

General Employees
Retirement Plan of Minnesota
4-Year Experience Study
July 1, 2018 Through June 30, 2022





June 29, 2023

Public Employees Retirement Association of Minnesota
General Employees Retirement Plan
St. Paul, Minnesota

Dear Trustees of the General Employees Retirement Plan:

The results of the four-year **actuarial experience study** of the General Employees Retirement Plan (GERP) are presented in this report. The investigation was conducted for the purpose of updating the actuarial assumptions used in valuing the actuarial liabilities of the General Employees Retirement Plan.

The investigation was based upon the statistical data furnished for annual active member and retired life actuarial valuations concerning members who died, withdrew, became disabled or retired during the four-year period of the study by the Public Employees Retirement Association of Minnesota (PERA). We checked for internal and year-to-year consistency, but did not audit the data. We are not responsible for the accuracy or completeness of the information provided by PERA.

The investigation covered the four-year period from **July 1, 2018 to June 30, 2022**, and was carried out using generally accepted actuarial principles and techniques.

We believe that the actuarial assumptions recommended in this experience study report represent individually and in the aggregate reasonable estimates of future experience of the General Employees Retirement Plan.

This report should not be relied on for any purpose other than that described above. It was prepared at the request of PERA and is intended for use by the Retirement Association and those designated or approved by the Trustees. This report may be provided to parties other than the Association only in its entirety and only with the permission of the Trustees.

This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. To the best of our knowledge and belief, the information contained in this report was performed in accordance with Minnesota Statutes Section 356.215 and the requirements of the Standards for Actuarial Work established by the Legislative Commission on Pensions and Retirement. We certify that, to the best of our knowledge, this report is complete and accurate and was made in accordance with standards of practice promulgated by the Actuarial Standards Board.

Public Employees Retirement Association of Minnesota
General Employees Retirement Plan
June 29, 2023

Brian B. Murphy, Bonita J. Wurst and Sheryl L. Christensen are independent of the plan sponsor and are Members of the American Academy of Actuaries (MAAA) and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. In addition, GRS meets the requirements of "approved actuary" under Minnesota Statutes Section 356.215, Subdivision 1, Paragraph (c).


Respectfully submitted,
Gabriel, Roeder, Smith & Company



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Actuarial Experience Study 2018 - 2022

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SECTION A

OVERVIEW AND SUMMARY OF RESULTS

Summary of Findings

The four-year period (July 1, 2018 to June 30, 2022) covered by this experience study provided sufficient data to form a basis for recommending changes in some of the assumptions and/or methods used in actuarial valuations of the General Employees Retirement Plan. The recommended changes in actuarial assumptions and methods resulting from this experience study are summarized below:

Recommendations

- Adjust rates of merit and seniority, resulting in slightly higher proposed merit and seniority overall.
- Adjust assumed retirement rates:
 - Increase the rate of assumed unreduced retirements (i.e., Normal Retirement).
 - Slight adjustments to Rule of 90 retirement rates.
 - Slight adjustments to early retirement rates for Tier 1 and Tier 2 members.
- Change the assumed rates of withdrawal (termination of membership before eligible to retire):
 - The overall impact is a minor increase in assumed terminations for males and females.
- Lower rates of disability.
- Continued use of the Pub-2010 general mortality table, with rates adjusted to better fit observed plan experience and with future improvement projected using scale MP-2021.
- No change in the actuarial funding method.
- Consider alternatives to the current closed period amortization policy.
- Change Minnesota Standards for Actuarial Work requirements related to projected payroll.
- Minor changes to the form of payment assumptions for male and female retirees.
- Minor changes to the assumptions made with respect to missing participant data.

The recommendations are summarized on the following pages.

Introduction

Each year as of June 30, the actuarial liabilities of the Association are valued. In order to perform the valuation, assumptions must be made regarding the future experience of the System with regard to the following risk areas:

- Rates of **withdrawal** of active members (leaving before eligible to retire).
- Rates of **disability** among active members.
- Patterns of **pay increases** to active members.
- Rates of **retirement** among active members.
- Rates of **mortality** among active members, retirees, and beneficiaries.
- Long-term rates of **investment return** to be generated by the assets of the System.

Assumptions should be carefully chosen and continually monitored. An unrealistic set of assumptions can lead to:

- Understated costs resulting in either an inability to pay benefits when due, or gradual increases in required contributions as time progresses; and
- Overstated costs resulting in an unnecessarily large burden on the current generation of employers and taxpayers.

All actuarial assumptions are prescribed by Minnesota Statutes, the Legislative Commission on Pensions and Retirement or the PERA Trustees.

A single set of assumptions will not be suitable indefinitely. Things change, and our understanding of things (whether or not they are changing) also changes. The package of assumptions is then adjusted to reflect basic experience trends -- but not random year to year fluctuations. Actuarial assumptions were last revised for the 2020 actuarial valuations based on the results of the most recent experience study. Assumptions in effect prior to June 30, 2022 are ignored for purposes of this report.

No single experience period should be given full credibility in the setting of actuarial valuation assumptions. When we see significant differences between what is expected from our assumptions and the actual experience, we generally recommend a change in assumptions that produces results somewhere between the actual and expected experience. In this way, with each experience study the actuarial assumptions become better and better representations of actual experience. Consequently, temporary conditions that might influence a particular experience study period will not unduly influence the choice of long-term assumptions.

We are recommending certain changes in assumptions and methods. The various assumption changes are described on the following pages.

Summary of Decrement Experience 2018 - 2022

Results presented in this exhibit and in the body of the report are liability weighted for retirement, withdrawal and active mortality and benefit weighted for healthy and disabled retiree mortality.

Decrement Risk Area	Actual Number	Expected		
		Present Assumptions	Proposed Assumptions	Change
<i>Unreduced Retirement (\$000s)</i>				
Normal Retirement*	1,279,985	1,028,578	1,191,237	162,659
Rule of 90	1,291,744	1,307,656	1,283,302	(24,354)
<i>Reduced Retirement (\$000s)</i>				
Tier 1 Early Retirement	231,113	219,455	228,303	8,848
Tier 2 Early Retirement	1,409,759	1,335,847	1,383,787	47,940
<i>Withdrawal (\$000s)</i>				
Males	573,453	562,393	569,661	7,268
Females	1,072,059	1,013,413	1,030,080	16,667
<i>Disability</i>				
Males	132	299	209	(90)
Females	166	364	255	(109)
<i>Mortality (\$000s)</i>				
Healthy Retired Lives - Male	99,106	88,006	94,045	6,039
- Female	76,583	65,980	73,311	7,331
Disabled Retired Lives** - Male	5,871	5,235	5,192	(43)
- Female	4,531	4,189	3,960	(229)
Active Lives** - Male	42,114	46,136	43,117	(3,019)
- Female	33,892	37,058	35,545	(1,513)

* Normal retirements less than age 71. See Section D for full detail.

** Adjustments to fit plan experience are limited due to a lack of credible data (deaths).



SECTION B

ECONOMIC ASSUMPTIONS

Economic Assumptions – Introduction

Economic assumptions include **long-term rates of investment return** (net of administrative and investment expenses), **inflation** (the across-the-board portion of salary increases), **payroll growth**, and pay increases due to **merit and seniority**. Unlike demographic activities, economic activities do not lend themselves to analysis solely on the basis of internal historical patterns because both salary increases and investment return are affected more by external forces; namely inflation (both wage and price), general productivity changes and the local economic environment which defy accurate long-term prediction. Estimates of economic activities are generally selected on the basis of the expectations in an inflation-free environment and then both long-term rates of investment return and wage inflation are increased by some provision for long-term inflation.

Current economic assumptions for PERA are as follows:

Investment Return	7.00%*
Inflation	2.25%
Payroll Growth	3.00%

** Recent legislation changed the investment return assumption from 7.5% to 7.0% effective July 1, 2023.*

The remainder of this section addresses the economic assumptions other than pay increases due to merit and seniority. Pay increases due to merit and seniority are addressed in Section C.

Sources considered in the analysis of the economic assumptions included:

- Asset allocation information provided on May 31, 2023 by the State Board of Investment (SBI) for the State of Minnesota
- Future expectations of other investment consultants
- 2023 Social Security Trustees Report
- Historical observations of inflation statistics and investment returns
- U.S. Department of the Treasury yield curve rates (www.treasury.gov)
- National Average Wage Index

Economic Assumptions – ASOP No. 27

Guidance regarding the selection of economic assumptions for measuring pension obligations is provided by Actuarial Standards of Practice (ASOP) No. 27. The standard requires that the selected economic assumptions be consistent with each other. That is, the selection of the investment return assumption should be consistent with the selection of the payroll growth and inflation assumptions.

The relevant Actuarial Standard of Practice (ASOP) for economic assumptions is ASOP No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*. Under ASOP No. 27, Section 3.6, an economic assumption is reasonable if it has the following characteristics:

- It is appropriate for the purpose of the measurement;
- It reflects the actuary's professional judgment;
- It takes into account current and historical data that is relevant to selecting the assumption for the measurement date, to the extent such relevant data is reasonably available;
- It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data (if any), or a combination thereof; and
- It is expected to have no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included (as discussed in Section 3.5.1) or when alternative assumptions are used for the assessment of risk, in accordance with ASOP No. 51, *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions*.

Economic Assumptions – Inflation

Inflation. Over the past 70 years, price inflation has averaged 3.5%. This result is heavily affected by the high inflationary period of the 1970s and early 1980s. During the past decade, price inflation averaged 2.6%.

Calendar Year Period	Inflation (CPI)
1950-1959	2.2%
1960-1969	2.5%
1970-1979	7.4%
1980-1989	5.1%
1990-1999	2.9%
2000-2009	2.5%
2010-2019	1.8%
2010	1.5%
2011	3.0%
2012	1.7%
2013	1.5%
2014	0.8%
2015	0.7%
2016	2.1%
2017	2.1%
2018	1.9%
2019	2.3%
2020	1.4%
2021	7.0%
2022	6.4%
Last 5 Years	3.8%
Last 10 Years	2.6%
Last 20 Years	2.5%
Last 30 Years	2.5%
Last 40 Years	2.8%
Last 50 Years	4.0%
Last 60 Years	3.9%
Last 70 Years	3.5%

The 2016 Asset Liability Study done by Callan for the SBI used a 2.25% price inflation assumption. The Federal Reserve System has a target inflation rate of 2.0%.

Economic Assumptions – Inflation

Future Expectations

The table below shows forward looking price inflation forecasts:

Forward-Looking Price Inflation Forecasts^a	
Congressional Budget Office^b	
5-Year Annual Average	2.83%
10-Year Annual Average	2.57%
Federal Reserve Bank of Philadelphia^c	
5-Year Annual Average	2.50%
10-Year Annual Average	2.37%
Federal Reserve Bank of Cleveland^d	
10-Year Expectation	2.26%
20-Year Expectation	2.35%
30-Year Expectation	2.42%
Federal Reserve Bank of St. Louis^e	
10-Year Breakeven Inflation	2.30%
20-Year Breakeven Inflation	2.51%
30-Year Breakeven Inflation	2.26%
U.S. Department of the Treasury^f	
10-Year Breakeven Inflation	2.16%
20-Year Breakeven Inflation	2.40%
30-Year Breakeven Inflation	2.21%
50-Year Breakeven Inflation	2.33%
100-Year Breakeven Inflation	2.41%
Social Security Trustees^g	
Ultimate Intermediate Assumption	2.40%

^aEnd of the First Quarter, 2023. Version 2023-05-03 by Gabriel, Roeder, Smith & Company

^bThe Budget and Economic Outlook: 2023 to 2033, Release Date: February 2023, Consumer Price Index (CPI-U), Percentage Change from Year to Year, 5-Year Annual Average (2023 - 2027), 10-Year Annual Average (2023 - 2032).

^cFirst Quarter 2023 Survey of Professional Forecasters, Release Date: February 10, 2023, Headline CPI, Annualized Percentage Points, 5-Year Annual Average (2023 - 2027), 10-Year Annual Average (2023 - 2032).

^dInflation Expectations, Model output date: March 1, 2023.

^eThe breakeven inflation rate represents a measure of expected inflation derived from X-Year Treasury Constant Maturity Securities and X-Year Treasury Inflation-Indexed Constant Maturity Securities. Observation date: March, 2023.

^fThe Treasury Breakeven Inflation (TBI) Curve, Monthly Average Rates, March, 2023.

^gThe 2023 Annual Report of The Board of Trustees of The Federal Old-Age And Survivors Insurance and Federal Disability Insurance Trust Funds, March 31, 2023, Long-range (75-year) assumptions, Intermediate, Consumer Price Index (CPI-W).



Economic Assumptions – Inflation

Other Considerations

We examined the capital market assumption sets for eleven investment consulting firms, as shown in the investment return analysis in this section. The average assumption for inflation was 2.52%, with a range of 2.26% to 2.90%. However, the investment consulting firms typically set their assumptions based on a shorter time horizon, while actuaries must make much longer projections.

Recommendation

Although current inflation rates are higher than they have been in previous decades, the future outlook from the sources in the table on the prior page suggest 2.25% continues to be reasonable. We recommend maintaining a price inflation assumption of 2.25%.

Economic Assumptions – Payroll Growth

Payroll growth (wage inflation) represents the expected growth in total payroll for a stable population. Increases or decreases in covered population that lead to a change in total payroll are not reflected in this assumption. Wage inflation consists of two components: 1) a portion due to pure price inflation (i.e., increases due to changes in the CPI); and 2) increases on average salary levels in excess of pure price inflation (i.e., increases due to changes in productivity levels, supply and demand in the labor market and other macroeconomic factors).

The current payroll growth assumption is 3.00%, which is comprised of a 2.25% price inflation assumption plus a real wage growth assumption of 0.75%. The payroll growth assumption is used to develop the amount necessary to amortize the unfunded actuarial accrued liability using the level percent of pay methodology.

Salary increases for longer-service employees are almost entirely driven by wage inflation. Many of the factors that result in pay increases are largely inapplicable or have diminished importance for longer-service employees. Step or service-related increases have ceased or are minimal. Promotions occur with less frequency. Additional training or acquisition of advanced degrees usually occurs early in the career. Thus, longer service employees' wages are assumed to grow at the overall rate of wage inflation.

GERP salary increases observed in the study level off after about 25 years of service. For members with 25 or more years of service, the observed average salary increase during the four-year period was 3.4%. Inflation was volatile during this four-year period, averaging 1.1% for the first two fiscal years and 7.2% for the last two fiscal years, with the four-year average equal to 4.1%. Therefore, long-service employees received an average salary increase of 0.7% below inflation primarily due to the high inflation in the most recent years.

Based upon the data reviewed, we recommend keeping the current real wage growth assumption at 0.75%. When combined with the 2.25% price inflation assumption, the recommended payroll growth assumption remains at 3.00%. As noted above, the recommended payroll growth assumption is appropriate for a stable population.

Economic Assumptions – Investment Return

Investment Return. The investment return assumption is the actuarial assumption that has the largest impact on actuarial valuation results.

It is our understanding that the SBI's most recent asset liability study resulted in an expected net rate of return of 7.3%, comprised of an inflation assumption of 2.25%, and a real rate of return assumption of 5.05%. The asset liability study was completed by Callan in 2016.

PERA's Annual Comprehensive Financial Report for the fiscal year ending June 30, 2022 includes the following investment return statistics:

- SBI retirement funds returned 5.7 percentage points above the CPI over the last 20 years.
- The average return over the ten-year period ending June 30, 2022 was 9.4%.

The following chart shows the estimated annual investment return on an actuarial and market value basis for each year in the four-year period under consideration:

Fiscal Year Ending	Actuarial Value of Assets	Market Value of Assets
June 30, 2019	7.2%	7.2%
June 30, 2020	7.1%	4.2%
June 30, 2021	12.8%	30.3%
June 30, 2022	9.3%	-6.3%
Average annual investment return July 1, 2018 to June 30, 2022	9.1%	8.1%

Historical results provide some useful and interesting information but are not the sole basis for forward-looking assumptions.

Economic Assumptions – Investment Return

For purposes of budgeting contributions as a level percentage of payroll for public employee retirement systems, the assumed rate of investment return is used as the discount rate to determine the present value of a system's pension obligations. For most valuations, an actuarial investment return assumption based on expected future experience is a single estimate for all years and therefore implicitly assumes that returns above and below expectations will "average out" over time. In other words, the expected risk premium is reflected in the assumed rate of investment return in advance of being earned, while the investment risk is not reflected until actual experience emerges with each valuation.

The analysis of the investment return assumption in this report is based on forward-looking measures of likely investment return outcomes for the asset classes in the current investment policy. For purposes of this analysis, we have analyzed the System's investment policy with the capital market assumptions from eleven nationally recognized investment consultants.

Our analysis is based on the GRS Capital Market Assumption Modeler (CMAM). The purpose of the CMAM is to assess the reasonability of the assumed rate of return for use in the actuarial valuations for the plan. In our professional judgement, the CMAM has the capability to provide results that are consistent with this purpose. A description of the strengths, limitations and weaknesses of the model are incorporated in this report. In our opinion, the limitations and weaknesses are not material. We performed tests to ensure that the model reasonably represents that which is intended to be modeled.

We are relying on the GRS actuaries and Internal Software, Training, and Processes Team who developed and maintain the model.

Because GRS is a benefits consulting firm and does not develop or maintain our own capital market expectations, we request and monitor forward-looking expectations developed by several major investment consulting firms. We update our CMAM on an annual basis. The capital market assumptions in the 2023 CMAM are from the following investment consultants (in alphabetical order): Aon Hewitt, Blackrock, BNY Mellon, Callan, Cambridge, JPMorgan, Meketa, Mercer, NEPC, Verus, and Wilshire. We believe the benefit of performing this analysis using multiple investment consulting firms is to recognize the uncertain nature of the items affecting the selection of the investment return assumption. While there may be differences in asset classes, investment horizons, inflation assumptions, treatment of investment expenses, excess manager performance (i.e., alpha), etc., we have attempted to align the various assumption sets from the different investment consultants to be as consistent as possible. In some cases, we have made minor adjustments or assumptions to align the various assumptions sets with our model.

Each investment firm provided capital market assumptions over an investment horizon of approximately 10 years. Although investment firms often refer to this period as "short-term" it is important to remember that 10 years is actually a very long time. In fact, the duration of the liabilities of the General Employees Retirement Plan is 11 years. Therefore, returns during the next 10 years will affect the plan's funding materially. A subset of six investment firms provided capital market expectations over a longer horizon, varying between 20 and 30 years. For purposes of this report, the analysis is generally based on the 10-year expectations provided by the investment firms.



Economic Assumptions – Investment Return

In general, our understanding is that the methodology for developing these capital market expectations is forward-looking, not purely backward-looking. Over the years prior to 2022, we have observed a general decreasing trend in capital market expectations. However, we have also observed that some of the investment firms' assumption sets are dependent on the market conditions at the time they are developed and consequently may be sensitive to short-term market fluctuations. Some expectations are contrarian – meaning that when the market is high, future expectations are lowered and when the market is low, future expectations are raised. The amount of these fluctuations as they appear in the year-to-year capital market assumptions varies between the various investment firms.

Each year, the GRS CMAM reflects the most up-to-date information at the time the data was collected (typically reflecting the firms' expectations at the beginning of the calendar year). Compared to the 2022 survey, the 2023 survey generally shows higher return expectations for most asset classes. If we consider the three-year average of return expectations, the general decreasing trend has reversed and the short-term fluctuations are diminished.

To the best of our ability, we have adapted the System's investment policy to fit with the consultants' assumptions adjusting for these known differences in assumptions and methodology. The asset classes in the system's investment allocation often do not exactly align with the asset classes of all investment firms in the survey. This may require us to make approximations which can introduce some subjectivity into the process. In the following charts, to the extent possible, all returns are net of passive investment expenses and administrative expenses and have no assumption for excess manager performance (alpha) in excess of active management fees.

Presented below is the current target asset allocation, provided to GRS by the SBI for use in this study:

Asset Class	Asset Allocation
Public Equity	50%
Fixed Income	25
Private Markets	25

We note that any uninvested portion of the Private Markets allocation is held in cash.

Economic Assumptions – Investment Return

Additionally, the following background information was provided by the SBI regarding the actual asset allocation as of December 31, 2022. SBI staff provided assurances that no significant changes in asset allocation are expected and that these are appropriate to use going forward.

Asset Class	Total Fund Allocation
Domestic Equity	33.5%
International Equity	15.5%
Global Equity	1.0%
Core/Core Plus	5.4%
Return Seeking	5.0%
Treasury Protection	9.2%
Short Duration Ladder + Cash	4.7%
Private Equity	18.1%
Private Credit	2.1%
Real Assets	2.8%
Real Estate	2.4%
Cash (uninvested private market allocation)	0.3%

The CMAM begins with the nominal expected return from each Capital Market Assumption (CMA) set, takes out each CMA's price inflation assumption to arrive at the real return. We then incorporate the current price inflation assumption of 2.25% to get the adjusted nominal return. Investment expenses not already netted out of the return and/or administrative expenses paid out of trust assets which are not reflected in the employer contributions are netted out of the return. Note that the arithmetic return is in general higher than the median return due to the compounding effect of random returns. In general, the difference between the arithmetic and median return will be larger for larger standard deviation of returns.

We compare the probabilities of achieving returns over a 10-year horizon. We compute the 40th, 50th, and 60th percentiles of returns as well as the probability of achieving the assumption of 7.0% (effective July 1, 2023) over a 10-year horizon. These estimates are based on the assumption that the distribution of returns for the next 10 years is the same each year. The average median return from the last three years of CMAMs is shown at the bottom of the table on the next page for reference.



Economic Assumptions – Investment Return

GRS 2023 CMAM				
Capital Market Assumption Set (CMA)	Distribution of 10-Year Average Geometric Net Nominal Return			Probability of exceeding 7.00%
	40th	50th	60th	
(1)	(2)	(3)	(4)	(5)
1	5.09%	6.18%	7.28%	42.50%
2	5.38%	6.50%	7.63%	45.50%
3	5.77%	6.94%	8.12%	49.46%
4	6.02%	7.13%	8.24%	51.14%
5	6.06%	7.18%	8.32%	51.65%
6	6.26%	7.38%	8.50%	53.41%
7	6.35%	7.44%	8.54%	54.07%
8	6.33%	7.55%	8.78%	54.51%
9	6.76%	7.79%	8.83%	57.74%
10	6.79%	7.84%	8.90%	58.05%
11	6.75%	7.91%	9.08%	57.84%
Average	6.14%	7.26%	8.38%	52.35%
Average from last 3 CMAMs over 10-year horizon		6.32%		

The 50th percentile return is also related to the geometric average return. The geometric average of a sequence of returns over a number of years is the compound average of those returns over the number of years compounded. As the number of years in the geometric average increases and if the distributions of returns each year are independent and identically distributed, then the geometric average will converge to the median return. The median return may be considered a reasonable rate of return for purposes of the valuation. The average of 50th percentile returns is 7.26% per year.

Column 5 shows the estimated probability of achieving a 7.00% assumed rate of return over a 10-year period. The average probability of achieving 7.00% over 10 years is 52%.

As discussed, the 2023 CMAM generally results in higher expectations than previous years on the 10-year horizon. For reference, the 3-year average CMAM median return is 6.32%.

ASOP No. 27, Section 3.6.2, states that “[d]ue to the uncertain nature of the items for which assumptions are selected, the actuary may consider several different assumptions reasonable for a given measurement. Different actuaries will apply different professional judgment and may choose different reasonable assumptions. As a result, a range of reasonable assumptions may develop, both for an individual actuary, and across actuarial practice.” This range of reasonable assumptions is evident from the summaries we show from our CMAM.

In our opinion, the assumed rate of return effective July 1, 2023 of 7.00% is a reasonable assumption based on this analysis.

Nothing in this report should be construed as GRS giving investment advice.



SECTION C

PAY INCREASES

Pay Increases Due to Merit and Seniority

Pay increases granted to active members typically consist of two pieces:

- An across-the-board, economic type of increase granted to most or all members of the group. This increase is typically tied to inflation or cost-of-living changes, and
- An increase as a result of merit and seniority. This increase is typically related to the performance of an individual and includes promotions and increased years of experience.

The assumption for across-the-board increases is the pay inflation assumption discussed in Section B. The merit and seniority portion of pay increases is discussed on this page.

We reviewed the merit and seniority pay increases during the four-year period. For each year, we excluded individual pay increases that were more than 30% and also excluded individual pay increases that were less than -30%. Some occurrences of a negative salary increase are reasonable and expected in a plan that covers part-time employees. While this was a relatively small number of records, the experience distorted the experience of the overall group.

In order to study the merit and seniority portion of the salary increase assumption, it is necessary to separate out the portion attributable to wage inflation. Based on our review of salary experience for GERP members for the period July 1, 2018 through June 30, 2022, we observed that members with longer service averaged approximately a 3.4% annual increase for this period. For our analysis of the merit and seniority portion of total salary increase, we assumed that the salary increase amount in excess of the total salary increase for the longer-service members (i.e., those with 25 or more years of service) was attributable to wage inflation only. This assumes that once members reach a certain length of service, merit and seniority increases are much less common.

Pay Increases Due to Merit and Seniority

Findings

The assumed wage inflation was 3.00% during the study period. During the four years of the study, we estimated that the average actual wage inflation component of pay increases was around 3.40% for members of the General Employees Retirement Plan. This estimated actual increase was subtracted from the actual pay increases to obtain the estimated merit/seniority portion of the pay increases. It should be noted that the results of the analysis are very sensitive to the estimated wage inflation component.

Gross actual salary increases averaged 5.34% over the four-year period, ranging from 4.41% in 2021 to 6.08% in 2022. After adjusting for the 3.40% average wage inflation for this period, the average net salary increases (i.e., merit and seniority) averaged 1.94%, ranging from 1.01% to 2.68%.

