



# Police and Firemen's Retirement System of New Jersey

## ACTUARIAL EXPERIENCE REVIEW

### **Analysis of Actuarial Experience during the Period July 1, 2018 through June 30, 2021**

October 14, 2022 | Frank Santasiero, FSA, MAAA, FCA | Jonathan Scarpa FSA, MAAA

**Via Email**

October 14, 2022

Board of Trustees  
Police and Firemen's Retirement System of New Jersey  
50 West State Street  
Trenton, NJ 08625

**Re: Actuarial Experience Review for the Period July 1, 2019 through June 30, 2021**

Dear Board Members:

This report presents the results of the actuarial review of the demographic and economic experience of the Police and Firemen's Retirement System of New Jersey (PFRS) for the period July 1, 2018 through June 30, 2021. This experience review was prepared in accordance with Title 43, Chapter 16A-13 of the NJ State Statute which governs the System, which requires the actuary for PFRS to make an actuarial investigation into the mortality, service, and other experience of the members, retirees and beneficiaries covered under the System at least once every three years. Economic assumptions for PFRS are reviewed on an annual basis.

All current actuarial assumptions were reviewed as part of this study. This review is the basis for our recommendation of the assumptions to be used for the July 1, 2022 actuarial valuation.

In preparing the results presented in this report, we have relied upon data that PFRS and the prior actuary provided to us 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 the System'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 worth noting that this experience study analysis is based on census data and information between July 1, 2018 and June 30, 2021. The COVID-19 pandemic may have impacted market and demographic conditions for a portion of this period. The potential impact of the pandemic on the actuarial experience was considered when performing our analysis.

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 actuary is 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.

Respectively submitted,



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Jonathan Scarpa, FSA, MAAA, EA  
Vice President and Actuary

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# I. Executive Summary

## A. Introduction

Actuarial valuations are prepared annually to determine whether the contributions being made by members and employers are sufficient to fund the Police and Firemen's Retirement System of New Jersey (PFRS). Each actuarial valuation is dependent on the assumptions that the actuary uses to project the benefits expected to be paid in the future to all members of PFRS. 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 experience review of the actuarial assumptions used in the actuarial valuation of PFRS. With the Board's approval of the recommendations in this report, these assumptions will be first used beginning with the July 1, 2022 actuarial valuation.

The assumptions used in actuarial valuations can be grouped into two categories: (1) economic assumptions – the assumed long-term rate of investment return, inflation and salary increases, 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 forward-looking perspective of expected future trends.

In order 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 (or estimated liability, in the case of liability-weighted analysis) 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 5,000 active employees in the 20-24 age group at the beginning of the year and 500 of them terminate during the year, we would say the probability of termination in that age group is  $500 \div 5,000$  or 10%. Similarly, in a liability-weighted approach, if there were \$5,000,000 of active liability in the 20-24 age group and \$500,000 of this liability is released due to terminations during the year, we would arrive at the same 10% probability of termination.

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 may propose adjusting the termination rate closer to the actual experience.

# I: Executive Summary

For the mortality assumption, we have reviewed the experience during the study period on a benefit-weighted/liability-weighted basis. There has been a large number of studies showing high correlation between mortality and income such as a pension which supports evaluating this assumption on a benefit-weighted basis..

If actual experience exactly matches the expected experience, the actual annual cost of PFRS 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. PFRS recognizes actuarial gains and losses each year, reflecting the net difference between actual experience and anticipated experience. A pattern of gains or losses with respect to one or more assumptions is the 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*).

This study reviews the actuarial experience of PFRS for the three-year period beginning July 1, 2018 and ending June 30, 2021, 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.

# I: Executive Summary

## B. Recommendations

The experience review provides an opportunity for the Board, PFRS staff, and actuary to consider how specific assumptions affect the funding of the System, including the funded ratio 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 the System 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 PFRS.

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

### Economic Assumptions

Economic assumptions include inflation, rate of investment return (or discount rate), and rate of individual salary increases. It is important to note, the inflation and investment rate of return assumptions are evaluated on an annual basis in consultation with the Director of Finance for PFRS.

#### Inflation

For most of the past ten years, inflation has remained at historically low levels but over approximately the last year has significantly increased. Projections of inflation range between approximately 2.4% and 2.8%, depending on the time frame and the source. The current inflation assumption is 2.75% and falls within this range of expert forecasts. As a result of the information and the uncertainty surrounding the future, we recommend no change to the inflation assumption. The inflation assumption will be reviewed annually with the Chief Financial Officer of PFRS.

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

#### Rate of Investment Return

The investment return assumption is chosen based on direction from the Chief Financial Officer for PFRS and as adopted by the Board. The current investment return assumption is 7.0% and was last revised effective with the July 1, 2021 actuarial valuation.

The System has averaged market value investment returns of 10.8% and 8.7% over the last five-year and 10-year periods ending June 30, 2021, respectively.

Although Segal does not determine the investment return assumption, we have reviewed the target asset allocation policy and the 10-year and 20-year Capital Market Assumptions provided in the Horizon Survey of Capital Market Assumptions (2022 Edition) and feel the current assumption of 7.0% is reasonable.

# I: Executive Summary

## Rate of Individual Salary Increases

We study the merit and seniority increases separately from inflation and productivity. Analysis of the distribution of merit and seniority increases by years of service during the study period shows the actual salary increases over the three-year study period were for most ages greater than expected based on the prior assumption. Based on this experience, we recommend a revision to the salary increase rates to better reflect the experience over the three-year study period.

## Demographic Assumptions

The demographic assumptions include mortality, retirement, termination (or withdrawal), disability incidence and spouse information.

### Mortality

The current assumptions for pre-retirement mortality, post-retirement mortality and disabled retiree mortality are based on the Pub-2010 Public Safety Mortality Tables (sex-distinct), with adjustments made for each groups as determined in the prior experience study. These are the most recent tables published by the Society of Actuaries applicable to public pension plans. In addition, mortality improvement is projected using Scale MP-2018. The Society of Actuaries releases a new mortality projection scale each year.

Analysis of the mortality experience for the three year period ending June 30, 2021 shows that overall there were more deaths than expected for all groups.

Our recommendation for mortality is to use the same base table for all groups but revise the plan-specific adjustments to reflect the experience in the three-year study period. In determining the adjustments we have considered the credibility for each group, or lack thereof. In addition, because the COVID-19 pandemic impacted mortality for a portion of the study period we have also considered this when determining our recommendation. Finally, we recommend mortality improvement be projected with the most recent scale published by the Society of Actuaries, Scale MP-2021.

Additional Detail is provided in Section III.

### Other Demographic Experience

Based on a review of the retirement, termination and disability award experience during the study period, we have made recommendations for each assumption to reflect the new experience. None of the recommend changes are substantial and none will have a significant impact on the cost of the plan.

Additional detail is provided in Section III.

# I: Executive Summary

## Summary of Assumptions and Recommended Changes

The following table summarizes the actuarial assumptions used in the valuation and the changes recommended in this report.

Description	Current	Proposed
<b>Economic Assumptions</b>		
Inflation	2.75%	2.75%
Productivity	0.50%	0.50%
Salary Scale	Merit (including productivity) rates based on years of service plus inflation	<b>Adjustments to merit rates at various years of service plus productivity plus inflation</b>
Investment Return	7.00%	7.00%
<b>Demographic Assumptions</b>		
Healthy Post-Retirement Mortality	96.7% of Pub-2010 Safety Retiree Below Median amount-weighted mortality table for males and 96.0% of Pub-2010 Safety Retiree Below Median amount-weighted mortality table for females	<b>No change to the base table. Adjustment percentages for both males and females are revised to 100%</b>
Beneficiary Mortality	Pub-2010 General Retiree Below-Median amount-weighted mortality table	No Change
Disabled Mortality	152.0% of Safety Disabled Retiree amount-weighted mortality table for males and 109.3% of Safety Disabled Retiree amount-weighted mortality table for females,	<b>No change to the base table. Adjustment percentage for males revised to 144% and 100% for females.</b>
Pre-Retirement Mortality	105.6% of Pub-2010 Safety Employee amount-weighted mortality table for males and 102.5% of Public Safety Employee amount-weighted mortality table for females.	<b>No change to the base table. Adjustment percentages revised to 100% for males and females.</b>
Mortality Improvement	Generational projection using Scale MP-2018	<b>Generational projection using Scale MP-2021</b>
Active Retirement	Rates based on age with separate rate tables for those with less than 25 years of service, 25 years of service and more than 25 years of service.	<b>Adjust rates based on plan experience</b>
Termination	Rates based on years of service	<b>Adjust rates based on plan experience</b>
Disability	Rates based on age	<b>Adjust rates based on plan experience</b>

## I: Executive Summary

### Impact of Assumption Changes on Valuation Results

The following tables detail the impact of the recommended assumption changes, using the July 1, 2021 actuarial valuation results for illustrative purposes. When the proposed set of assumptions is used in the July 1, 2022 valuation, 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 impacts 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.

	Actuarial Accrued Liability (Millions)	Normal Cost (Millions)
<b>July 1, 2021 Actuarial Valuation</b>	<b>47,505.26</b>	<b>885.35</b>
<b>Assumption Change</b>	<b>Change in Liability</b>	<b>Change in Normal Cost</b>
Termination	+3.94	+0.62
Active Retirement	-108.94	-7.45
Disability	-93.65	-11.35
Mortality	-243.87	-2.31
Salary Scale	+193.64	+30.81
<b>Total</b>	<b>-248.88</b>	<b>+10.32</b>
<b>July 1, 2021 Actuarial Valuation with changes</b>	<b>47,256.38</b>	<b>895.67</b>

In total, the assumption changes decreased the total liability by 0.5%. The primary reason for the decrease was the proposed change to the assumed mortality rates, partially offset by an increase in the assumed salary increase rates. In addition, the normal cost increased by 1.2%.

