

# 2024 Annual Report to the Comptroller on **ACTUARIAL ASSUMPTIONS**

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Recommendations by  
**Aaron Schottin Young, MA, FSA, EA, MAAA**  
**Retirement Systems Chief Actuary**

Office of the New York State Comptroller  
Thomas P. DiNapoli



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August 2024

# Actuarial Certification

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As the Actuary for the Employees' Retirement System (ERS), the Police and Fire Retirement System (PFRS) and the Group Life Insurance Plan (GLIP), known collectively as the New York State and Local Retirement System (NYSLRS) or the "System," it is my duty to ensure that the System properly funds the benefits of members, retirees, and beneficiaries.

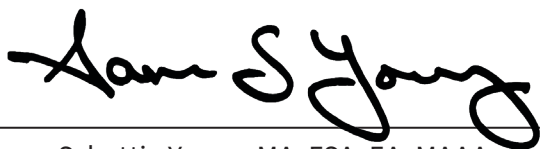
The System uses an aggregate funding method which has a funding objective of employer contributions that, over time, are a level percentage of payroll. Every April 1st, an Actuarial Valuation is conducted to determine employer contribution requirements for the fiscal year ending two years later. In preparation for the valuation, participant data is validated by running reasonableness tests and a participant reconciliation accounting for every individual on a year-over-year basis. Financial statements are also reviewed.

Proper funding requires that liabilities and employer contribution rates are developed using reasonable actuarial assumptions and methods. Actuarial assumptions are grouped into two broad categories: demographic assumptions (rates of employee turnover, disability, mortality, and retirement) and economic assumptions (interest rates, inflation, and salary growth).

The Actuary performs annual experience studies, ascertaining how closely the System's experience is conforming to the assumptions. If significant differences occur that the Actuary believes may indicate permanent shifts, the Actuary may recommend changes to the assumption.

An Actuarial Advisory Committee (AAC), for whom this report has been prepared, meets annually to review the actuarial assumptions and the results of the Actuarial Valuation. The System also retains an external auditor to independently review its financial records every year, as well as engages the services of an outside actuarial consultant to perform a review every five years. Similarly, every five years, the System is audited by the New York State Department of Financial Services. Lastly, the State Comptroller, in his role as sole trustee of the System, established the Office of Internal Audit to help fulfill his fiduciary duties. Auditors with this office periodically review the Actuarial bureau's processes.

I hereby certify that, to the best of my knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial practices which are consistent with the principles prescribed by the Actuarial Standards Board as well as the Code of Professional Conduct and Qualification Standards for Actuaries Issuing Statements of Actuarial Opinion of the American Academy of Actuaries, of which I am a member. In addition, the assumptions and methods meet the parameters set for disclosures by Governmental Accounting Standards Board (GASB) Statements No. 67 and 68.



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Aaron Schottin Young, MA, FSA, EA, MAAA  
Retirement Systems Chief Actuary

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8/30/2024

Dated

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# Executive Summary

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This report will detail the assumptions recommended for use in the Actuarial Valuation for fiscal year beginning April 1, 2024 establishing employer billing rates for bills paid February 1, 2026 (local participating employers) or March 1, 2026 (the State of New York).

Should these recommendations be adopted by the New York State Comptroller, the ERS average employer contribution rate is estimated to be 16.5% and the PFRS average employer contribution rate is estimated to be 33.7% for fiscal year ending March 31, 2026.

This report serves to document the considerations and rationale underpinning the recommendation to maintain all assumptions, in keeping with Actuarial Standards of Practice (ASOPs). The Risk Analysis and Disclosures section was first introduced in 2019 and, partially in response to requests by members of the AAC, is expanded this year to include additional metrics.

This report, and the recommended assumptions herein, have been shared with the members of the AAC for their review and commentary. The AAC is composed of volunteers who are current or retired actuaries from major insurance companies or pension plans.

Since the last meeting of the AAC in August 2023, PICM completed an asset allocation study resulting in the Comptroller's adoption of a new Asset Allocation (AA) Policy effective February 1, 2024. Additionally, the Department of Financial Services audit of NYSLRS (covering the period April 1, 2016 through March 31, 2021) has progressed but no formal feedback has been received by NYSLRS. A copy of other publications issued by the Actuarial bureau over the prior year were made available to the committee members.

Actuarial funding is a long-term endeavor, intended to accumulate sufficient assets over the next 30 years to provide benefits that are payable over the next 100 years. Therefore, the assumptions used to establish the billing rates are similarly long term in nature. While the assumptions are reviewed annually, a change is only appropriate when the revision is considered material and expected to better forecast future outcomes.

Recognizing this, NYSLRS has a history of revising major assumptions in a five-year cycle. The fiscal year ending 2024 is the fourth year in the current five-year experience study cycle. All major assumptions have been subject to comprehensive review in the past four years, resulting in updates for most.

Major Assumption or Method	Last Changed in Valuation Dated	Assumption at Fiscal Year Beginning 2023
Inflation	April 1, 2022	2.9%
Cost-of-Living Adjustment	April 1, 2022	1.5%
Investment Return	April 1, 2021	5.9%
PFRS Salary Scale	April 1, 2021	Based on System experience FYE 2012 – FYE 2021 (5.8% average expected for FYE 2023 cohort)
ERS Salary Scale	April 1, 2018	Based on System experience FYE 2016 – FYE 2018 (4.2% average expected for FYE 2023 cohort)
Asset Smoothing Method	April 1, 2022	8-year level smoothing of unexpected gain/(loss)
Retiree Mortality	April 1, 2020	Based on System experience FYE 2016 – FYE 2020
Mortality Improvement	April 1, 2022	Society of Actuaries' MP-2021 (for retirees only)
Active Member Decrements	April 1, 2020	Based on System experience FYE 2016 – FYE 2020

The above assumptions were recommended by the Retirement System's Chief Actuary and were adopted by the Comptroller of the State of New York, Thomas P. DiNapoli, in his capacity as administrator, for use in the April 1, 2023 Actuarial Valuation.

Since all the assumptions have changed in the near past, further revision is undesirable except where an assumption is considered unreasonable. It is preferable to allow the current set of assumptions to run its course, in keeping with their long-term nature.

I have evaluated the appropriateness of each assumption and I consider all to be reasonable. **Therefore, I recommend maintaining all economic and demographic assumptions for the April 1, 2024 Actuarial Valuation.**

During the 2023 and 2024 legislative sessions, the New York State Legislature provided certain benefit enhancements to members of Tier 6. This necessitated a realignment of certain methods and minor adjustments used in developing liabilities and plan indices.

The most notable benefit improvement provided Tier 6 members with a 3-year final average salary (FAS). Previously, a Tier 6 member's retirement benefit was calculated using a 5-year FAS. In addition to modifying the benefit formula used to project Tier 6 benefits, certain assumptions needed to be revised. In particular, the 1-year FAS multiplier (changed from a 1.09 multiplier to 1.14 for both Tier 5 and Tier 6; PFRS only) and the impact of overtime limits (changed from 0.90 to 0.95; only for calculating indices; PFRS only).

Since this benefit improvement materially increased the value of Tier 6 benefits, it is necessary to update the plan indices, which measure the relative lucrateness of each plan and are used to differentiate billing rates by tier and plan. Appendix B provides a summary of how Tier 6 indices changed due to this benefit enhancement and subsequent adjustment factors.

# Economic Assumptions

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Economic assumptions include the inflation rate, cost-of-living adjustment, liability discount rate (and the investment rate of return), and salary scale assumptions. Economic assumptions are forward looking, and therefore based more on future expectations and professional judgement than past economic experience. This gives economic assumptions a degree of subjectivity.

While actuaries are well versed in economic and investment considerations, it is not a pension actuary's primary area of expertise. For this reason, the setting of economic assumptions typically relies in part on the expertise of investment professionals and economists. NYSLRS has a team of investment professionals in PICM who work with RVK, an investment consultant, to develop expected returns and volatility by asset class. RVK then applies the asset class estimates to the current and target AA Policy for the Common Retirement Fund (CRF).

Chapter 775 of the Laws of 2022 increased flexibility in designing the CRF's AA Policy by easing restrictions on allowable investments by public pension funds in New York State. In response, PICM initiated an asset allocation study, which was completed on February 1, 2024. A natural consequence of any asset allocation study is recommended changes in the CRF's AA Policy and updated capital market forecasts by asset class. The investment rate of return forecasted by the 2024 AA Policy and the 2023 capital market assumptions serves as the primary consideration, but not only consideration, when evaluating the liability discount rate assumption.

Economic assumptions are interconnected. Setting these assumptions often includes consideration of a "building block" approach. Based upon the recommended assumptions, the implied building block components are as follows:

Cost-of-Living Adjustment = Inflation Rate / 2	= 2.9% / 2	= 1.5%
Liability Discount Rate $\approx$ Investment Rate of Return		
= Inflation Rate + Risk Premium	= 2.9% + 3.0%	= 5.9%
Salary Scale = Inflation Rate + (Merit + Productivity)	= 2.9% + 3.1%	= 6.0% in PFRS
	= 2.9% + 1.4%	= 4.3% in ERS

Since each assumption is built upon the inflation assumption, we will start with the Rate of Inflation assumption and then proceed in the order above (Cost-of-Living Adjustment, Liability Discount Rate, Salary Scales).

## Rate of Inflation

Prices for goods and services vary over time. If a “basket” of goods and services is held constant, its change in price over time is attributed to a change in the value of currency. The Federal Bureau of Labor and Statistics (BLS) measures and tracks this phenomenon. Its Consumer Price Indexes (CPI) program produces monthly data on changes in the prices paid by consumers for a representative basket of goods and services. The two CPI measures of greatest interest today are the CPI for All Urban Consumers (CPI-U) and the Chained CPI for All Urban Consumers (C-CPI-U).

A general and progressive increase in prices is called inflation.

A general and progressive decrease in prices is called deflation.

The CPI-U reflects changes in prices for a fixed “basket” of goods.

Inflation does not impact all socioeconomic levels equally. Those with marginal purchasing power are often purchasing lower-cost goods; when inflation strikes, the cost of those goods increases. In contrast, a person who purchases higher-quality goods at a premium price has the option to purchase lower-quality goods for a lower price, thereby mitigating the impact of inflation.

Similarly, shifts in the relative cost of individual goods can trigger a change in consumer behavior. For example, a spike in the cost of orange juice could trigger increased consumption of another juice where price did not increase.

The C-CPI-U was developed to reflect changes in prices where the “basket” of goods reflected shifts in consumer behavior. The C-CPI-U is considered “a closer approximation to the true cost-of-living index for the average consumer than the CPI-U” according to the BLS. Since consumer behavior tends to counteract inflation, the C-CPI-U generally increases at a slightly lower rate than the CPI-U.

Historically, there have been varying levels of inflation, with occasional brief episodes of deflation. In recent years, inflation has been elevated following increases in consumer spending combined with restricted supply chains and a strong labor market.

The annualized increase in the C-CPI-U over the past twenty years is given by:

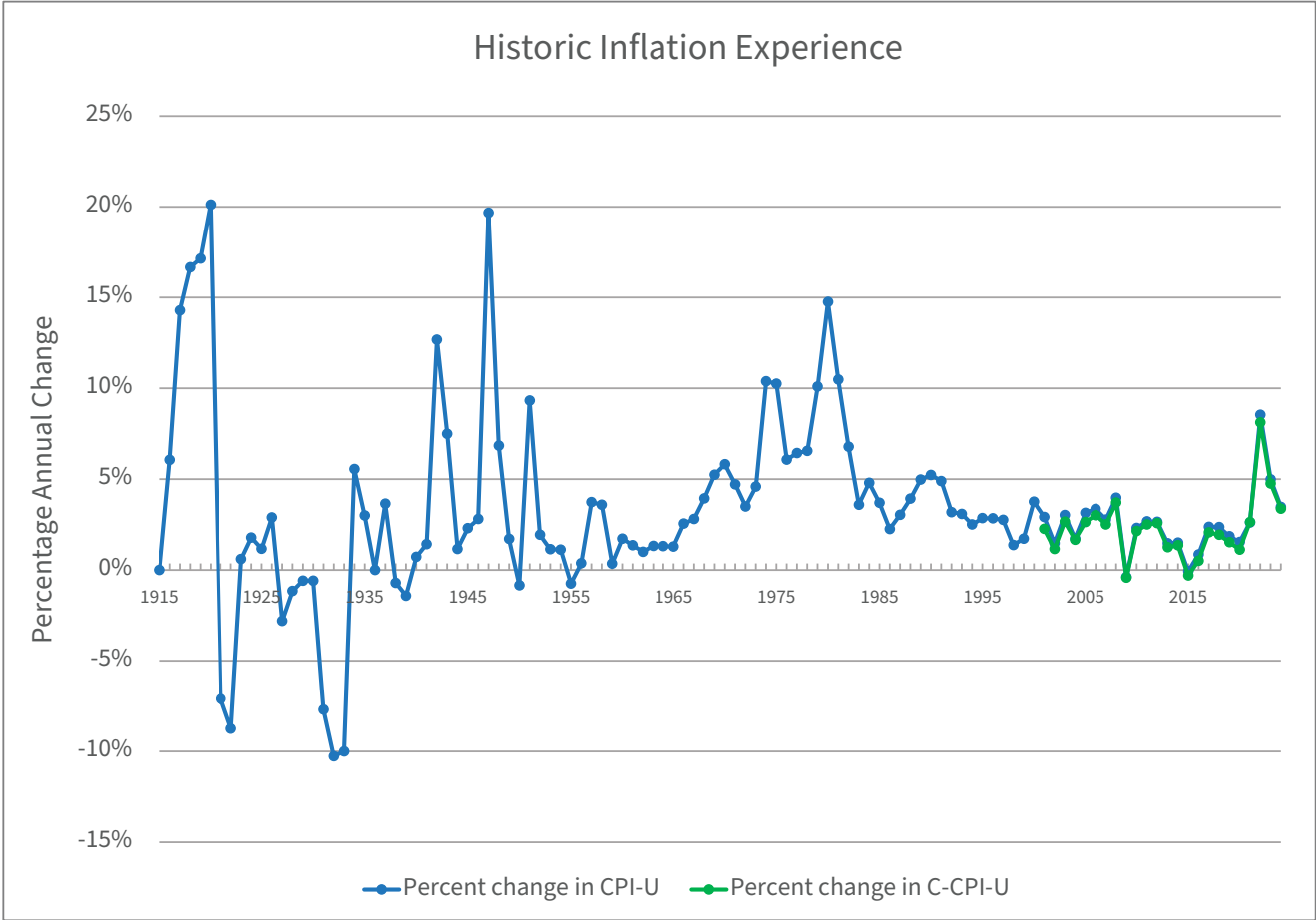
$$(174.190 / 109.7)^{1/20} - 1 = 2.34\%$$

The annualized increase in the C-CPI-U over the past four years is given by:

$$(174.190 / 144.913)^{1/4} - 1 = 4.71\%$$



The current level of inflation is neither unprecedented nor is it particularly exceptional when viewed within a longer historical context. This is visualized in the following graph using the CPI-U.



In addition to past experience, consideration is given to four methods that forecast inflation.

### **1. Input from the Federal Open Market Committee (FOMC)**

The FOMC, a key entity of the Federal Reserve (the “Fed”) whose membership consists of financial and economic experts, establishes monetary policy with two goals in mind: (1) to pursue maximum employment, and (2) to promote stable prices (that is, control inflation). A change in monetary policy consists of raising or lowering the federal funds rate, which is the interest rate for overnight borrowing for banks. When the economy is slowing or inflation is too low, the FOMC can ease monetary policy by decreasing the federal funds rate. In contrast, if the economy is overheating or inflation is too high, the FOMC can tighten monetary policy by increasing the federal funds rate.

On January 30, 2024, the FOMC Open Market Committee reaffirmed a target inflation rate of 2.0%.

The July 5, 2024 Monetary Policy Report, issued by the Fed, acknowledged that current inflation remains above the 2.0% target but that additional tightening of monetary policy is likely unnecessary. An easing of the monetary policy (by way of reducing the federal funds rate) is not expected until inflation moves sustainably toward the 2.0% target. This message is consistent with the anti-inflationary stance taken in prior years.

**2. Yields on US Treasury Bills (T-bills) versus Treasury Inflation-Protected Securities (TIPS)**

When a T-bill is purchased, the buyer is promised an interest payment every six months, based on the principal and the yield, through the maturity date. At maturity, in addition to the semi-annual interest payment, the principal is paid.