Fiscal Year Ending	Exposures	Gross		Net*	
		Actual	Expected	Actual	Expected
2019	115,693	5.78%	4.68%	2.38%	1.68%
2020	116,993	5.12%	4.70%	1.72%	1.70%
2021	115,744	4.41%	4.71%	1.01%	1.71%
2022	107,496	6.08%	4.60%	2.68%	1.60%
Total	455,926	5.34%	4.67%	1.94%	1.67%

* Net Expected increases are equal to Gross Expected increases minus the current assumed wage inflation assumption of 3.00%. Net Actual increases are equal to Gross Actual increases minus the estimated actual wage inflation for the period of 3.40%.

The results of our analysis are shown on the following page. Using the techniques described above, observed merit and seniority pay increases were generally slightly higher than the presently assumed increase during the first year, lower in the second year, and generally slightly higher than the current assumption during years five through twenty. The result is the proposed merit and seniority increases are slightly higher in total but with a slightly different allocation.

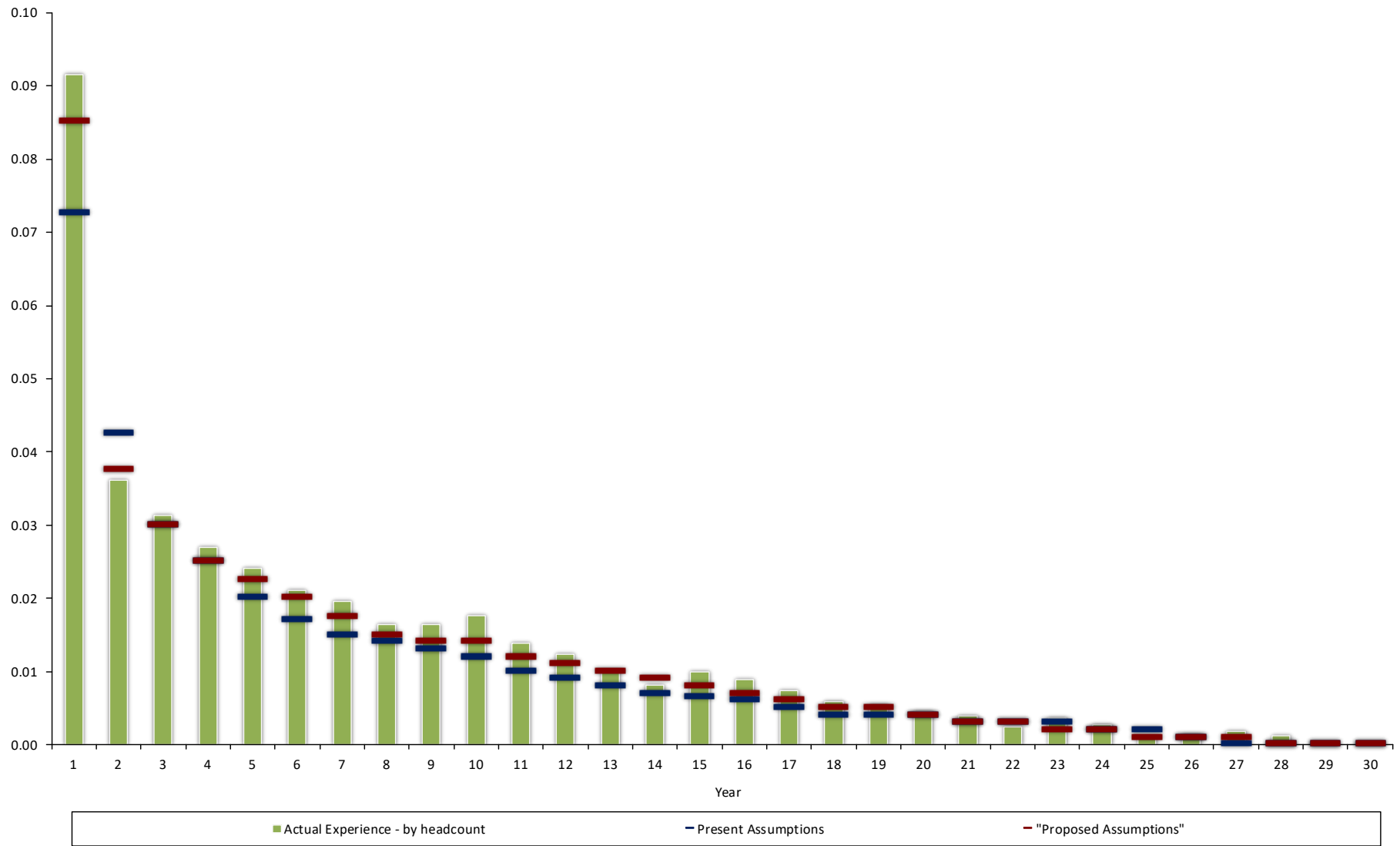
Recommendation

We recommend adjustments to the current merit/seniority pay increase assumption as shown on the following page.

Pay Increases Due to Merit and Seniority

Year	Exposures	Total % Increase			Merit/Seniority % Increase		
		Actual	Rates		Actual	Rates	
		Population Weighted	Current	Proposed	Population Weighted	Current	Proposed
1	48,927	12.55 %	10.25 %	11.50 %	9.15 %	7.25 %	8.50 %
2	37,118	7.01 %	7.25 %	6.75 %	3.61 %	4.25 %	3.75 %
3	34,108	6.53 %	6.00 %	6.00 %	3.13 %	3.00 %	3.00 %
4	30,914	6.09 %	5.50 %	5.50 %	2.69 %	2.50 %	2.50 %
5	27,918	5.81 %	5.00 %	5.25 %	2.41 %	2.00 %	2.25 %
6	24,293	5.51 %	4.70 %	5.00 %	2.11 %	1.70 %	2.00 %
7	20,064	5.36 %	4.50 %	4.75 %	1.96 %	1.50 %	1.75 %
8	16,377	5.04 %	4.40 %	4.50 %	1.64 %	1.40 %	1.50 %
9	13,488	5.05 %	4.30 %	4.40 %	1.65 %	1.30 %	1.40 %
10	12,137	5.17 %	4.20 %	4.40 %	1.77 %	1.20 %	1.40 %
11	12,289	4.79 %	4.00 %	4.20 %	1.39 %	1.00 %	1.20 %
12	12,792	4.64 %	3.90 %	4.10 %	1.24 %	0.90 %	1.10 %
13	13,302	4.42 %	3.80 %	4.00 %	1.02 %	0.80 %	1.00 %
14	12,485	4.22 %	3.70 %	3.90 %	0.82 %	0.70 %	0.90 %
15	11,012	4.40 %	3.65 %	3.80 %	1.00 %	0.65 %	0.80 %
16	10,406	4.28 %	3.60 %	3.70 %	0.88 %	0.60 %	0.70 %
17	10,096	4.14 %	3.50 %	3.60 %	0.74 %	0.50 %	0.60 %
18	10,299	3.99 %	3.40 %	3.50 %	0.59 %	0.40 %	0.50 %
19	10,553	3.95 %	3.40 %	3.50 %	0.55 %	0.40 %	0.50 %
20	10,219	3.86 %	3.40 %	3.40 %	0.46 %	0.40 %	0.40 %
21	9,430	3.79 %	3.30 %	3.30 %	0.39 %	0.30 %	0.30 %
22	8,348	3.65 %	3.30 %	3.30 %	0.25 %	0.30 %	0.30 %
23	7,406	3.76 %	3.30 %	3.20 %	0.36 %	0.30 %	0.20 %
24	6,661	3.67 %	3.20 %	3.20 %	0.27 %	0.20 %	0.20 %
25	5,890	3.50 %	3.20 %	3.10 %	0.10 %	0.20 %	0.10 %
26	5,315	3.54 %	3.10 %	3.10 %	0.14 %	0.10 %	0.10 %
27	4,783	3.58 %	3.00 %	3.10 %	0.18 %	0.00 %	0.10 %
28	4,343	3.52 %	3.00 %	3.00 %	0.12 %	0.00 %	0.00 %
29	4,018	3.27 %	3.00 %	3.00 %	(0.13)%	0.00 %	0.00 %
30+	20,935	3.26 %	3.00 %	3.00 %	(0.14)%	0.00 %	0.00 %
Total	455,926	5.34 %	4.67 %	4.81 %	1.94 %	1.67 %	1.81 %

Pay Increases Due to Merit and Seniority



SECTION D

RETIREMENT EXPERIENCE

Liability Weighted Analysis

In most recent experience studies, we have noticed that in order to develop assumptions that reduce the size of the gain or loss in a particular decrement it is necessary to consider the relative magnitude of the liability of the members that decrement, rather than number counts alone. For example, consider a plan with only two members who are both the same age and assume member one has a liability of \$10,000 and member two has a liability of \$90,000. If one of the members leaves and forfeits all of his or her liability, the net rate of decrement is one out of two for a rate of 50%. However, the net gain or loss to the system will be 10% if member one leaves versus 90% if member two leaves.

As a result, some of our tables include a column entitled 'liability weighted rate' or 'benefit weighted'. This represents the crude rate of decrement on a liability or benefit weighted basis as opposed to strictly a number count basis. The liability weighted rates were found to be most highly correlated with withdrawal and retirement decrements. This makes some intuitive sense, since retirement and termination decisions are often made based on how much the members have to gain or lose if they retire or change jobs, whereas death and disability is typically not a decision at all, rather an event that happens to someone. Comments on specific assumptions are provided on the following pages.

While mortality is not a voluntary human behavior, a recent study by the Society of Actuaries found that mortality experience was highly correlated with education and income. That is, people with higher incomes and higher levels of education tended to live longer than others. As such, we also studied mortality rates on a "benefit weighted" basis. This is discussed in more detail on page G-1.

Age and Service Unreduced (Normal) Retirement

Findings

The benefit provisions of the General Employees Retirement Plan (GERP) establish the minimum age and service requirements for unreduced or normal retirement. However, the actual cost of retirement is determined when members actually retire. The assumption about timing of retirements is a major ingredient in cost calculations. Note that higher rates of retirement with full benefits generally results in higher computed contributions, and vice versa.

Some members terminate employment with eligibility for retirement but elect to defer the benefit. We included these terminations as retirements for the purposes of this study.

The current assumption ends at age 71; in other words, we assume all members currently under the age of 71 will retire by the age of 71. However, for members currently age 71 or older, we assume retirement one year after the valuation date (effectively 18 months due to mid-year decrementing), as required by the Minnesota Standards for Actuarial Work. As such, members over age 70 are not included in our analysis since these members are assumed to work an additional year and then retire. During the four-year period, there were 1,023 actual retirements at ages 71 and older including 238 actual retirements at age 71. We believe assuming 100% retirement at age 71 is an appropriately conservative approach.

Overall, on both a population-weighted and liability-weighted basis, the plan experienced more unreduced retirements than projected by the present assumptions. We recommend increasing the assumed unreduced retirement rates, as shown on the next page.

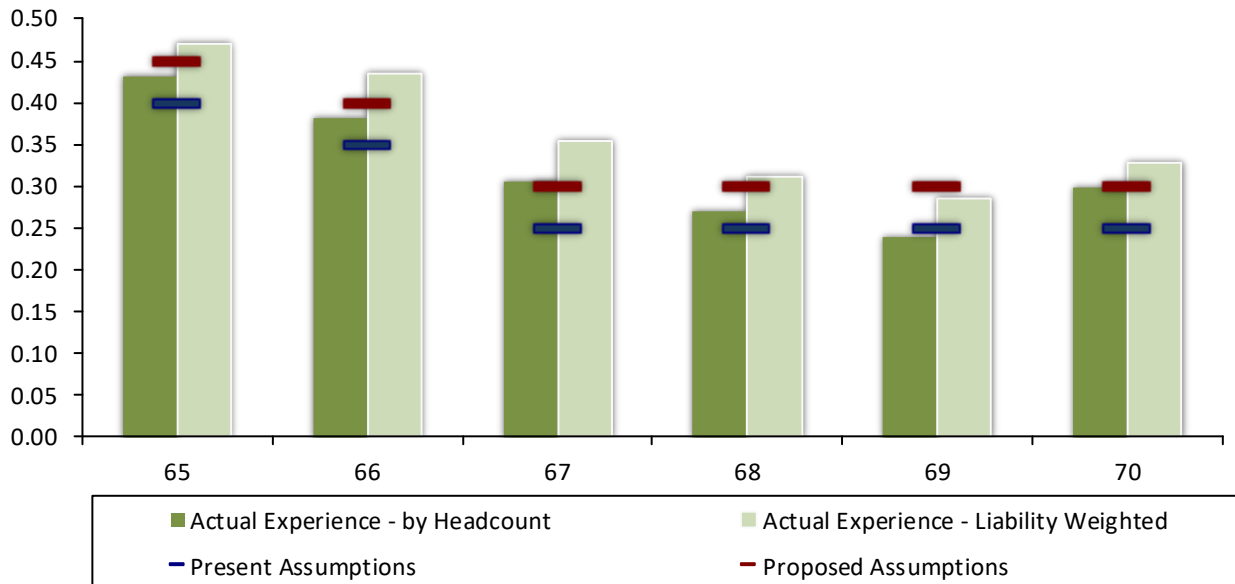
Age and Service Unreduced (Normal) Retirement

Recommendations

We recommend changes to the retirement rates as indicated below, which increase rates at all ages but not as much as the liability weighted actual experience suggests. In addition, we recommend the Minnesota Standards for Actuarial Work be modified to remove the requirement that members currently over age 70 delay retirement one year and instead assume these members retire mid-year, the same as members younger than age 71.

Age	Actual Retirements (\$000s)	Exposure (\$000s)	Crude Rates		Rates		Expected Retirements (\$000s)		Actuals/Expecteds	
			Population	Liability	Present	Proposed	Present	Proposed	Present	Proposed
65	344,983	734,582	43.22%	46.96%	40.00%	45.00%	293,833	330,562	117.4%	104.4%
66	456,753	1,050,966	38.17%	43.46%	35.00%	40.00%	367,838	420,387	124.2%	108.7%
67	212,285	600,263	30.44%	35.37%	25.00%	30.00%	150,066	180,079	141.5%	117.9%
68	123,074	396,554	26.89%	31.04%	25.00%	30.00%	99,138	118,966	124.1%	103.5%
69	78,952	276,151	23.89%	28.59%	25.00%	30.00%	69,038	82,845	114.4%	95.3%
70	63,938	194,659	29.73%	32.85%	25.00%	30.00%	48,665	58,398	131.4%	109.5%
71+	*	*	N/A	N/A	100.00%	*	-	-	N/A	N/A
Totals	1,279,985	3,253,176	33.10%	39.35%	31.62%	36.62%	1,028,578	1,191,237	124.4%	107.5%

* The current assumption prescribed by the Minnesota Standards for Actuarial Work is that members who have reached 100% retirement eligibility will delay retirement for one year. Therefore, even though there are members that are over age 70, these members are not included in the analysis above since retirement is assumed to be delayed one year. There were 1,023 actual retirements over age 70.



Rule of 90 (Unreduced) Early Retirement

Findings

GERP members who were hired prior to July 1, 1989 may retire with an unreduced benefit when age plus service is at least 90 years. We refer to these cases as Rule of 90 early retirements.

Generally, because of the subsidized early retirement benefit, these members are expected to retire at a higher rate than those members that do not qualify for Rule of 90. Higher rates of Rule of 90 retirement generally result in higher computed contributions due to the enhanced benefit, and vice versa.

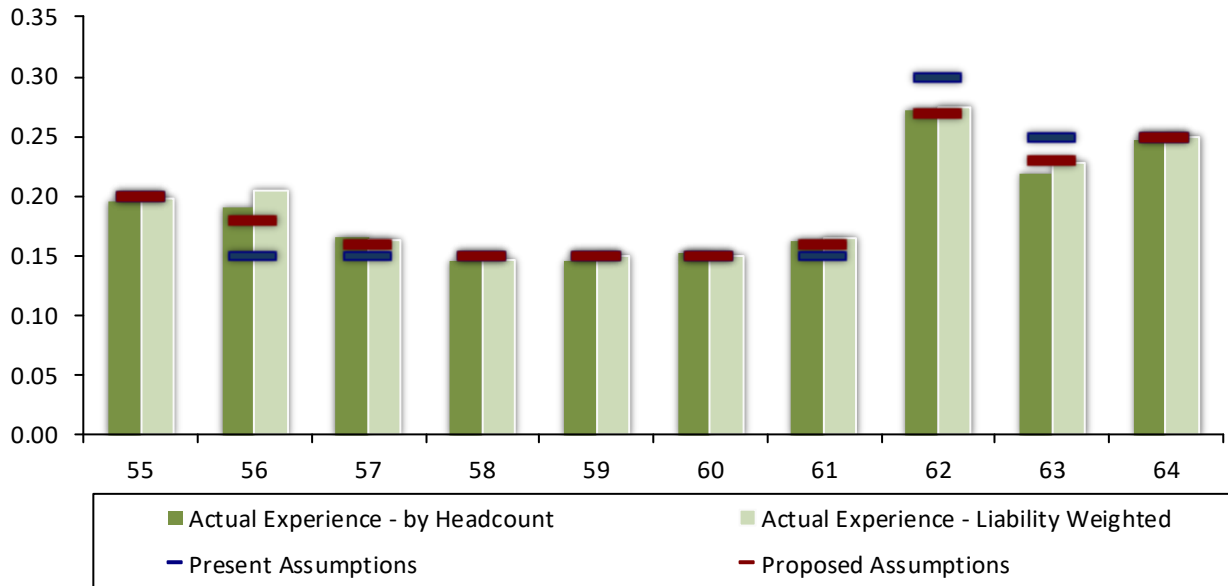
We reviewed the experience during the study period. Overall, on both a population-weighted and liability-weighted basis, the plan experienced slightly fewer Rule of 90 early retirements than projected by the present assumptions.

Recommendation

We recommend minor changes to the assumed Rule of 90 retirement rates as indicated on the next page.

Rule of 90 (Unreduced) Early Retirement

Age	Actual Retirements (\$000s)	Exposure (\$000s)	Crude Rates		Rates		Expected Retirements (\$000s)		Actuals/Expecteds	
			Population	Liability	Present	Proposed	Present	Proposed	Present	Proposed
55	19,637	99,485	19.50%	19.74%	20.00%	20.00%	19,897	19,897	98.7%	98.7%
56	47,847	233,966	19.00%	20.45%	15.00%	18.00%	35,095	42,114	136.3%	113.6%
57	72,319	443,921	16.52%	16.29%	15.00%	16.00%	66,588	71,027	108.6%	101.8%
58	99,400	677,569	14.63%	14.67%	15.00%	15.00%	101,635	101,635	97.8%	97.8%
59	124,537	835,591	14.57%	14.90%	15.00%	15.00%	125,339	125,339	99.4%	99.4%
60	137,447	920,703	15.18%	14.93%	15.00%	15.00%	138,105	138,105	99.5%	99.5%
61	155,671	946,233	16.27%	16.45%	15.00%	16.00%	141,935	151,397	109.7%	102.8%
62	262,579	958,282	27.24%	27.40%	30.00%	27.00%	287,485	258,736	91.3%	101.5%
63	187,638	826,224	21.80%	22.71%	25.00%	23.00%	206,556	190,031	90.8%	98.7%
64	184,669	740,084	24.63%	24.95%	25.00%	25.00%	185,021	185,021	99.8%	99.8%
Totals	1,291,744	6,682,058	19.11%	19.33%	19.57%	19.21%	1,307,656	1,283,302	98.8%	100.7%



Tier 1 Reduced Early Retirement

Findings

GERP members who were hired prior to July 1, 1989 (Tier 1 members) may also retire with a reduced benefit prior to the attainment of Normal Retirement. We refer to these cases as Tier 1 early retirements.

The early retirement benefit payable to Tier 1 members is the greater of (a) or (b):

- (a) 1.2% of average salary for each of the first ten years of service and 1.7% for each subsequent year with a reduction equal to 0.25% for each month the member is under age 65 (or age 62 if 30 or more years of service).
- (b) 1.7% of average salary for each year of service with actuarial reduction for each month the member is under age 65.

Early retirement benefits were changed as follows effective June 30, 2018:

- The augmentation adjustment in actuarial early retirement factors is eliminated over a five-year period starting July 1, 2019, resulting in actuarial equivalence after June 30, 2024; and
- The first benefit increase is delayed until Normal Retirement Age for retirements on or after January 1, 2024 (2023 legislation reversed this benefit change and will therefore never be implemented).

Because these benefits are reduced, these members are expected to retire at a lower rate than Tier 1 members who have attained Rule of 90. Higher rates of early retirement generally result in higher computed contributions and vice versa.

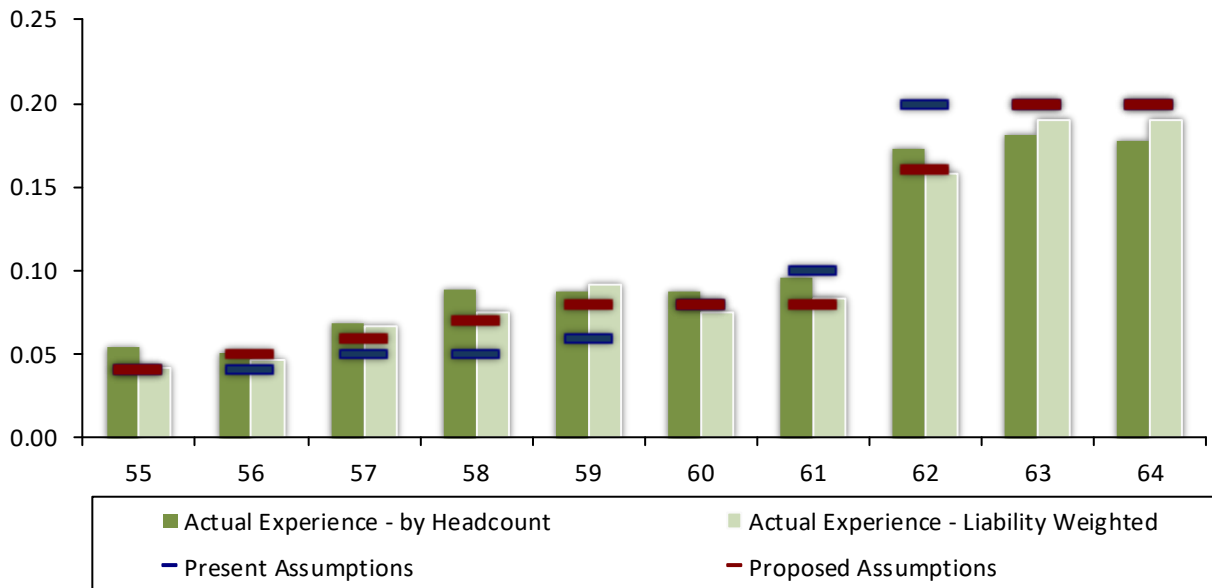
We reviewed the experience during the study period. Overall, on both a population-weighted and liability-weighted basis, the plan experienced more Tier 1 reduced early retirements three out of four years than projected by the present assumptions. However, we note the experience in the last year reflects more retirements than earlier years and may be related to the pandemic. Due to this volatility, we did not adjust the retirement rates as much as we would have otherwise.

Recommendation

We recommend changes to the Tier 1 Reduced early retirement rates, as indicated on the next page, with more weight given to the first three years of experience.

Tier 1 Reduced Early Retirement

Age	Actual Retirements (\$000s)	Exposure (\$000s)	Crude Rates		Rates		Expected Retirements (\$000s)		Actuals/Expecteds	
			Population	Liability	Present	Proposed	Present	Proposed	Present	Proposed
55	18,792	445,855	5.37%	4.21%	4.00%	4.00%	17,834	17,834	105.4%	105.4%
56	21,661	465,422	5.11%	4.65%	4.00%	5.00%	18,617	23,271	116.3%	93.1%
57	27,749	417,948	6.80%	6.64%	5.00%	6.00%	20,897	25,077	132.8%	110.7%
58	24,373	326,004	8.86%	7.48%	5.00%	7.00%	16,300	22,820	149.5%	106.8%
59	23,342	254,099	8.74%	9.19%	6.00%	8.00%	15,246	20,328	153.1%	114.8%
60	16,591	220,787	8.79%	7.51%	8.00%	8.00%	17,663	17,663	93.9%	93.9%
61	16,811	202,276	9.61%	8.31%	10.00%	8.00%	20,228	16,182	83.1%	103.9%
62	29,678	188,543	17.26%	15.74%	20.00%	16.00%	37,709	30,167	78.7%	98.4%
63	29,561	155,988	18.14%	18.95%	20.00%	20.00%	31,198	31,198	94.8%	94.8%
64	22,555	118,815	17.76%	18.98%	20.00%	20.00%	23,763	23,763	94.9%	94.9%
Totals	231,113	2,795,739	9.96%	8.27%	7.85%	8.17%	219,455	228,303	105.3%	101.2%



Tier 2 Reduced Early Retirement

Findings

GERP members who were hired after June 30, 1989 (Tier 2 members) may retire with a reduced benefit prior to the attainment of Normal Retirement. We refer to these cases as Tier 2 early retirements.

Early retirement benefits were changed as follows effective June 30, 2018:

- The augmentation adjustment in actuarial early retirement factors is eliminated over a five-year period starting July 1, 2019, resulting in actuarial equivalence after June 30, 2024; and
- The first benefit increase is delayed until Normal Retirement Age for retirements on or after January 1, 2024 (2023 legislation reversed this benefit change and will therefore never be implemented).

The Tier 2 early retirement benefit is the actuarial equivalent of the member's Normal Retirement benefit. In other words, there is no subsidy for early retirement. Because of the actuarially equivalent early retirement reduction, these members' benefits have about the same value as the deferred benefit to which they would be eligible if they did not request early commencement of the benefit. Higher rates of early retirement generally result in slightly lower computed contributions, and vice versa.