	State			Local		
	Statutory Contribution Prior to State-Paid Local Adjustments (\$Millions)	Statutory Contribution After State-Paid Local Adjustments (\$Millions)	Funded Percentage (Based on MVA)	Statutory Contribution Prior to State-Paid Local Adjustments (\$Millions)	Statutory Contribution After State-Paid Local Adjustments (\$Millions)	Funded Percentage (Based on MVA)
July 1, 2021 Actuarial Valuation	\$377.32	\$608.90	35.5%	\$1,532.89	\$1,301.31	76.7%
Change due to Assumption Changes	-0.67	+\$4.11	+0.1%	-8.77	-13.55	+0.4%
Total	\$376.65	\$613.01	35.6%	\$1,524.12	\$1,287.76	77.1%

## I: Executive Summary

After reflecting the proposed assumption changes and statutory state-paid local cost shifting, the statutory contribution for the State portion of the plan increased slightly by 0.7% and the funded percentage based on the increased from 35.5% to 35.6%. For the Local portion of the plan, the proposed changes in assumption decreased the statutory contribution by 1.0% and increased the funded percentage from 76.7% to 77.1%.

## II: Economic Assumptions

# II. Economic Assumptions

The economic assumptions have a significant impact on the development of plan liabilities. Changes to these assumptions can substantially alter the actuarial valuation results.

The primary economic assumptions that affect PFRS' valuation results are:

- Inflation;
- Rate of Investment Return;
- Rate of Individual Salary Increases;

The Actuarial Standards Board (ASB) has adopted Actuarial Standard of Practice 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 rate of investment return assumption includes an inflation component and a real rate of return component. The components of the salary increase assumption are inflation, real wage growth, and merit and seniority increases.

## 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.

The table below present recent inflation experience over the past fifty years.

### Historical Consumer Price Index – Averages (U.S. City Average - All Urban Consumers)

Average Annual Change as of August 31, 2022	CPI-U
1-Year Average	8.26%
5-Year Average	3.82%
10-Year Average	2.54%
20-Year Average	2.50%
50-Year Average	3.98%

As can be seen in the table above, over the prior ten to twenty year period the average annual change in CPI had been historically lower. However, over the most recent year there has been a significant increase in inflation. 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 2<sup>nd</sup>

## II: Economic Assumptions

Edition of the Survey of Capital Market Assumptions, the average 10-year inflation assumption across 40 survey respondents was 2.46% and the average 20-year inflation assumption across a subset of 20 survey respondents that provided assumptions for 20 years was 2.44%.

Yet another source of inflation data is the Survey of Professional Forecasters published by the Federal Reserve Bank of Philadelphia. The 10-year forecast from the Third Quarter 2022 report is 2.80%. The Philadelphia Fed also publishes the Livingston Survey, which shows a median 2.50% projected long-term inflation assumption in the June 2022 survey.

The table below compares the 2022 Horizon Survey results to other sources.

Source	10-Year	20-Year
Federal Reserve Bank of Philadelphia First Quarter 2022 Survey of Professional Forecasters (2022 Q3)	2.80%	
Federal Reserve Bank Of Philadelphia Livingston Survey (June 2022)	2.50%	
Segal Marco Advisors	2.40%	2.40%
2022 Horizon Survey of Capital Market Assumptions	2.46%	2.44%

Next, we consider the measure of future inflation expectation. An indication of future expectation 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 , with and without inflation indexing.

US Treasury Bonds as of May 31, 2021	10-Year Yield	30-Year Yield
Non-Inflation Indexed	3.89%	3.85%
Inflation Indexed	1.62%	1.74%
Difference	2.27%	2.11%

Because of the inflation protection, TIPS' yields are considerably lower than those of regular Treasury securities of similar maturities. As October 7, 2022, 30-year Treasuries yielded 3.85% while 30-year TIPS yielded 1.74%. 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 2.11% per year over the next 30 years. In addition, it is also important to note that the market's view of inflation over the shorter term period of ten years is higher than over the 30-year period.

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.

## II: Economic Assumptions

We also referred to the 2022 report on the financial status of the Social Security program<sup>1</sup>. 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)<sup>2</sup>. 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.

**Considering all of this information, and given the recent history of uncertainty regarding inflation over the past year, there is no recommendation to change the current inflation assumption of 2.75%. This assumption will be evaluated on an annual basis.**

<sup>1</sup> Source: Social Security Administration – The 2022 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds

<sup>2</sup> 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

### B. Rate of Investment Return

The rate of investment 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, the Systems' portfolio mix, and, to a lesser extent, historical returns.

The current assumption is 7.00%, which is comprised of the following components:

- Inflation: 2.75%
- Real Rate of Return: 4.25%

The table below shows the System's actual investment returns on a fair value basis as well as an actuarial value basis.

Average Annual Return as of June 30, 2021	Fair Value of Assets	Actuarial Value of Assets
Past 5 Years	10.81%	6.98%
Past 10 Years	8.67%	6.48%
Past 15 Years	7.51%	5.91%
Past 20 Years	6.92%	5.39%

Over the past twenty years, both the average actuarial and market returns have been lower than the current investment return assumption of 7.0%. However, the average market value return over the past 5, 10, and 15-year periods are higher than the current assumption and were particularly high over the last five years. Historical trend is a less important consideration for the assumed rate of investment return, but assists in determining the reasonable bounds of expected investment return.

The investment rate of return assumption is developed using the "building block" approach as outlined in ASOP 27. Under this approach, the investment rate of return assumption is made up of two components; the inflation component and the real investment rate of return component. The inflation component determined above is combined with the reasonable real rate of return component. This total return is then evaluated and refined. The final recommendation is then made.

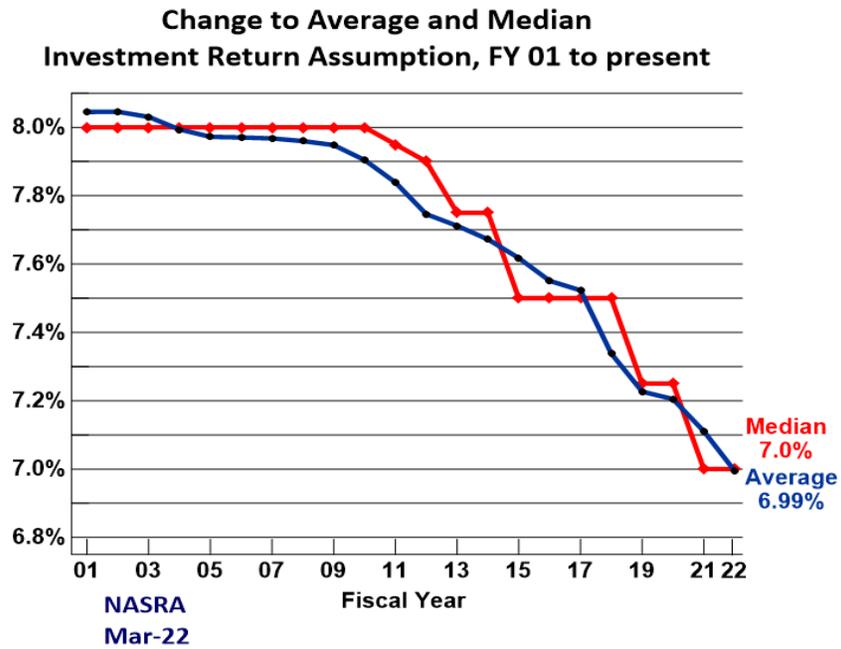
The investment return assumption is reviewed annually with direction from the Chief Financial Officer. Based on our review of the plan's target asset allocation policy as well as projected returns for various asset classes we do not feel the current assumption of 7.0% is unreasonable.

### Comparison to the Public Sector Universe

The 7.00% investment return assumption is in-line with the rest of the public sector universe. In their November 2021 Public Fund Survey and their March 2022 Issue Brief update, the National Association of State Retirement Administrators (NASRA) notes that among the 131 plans in its survey, the average investment return assumption is now 6.99% and the median assumption is

## II: Economic Assumptions

7.00%. The graph below, from NASRA's March 2022 Issue Brief update, shows the trend in the investment return assumption from 2001 to 2022.



## II: Economic Assumptions

### C. Rate of Individual Salary Increase

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

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

- Inflation
- Productivity
- Merit and seniority increases

The inflation component represents the "across the board" average annual increase in salaries shown in the experience data. The merit and seniority component includes productivity and the additional increases in salary due to performance, seniority, promotions, etc.

Since merit and seniority increases are unique to each retirement system, it is appropriate to base this assumption on recent experience. We study the merit and seniority increases (plus productivity) separately from inflation, which represents "non-inflation" increases in individual salaries.

We also recommend a non-inflationary component of 0.50% be added to the merit and seniority increases recommended in this section. This component accounts for factors such as productivity improvements or growth in the payroll base and is also used as a component of the projection of the Social Security Wage Base. This is the same as the current assumption for these purposes.

The current salary increase assumption (including inflation) uses service-based rates that range from 15.25% at one year of service to 3.25% at 13 or more years of service. The historical compensation data, adjusted by inflation during the study period, was evaluated based on age and service. The strongest relationship continues to be based on members' service.

