

Vermont State Teachers' Retirement System

Actuarial Experience Review

July 1, 2019, through June 30, 2022

September 2023 / Matt Strom / Kathy Riley / Patryk Tabernacki / Austin Miller

Actuarial Certification

We are pleased to submit this report on the actuarial experience of the Vermont State Teachers' Retirement System for the three-year period ending June 30, 2022. This investigation is the basis for our recommendation of the assumptions and methods to be used for the June 30, 2023, actuarial valuation.

All current actuarial assumptions and methods were reviewed as part of this study. Some of our recommendations reflect changes to the assumptions and methods used in the June 30, 2022, actuarial valuation while other current assumptions and methods remain appropriate.

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

The undersigned actuary is experienced with performing experience studies for large public-sector pension plans and is qualified to render the opinions contained in this report. To the best of my knowledge, the information supplied in this experience study is complete and accurate. Further, in my opinion, the recommended assumptions are reasonably related to the experience of and the expectations for the System.



Matthew A. Strom, FSA, MAAA, EA
Senior Vice President and Actuary

September 18, 2023

Date

Agenda

Overview and Executive Summary

Analysis:

- Economic Assumptions
- Demographic Assumptions

Summary of Recommended Assumptions

Cost Impact

Appendix

Overview: Purpose of an Experience Study

An experience study provides the basis for developing recommended assumptions to be used in the annual actuarial valuation

- Performed on a periodic basis, typically every three-to-five years
- Last VSTRS experience study reviewed demographic and economic assumptions over the **five-year** period ending June 30, 2019
- Current study is based on the **three-year¹** period from July 1, 2019, through June 30, 2022

Segal's role is to make appropriate recommendations to the Board for each assumption

- The assumptions are the Board's assumptions, and the Board can adopt all, none, or some of the recommendations of the actuary
- Segal's recommendations will follow the guidance of the applicable Actuarial Standards of Practice. Assumptions should be reasonable individually and in the aggregate (ASOP No. 27 and 35).
- The Vermont Pension Investment Commission (VPIC) has authority over setting the inflation and investment return assumptions. The inflation and investment return assumptions were recommended by VPIC's actuary, GRS, and were adopted by VPIC during their meeting on July 25, 2023.

¹ To increase the credibility of the data set, five years of historical data (July 1, 2017, through June 30, 2022) were studied for pre- and post-retirement mortality.

Overview: How Assumptions Are Set

Review past experience (“actual”) and compare with assumptions (“expected”)

Determine trends – make judgments about the future

Develop component parts of each assumption

- Maintain internal consistency

Keep in mind:

- No “right” answer
- Assumptions are long-term in nature
- Assumptions do not directly affect the payment of benefits, only the timing of contributions

Overview: Actuarial Assumptions

Economic

- Inflation¹
- Investment return¹
- Salary increase²
- Payroll growth²
- COLA²
- Administrative expense

Demographic

- Death after retirement
- Death in active service
- Retirement
- Termination before retirement
- Disability incidence
- Other miscellaneous

Actuaries make assumptions as to when and why a member will leave active service and estimate the amount, duration and present value of the pension benefits paid.

¹ The inflation and investment return assumptions were recommended by VPIC's actuary, GRS, and adopted by VPIC during their July 25, 2023, meeting.

² The salary increase, payroll growth, and COLA assumptions reflect the inflation assumption referenced above.

Executive Summary

Five-Year History of Gain/(Loss)

\$ in thousands	2018	2019	2020	2021	2022
Investments	-\$8,437	-\$11,593	-\$21,307	\$57,786	-\$29,490
Admin expenses	N/A	N/A	N/A	N/A	\$144
Demographics					
• Turnover	-\$29,368	-\$21,031	-\$21,771	-\$10,519	-\$8,154
• Retirement	-15,053	-20,019	-24,972	-16,872	-13,883
• Mortality	748	-2,744	-3,335	1,761	5,596
• Disability retirement	-36	-128	-54	-561	45
• Salary/service	10,511	10,407	10,408	9,493	7,257
• COLA experience	-1,387	7,683	8,838	-22,594	-28,712
• Miscellaneous	-8,326	-11,508	-6,226	-6,408	-11,032
• Subtotal	-\$42,912	-\$37,340	-\$37,112	-\$45,699	-\$48,883
Total	-\$51,349	-\$48,933	-\$58,419	\$12,087	-\$78,229

Based on changes adopted from prior experience study

Lower assumed rates of turnover resulted in significantly smaller losses

- Recommend additional decreases to turnover rates

Similarly, modifications to rates of retirement resulted in smaller losses

- Recommend appropriate changes to retirement rates

Modified rates of assumed individual salary raises reduced the level of gains

- Recommend additional decreases to assumed salary raises

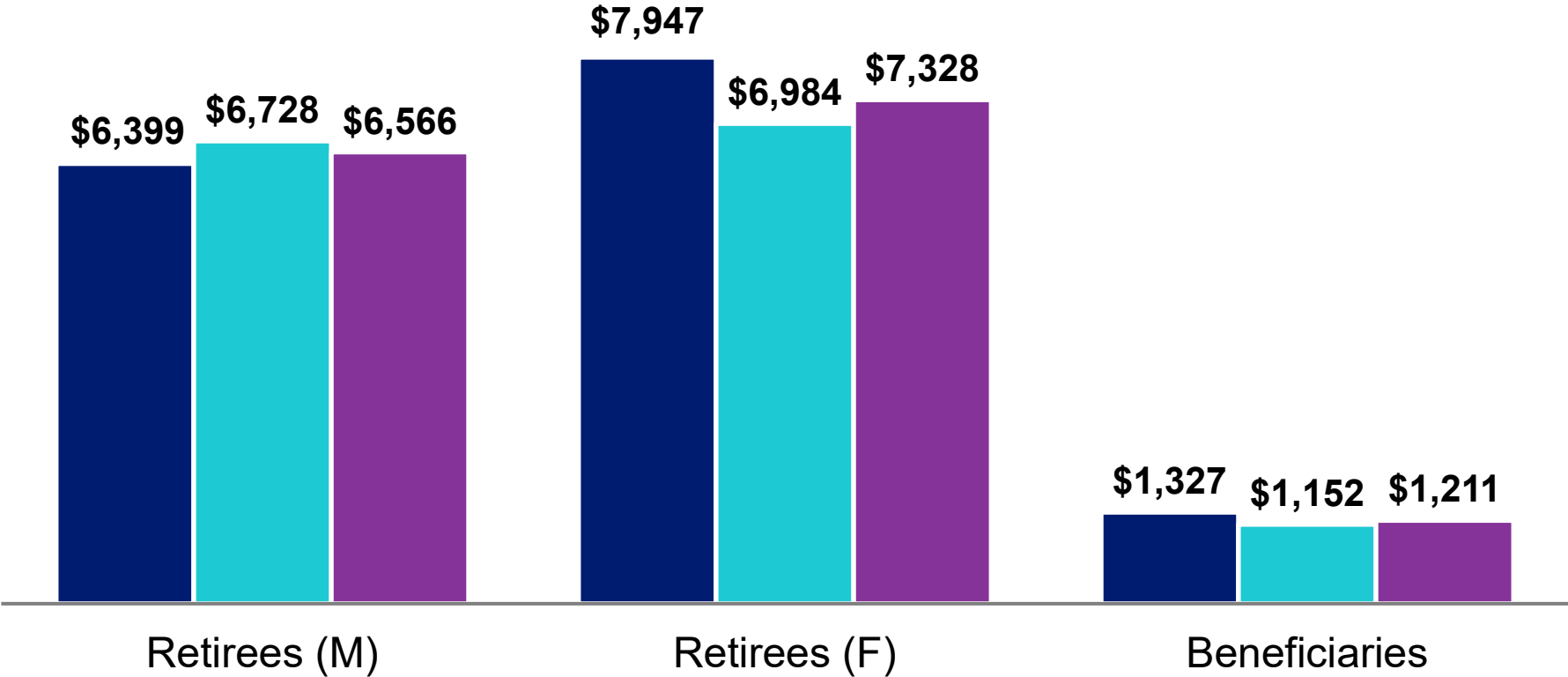
Due to rounding, values shown here may not sum as expected

Executive Summary (continued)

Five-year history of benefits released due to post-retirement mortality (\$ in thousands)

Post-retirement Mortality

■ Expected ■ Actual¹ ■ Proposed



Actual amounts have been adjusted¹ to approximate the level of mortality expected in the absence of the pandemic

- \$6.73M actual benefits released a bit higher compared to \$6.40M expected for male retirees
- \$6.98M and \$1.15M actual benefits released were lower than the \$7.95M and \$1.33M expected for female retirees and all beneficiaries, respectively

Proposed tables based on Pub-2010 Teacher and Contingent Survivor mortality rates, adjusted for “credible” actual experience²; updated mortality improvement scale

- Net impact is a slight increase in liabilities and contributions

¹ Adjusted based on data from the CDC related to observed “excess mortality” (all causes) relative to expected

² If/where applicable

Executive Summary *(continued)*

VPIC elected to maintain the current investment return assumption of 7.00% per year

- Segal has independently reviewed this assumption and believes 7.00% continues to be reasonable

VPIC elected to maintain the current inflation assumption of 2.30% per year

- Segal has independently reviewed this assumption and believes 2.30% continues to be reasonable

Expected COLAs are primarily driven by assumed inflation, subject to applicable provisions

- While the inflation assumption is not changing, we recommend slight decreases to the various COLA assumptions based on changes to plan provisions and methodology used to develop these assumptions, which results in a decrease in liabilities and required contributions:
 - Group A – decrease from 2.40% to 2.30%
 - Group C first eligible for normal retirement on or after July 1, 2022 – decrease from 1.20% to 1.10%
 - All other Group B/C – decrease from 1.35% to 1.15%

Administrative expenses are assumed to equal 0.40% of projected payroll

- Current assumption has tracked closely; however, increases to staff warrant a slight increase in this assumption from 0.40% to 0.45%

Executive Summary *(continued)*

Estimated cost impact of recommended assumption changes
Based on the June 30, 2022, actuarial valuation
(\$ in millions)