A TIPS is a T-bill where the principal increases with inflation and decreases with deflation, so the semi-annual interest payments are inflation-adjusted. At maturity, the larger of the original principal or the inflation-adjusted principal is paid.

When inflation is higher than expected, the TIPS outperform the T-bill. When inflation is less than expected, the T-bill outperforms the TIPS. As a result, the T-bill yield minus the TIPS yield approximates investor expectations of future inflation in the open market.

<b>Asset Duration</b>	<b>T-bill Yield</b>	<b>TIPS Yield</b>	<b>Breakeven Inflation (T-bill - TIPS)</b>
5 years	4.21%	1.83%	2.38%
7 years	4.20%	1.85%	2.35%
10 years	4.20%	1.88%	2.32%
20 years	4.45%	1.99%	2.46%
30 years	4.34%	2.07%	2.27%

**3. RVK (Investment Consultant for NYSLRS)**

RVK uses an inflation assumption of 2.5% in forecasting asset performance in the 2023 asset allocation study. This forecast reflects a 10-year investment horizon.

In 2023, RVK conducted a stochastic simulation of inflation reflecting assumptions used in the 2023 asset allocation study. RVK provided the data for 2,000 simulations. The model used ProVal to project annual inflation over 20 years. Model inputs, as of June 30, 2022 included an initial inflation rate of 9.06%, a long-term target of 2.5% with standard deviation of 2.5%, and a serial correlation coefficient of 0.70 based on historical analysis of the CPI-U. Using the model’s output, the 20-year annual rate of inflation was 3.3%, when averaged over the 2,000 simulations.

**4. Actuarial Bureau Multiple-State Stochastic Model for Inflation Forecasting**

The model, built within the actuarial bureau, assumed three possible states:

- Increasing      inflation is rising, causing an increase in annual inflation of 2.0%
- Normalized    inflation is well managed and gliding toward Fed target of 2.0%
- Decreasing     inflation is falling, potentially due to Fed combating high inflation

Each year, the modeled state at the beginning of the year (BOY) will influence the modeled state at the end of the year (EOY). A random variable is used to determine the state at EOY according to transition probabilities.

Transition Probabilities		EOY		
		Increasing	Normalized	Decreasing
BOY	Increasing	50%	25%	25%
	Normalized	20%	60%	20%
	Decreasing	10%	60%	30%

The change in the rate of inflation is then determined using prescribed rules intended to reflect different scenarios and the historical average change in the CPI-U, especially the standard deviation of average annual change in the CPI-U (SD\_Annual), which is 2.0%.

EOY	Change in Rate of Inflation
Increasing	Rate of inflation increases by 2%, the SD_Annual
Normalized	Rate of inflation moves half the distance toward the FED long-term target
Decreasing	BOY state of <i>Increasing</i> indicates decrease is triggered by Fed Involvement. Rate of inflation decreases by 4%, double the SD_Annual.
	BOY state of <i>Normalized</i> indicates the decrease is naturally occurring. Rate of Inflation decreases 1%, half the SD_Annual.
	BOY state of <i>Decreasing</i> could mean decrease is natural or triggered by Fed. Rate of inflation decreases half the distance toward 0%, generating a large change when inflation is high and minimal change when inflation is low.

The initial state was defined as “decreasing” (reflecting the continued Fed action to restrain inflation) with a current rate of inflation of 8.04% (equal to the annualized 1-month rate of inflation ending March 31, 2024).

The 30-year annual rate of inflation resulting from this model was 3.0%, when averaged over 5,000 simulations, with median 2.8%.

Currently, the inflation assumption is 2.9%.

While past experience and deterministic models suggest the inflation assumption could be lower, the more robust stochastic models used to forecast inflation suggest that the assumption is understated. Similarly, near-term inflation is expected to exceed the 2.9% assumption, even as the Fed continues to demonstrate a commitment to bringing inflation back toward the 2.0% target. With some indicators above and others below, I consider the assumption reasonable.

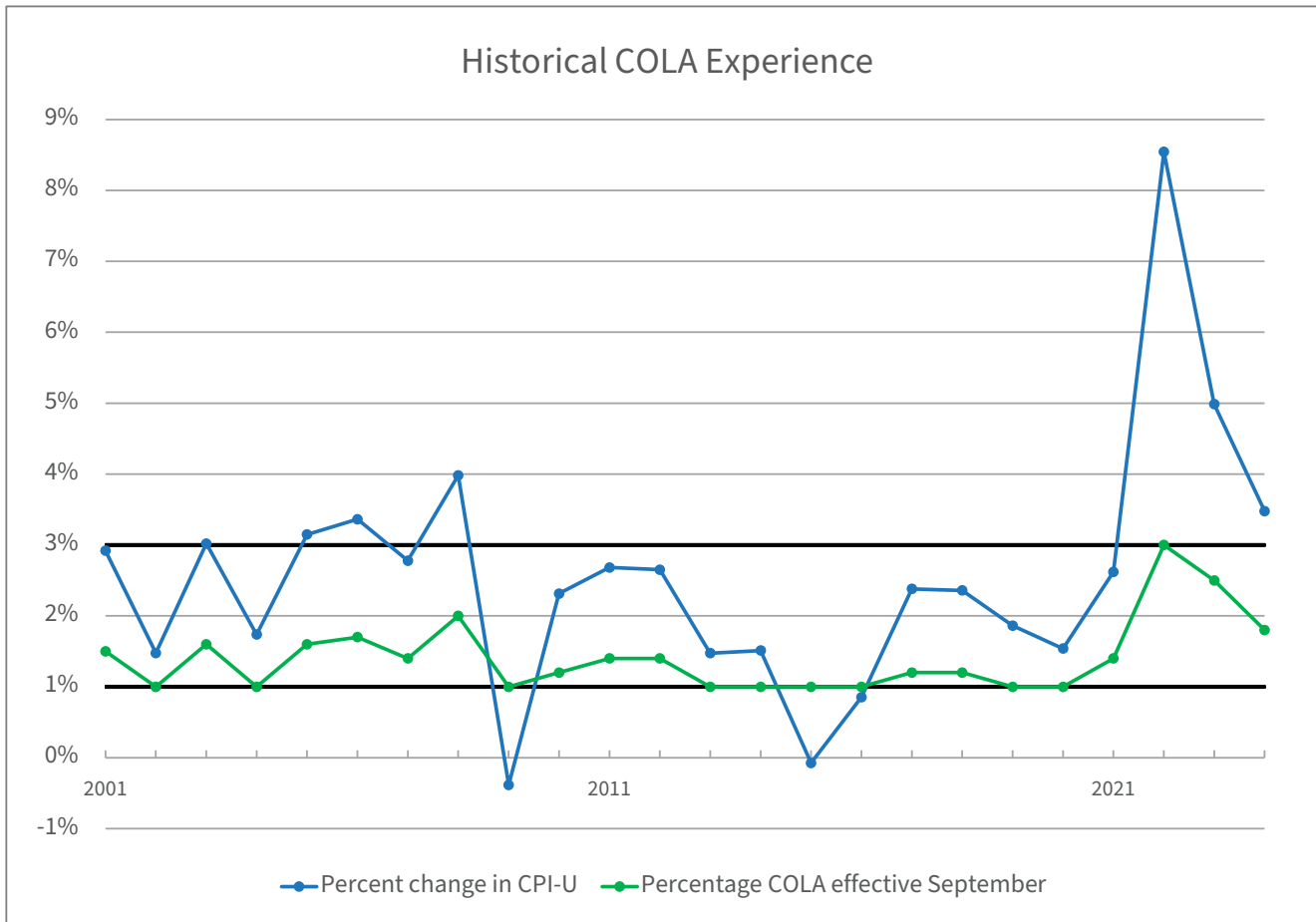
**I recommend maintaining the current inflation assumption of 2.9%.**

## Cost-of-Living Adjustment (COLA)

Inflation reduces the buying power of consumers with a fixed income, as is often the case with retirees and beneficiaries. To combat this, NYSLRS retiree benefits include an annual COLA.

Chapter 125 of the Laws of 2000 established a permanent COLA program first implemented in September 2001. The program provides an annual COLA (each September) equal to one-half of the CPI-U increase for the previous fiscal year (April through March). The COLA is rounded to the next highest 0.1%, subject to a 1% floor and a 3% ceiling. The COLA percentage is applied to the first \$18,000 of a retiree's pension benefit or a beneficiary's accidental death benefit. Most spouses of a deceased retiree are entitled to 50% of the retiree's COLA.

The Actuarial Valuation must estimate future COLAs, which is done by means of a COLA assumption. The graph below summarizes the COLA percentage data since the program's inception, alongside the annual rate of inflation (as measured by the percentage change in the CPI-U).



The accumulated COLA over the past 20 years is approximately:

$$1.016 * 1.017 * 1.014 * 1.020 * 1.010 * 1.012 * 1.014 * 1.014 * 1.010 * 1.010 \\ * 1.010 * 1.010 * 1.012 * 1.012 * 1.010 * 1.010 * 1.014 * 1.030 * 1.025 * 1.018 - 1 = 33.07\%$$

The level COLA, rounded to tenths of a percent, that best matches this experience is 1.4%.

$$1.013^{20} - 1 = 29.47\%$$

$$1.014^{20} - 1 = 32.06\%$$

$$1.015^{20} - 1 = 34.69\%$$

In addition to past experience, consideration is given to methods that forecast the COLA assumption.

### 1. The Inflation Assumption

An inflation assumption of 2.9% would project COLAs of 1.5% for all future years:

$$2.9\% / 2 = 1.45\% \text{ rounded up to } 1.5\%$$

### 2. RVK (Investment Consultant for NYSLRS)

The inflation assumption of 2.5% used by RVK in forecasting asset performance would imply a COLA of 1.3% for all future years.

In 2023, RVK performed stochastic simulations to forecast inflation. The results of this study can be used to inform the COLA assumption by applying the COLA formula (half the annual rate of inflation, round up, and apply the 1% floor and 3% cap). Using the model's output, the 20-year annualized COLA was 1.83%.

### 3. Actuarial Bureau Multiple-state Stochastic Model for Inflation Forecasting

This model is described in the Rate of Inflation section of this report. The model can be used to forecast the annual COLA percentage increase by applying the COLA formula (half the annual rate of inflation, round up, and apply the 1% floor and 3% cap). Using the model's output, the 30-year annualized COLA was 1.6%, when averaged over the 5,000 simulations, with median 1.5%.

Currently, the COLA assumption is 1.5%.

The results of this analysis are very similar to the inflation assumption. With some indicators above and others below, I consider the COLA assumption reasonable.

**I recommend maintaining the current COLA assumption of 1.5%.**

## Liability Discount Rate (and the Investment Rate of Return)

The actuarial liability discount rate assumption is closely related to the long-term (that is, 30-year) rate of return on pension plan assets. The liability discount rate is used to discount the value of projected contributions and projected benefits.

The concept of discounting is perhaps best understood by way of illustration. Consider the following question:

Who is older, person A, age 50 today, or person B, age 62 ten years from now?

We trust that you answered person B. You probably arrived at your answer by adding ten years to person A's age and comparing 60 with 62, or by subtracting ten years from person B's age, and comparing 50 with 52. In either case, you brought the data to a common date and then made your comparison. You intuitively understood the "time value of age."

The *time value of money* can be illustrated with a question:

Assuming that you have an investment fund that has an annual rate of return of 5.9%, which is worth more, \$100 today or \$115 three years from now?

Your intuition may have led you to select \$100, as you reasoned that even at simple interest, \$100 earning 5.9% per year adds \$17.70 in interest, and your investment grew to \$117.70 after three years.

Assuming compound returns, \$100 would become  $\$100 * 1.059 * 1.059 * 1.059 = \$118.76$

Again, you likely brought the data to a common date and made your comparison. Perhaps in this case you were more likely to bring the \$100 forward in time (accumulating) than you were to bring the \$115 backward in time (discounting), but the idea was the same.

To solve the problem by discounting, you would divide the \$115 by 1.059 three times to compare to the \$100 today.

$$\$115 / (1.059 * 1.059 * 1.059) = \$96.83$$

So, \$100 today is more valuable than \$115 three years from now.

These calculations illustrate the concept of the "time value of money." Note, however, that the answer would have been different if your investment returned only 4% annually.

The liability discount rate assumption is used to discount projected cash flows to a valuation date. If the assumption is too optimistic, then there will be more investment losses than gains, and contributions to the fund will be less timely. If the assumption is too pessimistic, then there will be more investment gains than losses and contributions to the fund will be front-loaded.

Historically, NYSLRS' returns by fiscal year (since 1981, the first year of serious commitment to equities) are as follows:

Year	Return	Year	Return	Year	Return	Year	Return	Year	Return
81	16.7%	91	11.7%	01	-8.7%	11	14.6%	21	33.6%
82	3.3%	92	10.7%	02	2.8%	12	6.0%	22	9.5%
83	21.4%	93	12.5%	03	-10.2%	13	10.4%	23	-4.4%
84	7.9%	94	6.9%	04	28.8%	14	13.0%	24	11.7%
85	13.7%	95	8.8%	05	8.5%	15	7.2%		
86	24.0%	96	21.8%	06	14.6%	16	0.2%		
87	17.8%	97	10.9%	07	12.6%	17	11.5%		
88	1.6%	98	30.4%	08	2.6%	18	11.4%		
89	13.4%	99	8.8%	09	-26.4%	19	5.2%		
90	13.9%	00	17.8%	10	25.9%	20	-2.7%		

This produces the following time-weighted annualized returns (gross of expenses) after consideration of benefits paid and contributions collected throughout each fiscal year:

Period ending March 31, 2024	Annualized Return
4 year	12.5%
5 year	8.6%
10 year	7.6%
15 year	10.0%
20 year	7.2%
25 year	6.6%
30 year	8.6%
35 year	9.2%
40 year	9.8%

In addition to past experience, consideration is given to methods that forecast asset returns.



The Comptroller, as the trustee of the CRF, establishes the AA Policy. A portfolio’s AA Policy is the single most important factor in establishing the fund’s long-term rate of return. Pursuing higher returns requires more risk (volatility in returns year over year), which triggers volatility in employer contribution rates (potentially putting stress on municipal budgets). In this way, establishing the AA Policy allows the Comptroller to set the risk appetite for PICM and define the level of volatility expected in employer billing rates.

The last trustee-approved AA Policy was issued February 1, 2024 and is based on especially robust analysis by PICM and RVK (the investment consultant for NYSLRS since 2010). The AA Policy reflects the following risk (*standard deviation*) and reward (*arithmetic return*) relationship by asset class.

<b>Asset Class</b>	<b>(A) Allocation</b>	<b>(B) Arithmetic Return Assumption</b>	<b>Standard Deviation Assumption</b>	<b>(A) * (B)</b>
Broad US Equity	25%	6.80%	16.10%	1.700%
Broad International Equity	14	9.35	18.70	1.309
US Agg Fixed Income	22	4.00	5.00	0.880
CRF Credit	4	7.93	12.45	0.317
Core Real Estate	12	7.10	16.32	0.852
CRF Private Equity	15	10.00	20.00	1.500
CRF Opportunistic	3	7.88	14.32	0.236
CRF Real Assets	4	8.34	17.01	0.334
Cash Equivalents	1	2.50	2.00	0.025
<b>Expected Arithmetic Return</b>				<b>7.153%</b>

The capital market assumptions used in the report are applicable to a 10-year time frame and are net of investment fees and expenses.

The expected arithmetic return for this portfolio is 7.15% (previously 6.76%), with a standard deviation of 10.89%, for a geometric return of 6.60% (previously 6.07%). A discussion of arithmetic returns versus geometric returns can be found later in this report (see *Sidebar: Understanding the difference between Arithmetic Return and Geometric Return* in Appendix D).

This represents a bold increase in the forecasted returns over the next 10 years. But it will take approximately 5 years for the asset portfolio to conform with the new AA Policy. During that time, the CRF will transition away from the 2020 asset allocation, which, when combined with the updated capital market assumptions, suggests an arithmetic return is 6.97% and geometric return is 6.40%.

Beyond the AA Policy and the capital market assumptions, additional considerations apply in selecting a liability discount rate, including the maturity and cashflow needs of the pension plan, as well as the potential to worsen the credit risk of participating employers.

For funding purposes, the liability discount rate is applied in a geometric manner. To sustain this discount rate, the investments must earn a return close to the arithmetic return. Why? NYSLRS has a strongly negative net cashflow (benefit payments are nearly triple employer contributions), meaning that investment earnings are used to pay benefits and are not reinvested. The portion of investment earnings that are used to pay benefits do not get compounded. This inhibits the fund's ability to rebound from a market downturn. To mitigate the funding risk posed by a strongly negative annual cashflow, it is appropriate to use a liability discount rate that is lower than the geometric returns projected under the AA Policy and capital market assumptions.