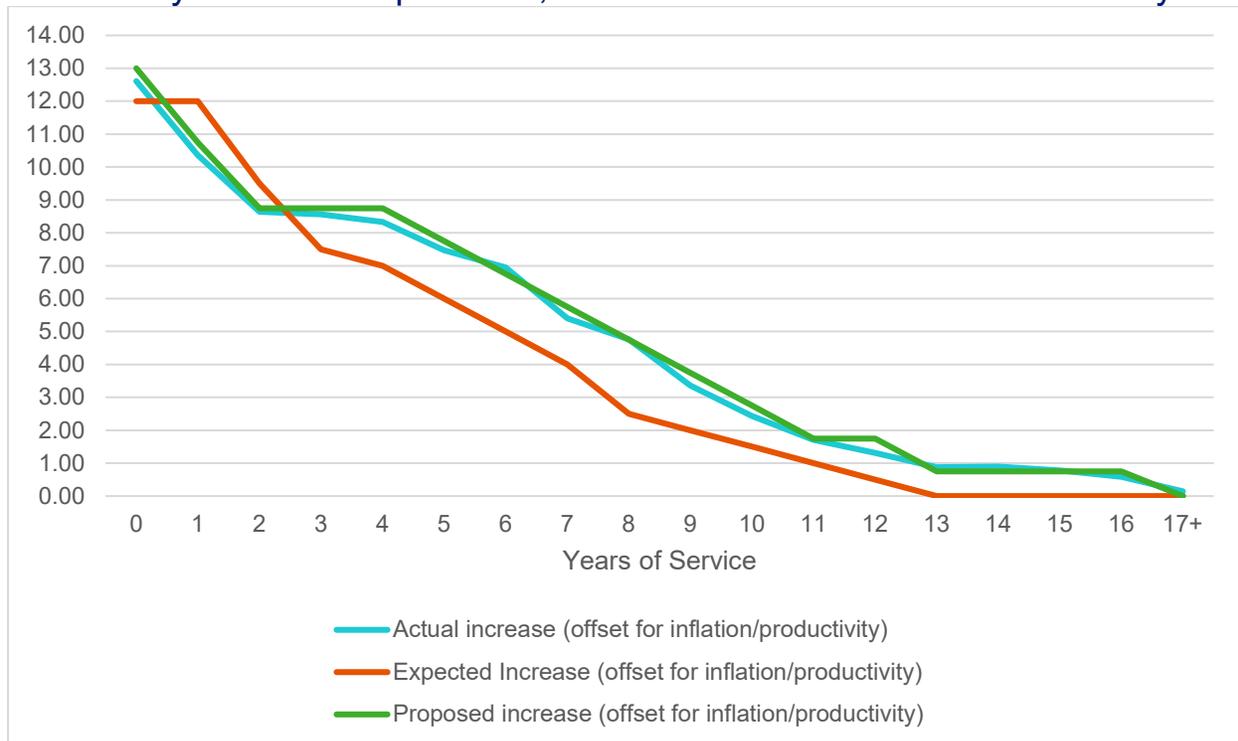
The actual salary increases over the three-year study period were greater for some service bands and lower for others. Based on the experience outlined above, **we recommend a revision to the salary increase rates to more closely match the experience over the three-year study period.**

The following table and graph compare the actual, expected and proposed individual salary increases during the period of the experience study, adjusted to remove inflation.

## II: Economic Assumptions

Years of Service	Prior Year Salaries (in \$000s)	Actual Salaries <sup>1</sup> (in \$000s)	Actual Salary Increase Rate	Expected Salaries <sup>2</sup> (in \$000s)	Expected Salary Increase Rate	Proposed Salary Increase Rate
0	66,797	75,220	12.61	74,561	12.00	13.00
1	261,913	289,049	10.36	292,345	12.00	10.75
2	317,180	344,578	8.64	346,372	9.50	8.75
3	348,816	378,674	8.56	374,167	7.50	8.75
4	370,313	401,157	8.33	395,422	7.00	8.75
5	388,100	417,104	7.47	410,662	6.00	7.75
6	370,588	396,332	6.95	388,545	5.00	6.75
7	324,601	342,124	5.40	337,185	4.00	5.75
8	247,888	259,698	4.76	253,900	2.50	4.75
9	228,922	236,618	3.36	233,357	2.00	3.75
10	274,360	281,021	2.43	278,345	1.50	2.75
11	377,420	383,871	1.71	381,076	1.00	1.75
12	468,375	474,516	1.31	470,646	0.50	1.75
13	534,768	539,437	0.87	534,773	0.00	0.75
14	519,168	523,825	0.90	519,168	0.00	0.75
15	499,869	503,762	0.78	499,869	0.00	0.75
16	459,639	462,343	0.59	459,640	0.00	0.75
17+	5,023,202	5,030,435	0.14	5,023,203	0.00	0.00

Salary Increase Experience, in Excess of Inflation and Productivity



<sup>1</sup> Adjusted for actual average inflation and productivity, a total of approximately 3.25% during the experience period.

<sup>2</sup> Adjusted for assumed inflation and productivity, a total of 3.25%.

# III. Demographic Assumptions

The demographic assumptions used to value PFRS reflect the expected occurrences of various events among members of the System. The assumptions should reflect specific characteristics of PFRS 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 spouse information, sick leave service credit, optional service purchase, future service accrual rate, and buyout election percentages.

The Actuarial Standards Board (ASB) has adopted Actuarial Standard of Practice No. 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 procedure for selecting demographic assumptions. The first step 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 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 System 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.

## III: Demographic Assumptions

### A. Mortality

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. PFRS currently uses four sets of mortality tables for its population: post-retirement mortality, beneficiary 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, especially considering that credibility for the female population is quite low. 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.

In addition, for the three-year study period ending June 30, 2021 the mortality experience of the plan was likely impacted by the COVID-19 pandemic. Based on CDC data regarding National and State Estimates of Excess deaths there may have been between 14-18% due to COVID during 2020 and 2021. As a result, we have considered this and used professional judgment when recommending an assumption for this experience study.

**When reviewing the actual experience under each of the four categories below, we compared actual experience with the current mortality table the Pub-2010 Public Safety mortality tables. We recommend the continued used of current the base tables, with adjustments for PFRS-specific experience where credible data exists. In order to reflect future improvements in mortality, we recommend using the mortality projection scale to MP-2021.**

### III: Demographic Assumptions

#### 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, PFRS uses healthy post-retirement mortality rates based on the Pub-2010 Public Safety Retiree Below Median Annuitant Mortality Table (sex-distinct), with an 96.7% adjustment for credibility for males and a 96.0% adjustment for females. Mortality is projected generationally using Scale MP-2018.

During the experience study period, there were 41 female deaths and 2,166 male deaths, broken out as follows:

Female		Male	
Deaths	Credibility	Deaths	Credibility
41	17.8%	2,166	100.0%

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 for healthy annuitants by gender for the study period as compared to the unadjusted base table:

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
<b>Benefits Basis (in 000's)</b>				
Male	5,980,585	110,514	107,065	1.03
Female	302,560	1,944	2,106	0.92

The experience during the study period shows that, in total, fewer female participants in pay status have died than expected. On a benefits-weighted basis, the actual amount of benefits released due to deaths was 92% of expected. However, it should be noted that the credibility factor for female deaths is low. For males, on a benefits-weighted basis, more benefits in pay status were released due to deaths than expected; the ratio of actual-to-expected was 103%.

**Although over the three-year study period, there were more deaths than expected we have also considered the impact of the COVID-19 pandemic for a portion of this period. Therefore, we have used professional judgment and not fully weighted the experience during the study period. We recommend that the mortality table for healthy retirees continues to be the PubT-2010 Public Safety Below-Median Retiree Mortality Table (sex-distinct). In addition, it is recommended that the adjustment factor to the base table be increased from 96.7% to 100.0% for male participants and, because of the low credibility for the female retiree population, we recommend the same adjustment factor as used for the male population (i.e 100%). Finally, in order to reflect future improvements in life**

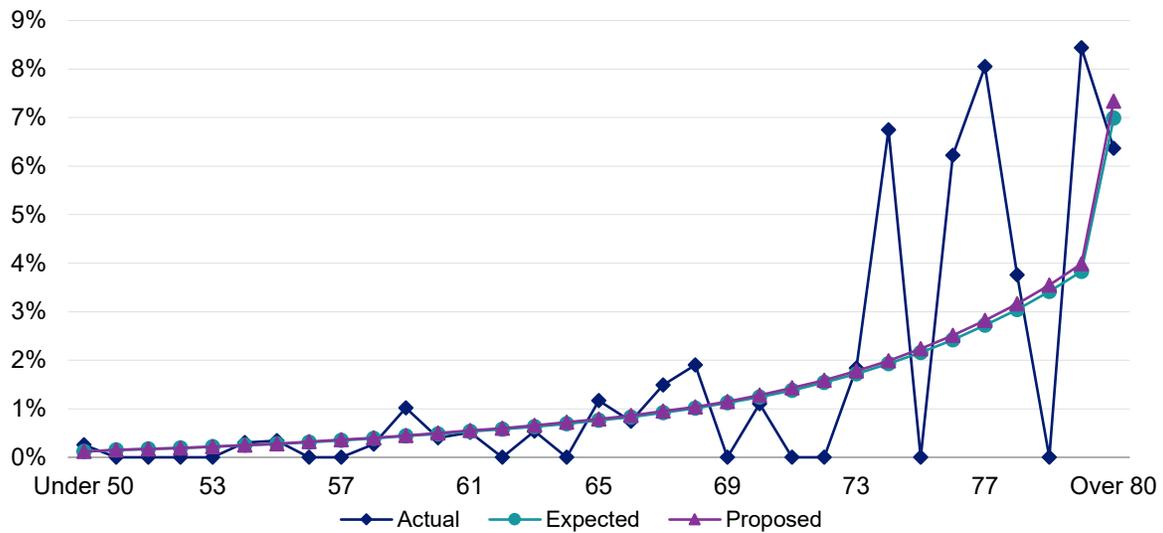
### III: Demographic Assumptions

expectancy, we recommend updating the mortality projection scale to MP-2021, the most recent scale published by the Society of Actuaries.