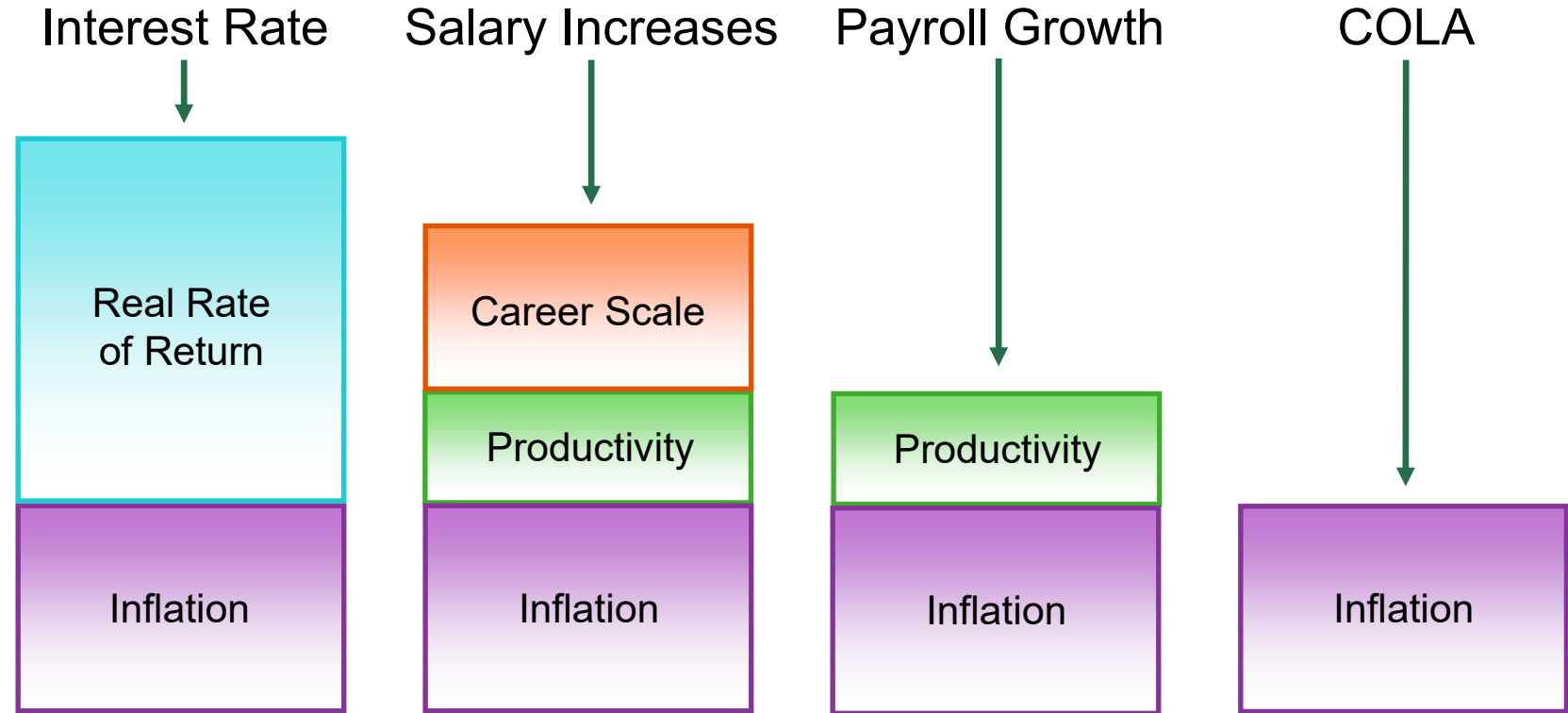
	Before Changes (Baseline)	Reflecting COLA	Reflecting COLA and Mortality	Reflecting COLA, Mortality, and All Other Assumptions
Present Value of Future Benefits	\$5,133.2	\$5,069.7	\$5,091.6	\$5,134.8
% Change		-1.2%	0.4%	0.8%
Cumulative		-1.2%	-0.8%	0.0%
Actuarial Accrued Liability	\$4,289.8	\$4,233.2	\$4,252.8	\$4,245.2
% Change		-1.3%	0.5%	-0.2%
Cumulative		-1.3%	-0.9%	-1.0%
Total Normal Cost¹	\$79.7	\$79.1	\$79.3	\$80.3
% Change		-0.8%	0.3%	1.3%
Cumulative		-0.8%	-0.5%	0.8%
Funded Percentage	57.3%	58.0%	57.8%	57.9%
Delta		0.7%	-0.2%	0.1%
Cumulative		0.7%	0.5%	0.6%
Actuarially Determined Contribution for FY24	\$194.3	\$188.2	\$190.3	\$191.1
% Change		-3.1%	1.1%	0.4%
Cumulative		-3.1%	-2.1%	-1.6%

Due to rounding, values shown here may not sum as expected

¹ Total normal cost as of July 1, 2022, adjusted for timing

Basis for Setting Economic Assumptions

Most economic assumptions have 2 or 3 components



Each component should be consistent across all economic assumptions, but may include a provision for adverse deviation.

Assumed Rate of Inflation

Inflation represents the annual increase in the cost of living and reflects long-term expectations

The current inflation assumption is 2.30%

- Inflation is a component of the following economic assumptions:
 - Investment return
 - Individual salary increases
 - Payroll growth
 - Cost-of-living-adjustments

VPIC's actuary, GRS, recommended maintaining the current inflation assumption of 2.30% and this recommendation was adopted by VPIC during their meeting on July 25, 2023.

Assumed Rate of Inflation

Our analysis of inflation is based on a review of historical inflation as well as expectations of the future

Historical national inflation (CPI-U) averages are:

As of	1-year	5-year	10-year	20-year	30-year	50-year
06/30/2023	2.97%	3.90%	2.71%	2.57%	2.52%	3.94%
06/30/2022	9.06%	3.88%	2.59%	2.53%	2.53%	4.00%

- Indicators for expectations of future inflation:
 - The Philadelphia Federal Reserve Bank Survey of Professional Forecasters 10-year outlook is 2.36% as of Q2 2023 (down from 2.80% as of Q2 2022)
 - The median 20-year inflation assumption from the 2023 Horizon Survey of Capital Market Expectations is 2.46% (nearly unchanged from 2.44% from the 2022 Horizon Survey)
 - Spread between yields on 20-year and 30-year US Treasury bonds with and without inflation indexing is 2.50% and 2.23% as of June 30, 2023, respectively
 - 2022 OASDI Trustees Report's intermediate inflation assumption is 2.40% (unchanged from 2020 report)

We believe continued use of an inflation assumption of 2.30% is reasonable

Assumed Rate of Investment Return

The investment return is a principal assumption used in any actuarial valuation and is used to discount future expected benefit payments to the valuation date in order to determine the liabilities of the plan

The current investment return assumption of 7.00% consists of three components:

- Inflation¹: 2.30%
- Real rate of return: 4.95%
- Adjustment for conservatism: (0.25%)

VPIC's actuary, GRS, recommended maintaining the current investment return assumption of 7.00% and this recommendation was adopted by VPIC during their meeting on July 25, 2023.

¹ The inflation assumption of 2.30% was adopted by VPIC during their meeting on July 25, 2023.

Assumed Rate of Investment Return

Our analysis is based on Segal Marco Advisors 2023 capital market assumptions and VPIC's current target asset allocation

Asset Classes	SMA 20-Year Horizon Arithmetic Real Return ¹	Target Allocation	Weighted Real Return	Component	Current Rate (7.00%)
Domestic Equity	6.91%	22.78%	1.57%	Inflation	2.30%
International Equity	7.21%	14.93%	1.08%	Geometric Real Rate of Return	<u>5.08%</u>
Emerging Equity	8.71%	6.29%	0.55%	Total Expected Rate of Return	7.38%
Core Fixed Income	1.61%	19.00%	0.31%	Adjustment ²	<u>(0.38%)</u>
Emerging Debt	6.71%	2.00%	0.07%	Total	7.00%
Real Estate	3.61%	8.00%	0.29%	Confidence Level	56%
Commodities	5.71%	5.00%	0.29%		
Short Term	0.71%	2.00%	0.01%		
Private Credit	6.31%	10.00%	0.63%		
Private Equity	9.96%	<u>10.00%</u>	<u>1.00%</u>		
Total		100.00%	5.79%		
Adjustment to Geometric			(0.71%)		
Geometric Real Rate of Return¹			5.08%		

We believe continued use of an investment return assumption of 7.00% is reasonable

¹ Reflecting assumed inflation of 2.30%

² Adjusting the real rate of return for adverse deviation increases the likelihood of meeting the expectation over a 20-year period. For example, the 38 basis point reduction increases the likelihood of meeting the expectation from 50% to 56%.

Assumed Rates of Individual Salary Increase

In order to project future benefits, salaries are projected forward over the expected career for each active member

Individual member salary increase components:

- Inflation
- Productivity
- Merit and seniority increases

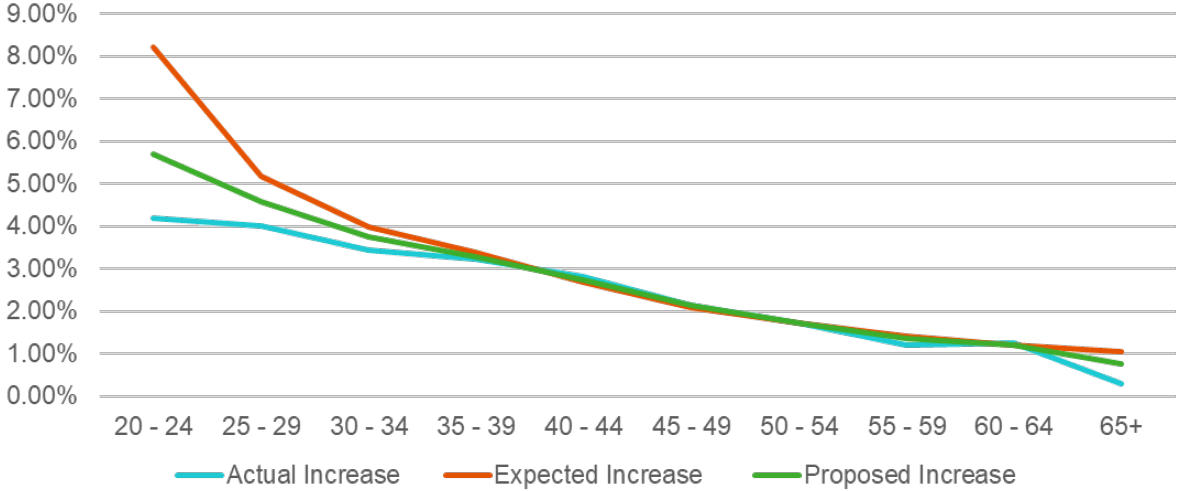
Since merit and seniority increases are unique to each retirement system, it is appropriate to base this assumption on recent experience

- We study the merit and seniority increases (plus productivity) separately from inflation
- Between 2018 and 2020 inflation averaged 1.72%, which does not include inflation of 5.39% in 2021
 - This assumes that the effects of 2021 inflation are not yet reflected in the historical salary data over the study period

Assumed Rates of Salary Increase *(continued)*

The following table compares the actual and expected individual salary increases over the past 3 years. This table is adjusted to remove actual annual inflation of about 1.72% over the experience period; however, this analysis excludes participants with less than 1 year of service:

Age	Expected Increase	Actual Increase	Proposed Increase
20 – 24	8.20%	4.19%	5.69%
25 – 29	5.17%	4.02%	4.59%
30 – 34	3.99%	3.43%	3.75%
35 – 39	3.39%	3.22%	3.27%
40 – 44	2.68%	2.82%	2.73%
45 – 49	2.10%	2.14%	2.14%
50 – 54	1.72%	1.73%	1.73%
55 – 59	1.40%	1.21%	1.35%
60 – 64	1.21%	1.27%	1.21%
65+	1.04%	0.29%	0.75%
Total	2.50%	2.34%	2.42%



Including the inflation assumption of 2.30%, the total proposed salary increase assumption will average 4.72% per year (a net decrease from the current average expected rate of 4.80%)

Based on this experience, we recommend slight **decreases** to the non-inflationary portion of individual salary increases for most ages. Productivity is included above for purposes of the salary scale analysis.

Assumed Rate of Payroll Growth

The payroll growth assumption is used to project covered payroll to estimate the employer normal cost for the two fiscal years following the valuation year for budgeting purposes

A higher payroll growth assumption is more conservative

- A higher assumption relative to actual experience results in an otherwise larger employer normal cost

The current payroll growth assumption of 3.00% consists of the following components:

Inflation	2.30%
Productivity	<u>0.70%</u>
Total payroll growth	3.00%

Assumed Rate of Payroll Growth (*continued*)

As the adopted inflation component is 2.30%, we need to examine the productivity component

**Productivity can be measured as the excess of the increase in the National Average Wage over inflation.
As of 2022:**

- The 20-year average of the National Average Wage is 3.1%
- The 20-year average inflation is 2.3%
- Therefore, productivity has averaged about 0.8% over the last 20 years

We have no reason to believe that continued use of the 0.70% productivity component is inappropriate going forward

Assumed Rate of Payroll Growth (*continued*)

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

Year Ended June 30	Annualized Payroll (\$ in Millions)	Active Members
2022	\$701.6	10,387
2017	607.4	10,028
2012	561.2	10,262
2007	515.6	10,675
2002	418.9	10,257
• 5-year average:	2.9%	0.7%
• 10-year average:	2.3%	0.1%
• 15-year average:	2.1%	-0.2%
• 20-year average:	2.6%	0.1%

Increases in total payroll have averaged roughly 2.5% per year since 2002, adjusting for headcount

Assumed Rate of Payroll Growth *(continued)*

The following table summarizes the components of the current and recommended payroll growth assumption:

Component	Current	Recommended
Inflation	2.30%	2.30%
Productivity	<u>0.70%</u>	<u>0.70%</u>
Total payroll growth	3.00%	3.00%

We recommend no change to the 3.00% payroll growth assumption

Assumed COLA Increases

Cost of Living Adjustments (COLAs) are generally linked to inflation

VSTRS contains the following COLA provisions:

- Active Group C members first eligible for normal retirement on or after July 1, 2022¹:
 - 50% of the lesser of (**CPI**, 4%). If **CPI** is less than 0%, then no increase²
- All other members:
 - Group A:
 - **CPI**, capped at 5%. If **CPI** is less than 0%, then no increase²
 - Groups B/C:
 - 50% of the lesser of (**CPI**, 5%). If **CPI** is less than 0%, then no increase²

¹ Effective for the June 30, 2022, actuarial valuation, this provision was updated to reflect Act 114 and Act 173, which decreased the “lesser of (CPI, 5%)” constraint to the “lesser of (CPI, 4%)”.