The Risk Disclosure section of this report includes additional details regarding volatility in employer billing rates. For a credit rating perspective, we can look to the funding guidelines published by S&P Global Ratings. Credit rating agencies review the financial health of public entities, including states and municipalities. Like an individual's credit score, a credit rating agency's analysis of a public entity will affect the cost of issuing debt and may limit the ability to borrow altogether (for example, the interest rate paid on municipal bonds). This can have serious consequences that impact the financial health of the public entity for a prolonged period.

One consideration of S&P Global Ratings is the discount rate used to value pension plan liabilities. The guidance expects the assumption:

- To not exceed 6.0% based on current market conditions for a typical public pension plan,
- To reflect realistic performance of the target investment portfolio, and
- To be cognizant of the level of budgetary stress the participating employers can withstand.

In light of these considerations (the 10-year PICM projections and other capital market assumptions, the implications of maturity and net cashflows, and the credit rating guidance), I consider the recommended assumption within a reasonable range.

Currently, the liability discount rate assumption is 5.9%.

**I recommend maintaining the current liability discount rate assumption of 5.9%, which will be used to discount future projected contributions and benefits.**

The data below is taken from the National Association of State Retirement Administrators (NASRA) and represents the investment return assumption distribution for public systems in their database. Investment portfolios vary significantly from one system to another, making it impractical to rely upon the assumptions used by other systems. But a comparison to other systems can serve as a reasonability check or reveal trends across the larger group.

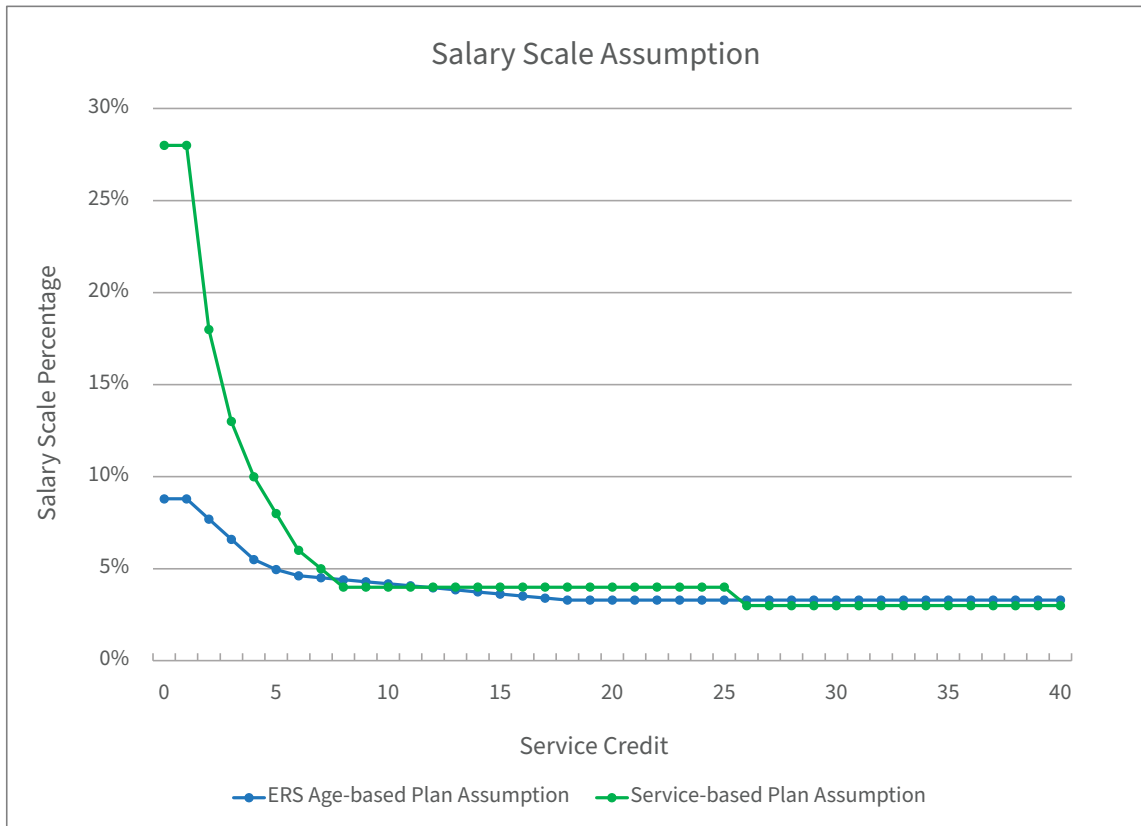
Investment Return Assumption	Number of Public Systems			
	July 2024	July 2020	May 2015	March 2010
< 6.00	* 3 *	2	4	0
6.00	2			
6.01 – 6.49	6			
6.50	12	5	* 43 *	1
6.51-6.99	25	* 17 *		
7.00	54	32	36	21
7.01-7.49	26	38		
7.50	3	26		
7.51-7.99	0	7	34	16
8.00	0	3	3	* 51 *
8.01-8.49	0	0	2	16
8.50	0	0		19
Median	7.00%	7.25%	7.75%	7.97%
* NYSLRS *	5.90%	6.80%	7.50%	8.00%

This table shows that there has been a steady shift downward over the past fifteen years.

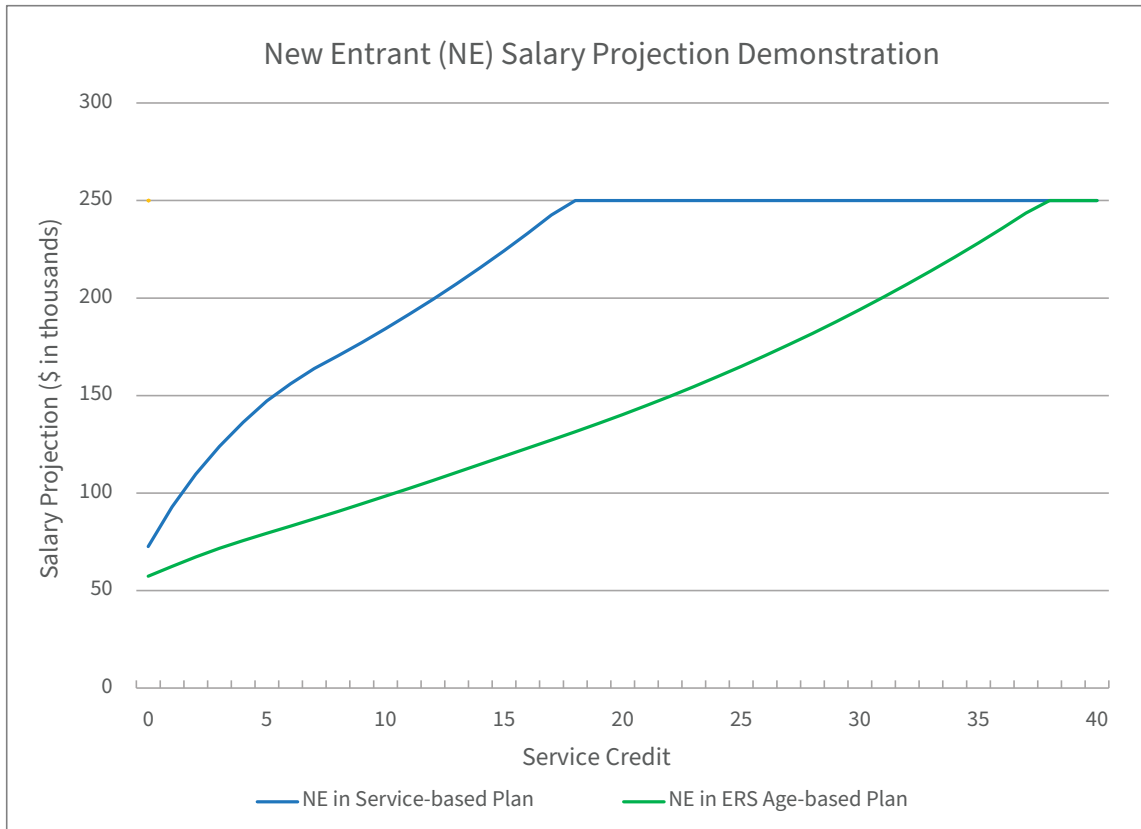
## Salary Scales

The purpose of the salary scale assumption is to project future billable salary and estimate a member's FAS and future benefits.

There are two salary scale assumptions. The first applies to ERS members who must attain age 55 to be eligible for a service retirement benefit (called an age-based plan), and the second applies to everyone else, including all PFRS members and ERS members who become retirement eligible upon attaining 20 or 25 years of service credit (called a service-based plan). In both cases, the salary scale factor varies by service credit. The current assumption is illustrated in the graph below.



Notice that salary increases are very high for new entrants with little service credit, dropping off rather quickly over 8 years and stabilizing through retirement. The assumptions are intentionally simplistic, intended to predict the salary of the cohort, not any one individual. Predicting the general trajectory of pensionable earnings will result in accurate estimates of billable salary and average benefits for similarly positioned members at retirement. Additional granularity does not materially change results.



The ERS age-based plan assumptions reflect members’ experience for the 5-year period ending 3/31/2021. (The ERS salary scale assumption was adopted with the valuation dated April 1, 2018<sup>1</sup> and is reasonably consistent with the more recent 5-year experience ending 3/31/2021.) The service-based plan assumptions reflect the PFRS members’ experience for the 10-year period ending 3/31/2021. A longer lookback was necessary for service-based plans because of limited exposure. (The ERS service-based plan experience was not used to set the assumption given the volatility caused by sporadic contract settlements.)

Experience over the past four years has been erratic, likely owed to disruptions due to COVID where accelerated retirements and diminished hiring created pent-up demand for new hires, now driving a strong labor market. Add to this an increased rate of inflation, and we see all elements of the salary scale building blocks increasing.

<sup>1</sup> The salary scale set with the 4/1/2018 valuation is equal to a 10% increase of the experience measured over the 5-year period ending 3/31/2015.

Fiscal Year Ending	ERS			PFRS			The Fed Median Wage Growth (Full-time)
	Actual	Expected	A/E	Actual	Expected	A/E	
2021	2.301%	4.484%	0.513	3.971%	5.865%	0.677	3.5%
2022	7.571%	4.356%	1.738	8.532%	5.570%	1.532	4.8%
2023	6.183%	4.343%	1.424	8.542%	5.612%	1.522	6.4%
2024 <sup>2</sup>	5.316%	4.392%	1.210	9.061%	5.760%	1.573	5.2% <sup>3</sup>
<b>Combined 2021 - 2024</b>	<b>5.316%</b>	<b>4.394%</b>	<b>1.210</b>	<b>7.563%</b>	<b>5.703%</b>	<b>1.326</b>	<b>5.0%</b>

When salary grows faster than assumed (an A/E ratio greater than 1.000), projected benefits will grow faster than projections in billable salary. This will create upward pressure on billing rates.

In addition to recent experience, consideration is given to recent contract settlements. The State of New York represents approximately 40% of all billable salary in ERS. While there are many different collective bargaining units, the majority of NYS employees are represented by the Civil Service Employees Association (CSEA), and the Public Employees Federation (PEF). Existing collective bargaining agreements and pay legislation provide prospective salary increases.

Date Ratified	CSEA	PEF
	June 2022	July 2023
Increase effective FYB 2023	3%	3%
Increase effective FYB 2024	3%	3%
Increase effective FYB 2025	3%	3%

While this may seem to suggest that a salary scale of just 3% is more suitable for ERS, the salary scale is not limited to increases in base pay. For example, promotions and “steps” (automatic pay increases after assuming a higher-level position at a hiring rate) will cause an individual’s salary to increase beyond the fixed 3% negotiated in employment contracts.

There is evidence that the salary scale assumption is understated, likely a consequence of higher rates of inflation and a strong labor market. A revision this year is unnecessary; to the extent that near-term salary increases exceed expectations next year, there will be additional upward pressure on the billing rates in the form of actuarial losses. Changing the assumption now would simply accelerate that outcome by one year. An additional year of experience will help to determine whether the strong salary growth experienced over the past few years is likely to continue prospectively.

**Therefore, I recommend maintaining the salary scale assumptions,** mindful that the salary scale assumptions may need to be increased next year, in keeping with the quinquennial cycle.

<sup>2</sup> When year-over-year salary increases are limited to 14%, which is intended to prevent the consideration of large retroactive salary increases. This cap is only applied if a member has more than 10 years of service credit.

<sup>3</sup> As of the writing of this report, the Bureau of Labor Statistics and the Federal Bank of Atlanta Calculations has not released the April 1, 2024 median wage growth for full-time workers as they work to ensure the accuracy of the results following the implementation of changes to the 2023 Current Population Survey Public Use File. This report used the March 1, 2024 statistic as a proxy.

# Asset Valuation Method

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Pension fund managers could direct all assets to be invested in a fixed income portfolio. While this would greatly reduce investment income volatility, it would also increase the expected employer contribution rates.

In general, one expects to profit more as an owner (that is, an investor in equities) than as a lender (that is, an investor in bonds), especially if the equity ownership can be diversified and held. Thus, pension funds invest in equity index funds. Unfortunately, this introduces volatility in investment income.

The following basic equation governs pension funding:  $C + I = B + E$

where,     C = Contributions (both employer and employee)  
              I = Investment income  
              B = Benefits  
              E = Expenses

In NYSLRS, administrative expenses are funded independently of the benefits.

The basic funding equation highlights the fact that volatility in investment income translates into volatility in employer contributions. The right side of the equation (benefits plus expenses) is highly predictable and, barring a major change in assumptions, fluctuates little year over year. Employee contributions are defined in law and are therefore predictable year over year. As a result, any volatility in investment income is countered by a change in future employer contributions.

Asset valuation methods “smooth” the investment income volatility by phasing in both “unexpected” gains and “unexpected” losses. The amount deemed “unexpected” and the period of smoothing are defined by the method.

NYSLRS’ asset valuation method was revised in 2022 and has the following features:

1. Expects a gain of the assumed rate of return on the plan net position and fiscal year cash flows,
2. Recognizes (smooth) the unexpected gain (= actual gain – expected gain) over 8 years in equal annual portions,
3. Does not apply a market value corridor.

A market value corridor would require the Actuarial Value of Assets (AVA) to remain within a certain range around the Market Value of Assets (MVA). This can generate increased employer contribution requirements after experiencing market losses, and reduced employer contribution requirements after experiencing market gains. That is, it reinforces contribution rates that are cyclical with investment markets, giving rate relief when least necessary and rate increases when least affordable. This conflicts with the System’s objective of smooth employer contribution rates.

**I recommend that we maintain the current asset valuation method.**

The table below provides a summary of key values related to the Asset Smoothing Method and metrics related to funding progress. Definitions are provided below the table.

**Market Value of Assets (MVA) vs. Actuarial Value of Assets (AVA)**

FY	MVA <sup>a</sup>	AVA	AL <sub>EAN</sub>	UAL <sub>EAN</sub>	Roll-forward TPL <sub>EAN</sub>	GASB 67 Ratio
2015	\$ 189.3	\$ 184.2	\$ 196.5	\$ 12.4	\$ 193.1	98.0%
2016	183.5	190.6	203.0	12.4	202.7	90.6
2017	197.5	198.0	210.1	12.1	209.1	94.5
2018	212.0	206.7	217.6	10.9	216.3	98.0
2019	215.2	212.8	224.0	11.2	223.9	96.1
2020	198.1	214.1	231.9	17.8	229.9	86.2
2021 <sup>b</sup>	260.1	260.1	260.4	0.3	237.9 261.9	99.3
2022	273.7	267.2	270.9	2.8	266.1	102.9
2023	249.5	269.6	281.1	11.5	276.5	90.3
2024	\$ 267.4	\$ 272.1	\$ 290.3	\$ 18.1	286.8	93.2%
2025					\$ 296.3	

<sup>a</sup> Financial Statement Plan Net Position (that is, Invested Assets + Receivables)

<sup>b</sup> The market restart led to recomputing the TPL<sub>EAN</sub> under new assumptions.

**Accrued Liability under the Entry Age Normal actuarial funding method (AL<sub>EAN</sub>)**

The Present Value of Future Benefits (PVFB) is the current cost of the ultimate benefit payable. The PVFB can be split into the part earned to date and the part expected to be earned in the future. The accrued liability is the part of the PVFB earned as of the valuation date. That is, the “past cost” of the benefit promise.