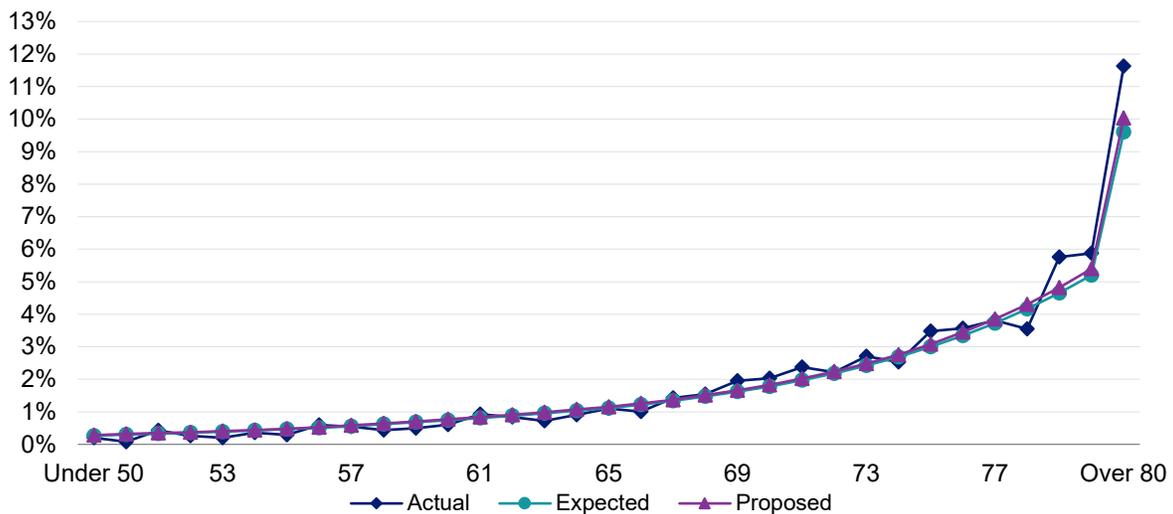
The proposed healthy post-retirement mortality rates are included in Appendix B.

The following graphs show the actual mortality rate, expected mortality rate, and proposed mortality rates for females and males.

Actual Versus Proposed Experience, Benefits-Weighted Basis  
Healthy Post-Retirement Mortality – Female



Actual Versus Proposed Experience, Benefits-Weighted Basis  
Healthy Post-Retirement Mortality – Male



### III: Demographic Assumptions

#### Disabled Mortality

Mortality experience among disabled annuitants is studied separately from healthy retirees because of characteristically higher levels of mortality exhibited by disability retirees. The current mortality table for all disabled lives is based on the Pub-2010 Public Safety Disabled Retiree Mortality Table, projected generationally using Scale MP-2018. Male rates are adjusted by 152.0% for all ages and female rates are adjusted by 109.3% for all ages.

The following table details the mortality experience for disabled retirees over the study period for males and females.

Age	Male		Female	
	Deaths	Credibility	Deaths	Credibility
<b>Total</b>	<b>339</b>	<b>49.1%</b>	<b>22</b>	<b>13.2%</b>

The following table summarizes the disabled annuitant mortality experience for the study period compared to the unadjusted base table:

Gender	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
<b>Total</b>	<b>11,147</b>	<b>5,973</b>	<b>187%</b>

The experience during the study period shows that more benefits for disabled annuitants have been released due to mortality than expected. On a benefit-weighted basis, the ratio of actual to expected was 187%.

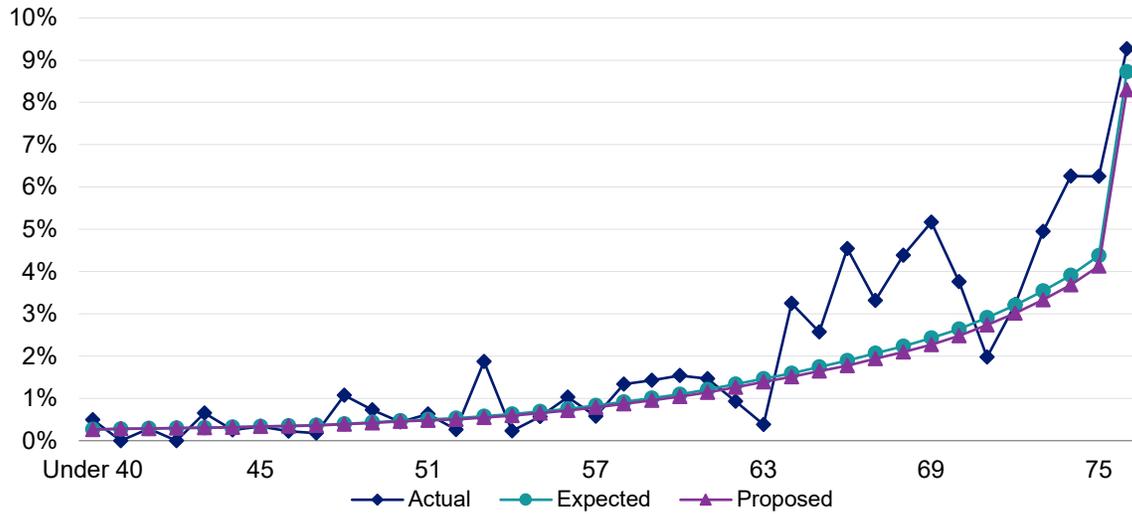
However, due to the limited credibility of the data over the study period and the known potential impacts of the COVID-19 pandemic we have only partially reflected the actual experience over this time period. **We recommend that the mortality table for disability retirees remain the same, specifically the Pub-2010 Safety Disabled Retiree Table (sex-distinct) with a 144% adjustment for males (as compared to 152% in the current assumption) and with no adjustment for females. In order to reflect future improvements in life expectancy, we recommend updating the mortality projection scale to MP-2021.**

The proposed disabled post-retirement mortality rates are included in Appendix B.

The following graph shows the actual mortality rate, expected mortality rate, and proposed mortality rate for males and females combined (although as noted earlier, the mortality table will be applied on a sex-distinct basis for valuation purposes).

### III: Demographic Assumptions

#### Actual Versus Proposed, Benefits-Weighted Basis Disabled Retiree Mortality – All



### III: Demographic Assumptions

#### Beneficiary (Contingent Annuitant) Mortality

Mortality experience among beneficiaries is studied separately from healthy retirees because the industry effects that retirees experience may not be present in the mortality experience for those retirees' widows. In other words, the Safety Mortality Tables used for other purposes may overstate the expected deaths for beneficiaries. For that reason the Pub-2010 General Retiree Below Median Income Amount-Weighted Tables were used for the purposes of projecting beneficiary mortality experience with generational projection using Scale MP-2018.

The experience and credibility factor over the three-year period for males and females is shown below.

Female		Male	
Deaths	Credibility	Deaths	Credibility
897	95.4%	6	8.8%

The following table summarizes the pre-retirement mortality experience for the study period compared to the unadjusted base table:

Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
	31,162	25,107	124.1%

The pre-retirement mortality experience during the study period shows that there were more benefits released due to death than expected. On a benefit-weighted basis, the ratio of actual to expected was 124.1%.

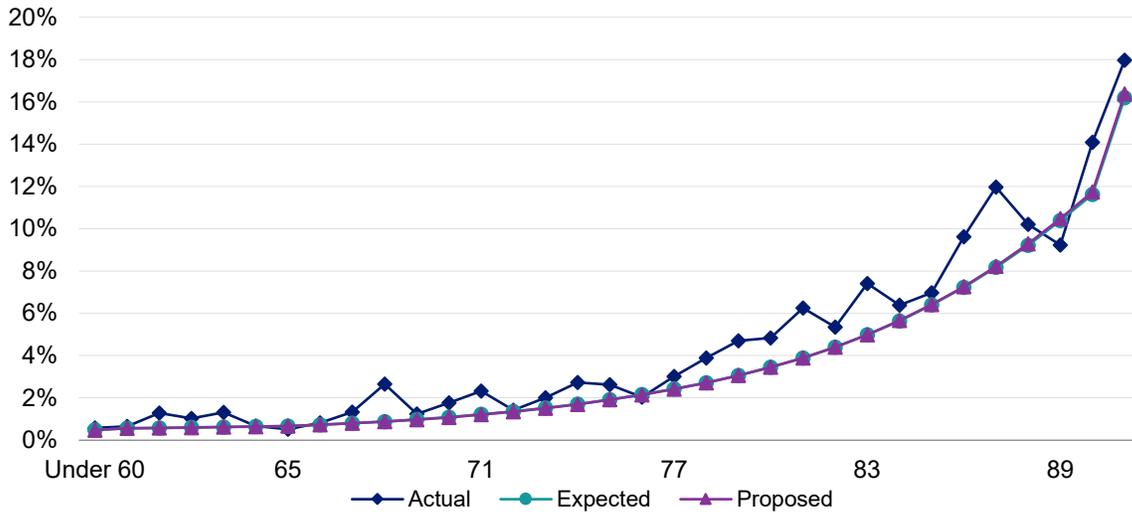
As discussed regarding retirees, due to the COVID-19 pandemic and the limited credibility of plan experience for certain subgroups, we have placed a lower weight on plan experience over the study period than we typically would. **As a result, we recommend the continued use of the same base table, Pub-2010 General Retiree Below Median Income Amount-Weighted Tables.. Finally, we recommend updating the mortality projection scale to MP-2021.**

The proposed beneficiary rates are included in Appendix B.

The following graphs show the actual mortality rate, expected mortality rate, and proposed mortality rate males and females combined (although as noted earlier, the mortality table will be applied on a sex-distinct basis for valuation purposes).

### III: Demographic Assumptions

#### Actual Versus Proposed, Benefits-Weighted Basis Beneficiary Mortality – All



### III: Demographic Assumptions

#### Pre-Retirement Mortality

The mortality experience of active members should be considered for several reasons. First, in combination with termination 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.

The current mortality assumption for active and terminated vested members is based on the Pub-2010 Public Safety Employee Mortality Table with generational projection using Scale MP-2018. The table is adjusted by 105.6% for males and 102.5% for females for all aged.