² Per statute, the COLA will be 0% in years that follow a year with negative CPI, subject to applicable offset of future increases.

Assumed COLA Increases (*continued*)

We studied expected future COLAs based on stochastic projections of the adopted 2.30% inflation assumption, subject to the parameters on the prior slide

As a result, we recommend the following COLA assumptions:

- Active Group C members first eligible for normal retirement on or after July 1, 2022:
 - 1.10% (currently 1.20%)
- All other members:
 - Group A:
 - 2.30% (currently 2.40%)
 - Groups B/C:
 - 1.15% (currently 1.35%)

Administrative Expenses

Current assumption:

- 0.40% of projected payroll is added to normal cost

Year Ended June 30	Administrative Expenses ¹	Projected Payroll ¹	Percentage
2022	\$2.715	\$689.9	0.394%
2021	2.782	677.3	0.411%
2020	2.815	654.0	0.430%
Total	\$8.313	\$2,021.2	0.411%

Due to rounding, values shown here may not sum as expected

Actual administrative expenses have emerged reasonably close to 0.40% of projected payroll

Additional staff expected to increase VSTRS-related expenses² by approximately \$325,000 per year

- Or roughly 0.048% of \$673,700,000 average projected payroll

Therefore, we recommend increasing this assumption from 0.40% to 0.45% of projected payroll

¹ Dollars in millions

² Allocated portion of expected total administrative expense increase of approximately \$750,000 per year

Overview: How Mortality Assumption Is Set

Review past experience

Compare past experience (“actual”) with assumptions (“expected”)

- Examine on a “benefit-weighted” basis as opposed to a “headcount-weighted” basis

Determine appropriate standardized table as basis for new assumption

Assess credibility of data set and calculate weighting factor

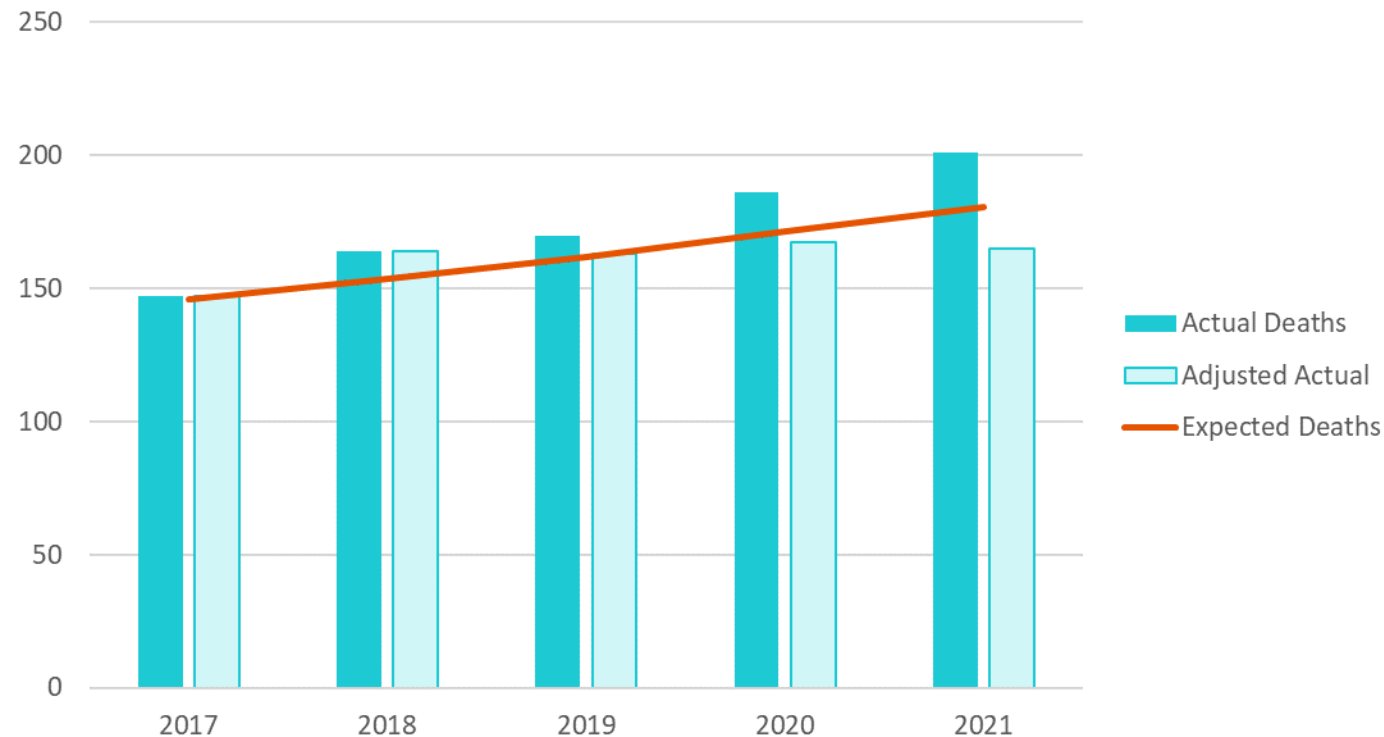
- Actual experience can be the assumption basis for fully-credible data
- Partially-credible data is blended with standardized table
- Typically, we assume 1,082 deaths needed in a subgroup to be considered fully-credible
 - 90% confident that results are within a range of 5% around the mean
- *Solely for mortality purposes, we included experience from July 1, 2017, through June 30, 2022 (five-year period) in order to increase the overall credibility of the data analyzed*

The mortality analysis was adjusted for COVID-19

- Adjustments of 96%, 90%, and 82% were applied to actual experience in 2020, 2021, and 2022, respectively, based on data from the CDC related to observed “excess mortality” (all causes) relative to expected
 - These adjustments approximate the level of mortality VSTRS would have experienced in 2020, 2021, and 2022 in the absence of the pandemic

Adjusting for Excess Mortality

Actual Retiree Deaths Relative to Expected¹, Headcount Basis – Total



Years where excess mortality likely exist – primarily the Plan Years beginning July 1, 2020, and July 1, 2021 in this case – can be adjusted² to approximate “pandemic-less” data

- A 96% adjustment factor is applied to experience beginning July 1, 2019 to capture the partial year impact
- “Full-year” adjustment factors of 90% and 82% are applied to experience years beginning July 1, 2020, and 2021, respectively

Then “adjusted actual” experience can be used to develop recommended adjustments to the base table under the premise that a pandemic-like event will not persist

¹ Expected deaths for all years is estimated based on the current mortality table

² Adjustment factors based on data from the CDC related to observed “excess mortality” (all causes) relative to expected

Death After Retirement

Our analysis uses a benefit-weighted approach, which weights the probability of death with each annuitant's pension benefit

- This methodology takes into consideration any correlation between the health of the annuitant and the size of the benefit

In 2019, the Society of Actuaries published a series of Pub-2010 mortality tables derived from public plan experience

- Three broad classifications based on teachers, public safety, and general employees
- Three separate versions of each of the table classifications: Baseline, Above Median, and Below Median
- Contingent annuitant mortality studied separately from retiree mortality
 - Contingent annuitant mortality is generally worse than retiree mortality
- Separate mortality tables for “healthy” annuitants and those members retiring with a disability pension

In order to determine which Pub-2010 table(s) should be applied, we separate the data by group, status and gender and recommended the Pub-2010 table variation that most accurately fits the data

Death After Retirement (*continued*)

The current assumptions are the following:

- Healthy Post-Retirement – Retirees: PubT-2010 Teacher Healthy Retiree Amount-Weighted Table
- Healthy Post-Retirement – Beneficiaries: 109% of the Pub-2010 Contingent Survivor Amount-Weighted Table
- Disabled Post-Retirement: PubNS-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table
- These mortality tables are applied to all groups
- All rates are projected generationally using the MP-2019 mortality improvement scale

Death After Retirement (*continued*)

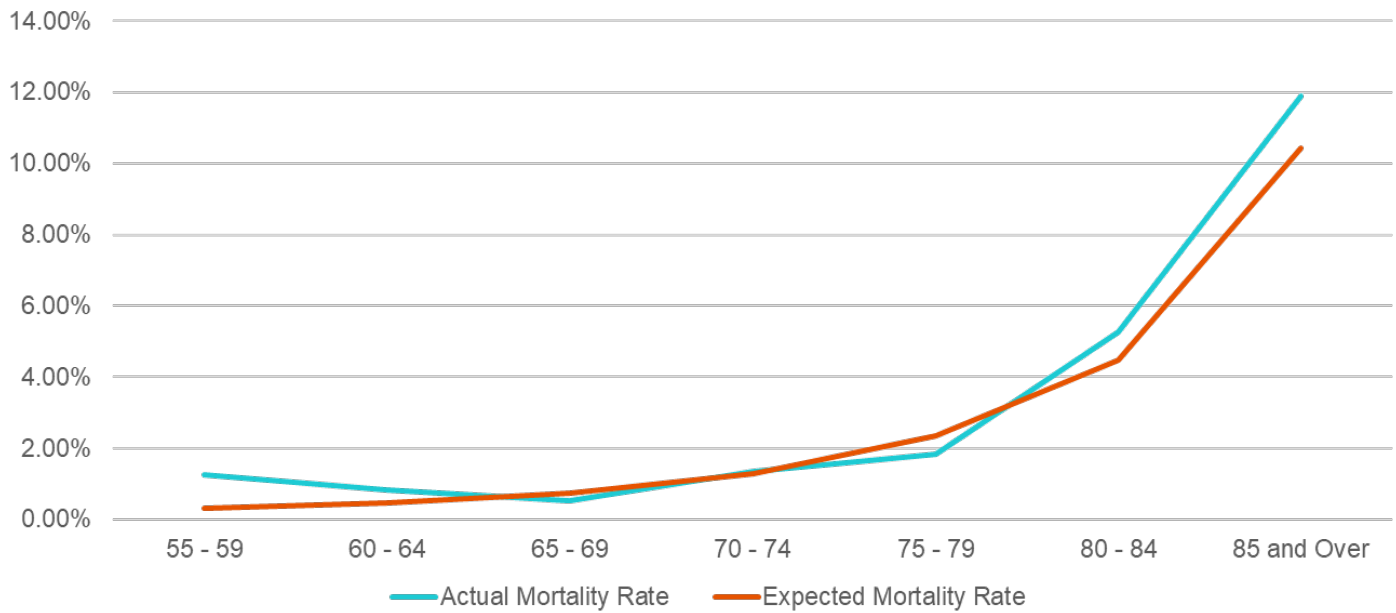
Over the five-year experience period, there were fewer actual retiree, beneficiary, and disabled deaths than expected

Recommend maintaining the current base tables, while applying adjustments based on experience where “credible” data exists. Specifically, we recommend the following:

- Healthy Post-Retirement – Retirees: PubT-2010 Teacher Healthy Retiree Amount-Weighted table for males and females with credibility adjustments of 103% and 93%, respectively, of the rates for all ages
- Healthy Post-Retirement – Beneficiaries: Pub-2010 Contingent Survivor Amount-Weighted Table with no credibility adjustments
- Disabled Post-Retirement: PubNS-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table with no credibility adjustments
- Update the mortality projection scale to MP-2021 to reflect future improvements in mortality for all groups

Healthy Post-Retirement – Retirees – Male

Actual Versus Expected Experience, Benefit-Weighted Basis – Male



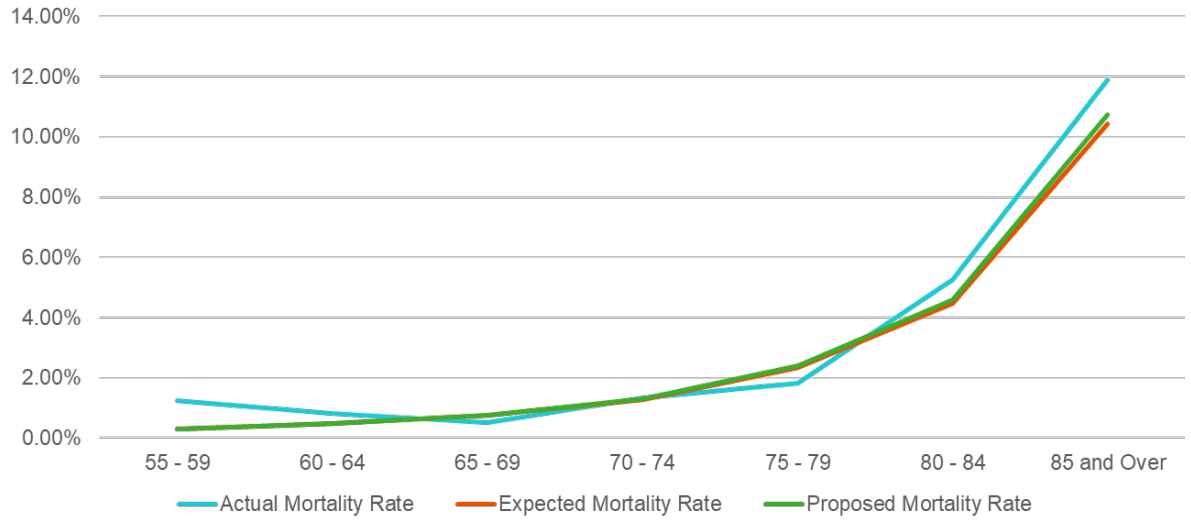
Basis	Exposures	Actual Deaths	Expected	Actual to Expected
Counts	14,385	357 ¹	326	109%
Benefits	\$328,381 ²	\$6,728 ²	\$6,399 ²	105%