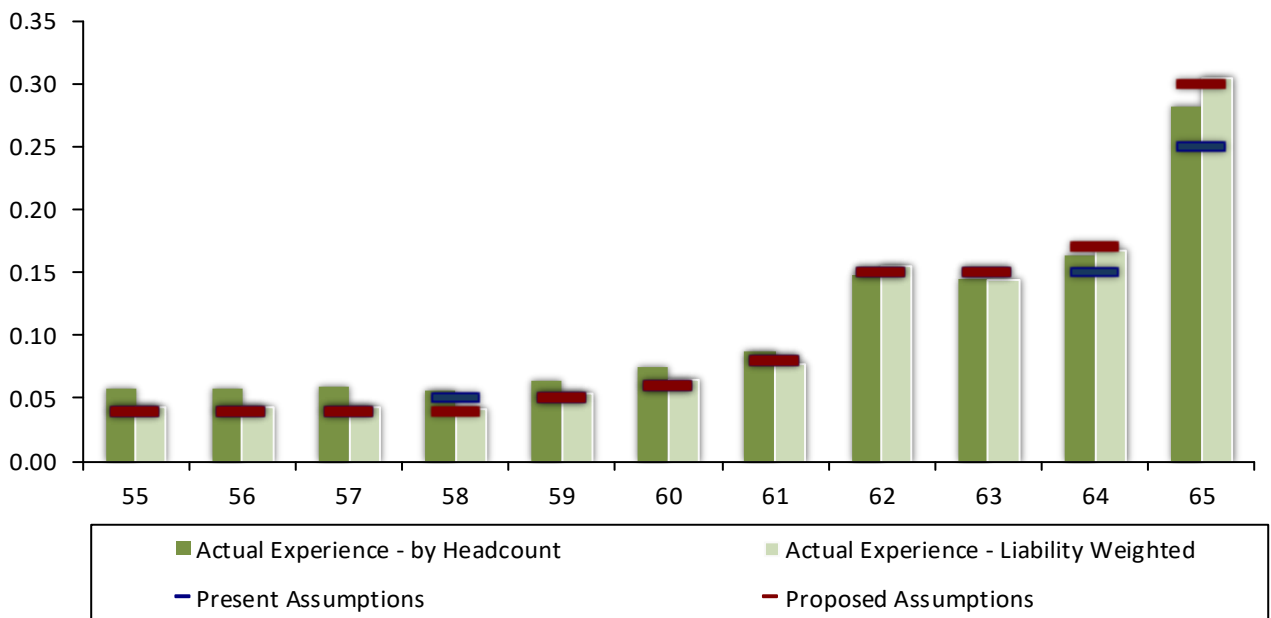
We reviewed the experience during the study period. On both a population and liability weighted basis, there were more Tier 2 reduced early retirements than projected by the present assumptions. However, we note the experience in the last year reflects more retirements than the earlier years and may be related to the pandemic. Due to this volatility, we did not adjust the retirement rates as much as we would have otherwise.

Recommendation

We recommend minor changes in Tier 2 early retirement rates, as indicated on the next page, with more weight given to the first three years of experience.

Tier 2 Reduced Early Retirement

Age	Actual Retirements (\$000s)	Exposure (\$000s)	Crude Rates		Rates		Expected Retirements (\$000s)		Actuals/Expecteds	
			Population	Liability	Present	Proposed	Present	Proposed	Present	Proposed
55	64,537	1,520,418	5.85%	4.24%	4.00%	4.00%	60,817	60,817	106.1%	106.1%
56	66,701	1,573,683	5.85%	4.24%	4.00%	4.00%	62,947	62,947	106.0%	106.0%
57	69,152	1,607,025	5.95%	4.30%	4.00%	4.00%	64,281	64,281	107.6%	107.6%
58	66,949	1,627,652	5.63%	4.11%	5.00%	4.00%	81,383	65,106	82.3%	102.8%
59	88,731	1,633,610	6.45%	5.43%	5.00%	5.00%	81,680	81,680	108.6%	108.6%
60	102,302	1,584,109	7.54%	6.46%	6.00%	6.00%	95,047	95,047	107.6%	107.6%
61	116,678	1,519,920	8.68%	7.68%	8.00%	8.00%	121,594	121,594	96.0%	96.0%
62	220,055	1,419,035	14.88%	15.51%	15.00%	15.00%	212,855	212,855	103.4%	103.4%
63	175,885	1,213,944	14.50%	14.49%	15.00%	15.00%	182,092	182,092	96.6%	96.6%
64	174,047	1,041,357	16.44%	16.71%	15.00%	17.00%	156,204	177,031	111.4%	98.3%
65	264,722	867,793	28.18%	30.51%	25.00%	30.00%	216,948	260,338	122.0%	101.7%
Totals	1,409,759	15,608,545	9.68%	9.03%	8.56%	8.87%	1,335,847	1,383,787	105.5%	101.9%



Retirement from Deferred Status

Members who terminate after completing three years of service (five if hired after June 30, 2010) are vested and entitled to either a refund of employee contributions, with interest, or a deferred retirement benefit.

While some members actually elect a refund even if it is less valuable than the deferred annuity, the current valuation assumption is that members will elect a refund only if it is more valuable than the deferred annuity. When a member elects a refund that is less valuable than his or her deferred annuity (or when a member elects the deferred annuity even if the refund is more valuable), the plan experiences a small liability gain. Since the current assumption results in very small gains to the plan, we recommend no change to this assumption.

For those deferred vested members for whom the deferred benefit is more valuable than a refund, the current valuation assumption is that the member will commence benefits at Normal Retirement Age. Except for long-service members hired prior to July 1, 1989 that may qualify for a subsidized reduction, when a member elects to commence benefits prior to Normal Retirement Age, the benefit is reduced on an actuarially equivalent basis, meaning there is no liability gain or loss to the plan. We recommend no change to this set of assumptions.



SECTION E

WITHDRAWAL EXPERIENCE

Withdrawal Experience

Members who leave active employment, for reasons other than retirement, disability or death, may be eligible for the following payments from the pension trust:

- A refund of employee contributions, or
- A deferred retirement benefit, if they are vested.

Deferred retirement benefits are based on the pay and service credit at the time of withdrawal. The benefit is increased with augmentation (if applicable) from termination until January 1, 2019 and is payable at Normal Retirement (or at Early Retirement with a reduction). Consequently, members who withdraw receive much less from the plan than members who stay in employment until retirement. Higher rates of withdrawal result in lower computed contributions, and vice versa.

Some members are eligible for retirement when they terminate employment but elect to defer the benefit and are consequently reported for the valuation as a termination with a deferred benefit. We included these terminations as retirements for the purposes of this study.

Current valuation termination rates for members are gender-specific and service-based. The withdrawal assumption review was done on a liability-weighted basis, as described earlier in the report.

Withdrawal Experience

Findings

When we reviewed the liability that decremented out of the plan during the prior four-year period, we observed that the plan experienced slightly more liability decrementing from the plan due to terminations than expected. We also note that terminations for both male and female members during the 2021-2022 fiscal year were higher than the other years in this study. Due to this volatility, we did not adjust the withdrawal rates as much as we would have otherwise.

Recommendation

We have recommended proposed rates which are a closer match to actual experience during the period with more weight given to the first three years of experience.

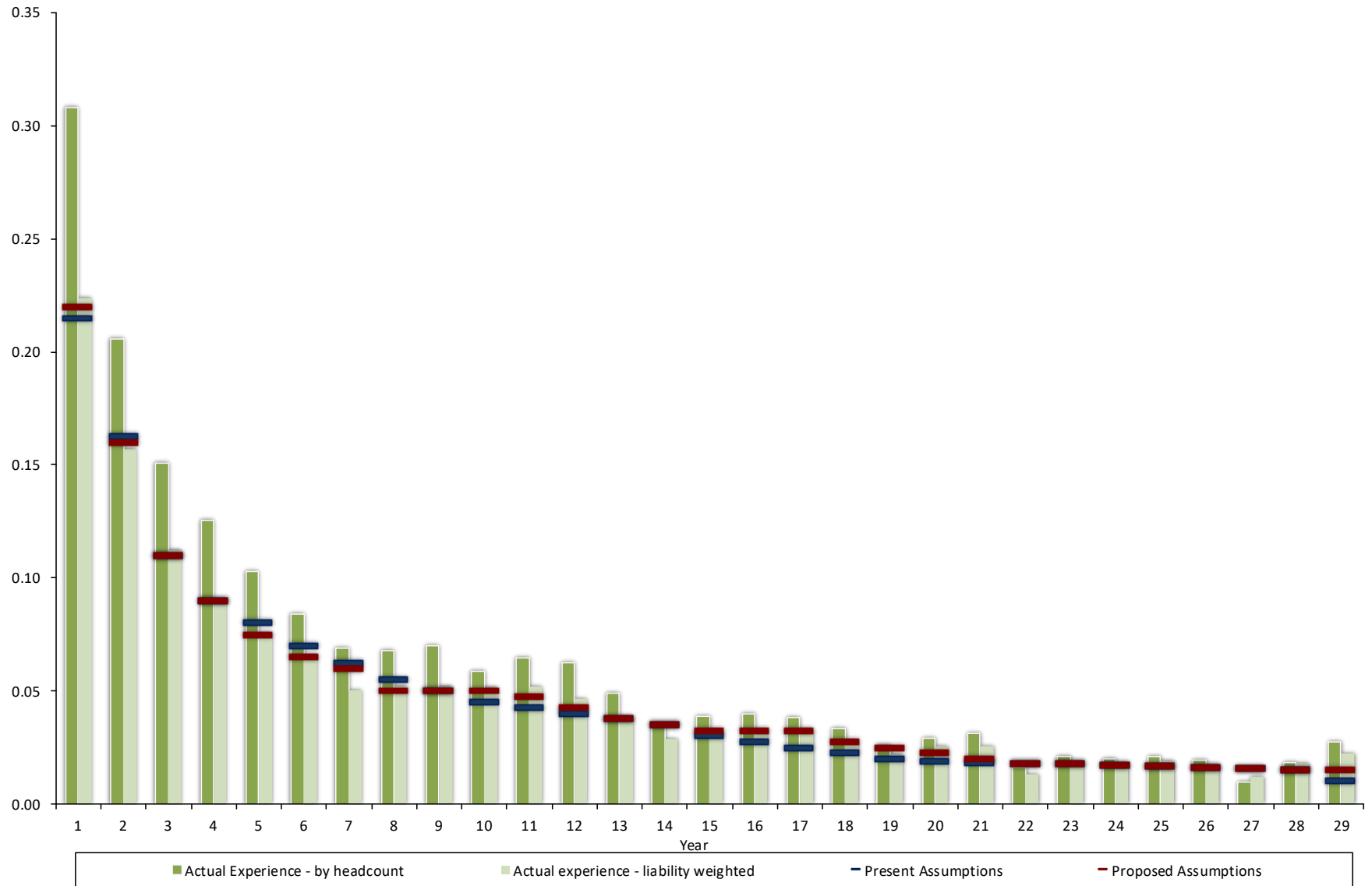
Withdrawal Experience

Males

Year	Liability Weighted (\$000s)		Crude Rates		Sample Rates		Liability Weighted (\$000s)		Ratio of	
	Withdrawal	Exposure	Population Weighted	Liability Weighted			Expected Withdrawals		Actuals/Expecteds	
					Present	Proposed	Present	Proposed	Present	Proposed
1	37,825	169,148	30.81%	22.36%	21.50%	22.00%	36,367	37,213	104.0%	101.6%
2	83,959	534,573	20.59%	15.71%	16.25%	16.00%	86,868	85,532	96.7%	98.2%
3	68,331	609,269	15.09%	11.22%	11.00%	11.00%	67,020	67,020	102.0%	102.0%
4	55,654	620,750	12.53%	8.97%	9.00%	9.00%	55,868	55,868	99.6%	99.6%
5	43,640	580,279	10.27%	7.52%	8.00%	7.50%	46,422	43,521	94.0%	100.3%
6	33,742	521,980	8.41%	6.46%	7.00%	6.50%	36,539	33,929	92.3%	99.4%
7	25,239	499,216	6.91%	5.06%	6.25%	6.00%	31,201	29,953	80.9%	84.3%
8	23,200	447,406	6.76%	5.19%	5.50%	5.00%	24,607	22,370	94.3%	103.7%
9	19,888	381,756	7.02%	5.21%	5.00%	5.00%	19,088	19,088	104.2%	104.2%
10	16,535	320,135	5.86%	5.16%	4.50%	5.00%	14,406	16,007	114.8%	103.3%
11	15,595	299,455	6.45%	5.21%	4.25%	4.75%	12,727	14,224	122.5%	109.6%
12	14,971	321,235	6.26%	4.66%	4.00%	4.25%	12,849	13,652	116.5%	109.7%
13	13,303	351,558	4.90%	3.78%	3.75%	3.75%	13,183	13,183	100.9%	100.9%
14	11,404	399,233	3.42%	2.86%	3.50%	3.50%	13,973	13,973	81.6%	81.6%
15	12,364	391,959	3.85%	3.15%	3.00%	3.25%	11,759	12,739	105.1%	97.1%
16	11,382	352,079	3.98%	3.23%	2.75%	3.25%	9,682	11,443	117.6%	99.5%
17	10,686	328,397	3.84%	3.25%	2.50%	3.25%	8,210	10,673	130.2%	100.1%
18	8,579	316,607	3.31%	2.71%	2.25%	2.75%	7,124	8,707	120.4%	98.5%
19	7,248	332,896	2.58%	2.18%	2.00%	2.50%	6,658	8,322	108.9%	87.1%
20	9,172	358,222	2.90%	2.56%	1.90%	2.25%	6,806	8,060	134.8%	113.8%
21	9,254	361,874	3.10%	2.56%	1.85%	2.00%	6,695	7,237	138.2%	127.9%
22	4,476	343,785	1.60%	1.30%	1.80%	1.75%	6,188	6,016	72.3%	74.4%
23	5,240	310,385	2.11%	1.69%	1.75%	1.75%	5,432	5,432	96.5%	96.5%
24	4,760	277,395	1.99%	1.72%	1.70%	1.70%	4,716	4,716	100.9%	100.9%
25	4,632	242,372	2.08%	1.91%	1.65%	1.65%	3,999	3,999	115.8%	115.8%
26	3,413	207,972	1.95%	1.64%	1.60%	1.60%	3,328	3,328	102.5%	102.5%
27	2,161	177,748	0.99%	1.22%	1.55%	1.55%	2,755	2,755	78.4%	78.4%
28	2,816	157,696	1.82%	1.79%	1.50%	1.50%	2,365	2,365	119.1%	119.1%
29	2,881	130,295	2.74%	2.21%	1.00%	1.50%	1,303	1,954	221.1%	147.4%
30+	11,103	425,499	2.07%	2.61%	1.00%	1.50%	4,255	6,382	260.9%	174.0%
Totals	573,453	10,771,175	12.47%	5.32%	5.22%	5.29%	562,393	569,661	102.0%	100.7%



Withdrawal Experience Males

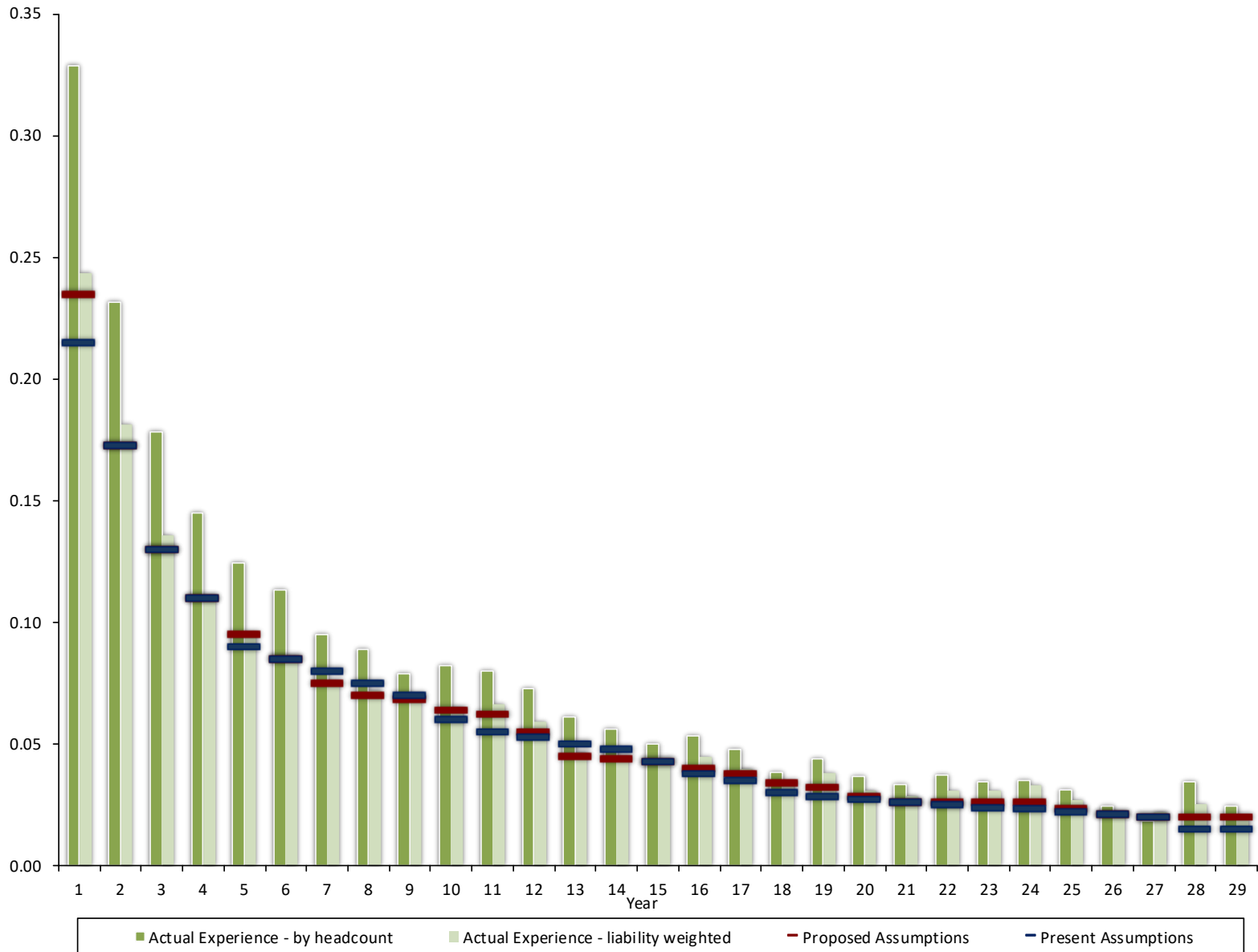


Withdrawal Experience Females

Year	Liability Weighted (\$ 000s)		Crude Rates		Liability Weighted (\$ 000s)					
					Expected Withdrawals		Ratio of Actuals/Expecteds			
	Withdrawals	Exposure	Population Weighted	Liability Weighted	Sample Rates		Present	Proposed	Present	Proposed
					Present	Proposed				
1	53,634	220,291	32.87%	24.35%	21.50%	23.50%	47,363	51,768	113.2%	103.6%
2	140,192	774,019	23.13%	18.11%	17.25%	17.25%	133,518	133,518	105.0%	105.0%
3	121,817	896,926	17.79%	13.58%	13.00%	13.00%	116,600	116,600	104.5%	104.5%
4	102,269	930,973	14.49%	10.99%	11.00%	11.00%	102,407	102,407	99.9%	99.9%
5	83,889	883,651	12.41%	9.49%	9.00%	9.50%	79,529	83,947	105.5%	99.9%
6	68,664	808,900	11.30%	8.49%	8.50%	8.50%	68,756	68,756	99.9%	99.9%
7	57,709	762,789	9.50%	7.57%	8.00%	7.50%	61,023	57,209	94.6%	100.9%
8	48,340	674,249	8.88%	7.17%	7.50%	7.00%	50,569	47,197	95.6%	102.4%
9	39,604	581,099	7.88%	6.82%	7.00%	6.80%	40,677	39,515	97.4%	100.2%
10	31,992	495,780	8.22%	6.45%	6.00%	6.40%	29,747	31,730	107.5%	100.8%
11	30,848	465,766	7.96%	6.62%	5.50%	6.20%	25,617	28,878	120.4%	106.8%
12	28,473	481,990	7.27%	5.91%	5.25%	5.50%	25,304	26,509	112.5%	107.4%
13	24,757	532,625	6.10%	4.65%	5.00%	4.50%	26,631	23,968	93.0%	103.3%
14	25,725	585,632	5.62%	4.39%	4.75%	4.35%	27,818	25,475	92.5%	101.0%
15	23,250	557,641	4.99%	4.17%	4.25%	4.25%	23,700	23,700	98.1%	98.1%
16	22,404	500,147	5.31%	4.48%	3.75%	4.00%	18,756	20,006	119.4%	112.0%
17	18,497	469,822	4.78%	3.94%	3.50%	3.75%	16,444	17,618	112.5%	105.0%
18	15,853	464,598	3.84%	3.41%	3.00%	3.40%	13,938	15,796	113.7%	100.4%
19	19,089	503,447	4.40%	3.79%	2.80%	3.20%	14,097	16,110	135.4%	118.5%
20	16,082	523,266	3.68%	3.07%	2.70%	2.80%	14,128	14,651	113.8%	109.8%
21	14,457	510,137	3.31%	2.83%	2.60%	2.60%	13,264	13,264	109.0%	109.0%
22	14,582	470,550	3.69%	3.10%	2.50%	2.60%	11,764	12,234	124.0%	119.2%
23	12,872	417,741	3.43%	3.08%	2.40%	2.60%	10,026	10,861	128.4%	118.5%
24	12,230	368,393	3.51%	3.32%	2.30%	2.60%	8,473	9,578	144.3%	127.7%
25	8,559	316,931	3.09%	2.70%	2.20%	2.30%	6,972	7,289	122.8%	117.4%
26	5,851	277,332	2.41%	2.11%	2.10%	2.10%	5,824	5,824	100.5%	100.5%
27	5,308	242,815	1.83%	2.19%	2.00%	2.00%	4,856	4,856	109.3%	109.3%
28	5,278	211,677	3.41%	2.49%	1.50%	2.00%	3,175	4,234	166.2%	124.7%
29	3,435	182,267	2.44%	1.88%	1.50%	2.00%	2,734	3,645	125.6%	94.2%
30+	16,401	646,846	3.05%	2.54%	1.50%	2.00%	9,703	12,937	169.0%	126.8%
Totals	1,072,059	15,758,299	14.69%	6.80%	6.43%	6.54%	1,013,413	1,030,080	105.8%	104.1%



Withdrawal Experience Females



SECTION F

DISABILITY EXPERIENCE

Disability Experience

The assumed rates of disability (leaving active service due to injury or illness while not entitled to age and service retirement benefits) are a minor ingredient in cost calculations, since the incidence of disability is low. Higher rates of disability generally result in somewhat higher computed contributions, and vice versa.

Findings

We reviewed the disability experience during the four-year period. The results are shown on the following pages. Overall, the actual number of disability retirements (298) is about 45 percent of the number projected by the present assumption (663 – see charts on the following pages).

The process of qualifying for a disability benefit requires some burden of proof. This process may result in a member being reported as a termination or withdrawal while the disability application is being reviewed. In fact, over the course of the four-year period, there were approximately 117 members who were reclassified as a disability retirement after first being reported as a termination. In recognition of this process, we recommend lowering the assumed rates of disability, but not as low as reported by the actual experience.

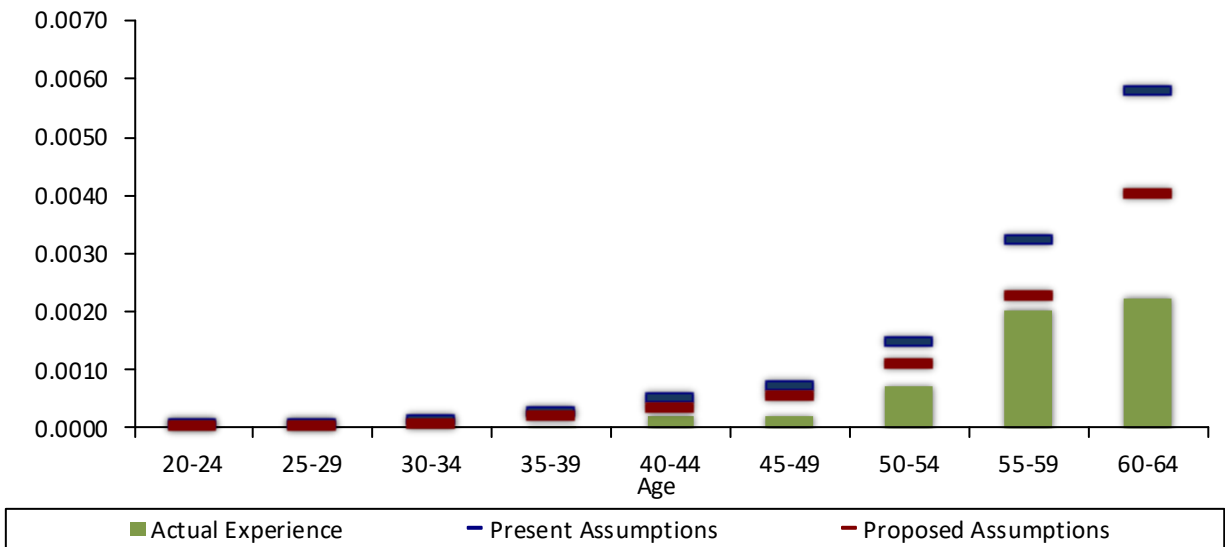
Recommendation

We recommend adopting lower rates of disability, equal to 70% of the current assumed rates of disability.