The actuarial funding method decides what portion of the PVFB is a “past cost” and what portion is a “future cost.” The entry age normal method allocates the PVFB on a level basis over the member’s career (from entry age through assumed exit age). As a member collects salary, the benefit is accrued and the PVFB shifts from a “future cost” to a “past cost.” When the member leaves active employment and a benefit is payable, the PVFB is fully accrued and therefore equal to the AL.

Put simply, the AL<sub>EAN</sub> is a measure of the pension benefits earned by members and retirees as of the valuation date.

**Unfunded Accrued Liability under the Entry age Normal actuarial funding method (UAL<sub>EAN</sub>)**

The unfunded accrued liability is the portion of the system accrued liability that is not covered by current Actuarial Value of Assets. Therefore, UAL<sub>EAN</sub> = AL<sub>EAN</sub> – AVA.



### **Total Pension Liability under the Entry age Normal actuarial funding method ( $TPL_{EAN}$ )**

The total pension liability is the sum of all accrued liabilities (for active members and those collecting benefits) plus certain dedicated liabilities. This value is rolled forward from the prior year valuation to allow auditors time to review the calculation.

### **Governmental Accounting Standards Board Statement No. 67 Ratio (GASB 67 Ratio)**

GASB 67 amended GASB 27, changing financial reporting required by public pension plans. The GASB 67 Ratio was first reported for the fiscal year ending 2015 and is equal to the plan net position (equal to the MVA) divided by the total pension liability. Therefore,  $GASB\ 67\ Ratio = MVA / TPL_{EAN}$ .

# Demographic Assumptions

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Demographic assumptions include retiree mortality, retiree mortality improvement, and assumptions estimating the method and timing of an active member separating from service (called active member *decrements*). While demographic assumptions are forward looking, they are generally best estimated by recent experience of similarly positioned individuals.

What is meant by *similarly positioned individuals*?

The type of work performed by civil servants can vary widely. The careers of firefighters, correction officers, and clerks are not likely to mirror one another. When evaluating relevant experience, consideration must be given to differences in job duties and plan provisions. Accordingly, it is preferable to set assumptions based on specific retiree and member cohorts rather than to rely upon the experience of non-participants (such as Social Security recipients or the Bureau of Labor Statistics workforce measurements).

What is meant by *recent experience*?

Member behavior is influenced by outside forces, such as legislative decisions (for example, retirement incentives) and economic forces (such as opportunities in the private sector). As conditions change, so will member behavior and demographic experience. Generally, the more recent the experience, the more reliable in predicting future experience.

However, COVID fueled a particularly intense collection of outside forces. The workplace was in a state of flux, responding to societal changes, law changes, and the impact of unique economic conditions on the labor markets. As a result, COVID has developed a challenging environment for assumption setting.

Ultimately, the recent COVID experience may not prove predictive of the future.

The accuracy of demographic assumptions in predicting actual experience is evaluated annually by conducting an *experience study*. Ideally, the ratio of “actual to expected” (called an A/E ratio) is close to 1.000. A large divergence suggests the assumptions are not closely predicting experience. As a result, actuarial gains or losses could lead to fluctuation in the annual billing rates, especially when assumptions are updated.

## Retiree Mortality Experience

The most significant demographic assumption is retiree mortality. Our retiree mortality tables are not developed on a “by-number” basis, but on a “by-liability” basis.

For example, a retiree mortality rate of 1% for age 65 retirees does not mean that we expect 1 in every 100 age 65 retirees to expire within the year, rather it means that we expect \$1 in every \$100 age 65 retiree liabilities to expire within a year.

The *by-liability* method is preferred over the *by-number* method because the valuation is concerned with the cessation of benefit obligations, not necessarily the cessation of benefit recipients. Generally, mortality by number and mortality by liability should be roughly equivalent. However, experience studies have shown that retirees with more lucrative benefits enjoy better longevity than those with lesser benefits. Thus, mortality by number would undervalue the present value of future benefits.

Currently, the retiree mortality assumption is based on NYSLRS’ retiree experience from April 1, 2015 through March 31, 2020 with mortality improvement under the SOA’s MP-2021 scale. Historically, retiree mortality experience was determined to be best reflected by the recent experience of NYSLRS retirees. And this is still true, in general. However, recent COVID experience may present challenges.

As of July 19, 2023, the World Health Organization estimated that COVID resulted in 340 deaths per 100,000 people in the United States, or an excess mortality rate of approximately 0.34% over nearly 3.5 years. This is estimated to be an annual mortality rate of 0.10%. For New York State, which represented 7.2% of COVID deaths but only 6% of the US population, the excess mortality rate is closer to 0.12% ( $\approx 0.1\% * 7.2\%/6.0\%$ ). This is reflected in NYSLRS’ retiree mortality experience measured between April 1, 2020 and March 31, 2023, where our retiree members and beneficiaries experienced excess mortality of approximately 0.15%.

In 2024, the number of retiree deaths fell short of the actuarial expectation. This partially reverses the excess deaths measured over the first three years of the quinquennial experience period.

Retiree Deaths <sup>4</sup>	FYE 2024			FYE 2021 – FYE 2024		
	Actual	Expected	A/E	Actual	Expected	A/E
ERS Service (Males)	155.764	160.577	0.970	624.467	596.351	1.047
ERS Service (Females)	105.403	107.764	0.978	419.786	395.569	1.061
ERS Disability	13.396	13.446	0.996	55.023	52.061	1.057
PFRS All Plans	32.085	33.913	0.946	124.335	123.569	1.006
ERS & PFRS Beneficiaries	21.768	26.141	0.833	89.543	94.558	0.947
<b>All Retiree Mortality</b>	<b>328.417</b>	<b>341.840</b>	<b>0.961</b>	<b>1,313.154</b>	<b>1,262.109</b>	<b>1.040</b>

<sup>4</sup> Retiree Mortality is studied in 10 groupings (ERS service retirees are grouped by sex identification and collar color, ERS disability retirees are grouped by sex identification, PFRS retirees are grouped by retirement type, and beneficiaries are grouped by sex identification) but these groups are combined for display purposes in this table.

The A/E for All Retiree Mortality over the four-year period is 1.040 (down from 1.070 last year), which implies actual mortality is 4% higher than the base mortality assumption predicted.

For setting assumptions, the question becomes: does mortality experience over the past four years represent a material change in prospective mortality? The answer is no. The extreme nature of COVID is not permanent, as evidenced by the success of vaccines and the steady decline in COVID deaths. Therefore, updating the retiree mortality assumptions based upon NYSLRS' more recent 4-year experience period is not appropriate.

A logical follow-up question might be: if adjustments were applied to the recent experience, would it better reflect prospective mortality than the current assumption, based on NYSLRS' FYE 2016 – FYE 2020 experience study? There is still much debate about how COVID has impacted future mortality rates. For example:

1. **IF** COVID becomes a second “flu-like” disease, persistently adding additional deaths **THEN** mortality might be higher than pre-COVID experience (but still not so extreme as the April 1, 2020 – March 31, 2023 experience).
2. **IF** COVID accelerated deaths by one or two years **THEN** mortality might be lower than pre-COVID experience for a short time before returning to pre-COVID experience.
3. **IF** COVID deaths disproportionately impacted those with a shorter life expectancy **THEN** mortality might be lower than pre-COVID experience as survivors express superior longevity.

Regardless of which theory is preferred, there is general agreement that more time is needed before drawing conclusions.

**Therefore, I recommend maintaining the retiree mortality assumption, which is based on NYSLRS' retiree experience beginning April 1, 2015 and ending March 31, 2020.**

## Retiree Mortality Improvement Assumption

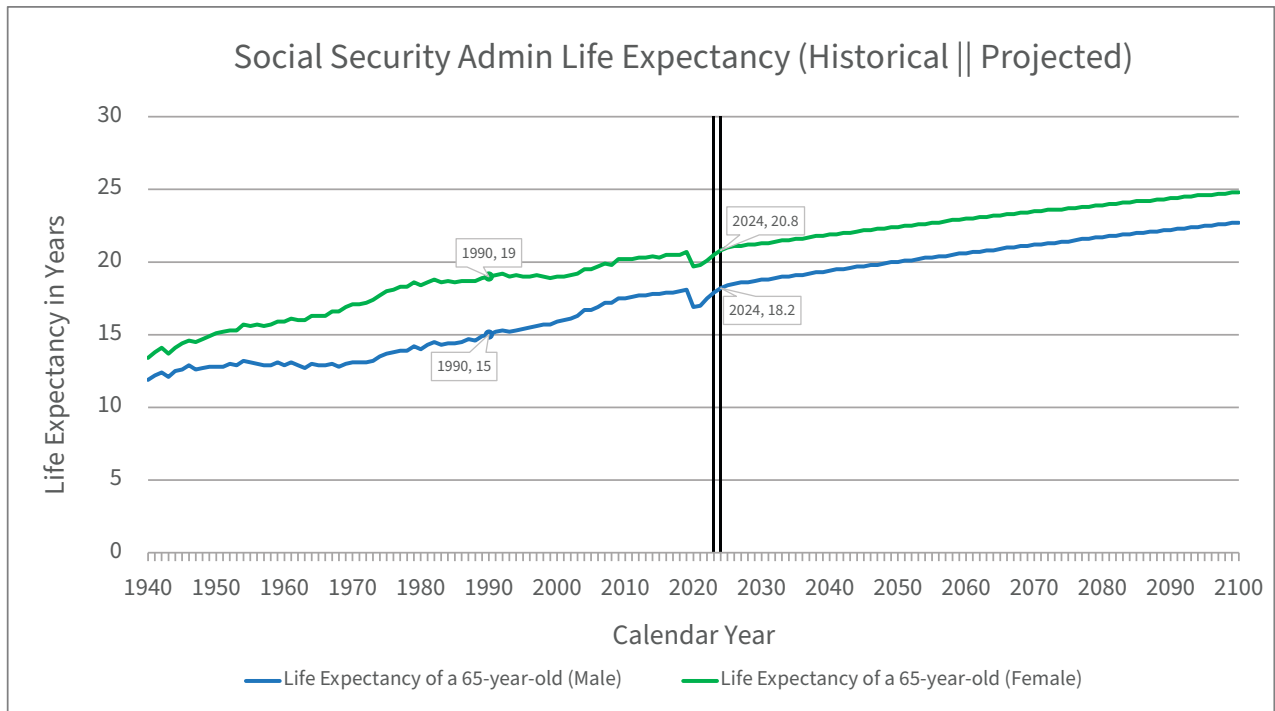
A second feature of the retiree mortality assumption is the inclusion of a projection regarding mortality improvement. The interaction of the (static) mortality assumption and the mortality improvement assumption is best demonstrated with real-world context.

Pretend it is 1990. How long do we expect a 65-year-old to live? Well, the Social Security Administration estimated life expectancy was 15 years for a male and 19 years for a female.

Fast forward to 2020 and ignore the potential bias from COVID. Do we expect a 65-year-old to live longer? It is generally agreed that the medical advancements of the past thirty years have resulted in longer life expectancy, including dramatic improvements in heart disease, reduced rates of tobacco use, and improvements in vehicular safety.

But in 1990, to calculate the future retirement benefit payable, the Actuary needed to estimate the life expectancy of a 65-year-old (newly retired, perhaps) and the 35-year-old (newly hired, perhaps) who would be 65 in 2020. To do this, a mortality improvement factor is applied.

Without a mortality improvement assumption, the life expectancy of all 65-year-olds would be the same, regardless of when the person turns 65. The mortality improvement assumption essentially says, “given two people survive to age 65, the person that was born later in time will survive longer.”



The guidance issued by S&P Global Ratings suggests the use of an up-to-date generational improvement projection, citing that the incremental updates possible with generational scales minimize the impact on employer billing rates.

The debate about how COVID will impact future mortality experience is also fundamental to the mortality improvement assumption. Currently, NYSLRS relies upon a mortality improvement scale developed by the Society of Actuaries denoted MP-2021, which is developed by the Retirement Plans Experience Committee (RPEC). RPEC has not issued an updated MP scale since 2021 because the COVID experience generated illogical results when included in the model. RPEC's official statement said:

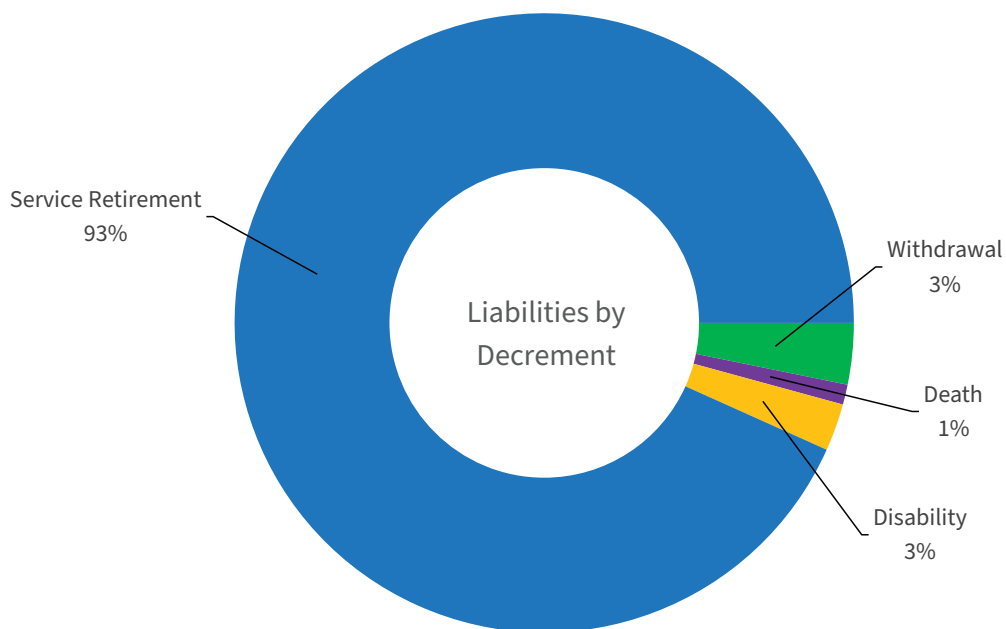
*“The committee does not believe it would be appropriate to incorporate, without adjustment, the substantially higher rates of mortality experience from 2020 into the graduation and projection models used by RPEC to forecast future mortality...adjusting the experience data to give reduced or no weight to deaths specifically identified as caused by COVID-19, even if possible from the underlying datasets, would not completely adjust for the indirect impact of the pandemic on other causes of death nor reflect any potential mis-reporting of COVID-19 deaths as other causes.”*

So, the current generational mortality improvement assumption is the most recent.

**Therefore, I recommend maintaining the mortality improvement assumption, which is the Society of Actuaries' Mortality Projection Scale MP-2021.**

## Active Member Experience

Active Members separate from service in one of four ways: withdrawal, death, disablement, or retirement. These are called *decrements*. Whenever a member separates from service, they are entitled to a benefit from NYSLRS. Sometimes the benefit is simply a return of member contributions, other times a lump sum payment. In most cases, a monthly benefit is paid for life (called an annuity). The benefit amount and form of payment are defined in the Retirement and Social Security Law, but will vary by plan, service, and salary.



Assumptions are needed to estimate the timing and type of benefit payable under each decrement. Like retiree deaths, an annual experience study is conducted to compare the fiscal year experience to the assumptions. Unlike retiree mortality, this experience study is done on a by-number basis. That is, the number of people (not dollars) are counted.

Active member decrements were determined to be best reflected by the recent experience of NYSLRS retirees. While this is still true, recent COVID experience may present challenges.

While the past four years of experience diverge significantly from the assumptions, this does not in itself motivate a change to the current assumption sets. As with retiree mortality, the COVID experience may not be a reliable predictor of the future.

**I recommend maintaining the active member decrement assumptions, which are based on NYSLRS' active member experience from April 1, 2015 through March 31, 2020.**

A review of each active member decrement experience follows. Ideally, the ratio of “actual to expected” is close to 1.000. A large divergence suggests the assumptions are not closely predicting experience. As a result, actuarial gains/losses could lead to fluctuation in the annual billing rates, especially when assumptions are updated.

**Withdrawals**

When a member withdraws from active service, the form of benefit depends upon the service credit accrued. If less than 5 years, the member is not vested, and the benefit is a return of the member’s contributions. If more than 10 years, the member is vested, and the benefit is a deferred annuity benefit payable after attaining age 55. A member with service credit between 5 and 10 years is allowed to choose either the non-vested benefit or the vested benefit.

Generally, when members withdraw, actuarial gains apply downward pressure on the billing rates. As shown in the table below, NYSLRS members are withdrawing at greater rates than expected.