¹ 357 actual (adjusted) deaths in the observation period yields partial credibility of 57%

² Based on annual benefits in thousands of dollars

Healthy Post-Retirement – Retirees – Male

Actual Versus Proposed Experience, Benefit-Weighted Basis – Male



On a benefit-weighted basis, unadjusted PubT-2010 Retiree Table (male) results in a reduction of \$6,374,000 in benefits due to the proposed assumption

- Credibility-weighted adjustment (57%) results in a reduction of \$6,566,000 in benefits

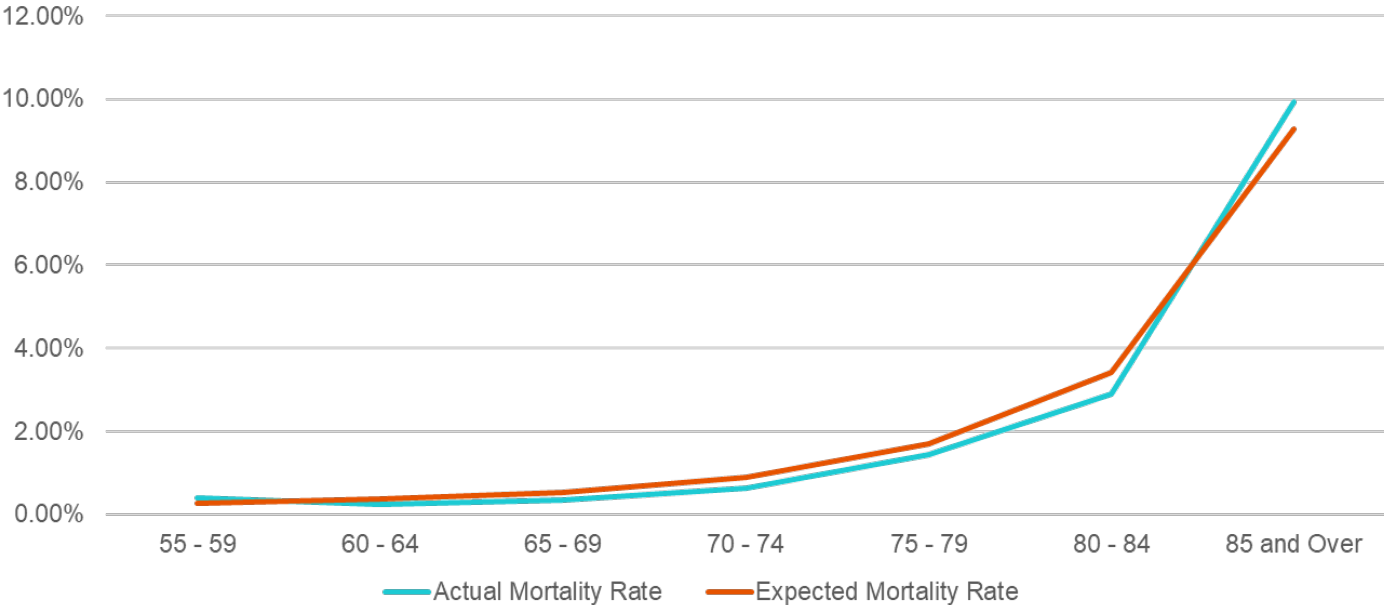
Recommend 103% of PubT-2010 Retiree Table (male), which results in \$6,566,000 proposed reduction

Basis	Exposures	Actual Deaths	Proposed Deaths	Actual to Proposed
Benefits	\$328,381 ¹	\$6,728 ¹	\$6,566 ¹	102%

¹ Based on annual benefits in thousands of dollars

Healthy Post-Retirement – Retirees – Female

Actual Versus Expected Experience, Benefit-Weighted Basis – Female



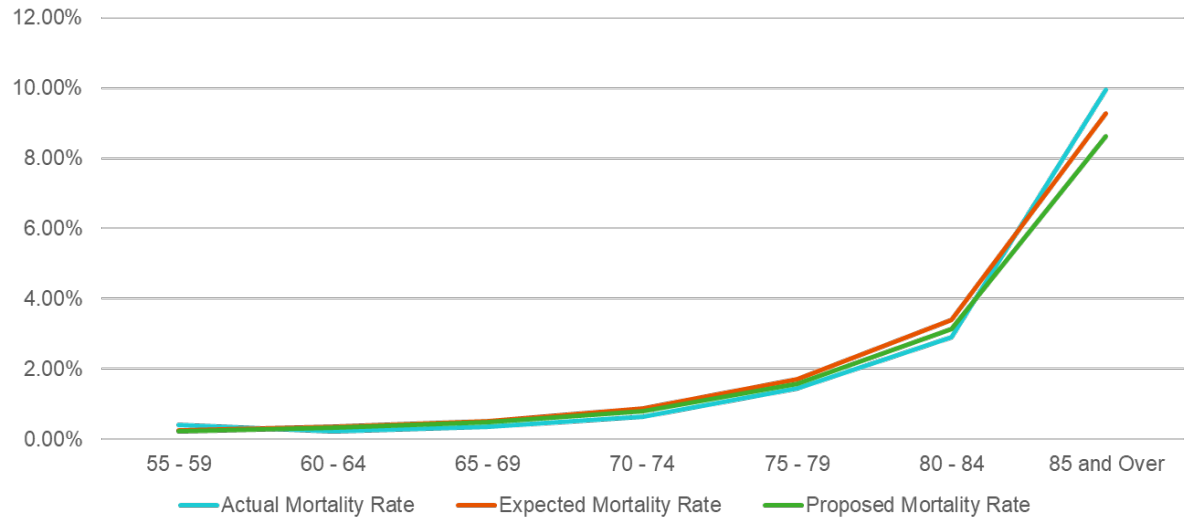
Basis	Exposures	Actual Deaths	Expected	Actual to Expected
Counts	30,107	450 ¹	487	92%
Benefits	\$625,589 ²	\$6,984 ²	\$7,947 ²	88%

¹ 450 actual (adjusted) deaths in the observation period yields partial credibility of 65%

² Based on annual benefits in thousands of dollars

Healthy Post-Retirement – Retirees – Female

Actual Versus Proposed Experience, Benefit-Weighted Basis – Female



On a benefit-weighted basis, unadjusted PubT-2010 Retiree Table (female) results in a reduction of \$7,879,000 in benefits due to the proposed assumption

- Credibility-weighted adjustment (65%) results in a reduction of \$7,328,000 in benefits

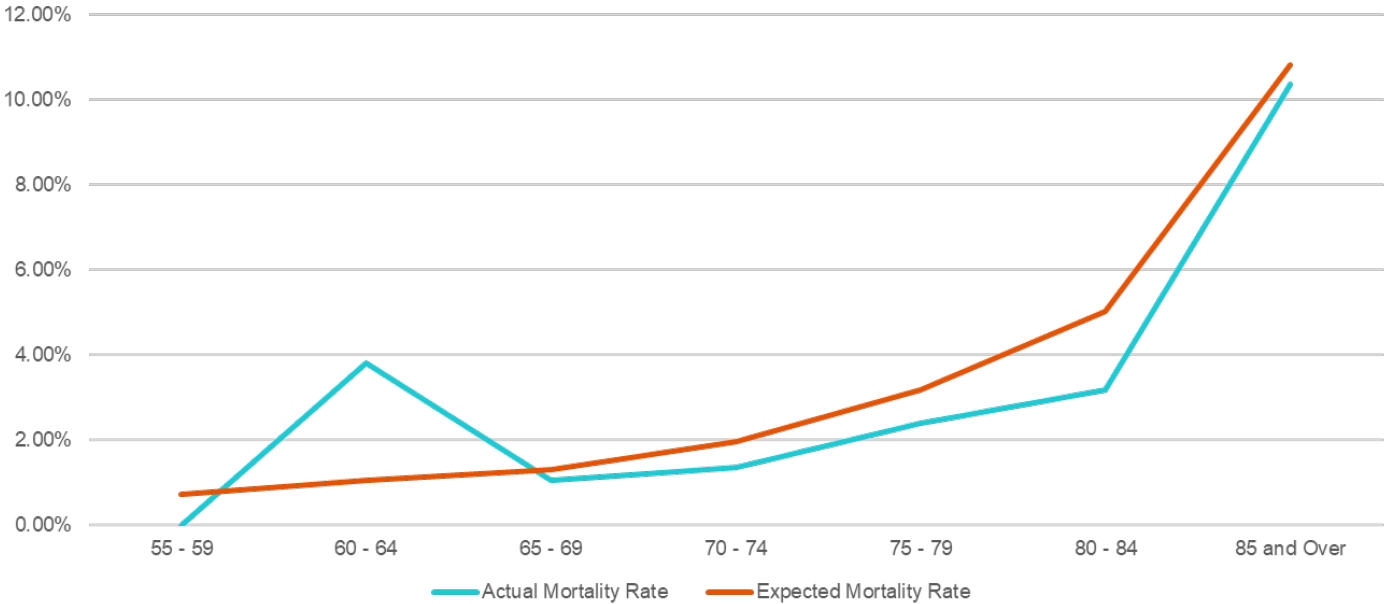
Recommend 93% of PubT-2010 Retiree Table (female), which results in \$7,328,000 proposed reduction

Basis	Exposures	Actual Deaths	Proposed Deaths	Actual to Proposed
Benefits	\$625,589 ¹	\$6,984 ¹	\$7,328 ¹	95%

¹ Based on annual benefits in thousands of dollars

Healthy Post-Retirement – Beneficiaries

Actual Versus Expected Experience, Benefit-Weighted Basis – Unisex



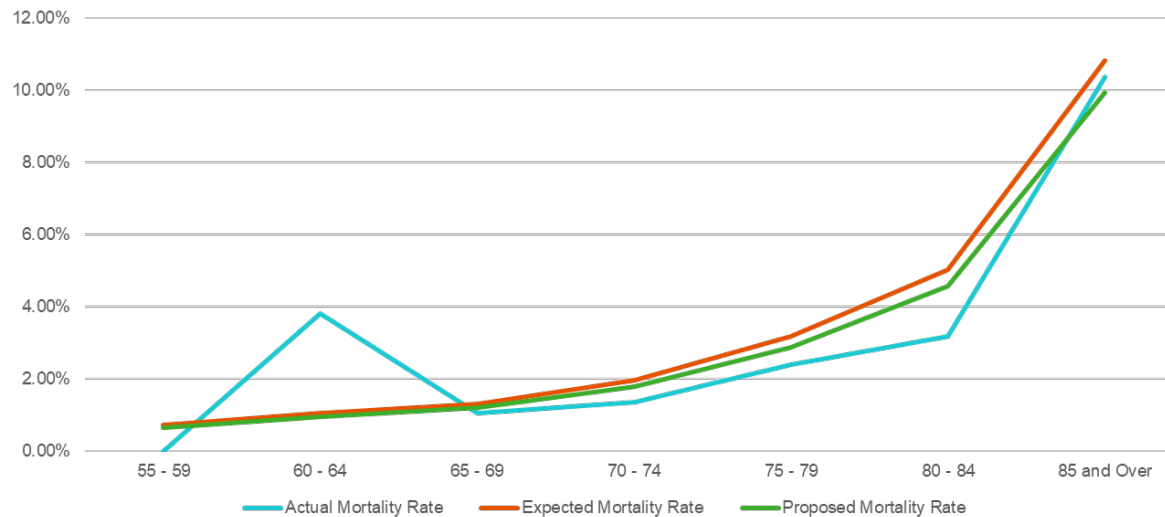
Basis	Exposures	Actual Deaths	Expected	Actual to Expected
Counts	2,313	107 ¹	109	98%
Benefits	\$32,966 ²	\$1,152 ²	\$1,327 ²	87%

¹ 107 actual (adjusted) deaths in the observation period yields partial credibility of 31%

² Based on annual benefits in thousands of dollars

Healthy Post-Retirement – Beneficiaries

Actual Versus Proposed Experience, Benefit-Weighted Basis – Unisex



On a benefit-weighted basis, unadjusted Pub-2010 Contingent Survivor Table results in a reduction of \$1,211,000 in benefits due to the proposed assumption

- 107 actual deaths in the observation period does not yield enough partial credibility to warrant further adjustment

Recommend unadjusted (due to limited experience) Pub-2010 Contingent Survivor Table, which results in \$1,211,000 proposed reduction

Basis	Exposures	Actual Deaths	Proposed Deaths	Actual to Proposed
Benefits	\$32,966 ¹	\$1,152 ¹	\$1,211 ¹	95%

¹ Based on annual benefits in thousands of dollars

Disabled Post-Retirement

The current mortality table for all disabled lives is the PubNS-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table.