The experience and credibility factor over the three-year period for males and females is shown below.

Female		Male	
Deaths	Credibility	Deaths	Credibility
109	25.7%	8	7.1%

The following table summarizes the pre-retirement mortality experience for the study period compared to the unadjusted base table:

Actual Deaths	Expected Deaths	Ratio of Actual to Expected
4,462	4,100	108.9%

The pre-retirement mortality experience during the study period shows that there were more benefits released due to death than expected. On a benefit-weighted basis, the ratio of actual to expected was 108.9%.

The credibility factors shown above are relatively low and therefore we have determined they should not be used for purposes of setting this assumption. **As a result, we recommend the continued use of the same base table, Pub-2010 Public Safety Employee Mortality Table. However, because of the lack of credibility we recommend removing the adjustment for both males and females that is used with the current assumption. Finally, we recommend updating the mortality projection scale to MP-2021.**

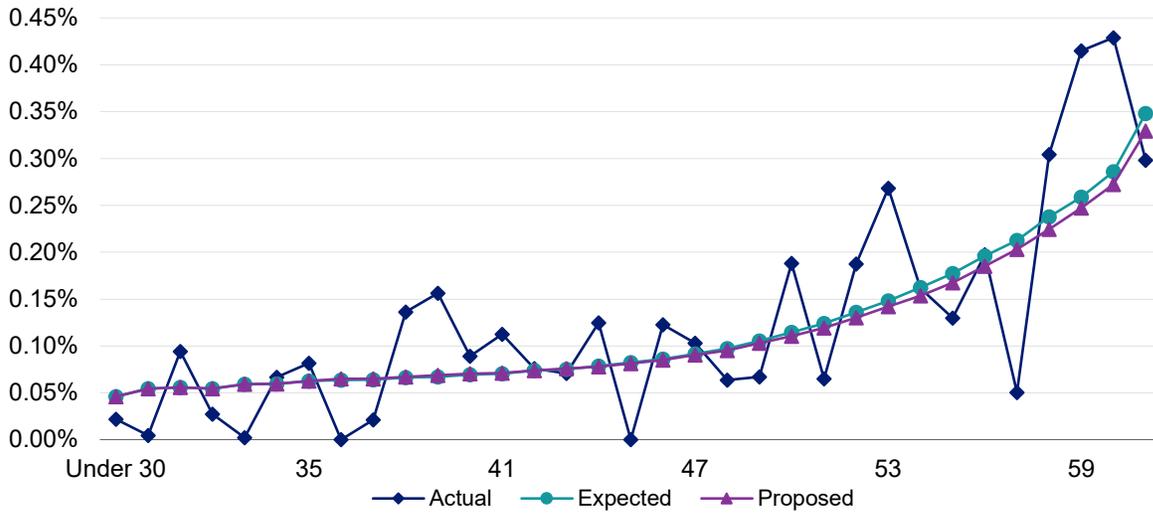
Additionally, of the 117 pre-retirement deaths in the study period, 6 (5.1%) were accidental. **Therefore, we recommend maintaining the current assumption that 5% of deaths in active service are accidental.**

The proposed healthy pre-retirement mortality rates are included in Appendix B.

The following graphs show the actual mortality rate, expected mortality rate, and proposed mortality rate males and females combined (although as noted earlier, the mortality table will be applied on a sex-distinct basis for valuation purposes).

### III: Demographic Assumptions

Actual Versus Proposed, Benefits-Weighted Basis  
Pre-Retirement Mortality – All



## III: Demographic Assumptions

### B. Retirement

#### Active Retirement

Under the plan, members are eligible to retire with a Service Retirement following attainment of age 55, unless they were active as of January 18, 2000. These members can retire upon the earlier of age 55 and the attainment of 20 years of Creditable Service. The plan also offers a Special Retirement which allows all members to retire upon the attainment of 25 years of Creditable Service and has a mandatory retirement at age 65.

The current assumption for retirement from active status is based on rates by age and service. There are three separate tables for each age depending on the service each member has: Less than 25 years, 25 Years, or More than 25 Years of Service. There is not a sufficient amount of female data to evaluate retirement patterns by gender.

We have analyzed retirement patterns before mandatory retirement at 65 for each of the three groups noted above. Following is a brief discussion of our observations and recommendations for each of the three groups;

- For members with less than 25 years of service: In aggregate, there were 1,058 new retirees (below age 65) as compared to 585 expected based on the current assumption (i.e actual to expected ratio of 1.81). Based on a review of data by age, there were fewer retirements for very young ages but consistently more for the older ages. **As a result, we recommend adjusting the current assumption at each age to match the actual experience over the three-year study period.** If the proposed rates had been in effect over the three-year study period, the number of expected retirements before age 65 would have been 1,060, or an actual to expected ratio of 1.0.
- For members with 25 years of service: In aggregate, there were 1,698 new retirees as compared to 1,856 expected based on the current assumption (i.e actual to expected ratio of 0.91). Based on a review of data by age, there were fewer retirements than expected at various ages. **As a result, we recommend adjusting the current assumption at these age to match the actual experience over the three-year study period.** If the proposed rates had been in effect over the three-year study period, the number of expected retirements would have been 1,728, or an actual to expected ratio of 0.98.
- For members with more than 25 years of service: In aggregate, there were 1,713 new retirees as compared to 1,805 expected based on the current assumption (i.e actual to expected ratio of 0.95). Based on a review of data by age, there were fewer retirements than expected at select ages. **As a result, we recommend adjusting the current assumption at these age to match the actual experience over the three-year study period.** If the proposed rates had been in effect over the three-year study period, the number of expected deaths would have been 1,729, or an actual to expected ratio of 0.99.

The following tables and graphs show the actual active retirement experience for the study period compared to the current and proposed assumptions. The proposed active retirement rates for all ages by service are included in Appendix C.

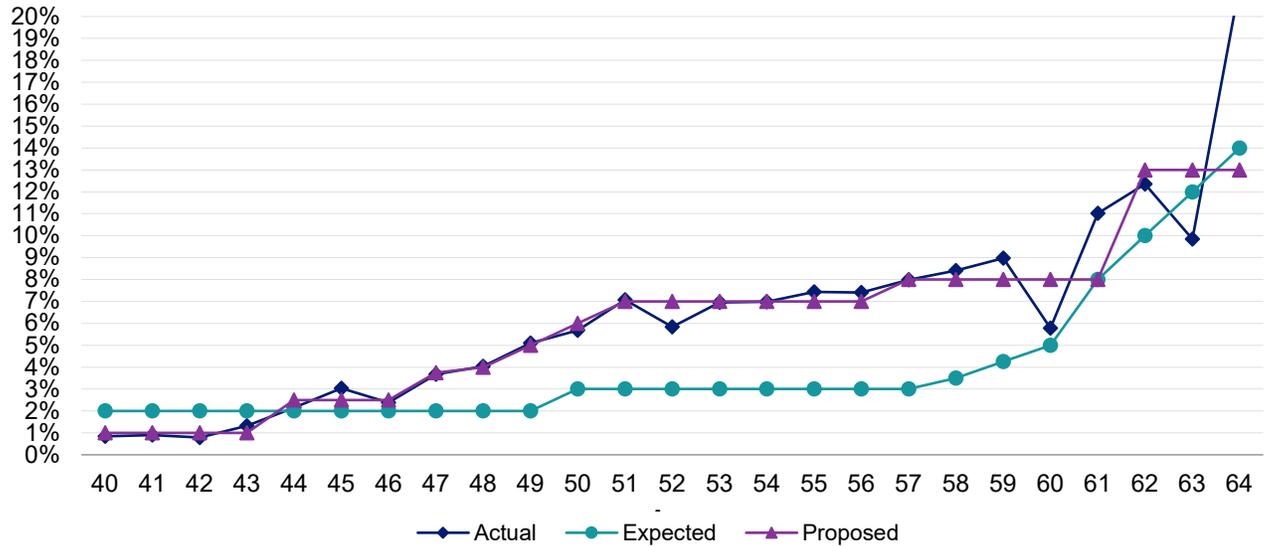
### III: Demographic Assumptions

#### Active Member Retirement, Less Than 25 Years of Service – Unisex

Age	Exposures	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
40	234	0.9	2.00	0.4	1.00	0.9
41	442	0.9	2.00	0.5	1.00	0.9
42	763	0.8	2.00	0.4	1.00	0.8
43	1,135	1.3	2.00	0.7	1.00	1.3
44	1,491	2.2	2.00	1.1	2.50	0.9
45	1,846	3.0	2.00	1.5	2.50	1.2
46	2,105	2.4	2.00	1.2	2.50	1.0
47	2,258	3.7	2.00	1.8	3.75	1.0
48	2,230	4.0	2.00	2.0	4.00	1.0
49	2,077	5.1	2.00	2.6	5.00	1.0
50	1,709	5.7	3.00	1.9	6.00	0.9
51	1,316	7.1	3.00	2.4	7.00	1.0
52	1,096	5.8	3.00	2.0	7.00	0.8
53	962	7.0	3.00	2.3	7.00	1.0
54	802	7.0	3.00	2.3	7.00	1.0
55	833	7.4	3.00	2.5	7.00	1.1
56	594	7.4	3.00	2.5	7.00	1.1
57	401	8.0	3.00	2.7	8.00	1.0
58	309	8.4	3.50	2.4	8.00	1.1
59	245	9.0	4.25	2.1	8.00	1.1
60	173	5.8	5.00	1.2	8.00	0.7
61	127	11.0	8.00	1.4	8.00	1.4
62	89	12.4	10.00	1.2	13.00	1.0
63	61	9.8	12.00	0.8	13.00	0.8
64	42	21.4	14.00	1.5	13.00	1.6
<b>Total</b>	<b>23,427</b>	<b>4.52</b>	<b>2.50</b>	<b>1.81</b>	<b>4.52</b>	<b>1.00</b>