Disability Experience Males

Male Disability Table

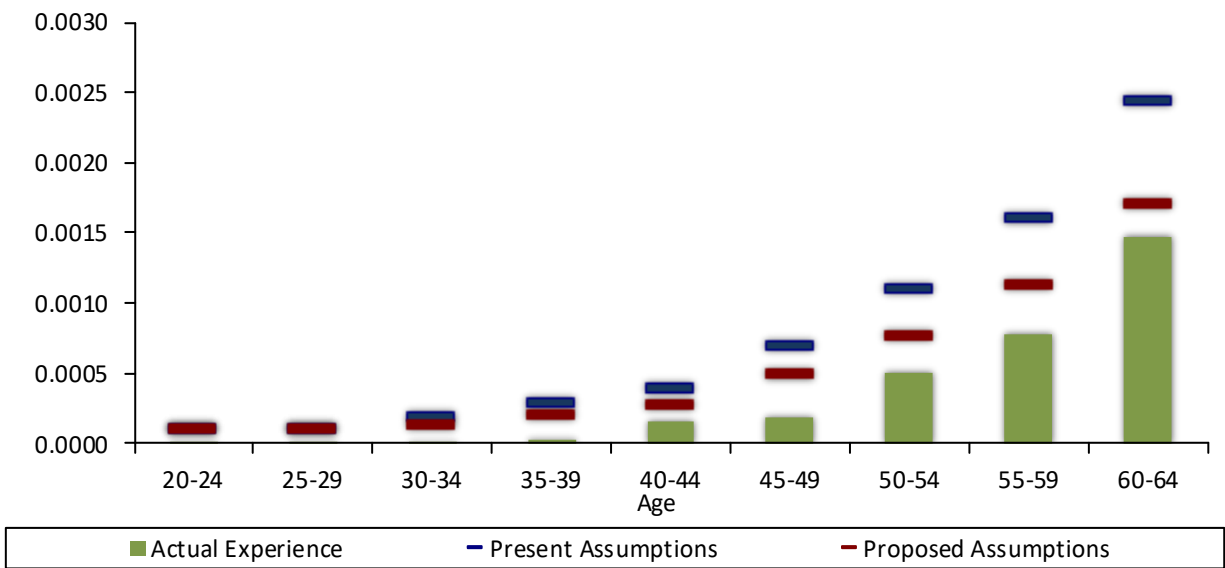
Age	Population Weighted		Crude Rates	Sample Rates		Expected Disabilities		Ratio of Actuals/Expecteds	
	Disabilities	Exposure		Present	Proposed	Present	Proposed	Present	Proposed
	Under 20	0	-	N/A	0.0075%	0.0052%	-	-	N/A
20-24	0	7,570	0.0000%	0.0075%	0.0052%	0.6	0.4	0.0%	0.0%
25-29	0	16,277	0.0000%	0.0075%	0.0052%	1.2	0.9	0.0%	0.0%
30-34	0	20,128	0.0000%	0.0150%	0.0085%	2.4	1.7	0.0%	0.0%
35-39	1	21,817	0.0046%	0.0300%	0.0211%	6.6	4.6	15.2%	21.7%
40-44	4	21,222	0.0188%	0.0525%	0.0345%	10.5	7.3	38.2%	54.6%
45-49	4	20,503	0.0195%	0.0750%	0.0549%	16.1	11.3	24.9%	35.6%
50-54	16	22,721	0.0704%	0.1500%	0.1127%	36.6	25.6	43.7%	62.5%
55-59	53	26,175	0.2025%	0.3225%	0.2295%	85.8	60.1	61.8%	88.2%
60-64	54	24,132	0.2238%	0.5800%	0.4042%	139.3	97.5	38.8%	55.4%
Totals	132	180,545	0.0731%	0.1656%	0.1159%	299.1	209.3	44.1%	63.1%



Disability Experience Females

Female Disability Table

Age	Population Weighted		Crude Rates	Sample Rates		Population Weighted Expected Disabilities		Ratio of Actuals/Expecteds	
	Disabilities	Exposure		Present	Proposed	Present	Proposed	Ratio of Actuals/Expecteds	
								Present	Proposed
Under 20	0	-	N/A	0.0100%	0.0100%	-	-	N/A	N/A
20-24	0	15,307	0.0000%	0.0100%	0.0100%	1.5	1.1	0.0%	0.0%
25-29	0	31,426	0.0000%	0.0100%	0.0100%	3.1	2.2	0.0%	0.0%
30-34	0	38,091	0.0000%	0.0200%	0.0140%	6.2	4.3	0.0%	0.0%
35-39	1	44,800	0.0022%	0.0300%	0.0210%	11.7	8.2	8.6%	12.2%
40-44	7	46,029	0.0152%	0.0400%	0.0280%	19.3	13.5	36.2%	51.8%
45-49	9	46,862	0.0192%	0.0700%	0.0490%	32.1	22.4	28.1%	40.1%
50-54	27	53,489	0.0505%	0.1100%	0.0770%	63.3	44.3	42.6%	60.9%
55-59	47	59,997	0.0783%	0.1615%	0.1131%	101.8	71.2	46.2%	66.0%
60-64	75	50,933	0.1473%	0.2450%	0.1715%	124.7	87.3	60.1%	85.9%
Totals	166	386,934	0.0429%	0.0940%	0.0658%	363.7	254.6	45.6%	65.2%



SECTION G

MORTALITY EXPERIENCE

Mortality Experience

Post-retirement mortality is an important component in cost calculations and should be updated from time to time to reflect current and expected future longevity improvements. Pre-retirement mortality is a relatively minor component in cost calculations. The frequency of pre-retirement deaths is so low that mortality assumptions based on actual experience can only be produced for very large retirement systems, if at all.

Actuarial Standards of Practice

Actuarial Standards of Practice (ASOP) No. 35 Disclosure Section 4.1.1 states, “The disclosure of the mortality assumption should contain sufficient detail to permit another qualified actuary to understand the provision made for future mortality improvement. If the actuary assumes zero mortality improvement after the measurement date, the actuary should state that no provision was made for future mortality improvement.” The current mortality rates used in the valuation include a provision for future mortality improvement.

Mortality Tables and Projection Scales

Prior to the last experience study, the Society of Actuaries published a mortality study that was specific to public sector retirement systems. This is a very comprehensive study and there are numerous mortality tables created for each classification of employee (General members, Public Safety, Teachers, Survivors, Juvenile, headcount-weighted, benefit-weighted, above median, below median).

One of the key findings of the study is that there is a high correlation between longevity and income and education. As such, the SOA highly recommended the use of ‘benefit weighted’ rates when developing mortality tables. We were able to review GERP retiree and disability mortality on a ‘benefit weighted’ basis and have shown the results on pages G-4 through G-7 of this report. Consistent with the SOA study, GERP members with higher benefits generally appear to experience longer lifespans, resulting in lower mortality rates.

Fully generational tables, which are utilized for the PERA valuations, help take into account future improvements in mortality that are expected to occur. Typically, the Society of Actuaries updates the projection scale annually; however, no Scale MP-2022 was issued due to skewed mortality experience during the COVID-19 pandemic. The latest published table is called the MP-2021 Projection Scale.

Credibility

During the four-year period, there were 4,357 male retiree deaths and 6,435 female retiree deaths. Therefore, the experience is considered fully credible and there is no credibility constraint when fitting the standard mortality tables to the plan’s experience.

For the pre-retirement and disabled retiree mortality analysis, we use what is termed “the limited fluctuation credibility procedure” to determine the appropriate scaling factor of the base mortality tables for each gender. In each case, the Credibility Factor is computed based on the experience over the last eight years of the specific group being studied. This Credibility Factor is a measure of the credibility of the pertinent group with a 90% confidence interval.



Mortality Experience

The Best Fit is the ratio of actual to expected deaths using the base table. The Final Scale Factor is then determined as the weighted average of the Best Fit and 100% based on the Credibility Factor. For example, the Credibility Factor for Disabled Male Retirees is 60%, suggesting that the data for this group is 60% credible (there were not enough deaths among disabled retirees to be completely credible). The Best Fit for this group would be to scale the base tables by 120%. The Final Scale Factor of 112% is the credibility-weighted average ($112\% = 60\% \times 120\% + 40\% \times 100\%$). The Final Scale Factors for disabled female retiree mortality and active female mortality are determined similarly.

	Deaths Needed for Full Credibility	Observed Deaths	Credibility Factor	Best Fit	Final Scale Factor
Disabled male retirees	1,674	607*	.6021	1.20	1.12
Disabled female retirees	1,967	738*	.6124	1.37	1.23
Active male deaths	2,083	610*	.5411	1.02	1.01**
Active female deaths	2,402	681*	.5324	0.88	0.94

* Observed deaths over the past eight years

** Since the Final Scale Factor is so close to 1.0, we recommend using the standard table without any adjustments applied.

Findings

We reviewed the mortality experience during the four-year period. The results are shown on the following pages.

Healthy Retirees

Due to potential anti-selection bias as well as data needs which are outside the scope of the annual valuation process, we did not include beneficiary and survivor mortality experience in our study.

In total, on a benefit weighted basis, the plan experienced more liabilities removed due to male deaths than expected (\$99,106,000 actual versus \$88,006,000 expected). The actual number of deaths on a benefit weighted basis among retired females (\$76,583,000) was also more than the number projected by the present assumptions (\$65,980,000). Actual experience was consistently more than expected during all four years of the study.

Disabled Retirees

On a benefit weighted basis, the plan experienced more liabilities removed due to deaths among disabled males (\$5,871,000) as projected by the present assumptions (\$5,235,000). The actual number of deaths on a benefit weighted basis among disabled females (\$4,531,000) was also more than the number projected by the present assumptions (\$4,189,000).

Active Members

On a liability weighted basis, the actual amount of liabilities removed due to deaths among active male members (\$42,114,000) was lower than the number projected by the present assumption (\$46,136,000). The plan also experienced fewer deaths on a liability weighted basis among females (\$33,892,000) than projected by the present assumptions (\$37,058,000).



Mortality Experience

Recommendations

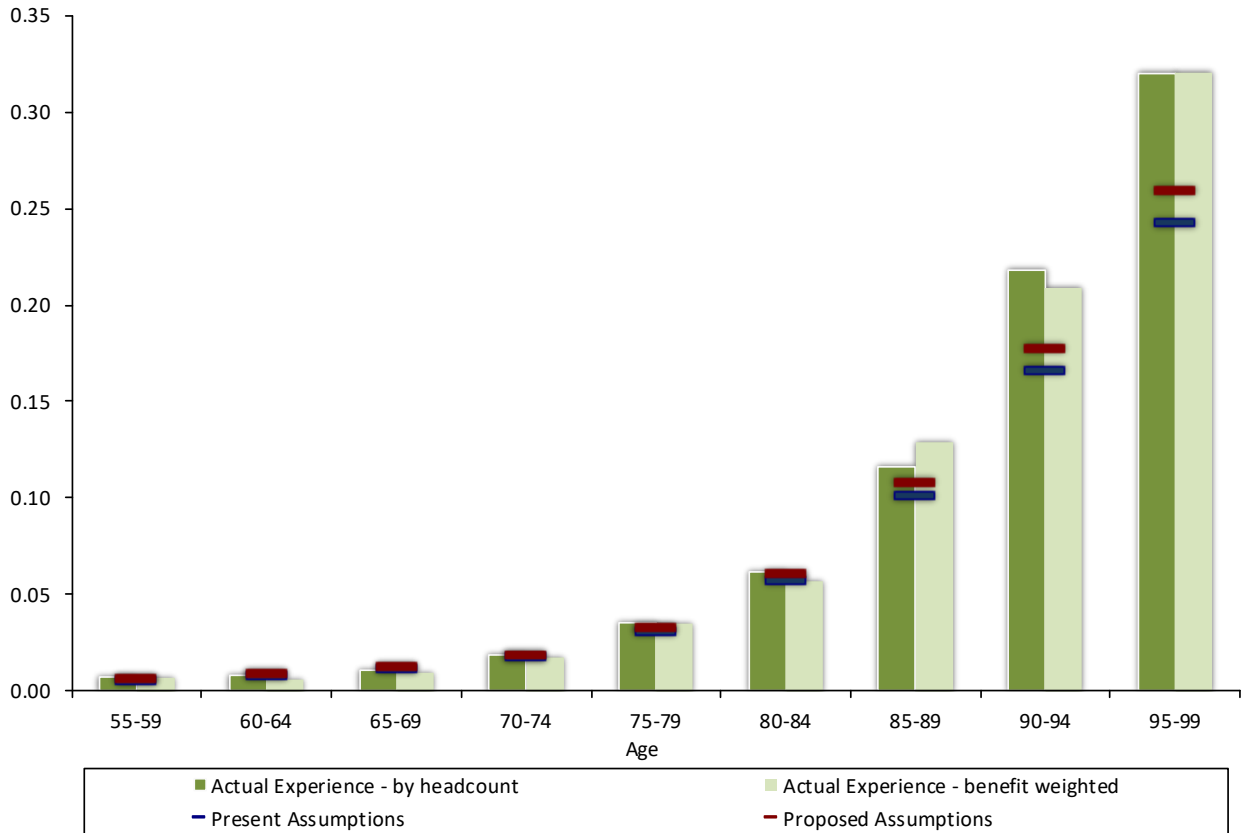
We did not find a published standard table that fit the observed experience at all ages. We recommend continued use of the Pub-2010 mortality tables, with adjustments, in order to produce a better fit to observed experience when possible. In some cases, even after adjustments, the fit was not uniform and we put more credibility on the rates in the published table than the plan's experience over the past four years. Finally, we did not increase healthy post-retirement mortality rates as much as indicated by the experience as a measure of conservatism and due to potential adverse experience from the COVID-19 pandemic.

We recommend adoption of the following mortality tables (all recommended tables are Benefit Weighted):

Healthy Male Retirees:	Pub-2010 Male Healthy Retired General Mortality Table adjusted for mortality improvements using projection scale MP-2021. Rates are multiplied by a factor of 1.09.
Healthy Female Retirees:	Pub-2010 Female Healthy Retired General Mortality Table, adjusted for mortality improvements using projection scale MP-2021.
Disabled Male Retirees:	Pub-2010 Male General/Teacher Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2021. Rates are multiplied by a factor of 1.12.
Disabled Female Retirees:	Pub-2010 Female General/Teacher Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2021. Rates are multiplied by a factor of 1.23.
Male Active Members:	Pub-2010 Male General Employee Mortality Table adjusted for mortality improvements using projection scale MP-2021.
Female Active Members:	Pub-2010 Female General Employee Mortality Table adjusted for mortality improvements using projection scale MP-2021. Rates are multiplied by a factor of 0.94.

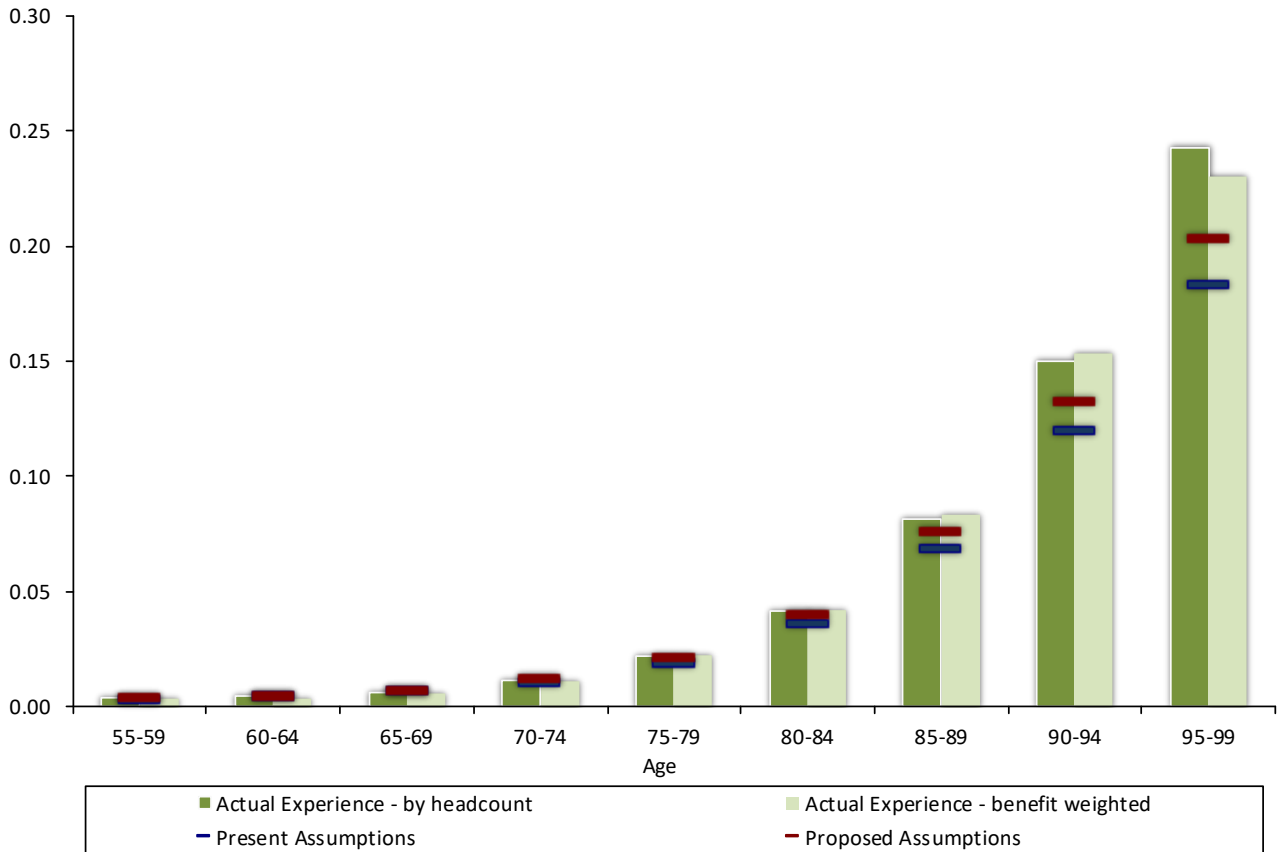
Post-Retirement Mortality Experience Healthy Males

Age	Benefit Weighted (\$000s)		Crude Rates		Sample Rates		Benefit Weighted (\$000s)		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Benefit Weighted	Headcount Weighted	Present	Proposed	Present	Proposed	Present	Proposed
55-59	296	42,999	0.69%	0.70%	0.56%	0.60%	239	256	123.4%	115.5%
60-64	1,572	260,616	0.60%	0.77%	0.79%	0.84%	2,053	2,194	76.5%	71.6%
65-69	5,748	637,495	0.90%	1.09%	1.13%	1.21%	7,213	7,708	79.7%	74.6%
70-74	10,905	619,552	1.76%	1.82%	1.77%	1.89%	10,935	11,686	99.7%	93.3%
75-79	12,701	366,180	3.47%	3.55%	3.06%	3.28%	11,223	11,993	113.2%	105.9%
80-84	14,857	260,193	5.71%	6.15%	5.68%	6.07%	14,787	15,801	100.5%	94.0%
85-89	25,307	196,438	12.88%	11.61%	10.13%	10.82%	19,892	21,257	127.2%	119.1%
90-94	19,687	94,332	20.87%	21.80%	16.63%	17.77%	15,684	16,760	125.5%	117.5%
95-99	7,313	22,795	32.08%	32.01%	24.28%	25.95%	5,535	5,915	132.1%	123.6%
100+	721	1,338	53.85%	47.46%	33.29%	35.57%	445	476	161.8%	151.4%
Totals	99,106	2,501,939	3.96%	3.58%	3.52%	3.76%	88,006	94,045	112.6%	105.4%



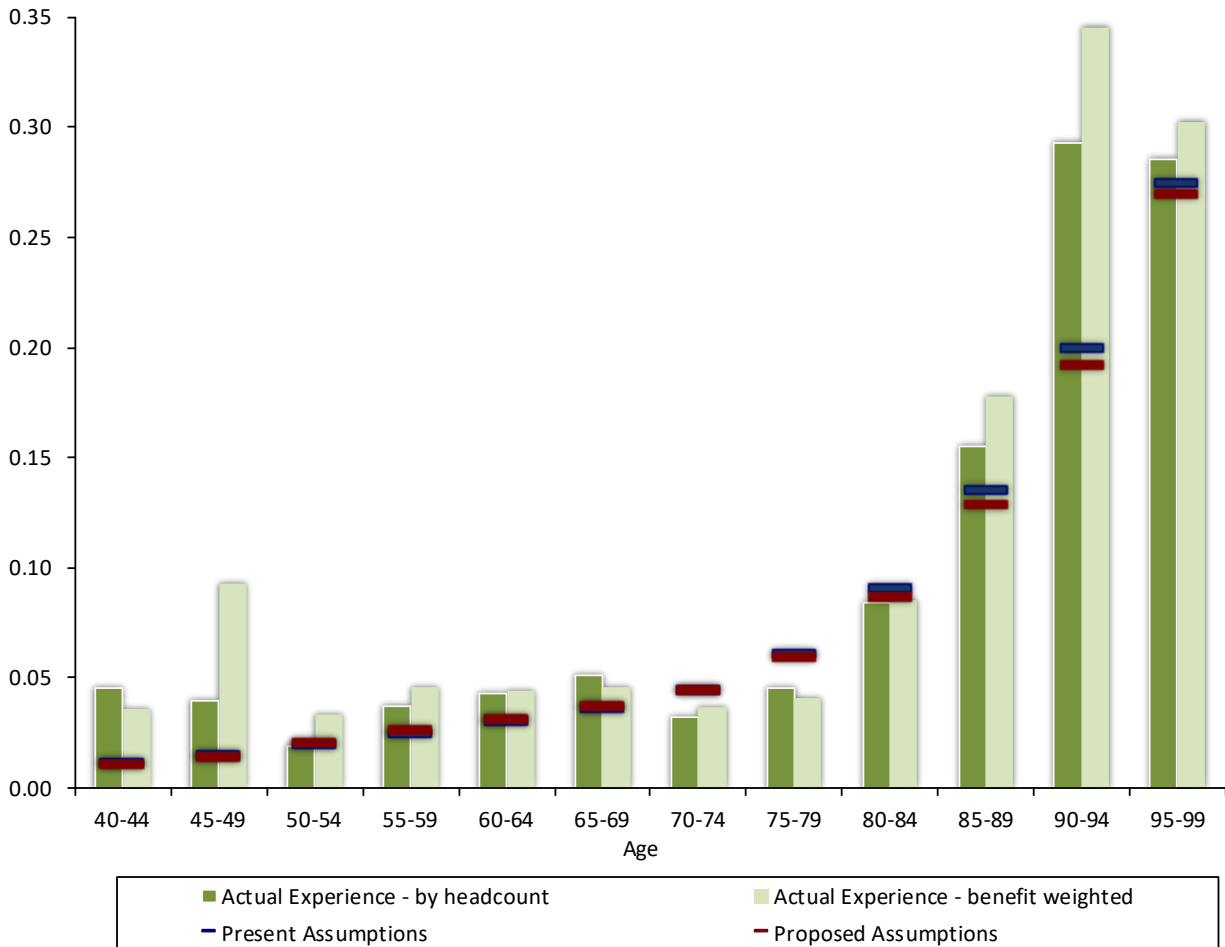
Post-Retirement Mortality Experience Healthy Females

Age	Benefit Weighted (\$000s)		Crude Rates		Sample Rates		Benefit Weighted (\$000s)		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Benefit Weighted	Headcount Weighted	Present	Proposed*	Present	Proposed*	Present	Proposed*
55-59	221	64,818	0.34%	0.39%	0.32%	0.35%	207	230	106.7%	96.1%
60-64	1,371	365,179	0.38%	0.42%	0.44%	0.49%	1,596	1,773	85.9%	77.3%
65-69	4,820	876,770	0.55%	0.60%	0.64%	0.72%	5,644	6,271	85.4%	76.9%
70-74	8,232	740,731	1.11%	1.12%	1.06%	1.18%	7,835	8,706	105.1%	94.6%
75-79	9,942	442,045	2.25%	2.19%	1.92%	2.14%	8,494	9,438	117.0%	105.3%
80-84	11,659	278,227	4.19%	4.14%	3.60%	4.00%	10,020	11,133	116.4%	104.7%
85-89	15,120	181,386	8.34%	8.11%	6.84%	7.60%	12,415	13,794	121.8%	109.6%
90-94	15,798	103,213	15.31%	15.02%	11.97%	13.30%	12,352	13,724	127.9%	115.1%
95-99	7,411	32,147	23.05%	24.25%	18.30%	20.33%	5,883	6,537	126.0%	113.4%
100+	2,010	5,761	34.89%	36.91%	26.65%	29.61%	1,535	1,706	130.9%	117.8%
Totals	76,583	3,090,277	2.48%	2.52%	2.14%	2.37%	65,980	73,311	116.1%	104.5%



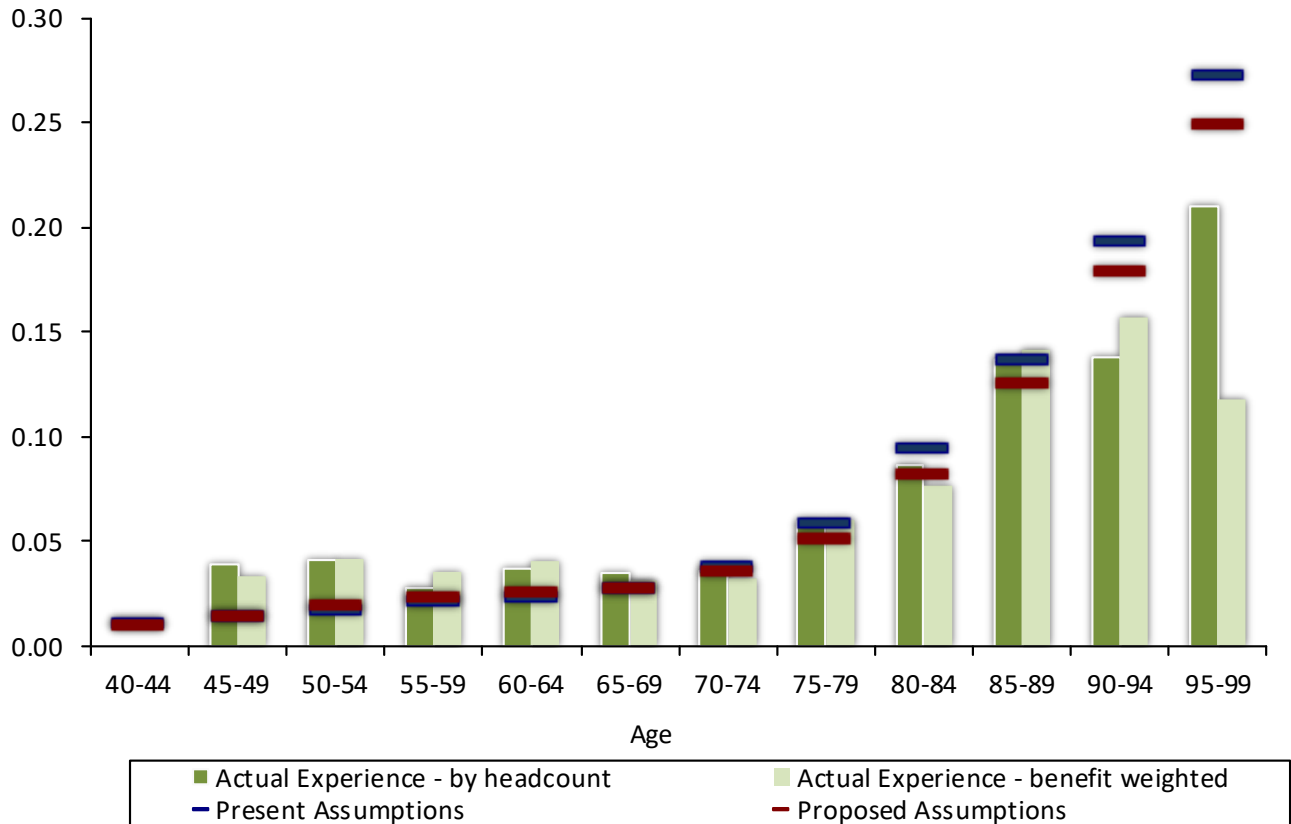
Post-Retirement Mortality Experience Disabled Males