Mortality experience for disabled annuitants has been less than the current assumption

- The ratio of actual to expected deaths on a benefit-weighted basis is 71%
- Based on 18 actual deaths over the five-year study period

We recommend:

- **Maintaining the current mortality table with no credibility adjustments (the limited actual experience is insufficient to warrant making an adjustment to the published table)**
- **Updating the mortality projection scale to MP-2021**

Gender	Exposures ¹	Actual Deaths ¹	Expected Deaths ¹	Actual to Expected	Proposed Deaths ¹	Actual to Proposed
Male	\$3,981	\$133	\$194	69%	\$193	69%
Female	\$10,316	\$218	\$300	73%	\$296	74%

¹ Based on annual benefits in thousands of dollars

Death While In Active Service

Mortality rates applied to active members

- Very few members die in active service
 - Liability associated with active death is a small percentage of the total liability
 - Plan experience is insufficient to set assumption

The current assumptions are based on the PubT-2010 Teacher Employee Amount-Weighted Table, unadjusted, for all groups. The rates are projected generationally using the MP-2019 scale.

We recommend:

- **Maintaining the current mortality table with no credibility adjustments (the limited actual experience is insufficient to warrant making an adjustment to the published table)**
- **Updating the mortality projection scale to MP-2021**

Active Retirements

Current rates:

- Separate, complex series of rates applicable to each group (Group A, Group C Grandfathered, and Group C Non-Grandfathered)
- Unisex rates that vary based on members' age and service amounts

Eligibility criteria for retirement differs by group, age, and service. We analyzed retirement experience on a benefit-weighted basis for the following groups:

- Group A – separate rates for members with and without 30 years of service
- Group C Grandfathered (GF) – members who were hired within five years of normal retirement eligibility as defined prior to July 1, 2010
- Group C Non-Grandfathered (NGF) – members who do not meet the criteria to be grandfathered:
 - Before satisfying rule of 90 (prior to age 65)
 - First year after meeting rule of 90 (prior to age 65)
 - More than 1 year after meeting rule of 90 (prior to age 65)
 - Age 65+

Active Retirements – Group A

All members:

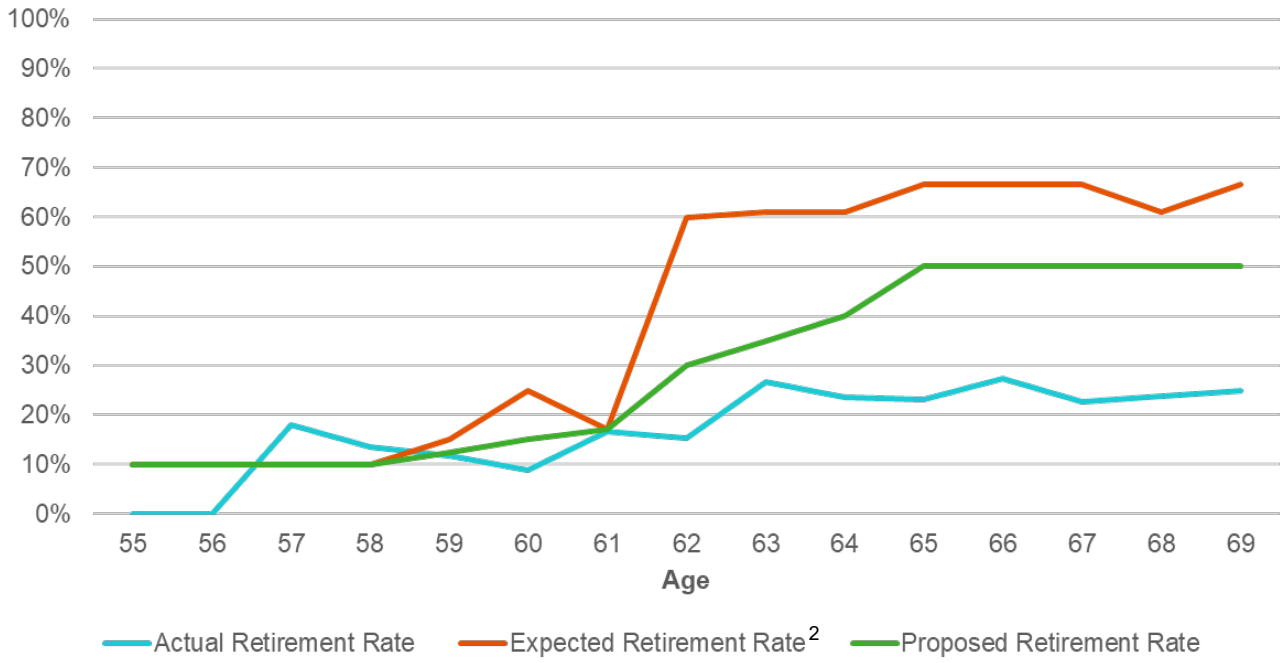
- There were no exposures during the three-year experience period

Recommend leaving all Group A retirement rates unchanged

Active Retirements – Group C – GF

All members:

- Overall, fewer retirements than expected
- Fewer retirements at most ages



Exposures ¹	Actual Retirements ¹	Expected Retirements ^{1,2}	Actual to Expected	Proposed Retirements ¹	Actual to Proposed
\$18,010	\$3,562	\$8,735	41%	\$6,211	57%

Recommend applying one set of active retirement rates for all Group C – GF members, decreasing rates at various ages, and delaying the 100% assumed retirement rate until age 70

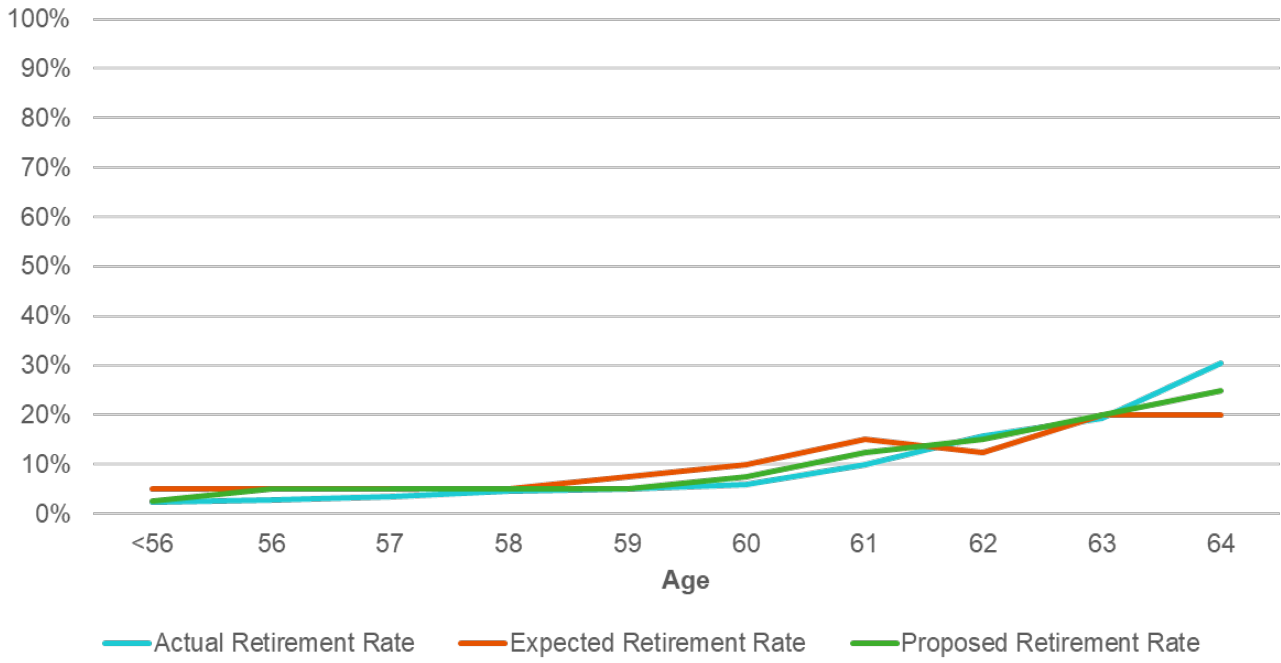
¹ Based on annual benefits in thousands of dollars

² Expected retirement rates illustrated for ages 62-69 represent a composite average of current rates based on with and without 30 years of service

Active Retirements – Group C – NGF

Before satisfying rule of 90 (prior to age 65):

- Overall, fewer retirements than expected
- Pattern of retirement generally consistent with current assumption



Exposures ¹	Actual Retirements ¹	Expected Retirements ¹	Actual to Expected	Proposed Retirements ¹	Actual to Proposed
\$105,503	\$7,285	\$8,856	82%	\$8,065	90%

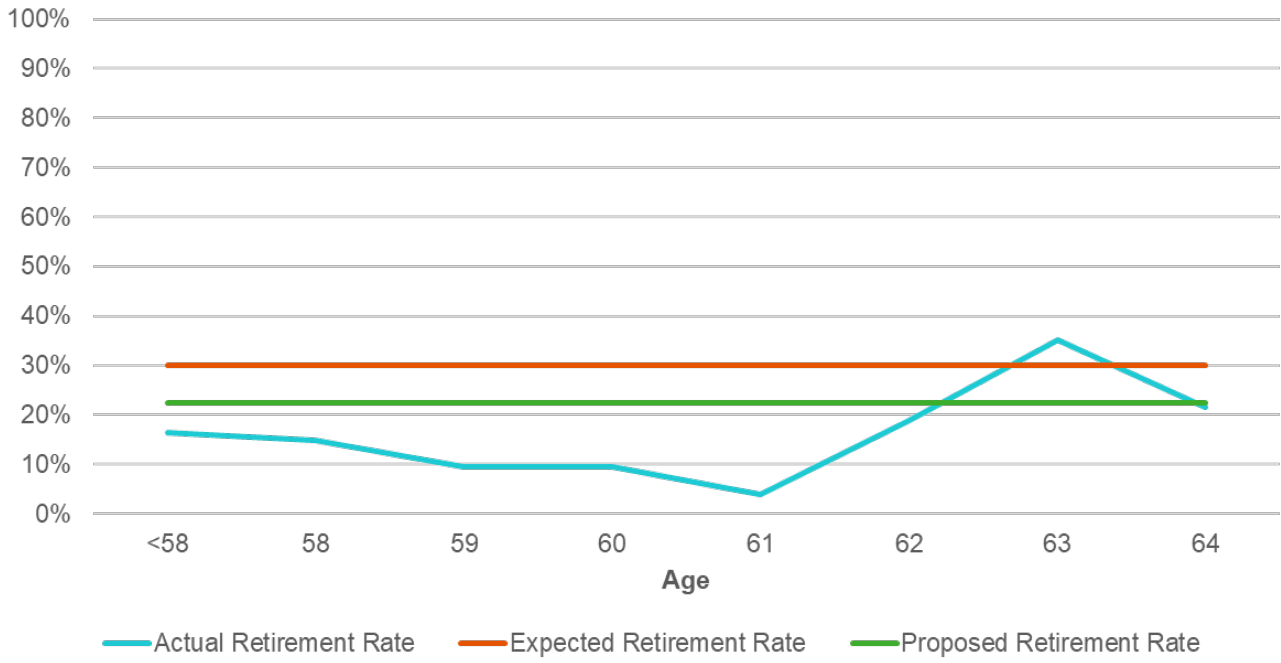
Recommend modifying rates to better match actual experience