Withdrawals <sup>5</sup>	FYE 2024				FYE 2021 – FYE 2024			
	Exposures	Actual	Expected	A/E	Exposures	Actual	Expected	A/E
ERS Regular Plans	336,843	34,932	22,314	1.565	1,216,118	124,211	71,881	1.728
PFRS All Plans	25,487	636	333	1.907	93,550	2,049	1,031	1.987

Chapter 56 of the Laws of 2022 changed Tiers 5 and 6 from 10-year vesting to 5-year vesting. The April 1, 2022 Actuarial Valuation revised Tiers 5 and 6 withdrawal assumptions to match earlier tiers.

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<sup>5</sup> Rates of withdrawal for ERS regular plans are defined by age and service credit while assumptions for PFRS plans are defined by service credit. To summarize experience, similar groups are combined.



## Active Member Deaths

When an active member dies, a benefit is payable to a named beneficiary or a statutory beneficiary (spouse, child(ren), dependent parents). Ordinary death benefits are payable as a lump sum while accidental death benefits are often payable for the life of the beneficiary.

Excess deaths can result in downward pressure on the billing rates. Like retiree mortality, active member deaths have exceeded expectations, as shown in the table below.

Active Member Deaths <sup>6</sup>	FYE 2024				FYE 2021 – FYE 2024			
	Exposures	Actual	Expected	A/E	Exposures	Actual	Expected	A/E
ERS	431,008	538	591	0.910	1,615,658	2,683	2,306	1.163
PFRS	31,587	17	14	1.227	120,312	88	56	1.580

## Disability Retirements

When an active member becomes permanently disabled, typically annuity (lifetime) benefits become payable. There are three types of disability, although not all plans provide all three types. An accidental disability generally requires a *sudden, fortuitous mischance, out of the ordinary and injurious on impact*. An injury emanating from risks inherent in an employee’s regular duties does not constitute an accident but may suffice for a disability in the performance of duty (POD). An ordinary disability benefit is payable after a member attains 10 years of service credit.

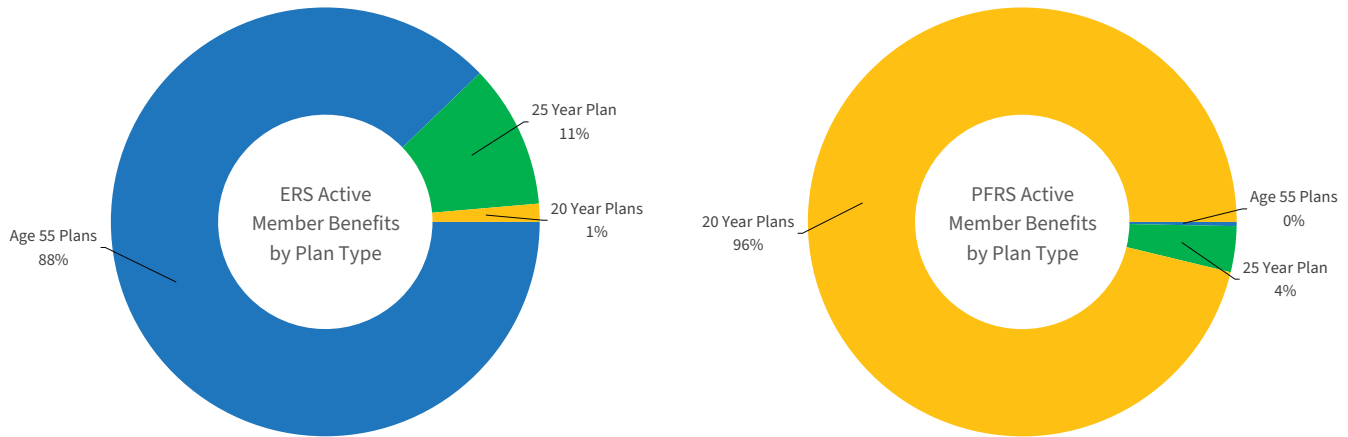
Disability Retirements		FYE 2024				FYE 2021 – FYE 2024			
		Exposures	Actual	Expected	A/E	Exposures	Actual	Expected	A/E
ERS	Accidental	233,787	1	5	0.187	795,148	1	20	0.051
	Ordinary	100,686	34	185	0.184	417,776	130	778	0.167
PFRS	Accidental	31,587	106	46	2.289	120,312	278	193	1.441
	Ordinary	10,354	5	2	2.031	41,687	15	10	1.492
	POD	31,587	87	46	1.879	120,312	208	193	1.078

Chapter 55 of the Laws of 2023, Part LL, allows accidental disability benefits to be paid to certain ERS members and all PFRS members when the disability is caused by diseases of the heart, even if the definition of an accident has not been met.

<sup>6</sup> Active member deaths are studied in four groupings (ERS Accidental, ERS Ordinary, PFRS Accidental, and PFRS Ordinary) with assumptions defined by age. To summarize system-level mortality experience, the different benefit types are combined.

## Service Retirements

When a member does not withdraw, die, or become disabled, they file for a service retirement benefit. Service retirement benefits represent approximately 93% of all active member liabilities making these the most important active member assumptions. There are a variety of different assumptions based on plan provisions (such as 20-year plans, 25-year plans, and provisions for additional accruals after initial eligibility) and population (such as public safety, correction officers, and others).



Service retirement benefits are most costly when members retire at first eligibility for an unreduced benefit. Therefore, actual service retirements exceeding expectations will create an upward pressure on billing rates. As shown in the table below, NYSLRS members are retiring at greater rates than expected.

Service Retirements <sup>7</sup>	FYE 2024				FYE 2021 – FYE 2024			
	Exposures	Actual	Expected	A/E	Exposures	Actual	Expected	A/E
ERS	96,432	15,618	12,647	1.235	410,327	70,970	53,665	1.322
PFRS	5,892	1,198	769	1.558	25,887	5,457	3,407	1.601

Service retirement experience for Tier 5 and 6 members lacks sufficient credibility to be used in defining tier-specific rates. Instead, adjustments are applied to the credible experience of earlier tiers to capture differences in plan provisions. These adjustments are detailed in Appendix C.

<sup>7</sup> Rates of service retirement for age-based plans are defined by age and attainment of service milestones (which occur upon attaining 20 years and 30 years of service credit) while assumptions for service-based plans are defined by service credit. To summarize system-level experience, different plans are combined.

# Effect on Contributions

The table below summarizes the projected average employer contribution rates for the most recent valuations.

Valuation 4/1	Local Employer Billing Date 2/1	ERS Avg Rate (reg plan GLIP)	PFRS Avg Rate (GLIP)	Employer Contributions/ FY Benefits (\$ billions)	CSP Mitigated Rates (does not apply to GLIP, strikethrough => no amortizing)				CSP Amort/ Reserve (billions)
					ERS		PFRS		
					Original	Alternate	Original	Alternate	
2009	2011	11.9 (0.4)	18.2 (0.1)	\$ 3.6 / 8.5	9.5%		17.5%		
2010	2012	16.3 (0.4)	21.6 (0.0)	4.9 / 8.9	10.5		18.5		
2011	2013	18.9 (0.4)	25.8 (0.1)	5.5 / 9.5	11.5		19.5		\$ 0.3
2012	2014	20.9 (0.4)	28.9 (0.0)	6.2 / 10.0	12.5	12.0%	20.5	20.0%	1.1
2013	2015	20.1 (0.4)	27.6 (0.1)	6.1 / 10.5	13.5	12.0	21.5	20.0	2.1
2014	2016	18.2 (0.5)	24.7 (0.0)	5.5 / 11.1	14.5	12.5	22.5	20.5	3.3
2015	2017	15.5 (0.4)	24.3 (0.0)	4.8 / 11.5	<del>15.1</del>	13.0	23.5	21.0	4.1
2016	2018	15.3 (0.4)	24.4 (0.1)	4.9 / 12.1	<del>14.9</del>	13.5	<del>24.3</del>	21.5	4.2
2017	2019	14.9 (0.5)	23.5 (0.0)	4.9 / 12.8	<del>14.4</del>	14.0	<del>23.5</del>	22.0	3.8 / 0.0
2018	2020	14.6 (0.4)	23.5 (0.0)	4.9 / 13.4	<del>14.2</del>	<del>14.2</del>	<del>23.5</del>	22.5	3.3 / 0.0
2019	2021	14.6 (0.5)	24.4 (0.0)	5.1 / 14.0	<del>14.1</del>	<del>14.1</del>	<del>24.4</del>	23.0	2.8 / 0.0
2020	2022	16.2 (0.4)	28.3 (0.0)	5.9 / 14.7	15.1	14.6	25.4	23.5	2.3 / 0.0
2021	2023	11.6 (0.2)	27.0 (0.0)	4.4 / 15.4	<del>14.1</del>	<del>14.1</del>	26.4	24.0	0.8 / 0.0
2022	2024	13.1 (0.7)	27.8 (0.1)	5.1 / 16.2	<del>13.1</del>	<del>13.6</del>	27.4	24.5	0.4 / 0.0
2023	2025	15.2 (0.4)	31.2 (0.1)	6.2 / 17.4	14.1	14.1	28.4	25.0	0.1 / 0.3
2024	2026	16.5 (0.4)	33.7 (0.0)	\$ 7.1 / 17.6	15.1%	14.6%	29.4%	25.5%	\$ 0.1 / 0.4

The new entrant rate for the:

- ERS A15 Tier 6 plan is 9.8% normal cost + 1.3% GLIP & Admin = 11.1% total rate
- ERS valuation cohort is 14.4% normal cost + 1.3% GLIP & Admin = 15.7% total rate
- PFRS 384D contrib Tier 6 plan is 20.3% normal cost + 0.7% GLIP & Admin = 21.0% total rate
- PFRS valuation cohort is 24.7% normal cost + 0.7% GLIP & Admin = 25.4% total rate

The March 31, 2024 Contribution Stabilization Program (CSP) amortization balance is \$100 million, all held by local employers, and a CSP reserve balance of \$400 million, with approximately \$300 million allocated to the State and \$100 million with local participating employers.

Employers participating in the CSP are always required to pay their graded rate (plus GLIP and amortization payments). For FYE 2026, the graded rate is less than the system average rate under both versions of the program and in both systems. This means all employers participating in the Original or Alternate CSP will be eligible to amortize a portion of their invoice. For employers that have a reserve fund balance, the amount eligible for amortization will first be paid using the reserve fund assets, which will reduce or eliminate the amortization and the resulting installment payments in future years. This amount is then applied to their invoice and reduces the total amount due.

## Gain/Loss Analysis

	ERS	PFRS
<b>2025 System Average Rate (Feb 1, 2025 Payment)</b>	<b>15.2%</b>	<b>31.2%</b>
<b>Changes Due to Gains/Losses In:</b>		
FYE 2024 Benefit Improvements	0.5%	0.8%
FYE 2022 Investment Performance (9.5% v 5.9%)	-0.3%	-0.3%
FYE 2023 Investment Performance (-4.4% v 5.9%)	1.1%	1.2%
FYE 2024 Investment Performance (11.6% v 5.9%)	-0.5%	-0.6%
FY Member Experience: Demographics	0.7%	1.4%
FY Member Experience: Salary	0.4%	1.3%
FY Retiree Experience: COLA	0.1%	0.0%
New Entrant	-0.6%	-1.1%
Administrative Contributions	0.0%	-0.2%
GLIP Contributions	-0.1%	-0.1%
Data Extraction Improvements	-0.2%	0.1%
Miscellaneous	0.2%	0.0%
<b>Net Change</b>	<b>1.3%</b>	<b>2.5%</b>
<b>2026 System Average Rate (Feb 1, 2026 Payment)</b>	<b>16.5%</b>	<b>33.7%</b>

The fiscal year ending 2024 was marked by Tier 6 benefit improvements, significant salary growth for active members, and demographic shifts, which collectively push the billing rates higher. Unexpected investment return is recognized evenly over 8 years, and the investment performance over the past three years, primarily FYE 2023, continues to apply modest upward pressure on the billing rates. New entrants continue to provide significant rate relief, although Tier 6 benefit improvements may temper the billing rate impact in future years.

# Summary of Assumptions and Methods

I recommend maintaining all assumptions used in the Actuarial Valuation dated April 1, 2023.

Major Assumption or Method	Last Changed in Valuation Dated	Assumption Recommended for the Actuarial Valuation dated April 1, 2024
Inflation	April 1, 2022	2.9%
Cost-of-Living Adjustment	April 1, 2022	1.5%
Investment Return	April 1, 2021	5.9%
PFRS Salary Scale	April 1, 2021	Based on System experience FYE 2012 – FYE 2021 (6.0% average expected for FYE 2024 cohort)
ERS Salary Scale	April 1, 2018	Based on System experience FYE 2016 – FYE 2018 (4.3% average expected for FYE 2024 cohort)
Asset Smoothing Method	April 1, 2022	8-year level smoothing of unexpected gain/(loss)
Retiree Mortality	April 1, 2020	Based on System experience FYE 2016 – FYE 2020
Mortality Improvement	April 1, 2022	Society of Actuaries’ MP-2021 (for retirees only)
Active Member Decrements	April 1, 2020	Based on System experience FYE 2016 – FYE 2020

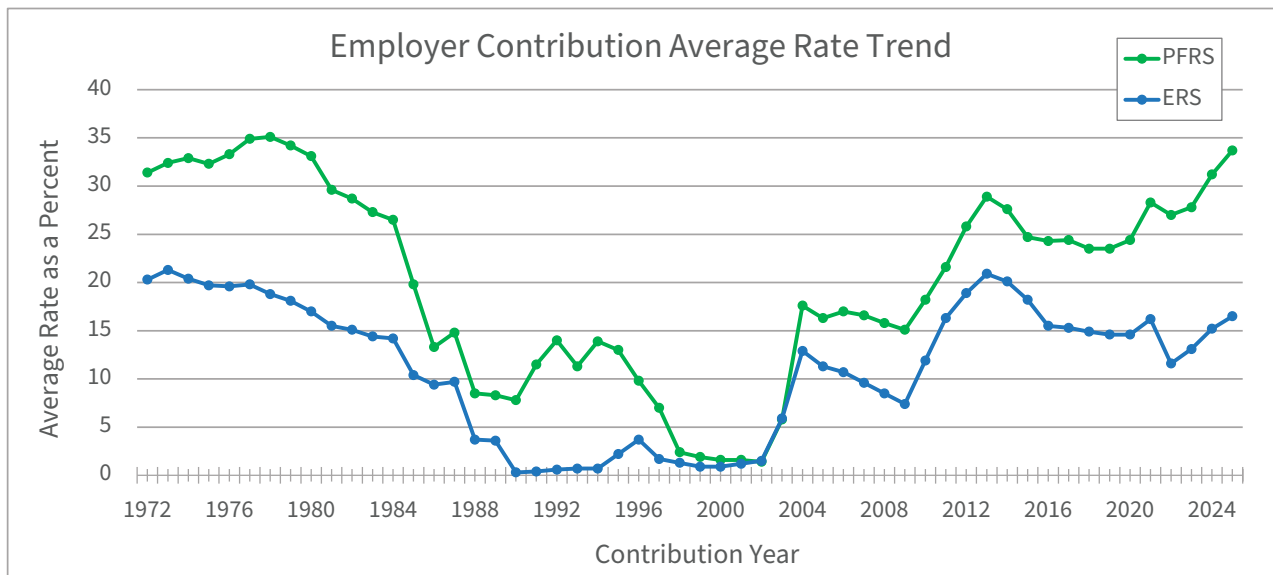
This recommendation was reviewed by the AAC in a meeting on August 8, 2024.

# Historic Employer Contribution Average Rate

Average Rate		
Year	ERS	PFRS
1972	21.9	28.8
1973	20.3	31.4
1974	21.3	32.4
1975	20.4	32.9
1976	19.7	32.3
1977	19.6	33.3
1978	19.8	34.9
1979	18.8	35.1
1980	18.1	34.2
1981	17.0	33.1
1982	15.5	29.6
1983	15.1	28.7
1984	14.4	27.3
1985	14.2	26.5
1986	10.4	19.8
1987	9.4	13.3
1988	9.7	14.8
1989	3.7	8.5
1990	3.6	8.3

Average Rate		
Year	ERS	PFRS
1991	0.3	7.8
1992	0.4	11.5
1993	0.6	14.0
1994	0.7	11.3
1995	0.7	13.9
1996	2.2	13.0
1997	3.7	9.8
1998	1.7	7.0
1999	1.3	2.4
2000	0.9	1.9
2001	0.9	1.6
2002	1.2	1.6
2003	1.5	1.4
2004	5.9	5.8
2005	12.9	17.6
2006	11.3	16.3
2007	10.7	17.0
2008	9.6	16.6
2009	8.5	15.8

Average Rate		
Year	ERS	PFRS
2010	7.4	15.1
2011	11.9	18.2
2012	16.3	21.6
2013	18.9	25.8
2014	20.9	28.9
2015	20.1	27.6
2016	18.2	24.7
2017	15.5	24.3
2018	15.3	24.4
2019	14.9	23.5
2020	14.6	23.5
2021	14.6	24.4
2022	16.2	28.3
2023	11.6	27.0
2024	13.1	27.8
2025	15.2	31.2
2026	16.5	33.7



## Risk Disclosures

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Why should a governmental entity take on defined benefit (DB) pension risk? DB plans are an economically efficient means of attracting and retaining employees. For example, in the matter of public safety, special plans that offer half-pay at 20 or 25 years of service will guarantee income in middle age when physicality may wane while tasks remain grueling. During their career, disability and death benefits provide income protection to those who risk their lives in service to the public.