Age	Benefit Weighted (\$000s)		Crude Rates		Sample Rates		Benefit Weighted (\$000s)		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Benefit Weighted	Headcount Weighted	Present	Proposed	Expected Deaths		Present	Proposed
							Present	Proposed		
40-44	4	112	3.57%	4.55%	1.13%	1.05%	1	1	315.8%	339.4%
45-49	53	573	9.25%	3.92%	1.50%	1.41%	9	8	616.1%	654.0%
50-54	66	1,981	3.33%	1.85%	1.99%	2.03%	39	40	167.3%	164.4%
55-59	401	8,817	4.55%	3.71%	2.48%	2.61%	219	230	183.1%	174.3%
60-64	941	21,337	4.41%	4.27%	3.06%	3.15%	652	672	144.4%	140.1%
65-69	1,243	27,033	4.60%	5.07%	3.62%	3.67%	978	991	127.1%	125.4%
70-74	879	24,114	3.65%	3.22%	4.45%	4.44%	1,073	1,070	81.9%	82.2%
75-79	495	12,095	4.09%	4.55%	6.12%	5.95%	740	720	66.9%	68.8%
80-84	728	8,500	8.56%	8.42%	9.03%	8.66%	767	736	94.9%	98.9%
85-89	638	3,586	17.79%	15.48%	13.48%	12.84%	483	460	132.0%	138.6%
90-94	339	981	34.56%	29.27%	19.94%	19.22%	196	189	173.3%	179.8%
95-99	84	278	30.22%	28.57%	27.45%	27.01%	76	75	110.1%	111.9%
100+	-	-	N/A	N/A			-	-	N/A	N/A
Totals	5,871	109,407	5.37%	4.86%	4.78%	4.75%	5,235	5,192	112.2%	113.1%



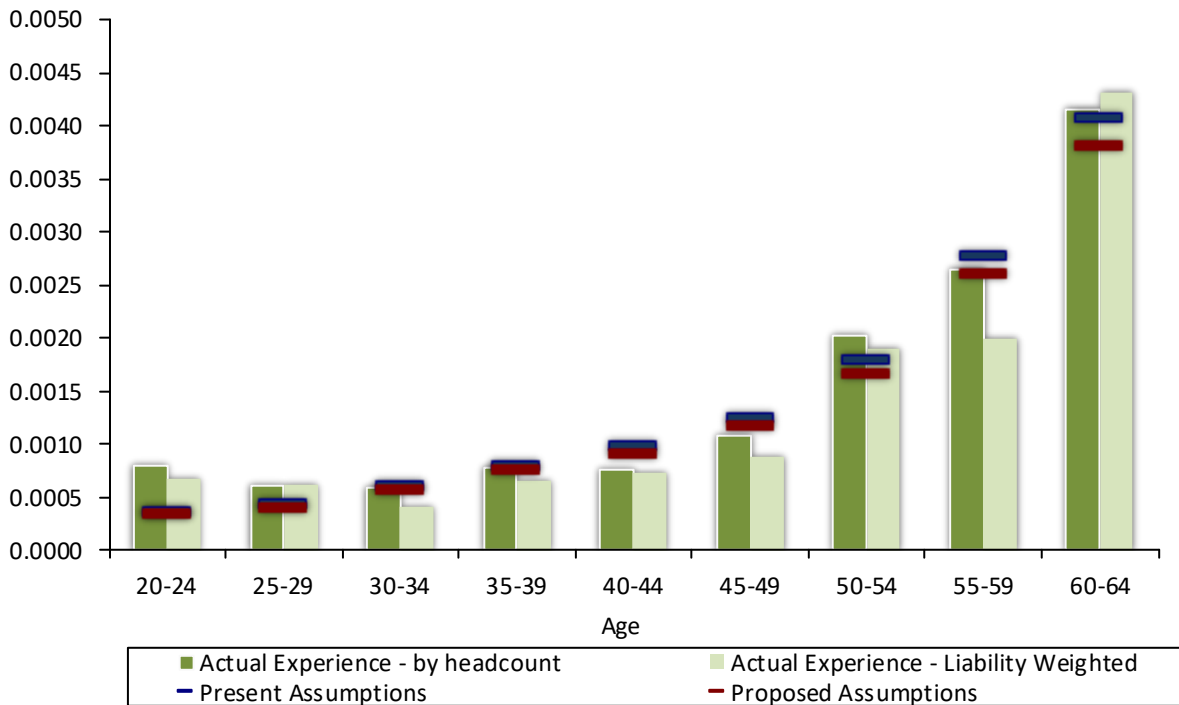
Post-Retirement Mortality Experience Disabled Females

Age	Benefit Weighted (\$000s)		Crude Rates		Sample Rates		Benefit Weighted (\$000s)		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Benefit Weighted	Headcount Weighted	Present	Proposed	Expected Deaths		Present	Proposed
							Present	Proposed		
40-44	-	394	0.00%	0.00%	1.16%	1.01%	5	4	0.0%	0.0%
45-49	42	1,267	3.31%	3.88%	1.44%	1.38%	18	17	230.1%	240.1%
50-54	118	2,838	4.16%	4.14%	1.75%	1.92%	50	54	238.2%	217.0%
55-59	335	9,396	3.57%	2.77%	2.11%	2.37%	198	222	169.0%	150.7%
60-64	780	19,005	4.10%	3.66%	2.40%	2.57%	457	489	170.7%	159.4%
65-69	662	21,223	3.12%	3.51%	2.81%	2.79%	597	592	110.9%	111.9%
70-74	573	17,793	3.22%	3.60%	3.84%	3.54%	683	630	83.9%	90.9%
75-79	728	12,092	6.02%	5.96%	5.85%	5.15%	707	622	102.9%	117.0%
80-84	490	6,371	7.69%	8.64%	9.42%	8.19%	600	522	81.7%	93.9%
85-89	514	3,625	14.18%	13.67%	13.67%	12.58%	495	456	103.7%	112.8%
90-94	225	1,432	15.71%	13.83%	19.38%	17.96%	278	257	81.1%	87.5%
95-99	40	340	11.76%	21.05%	27.33%	24.90%	93	85	43.1%	47.3%
100+	24	24	100.00%	100.00%	37.59%	36.32%	9	9	266.0%	275.4%
Totals	4,531	95,800	4.73%	4.62%	4.37%	4.13%	4,189	3,960	108.2%	114.4%



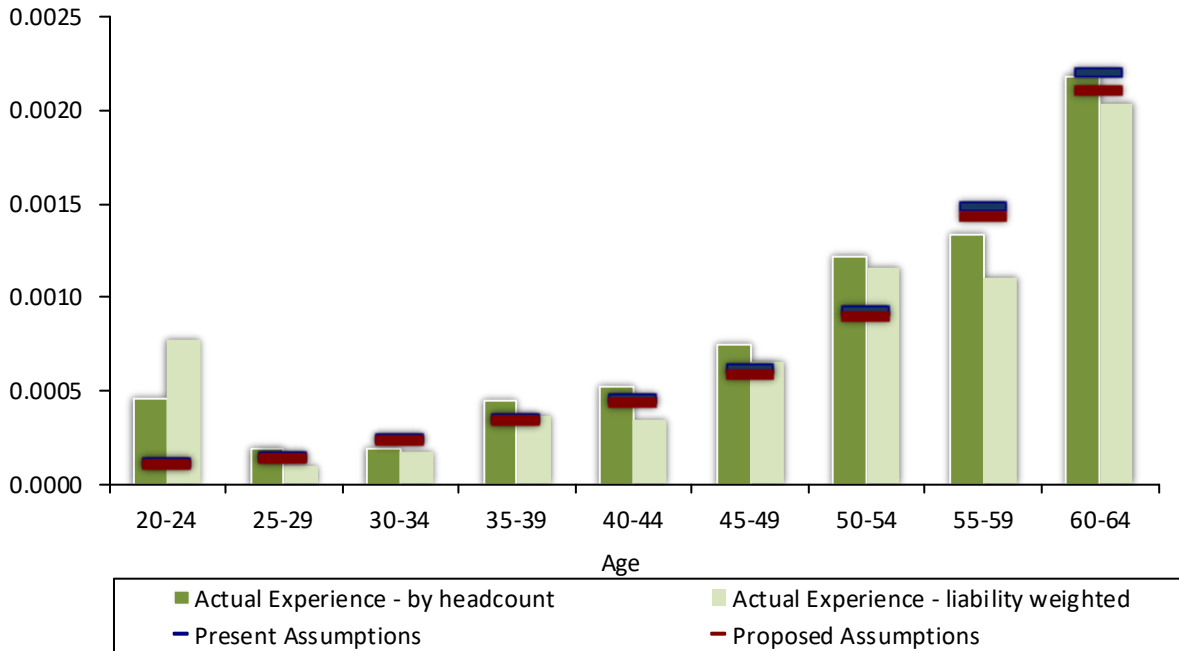
Pre-Retirement Mortality Experience Healthy Males

Age	Liability Weighted (\$000s)		Crude Rates		Sample Rates		Liability Weighted (\$000s)		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Liability Weighted	Population Weighted	Sample Rates		Expected Deaths		Ratio of Actuals/Expecteds	
					Present	Proposed	Present	Proposed	Present	Proposed
Under 20	-	1,858	0.00%	0.00%	0.04%	0.04%	1	1	0.0%	0.0%
20-24	65	97,512	0.07%	0.08%	0.04%	0.03%	36	33	182.9%	195.7%
25-29	270	442,488	0.06%	0.06%	0.04%	0.04%	190	178	142.2%	152.1%
30-34	367	911,450	0.04%	0.06%	0.06%	0.06%	559	522	65.7%	70.3%
35-39	954	1,445,383	0.07%	0.08%	0.08%	0.07%	1,160	1,084	82.3%	88.0%
40-44	1,396	1,899,898	0.07%	0.08%	0.10%	0.09%	1,855	1,734	75.3%	80.5%
45-49	2,044	2,327,380	0.09%	0.11%	0.12%	0.12%	2,905	2,715	70.4%	75.3%
50-54	6,300	3,302,827	0.19%	0.20%	0.18%	0.17%	5,912	5,525	106.6%	114.0%
55-59	9,749	4,910,094	0.20%	0.26%	0.28%	0.26%	13,656	12,763	71.4%	76.4%
60-64	20,969	4,871,903	0.43%	0.41%	0.41%	0.38%	19,862	18,563	105.6%	113.0%
Totals	42,114	20,210,793	0.21%	0.16%	0.23%	0.21%	46,136	43,117	91.3%	97.7%



Pre-Retirement Mortality Experience Healthy Females

Age	Liability Weighted (\$000s)		Crude Rates		Sample Rates		Liability Weighted (\$000s)		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Liability Weighted	Population Weighted	Present	Proposed	Expected Deaths		Present	Proposed
							Present	Proposed		
Under 20	5	3,483	0.14%	0.11%	0.01%	0.01%	0	0	0.0%	0.0%
20-24	107	138,684	0.08%	0.05%	0.01%	0.01%	16	15	683.5%	713.3%
25-29	61	654,119	0.01%	0.02%	0.01%	0.01%	93	89	65.5%	68.3%
30-34	222	1,287,244	0.02%	0.02%	0.02%	0.02%	311	298	71.3%	74.4%
35-39	731	1,990,582	0.04%	0.04%	0.03%	0.03%	694	666	105.3%	109.8%
40-44	892	2,615,093	0.03%	0.05%	0.05%	0.04%	1,185	1,136	75.3%	78.5%
45-49	2,221	3,401,410	0.07%	0.07%	0.06%	0.06%	2,089	2,004	106.3%	110.8%
50-54	6,073	5,242,197	0.12%	0.12%	0.09%	0.09%	4,875	4,675	124.6%	129.9%
55-59	8,446	7,667,180	0.11%	0.13%	0.15%	0.14%	11,422	10,956	73.9%	77.1%
60-64	15,134	7,439,372	0.20%	0.22%	0.22%	0.21%	16,372	15,705	92.4%	96.4%
Totals	33,892	30,439,364	0.11%	0.09%	0.12%	0.12%	37,058	35,545	91.5%	95.3%



SECTION H

ACTUARIAL METHODS

Asset Valuation Method

Background

Employer contribution calculations are based on a smoothed asset valuation method (the actuarial value of assets). Such smoothed valuation methods aid in developing a contribution amount calculated to remain approximately level from year-to-year.

Per Minnesota Statute 356.215(f), the actuarial value of assets is based on a five-year moving average of expected and market values determined as follows:

- At the end of each plan year, an average asset value is calculated as the average of the market asset value at the beginning and end of the fiscal year, net of investment income for the fiscal year;
- The investment gain or (loss) is equal to the excess of actual investment income over the expected investment income based on the average asset value as calculated above;
- The investment gain or (loss) so determined is recognized over five years at 20% per year; and
- The asset value is the sum of the expected asset value plus the scheduled recognition of investment gains or (losses) during the current and the preceding four plan years.

During periods when investment performance exceeds the assumed rate, the actuarial value of assets will tend to be less than the market value of assets. During periods when investment performance is less than the assumed rate, the actuarial value of assets will tend to be greater than the market value of assets. If assumed rates are exactly realized for four consecutive years, the actuarial value of assets will become equal to market value of assets.

This asset valuation method satisfies current standards of practice, which require that the asset valuation method reflect some function of market value, be unbiased in relation to market value, and recognize gains and losses consistently and over a reasonable period.

In 2007, the Actuarial Standards Board issued a standard on asset valuation methods which requires that the asset valuation method bear a reasonable relationship to current market value. There may be some concern that if the deviation between the funding value of assets and the market value of assets becomes too large, it could be considered unreasonable. The alternative to allowing large deviations usually involves setting upper and lower bounds (corridors) for the relationship between funding value and market value. Once a corridor limit is reached, any further market experience in the same direction is recognized immediately, which can introduce substantial fluctuations in the results of the actuarial valuation. If a 20% corridor were applied to the June 30, 2022 actuarial value of assets, it would not change the numerical result (the asset value would be unchanged).

Recommendation

We recommend continued use of the current asset valuation method. PERA should continue to consider results based on the market value of assets as well as the actuarial value of assets, especially when the two values are significantly different.

Funding Policy – Actuarial Funding Method

An actuarial funding method is a set of techniques for conversion of the actuarial present values of benefits into contribution information. Minnesota Statute requires the actuary to use the entry age actuarial cost method, characterized by:

1. Normal Cost – the level percent of payroll contribution, paid from each member’s date of plan entry to date of retirement, which will accumulate enough assets at retirement to fund the member’s projected benefits from retirement to death.
2. Actuarial Accrued Liability – the assets which would have accumulated to date had contributions been made at the level of the normal cost since the date of the first benefit accrual, all actuarial assumptions had been exactly realized, and there had been no benefit changes. It is the amount sufficient, when combined with the accumulation of future normal cost amounts, to theoretically fund all benefits at retirement for a member.

The total contribution produced by an actuarial method is the total of the normal cost and an amount to amortize any unfunded actuarial accrued liability.

The entry age actuarial method is the most prevalent funding method in the public sector. It is appropriate for the public sector because it produces costs that remain stable as a percentage of payroll over time, resulting in normal cost contributions that are theoretically level as a percentage of payroll.

Recommendations

We recommend continued use of the entry age actuarial cost method.

Funding Policy – Amortization

Amortization Period

Minnesota Statute 356.215, Subdivision 11 specifies June 30, 2048 as the established date for full funding of the General Employees Retirement Plan (GERP). If the unfunded liability increases due to changes in benefits, assumptions, or methods, the statutory amortization date may be extended (limited to 30 years). The June 30, 2022 actuarial valuation amortizes the UAAL over a 26-year period. The amortization period decreases each year by one year (like a typical mortgage).

Past practice has typically been to re-establish a new 30-year statutory amortization period occasionally in order to minimize volatility and manage cost requirements. This practice shifts costs to the future. In lieu of this, PERA could consider using a shorter maximum period, such as 15, 20 or 25 years. Actuarial practice, including Actuarial Standards of Practice, is moving toward shorter amortization periods than in the past.

Another option to consider is the use of “layered” amortization – which continues to amortize the initial unfunded liability over separate closed periods, but spreads out gains and losses and other liability changes as they occur over a separate closed period. This methodology maintains steady progress toward eliminating the unfunded liability.

Amortization Method

Because GERP is an open retirement plan (new employees enter the plan) and contributions are intended to remain approximately as a percent of payroll, level percent of payroll amortization payments are used.

Longer amortization periods combined with the level percent of pay methodology results in initial payments that are less than the “interest only” payment on the unfunded actuarial accrued liability (UAAL), i.e., “negative amortization.” Payments less than the interest only amount will result in the UAAL increasing for an initial period of time. Based on the proposed assumptions of 7.00% interest and 3.00% payroll growth, payments will continue to be less than the interest only amount, with amortization payments exceeding the interest only amount once the period declines to 21 years. This means that the UAAL is expected to increase for approximately 5 years under the current funding policy. Negative amortization, once commonly accepted, is increasingly attracting criticism. We greatly prefer combinations of amortization methods and assumptions that result in the UAAL decreasing each year.

We note that the legislature extended the amortization period 15 years in 2018 (from 2033 to 2048). If the legislature hadn’t taken this action, the amortization payment for the 2023 fiscal year would be greater than the interest on the UAAL and the plan would not be experiencing negative amortization.

Funding Policy – Amortization

In the last four years, actual growth in GERP payroll has been slightly below the expected rate of 3.00%, primarily due to low payroll growth during fiscal year 2021 (likely due to the pandemic). Over the past 10 years, actual growth in GERP payroll has averaged slightly above the expected rate of 3.00%. When payroll grows slower than expected, contributions collected will also be less than expected, and insufficient to eliminate the UAAL by the statutory amortization date. Some plans address this issue by not permitting the payroll growth assumption to exceed the actual average growth rate over the past 5 years. If payroll growth continues to fall short of expectations, a method change should be considered.

Recommendation

We recommend PERA consider an alternative to the current amortization policy, since the current method results in approximately five years of negative amortization and an increasing Unfunded Actuarial Accrued Liability. Alternatives to consider include layered amortization, a shorter closed period, or applying a minimum amortization amount that is equal to interest on the unfunded actuarial accrued liability. We also recommend continued use of the level percent of payroll amortization method. Lastly, we recommend closely monitoring actual payroll growth with implementation of a payroll growth assumption equal to recent experience if payroll growth consistently falls short of the recommended 3.0% growth assumption.

Funding Policy – Post-Retirement Benefit Increases

Valuation of Future Post-Retirement Benefit Increases

Effective January 1, 2019, benefit increases after retirement equal 50% of the Social Security Cost-of-Living Adjustment, not less than 1.0%, and not more than 1.5%. For valuation purposes, we must make an assumption about future post-retirement benefit increases. The current post-retirement benefit increase assumption is 1.25% based on analysis completed in 2020 and an inflation assumption of 2.25%.

Actual benefit increases since this plan provision was enacted are summarized in the table below:

Effective Date	Benefit Increase
January 1, 2019	1.4%
January 1, 2020	1.0%
January 1, 2021	1.0%
January 1, 2022	1.5%
January 1, 2023	1.5%

We examined the capital market inflation assumptions for 11 investment consulting firms based on the GRS Capital Market Assumption Modeler (CMAM). Because GRS is a benefits consulting firm and does not develop or maintain its own capital market expectations, we request and monitor forward-looking expectations developed by several major investment consulting firms. We update our CMAM on an annual basis. The capital market assumptions in the 2023 CMAM are from the following investment consultants (in alphabetical order): Aon, Blackrock, BNY Mellon, Callan, Cambridge, JPMorgan, Meketa, Mercer, NEPC, Verus and Wilshire.

The average assumption for inflation was 2.52%, with a range of 2.26% to 2.90%, and the average standard deviation was 1.85% (note that not every investment consulting firm provided a standard deviation). However, the investment consulting firms typically set their assumptions based on a shorter time horizon, while actuaries must make much longer projections.

We normalized these parameters slightly so that they would correspond to the current inflation assumption of 2.25%. Then, based on a Monte Carlo simulation (1,000 simulations) of the post-retirement benefit increases as described above, we determined that the following assumption would be appropriate to model the effect of the post-retirement benefit increases as described below:

	Post-Retirement Benefit Increase	Actuarial Assumption
GERP	50% of the Social Security Cost-of-Living Adjustment, not less than 1.0%, and not more than 1.5%	1.25% per year

Note that the result of the simulation was 1.22% (no change since the 2020 analysis); our recommendation to maintain the current actuarial assumption of 1.25% reflects a general policy to round up to the nearest five basis points.

Recommendation

We recommend continued use of the methodologies described above.



Funding Policy – Projected Payroll

Required contributions are expressed as a percent of payroll. The Minnesota Standards for Actuarial Work state that the projected payroll will be developed from the reported payroll in the base year by increasing each person's pay by one full year's pay increase according to the actuarial salary scale. This appears to make sense on the surface, but in our judgment such a calculation is not fully in compliance with level percent of payroll funding. There are two issues:

1. With respect to the total payroll used for the amortization of the unfunded liability: Total payroll is expected to increase at 3% according to the actuarial assumptions. The total payroll, increased at the assumed payroll growth rate is the proper series of payroll amounts over which to fund the unfunded liability. The first year payroll stated in the Minnesota Standards is not consistent with this principle. It produces a higher value for the payroll and therefore lowers the contribution rate as a percent of payroll.
2. With respect to the normal cost dollar amount: The normal cost percentage for active members is developed as the ratio of the present value of future benefits at entry age to the present value of future pay at entry age. The present value of future pay must take into account both the timing of pay increases within the year, and the probability that an individual may exit the active member group during the year. The first year payroll stated in the Minnesota Standards is not mathematically consistent with this principle since it assumes the member will earn an entire year of payroll, even though there may be a probability of decrement for the member during the year.

Recommendation

We recommend the Minnesota Standards for Actuarial Practice be amended to be less prescriptive and more principles-based, so that the actuaries for the systems may use their best judgment to calculate contribution rates and liabilities in a mathematically consistent manner and in accordance with actuarial standards of practice.

SECTION I

MISCELLANEOUS AND TECHNICAL ASSUMPTIONS

Marital Status

Married members will frequently make different annuity selections than non-married members. The current valuation assumption is that 80% of male members are married and 70% of female members are married. Actual marital status is used for retired members.

Findings

We reviewed the marital status of healthy members retiring from active status during the four-year period. The results are shown below:

Gender	Married New Retirees	Total New Retirees	Crude Rates	Sample Rates		Expected Married Retirees		Ratio of Actual/Expected	
				Present	Proposed	Present	Proposed	Present	Proposed
Males	3,383	4,386	77.13%	80.00%	80.00%	3,509	3,509	96.4%	96.4%
Females	5,629	8,175	68.86%	70.00%	70.00%	5,723	5,723	98.4%	98.4%
Total	9,012	12,561	71.75%			9,231	9,231	97.6%	97.6%

The experience shows the number of married new retirees is approximately as expected for male and female retirees.

Recommendation

We recommend maintaining the current marital status assumption.

Age of Survivor

Joint & Survivor annuity benefit amounts are determined based on the member's and survivor's age. Currently, the valuation assumes that male members have a beneficiary three years younger and female members have a beneficiary one year older. This assumption is used to predict the length of expected payments payable to a future survivor.

Findings

We reviewed the ages of married new retirees and their beneficiaries during the four-year period. In cases where a new retiree had a beneficiary that is more than 20 years older or younger, we classified those retirees as unmarried in order to not skew the age difference results.

The results are shown below:

Gender	Married New Retirees	Average Age Difference	Expected Age Difference		Ratio of Actual/Expected	
			Present	Proposed	Present	Proposed
Males	3,383	2.47	3.00	3.00	82.3%	82.3%
Females	5,629	-0.57	-1.00	-1.00	57.0%	57.0%
Total	9,012					

The experience shows the age difference of married new retirees is approximately as expected for male and female retirees.

Recommendation

We recommend maintaining the current survivor age difference assumption.

Form of Payment

Upon retirement, a member can elect any of the following forms of payment:

- Single-life annuity – the benefit is paid for the lifetime of the member. No benefit is payable to a beneficiary upon the member’s death.
- 25% Joint & Survivor – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 25% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.
- 50% Joint & Survivor – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 50% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.
- 75% Joint & Survivor – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 75% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.
- 100% Joint & Survivor – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 100% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.