¹ Based on annual benefits in thousands of dollars

Active Retirements – Group C – NGF

First year after meeting rule of 90 (prior to age 65):

- Overall, fewer retirements than expected
- Fewer retirements at most ages



Exposures ¹	Actual Retirements ¹	Expected Retirements ¹	Actual to Expected	Proposed Retirements ¹	Actual to Proposed
\$8,259	\$1,252	\$2,478	51%	\$1,858	67%

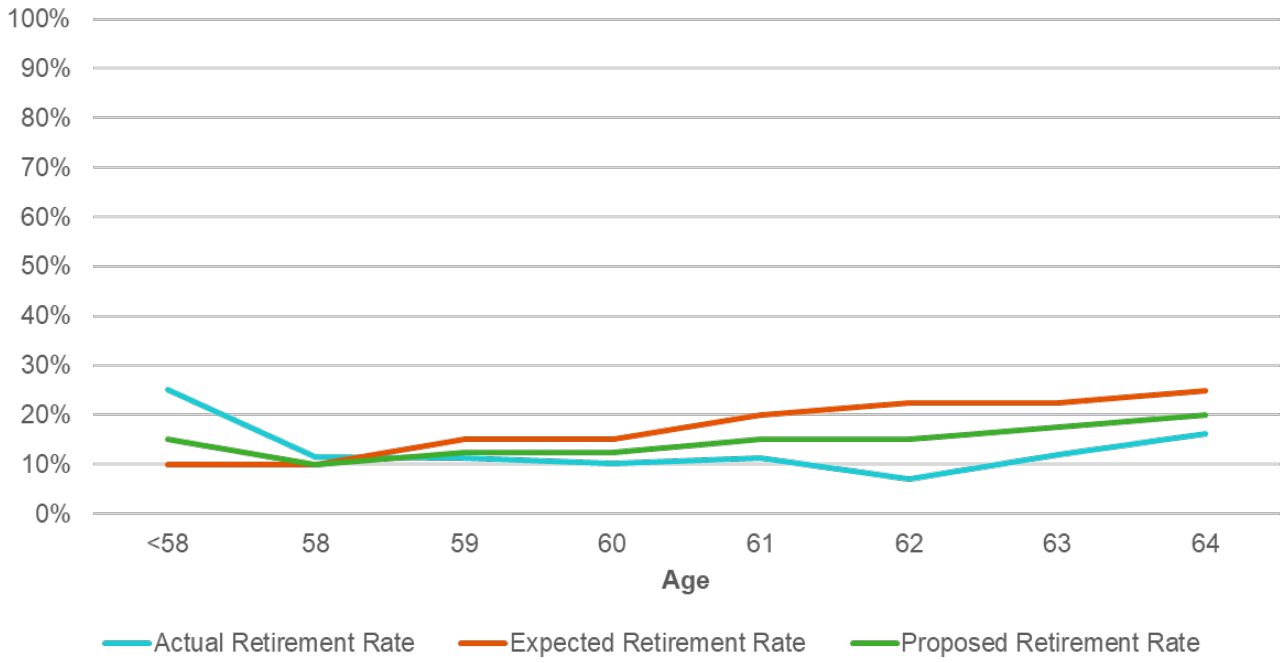
Recommend decreasing rates to better match actual experience

¹ Based on annual benefits in thousands of dollars

Active Retirements – Group C – NGF

More than 1 year after meeting rule of 90 (prior to age 65):

- Overall, fewer retirements than expected
- Fewer retirements at most ages



Exposures ¹	Actual Retirements ¹	Expected Retirements ¹	Actual to Expected	Proposed Retirements ¹	Actual to Proposed
\$12,447	\$1,463	\$2,369	62%	\$1,872	78%

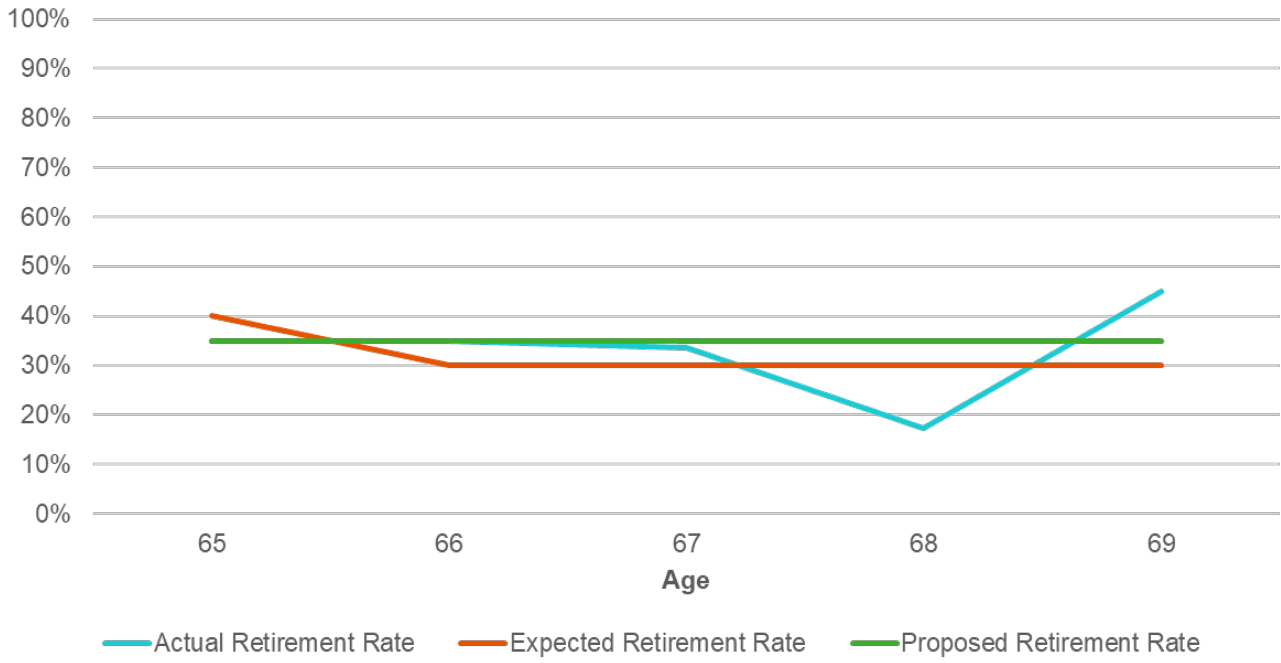
Recommend modifying rates to better match actual experience

¹ Based on annual benefits in thousands of dollars

Active Retirements – Group C – NGF

Age 65+:

- Actual experience was relatively consistent with expected
- Slightly fewer retirements in this cohort
- 100% retirement assumed at age 70+



Exposures ¹	Actual Retirements ¹	Expected Retirements ¹	Actual to Expected	Proposed Retirements ¹	Actual to Proposed
\$7,459	\$2,554	\$2,655	96%	\$2,611	98%

Recommend slight modifications to rates to better match actual experience

¹ Based on annual benefits in thousands of dollars

Inactive Vested Retirements – Group A

The current assumptions are as follows:

- 10% of members are assumed to retire from Early Retirement Age until Normal Retirement Age, then 100% of members are assumed to retire at their Normal Retirement Age

There was very limited experience available during the three-year experience period

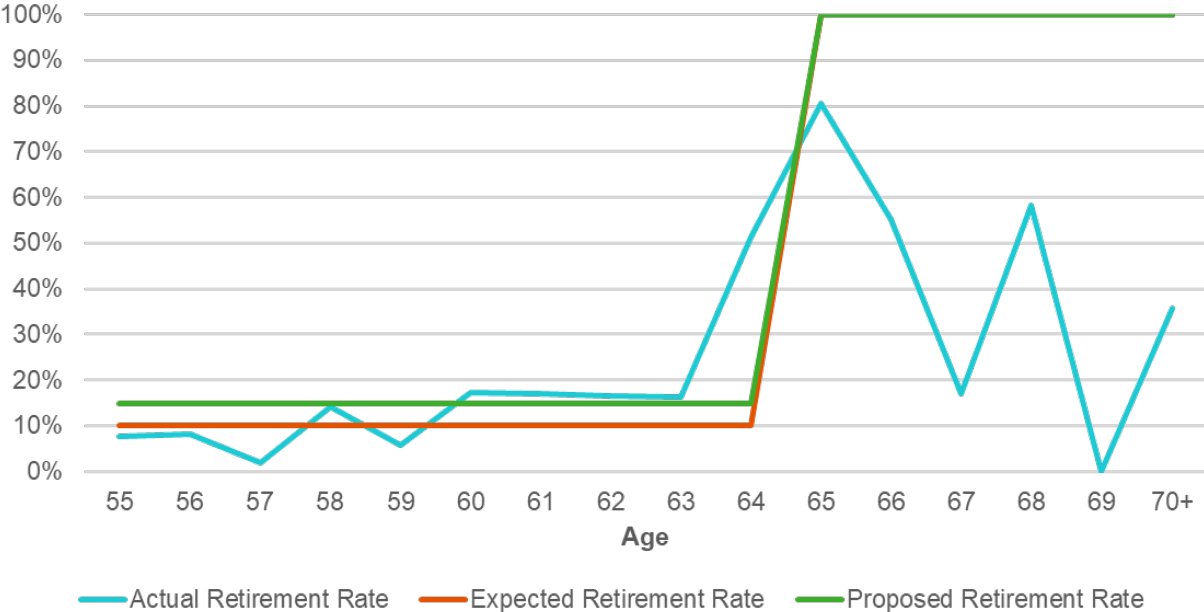
Recommend leaving all Group A inactive vested retirement rates unchanged

Inactive Vested Retirements – Group C – NGF

The current assumptions are as follows:

- 10% of members are assumed to retire from Early Retirement Age until Normal Retirement Age, then 100% of members are assumed to retire at their Normal Retirement Age

We have analyzed inactive vested retirement experience on a unisex, benefit-weighted basis. Experience shows that more inactive vested members are retiring than expected. We recommend increasing the pre-Normal Retirement Age rates.



Exposures ¹	Actual Retirements ¹	Expected Retirements ¹	Actual to Expected	Proposed Retirements ¹	Actual to Proposed
\$12,329	\$2,792	\$2,218	126%	\$2,777	101%

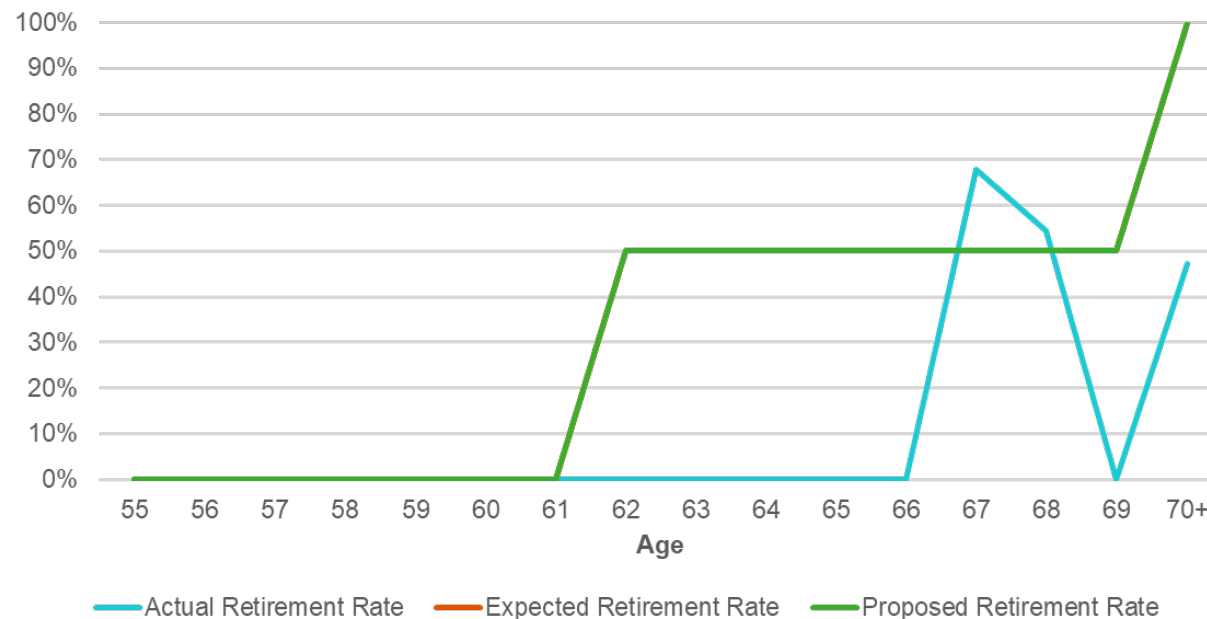
¹ Based on annual benefits in thousands of dollars

Inactive Vested Retirements – Group C – GF

The current assumptions are as follows:

- 50% of members are assumed to retire from age 62-69, then 100% at age 70

We have analyzed inactive vested retirement experience on a unisex, benefit-weighted basis. Experience shows that fewer inactive vested members are retiring than expected. However, due to the limited experience, we recommend maintaining the current rates.