Optimizing the economic efficiencies of a DB plan requires prefunding the benefit promises, ideally by way of smooth employer contribution rates. ASOP No. 51 (Assessment and Disclosure of Risk Associated with measuring Pension Obligations and Determining Pension Plan Contributions) requires assessment and disclosure of risks inherent in the funding of DB plans. The two primary forms of risk are:

- 1) Insufficient employer contributions to fund the benefits, and
- 2) Intolerable volatility in the employer contribution rate.



## Employer Contribution Sufficiency Risk

### Contribution Fulfillment Risk

In New York State, employers are required to pay the actuarially determined contribution. Employers who are delinquent are pursued and interest is charged on any late payments. Thus, there is very little risk that employer contributions will not be paid. This is the most significant component of a well-funded DB plan. Poorly funded DB plans invariably have a stretch of time when employer contributions are neglected.

### Actuarial Assumptions

Actuarial assumptions and methods determine the allocation of benefit costs over time; they do not, however, determine the ultimate benefit costs. The ultimate cost of benefits is based on the lucrativeness of the promises and the performance of the assets.

The expected long-term employer contribution rate is the rate that would be charged if all assumptions were met annually. As experience deviates from what was assumed, the employer contribution rates deviate from the expected long-term rate. When billing rates are greater than the expected long-term rates, the current taxpayer is funding benefits earned in prior years. When billing rates are less than the expected long-term rates, the current taxpayer is benefiting from contributions collected in prior years. The more conservative a set of assumptions, the more quickly contributions are collected, possibly levying too great a cost to current taxpayers. The less conservative a set of assumptions, the more likely contributions will increase, possibly levying too great a cost to future taxpayers. The best assumptions decrease the likelihood of deviations in one direction persisting over long periods. In so doing, governmental services are compensated by the taxpayers benefitting from those services (that is, there is intergenerational equity).

New York State Retirement and Social Security Law requires a review of all assumptions at least once every five years. To comply, NYSLRS undertakes a quinquennial comprehensive experience study with a reasonableness review every year. Any emerging trends that are believed to continue in the future may warrant an assumption adjustment between quinquennial studies. Assumptions are reviewed annually by the Comptroller's AAC and quinquennially by a consulting firm. The annual online publishing of the actuarial assumptions provides transparency to interested parties.

## Assumed Investment Return Expectation Risk

Employer contribution rates are most sensitive to the assumed investment return. The following table shows the FYE 2026 system average billing rates and April 1, 2024 total pension liability (actuarial accrued liability under the Entry Age Normal method + dedicated assets) for various assumed investment returns using the April 1, 2024 valuation cohort. The exceedance column shows the probability that the return on assets exceeds the assumed discount rate over a 30-year period. PICM completed a comprehensive asset/liability analysis resulting in a new AA Policy as of February 1, 2024. The probability of exceedance was determined using a stochastic model, which relied upon the new trustee-approved target asset allocation and PICM's updated capital market assumptions from 2023.

Assumed Rate	Employees' Retirement System		Police and Fire Retirement System		2024 CAPM Assumptions
	FYE 2026 System Average Billing Rate	April 1, 2024 TPL (\$ in billions)	FYE 2026 System Average Billing Rate	April 1, 2024 TPL (\$ in billions)	Probability of Assumed Rate Exceedance
3.90%	45.4%	\$307.8	73.2%	\$61.0	92.2%
4.40%	37.6%	\$289.3	62.4%	\$57.1	87.6%
4.90%	30.2%	\$272.5	52.3%	\$53.6	80.9%
5.40%	23.2%	\$257.1	42.7%	\$50.4	73.0%
<b>5.90%</b>	<b>16.5%</b>	<b>\$243.1</b>	<b>33.7%</b>	<b>\$47.5</b>	<b>63.6%</b>
6.90%	3.8%	\$218.4	17.0%	\$42.5	43.2%

ASOP No. 4 (Measuring Pension Obligations and Determining Pension Plan Costs or Contributions) requires disclosure of a Low-Default Risk Obligation Measure (LDRM). It represents the funding liability if the plan invested solely in high-quality bonds with cash flows matching future benefit payments. An all-bond investment strategy is approximated by an assumed rate of return of 3.9% resulting in a liability of approximately \$307.8 billion in ERS and \$61.0 billion in PFRS. Under the current assumed rate of return, which reflects the plan's diversified portfolio, the pension liability is approximately \$243.1 billion in ERS and \$47.5 in PFRS. The difference between these liability measures represents the expected tax savings due to investment in the plan's diversified portfolio instead of solely in high-quality bonds. If the plan switched to investing in high-quality bonds, the lower LDRM implies higher employer contribution rates. Unnecessarily high contribution rates in the near term may not be affordable and could jeopardize the sustainability of the DB plan.

## **Inflation and Salary Scale Expectation Risk**

The inflation assumption is used to compute COLA payments to retirees and beneficiaries. The COLA program provides payments equal to one-half of the inflation rate based on the first \$18,000 of the single life allowance. A floor of 1% and a cap of 3% reduces the risk of extreme gains or losses due to inflation being different than assumed.

The salary scale assumption is used to project future increases in a member's salary to estimate the FAS at retirement and determine the billable salary over a member's career. If members receive greater salary increases than assumed, greater benefits will be paid out in the future than expected, requiring an increase in employer contributions to make up for the shortfall. Salary increases being different from assumed typically comprise the largest component of gains and losses related to active members.

## **Demographic Expectation Risks**

Demographic assumptions estimate member behavior regarding decrements (that is, change in status) such as retiring, withdrawing or dying. Since NYSLRS is sufficiently large (over 1.2 million participants), these assumptions are developed with a high degree of credibility using NYSLRS' own experience. Actual/Expected (A/E) ratios are displayed earlier in this report to show how actual retiree mortality and active member decrements track expectations. Decrement vary within a relatively narrow range, so there is minor risk of significant gains or losses in this valuation component.

NYSLRS is not large enough to develop in-house mortality improvement assumptions and thus relies on mortality improvement scales based on nationwide experience derived from data collected from the Social Security Administration by the Society of Actuaries (SOA). This report recommends using scale MP-2021 for the April 1, 2024 valuation. Updated SOA tables gradually incorporate new data after decades of experience, and there is low risk of significant gains or losses in this valuation component.

## Employer Contribution Volatility Risk

### Investment Volatility Risk

Employer contribution rate smoothness is most sensitive to the investment return experience. We can evaluate exposure to investment volatility risk using the following Asset Leverage Ratio:

$$\text{Asset Leverage Ratio} = \frac{\text{Market Value of Assets (MVA)}}{\text{Present Value of Valuation Cohort Billable Salary (PVBS)}}$$

The following table displays the ratio and its components in the middle of the last four decades and for the most recent year (dollar amounts in billions).

	FYE	1985	1995	2005	2015	2024
<b>ERS</b>	MVA	\$22.8	\$53.3	\$108.7	\$161.2	\$226.0
	PVBS	\$102.0	\$158.2	\$176.1	\$203.1	\$298.1
	Asset Leverage Ratio	22%	34%	62%	79%	76%
	Smoothing Period	5	5	5	5	8
	Smoothed Asset Leverage Ratio	4.5%	6.7%	12.3%	15.9%	9.5%
<b>PFRS</b>	MVA	\$4.1	\$9.8	\$19.3	\$28.2	\$41.4
	PVBS	\$11.9	\$16.5	\$27.0	\$30.9	\$50.4
	Asset Leverage Ratio	34%	59%	71%	91%	82%
	Smoothing Period	5	5	5	5	8
	Smoothed Asset Leverage Ratio	6.9%	11.9%	14.3%	18.3%	10.3%

The ratio is zero at plan inception but increases as assets accumulate. Poor investment performance in a new plan is not problematic as there was not much asset value to lose and there was plenty of billable salary from which to collect contributions and accumulate assets before benefits become due. In a more mature fund with a high asset leverage ratio, investment volatility has a greater impact on the employer contribution rate. NYSLRS is now a mature plan with the associated significant exposure to investment volatility risk.

**Increasing Plan Maturity**

Pension plans mature slowly with a regular infusion of new entrants and the release of liabilities as retirees decrease. A pension plan becomes mature when those collecting a benefit (retirees) outweigh those contributing to the plan (active members). The following ratio of the retiree actuarial accrued liability to total actuarial accrued liability shows the scales tipping in favor of the retiree population.

**Ratio of Inactive Liability to Total Accrued Liability by Fiscal Year**

<b>FYE</b>	<b>1985</b>	<b>1995</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
<b>ERS</b>	21%	26%	45%	47%	54%	60%	61%
<b>PFRS</b>	20%	36%	54%	56%	58%	64%	66%

As NYSLRS becomes more heavily steeped in inactive liability (retirees and beneficiaries) shortfalls of assets will trigger a larger increase in the billing rates, as a smaller contribution base must recoup the shortfall for a larger inactive population. Since active members must support the retiree population liability after a market decline, it may be necessary to limit investment risk. Liquidity risk also becomes a concern if the cash contributions are not enough to pay benefit payments as they come due.

## Cashflow Timing Risk

Cash assets are required to fulfill benefit promises when due. As a plan matures and more benefits are being paid out of the fund, there is a cash flow concern. The net cash flow is the difference between the cash inflows (employer contributions, member contributions, and member loan repayments) and the cash outflows (benefit payments and administrative expenses). A positive net cash flow indicates that assets are accumulating. A negative net cash flow will require the drawdown of assets (or investment gains) to pay benefits.

$$\text{Net Benefits Cash Flow Ratio} = \frac{\text{Contributions} - \text{Benefit Payments and Expenses}}{\text{Market Value of Assets}}$$

NYSLRS has had a negative net cash flow over recent years, but this does not indicate a financial hardship. The purpose of prefunding a pension plan is to accumulate assets, which are then drawn down to settle benefits. In fact, negative net cash flows are expected when a system is well-funded, because employer contributions (the largest source of cash inflow) are relatively lower.

However, a slow and steady change in membership demographics will change a pension plan's liquidity needs and risk exposure. To monitor exposure to liquidity risk over time, we can use the Net Cash Flow Ratio.

### Net Benefits Cash Flow Ratio by Fiscal Year

FYE	1995	2005	2010	2015	2020	2024
ERS	-3.1%	-1.8%	-3.8%	-2.3%	-4.2%	-4.1%
PFRS	-2.1%	-2.3%	-3.9%	-2.4%	-3.9%	-3.1%

Because its net cash flow is relatively small compared to its assets, the ability of NYSLRS to make timely benefit payments is not impaired and there is little concern of liquidity risk in the near term. Liquidity concerns are further mitigated by cash flows available from assets (interest, dividends, bond maturities, and rental income from real estate) and the ability to sell highly liquid assets to meet benefit requirements.

A negative Net Cash Flow Ratio does make the system more sensitive to short-term investment performance. After a market decline, it is necessary to draw down liquid assets to continue benefit payments. This can compete with an investment strategy directing the purchase of cheap equity investments in anticipation of a market recovery, potentially constraining the flexibility of the PICM division. More conservative asset allocations may limit exposure to market declines, while larger cash allocation could improve flexibility. But both would be expected to reduce the expected investment return in the long term. While higher expected returns could reduce contributions, a negative net cashflow creates risk that is greatly reduced by a lower liability discount rate.

The negative Net Cash Flow Ratio can also be viewed in terms of continued accumulation of assets. Cash inflows are directed toward benefits, so the fund is reliant upon investment income to continue asset accumulation. This increases exposure to investment risk.

### COVID Demographic Experience Risk

Every five years, NYSLRS conducts a comprehensive study of demographic experience and revises assumptions to reflect the most recent five years of experience. Typically, any change in assumptions is relatively small.

The COVID-19 pandemic impacted all aspects of society, the consequences of which are evident in the demographic experience of NYSLRS members and retirees over the past four years. Should member behavior continue to diverge from current assumptions, the rate consequences in 2025 will be more severe than in the past. The following approximates the rate impact of aligning assumptions to reflect the past four years of experience, focusing on three categories:

- 1. Rates of withdrawal: members are separating from service at higher levels than expected.
- 2. Salary Scale: salary increases have exceeded expectations, resulting in higher projected benefits at retirement.
- 3. Rates of retirement: members have been retiring more quickly than expected reducing billable salary and increasing benefits payable in retirement.

Assumption	ERS Rate Impact	PFRS Rate Impact
Withdrawals	- 0.4%	+ 0.1%
Salary Scale	+ 2.8%	+ 4.4%
Service Retirements	+ 1.2%	+ 5.9%

In evaluating if and how assumptions should be changed, the underlying raw data measurements may need to be adjusted before drawing conclusions. These adjustments represent greater uncertainty and increase the degree of subjectivity. This could limit the precision of future assumption changes, so future demographic shifts may contribute more volatility than experienced in prior periods.