If the member elects a joint & survivor form of payment and the beneficiary predeceases the member, the benefit “bounces back” to the single life annuity at the time of the beneficiary’s death. There is no actuarial reduction for the bounce-back feature (i.e., this is subsidized by the plan). In order to capture the cost of this subsidy in the annual valuation, an assumption is made regarding the form of payment elections for future retirees.

Married members retiring from active status are currently assumed to elect annuities as follows:

Males:	10% elect 25% Joint & Survivor option
	15% elect 50% Joint & Survivor option
	10% elect 75% Joint & Survivor option
	45% elect 100% Joint & Survivor option
Females:	10% elect 25% Joint & Survivor option
	10% elect 50% Joint & Survivor option
	5% elect 75% Joint & Survivor option
	15% elect 100% Joint & Survivor option

Remaining married and unmarried members are assumed to elect the Single-life option.

Findings

We reviewed the benefit elections of married new retirees during the four-year period. The results are shown on the following pages.

We found more married new retirees are electing the joint & survivor options for both males and females.

Recommendation

We recommend changes to the form of payment assumptions as indicated on the next page.



Form of Payment

Male Experience

Form of Payment	Actual	Married	Crude	Sample Rates		Expected		Ratio of	
	Electing	New		Present	Proposed	Electing Annuity		Actuals/Expected	
	Annuity	Retirees				Rates	Present	Proposed	Present
Single-life annuity	456	3,383	13.48%	20.00%	15.00%	676.60	507.45	67.4%	89.9%
25% joint & survivor	154	3,383	4.55%	10.00%	5.00%	338.30	169.15	45.5%	91.0%
50% joint & Survivor	339	3,383	10.02%	15.00%	10.00%	507.45	338.30	66.8%	100.2%
75% joint & Survivor	261	3,383	7.72%	10.00%	10.00%	338.30	338.30	77.2%	77.2%
100% joint & Survivor	2,173	3,383	64.23%	45.00%	60.00%	1522.35	2029.80	142.7%	107.1%
Total	3,383	3,383	100.00%	100.00%	100.00%	3383.00	3383.00		

Female Experience

Form of Payment	Actual	Married	Crude	Sample Rates		Expected		Ratio of	
	Electing	New		Present	Proposed	Electing Annuity		Actuals/Expected	
	Annuity	Retirees				Rates	Present	Proposed	Present
Single-life annuity	2,083	5,629	37.00%	45.00%	35.00%	2533.05	1970.15	82.2%	105.7%
25% joint & survivor	422	5,629	7.50%	10.00%	10.00%	562.90	562.90	75.0%	75.0%
50% joint & Survivor	526	5,629	9.34%	10.00%	10.00%	562.90	562.90	93.4%	93.4%
75% joint & Survivor	308	5,629	5.47%	5.00%	5.00%	281.45	281.45	109.4%	109.4%
100% joint & Survivor	2,290	5,629	40.68%	30.00%	40.00%	1688.70	2251.60	135.6%	101.7%
Total	5,629	5,629	100.00%	100.00%	100.00%	5629.00	5629.00		

Actuarial Equivalent Factors

Early retirement and Joint and Survivor benefits are actuarially equivalent to the Single-life annuity. Effective July 1, 2019, actuarial equivalent factors are based on the RP-2014 mortality table for healthy annuitants for a member turning age 62 in 2021, reflecting projected mortality improvements using Scale MP-2017, white collar adjustment, male rates set forward two years, female rates multiplied by 0.90, blended 40% males, 6.17% post-retirement interest and 7.5% pre-retirement interest. Reflecting statutory requirements, joint and survivor factors are based on an interest assumption of 6.5%.

Recommendation

We recommend updating the actuarial equivalent factors to reflect changes in interest and expected mortality and developing an appropriate implementation schedule.

Assumptions for Missing Participant Data

Background

To prepare the annual valuation report, GRS uses and relies on participant data supplied by PERA. In cases where submitted data was missing or incomplete, the following assumptions are currently applied:

Data for active members:

- For members reported with zero or invalid salary (<\$100): Salary is set equal to prior year salary, if available, otherwise, high five salary with a 10% load to account for salary increases. If neither pay nor high five salary is available, salary is set to \$30,000.
- For members reported without a gender: assume the member is female.
- For members reported with an invalid date of birth: assume the member was hired at age 36.

Data for terminated members:

- For members reported without Average Salary: assume a value of \$24,000.
- For members reported without Credited Service: assume a value equal to elapsed time from hire to termination date; if elapsed time is not available, assume six years.
- For members reported with a termination date: assume termination date is equal to hire date plus credited service; otherwise the valuation date unless they are noted as a pre-July 1, 1989 hire, then June 30, 1989. If reported termination date occurs prior to reported hire date, the two dates are swapped.
- For members reported without a gender: assume female gender.
- For members reported without a date of birth: assume a birth date of July 1, 1970.

Data for retired members:

- For members reported without a gender: assume retirees are female and beneficiaries are male.
- Because PERA reclassifies disabled members as retirees once the member reaches Normal Retirement Age, GRS compares the members that PERA reports as retirees to our disabled group from the last valuation. If a member was disabled in the prior valuation, we reclassify that member as a disabled retiree in this year's valuation.

Recommendation

We recommend updating the assumptions for missing participant data as follows:

- *For active members reported with zero or invalid salary (<\$100) and prior pay or high five salary is not available, assume salary is equal to the average salary at hire of new members with one to five years of service as of the prior valuation date. This value is \$36,000 as of July 1, 2022.*
- *For active members reported with an invalid date of birth: assume the member was hired at age 37.*
- *For terminated members and Average Salary was not reported or invalid, assume Average Salary equals \$36,000.*
- *For terminated members reported without Credited Service: assume a value equal to elapsed time from hire to termination date; if elapsed time is not available, assume seven years.*
- *For terminated members reported without a date of birth: assume age 48 at valuation date.*

Proposed Miscellaneous and Technical Assumptions

Background

A number of miscellaneous and technical assumptions are used in the actuarial valuation. The present assumptions are listed on the following page.

The Allowance for Combined Service Annuity assumptions are based on an analysis completed by the LCPR actuary and documented in a report dated October 2016.

Recommendation

Miscellaneous and Technical Assumptions are listed on the next page. We recommend continued use of the other Miscellaneous and Technical Assumptions.

Miscellaneous and Technical Assumptions

<i>Benefit Service</i>	Exact fractional service is used to determine the amount of benefit payable.
<i>Decrement Operation</i>	Withdrawal decrements do not operate during retirement eligibility.
<i>Decrement Timing</i>	Decrements of all types are assumed to occur mid-year.
<i>Eligibility Testing</i>	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
<i>Forfeitures</i>	For vested separations from service, it is assumed that members separating will withdraw their contributions and forfeit an employer financed benefit when the value of member contributions is greater than the value of the employer financed benefit.
<i>Incidence of Contributions</i>	Contributions are assumed to be received on a monthly basis, per the Standards of Actuarial Work.
<i>Liability Adjustments</i>	Liabilities for former members are increased by 15% for vested members and 3% for non-vested members to account for the effect of some participants having eligibility for a Combined Service Annuity.
<i>Pay Increase Timing</i>	Pay increases were assumed to be at the beginning of the fiscal year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.
<i>Service Credit Accruals</i>	Members were assumed to accrue one year of service credit per year.

SECTION J

PROPOSED ASSUMPTION LISTING

Proposed Actuarial Assumptions Based on 2018-2022 Experience Study

Merit and Seniority Pay Increases

% Merit Increases in Salaries Next Year	
Service Index	Rate
1	8.50%
2	3.75%
3	3.00%
4	2.50%
5	2.25%
6	2.00%
7	1.75%
8	1.50%
9	1.40%
10	1.40%
11	1.20%
12	1.10%
13	1.00%
14	0.90%
15	0.80%
16	0.70%
17	0.60%
18	0.50%
19	0.50%
20	0.40%
21	0.30%
22	0.30%
23	0.20%
24	0.20%
25	0.10%
26	0.10%
27	0.10%
28	0.00%
29	0.00%
30+	0.00%

Proposed Actuarial Assumptions Based on 2018-2022 Experience Study

Age & Service Retirement Pattern Unreduced (Normal) Retirement

Age	% Retiring
65	45%
66	40%
67	30%
68	30%
69	30%
70	30%
71+*	100%

* *The current assumption prescribed by the Minnesota Standards for Actuarial Work is that members who have reached 100% retirement eligibility will delay retirement one year.*

Proposed Actuarial Assumptions Based on 2018-2022 Experience Study

Rule of 90 Retirement Pattern

Age	% Retiring
55	20%
56	18%
57	16%
58	15%
59	15%
60	15%
61	16%
62	27%
63	23%
64	25%

Proposed Actuarial Assumptions Based on 2018-2022 Experience Study

Age & Service Retirement Pattern Tier 1 Reduced (Early) Retirement

Age	% Retiring
55	4%
56	5%
57	6%
58	7%
59	8%
60	8%
61	8%
62	16%
63	20%
64	20%

Proposed Actuarial Assumptions Based on 2018-2022 Experience Study

Age & Service Retirement Pattern Tier 2 Reduced (Early) Retirement

Age	% Retiring
55	4%
56	4%
57	4%
58	4%
59	5%
60	6%
61	8%
62	15%
63	15%
64	17%
65	30%

Proposed Actuarial Assumptions Based on 2018-2022 Experience Study

Withdrawal

Year	% Withdrawals	
	Male	Female
1	22.00%	23.50%
2	16.00%	17.25%
3	11.00%	13.00%
4	9.00%	11.00%
5	7.50%	9.50%
6	6.50%	8.50%
7	6.00%	7.50%
8	5.00%	7.00%
9	5.00%	6.80%
10	5.00%	6.40%
11	4.75%	6.20%
12	4.25%	5.50%
13	3.75%	4.50%
14	3.50%	4.35%
15	3.25%	4.25%
16	3.25%	4.00%
17	3.25%	3.75%
18	2.75%	3.40%
19	2.50%	3.20%
20	2.25%	2.80%
21	2.00%	2.60%
22	1.75%	2.60%
23	1.75%	2.60%
24	1.70%	2.60%
25	1.65%	2.30%
26	1.60%	2.10%
27	1.55%	2.00%
28	1.50%	2.00%
29	1.50%	2.00%
30+	1.50%	2.00%

Proposed Actuarial Assumptions Based on 2018-2022 Experience Study

Disability Rates

Age	% Becoming Disabled	
	Male	Female
20	0.0053%	0.0070%
21	0.0053%	0.0070%
22	0.0053%	0.0070%
23	0.0053%	0.0070%
24	0.0053%	0.0070%
25	0.0053%	0.0070%
26	0.0053%	0.0070%
27	0.0053%	0.0070%
28	0.0053%	0.0070%
29	0.0053%	0.0070%
30	0.0053%	0.0070%
31	0.0053%	0.0070%
32	0.0105%	0.0140%
33	0.0105%	0.0140%
34	0.0105%	0.0140%
35	0.0158%	0.0140%
36	0.0210%	0.0140%
37	0.0210%	0.0210%
38	0.0210%	0.0210%
39	0.0263%	0.0210%
40	0.0263%	0.0280%
41	0.0315%	0.0280%
42	0.0368%	0.0280%
43	0.0368%	0.0280%
44	0.0420%	0.0350%
45	0.0420%	0.0350%
46	0.0525%	0.0420%
47	0.0525%	0.0490%
48	0.0578%	0.0560%
49	0.0683%	0.0560%
50	0.0788%	0.0700%
51	0.0945%	0.0770%
52	0.1050%	0.0770%
53	0.1313%	0.0910%
54	0.1523%	0.0980%
55	0.1785%	0.0980%
56	0.2048%	0.1012%
57	0.2258%	0.1131%
58	0.2520%	0.1309%
59	0.2783%	0.1488%
60	0.3710%	0.1488%
61	0.3710%	0.1519%
62	0.4060%	0.1715%
63	0.4340%	0.1911%
64	0.4620%	0.2107%

Proposed Actuarial Assumptions Based on 2018-2022 Experience Study

Healthy Post-Retirement Mortality Rates

Age in 2022	% Dying Next Year*		Age in 2022	% Dying Next Year*	
	Male	Female		Male	Female
50	0.31%	0.20%	81	5.28%	3.50%
51	0.33%	0.22%	82	5.98%	3.97%
52	0.35%	0.23%	83	6.76%	4.52%
53	0.38%	0.25%	84	7.63%	5.14%
54	0.41%	0.27%	85	8.61%	5.86%
55	0.45%	0.28%	86	9.68%	6.67%
56	0.49%	0.31%	87	10.86%	7.59%
57	0.54%	0.33%	88	12.13%	8.62%
58	0.58%	0.35%	89	13.52%	9.75%
59	0.64%	0.37%	90	15.00%	10.98%
60	0.69%	0.40%	91	16.57%	12.28%
61	0.75%	0.43%	92	18.20%	13.62%
62	0.81%	0.46%	93	19.90%	15.01%
63	0.87%	0.50%	94	21.65%	16.44%
64	0.93%	0.54%	95	23.43%	17.93%
65	1.00%	0.59%	96	25.37%	19.56%
66	1.09%	0.64%	97	27.38%	21.29%
67	1.18%	0.69%	98	29.46%	23.11%
68	1.28%	0.76%	99	31.61%	25.04%
69	1.40%	0.84%	100	33.80%	27.07%
70	1.54%	0.93%	101	36.02%	29.17%
71	1.70%	1.04%	102	38.22%	31.29%
72	1.88%	1.16%	103	40.41%	33.41%
73	2.08%	1.31%	104	42.54%	35.52%
74	2.32%	1.47%	105	44.61%	37.61%
75	2.59%	1.66%	106	46.62%	39.64%
76	2.90%	1.88%	107	48.56%	41.61%
77	3.26%	2.12%	108	50.39%	43.51%
78	3.67%	2.40%	109	52.14%	45.33%
79	4.14%	2.72%	110	53.56%	47.04%
80	4.67%	3.08%			

* The rates shown are Pub-2010 mortality for healthy annuitants, General table, with adjustments, if applicable (see Section G). Rates are adjusted for mortality improvements using Scale MP-2021, from a base year of 2010.

Proposed Actuarial Assumptions Based on 2018-2022 Experience Study

Disabled Post-Retirement Mortality Rates

Age in 2022	% Dying Next Year*		Age in 2022	% Dying Next Year*	
	Male	Female		Male	Female
20	0.48%	0.31%	56	2.40%	2.23%
21	0.45%	0.29%	57	2.53%	2.32%
22	0.42%	0.27%	58	2.65%	2.40%
23	0.39%	0.25%	59	2.77%	2.46%
24	0.37%	0.24%	60	2.89%	2.51%
25	0.37%	0.25%	61	3.00%	2.54%
26	0.40%	0.28%	62	3.11%	2.57%
27	0.43%	0.31%	63	3.22%	2.59%
28	0.47%	0.35%	64	3.33%	2.62%
29	0.51%	0.39%	65	3.44%	2.65%
30	0.55%	0.44%	66	3.55%	2.69%
31	0.60%	0.48%	67	3.66%	2.75%
32	0.64%	0.53%	68	3.78%	2.84%
33	0.68%	0.58%	69	3.91%	2.95%
34	0.73%	0.63%	70	4.05%	3.09%
35	0.77%	0.69%	71	4.21%	3.27%
36	0.81%	0.73%	72	4.40%	3.47%
37	0.85%	0.78%	73	4.62%	3.72%
38	0.89%	0.82%	74	4.88%	4.01%
39	0.93%	0.87%	75	5.17%	4.34%
40	0.96%	0.91%	76	5.51%	4.72%
41	1.00%	0.96%	77	5.90%	5.15%
42	1.05%	1.00%	78	6.34%	5.64%
43	1.09%	1.05%	79	6.83%	6.17%
44	1.15%	1.11%	80	7.39%	6.77%
45	1.21%	1.17%	81	8.01%	7.44%
46	1.28%	1.25%	82	8.69%	8.17%
47	1.37%	1.33%	83	9.44%	8.98%
48	1.46%	1.43%	84	10.26%	9.87%
49	1.57%	1.54%	85	11.14%	10.83%
50	1.69%	1.67%	86	12.08%	11.84%
51	1.79%	1.75%	87	13.10%	12.87%
52	1.90%	1.83%	88	14.19%	13.92%
53	2.02%	1.93%	89	15.56%	14.98%
54	2.14%	2.03%	90	17.07%	16.07%
55	2.27%	2.13%			

* The rates shown are Pub-2010 mortality for disabled annuitants, General/Teachers table, with adjustments, if applicable (see Section G). Rates are adjusted for mortality improvements using Scale MP-2021, from a base year of 2010.



Proposed Actuarial Assumptions Based on 2018-2022 Experience Study

Healthy Pre-Retirement Mortality Rates

Age in 2022	% Dying Next Year*		Age in 2022	% Dying Next Year*	
	Male	Female		Male	Female
20	0.04%	0.01%	46	0.11%	0.05%
21	0.04%	0.01%	47	0.12%	0.06%
22	0.04%	0.01%	48	0.12%	0.06%
23	0.03%	0.01%	49	0.13%	0.07%
24	0.03%	0.01%	50	0.14%	0.07%
25	0.03%	0.01%	51	0.15%	0.08%
26	0.04%	0.01%	52	0.16%	0.09%
27	0.04%	0.01%	53	0.18%	0.09%
28	0.04%	0.01%	54	0.19%	0.10%
29	0.05%	0.02%	55	0.21%	0.12%
30	0.05%	0.02%	56	0.23%	0.13%
31	0.05%	0.02%	57	0.25%	0.14%
32	0.06%	0.02%	58	0.28%	0.15%
33	0.06%	0.03%	59	0.30%	0.17%
34	0.07%	0.03%	60	0.33%	0.18%
35	0.07%	0.03%	61	0.36%	0.20%
36	0.07%	0.03%	62	0.38%	0.21%
37	0.08%	0.03%	63	0.41%	0.23%
38	0.08%	0.04%	64	0.44%	0.25%
39	0.08%	0.04%	65	0.47%	0.27%
40	0.09%	0.04%	66	0.50%	0.29%
41	0.09%	0.04%	67	0.53%	0.31%
42	0.09%	0.04%	68	0.57%	0.34%
43	0.10%	0.05%	69	0.61%	0.37%
44	0.10%	0.05%	70	0.65%	0.40%
45	0.11%	0.05%			

* The rates shown are Pub-2010 mortality for employees, General table, with adjustments, if applicable (see Section G). Rates are adjusted for mortality improvements using Scale MP-2021, from a base year of 2010.

SECTION K

GLOSSARY

Glossary

The following glossary is intended to provide definitions of a number of terms which are used throughout this report and which are somewhat unique to the discussion of an Experience Study.

Actuarial Decrement. The actual number of decrements which occurred during the study. This number is a straight tabulation of the actual number of occurrences of the particular decrement in question. Normally, the actual number of decrements will be subdivided by age and possibly sex.

Aggregate Assumptions. Assumptions which vary only by sex and/or age. The impact of year of service on the decrement is ignored. All experience is combined by age and/or sex without regard to service. Rates of death and disablement are more appropriate to aggregate measurement in a retirement system.

Crude Rate of Decrement. The rate of decrement determined by dividing the actual number of the respective decrement for that age and sex by the corresponding exposure for that age and sex. The rate is described as a crude rate because no smoothing or elimination of statistical fluctuations has been made. It is indicative of the underlying true rate of the decrement and is the basis used in graduation to obtain the graduated or tabular rate.

Decrements. The decrements are the means by which a member ceases to be a member. For active members, the decrements are death, withdrawal, service retirement, and disability retirement. For retired members, the only decrement is death. The purpose of the Experience Study is to determine the underlying rates of each decrement.

Expected Decrement. This is the number of occurrences of a given decrement expected to occur for a given age and sex based on the number of lives exposed to the risk of the particular decrement and the current assumed rate for that decrement. It may also be referred to as the tabular number of decrements. It is the number of deaths, withdrawals, retirements, or disabilities (whichever is applicable) that would have actually occurred had the actuarial assumptions been exactly realized.

Exposure. The number of lives exposed to a given risk of decrement for a particular age and sex. It represents the number of members who could have potentially died, retired, become disabled, or withdrawn at that particular age and for that particular sex. This term will also be described as “the number exposed to a given risk.”

Graduated Rates. Graduation is the mathematical process by which a set of crude rates of a particular type is translated into graduated or tabular rates. The graduation process attempts to smooth out statistical fluctuations and to arrive at a set of rates that adequately fit the underlying actual experience of the crude rates that are being graduated. The graduation process involves smoothing the results, but at the same time trying to fit the results to be consistent with the original data. It requires that the actuary exercise his or her judgment in what the underlying shape of the risk curve should look like.

Interpolated Rates. For the active rates of decrement (death, disability, retirement, and withdrawal), the actuary will develop graduated rates based on quinquennial age groupings (see definition). To arrive at the rates of decrement for ages between two quinquennial ages, the graduated quinquennial rates must be interpolated for these intermediate ages. The interpolated results are arrived at by applying a mathematical interpolation formula to the quinquennial graduated rates.



Glossary

Merit and Seniority Pay Increase Rate. The portion of the total salary scale which varies by service. It reflects the impact of moving up the salary grid in a given year, rather than the increase in the overall grid. It includes the salary increase associated with promotions during the year.

Quinquennial Age Groupings. For the active decrements, it is preferable to group the experience in five-year age groups for graduation and analysis purposes so as to minimize statistical fluctuations resulting from a lack of exposure which may occur for individual ages. Quinquennial age grouping is the five-year age grouping which is used to develop the graduated rates of decrement for active membership. The quinquennial age is the central age of the five-year grouping.

SECTION L

APPENDIX

Appendix – Detailed Experience Analysis

In this section, we present the annual experience for each major assumption that was analyzed for the study. Please note that totals may not sum correctly due to rounding of intermediate results.

Appendix – Detailed Experience Analysis Salary Increases

2018-2022 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	48,927	12.55%	10.25%
2	37,118	7.01%	7.25%
3	34,108	6.53%	6.00%
4	30,914	6.09%	5.50%
5	27,918	5.81%	5.00%
6	24,293	5.51%	4.70%
7	20,064	5.36%	4.50%
8	16,377	5.04%	4.40%
9	13,488	5.05%	4.30%
10	12,137	5.17%	4.20%
11	12,289	4.79%	4.00%
12	12,792	4.64%	3.90%
13	13,302	4.42%	3.80%
14	12,485	4.22%	3.70%
15	11,012	4.40%	3.65%
16	10,406	4.28%	3.60%
17	10,096	4.14%	3.50%
18	10,299	3.99%	3.40%
19	10,553	3.95%	3.40%
20	10,219	3.86%	3.40%
21	9,430	3.79%	3.30%
22	8,348	3.65%	3.30%
23	7,406	3.76%	3.30%
24	6,661	3.67%	3.20%
25	5,890	3.50%	3.20%
26	5,315	3.54%	3.10%
27	4,783	3.58%	3.00%
28	4,343	3.52%	3.00%
29	4,018	3.27%	3.00%
30+	20,935	3.26%	3.00%
Totals	455,926	5.34%	4.67%

Appendix – Detailed Experience Analysis Salary Increases

2018-2019 Experience				2019-2020 Experience			
Year	Exposure	Gross Actual Increases	Gross Expected Increases	Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	12,989	13.05%	10.25%	1	12,970	12.55%	10.25%
2	9,784	7.51%	7.25%	2	9,655	6.94%	7.25%
3	9,020	7.09%	6.00%	3	8,960	6.46%	6.00%
4	7,786	6.62%	5.50%	4	8,220	5.89%	5.50%
5	6,434	6.24%	5.00%	5	7,170	5.72%	5.00%
6	5,348	6.01%	4.70%	6	5,951	5.39%	4.70%
7	4,028	5.62%	4.50%	7	4,959	5.13%	4.50%
8	3,201	5.66%	4.40%	8	3,762	4.92%	4.40%
9	2,932	5.66%	4.30%	9	3,012	4.44%	4.30%
10	3,686	5.51%	4.20%	10	2,694	4.82%	4.20%
11	3,950	5.13%	4.00%	11	3,461	4.30%	4.00%
12	3,714	5.13%	3.90%	12	3,702	4.21%	3.90%
13	3,503	4.71%	3.80%	13	3,512	4.18%	3.80%
14	2,845	4.82%	3.70%	14	3,279	3.69%	3.70%
15	2,395	5.13%	3.65%	15	2,669	3.99%	3.65%
16	2,994	4.54%	3.60%	16	2,230	3.87%	3.60%
17	3,013	4.28%	3.50%	17	2,818	3.80%	3.50%
18	3,106	4.37%	3.40%	18	2,835	3.55%	3.40%
19	2,779	4.32%	3.40%	19	2,880	3.58%	3.40%
20	2,667	4.22%	3.40%	20	2,592	3.52%	3.40%
21	2,278	4.37%	3.30%	21	2,452	3.53%	3.30%
22	1,967	3.90%	3.30%	22	2,093	3.30%	3.30%
23	1,761	4.02%	3.30%	23	1,814	3.53%	3.30%
24	1,741	4.17%	3.20%	24	1,627	3.34%	3.20%
25	1,461	4.01%	3.20%	25	1,585	3.08%	3.20%
26	1,322	3.84%	3.10%	26	1,326	3.39%	3.10%
27	1,194	4.05%	3.00%	27	1,181	3.10%	3.00%
28	1,214	3.77%	3.00%	28	1,078	3.25%	3.00%
29	1,164	3.91%	3.00%	29	1,067	3.04%	3.00%
30+	5,417	3.68%	3.00%	30+	5,439	3.05%	3.00%
Totals	115,693	5.78%	4.68%	Totals	116,993	5.12%	4.70%

Appendix – Detailed Experience Analysis Salary Increases

2020-2021 Experience				2021-2022 Experience			
Year	Exposure	Gross Actual Increases	Gross Expected Increases	Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	13,460	11.56%	10.25%	1	9,508	13.26%	10.25%
2	9,311	5.82%	7.25%	2	8,368	7.85%	7.25%
3	8,383	5.25%	6.00%	3	7,745	7.37%	6.00%
4	7,870	5.06%	5.50%	4	7,038	6.94%	5.50%
5	7,380	4.66%	5.00%	5	6,934	6.75%	5.00%
6	6,480	4.27%	4.70%	6	6,514	6.41%	4.70%
7	5,436	4.31%	4.50%	7	5,641	6.39%	4.50%
8	4,568	4.06%	4.40%	8	4,846	5.68%	4.40%
9	3,455	4.04%	4.30%	9	4,089	5.88%	4.30%
10	2,705	4.05%	4.20%	10	3,052	5.99%	4.20%
11	2,460	3.93%	4.00%	11	2,418	5.75%	4.00%
12	3,173	3.85%	3.90%	12	2,203	5.71%	3.90%
13	3,408	3.67%	3.80%	13	2,879	5.24%	3.80%
14	3,258	3.17%	3.70%	14	3,103	5.33%	3.70%
15	3,016	3.49%	3.65%	15	2,932	5.13%	3.65%
16	2,452	3.36%	3.60%	16	2,730	5.12%	3.60%
17	2,026	3.25%	3.50%	17	2,239	5.08%	3.50%
18	2,546	3.33%	3.40%	18	1,812	4.98%	3.40%
19	2,585	3.21%	3.40%	19	2,309	4.84%	3.40%
20	2,621	3.01%	3.40%	20	2,339	4.74%	3.40%
21	2,341	2.74%	3.30%	21	2,359	4.53%	3.30%
22	2,169	2.84%	3.30%	22	2,119	4.57%	3.30%
23	1,889	2.95%	3.30%	23	1,942	4.52%	3.30%
24	1,624	2.79%	3.20%	24	1,669	4.33%	3.20%
25	1,408	2.68%	3.20%	25	1,436	4.22%	3.20%
26	1,402	2.87%	3.10%	26	1,265	4.12%	3.10%
27	1,168	2.69%	3.00%	27	1,240	4.43%	3.00%
28	1,035	2.94%	3.00%	28	1,016	4.11%	3.00%
29	917	2.16%	3.00%	29	870	3.88%	3.00%
30+	5,198	2.51%	3.00%	30+	4,881	3.83%	3.00%
Totals	115,744	4.41%	4.71%	Totals	107,496	6.08%	4.60%

Appendix – Detailed Experience Analysis Rule of 90 Retirement*

2018-2022 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	19,637	99,485	19,897	98.7%
56	47,847	233,966	35,095	136.3%
57	72,319	443,921	66,588	108.6%
58	99,400	677,569	101,635	97.8%
59	124,537	835,591	125,339	99.4%
60	137,447	920,703	138,105	99.5%
61	155,671	946,233	141,935	109.7%
62	262,579	958,282	287,485	91.3%
63	187,638	826,224	206,556	90.8%
64	184,669	740,084	185,021	99.8%
Totals	1,291,744	6,682,058	1,307,656	98.8%

* Results are liability weighted.