Exposures ¹	Actual Retirements ¹	Expected Retirements ¹	Actual to Expected	Proposed Retirements ¹	Actual to Proposed
\$456	\$192	\$334	57%	\$334	57%

¹ Based on annual benefits in thousands of dollars

Termination Before Retirement

Experience shows that fewer active members are terminating prior to retirement than expected, in aggregate.

Current rates are age-based and sex-distinct

- The current turnover rates have been generating net experience losses for many years

We have analyzed termination experience on a headcount-weighted basis. When analyzing the combined experience for males and females on a unisex basis, the experience is similar for both males and females.

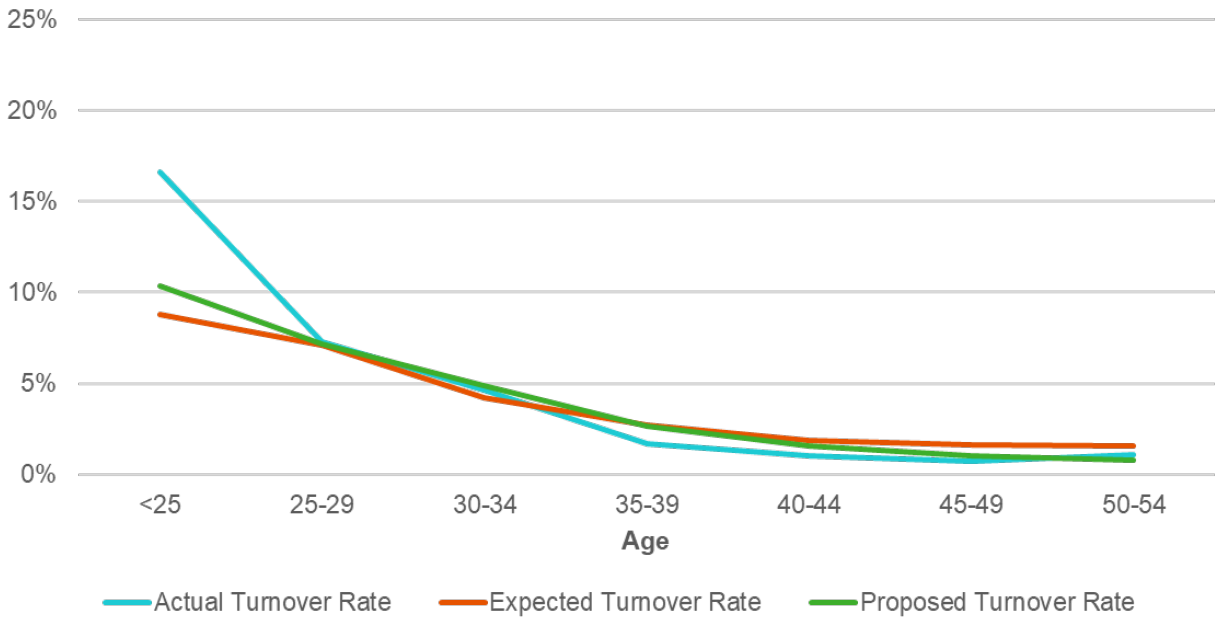
We recommend applying the termination rates on a unisex basis and adjusting the termination rates to better fit experience where applicable.

Termination – Unisex

Unisex:

- Overall, slightly fewer terminations than expected
- Fewer terminations at some ages and more terminations at other ages

Recommend applying the termination rates on a unisex basis and adjusting the termination rates to better fit experience where applicable.



Exposures	Actual Terminations	Expected Terminations	Actual to Expected	Proposed Terminations	Actual to Proposed
22,739	559	648	86%	600	93%

Disability Retirement

Experience over the prior three years shows that fewer female active members and more male active members retired under a disability pension than expected

The current disability retirement assumptions are sex-distinct and are based on age. We have analyzed disability retirement experience on a benefit-weighted basis.

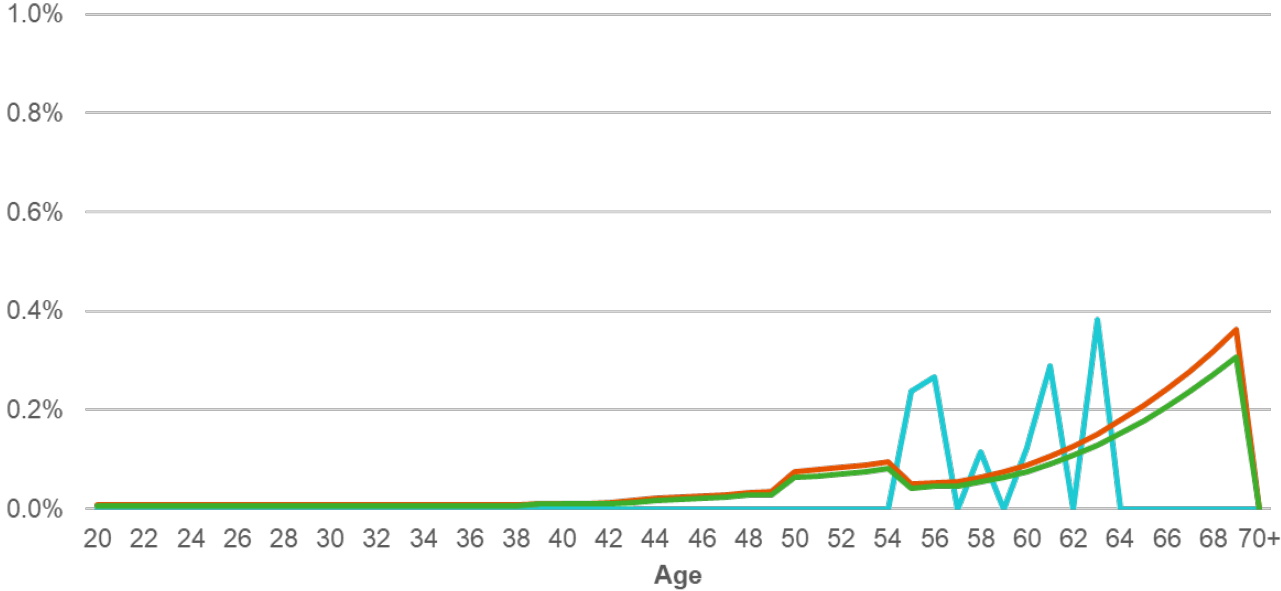
We recommend a 15% decrease to current female rates related to disability retirement and a 20% increase to current male rates related to disability retirement

Disability Retirements – Females

Females:

- Fewer disabilities than expected

Recommend decreasing the rates uniformly by 15% for all ages



— Actual Retirement Rate — Expected Retirement Rate — Proposed Retirement Rate

Exposures ¹	Actual Retirements ¹	Expected Retirements ¹	Actual to Expected	Proposed Retirements ¹	Actual to Proposed
\$308,420	\$144	\$192	75%	\$163	89%

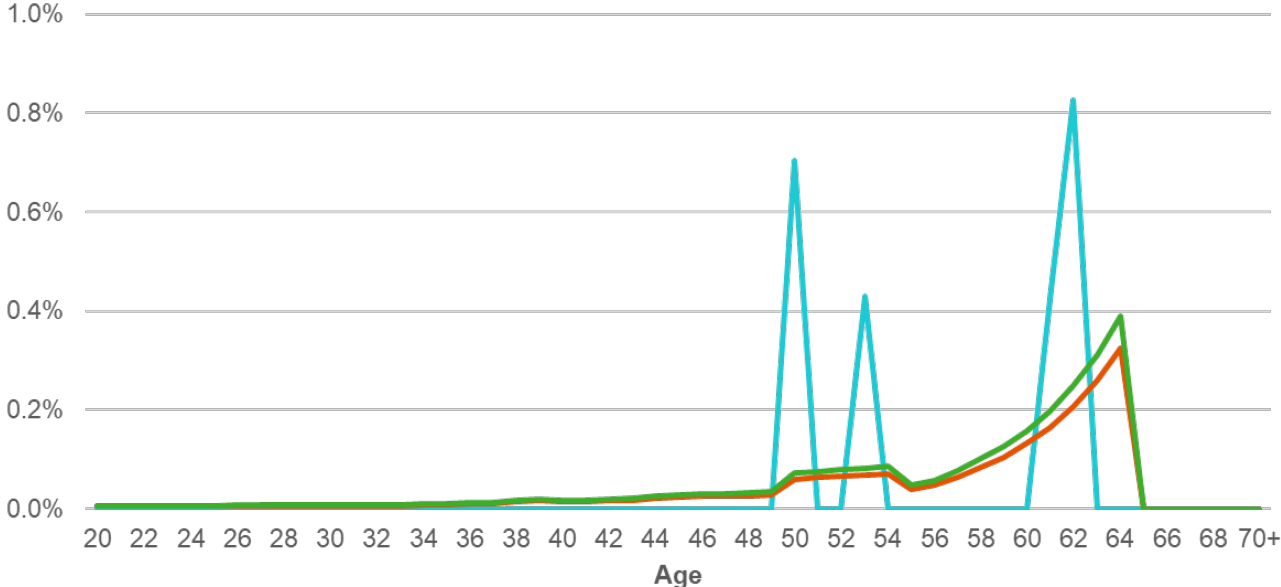
¹ Based on annual benefits in thousands of dollars

Disability Retirements – Males

Males:

- More disabilities than expected

Recommend increasing the rates uniformly by 20% for all ages



— Actual Retirement Rate — Expected Retirement Rate — Proposed Retirement Rate

Exposures ¹	Actual Retirements ¹	Expected Retirements ¹	Actual to Expected	Proposed Retirements ¹	Actual to Proposed
\$114,889	\$101	\$70	144%	\$84	120%

¹ Based on annual benefits in thousands of dollars

Spouse Information

Current assumptions:

- 85% of male members and 35% of female members are married
- Male spouses are three years older than female spouses
- 100% of spouses are opposite gender

We have limited information on marital status and spouse information

We reviewed actual election information from the data and the percentages are slightly lower than the current assumption of 85%/35%. However, the same assumption is used to value pre-retirement death benefits, which is based on actual marital status at the time of death.

