.20
27	8.60	8.70	8.10	8.00
28	8.18	8.30	7.58	7.60
29	7.76	7.90	7.06	7.10
30	7.34	7.50	6.54	6.70
31	6.92	7.10	6.02	6.20
32	6.50	6.70	5.50	5.80
33	6.17	6.20	5.20	5.40
34	5.84	5.80	4.90	5.10
35	5.51	5.30	4.60	4.70
36	5.18	4.90	4.30	4.40
37	4.85	4.40	4.00	4.00
38	4.68	4.30	3.88	3.90
39	4.51	4.10	3.76	3.70
40	4.34	4.00	3.64	3.60
41	4.17	3.80	3.52	3.40
42	4.00	3.70	3.40	3.30
43	4.00	3.70	3.38	3.30
44	4.00	3.70	3.36	3.20
45	4.00	3.70	3.34	3.20
46	4.00	3.70	3.32	3.10
47	4.00	3.70	3.30	3.10
48	4.00	3.70	3.28	3.10
49	4.00	3.70	3.26	3.10
50	4.00	3.70	3.24	3.10
51	4.00	3.70	3.22	3.10
52	4.00	3.70	3.20	3.10
53	4.00	3.70	3.20	3.10
54	4.00	3.70	3.20	3.10
55	4.00	3.70	3.20	3.10
56	4.00	3.70	3.20	3.10
57 & over	4.00	3.70	3.20	3.10

Judicial Division
Ultimate Termination Rates - Unisex

Age	Current	Proposed
All Ages	1.50%	1.50%

V. Appendix

DPS Division (PERA Benefit Structure)
Ultimate Termination Rates

Age	Current Females	Proposed Females	Current Males	Proposed Males
20	12.80%	12.80%	19.20%	16.20%
21	12.40	12.40	17.60	14.60
22	12.00	12.00	16.00	13.00
23	11.60	11.70	14.40	12.90
24	11.20	11.40	12.80	12.70
25	10.80	11.10	11.20	12.60
26	10.40	10.80	9.60	12.40
27	10.00	10.50	8.00	12.30
28	9.80	10.40	7.90	11.40
29	9.60	10.30	7.80	10.60
30	9.40	10.20	7.70	9.70
31	9.20	10.10	7.60	8.90
32	9.00	10.00	7.50	8.00
33	8.60	9.50	7.20	7.70
34	8.20	9.00	6.90	7.40
35	7.80	8.40	6.60	7.10
36	7.40	7.90	6.30	6.80
37	7.00	7.40	6.00	6.50
38	6.80	7.10	6.00	6.40
39	6.60	6.80	6.00	6.40
40	6.40	6.60	6.00	6.30
41	6.20	6.30	6.00	6.30
42	6.00	6.00	6.00	6.20
43	6.00	5.90	6.00	6.20
44	6.00	5.90	6.00	6.10
45	6.00	5.80	6.00	6.10
46	6.00	5.80	6.00	6.00
47	6.00	5.70	6.00	6.00
48	5.80	5.70	6.00	6.00
49	5.60	5.60	6.00	5.90
50	5.40	5.60	6.00	5.90
51	5.20	5.50	6.00	5.80
52	5.00	5.50	6.00	5.80
53	5.00	5.40	6.00	5.70
54	5.00	5.30	6.00	5.70
55	5.00	5.30	6.00	5.60
56	5.00	5.20	6.00	5.60
57 & over	5.00	5.10	6.00	5.50

V. Appendix

All Divisions (DPS Benefit Structure)
Ultimate Termination Rates

Age	Current Females	Proposed Females	Current Males	Proposed Males
20	10.00%	10.00%	8.00%	10.00%
21	10.00	10.00	8.00	10.00
22	10.00	10.00	8.00	10.00
23	9.60	9.60	7.80	9.60
24	9.20	9.20	7.60	9.20
25	8.80	8.80	7.40	8.80
26	8.40	8.40	7.20	8.40
27	8.00	8.00	7.00	8.00
28	7.90	7.40	6.95	7.40
29	7.80	6.80	6.90	6.80
30	7.70	6.20	6.85	6.20
31	7.60	5.60	6.80	5.60
32	7.50	5.00	6.75	5.00
33	7.40	4.90	6.70	4.90
34	7.30	4.80	6.65	4.80
35	7.20	4.70	6.60	4.70
36	7.10	4.60	6.55	4.60
37	7.00	4.50	6.50	4.50
38	6.65	4.30	6.15	4.30
39	6.30	4.10	5.80	4.10
40	5.95	3.90	5.45	3.90
41	5.60	3.70	5.10	3.70
42	5.25	3.50	4.75	3.50
43	4.97	3.40	4.73	3.40
44	4.69	3.30	4.71	3.30
45	4.41	3.20	4.69	3.20
46	4.13	3.10	4.67	3.10
47	3.85	3.00	4.65	3.00
48	3.85	2.90	4.60	2.90
49	3.85	2.80	4.55	2.80
50	3.85	2.70	4.50	2.70
51	3.85	2.60	4.45	2.60
52	3.85	2.50	4.40	2.50
53	3.85	2.50	4.37	2.50
54	3.85	2.50	4.34	2.50
55	3.85	2.50	4.31	2.50
56	3.85	2.50	4.28	2.50
57 & over	3.85	2.50	4.25	2.50