Appendix – Detailed Experience Analysis Rule of 90 Retirement*

2018-2019 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	6,755	28,029	5,606	120.5%
56	12,637	60,254	9,038	139.8%
57	17,577	124,303	18,646	94.3%
58	31,091	205,868	30,880	100.7%
59	36,036	219,287	32,893	109.6%
60	36,777	249,360	37,404	98.3%
61	41,435	264,385	39,658	104.5%
62	78,584	286,764	86,029	91.3%
63	49,878	223,446	55,862	89.3%
64	50,511	186,377	46,594	108.4%
Totals	361,281	1,848,073	362,609	99.6%

2019-2020 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	6,093	27,261	5,452	111.8%
56	10,613	57,753	8,663	122.5%
57	17,890	104,058	15,609	114.6%
58	25,398	181,604	27,241	93.2%
59	31,182	245,839	36,876	84.6%
60	30,993	232,849	34,927	88.7%
61	38,884	239,083	35,862	108.4%
62	65,232	247,782	74,335	87.8%
63	45,951	226,607	56,652	81.1%
64	39,131	190,209	47,552	82.3%
Totals	311,367	1,753,045	343,169	90.7%

* Results are liability weighted.

Appendix – Detailed Experience Analysis Rule of 90 Retirement*

2020-2021 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	4,289	21,983	4,397	97.6%
56	12,031	63,565	9,535	126.2%
57	18,918	108,113	16,217	116.7%
58	22,445	155,128	23,269	96.5%
59	34,649	216,201	32,430	106.8%
60	38,462	240,508	36,076	106.6%
61	36,928	222,893	33,434	110.4%
62	63,961	223,308	66,992	95.5%
63	50,904	202,734	50,683	100.4%
64	57,077	199,609	49,902	114.4%
Totals	339,662	1,654,041	322,936	105.2%

2021-2022 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	2,499	22,213	4,443	56.3%
56	12,566	52,394	7,859	159.9%
57	17,934	107,447	16,117	111.3%
58	20,467	134,970	20,245	101.1%
59	22,670	154,265	23,140	98.0%
60	31,215	197,986	29,698	105.1%
61	38,424	219,872	32,981	116.5%
62	54,803	200,428	60,128	91.1%
63	40,906	173,437	43,359	94.3%
64	37,950	163,889	40,972	92.6%
Totals	279,434	1,426,899	278,942	100.2%

* Results are liability weighted.

Appendix – Detailed Experience Analysis Non-Rule of 90 Retirement* – Tier 1 Members

2018-2022 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	18,792	445,855	17,834	105.4%
56	21,661	465,422	18,617	116.3%
57	27,749	417,948	20,897	132.8%
58	24,373	326,004	16,300	149.5%
59	23,342	254,099	15,246	153.1%
60	16,591	220,787	17,663	93.9%
61	16,811	202,276	20,228	83.1%
62	29,678	188,543	37,709	78.7%
63	29,561	155,988	31,198	94.8%
64	22,555	118,815	23,763	94.9%
65	344,983	734,582	293,833	117.4%
66	199,019	451,751	158,113	125.9%
67	94,050	262,897	65,724	143.1%
68	60,434	185,452	46,363	130.4%
69	38,744	131,997	32,999	117.4%
70	31,001	94,366	23,591	131.4%
Totals	999,345	4,656,783	840,078	119.0%

* Results are liability weighted.

Appendix – Detailed Experience Analysis Non-Rule of 90 Retirement* – Tier 1 Members

2018-2019 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	7,430	159,013	6,361	116.8%
56	6,488	166,353	6,654	97.5%
57	9,359	167,998	8,400	111.4%
58	7,778	119,832	5,992	129.8%
59	6,264	87,443	5,247	119.4%
60	5,249	69,927	5,594	93.8%
61	3,858	53,974	5,397	71.5%
62	8,461	52,776	10,555	80.2%
63	6,760	37,931	7,586	89.1%
64	4,574	30,482	6,096	75.0%
65	94,285	193,069	77,228	122.1%
66	59,760	137,365	48,078	124.3%
67	20,439	63,882	15,971	128.0%
68	16,511	44,079	11,020	149.8%
69	10,847	28,438	7,109	152.6%
70	9,280	27,176	6,794	136.6%
Totals	277,345	1,439,738	234,081	118.5%

2019-2020 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	5,782	128,597	5,144	112.4%
56	7,096	134,004	5,360	132.4%
57	7,326	121,295	6,065	120.8%
58	9,472	104,654	5,233	181.0%
59	6,812	63,274	3,796	179.4%
60	4,548	54,190	4,335	104.9%
61	3,970	60,176	6,018	66.0%
62	6,375	45,326	9,065	70.3%
63	7,692	43,617	8,723	88.2%
64	5,568	30,449	6,090	91.4%
65	70,660	173,441	69,376	101.9%
66	45,964	103,385	36,185	127.0%
67	27,775	80,917	20,229	137.3%
68	13,171	45,784	11,446	115.1%
69	7,267	29,184	7,296	99.6%
70	4,268	19,209	4,802	88.9%
Totals	233,745	1,237,500	209,163	111.8%

* Results are liability weighted.

Appendix – Detailed Experience Analysis Non-Rule of 90 Retirement* – Tier 1 Members

2020-2021 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	2,392	100,144	4,006	59.7%
56	2,351	92,731	3,709	63.4%
57	7,732	80,967	4,048	191.0%
58	4,004	60,865	3,043	131.6%
59	3,713	53,898	3,234	114.8%
60	3,568	49,840	3,987	89.5%
61	4,514	45,285	4,529	99.7%
62	8,871	51,864	10,373	85.5%
63	7,822	33,972	6,794	115.1%
64	6,524	32,874	6,575	99.2%
65	85,921	187,696	75,078	114.4%
66	48,987	106,405	37,242	131.5%
67	20,996	58,960	14,740	142.4%
68	17,159	55,966	13,992	122.6%
69	10,353	33,707	8,427	122.9%
70	9,353	23,328	5,832	160.4%
Totals	244,262	1,068,502	205,608	118.8%

2021-2022 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	3,187	58,102	2,324	137.1%
56	5,725	72,334	2,893	197.9%
57	3,332	47,689	2,384	139.7%
58	3,119	40,653	2,033	153.4%
59	6,553	49,484	2,969	220.7%
60	3,226	46,830	3,746	86.1%
61	4,469	42,841	4,284	104.3%
62	5,971	38,578	7,716	77.4%
63	7,287	40,468	8,094	90.0%
64	5,888	25,011	5,002	117.7%
65	94,117	180,377	72,151	130.4%
66	44,308	104,596	36,609	121.0%
67	24,839	59,138	14,785	168.0%
68	13,593	39,621	9,905	137.2%
69	10,277	40,668	10,167	101.1%
70	8,101	24,653	6,163	131.4%
Totals	243,993	911,043	191,225	127.6%

* Results are liability weighted.



Appendix – Detailed Experience Analysis Non-Rule of 90 Retirement* – Tier 2 Members

2018-2022 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	64,537	1,520,418	60,817	106.1%
56	66,701	1,573,683	62,947	106.0%
57	69,152	1,607,025	64,281	107.6%
58	66,949	1,627,652	81,383	82.3%
59	88,731	1,633,610	81,680	108.6%
60	102,302	1,584,109	95,047	107.6%
61	116,678	1,519,920	121,594	96.0%
62	220,055	1,419,035	212,855	103.4%
63	175,885	1,213,944	182,092	96.6%
64	174,047	1,041,357	156,204	111.4%
65	264,722	867,793	216,948	122.0%
66	257,734	599,216	209,725	122.9%
67	118,235	337,366	84,342	140.2%
68	62,640	211,102	52,776	118.7%
69	40,208	144,155	36,039	111.6%
70	32,937	100,294	25,073	131.4%
Totals	1,921,513	17,000,677	1,743,801	110.2%

* Results are liability weighted.

Appendix – Detailed Experience Analysis Non-Rule of 90 Retirement* – Tier 2 Members

2018-2019 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	13,415	350,848	14,034	95.6%
56	15,987	379,737	15,189	105.3%
57	15,478	371,131	14,845	104.3%
58	12,835	368,773	18,439	69.6%
59	15,080	352,656	17,633	85.5%
60	20,113	354,294	21,258	94.6%
61	28,241	334,437	26,755	105.6%
62	47,183	307,357	46,103	102.3%
63	33,004	248,525	38,144	86.5%
64	27,977	223,792	33,569	83.3%
65	50,188	179,146	44,787	112.1%
66	47,973	120,724	42,253	113.5%
67	24,035	73,287	18,322	131.2%
68	12,455	42,761	10,690	116.5%
69	7,614	26,937	6,734	113.1%
70	5,673	22,055	5,514	102.9%
Totals	377,251	3,756,460	374,269	100.8%

2019-2020 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	13,411	370,038	14,802	90.6%
56	13,506	378,123	15,125	89.3%
57	12,907	407,730	16,309	79.1%
58	15,411	398,749	19,937	77.3%
59	19,696	396,329	19,816	99.4%
60	20,456	374,386	22,463	91.1%
61	22,974	369,010	29,521	77.8%
62	44,749	338,185	50,728	88.2%
63	35,077	287,555	43,133	81.3%
64	32,273	239,910	35,987	89.7%
65	61,768	217,281	54,320	113.7%
66	58,533	140,822	49,288	118.8%
67	24,333	77,465	19,366	125.6%
68	15,941	53,707	13,427	118.7%
69	8,713	33,177	8,294	105.0%
70	6,729	20,818	5,204	129.3%
Totals	406,477	4,103,282	417,720	97.3%

* Results are liability weighted.

Appendix – Detailed Experience Analysis Non-Rule of 90 Retirement* – Tier 2 Members

2020-2021 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	13,977	392,691	15,708	89.0%
56	13,664	398,307	15,932	85.8%
57	17,090	406,855	16,274	105.0%
58	15,715	437,013	21,851	71.9%
59	21,236	426,709	21,335	99.5%
60	24,121	414,459	24,868	97.0%
61	29,632	391,188	31,295	94.7%
62	59,953	381,573	57,236	104.7%
63	52,863	325,572	48,836	108.2%
64	54,794	279,736	41,960	130.6%
65	72,642	228,670	57,167	127.1%
66	73,804	169,371	59,280	124.5%
67	31,596	86,906	21,726	145.4%
68	16,651	57,279	14,320	116.3%
69	11,660	40,779	10,195	114.4%
70	10,429	26,762	6,691	155.9%
Totals	519,828	4,463,870	464,674	111.9%

2021-2022 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	23,733	406,842	16,274	145.8%
56	23,544	417,515	16,701	141.0%
57	23,677	421,309	16,852	140.5%
58	22,988	423,118	21,156	108.7%
59	32,718	457,916	22,896	142.9%
60	37,611	440,969	26,458	142.2%
61	35,831	425,284	34,023	105.3%
62	68,171	391,921	58,788	116.0%
63	54,942	352,292	52,844	104.0%
64	59,003	297,919	44,688	132.0%
65	80,124	242,697	60,674	132.1%
66	77,424	168,299	58,905	131.4%
67	38,271	99,708	24,927	153.5%
68	17,592	57,355	14,339	122.7%
69	12,221	43,261	10,815	113.0%
70	10,106	30,659	7,665	131.9%
Totals	617,957	4,677,064	488,004	126.6%

** Results are liability weighted.*

Appendix – Detailed Experience Analysis Withdrawals*

2018-2022 Experience (\$000s)

Males					Females				
Year	Actual		Expected	Actual/	Year	Actual		Expected	Actual/
	Terminations	Exposure	Terminations	Expected		Terminations	Exposure	Terminations	Expected
1	37,825	169,148	36,367	104.0%	1	53,634	220,291	47,363	113.2%
2	83,959	534,573	86,868	96.7%	2	140,192	774,019	133,518	105.0%
3	68,331	609,269	67,020	102.0%	3	121,817	896,926	116,600	104.5%
4	55,654	620,750	55,868	99.6%	4	102,269	930,973	102,407	99.9%
5	43,640	580,279	46,422	94.0%	5	83,889	883,651	79,529	105.5%
6	33,742	521,980	36,539	92.3%	6	68,664	808,900	68,756	99.9%
7	25,239	499,216	31,201	80.9%	7	57,709	762,789	61,023	94.6%
8	23,200	447,406	24,607	94.3%	8	48,340	674,249	50,569	95.6%
9	19,888	381,756	19,088	104.2%	9	39,604	581,099	40,677	97.4%
10	16,535	320,135	14,406	114.8%	10	31,992	495,780	29,747	107.5%
11	15,595	299,455	12,727	122.5%	11	30,848	465,766	25,617	120.4%
12	14,971	321,235	12,849	116.5%	12	28,473	481,990	25,304	112.5%
13	13,303	351,558	13,183	100.9%	13	24,757	532,625	26,631	93.0%
14	11,404	399,233	13,973	81.6%	14	25,725	585,632	27,818	92.5%
15	12,364	391,959	11,759	105.1%	15	23,250	557,641	23,700	98.1%
16	11,382	352,079	9,682	117.6%	16	22,404	500,147	18,756	119.5%
17	10,686	328,397	8,210	130.2%	17	18,497	469,822	16,444	112.5%
18	8,579	316,607	7,124	120.4%	18	15,853	464,598	13,938	113.7%
19	7,248	332,896	6,658	108.9%	19	19,089	503,447	14,097	135.4%
20	9,172	358,222	6,806	134.8%	20	16,082	523,266	14,128	113.8%
21	9,254	361,874	6,695	138.2%	21	14,457	510,137	13,264	109.0%
22	4,476	343,785	6,188	72.3%	22	14,582	470,550	11,764	124.0%
23	5,240	310,385	5,432	96.5%	23	12,872	417,741	10,026	128.4%
24	4,760	277,395	4,716	100.9%	24	12,230	368,393	8,473	144.3%
25	4,632	242,372	3,999	115.8%	25	8,559	316,931	6,972	122.8%
26	3,413	207,972	3,328	102.6%	26	5,851	277,332	5,824	100.5%
27	2,161	177,748	2,755	78.4%	27	5,308	242,815	4,856	109.3%
28	2,816	157,696	2,365	119.1%	28	5,278	211,677	3,175	166.2%
29	2,881	130,295	1,303	221.1%	29	3,435	182,267	2,734	125.6%
30+	11,103	425,499	4,255	260.9%	30+	16,401	646,846	9,703	169.0%
Totals	573,453	10,771,175	562,392	102.0%	Totals	1,072,059	15,758,299	1,013,412	105.8%

* Results are liability weighted.



Appendix – Detailed Experience Analysis Withdrawals*

2018-2019 Experience (\$000s)

Males					Females						
Year	Actual		Expected		Actual/ Expected	Year	Actual		Expected		Actual/ Expected
	Terminations	Exposure	Terminations	Exposure			Terminations	Exposure	Terminations	Exposure	
1	7,816	39,772	8,551	91.4%	1	12,556	54,097	11,631	108.0%		
2	19,024	129,579	21,057	90.3%	2	32,152	194,787	33,601	95.7%		
3	14,639	142,180	15,640	93.6%	3	25,598	225,463	29,310	87.3%		
4	11,251	151,128	13,602	82.7%	4	21,340	231,301	25,443	83.9%		
5	8,973	136,807	10,945	82.0%	5	16,398	198,431	17,859	91.8%		
6	7,086	112,841	7,899	89.7%	6	12,646	169,732	14,427	87.7%		
7	5,569	97,310	6,082	91.6%	7	10,230	156,313	12,505	81.8%		
8	3,861	79,085	4,350	88.8%	8	8,628	122,841	9,213	93.6%		
9	4,206	63,287	3,164	132.9%	9	6,857	94,910	6,644	103.2%		
10	3,097	58,163	2,617	118.3%	10	7,003	95,385	5,723	122.4%		
11	2,937	87,851	3,734	78.7%	11	8,649	136,813	7,525	114.9%		
12	3,901	100,050	4,002	97.5%	12	9,077	149,397	7,843	115.7%		
13	3,602	98,451	3,692	97.6%	13	7,236	151,752	7,588	95.4%		
14	3,168	98,750	3,456	91.7%	14	6,107	143,878	6,834	89.4%		
15	2,970	81,727	2,452	121.1%	15	4,859	112,041	4,762	102.0%		
16	1,856	60,020	1,651	112.4%	16	5,181	96,030	3,601	143.9%		
17	2,053	81,235	2,031	101.1%	17	4,474	132,639	4,642	96.4%		
18	1,856	92,869	2,090	88.8%	18	4,503	138,163	4,145	108.6%		
19	1,691	96,581	1,932	87.6%	19	4,959	147,953	4,143	119.7%		
20	1,679	88,288	1,677	100.1%	20	3,082	124,280	3,356	91.8%		
21	2,614	83,262	1,540	169.7%	21	2,438	117,391	3,052	79.9%		
22	1,072	78,186	1,407	76.2%	22	3,123	105,629	2,641	118.3%		
23	628	70,775	1,239	50.7%	23	2,055	88,289	2,119	97.0%		
24	367	61,893	1,052	34.9%	24	2,629	80,136	1,843	142.6%		
25	878	54,341	897	97.9%	25	2,042	79,114	1,741	117.3%		
26	198	49,460	791	25.0%	26	1,395	67,940	1,427	97.7%		
27	136	38,274	593	23.0%	27	1,358	53,798	1,076	126.2%		
28	1,289	36,022	540	238.6%	28	658	48,845	733	89.8%		
29	445	33,517	335	132.8%	29	1,329	50,653	760	174.9%		
30+	4,253	127,212	1,272	334.3%	30+	3,302	197,913	2,969	111.2%		
Totals	123,113	2,528,918	130,289	94.5%	Totals	231,863	3,765,915	239,153	97.0%		

* Results are liability weighted.



Appendix – Detailed Experience Analysis Withdrawals*

2019-2020 Experience (\$000s)

Males					Females				
Year	Actual		Expected	Actual/	Year	Actual		Expected	Actual/
	Terminations	Exposure	Terminations	Expected		Terminations	Exposure	Terminations	Expected
1	10,957	45,187	9,715	112.8%	1	14,768	57,223	12,303	120.0%
2	22,140	144,333	23,454	94.4%	2	32,506	200,776	34,634	93.9%
3	17,989	154,706	17,018	105.7%	3	28,868	221,880	28,844	100.1%
4	13,756	152,014	13,681	100.5%	4	23,919	240,968	26,507	90.2%
5	9,555	150,441	12,035	79.4%	5	21,403	233,735	21,036	101.7%
6	7,271	131,690	9,218	78.9%	6	16,402	192,890	16,396	100.0%
7	4,943	119,048	7,440	66.4%	7	12,410	177,555	14,204	87.4%
8	4,829	103,966	5,718	84.5%	8	10,717	163,377	12,253	87.5%
9	3,907	83,021	4,151	94.1%	9	8,547	126,948	8,886	96.2%
10	3,256	65,449	2,945	110.5%	10	5,042	96,055	5,763	87.5%
11	2,761	58,362	2,480	111.3%	11	6,823	96,577	5,312	128.5%
12	4,157	93,114	3,725	111.6%	12	6,707	137,215	7,204	93.1%
13	2,993	102,974	3,862	77.5%	13	6,605	149,595	7,480	88.3%
14	3,062	101,742	3,561	86.0%	14	6,227	153,684	7,300	85.3%
15	1,579	100,658	3,020	52.3%	15	5,262	140,687	5,979	88.0%
16	2,817	84,256	2,317	121.6%	16	4,981	112,720	4,227	117.8%
17	2,091	60,361	1,509	138.5%	17	4,464	94,434	3,305	135.1%
18	2,247	81,532	1,834	122.5%	18	4,240	128,791	3,864	109.7%
19	1,853	95,891	1,918	96.6%	19	4,763	138,176	3,869	123.1%
20	2,480	94,275	1,791	138.4%	20	4,626	141,742	3,827	120.9%
21	3,096	89,086	1,648	187.9%	21	3,328	120,081	3,122	106.6%
22	1,387	85,037	1,531	90.6%	22	3,488	116,408	2,910	119.9%
23	886	73,437	1,285	69.0%	23	3,210	101,716	2,441	131.5%
24	889	66,524	1,131	78.6%	24	2,873	83,399	1,918	149.8%
25	1,484	56,897	939	158.1%	25	2,403	73,281	1,612	149.1%
26	926	49,406	790	117.1%	26	1,646	72,848	1,530	107.6%
27	311	46,460	720	43.1%	27	1,126	62,723	1,254	89.7%
28	-	34,417	516	0.0%	28	1,719	47,888	718	239.3%
29	641	33,027	330	193.9%	29	438	40,658	610	71.8%
30+	1,989	112,672	1,127	176.5%	30+	4,672	179,007	2,685	174.0%
Totals	136,250	2,669,983	141,411	96.4%	Totals	254,182	3,903,036	251,994	100.9%

* Results are liability weighted.



Appendix – Detailed Experience Analysis Withdrawals*

2020-2021 Experience (\$000s)

Males					Females				
Year	Actual		Expected		Year	Actual		Expected	
	Terminations	Exposure	Terminations	Actual/ Expected		Terminations	Exposure	Terminations	Actual/ Expected
1	9,067	41,840	8,996	100.8%	1	11,879	53,957	11,601	102.4%
2	20,092	145,064	23,573	85.2%	2	35,722	208,506	35,967	99.3%
3	16,728	158,271	17,410	96.1%	3	29,775	227,048	29,516	100.9%
4	13,523	158,890	14,300	94.6%	4	24,429	230,053	25,306	96.5%
5	9,600	145,213	11,617	82.6%	5	19,777	236,011	21,241	93.1%
6	8,336	143,123	10,019	83.2%	6	15,598	222,124	18,881	82.6%
7	5,860	135,412	8,463	69.2%	7	12,811	199,874	15,990	80.1%
8	5,701	124,019	6,821	83.6%	8	9,542	184,234	13,818	69.1%
9	4,082	109,064	5,453	74.9%	9	7,769	166,504	11,655	66.7%
10	3,497	85,960	3,868	90.4%	10	5,511	131,463	7,888	69.9%
11	2,914	66,780	2,838	102.7%	11	5,055	96,949	5,332	94.8%
12	2,385	60,968	2,439	97.8%	12	5,130	96,378	5,060	101.4%
13	2,970	90,383	3,389	87.6%	13	5,068	137,916	6,896	73.5%
14	1,599	106,922	3,742	42.7%	14	5,336	150,669	7,157	74.6%
15	2,074	102,166	3,065	67.7%	15	4,323	153,754	6,535	66.2%
16	2,377	103,927	2,858	83.2%	16	3,920	138,912	5,209	75.3%
17	2,341	83,496	2,087	112.1%	17	3,249	107,610	3,766	86.3%
18	1,545	59,567	1,340	115.3%	18	3,315	92,637	2,779	119.3%
19	1,671	81,398	1,628	102.6%	19	3,985	126,576	3,544	112.4%
20	944	94,986	1,805	52.3%	20	3,590	133,491	3,604	99.6%
21	919	95,261	1,762	52.1%	21	3,971	138,796	3,609	110.0%
22	396	85,003	1,530	25.9%	22	2,097	116,634	2,916	71.9%
23	1,184	82,761	1,448	81.8%	23	2,761	114,110	2,739	100.8%
24	1,201	72,243	1,228	97.8%	24	2,694	96,067	2,210	121.9%
25	1,447	63,752	1,052	137.5%	25	758	76,373	1,680	45.1%
26	1,110	48,141	770	144.1%	26	707	66,800	1,403	50.4%
27	475	49,082	761	62.4%	27	797	66,079	1,322	60.3%
28	1,050	41,218	618	169.8%	28	822	55,565	833	98.6%
29	712	28,797	288	247.1%	29	581	41,948	629	92.4%
30+	2,916	97,606	976	298.7%	30+	3,941	146,782	2,202	179.0%
Totals	128,716	2,761,314	146,146	88.1%	Totals	234,909	4,013,820	261,286	89.9%

* Results are liability weighted.