Therefore, we recommend no change to these assumptions



Summary of Assumption Impact

Assumption	Description	Impact on Liability/Cost	Impact on Gain/Loss
Inflation	The rate at which price levels are rising and purchasing power is falling	The impact that inflation has on liability and cost varies by each economic assumption	The impact that inflation has on gain/loss varies by each economic assumption
Investment Return	Based on invested plan asset categories and assumed rates of return for each asset class	Higher assumption causes lower liability and cost	Higher than anticipated actuarial return will create actuarial gains
Salary Increases	The expected rate of future salary increases for employees at various ages or years from hire	Higher assumption causes higher liability and cost	Higher than anticipated salary increases to actives will create actuarial losses
Payroll Growth	Used to project covered payroll to estimate the employer normal cost for budgeting purposes	Higher assumption causes higher cost, but has no impact on liability	Payroll growth has no impact on gain/loss
COLA	An annual increase in benefits to counteract inflation	Higher assumption causes higher liability and cost	Higher than anticipated COLAs will create actuarial losses
Mortality	The probability of dying within one year at each age	Lower mortality increases liability and cost	Higher than anticipated mortality will create actuarial gains
Retirement	The age (or ages) when employees are expected to retire	Earlier assumed retirement usually increases liability and cost	If more members retired later in their careers, this could result in gains. Generally, losses result when a member retires earlier without a full actuarial reduction. Other scenarios may result in gains/losses.
Termination	The expected rate of termination for employees at various ages or years from hire	Greater assumed termination decreases liability and cost	Higher than anticipated terminations will likely result in actuarial gains
Disability	The age (or ages) when employees are expected to become disabled	Greater incidence of disability usually slightly increases liability and cost	Greater incidence of disability than anticipated will likely result in slight actuarial losses

Summary of Economic Assumptions

Assumption	Current	Proposed	Impact on Actuarially Determined Contribution
Inflation ¹	2.30%	No change	N/A
Investment Return ¹	7.00%	No change	N/A
Salary Scale ²	Merit/seniority rates (including productivity) based on age plus inflation	Slight decreases to the merit and seniority (and productivity) portion of individual salary increases for most ages	Slight Decrease
Payroll Growth ²	3.00%	No change	N/A
COLA ²	Active Group C members first eligible for normal retirement on or after July 1, 2022: <ul style="list-style-type: none"> • 1.20% All other members: <ul style="list-style-type: none"> • Group A: 2.40% • Groups B/C: 1.35% 	Active Group C members first eligible for normal retirement on or after July 1, 2022: <ul style="list-style-type: none"> • 1.10% (Decrease) All other members: <ul style="list-style-type: none"> • Group A: 2.30% (Decrease) • Groups B/C: 1.15% (Decrease) 	Decrease
Administrative Expenses	0.40% of projected payroll is added to normal cost	0.45% of projected payroll is added to normal cost	Slight Increase

¹ The inflation and investment return assumptions were recommended by VPIC's actuary, GRS, and adopted by VPIC during their July 25, 2023, meeting.

² The salary scale, payroll growth, and COLA assumptions reflect the inflation assumption referenced above.

Summary of Demographic Assumptions

Assumption	Current	Proposed	Impact on Actuarially Determined Contribution
Healthy Post-Retirement Mortality - Retirees	PubT-2010 Teacher Healthy Retiree Amount-Weighted Table with generational projection using scale MP-2019	PubT-2010 Teacher Healthy Retiree Amount Weighted table for males and females with credibility adjustments of 103% and 93%, respectively, with generational projection using scale MP-2021	Slight Increase
Healthy Post-Retirement Mortality - Beneficiaries	109% of the Pub-2010 Contingent Survivor Amount-Weighted Table with generational projection using scale MP-2019	Pub-2010 Contingent Survivor Amount-Weighted Table with generational projection using scale MP-2021	Slight Increase
Disabled Post-Retirement Mortality	PubNS-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table with generational projection using scale MP-2019	PubNS-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table with generational projection using scale MP-2021	Slight Increase
Active Mortality	PubT-2010 Teacher Employee Amount-Weighted Table with generational projection using scale MP-2019	PubT-2010 Teacher Employee Amount-Weighted Table with generational projection using scale MP-2021	Slight Increase
Active Retirement	Group A: One set of age-based rates for members eligible for unreduced benefits and one set of age-based rates for all other members	Group A: No change	N/A
	Group C-GF: One set of age-based rates for members eligible for unreduced benefits and one set of age-based rates for all other members	Group C-GF: One set of age-based rates for all members and delay 100% assumed retirement until age 70	Slight Decrease
	Group C-NGF: A rate of 30% for members during the first year of unreduced eligibility, one set of age-based rates for members after the first year of unreduced eligibility, and one set of age-based rates for all other members	Group C-NGF: Decrease rates for members during the first year of unreduced eligibility, modify rates for all other members to better match actual experience	Slight Decrease

Summary of Demographic Assumptions

Assumption	Current	Proposed	Impact on Actuarially Determined Contribution
Inactive Retirement	Group A: 10% from ERA for each year until NRA, then 100% at NRA	Group A: No change	N/A
	Group C-NGF: 10% from ERA for each year until NRA, then 100% at NRA	Group C-NGF: Increase pre-Normal Retirement Age rates	Slight Decrease
	Group C-GF: 50% from age 62-69, then 100% at age 70	Group C-GF: No change	N/A
Termination	Gender distinct age-based rates	Apply on a unisex basis and adjust to better fit experience where applicable	Slight Increase
Disability Retirement	Gender distinct age-based rates	Decrease current female rates by 15% and increase current male rates by 20%	Slight Decrease
Spouse Information	85% male members and 35% female members are married, male spouses are three years older than female spouses, and 100% of spouses are opposite gender	No changes	N/A

Cost Impact

(Based on the June 30, 2022, Actuarial Valuation, \$ in Millions)

	Before Changes (Baseline)	Reflecting COLA	Reflecting COLA and Mortality	Reflecting COLA, Mortality, and All Other Assumptions
Present Value of Future Benefits	\$5,133.2	\$5,069.7	\$5,091.6	\$5,134.8
<i>% Change</i>		-1.2%	0.4%	0.8%
<i>Cumulative</i>		-1.2%	-0.8%	0.0%
Actuarial Accrued Liability	\$4,289.8	\$4,233.2	\$4,252.8	\$4,245.2
<i>% Change</i>		-1.3%	0.5%	-0.2%
<i>Cumulative</i>		-1.3%	-0.9%	-1.0%
Total Normal Cost¹	\$79.7	\$79.1	\$79.3	\$80.3
<i>% Change</i>		-0.8%	0.3%	1.3%
<i>Cumulative</i>		-0.8%	-0.5%	0.8%
Funded Percentage	57.3%	58.0%	57.8%	57.9%
<i>Delta</i>		0.7%	-0.2%	0.1%
<i>Cumulative</i>		0.7%	0.5%	0.6%
Actuarially Determined Contribution for FY24	\$194.3	\$188.2	\$190.3	\$191.1
<i>% Change</i>		-3.1%	1.1%	0.4%
<i>Cumulative</i>		-3.1%	-2.1%	-1.6%

Due to rounding, values shown here may not sum as expected

¹ Total normal cost as of July 1, 2022, adjusted for timing



Appendix

Assumed Rates of Salary Increase

The following tables show the total proposed individual salary increase rates by age, including the inflation assumption of 2.30%, for members in all groups:

Age	Proposed Total Salary Increase Rate
20-22	8.50%
23	8.18%
24	7.85%
25	7.53%
26	7.21%
27	6.89%
28	6.72%
29	6.54%
30	6.36%
31	6.19%
32	6.01%
33	5.93%
34	5.85%
35	5.77%
36	5.69%
37	5.61%

Age	Proposed Total Salary Increase Rate
38	5.49%
39	5.38%
40	5.27%
41	5.16%
42	5.05%
43	4.92%
44	4.79%
45	4.67%
46	4.54%
47	4.42%
48	4.34%
49	4.26%
50	4.18%
51	4.10%
52	4.03%
53	3.94%

Age	Proposed Total Salary Increase Rate
54	3.86%
55	3.77%
56	3.69%
57	3.61%
58	3.59%
59	3.58%
60	3.57%
61	3.55%
62	3.54%
63	3.42%
64	3.31%
65	3.19%
66	3.08%
67+	2.96%

Active Retirement

The following tables show the proposed active retirement rates for members in **Group C-GF** and **Group A**:

Group A – 30+ Years of Service

Age	Proposed Active Retirement Rate
50	40.00%
51-55	20.00%
56-59	10.00%
60	30.00%
61	25.50%
62	25.00%
63	22.00%
64	22.00%
65	33.00%
66	33.00%
67	33.00%
68	22.00%
69	33.00%
70+	100.00%

Group A – <30 Years of Service

Age	Proposed Active Retirement Rate
55-58	7.50%
59	12.50%
60	30.00%
61	25.00%
62	30.00%
63	30.00%
64	30.00%
65	40.00%
66	40.00%
67	40.00%
68	50.00%
69	50.00%
70+	100.00%

Group C-GF – All Members

Age	Proposed Active Retirement Rate
50	40.00%
51-54	20.00%
55	10.00%
56	10.00%
57	10.00%
58	10.00%
59	12.50%
60	15.00%
61	17.00%
62	30.00%
63	35.00%
64	40.00%
65-69	50.00%
70+	100.00%

Active Retirement

The following tables show the proposed active retirement rates for members in **Group C-NGF**:

Group C-NGF – Before Rule of 90

Age	Proposed Active Retirement Rate
<56	2.50%
56-59	5.00%
60	7.50%
61	12.50%
62	15.00%
63	20.00%
64	25.00%

Group C-NGF – Age 65+

Age	Proposed Active Retirement Rate
65-69	35.00%
70+	100.00%

Group C-NGF – First Year after Rule of 90

Age	Proposed Active Retirement Rate
<65	22.50%

Group C-NGF – More than 1 Year after Rule of 90

Age	Proposed Active Retirement Rate
<56	20.00%
56	15.00%
57	15.00%
58	10.00%
59	12.50%
60	12.50%
61	15.00%
62	15.00%
63	17.50%
64	20.00%

Inactive Retirement

The following tables show the proposed inactive retirement rates for members in all groups:

<u>Group A</u>	
Age	Proposed Inactive Retirement Rate
55	10.00%
56	10.00%
57	10.00%
58	10.00%
59	10.00%
60+	100.00%

<u>Group C-GF</u>	
Age	Proposed Inactive Retirement Rate
62	50.00%
63	50.00%
64	50.00%
65	50.00%
66	50.00%
67	50.00%
68	50.00%
69	50.00%
70+	100.00%

<u>Group C-NGF</u>	
Age	Proposed Inactive Retirement Rate
55	15.00%
56	15.00%
57	15.00%
58	15.00%
59	15.00%
60	15.00%
61	15.00%
62	15.00%
63	15.00%
64	15.00%
65+	100.00%

Disability Retirement – Females

The following tables show the proposed disability retirement rates for female members in all groups:

Age	Proposed Disability Retirement Rate
20-38	0.0068%
39	0.0094%
40	0.0094%
41	0.0094%
42	0.0111%
43	0.0136%
44	0.0179%
45	0.0204%
46	0.0221%
47	0.0247%
48	0.0272%
49	0.0289%
50	0.0629%
51	0.0672%
52	0.0714%

Age	Proposed Disability Retirement Rate
53	0.0757%
54	0.0808%
55	0.0425%
56	0.0451%
57	0.0468%
58	0.0544%
59	0.0638%
60	0.0748%
61	0.0901%
62	0.1080%
63	0.1284%
64	0.1522%
65	0.1777%
66	0.2066%
67	0.2372%

Age	Proposed Disability Retirement Rate
68	0.2712%
69	0.3077%

Disability Retirement – Males

The following tables show the proposed disability retirement rates for male members in all groups:

Age	Proposed Disability Retirement Rate
20-25	0.0060%
26	0.0084%
27	0.0084%
28	0.0084%
29	0.0084%
30	0.0084%
31	0.0084%
32	0.0084%
33	0.0084%
34	0.0108%
35	0.0108%
36	0.0132%
37	0.0132%
38	0.0168%
39	0.0192%

Age	Proposed Disability Retirement Rate
40	0.0168%
41	0.0180%
42	0.0204%
43	0.0216%
44	0.0264%
45	0.0276%
46	0.0300%
47	0.0312%
48	0.0324%
49	0.0348%
50	0.0720%
51	0.0756%
52	0.0792%
53	0.0816%
54	0.0852%

Age	Proposed Disability Retirement Rate
55	0.0480%
56	0.0576%
57	0.0768%
58	0.1020%
59	0.1260%
60	0.1584%
61	0.1980%
62	0.2484%
63	0.3108%
64-69	0.3888%

Termination – Unisex

The following tables show the proposed termination rates for all members in all groups:

Age	Proposed Termination Rate
15-22	12.00%
23	11.00%
24	10.00%
25	9.00%
26	8.00%
27	7.00%
28	6.60%
29	6.20%
30	5.80%
31	5.40%
32	5.00%
33	4.50%
34	4.00%
35	3.50%
36	3.00%

Age	Proposed Termination Rate
37	2.50%
38	2.30%
39	2.10%
40	1.90%
41	1.70%
42	1.50%
43	1.40%
44	1.30%
45	1.20%
46	1.10%
47	1.00%
48	0.95%
49	0.90%
50	0.85%
51	0.80%

Age	Proposed Termination Rate
52+	0.75%

Disclosures

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

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

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

It is important to note that this experience study analysis is based on census data and information through June 30, 2022. Due to the COVID-19 pandemic, market and demographic conditions may have changed significantly since this date. VSTRS' actuarial funded status does not reflect short-term fluctuations in the market or plan demographics, but rather is based on asset and liability values on the last day of a Plan Year.