### III: Demographic Assumptions

Actual Versus Proposed Experience, Benefit-Weighted Basis  
Active Member Retirement, Less Than 25 Years of Service – **Unisex**

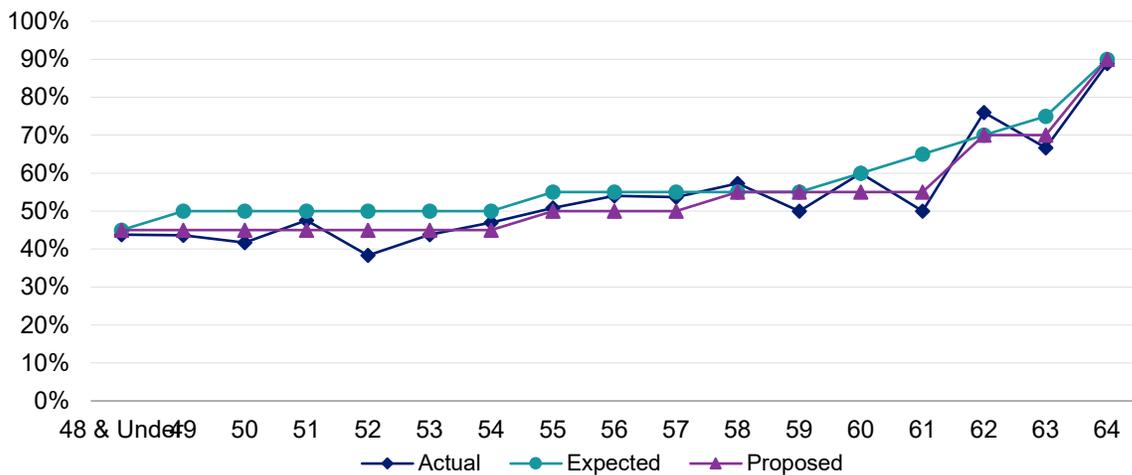


### III: Demographic Assumptions

#### Active Member Retirement, 25 Years of Service – Unisex

Age	Exposures	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
48 and Younger	1,004	43.8	45.0	1.0	45.0	1.0
49	481	43.7	50.0	0.9	45.0	1.0
50	446	41.7	50.0	0.8	45.0	0.9
51	353	47.6	50.0	1.0	45.0	1.1
52	274	38.3	50.0	0.8	45.0	0.9
53	240	43.8	50.0	0.9	45.0	1.0
54	198	47.0	50.0	0.9	45.0	1.0
55	187	50.8	55.0	0.9	50.0	1.0
56	124	54.0	55.0	1.0	50.0	1.1
57	110	53.6	55.0	1.0	50.0	1.1
58	82	57.3	55.0	1.0	55.0	1.0
59	66	50.0	55.0	0.9	55.0	0.9
60	55	60.0	60.0	1.0	55.0	1.1
61	32	50.0	65.0	0.8	55.0	0.9
62	25	76.0	70.0	1.1	70.0	1.1
63	21	66.7	75.0	0.9	70.0	1.0
64	9	88.9	90.0	1.0	90.0	1.0
<b>Total</b>	<b>3,707</b>	<b>45.8</b>	<b>50.1</b>	<b>0.9</b>	<b>46.6</b>	<b>1.0</b>

#### Actual Versus Proposed Experience, Benefit-Weighted Basis Active Member Retirement, 25 Years of Service – Unisex

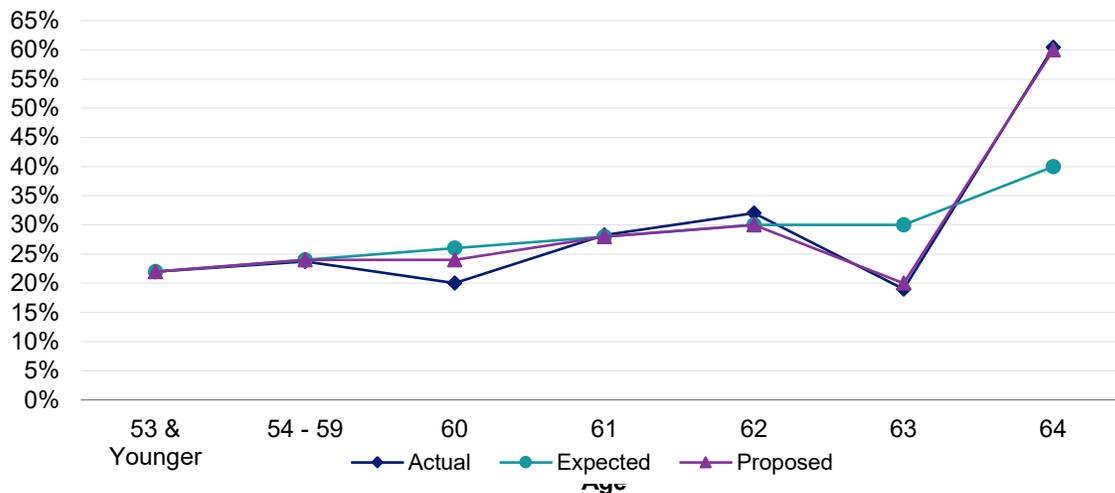


### III: Demographic Assumptions

#### Active Member Retirement, More than 25 Years of Service – Unisex

Age	Exposures	Actual Retirement Rate	Expected Retirement Rate	Ratio of Actual to Expected	Proposed Retirement Rate	Ratio of Actual to Proposed
53 and Younger	3,791	22.0	22.0	0.9	22.0	0.9
54-59	2,683	23.7	24.0	1.0	24.0	1.0
60	275	20.0	26.0	0.8	24.0	0.8
61	216	28.2	28.0	1.0	28.0	1.0
62	156	32.1	30.0	1.0	30.0	1.0
63	100	19.0	30.0	0.6	20.0	1.0
64	96	60.4	40.0	1.5	60.0	1.0
<b>Total</b>	<b>7,317</b>	<b>23.4</b>	<b>24.7</b>	<b>0.9</b>	<b>23.9</b>	<b>1.0</b>

#### Actual Versus Proposed Experience, Benefit-Weighted Basis Active Member Retirement, More than 25 Years of Service – Unisex



## III: Demographic Assumptions

### C. Termination

The termination rates used in annual actuarial valuations project the percentage of employees at each age or service duration that are expected to 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. In some cases, members who leave the plan with ten or more years of service and are eligible for deferred vested benefits withdraw their deposits, thus forfeiting the portion of their accrued benefit rights based on employer contributions.

The termination experience studied includes all terminations of active employment. Rehired members offset these terminations in order to determine the “net” terminations for each year of the study period.

The current assumption for termination uses rates based on a member’s service. Historically, for this plan service tends to be a better indicator of the probability of termination as compared to age. In addition, there is not sufficient data regarding female members to develop sex-distinct turnover rates.

Over the three-year study period, there were 944 actual terminations as compared to 920 expected based on the current assumption for an actual to expected ratio of 1.03. Based on a review of the terminations by age, **we recommend some minor adjustments to the proposed termination rates at all ages to reflect the additional actual experience over the three-year study period.** We have also extended the turnover rates to reflect the growing group of active participants who are ineligible to retire with prior to age 55 with 20 years of service, as exposure in this group increases in future years we will refine the assumption for this group.

The actual, expected and proposed termination rates are shown in the table on the following page.