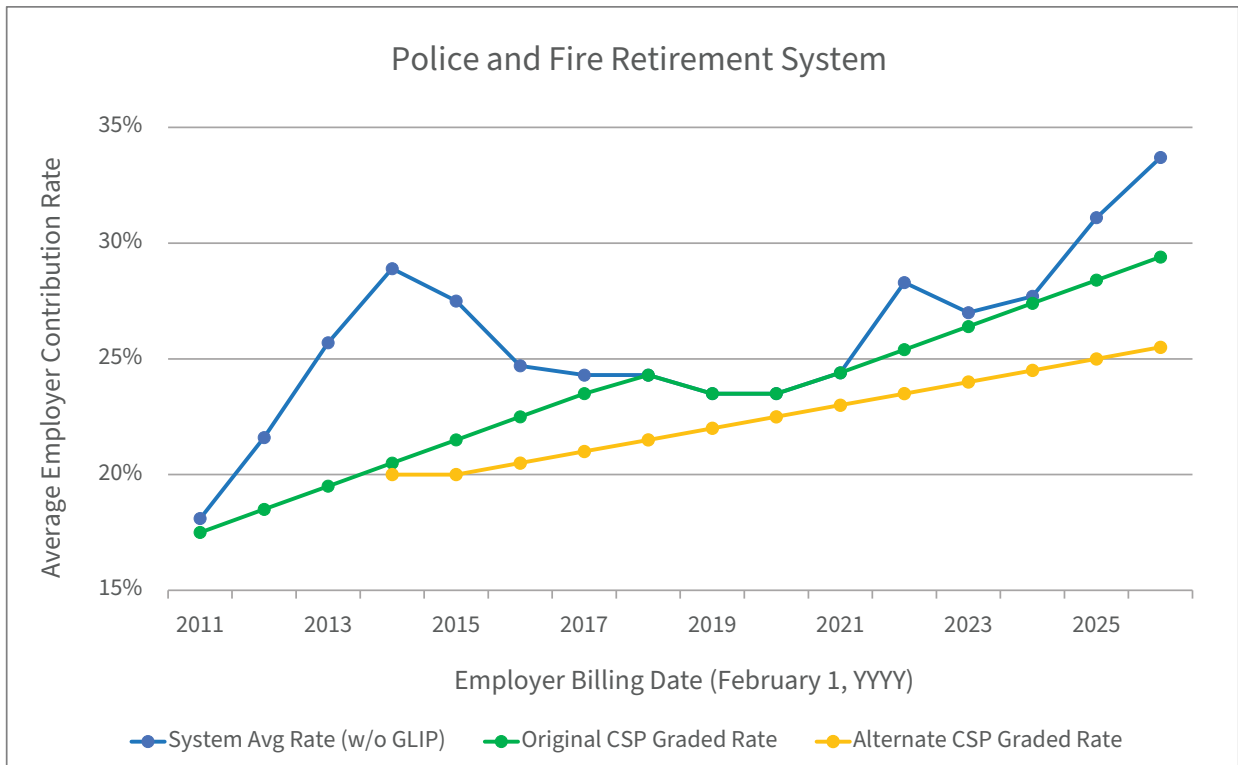
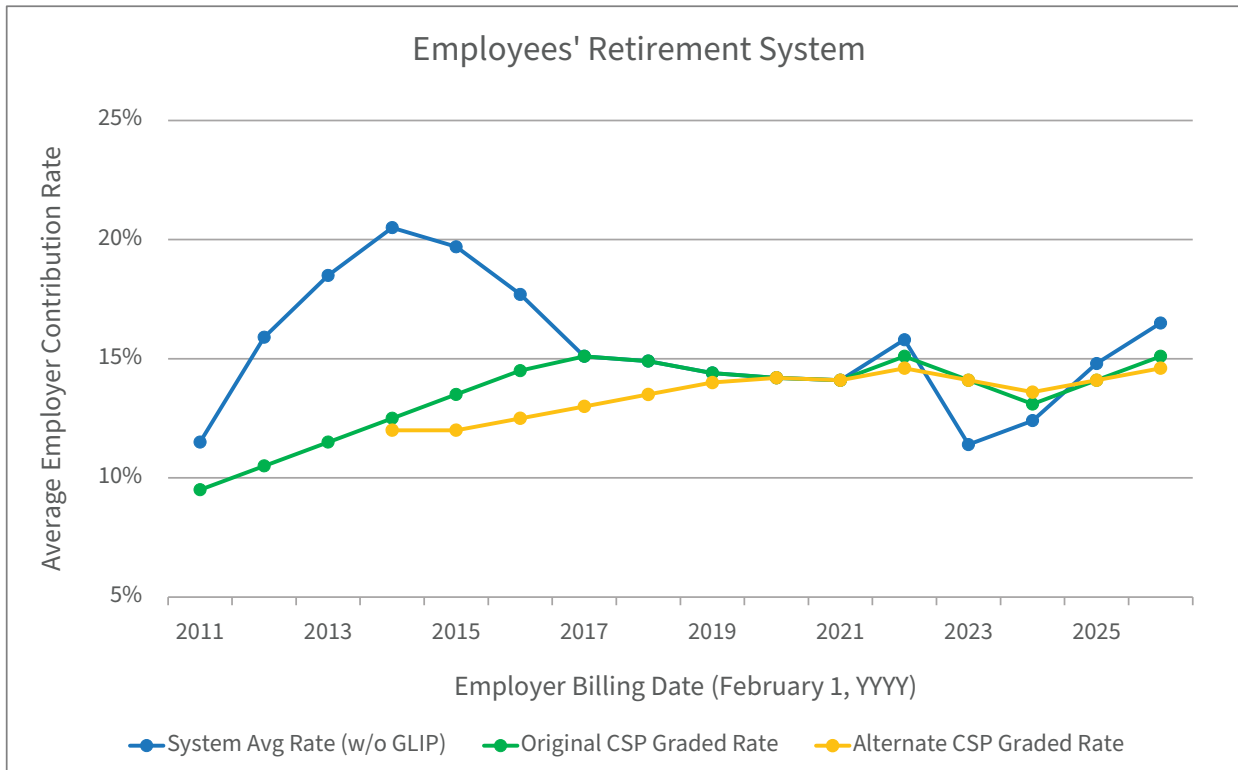
## Mitigating Employer Contribution Volatility Risk

NYSLRS' Actuarial Valuation currently employs two methods to reduce employer contribution rate volatility. An 8-year smoothing method is used to dampen annual investment return volatility. Any deviations from the current expected return of 5.9% are recognized in equal increments over a period of eight years. Note that 8-year smoothing in 2024 has the same impact as 5-year smoothing in the late 1990s for PFRS, and early 2000s in ERS.

The Contribution Stabilization Program (CSP) was signed into law in 2010. The Alternate Contribution Stabilization Program (Alternate CSP) was signed in 2014 and had a one-year opt-in window. The CSP provides an optional additional layer of employer contribution rate smoothing. Under the CSP, on the billing date, a participating employer is required to remit a graded rate contribution and permitted to amortize over a 10-year period the balance between the actuarial contribution and the graded rate contribution (12-year period for the Alternate CSP). The graded rate increases or decreases up to 1% each year (0.5% for the Alternate CSP) in the direction of the system average contribution rate. During "ordinary" investment periods, the actuarial and graded rates converge. Large deviations may occur when there is extraordinary asset performance, such as after the Global Financial Crisis of 2008 or the COVID pandemic.

The graphs on the following page show the graded rates versus the system average rates over the course of both programs. The system average rates are much more volatile than the graded rates. The graded rates peak lower and later than the system average rates. Therefore, employers in the CSP experience less contribution risk due to increased stability of billing rates.





# Appendices

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Appendix A: History of Cashflows, Assets, and Billing Rates

Appendix B: Long-Term New Entrant Rates

Appendix C: Assumption Details

Appendix D: Additional Considerations in Setting the Liability Discount Rate (and the Investment Rate of Return Assumption)

## Appendix A: History of Cashflows, Assets, and Billing Rates

FYE 3/31	Contributions* [C]		Benefits* [B]	Invested Assets* [CRF]	(C-B) CRF	S&P 500		Assumed CRF Return	Average Employer Contribution Rate	
	Employer	Employee							ERS	PFRS
1970	\$ 299.2	\$ 75.0	\$ 158.2	\$ 3,532.6	6.1%	89.63		4.87%	18.9%	22.2%
1971	346.0	77.4	194.3	3,888.2	5.9	100.31		4.87	19.8	23.9
1972	490.8	80.4	243.2	4,389.5	7.5	107.20		4.87	21.9	28.8
1973	553.0	73.0	287.9	5,167.8	6.5	111.52		4.87	20.3	31.4
1974	664.5	61.6	334.6	5,393.0	7.3	93.98		4.87	21.3	32.4
1975	749.3	52.9	373.4	5,915.3	7.2	83.36		5.50	20.4	32.9
1976	872.2	48.0	431.0	7,080.7	6.9	102.77		5.50	19.7	32.3
1977	981.3	41.7	461.3	7,852.0	7.2	98.42		5.50	19.6	33.3
1978	1,001.4	71.7	516.8	8,812.5	6.3	89.21		5.50	19.8	34.9
1979	1,020.6	61.2	568.8	10,326.7	5.0	101.59		5.50	18.8	35.1
1980	1,296.7	34.5	631.4	11,725.9	6.0	102.09		5.50	18.1	34.2
1981	1,296.0	47.8	695.5	14,194.6	4.6	136.00		5.50	17.0	33.1
1982	1,363.9	61.5	755.8	15,088.5	4.4	111.96		7.50	15.5	29.6
1983	1,481.3	84.0	840.3	18,626.5	3.9	152.96		7.50	15.1	28.7
1984	1,496.1	97.5	940.5	20,618.3	3.2	159.18		7.50	14.4	27.3
1985	1,610.5	116.0	1,063.4	24,062.3	2.8	180.66		7.50	14.2	26.5
1986	1,277.0	132.3	1,157.0	29,926.1	0.8	238.90		8.00	10.4	19.8
1987	1,174.0	151.2	1,275.8	35,621.8	0.1	291.70		8.00	9.4	13.3
1988	1,321.3	188.5	1,381.9	35,812.5	0.4	258.89		8.00	9.7	14.8
1989	759.4	194.7	1,624.7	40,280.6	-1.7	294.87		8.75	3.7	8.5
1990	412.2	229.9	1,670.4	45,189.3	-2.3	339.94		8.75	3.6	8.3
1991	-72.4	255.3	1,834.2	48,945.5	-3.4	375.22		8.75	0.3	7.8
1992	356.8	287.0	2,067.7	51,925.8	-2.7	403.69		8.75	0.4	11.5
1993	369.8	284.1	2,267.9	56,428.9	-2.9	451.67		8.75	0.6	14.0
1994	530.1	307.5	2,393.7	58,416.8	-2.7	445.77		8.75	0.7	11.3
1995	315.1	334.0	2,527.9	63,406.6	-3.0	500.71		8.75	0.7	13.9
1996	776.9	341.9	2,877.9	74,827.9	-2.4	645.50		8.75	2.2	13.0
1997	903.5	348.2	3,122.0	82,333.8	-2.3	757.12		8.75	3.7	9.8
1998	462.6	369.4	3,305.0	104,921.8	-2.4	1,101.75		8.50	1.7	7.0
1999	291.7	399.8	3,482.0	111,008.7	-2.5	1,286.37		8.50	1.3	2.4
2000	164.5	422.7	3,720.2	127,138.9	-2.5	1,498.58		8.50	0.9	1.9
2001	214.8	319.1	4,181.0	112,432.9	-3.2	1,160.33	Enron & 9/11	8.00	0.9	1.6
2002	263.8	210.2	4,488.3	111,168.5	-3.6	1,147.39		8.00	1.2	1.6
2003	651.9	219.2	4,984.6	95,598.3	-4.3	848.18		8.00	1.5	1.4
2004	1,286.5	221.9	5,347.5	119,245.0	-3.2	1,126.21		8.00	5.9	5.8
2005	2,964.8	227.3	5,674.7	126,083.5	-2.0	1,180.59		8.00	12.9	17.6
2006	2,782.2	241.2	6,028.9	140,453.3	-2.1	1,294.87		8.00	11.3	16.3
2007	2,718.6	250.2	6,383.4	154,575.5	-2.2	1,420.86		8.00	10.7	17.0
2008	2,648.4	265.7	6,835.6	153,877.7	-2.5	1,322.70		8.00	9.6	16.6
2009	2,456.2	273.3	7,212.1	108,960.7	-4.1	797.87	Financial Crisis	8.00	8.5	15.8
2010	2,344.2	284.3	7,718.9	132,500.2	-3.8	1,169.43		8.00	7.4	15.1
2011	4,164.6	286.2	8,520.2	147,237.0	-2.8	1,325.83		7.50	11.9	18.2
2012	4,585.2	273.2	8,937.8	150,658.9	-2.7	1,408.47		7.50	16.3	21.6
2013	5,336.0	269.1	9,521.5	160,660.8	-2.4	1,569.19		7.50	18.9	25.8
2014	6,064.1	281.4	9,977.5	176,835.1	-2.1	1,872.34		7.50	20.9	28.9
2015	5,797.4	284.8	10,513.7	184,502.0	-2.4	2,067.89		7.50	20.1	27.6
2016	5,140.2	306.6	11,060.5	178,639.7	-3.1	2,059.74		7.00	18.2	24.7
2017	4,787.0	328.8	11,508.3	192,410.6	-3.3	2,362.72		7.00	15.5	24.3
2018	4,823.3	349.4	12,128.9	207,416.0	-3.4	2,640.87		7.00	15.3	24.4
2019	4,744.3	386.5	12,833.9	210,523.7	-3.7	2,834.40	Tax Cuts and Deregulation	6.80	14.9	23.5
2020	4,782.7	453.7	13,311.1	194,317.2	-4.2	2,584.59	Bear Market	6.80	14.6	23.5
2021	5,029.8	492.3	14,122.0	258,135.8	-3.3	3,972.89		6.80	14.6	24.4
2022	5,627.7	577.6	14,905.0	272,121.3	-3.4	4,530.41		5.90	16.2	28.3
2023	4,404.1	656.8	15,174.3	248,524.9	-4.1	4,109.31	COVID Pandemic	5.90	11.4	27.0
2024	\$ 5,054.5	\$ 788.8	\$ 15,808.7	\$ 268,088.7	-4.0%	5,243.77		5.90%	13.1%	27.8%

\*millions of dollars

## Appendix B: Long-Term New Entrant Rates

New Entrant Rates (NER) are a measurement of the Employer Contribution Rate expected, based on current assumptions, for a hypothetical new hire entering a system with no unfunded liability/asset. Basically, it represents the employer billing rate necessary to fully fund the plan benefits for an individual in a vacuum. These rates are colloquially called the “long-term rates.”

Generally, actual billing rates will be higher than the NER, with the excess used to reduce the system’s unfunded liability, if any. In the case that the system reaches fully funded status, excess assets would instead *reduce* billing rates below the NER.

By comparing different plans’ NER, we gain insight into the relative generosity of each plan. Plans with higher NER are more costly to employers and more lucrative to members.

One desirable objective of a funding method should be the alignment of benefits with costs. An employer providing lucrative benefits should contribute more than an employer offering lesser benefits. Charging all employers the same billing rate would cause a “race to the top” as superior benefits could be offered without material increases in the employer’s required contributions, effectively subsidized by those offering lesser benefits.

At NYSLRS, this objective is met by using the NERs to differentiate billing rates by plan. By scaling the system “basic rate” by the NER, we develop different billing rates for each plan and achieve the desired feature that more lucrative plans have higher employer billing rates.

The table below summarizes how Tier 6 NERs were impacted by Chapter 56 of the Laws of 2024, which amended the number of years used in the FAS calculation for Tier 6 benefits. Notice that the NER increased as the benefits became more lucrative.

**Long-Term New Entrant Rates (NER)**

Age-based Plans				Service-based Plans			
Tier 6 Plan	5-year FAS	3-year FAS	Change	Tier 6 Plan	5-year FAS	3-year FAS	Change
ERS A15	9.3%	9.8%	0.5%	ERS 89-e	13.3%	14.0%	0.7%
ERS UCPO	9.5%	10.1%	0.6%	ERS A14CO	15.0%	15.9%	0.9%
				ERS 552	19.1%	20.2%	1.1%
				ERS 553	20.2%	21.3%	1.1%
PFRS 375-i	10.3%	11.7%	1.4%	PFRS 384	14.0%	15.8%	1.8%
				PFRS 383-d	14.3%	16.2%	1.9%
				PFRS 384-d	18.0%	20.3%	2.3%
				PFRS 384-e	18.3%	20.6%	2.3%
				PFRS 381-b	19.4%	21.9%	2.5%

By updating the indices, costs associated with the benefit improvement are paid by those benefiting (members of Tier 6).

	Total Contributions (\$ in billions)	Tier 6 Contributions (\$ in billions)
With 5-year FAS	6.983	2.785
With 3-year FAS	7.132	2.938
Change in Contributions	0.149	0.153

In the table, notice that the change in total system-wide contributions is approximately equal to the change in Tier 6 contributions. This means that the earlier tiers are not financing the benefit improvement.

## Appendix C: Assumption Details

This section strives to disclose all material assumptions, and details various decrement rates used in the valuation.

Some miscellaneous assumptions for ERS include:

- When a disability benefit is subject to a workers’ compensation offset, we assume the offset is 15% of the FAS.
- Some members can convert unused sick leave at retirement into additional service credit. We assume that 3 days are credited for each year of service for Tiers 1-5 and 2 days per year of service for Tier 6.
- Members in Tiers 5 and 6 are subject to a limitation of how much overtime can be included in the FAS.
  - For Tier 5, the limit increases 3% each year.
  - For Tier 6, the limit is indexed to inflation.

We assume no valuation impact.

- When calculating a Tier 6 member’s FAS, each year’s salary is capped at the Governor’s salary, which increased to \$250,000 in 2021. After 2021, the Governor’s salary is assumed to increase annually by the assumed rate of inflation.
- For projecting the billable salary base, tier specific assumptions are used, as shown below.

Tier	1	2	3	4	5	6
<b>Projection Factor</b>	0.75	0.75	0.80	0.96	1.01	1.20

- Chapter 56 of the Laws of 2022, effective 4/9/2022, changed the vesting schedule for members of Tiers 5 and 6 from 10-year cliff vesting to 5-year cliff vesting, aligning with the Tiers 1-4 vesting schedule. Before this law change, it was possible and necessary to develop two sets of withdrawal assumptions to reflect different vesting schedules. Now ERS withdrawal assumptions are obtained by applying the multipliers, below, to the rates reported in Table 12. Additionally, for Tiers 1-4, when service < 10, the age 58 central rate is used for all ages  $\geq 58$ .