Appendix – Detailed Experience Analysis Withdrawals*

2021-2022 Experience (\$000s)

Males					Females				
Year	Actual Terminations	Exposure	Expected Terminations	Actual/Expected	Year	Actual Terminations	Exposure	Expected Terminations	Actual/Expected
1	9,985	42,349	9,105	109.7%	1	14,431	55,014	11,828	122.0%
2	22,703	115,597	18,785	120.9%	2	39,812	169,950	29,316	135.8%
3	18,975	154,112	16,952	111.9%	3	37,577	222,536	28,930	129.9%
4	17,123	158,718	14,285	119.9%	4	32,581	228,651	25,152	129.5%
5	15,514	147,817	11,825	131.2%	5	26,311	215,474	19,393	135.7%
6	11,049	134,326	9,403	117.5%	6	24,018	224,155	19,053	126.1%
7	8,867	147,446	9,215	96.2%	7	22,258	229,047	18,324	121.5%
8	8,809	140,336	7,718	114.1%	8	19,454	203,797	15,285	127.3%
9	7,692	126,383	6,319	121.7%	9	16,431	192,736	13,492	121.8%
10	6,685	110,562	4,975	134.4%	10	14,436	172,878	10,373	139.2%
11	6,984	86,461	3,675	190.0%	11	10,321	135,428	7,449	138.6%
12	4,528	67,103	2,684	168.7%	12	7,559	99,000	5,198	145.4%
13	3,738	59,750	2,241	166.8%	13	5,848	93,361	4,668	125.3%
14	3,574	91,819	3,214	111.2%	14	8,055	137,401	6,527	123.4%
15	5,742	107,407	3,222	178.2%	15	8,806	151,160	6,424	137.1%
16	4,332	103,876	2,857	151.6%	16	8,322	152,484	5,718	145.5%
17	4,202	103,306	2,583	162.7%	17	6,310	135,139	4,730	133.4%
18	2,931	82,638	1,859	157.6%	18	3,795	105,007	3,150	120.5%
19	2,034	59,026	1,181	172.3%	19	5,382	90,742	2,541	211.8%
20	4,070	80,672	1,533	265.5%	20	4,784	123,752	3,341	143.2%
21	2,624	94,265	1,744	150.5%	21	4,720	133,869	3,481	135.6%
22	1,620	95,558	1,720	94.2%	22	5,874	131,878	3,297	178.2%
23	2,541	83,413	1,460	174.1%	23	4,846	113,626	2,727	177.7%
24	2,304	76,735	1,304	176.6%	24	4,034	108,790	2,502	161.2%
25	823	67,383	1,112	74.0%	25	3,356	88,163	1,940	173.0%
26	1,179	60,966	975	120.9%	26	2,103	69,744	1,465	143.6%
27	1,240	43,931	681	182.0%	27	2,028	60,215	1,204	168.4%
28	477	46,039	691	69.1%	28	2,080	59,378	891	233.5%
29	1,084	34,954	350	310.0%	29	1,087	49,008	735	147.9%
30+	1,945	88,009	880	221.0%	30+	4,486	123,144	1,847	242.9%
Totals	185,374	2,810,959	144,547	128.2%	Totals	351,104	4,075,528	260,978	134.5%

* Results are liability weighted.



Appendix – Detailed Experience Analysis Disability Retirements

Age Group	Males				Age Group	Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected		Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	7,570	0.6	0.0%	20-24	-	15,307	1.5	0.0%
25-29	-	16,277	1.2	0.0%	25-29	-	31,426	3.1	0.0%
30-34	-	20,128	2.4	0.0%	30-34	-	38,091	6.2	0.0%
35-39	1	21,817	6.6	15.2%	35-39	1	44,800	11.7	8.6%
40-44	4	21,222	10.5	38.3%	40-44	7	46,029	19.3	36.2%
45-49	4	20,503	16.1	24.9%	45-49	9	46,862	32.1	28.1%
50-54	16	22,721	36.6	43.7%	50-54	27	53,489	63.3	42.6%
55-59	53	26,175	85.8	61.8%	55-59	47	59,997	101.8	46.2%
60-64	54	24,132	139.3	38.8%	60-64	75	50,933	124.7	60.1%
Totals	132	180,545	299.1	44.1%	Totals	166	386,934	363.7	45.6%

Appendix – Detailed Experience Analysis Disability Retirements

2018-2019 Experience

Age Group	Males				Age Group	Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected		Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	1,899	0.1	0.0%	20-24	-	3,726	0.4	0.0%
25-29	-	4,188	0.3	0.0%	25-29	-	8,104	0.8	0.0%
30-34	-	5,059	0.6	0.0%	30-34	-	9,571	1.6	0.0%
35-39	-	5,289	1.6	0.0%	35-39	-	10,898	2.9	0.0%
40-44	1	4,911	2.4	41.3%	40-44	-	11,119	4.7	0.0%
45-49	1	5,204	4.1	24.4%	45-49	4	12,170	8.4	47.7%
50-54	7	5,676	9.2	75.9%	50-54	10	13,877	16.5	60.6%
55-59	16	6,907	22.6	70.7%	55-59	13	15,800	26.7	48.7%
60-64	17	6,025	34.8	48.9%	60-64	21	12,611	30.8	68.3%
Totals	42	45,158	75.8	55.4%	Totals	48	97,876	92.6	51.8%

2019-2020 Experience

Age Group	Males				Age Group	Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected		Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	1,956	0.1	0.0%	20-24	-	3,827	0.4	0.0%
25-29	-	4,196	0.3	0.0%	25-29	-	8,084	0.8	0.0%
30-34	-	5,129	0.6	0.0%	30-34	-	9,611	1.6	0.0%
35-39	-	5,503	1.7	0.0%	35-39	-	11,452	3.0	0.0%
40-44	2	5,226	2.6	77.7%	40-44	3	11,374	4.8	62.8%
45-49	1	5,101	4.0	24.9%	45-49	2	11,969	8.2	24.4%
50-54	1	5,739	9.3	10.8%	50-54	8	13,456	15.9	50.2%
55-59	22	6,693	22.0	100.2%	55-59	15	15,486	26.3	57.1%
60-64	11	6,032	34.8	31.6%	60-64	19	12,717	31.1	61.1%
Totals	37	45,575	75.4	49.1%	Totals	47	97,976	92.0	51.1%



Appendix – Detailed Experience Analysis Disability Retirements

2020-2021 Experience

Age Group	Males				Age Group	Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected		Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	1,909	0.1	0.0%	20-24	-	3,843	0.4	0.0%
25-29	-	4,038	0.3	0.0%	25-29	-	7,817	0.8	0.0%
30-34	-	5,008	0.6	0.0%	30-34	-	9,643	1.6	0.0%
35-39	1	5,536	1.7	60.1%	35-39	-	11,495	3.0	0.0%
40-44	1	5,454	2.7	37.2%	40-44	3	11,706	4.9	61.2%
45-49	1	5,086	4.0	25.1%	45-49	-	11,627	7.9	0.0%
50-54	6	5,660	9.0	66.4%	50-54	3	13,295	15.7	19.1%
55-59	8	6,452	21.1	37.9%	55-59	11	14,844	25.2	43.6%
60-64	16	6,101	35.2	45.4%	60-64	19	13,003	31.9	59.5%
Totals	33	45,244	74.8	44.1%	Totals	36	97,273	91.4	39.4%

2021-2022 Experience

Age Group	Males				Age Group	Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected		Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	1,806	0.1	0.0%	20-24	-	3,911	0.4	0.0%
25-29	-	3,855	0.3	0.0%	25-29	-	7,421	0.7	0.0%
30-34	-	4,932	0.6	0.0%	30-34	-	9,266	1.5	0.0%
35-39	-	5,489	1.7	0.0%	35-39	1	10,955	2.9	34.9%
40-44	-	5,631	2.8	0.0%	40-44	1	11,830	5.0	20.2%
45-49	1	5,112	4.0	25.2%	45-49	3	11,096	7.5	39.8%
50-54	2	5,646	9.1	22.1%	50-54	6	12,861	15.2	39.4%
55-59	7	6,123	20.1	34.8%	55-59	8	13,867	23.6	33.9%
60-64	10	5,974	34.5	29.0%	60-64	16	12,602	30.9	51.8%
Totals	20	44,568	73.1	27.4%	Totals	35	93,809	87.7	39.9%



Appendix – Detailed Experience Analysis Post-Retirement Mortality*

2018-2022 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
55-59	296	42,999	239.48	123.4%	55-59	221	64,818	206.58	106.7%
60-64	1,572	260,616	2,053.10	76.5%	60-64	1,371	365,179	1,595.52	85.9%
65-69	5,748	637,495	7,212.77	79.7%	65-69	4,820	876,770	5,643.62	85.4%
70-74	10,905	619,552	10,935.25	99.7%	70-74	8,232	740,731	7,835.44	105.1%
75-79	12,701	366,180	11,222.78	113.2%	75-79	9,942	442,045	8,494.16	117.0%
80-84	14,857	260,193	14,786.56	100.5%	80-84	11,659	278,227	10,019.53	116.4%
85-89	25,307	196,438	19,891.52	127.2%	85-89	15,120	181,386	12,414.80	121.8%
90-94	19,687	94,332	15,684.00	125.5%	90-94	15,798	103,213	12,351.82	127.9%
95-99	7,313	22,795	5,534.72	132.1%	95-99	7,411	32,147	5,882.96	126.0%
100+	721	1,338	445.41	161.8%	100+	2,010	5,761	1,535.26	130.9%
Totals	99,106	2,501,939	88,005.59	112.6%	Totals	76,583	3,090,277	65,979.69	116.1%

* Results are benefits weighted



Appendix – Detailed Experience Analysis Post-Retirement Mortality*

2018-2019 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
55-59	79	12,318	69	114.4%	55-59	57	17,166	55	104.2%
60-64	386	69,126	546	70.7%	60-64	335	93,297	407	82.4%
65-69	1,320	155,930	1,757	75.1%	65-69	1,141	201,329	1,295	88.1%
70-74	2,234	134,499	2,369	94.3%	70-74	1,880	156,990	1,675	112.3%
75-79	2,965	81,307	2,533	117.1%	75-79	1,929	96,528	1,883	102.4%
80-84	3,931	65,348	3,748	104.9%	80-84	2,466	63,067	2,295	107.4%
85-89	6,321	49,897	5,046	125.2%	85-89	3,125	44,579	3,080	101.5%
90-94	4,354	23,812	3,946	110.3%	90-94	3,931	25,003	3,016	130.3%
95-99	1,685	5,301	1,284	131.2%	95-99	1,728	7,396	1,377	125.5%
100+	90	216	75	120.0%	100+	337	937	250	135.0%
Totals	23,365	597,754	21,374	109.3%	Totals	16,930	706,292	15,333	110.4%

2019-2020 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
55-59	93	11,485	64	144.0%	55-59	98	16,433	52	186.1%
60-64	160	65,424	515	31.0%	60-64	299	91,591	400	74.7%
65-69	1,313	160,910	1,820	72.1%	65-69	1,289	214,560	1,379	93.5%
70-74	2,550	148,152	2,611	97.6%	70-74	1,831	175,376	1,857	98.6%
75-79	2,978	86,855	2,675	111.3%	75-79	2,405	104,710	2,024	118.8%
80-84	3,358	64,702	3,685	91.1%	80-84	2,401	67,431	2,444	98.3%
85-89	6,222	50,022	5,077	122.6%	85-89	4,040	44,646	3,083	131.0%
90-94	4,824	24,012	4,037	119.5%	90-94	4,131	25,473	3,044	135.7%
95-99	1,423	5,071	1,247	114.1%	95-99	1,738	7,693	1,407	123.5%
100+	97	292	98	98.5%	100+	453	1,474	388	116.8%
Totals	23,017	616,927	21,830	105.4%	Totals	18,686	749,388	16,079	116.2%

* Results are benefits weighted



Appendix – Detailed Experience Analysis Post-Retirement Mortality*

2020-2021 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
55-59	80	9,951	55	144.9%	55-59	39	16,710	53	73.1%
60-64	513	63,964	504	101.8%	60-64	399	90,838	398	100.1%
65-69	1,642	160,500	1,820	90.2%	65-69	936	225,011	1,450	64.5%
70-74	3,070	163,343	2,887	106.4%	70-74	2,292	195,903	2,076	110.4%
75-79	3,322	93,454	2,855	116.4%	75-79	2,475	112,472	2,161	114.5%
80-84	3,547	65,366	3,715	95.5%	80-84	3,327	71,968	2,584	128.8%
85-89	6,681	48,590	4,945	135.1%	85-89	4,208	45,629	3,112	135.2%
90-94	5,222	23,796	3,968	131.6%	90-94	3,848	26,267	3,139	122.6%
95-99	1,834	5,864	1,427	128.5%	95-99	1,879	8,120	1,477	127.2%
100+	244	402	133	183.7%	100+	469	1,670	446	105.3%
Totals	26,155	635,229	22,308	117.2%	Totals	19,871	794,589	16,895	117.6%

2021-2022 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
55-59	44	9,245	51	86.3%	55-59	27	14,509	46	58.3%
60-64	513	62,103	488	104.9%	60-64	338	89,452	391	86.5%
65-69	1,473	160,155	1,816	81.1%	65-69	1,454	235,870	1,519	95.7%
70-74	3,051	173,558	3,068	99.4%	70-74	2,228	212,463	2,228	100.0%
75-79	3,436	104,564	3,160	108.8%	75-79	3,133	128,334	2,425	129.2%
80-84	4,021	64,777	3,639	110.5%	80-84	3,465	75,761	2,697	128.5%
85-89	6,083	47,928	4,824	126.1%	85-89	3,747	46,531	3,140	119.3%
90-94	5,287	22,712	3,732	141.7%	90-94	3,888	26,470	3,152	123.3%
95-99	2,371	6,559	1,576	150.5%	95-99	2,067	8,939	1,622	127.4%
100+	289	428	139	208.3%	100+	750	1,679	452	166.1%
Totals	26,569	652,029	22,493	118.1%	Totals	21,097	840,008	17,672	119.4%

* Results are benefits weighted



Appendix – Detailed Experience Analysis Disabled Mortality*

2018-2022 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
40-44	4	112	1	315.8%	40-44	-	394	5	0.0%
45-49	53	573	9	616.1%	45-49	42	1,267	18	230.1%
50-54	66	1,981	39	167.3%	50-54	118	2,838	50	238.2%
55-59	401	8,817	219	183.1%	55-59	335	9,396	198	169.0%
60-64	941	21,337	652	144.4%	60-64	780	19,005	457	170.7%
65-69	1,243	27,033	978	127.1%	65-69	662	21,223	597	110.9%
70-74	879	24,114	1,073	81.9%	70-74	573	17,793	683	83.9%
75-79	495	12,095	740	66.9%	75-79	728	12,092	707	102.9%
80-84	728	8,500	767	94.9%	80-84	490	6,371	600	81.7%
85-89	638	3,586	483	132.0%	85-89	514	3,625	495	103.7%
90-94	339	981	196	173.3%	90-94	225	1,432	278	81.1%
95-99	84	278	76	110.1%	95-99	40	340	93	43.1%
100+	-	-	-	N/A	100+	24	24	9	266.0%
Totals	5,871	109,407	5,235	112.2%	Totals	4,531	95,800	4,189	108.2%

* Results are benefits weighted

Appendix – Detailed Experience Analysis Disabled Mortality*

2018-2019 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
40-44	-	23	0	0.0%	40-44	-	110	1	0.0%
45-49	-	125	2	0.0%	45-49	29	336	5	596.5%
50-54	21	638	13	164.7%	50-54	59	806	14	412.5%
55-59	99	2,343	59	168.1%	55-59	88	2,625	56	157.2%
60-64	292	6,138	188	155.4%	60-64	139	4,762	114	121.7%
65-69	305	6,823	247	123.5%	65-69	159	5,193	146	108.8%
70-74	164	5,554	246	66.6%	70-74	102	4,435	174	58.8%
75-79	81	2,828	179	45.3%	75-79	104	2,454	145	71.6%
80-84	192	1,876	171	112.2%	80-84	97	1,613	153	63.6%
85-89	71	840	114	62.2%	85-89	35	855	117	29.9%
90-94	74	238	49	149.5%	90-94	62	353	70	88.6%
95-99	-	83	21	0.0%	95-99	-	43	12	0.0%
100+	-	-	-	N/A	100+	16	16	6	258.1%
Totals	1,299	27,509	1,289	100.7%	Totals	890	23,601	1,013	87.8%

2019-2020 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
40-44	-	15	0	0.0%	40-44	-	87	1	0.0%
45-49	-	144	2	0.0%	45-49	13	318	5	286.0%
50-54	-	525	10	0.0%	50-54	9	772	14	66.4%
55-59	105	2,283	56	185.9%	55-59	125	2,405	51	245.1%
60-64	143	5,476	167	85.5%	60-64	210	4,985	120	175.1%
65-69	276	6,896	249	110.9%	65-69	103	5,392	152	67.6%
70-74	262	6,062	269	97.4%	70-74	147	4,198	163	90.3%
75-79	102	2,820	173	59.0%	75-79	195	2,947	172	113.7%
80-84	141	2,196	197	71.4%	80-84	191	1,601	152	125.8%
85-89	222	901	123	180.0%	85-89	188	979	134	139.9%
90-94	114	277	54	209.3%	90-94	76	351	69	109.8%
95-99	84	121	33	254.9%	95-99	2	67	19	10.6%
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	1,449	27,716	1,335	108.5%	Totals	1,259	24,102	1,051	119.8%

* Results are benefits weighted



Appendix – Detailed Experience Analysis Disabled Mortality*

2020-2021 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
40-44	-	35	0	0.0%	40-44	-	97	1	0.0%
45-49	36	172	3	1366.2%	45-49	-	336	5	0.0%
50-54	45	440	9	512.0%	50-54	33	669	12	283.6%
55-59	89	2,185	54	164.5%	55-59	80	2,281	48	167.3%
60-64	170	5,043	154	110.4%	60-64	271	4,721	114	238.4%
65-69	331	6,835	248	133.5%	65-69	140	5,402	152	92.2%
70-74	238	6,076	271	87.8%	70-74	128	4,350	165	77.7%
75-79	220	3,119	188	116.7%	75-79	240	3,441	201	119.4%
80-84	258	2,200	196	131.5%	80-84	120	1,490	142	84.5%
85-89	181	987	134	135.3%	85-89	192	920	126	152.2%
90-94	70	198	39	177.7%	90-94	60	337	64	93.2%
95-99	-	37	11	0.0%	95-99	38	123	33	114.2%
100+	-	-	-	N/A	100+	8	8	3	283.6%
Totals	1,638	27,327	1,308	125.3%	Totals	1,310	24,175	1,065	123.0%

2021-2022 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
40-44	4	39	0	850.7%	40-44	-	100	1	0.0%
45-49	17	132	2	826.6%	45-49	-	277	4	0.0%
50-54	-	378	8	0.0%	50-54	17	591	10	169.3%
55-59	108	2,006	50	217.9%	55-59	42	2,085	43	96.8%
60-64	336	4,680	143	235.3%	60-64	160	4,537	109	146.8%
65-69	331	6,479	235	141.0%	65-69	260	5,236	146	177.6%
70-74	215	6,422	287	74.9%	70-74	196	4,810	182	107.6%
75-79	92	3,328	200	46.0%	75-79	189	3,250	190	99.7%
80-84	137	2,228	203	67.6%	80-84	82	1,667	154	53.4%
85-89	164	858	112	146.3%	85-89	99	871	118	84.1%
90-94	81	268	52	155.0%	90-94	27	391	74	36.5%
95-99	-	37	11	0.0%	95-99	-	107	29	0.0%
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	1,485	26,855	1,303	114.0%	Totals	1,072	23,922	1,060	101.2%

* Results are benefits weighted



Appendix – Detailed Experience Analysis Pre-Retirement Mortality*

2018-2022 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
Under 20	-	1,858	1	0.0%	Under 20	5	3,483	0	1069.6%
20-24	65	97,512	36	182.9%	20-24	107	138,684	16	683.5%
25-29	270	442,488	190	142.2%	25-29	61	654,119	93	65.5%
30-34	367	911,450	559	65.7%	30-34	222	1,287,244	311	71.3%
35-39	954	1,445,383	1,160	82.3%	35-39	731	1,990,582	694	105.3%
40-44	1,396	1,899,898	1,855	75.3%	40-44	892	2,615,093	1,185	75.3%
45-49	2,044	2,327,380	2,905	70.4%	45-49	2,221	3,401,410	2,089	106.3%
50-54	6,300	3,302,827	5,912	106.6%	50-54	6,073	5,242,197	4,875	124.6%
55-59	9,749	4,910,094	13,656	71.4%	55-59	8,446	7,667,180	11,422	73.9%
60-64	20,969	4,871,903	19,862	105.6%	60-64	15,134	7,439,372	16,372	92.4%
Totals	42,114	20,210,793	46,136	91.3%	Totals	33,892	30,439,364	37,058	91.5%

* Results are liability weighted



Appendix – Detailed Experience Analysis Pre-Retirement Mortality*

2018-2019 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
Under 20	-	331	0	0.0%	Under 20	-	545	0	0.0%
20-24	1	21,875	8	12.8%	20-24	21	31,102	3	611.6%
25-29	5	101,670	42	11.8%	25-29	28	157,243	22	128.4%
30-34	14	213,565	125	11.2%	30-34	17	301,529	70	24.2%
35-39	206	332,517	253	81.4%	35-39	28	450,721	151	18.5%
40-44	550	418,756	392	140.4%	40-44	118	588,514	262	45.1%
45-49	192	560,118	693	27.7%	45-49	704	837,054	519	135.5%
50-54	715	799,327	1,447	49.4%	50-54	2,116	1,299,379	1,231	171.9%
55-59	1,786	1,286,898	3,598	49.6%	55-59	1,705	1,973,894	2,953	57.7%
60-64	5,915	1,176,129	4,788	123.5%	60-64	3,517	1,807,372	3,965	88.7%
Totals	9,384	4,911,186	11,346	82.7%	Totals	8,254	7,447,353	9,177	89.9%

2019-2020 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
Under 20	-	520	0	0.0%	Under 20	-	1,077	0	0.0%
20-24	35	24,518	9	393.1%	20-24	15	33,623	4	397.4%
25-29	-	112,210	48	0.0%	25-29	19	165,439	23	81.1%
30-34	146	228,821	139	105.2%	30-34	136	317,738	76	178.8%
35-39	252	359,108	284	88.7%	35-39	172	487,627	168	102.4%
40-44	153	457,590	441	34.7%	40-44	177	631,307	284	62.3%
45-49	207	576,388	717	28.9%	45-49	1,007	848,395	523	192.5%
50-54	2,016	823,507	1,477	136.5%	50-54	1,623	1,306,038	1,221	133.0%
55-59	1,993	1,271,720	3,554	56.1%	55-59	2,288	1,958,358	2,931	78.1%
60-64	4,093	1,201,516	4,908	83.4%	60-64	3,466	1,842,609	4,062	85.3%
Totals	8,895	5,055,898	11,577	76.8%	Totals	8,903	7,592,211	9,292	95.8%

* Results are liability weighted



Appendix – Detailed Experience Analysis Pre-Retirement Mortality*

2020-2021 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
Under 20	-	449	0	0.0%	Under 20	5	960	0	3847.2%
20-24	29	26,265	10	301.0%	20-24	56	36,632	4	1347.1%
25-29	166	116,227	50	329.1%	25-29	14	168,325	24	57.8%
30-34	108	234,673	146	73.9%	30-34	28	332,868	82	34.3%
35-39	231	376,088	307	75.3%	35-39	358	518,775	183	195.7%
40-44	314	498,890	493	63.7%	40-44	480	673,424	306	156.6%
45-49	777	584,684	731	106.2%	45-49	191	852,270	521	36.6%
50-54	1,552	835,579	1,487	104.4%	50-54	850	1,319,992	1,219	69.8%
55-59	3,737	1,208,593	3,353	111.4%	55-59	2,885	1,912,952	2,850	101.2%
60-64	6,016	1,258,510	5,136	117.1%	60-64	4,976	1,902,102	4,200	118.5%
Totals	12,930	5,139,958	11,714	110.4%	Totals	9,843	7,718,300	9,389	104.8%

2021-2022 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
Under 20	-	558	0	0.0%	Under 20	-	901	0	0.0%
20-24	-	24,854	9	0.0%	20-24	15	37,327	4	349.8%
25-29	99	112,381	49	201.1%	25-29	-	163,112	24	0.0%
30-34	99	234,391	149	66.5%	30-34	41	335,109	83	49.1%
35-39	265	377,670	316	84.0%	35-39	173	533,459	192	90.1%
40-44	379	524,662	530	71.5%	40-44	117	721,848	332	35.2%
45-49	868	606,190	764	113.7%	45-49	319	863,691	525	60.7%
50-54	2,017	844,414	1,501	134.4%	50-54	1,484	1,316,788	1,204	123.2%
55-59	2,233	1,142,883	3,151	70.9%	55-59	1,568	1,821,976	2,689	58.3%
60-64	4,945	1,235,748	5,031	98.3%	60-64	3,175	1,887,289	4,146	76.6%
Totals	10,905	5,103,751	11,499	94.8%	Totals	6,892	7,681,500	9,200	74.9%

* Results are liability weighted