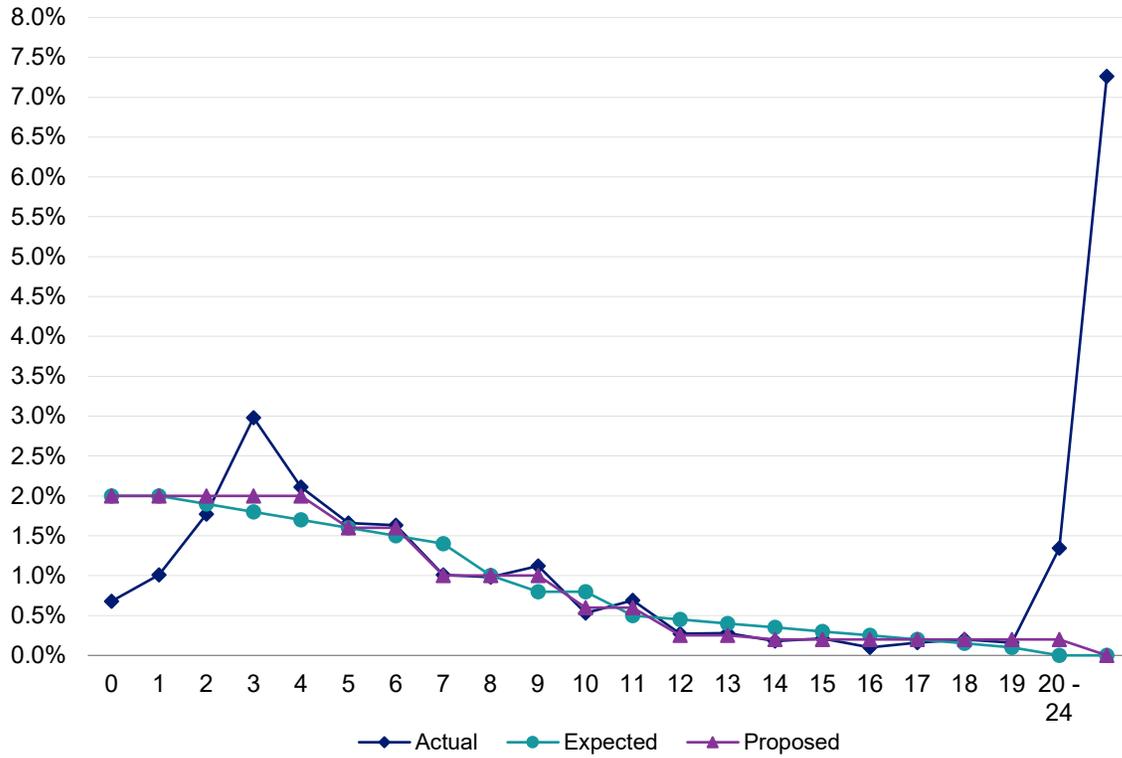
### III: Demographic Assumptions

#### Termination Rates by Years of Service

Service	Exposures	Actual Termination Rate	Expected Termination Rate	Ratio of Actual to Expected	Proposed Termination Rate	Ratio of Actual to Proposed
0	1,607	0.68	2.00	0.34	2.00	0.34
1	5,916	1.01	2.00	0.51	2.00	0.51
2	6,555	1.77	1.90	0.93	2.00	0.88
3	6,501	2.98	1.80	1.66	2.00	1.49
4	6,118	2.11	1.70	1.24	2.00	1.05
5	5,766	1.66	1.60	1.04	1.60	1.04
6	5,039	1.63	1.50	1.09	1.60	1.02
7	4,073	1.01	1.40	0.72	1.00	1.01
8	2,952	0.98	1.00	0.98	1.00	0.98
9	2,595	1.12	0.80	1.40	1.00	1.12
10	3,043	0.53	0.80	0.66	0.60	0.88
11	4,038	0.69	0.50	1.38	0.60	1.16
12	4,820	0.27	0.45	0.60	0.25	1.08
13	5,278	0.28	0.40	0.70	0.25	1.14
14	5,018	0.18	0.35	0.51	0.20	0.90
15	4,667	0.21	0.30	0.70	0.20	1.07
16	4,198	0.10	0.25	0.40	0.20	0.48
17	4,390	0.16	0.20	0.80	0.20	0.80
18	4,517	0.20	0.15	1.33	0.20	1.00
19	3,858	0.16	0.10	1.60	0.20	0.78
20 - 24	1,339	1.34	0.00	N/A	0.20	6.72
25+	303	7.26	0.00	N/A	0.00	N/A
<b>Total</b>	<b>92,593</b>	<b>1.02</b>	<b>0.99</b>	<b>1.03</b>	<b>1.00</b>	<b>1.02</b>

### III: Demographic Assumptions

Actual Versus Proposed Experience Termination By Years of Service



### III: Demographic Assumptions

#### D. Disability Retirement

Disability rate tables 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 the 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.

Since the plan offers two different disability benefits, ordinary and accidentally there are separate assumptions for each and therefore, we have studied the incidence of those two separately. The current assumption for both ordinary and accidental disability are based on rates by age. The following table summarizes the disability experience for the plan during the study period.

Type	Exposures	Actual Disabilities	Expected Disabilities	Ratio of Actual to Expected
Ordinary	107,309	245	278	88%
Accidental	127,245	232	319	73%

For ordinary disability in aggregate there were fewer new disabled awards than expected as indicated by the ratio of actual to expected disabled awards of 88%. In examining the experience by age it is clear that the number of actual ordinary disabled awards was less than what would have been expected based on the current assumption. **Therefore, we recommend adjusting the current rates to be consistent with the actual experience in the most recent three-year study period. The current and proposed rates are included in Appendix E. Note, if the proposed assumption had been in effect during the three-year period the expected number of deaths would have been 249, producing an actual to expected ratio of 0.98.**

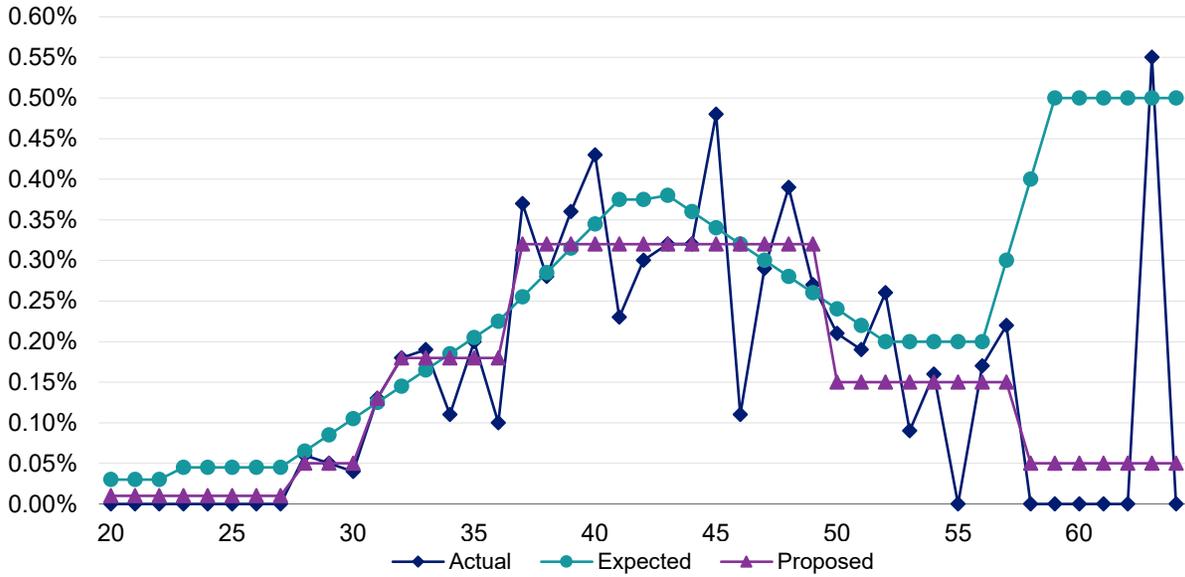
For accidental disability in aggregate there much fewer new disabled awards than expected as indicated by the ratio of actual to expected disabled awards of 73%. In examining the experience by age it is clear that the number of actual accidental disabled awards was less than what would have been expected based on the current assumption. **Therefore, we recommend adjusting the current rates to be consistent with the actual experience in the most recent three-year study period. The current and proposed rates are included in Appendix E. Note, if the proposed assumption had been in effect during the three-year period the expected number of deaths would have been 236, producing an actual to expected ratio of 0.98.**

**Additionally, due to very low incidence, we recommend maintaining the assumption that no participants receive an involuntary disability benefit.**

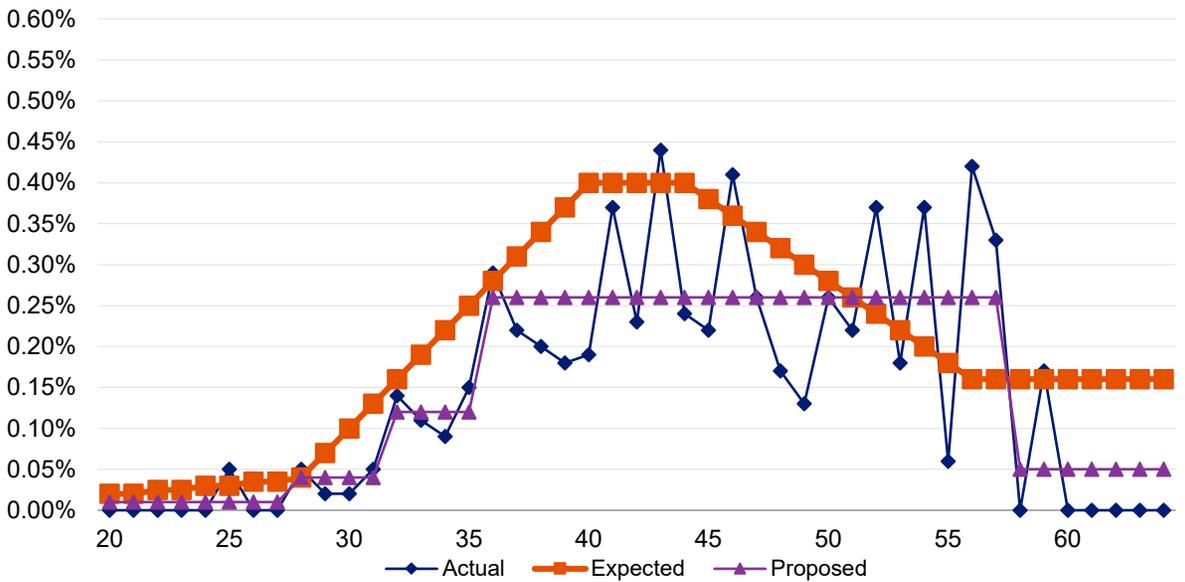
The following graphs show the actual, expected, and proposed select termination rates based on age.

### III: Demographic Assumptions

Actual Versus Proposed Experience  
Ordinary Disability Retirement



Actual Versus Proposed Experience  
Accidental Disability Retirement



## III: Demographic Assumptions

### E. Other Demographic Assumptions

#### Spouse Information

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

- 90% of active members are married
- Male spouses are three years older than female spouses
- 100% of spouses are of the opposite gender
- Retirees with a beneficiary allowance report are assumed to be married. None are assumed to have dependent children or parents.
- Current dependents receiving a pre-retirement accidental death benefit under age 24 are assumed to receive a benefit until age 24 while those over age 24 are assumed to receive a benefit for their lifetime.
- Current dependents receiving a benefit other than a pre-retirement accidental benefit under age 19 are assumed to receive a benefit until age 19 while those over age 19 are assumed to receive a benefit for their lifetime.

We have limited data to evaluate each of these assumptions. None have a significant impact on the liability of the plan. The current assumptions are reasonable and consistent with assumptions used for similar plans. Therefore, **we recommend no changes to the current assumptions.**

#### Retirement Age for Inactive Vested Participants

Members who terminate service prior to age 55 are able to retire with a deferred retirement benefit at age 55 provided they have ten years of service and do not elect to receive a refund of their aggregate contributions as a lump sum.

The current assumption is that all of these members will all retire at age 55. There is very limited data for this group as it is very rare that members elect to defer their retirement benefit and forgo the lump sum option. As of July 1, 2021 there were 60 inactive vested participants who were eligible for a deferred benefit. As a result of this limited data and due to the fact that the current assumption is reasonable and consistent with the plan design and with assumptions used for similar plans, **we recommend no changes to the current assumption.**

#### Inactive Vested Form of Payment Election

The plan allows for those who terminate prior to age 55 with more than ten years of service to elect their benefit be deferred to age 55 and paid as annuity. In lieu of the deferred benefit members can elect to have their aggregate contributions refunded, paid immediately as a lump sum.

The current assumption is that all terminations elect their benefit to be paid immediately as a lump sum, or 0% elect to defer their benefit to age 55. Historically, a very small percentage of terminated members elect to defer their benefit. That experience continued for the three-year study period. As a result of this historical experience,

### III: Demographic Assumptions

**we recommend maintaining the assumption that no eligible inactive vesteds opt for the deferred benefit rather than the lump sum cash out at termination.**

# IV. Appendix

## Appendix A: Proposed Salary Increases

Service	Current Total Salary Increase Rate	Proposed Total Salary Increase Rate <sup>1</sup>
0	15.25	16.25
1	15.25	14.00
2	12.75	12.00
3	10.75	12.00
4	10.25	12.00
5	9.25	11.00
6	8.25	10.00
7	7.25	9.00
8	5.75	8.00
9	5.25	7.00
10	4.75	6.00
11	4.25	5.00
12	3.75	5.00
13	3.25	4.00
14	3.25	4.00
15	3.25	4.00
16	3.25	4.00
17+	3.25	3.25

<sup>1</sup> Includes proposed 3.25% inflation and productivity total.

## Appendix B: Proposed Mortality Rates

### Healthy Post-Retirement Mortality<sup>1</sup>

Age	Male		Female	
	Current Mortality Rates	Proposed Mortality Rates	Current Mortality Rates	Proposed Mortality Rates
50	0.30	0.32	0.15	0.15
55	0.47	0.48	0.28	0.28
60	0.74	0.77	0.48	0.50
65	1.11	1.15	0.76	0.79
70	1.78	1.83	1.24	1.28
75	3.00	3.08	2.16	2.24
80	5.20	5.40	3.83	3.99
85	9.02	9.43	6.70	7.01
90	15.14	15.88	11.58	12.19
95	21.83	22.98	17.79	18.75
100	29.99	31.39	25.86	27.22

### Beneficiary Post-Retirement Mortality<sup>1</sup>

Age	Male		Female	
	Current Mortality Rates	Proposed Mortality Rates	Current Mortality Rates	Proposed Mortality Rates
50	0.66	0.68	0.41	0.41
55	0.88	0.88	0.49	0.48
60	1.12	1.13	0.56	0.56
65	1.32	1.32	0.67	0.67
70	1.97	1.95	1.08	1.07
75	3.20	3.18	1.91	1.90
80	5.39	5.41	3.44	3.44
85	9.32	9.42	6.36	6.38
90	15.34	15.49	11.61	11.73
95	23.62	23.62	18.21	18.45
100	32.61	32.61	27.01	27.26

<sup>1</sup> Current and proposed mortality rates above are sample rates for 2022. For actuarial valuation purposes, proposed mortality rates will be projected from 2010 on a generational basis using MP-2021 improvement scale.

## Appendix B: Proposed Mortality Rates

### Disabled Post-Retirement Mortality<sup>1</sup>

Age	Male		Female	
	Current Mortality Rates	Proposed Mortality Rates	Current Mortality Rates	Proposed Mortality Rates
40	0.30	0.30	0.20	0.18
45	0.36	0.35	0.24	0.21
50	0.49	0.48	0.32	0.29
55	0.71	0.67	0.53	0.47
60	1.16	1.10	0.80	0.73
65	1.82	1.72	1.11	1.01
70	2.74	2.57	1.60	1.45
75	4.51	4.25	2.46	2.23
80	7.80	7.41	4.09	3.73
85	12.99	12.43	7.14	6.56
90	22.57	21.68	12.91	11.81
95	43.84	32.53	20.72	18.96

### Healthy Pre-Retirement Mortality<sup>1</sup>

Age	Male		Female	
	Current Mortality Rates	Proposed Mortality Rates	Current Mortality Rates	Proposed Mortality Rates
25	0.04	0.04	0.02	0.02
30	0.05	0.05	0.03	0.04
35	0.06	0.06	0.05	0.05
40	0.07	0.07	0.06	0.05
45	0.08	0.08	0.07	0.06
50	0.12	0.11	0.09	0.09
55	0.18	0.17	0.13	0.13
60	0.29	0.27	0.18	0.18
65	0.44	0.41	0.22	0.22

<sup>1</sup> Current and proposed mortality rates above are sample rates for 2022. For actuarial valuation purposes, proposed mortality rates will be projected from 2010 on a generational basis using MP-2021 improvement scale.

# Appendix C: Proposed Retirement Rates

## Proposed Retirement (Unisex)

Age	Less than 25 Years of Service		25 Years of Service		More than 25 Years of Service	
	Current	Proposed	Current	Proposed	Current	Proposed
40	2.00	1.00	45.00	45.00	22.00	22.00
41	2.00	1.00	45.00	45.00	22.00	22.00
42	2.00	1.00	45.00	45.00	22.00	22.00
43	2.00	1.00	45.00	45.00	22.00	22.00
44	2.00	2.50	45.00	45.00	22.00	22.00
45	2.00	2.50	45.00	45.00	22.00	22.00
46	2.00	2.50	45.00	45.00	22.00	22.00
47	2.00	3.75	45.00	45.00	22.00	22.00
48	2.00	4.00	45.00	45.00	22.00	22.00
49	2.00	5.00	50.00	45.00	22.00	22.00
50	3.00	6.00	50.00	45.00	22.00	22.00
51	3.00	7.00	50.00	45.00	22.00	22.00
52	3.00	7.00	50.00	45.00	22.00	22.00
53	3.00	7.00	50.00	45.00	22.00	22.00
54	3.00	7.00	50.00	45.00	24.00	24.00
55	3.00	7.00	55.00	50.00	24.00	24.00
56	3.00	7.00	55.00	50.00	24.00	24.00
57	3.00	8.00	55.00	50.00	24.00	24.00
58	3.50	8.00	55.00	55.00	24.00	24.00
59	4.25	8.00	55.00	55.00	24.00	24.00
60	5.00	8.00	60.00	55.00	26.00	24.00
61	8.00	8.00	65.00	55.00	28.00	28.00
62	10.00	13.00	70.00	70.00	30.00	30.00
63	12.00	13.00	75.00	70.00	30.00	20.00
64	14.00	13.00	90.00	90.00	40.00	60.00
65	100.00	100.00	100.00	100.00	100.00	100.00

## Appendix D: Proposed Termination Rates

Years Of Service	Current Rate of Termination	Proposed Rate of Termination
0	2.00	2.00
1	2.00	2.00
2	1.90	2.00
3	1.80	2.00
4	1.70	2.00
5	1.60	1.60
6	1.50	1.60
7	1.40	1.00
8	1.00	1.00
9	0.80	1.00
10	0.80	0.60
11	0.50	0.60
12	0.45	0.25
13	0.40	0.25
14	0.35	0.20
15	0.30	0.20
16	0.25	0.20
17	0.20	0.20
18	0.15	0.20
19	0.10	0.20
20	0.00	0.20
21	0.00	0.20
22	0.00	0.20
23	0.00	0.20
24	0.00	0.20
25+	0.00	0.00

## Appendix E: Proposed Disability Retirement Rates

Age	Ordinary		Accidental	
	Current Disability Rates	Proposed Disability Rates	Current Disability Rates	Proposed Disability Rates
20	0.03	0.01	0.020	0.010
21	0.03	0.01	0.020	0.010
22	0.03	0.01	0.025	0.010
23	0.05	0.01	0.025	0.010
24	0.05	0.01	0.030	0.010
25	0.05	0.01	0.030	0.010
26	0.05	0.01	0.035	0.010
27	0.05	0.01	0.035	0.010
28	0.07	0.05	0.040	0.040
29	0.09	0.05	0.070	0.040
30	0.11	0.05	0.100	0.040
31	0.13	0.13	0.130	0.040
32	0.15	0.18	0.160	0.120
33	0.17	0.18	0.190	0.120
34	0.19	0.18	0.220	0.120
35	0.21	0.18	0.250	0.120
36	0.23	0.18	0.280	0.260
37	0.26	0.32	0.310	0.260
38	0.29	0.32	0.340	0.260
39	0.32	0.32	0.370	0.260
40	0.35	0.32	0.400	0.260
41	0.38	0.32	0.400	0.260
42	0.38	0.32	0.400	0.260
43	0.38	0.32	0.400	0.260
44	0.36	0.32	0.400	0.260
45	0.34	0.32	0.380	0.260
46	0.32	0.32	0.360	0.260
47	0.30	0.32	0.340	0.260
48	0.28	0.32	0.320	0.260
49	0.26	0.32	0.300	0.260
50	0.24	0.15	0.280	0.260
51	0.22	0.15	0.260	0.260
52	0.20	0.15	0.240	0.260
53	0.20	0.15	0.220	0.260

	Ordinary		Accidental	
54	0.20	0.15	0.200	0.260
55	0.20	0.15	0.180	0.260
56	0.20	0.15	0.160	0.260
57	0.30	0.15	0.160	0.260
58	0.40	0.05	0.160	0.050
59	0.50	0.05	0.160	0.050
60	0.50	0.05	0.160	0.050
61	0.50	0.05	0.160	0.050
62	0.50	0.05	0.160	0.050
63	0.50	0.05	0.160	0.050
64	0.50	0.05	0.160	0.050
65	0.00	0.00	0.000	0.000

END OF REPORT