Service	$0 \leq \text{Srv} < 2$	$2 \leq \text{Srv} < 3$	$3 \leq \text{Srv} < 4$	$4 \leq \text{Srv} < 5$	$5 \leq \text{Srv} < 10$	$10 \leq \text{Srv} < 11$	$11 \leq \text{Srv}$
<b>Multiplier</b>	1.30	1.30	1.30	1.30	1.20	1.00	1.00

Some miscellaneous assumptions for PFRS include:

- When a disability benefit is subject to a workers’ compensation offset, we assume the offset is 5% of the FAS. For accidental death benefits, we assume the workers’ compensation offset is 18% of the FAS, and we assume the social security offset is 6% of salary.
- Some members can convert unused sick leave at retirement into additional service credit. We assume that 4 days are credited for each year of service, subject to a maximum of 165 days.
- Some members are entitled to a benefit based upon a 1-year FAS. In these cases, salary is seen to increase faster than the assumed salary scale in the year prior to retirement. A factor (*OneYearFAS*) is multiplied by the plan’s usual FAS calculation to estimate the 1-year FAS.
  - For Tier 1 members with date of membership prior to April 1, 1972, *OneYearFAS* is 1.08.
  - For Tiers 5 and 6, where more strict overtime limits apply, *OneYearFAS* is 1.14.
  - And for all others, *OneYearFAS* is 1.18.
- Members in Tiers 5 and 6 are subject to a narrower definition of how much overtime can be included in the FAS. This reduces the lucrativeness of Tier 5 and 6 plans relative to earlier tiers. Therefore, in calculating plan indices, the active valuation includes an *OTLimit* factor that trims liabilities by 5% for affected plans. This factor is not used in developing valuation liabilities.
- When calculating a Tier 6 member’s FAS, each year’s salary is capped at the Governor’s salary, which increased to \$250,000 in 2021. After 2021, the Governor’s salary is assumed to increase annually by the assumed rate of inflation.
- For projecting the billable salary base, tier specific assumptions are used, as shown below.

<b>Tier</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>Projection Factor</b>	0.75	0.97	0.75	N/A	1.04	1.25

The remainder of this appendix provides the assumed decrement rates for retiree mortality (including beneficiary mortality) and active member decrements (withdrawal, death, disability, service retirement) and salary scale assumptions, for both systems.

Assumption sets are presented in a series of tables organized by system and decrement type.

Table 1	Employees' Retirement System <b>Male Clerk Service</b> Retiree Mortality <sup>1</sup>
Table 2	Employees' Retirement System <b>Female Clerk Service</b> Retiree Mortality <sup>1</sup>
Table 3	Employees' Retirement System <b>Male Laborer Service</b> Retiree Mortality <sup>1</sup>
Table 4	Employees' Retirement System <b>Female Laborer Service</b> Retiree Mortality <sup>1</sup>
Table 5	Employees' Retirement System <b>Male Disability</b> Retiree Mortality <sup>1</sup>
Table 6	Employees' Retirement System <b>Female Disability</b> Retiree Mortality <sup>1</sup>
Table 7	Police & Fire Retirement System <b>Service</b> Retiree Mortality <sup>1</sup>
Table 8	Police & Fire Retirement System <b>Disability</b> Retiree Mortality <sup>1</sup>
Table 9	Retirement System <b>Male Beneficiary</b> Mortality <sup>1,2</sup>
Table 10	Retirement System <b>Female Beneficiary</b> Mortality <sup>1,3</sup>
Table 11	Employees' Retirement System <b>Death and Disability</b> Central Rates of Decrement
Table 12	Employees' Retirement System <b>Withdrawal</b> Central Rates of Decrement
Table 13	Employees' Retirement System <b>Age-Based Plans Retirement</b> Central Rates of Decrement
Table 14	Employees' Retirement System <b>Service-Based Plans Retirement</b> Central Rates of Decrement
Table 15	Police & Fire Retirement System <b>Death and Disability</b> Central Rates of Decrement
Table 16	Police & Fire Retirement System <b>Withdrawal</b> Central Rates of Decrement
Table 17	Police & Fire Retirement System <b>Age-Based Plans Retirement</b> Central Rates of Decrement
Table 18	Police & Fire Retirement System <b>Service-Based Plans Retirement</b> Central Rates of Decrement
Table 19	Employees' Retirement System <b>Salary Scale</b>
Table 20	Police & Fire Retirement System <b>Salary Scale</b>

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<sup>1</sup> The base mortality ( $q_x$ ) is generally only changed once every five years, with the quinquennial review. We assume the base mortality is "as of" the midpoint of the experience study period (10/1/2017). To obtain the current year's mortality rates, we apply Mortality Improvement through the valuation date (4/1/2024). Therefore, the mortality improvement factors will change each year as an additional year of improvement is applied. This causes the valuation mortality rates (Val  $q_x$ ) to change year-over-year. The valuation projects benefits payable in the future. For each year projected forward, an additional year of mortality improvement applies. Therefore, the valuation mortality rates shown here are only illustrative of the initial value and are only applicable in the first year of the valuation.

<sup>2</sup> In the active valuation, it is assumed that all beneficiaries will be female. The liability impact is immaterial.

<sup>3</sup> In the active valuation, it is assumed that beneficiaries are the same age as the member.



**TABLE 1: Employees' Retirement System Male Clerk Service Retiree Mortality  
Effective 4/1/2024 (For Valuation Purposes Only)**

Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>	Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>
0	0.000190	1.049369	0.000199	55	0.004220	0.960621	0.004054
1	0.000190	1.049369	0.000199	56	0.004579	0.962574	0.004408
2	0.000190	1.049369	0.000199	57	0.004965	0.966786	0.004800
3	0.000190	1.049369	0.000199	58	0.005376	0.972670	0.005229
4	0.000190	1.049369	0.000199	59	0.005809	0.979298	0.005689
5	0.000190	1.049369	0.000199	60	0.006261	0.986360	0.006176
6	0.000190	1.049369	0.000199	61	0.006730	0.992748	0.006681
7	0.000190	1.049369	0.000199	62	0.007216	0.998275	0.007204
8	0.000190	1.049369	0.000199	63	0.007722	1.002455	0.007741
9	0.000190	1.049369	0.000199	64	0.008260	1.004543	0.008298
10	0.000190	1.049369	0.000199	65	0.008842	1.004678	0.008883
11	0.000190	1.049369	0.000199	66	0.009490	1.002581	0.009514
12	0.000190	1.049369	0.000199	67	0.010225	0.998338	0.010208
13	0.000190	1.049369	0.000199	68	0.011075	0.992468	0.010992
14	0.000190	1.049369	0.000199	69	0.012063	0.985512	0.011888
15	0.000190	1.049369	0.000199	70	0.013218	0.977957	0.012927
16	0.000200	1.049369	0.000210	71	0.014565	0.970499	0.014135
17	0.000220	1.049369	0.000231	72	0.016131	0.963427	0.015541
18	0.000230	1.049369	0.000241	73	0.017947	0.957411	0.017183
19	0.000240	1.049369	0.000252	74	0.020047	0.952554	0.019096
20	0.000260	1.049369	0.000273	75	0.022475	0.949225	0.021334
21	0.000270	1.050097	0.000284	76	0.025282	0.947027	0.023943
22	0.000290	1.053118	0.000305	77	0.028533	0.946001	0.026992
23	0.000300	1.058602	0.000318	78	0.032304	0.946192	0.030566
24	0.000320	1.067161	0.000341	79	0.036691	0.947170	0.034753
25	0.000340	1.078133	0.000367	80	0.041796	0.948604	0.039648
26	0.000360	1.091209	0.000393	81	0.047727	0.951045	0.045391
27	0.000380	1.106834	0.000421	82	0.054585	0.953635	0.052054
28	0.000400	1.123640	0.000449	83	0.062463	0.956231	0.059729
29	0.000420	1.141477	0.000479	84	0.071442	0.959099	0.068520
30	0.000450	1.159590	0.000522	85	0.081582	0.961926	0.078476
31	0.000470	1.177326	0.000553	86	0.092925	0.964663	0.089641
32	0.000500	1.193992	0.000597	87	0.105497	0.967164	0.102033
33	0.000530	1.209312	0.000641	88	0.119307	0.969475	0.115665
34	0.000560	1.222464	0.000685	89	0.134353	0.971669	0.130547
35	0.000590	1.232972	0.000727	90	0.150626	0.973354	0.146612
36	0.000620	1.239817	0.000769	91	0.168112	0.974724	0.163863
37	0.000660	1.242887	0.000820	92	0.186795	0.975556	0.182229
38	0.000690	1.241228	0.000856	93	0.206658	0.975752	0.201647
39	0.000730	1.234941	0.000902	94	0.227684	0.975434	0.222091
40	0.000780	1.223726	0.000955	95	0.249859	0.974382	0.243458
41	0.000820	1.208100	0.000991	96	0.273113	0.974504	0.266150
42	0.000870	1.188579	0.001034	97	0.297118	0.974895	0.289659
43	0.000920	1.166037	0.001073	98	0.321122	0.975262	0.313178
44	0.000970	1.141018	0.001107	99	0.345127	0.975948	0.336826
45	0.001020	1.114962	0.001137	100	0.369131	0.976781	0.360560
46	0.001080	1.089051	0.001176	101	0.394636	0.977836	0.385889
47	0.001140	1.063462	0.001212	102	0.422391	0.979137	0.413578
48	0.001210	1.039592	0.001258	103	0.453897	0.980513	0.445052
49	0.001280	1.018257	0.001303	104	0.490654	0.982112	0.481877
50	0.001350	0.999792	0.001350	105	0.534162	0.983393	0.525291
51	0.001924	0.984668	0.001895	106	0.587422	0.984897	0.578550
52	0.002498	0.973205	0.002431	107	0.653435	0.986577	0.644664
53	0.003072	0.965634	0.002966	108	0.738201	0.987962	0.729314
54	0.003646	0.961541	0.003506	109	0.849972	0.989472	0.841024
				110	1.000000	n/a	1.000000

**TABLE 2: Employees' Retirement System Female Clerk Service Retiree Mortality  
Effective 4/1/2024 (For Valuation Purposes Only)**

Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>	Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>
0	0.000190	1.062788	0.000202	55	0.004115	0.946609	0.003895
1	0.000190	1.062788	0.000202	56	0.004118	0.955941	0.003937
2	0.000190	1.062788	0.000202	57	0.004121	0.966442	0.003983
3	0.000190	1.062788	0.000202	58	0.004181	0.977605	0.004087
4	0.000190	1.062788	0.000202	59	0.004287	0.987866	0.004235
5	0.000190	1.062788	0.000202	60	0.004443	0.996381	0.004427
6	0.000190	1.062788	0.000202	61	0.004657	1.001985	0.004666
7	0.000190	1.062788	0.000202	62	0.004938	1.004380	0.004960
8	0.000190	1.062788	0.000202	63	0.005293	1.003395	0.005311
9	0.000190	1.062788	0.000202	64	0.005730	0.999006	0.005724
10	0.000190	1.062788	0.000202	65	0.006257	0.992044	0.006207
11	0.000190	1.062788	0.000202	66	0.006878	0.982971	0.006761
12	0.000190	1.062788	0.000202	67	0.007601	0.972693	0.007393
13	0.000190	1.062788	0.000202	68	0.008431	0.962722	0.008117
14	0.000190	1.062788	0.000202	69	0.009374	0.953173	0.008935
15	0.000190	1.062788	0.000202	70	0.010437	0.945230	0.009865
16	0.000200	1.062788	0.000213	71	0.011627	0.938933	0.010917
17	0.000220	1.062788	0.000234	72	0.012955	0.934582	0.012108
18	0.000230	1.062788	0.000244	73	0.014439	0.932202	0.013460
19	0.000240	1.062788	0.000255	74	0.016104	0.931497	0.015001
20	0.000260	1.062788	0.000276	75	0.017982	0.932511	0.016768
21	0.000270	1.065761	0.000288	76	0.020113	0.934492	0.018795
22	0.000290	1.070111	0.000310	77	0.022548	0.937493	0.021139
23	0.000300	1.075799	0.000323	78	0.025342	0.940906	0.023844
24	0.000320	1.082630	0.000346	79	0.028559	0.944664	0.026979
25	0.000340	1.091375	0.000371	80	0.032265	0.948625	0.030607
26	0.000360	1.101209	0.000396	81	0.036528	0.952864	0.034806
27	0.000380	1.112812	0.000423	82	0.041424	0.957096	0.039647
28	0.000400	1.125541	0.000450	83	0.047032	0.961174	0.045206
29	0.000420	1.138394	0.000478	84	0.053434	0.965025	0.051565
30	0.000450	1.150950	0.000518	85	0.060717	0.968694	0.058816
31	0.000470	1.162639	0.000546	86	0.068961	0.971959	0.067027
32	0.000500	1.172521	0.000586	87	0.078243	0.975137	0.076298
33	0.000530	1.179613	0.000625	88	0.088625	0.977979	0.086673
34	0.000560	1.183266	0.000663	89	0.100162	0.980288	0.098188
35	0.000590	1.183248	0.000698	90	0.112896	0.981986	0.110862
36	0.000620	1.178662	0.000731	91	0.126865	0.983268	0.124742
37	0.000660	1.169865	0.000772	92	0.142099	0.983910	0.139813
38	0.000690	1.157128	0.000798	93	0.158626	0.984206	0.156121
39	0.000730	1.141058	0.000833	94	0.176472	0.983467	0.173554
40	0.000780	1.121913	0.000875	95	0.195656	0.982309	0.192195
41	0.000820	1.100832	0.000903	96	0.220591	0.982309	0.216688
42	0.000870	1.078718	0.000938	97	0.246330	0.982383	0.241990
43	0.000920	1.056135	0.000972	98	0.272069	0.982530	0.267316
44	0.000970	1.034232	0.001003	99	0.297808	0.982703	0.292657
45	0.001020	1.013319	0.001034	100	0.323547	0.983245	0.318126
46	0.001080	0.994105	0.001074	101	0.350894	0.983960	0.345266
47	0.001140	0.976672	0.001113	102	0.380655	0.984971	0.374934
48	0.001210	0.961892	0.001164	103	0.414438	0.985910	0.408598
49	0.001280	0.950077	0.001216	104	0.453850	0.986997	0.447949
50	0.001350	0.941138	0.001271	105	0.500502	0.988061	0.494526
51	0.001903	0.935645	0.001781	106	0.557611	0.989125	0.551547
52	0.002456	0.933406	0.002292	107	0.628393	0.990315	0.622307
53	0.003009	0.934822	0.002813	108	0.719284	0.991382	0.713085
54	0.003562	0.939338	0.003346	109	0.839131	0.992449	0.832795
				110	1.000000	n/a	1.000000

**TABLE 3: Employees' Retirement System Male Laborer Service Retiree Mortality**  
**Effective 4/1/2024 (For Valuation Purposes Only)**

Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>	Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>
0	0.000190	1.049369	0.000199	55	0.007342	0.960621	0.007053
1	0.000190	1.049369	0.000199	56	0.007403	0.962574	0.007126
2	0.000190	1.049369	0.000199	57	0.007541	0.966786	0.007291
3	0.000190	1.049369	0.000199	58	0.007761	0.972670	0.007549
4	0.000190	1.049369	0.000199	59	0.008072	0.979298	0.007905
5	0.000190	1.049369	0.000199	60	0.008482	0.986360	0.008366
6	0.000190	1.049369	0.000199	61	0.009003	0.992748	0.008938
7	0.000190	1.049369	0.000199	62	0.009644	0.998275	0.009627
8	0.000190	1.049369	0.000199	63	0.010418	1.002455	0.010444
9	0.000190	1.049369	0.000199	64	0.011336	1.004543	0.011388
10	0.000190	1.049369	0.000199	65	0.012415	1.004678	0.012473
11	0.000190	1.049369	0.000199	66	0.013672	1.002581	0.013707
12	0.000190	1.049369	0.000199	67	0.015122	0.998338	0.015097
13	0.000190	1.049369	0.000199	68	0.016774	0.992468	0.016648
14	0.000190	1.049369	0.000199	69	0.018633	0.985512	0.018363
15	0.000190	1.049369	0.000199	70	0.020704	0.977957	0.020248
16	0.000200	1.049369	0.000210	71	0.022999	0.970499	0.022321
17	0.000220	1.049369	0.000231	72	0.025536	0.963427	0.024602
18	0.000230	1.049369	0.000241	73	0.028344	0.957411	0.027137
19	0.000240	1.049369	0.000252	74	0.031455	0.952554	0.029963
20	0.000260	1.049369	0.000273	75	0.034910	0.949225	0.033137
21	0.000270	1.050097	0.000284	76	0.038755	0.947027	0.036702
22	0.000290	1.053118	0.000305	77	0.043042	0.946001	0.040718
23	0.000300	1.058602	0.000318	78	0.047830	0.946192	0.045256
24	0.000320	1.067161	0.000341	79	0.053187	0.947170	0.050377
25	0.000340	1.078133	0.000367	80	0.059189	0.948604	0.056147
26	0.000360	1.091209	0.000393	81	0.065922	0.951045	0.062695
27	0.000380	1.106834	0.000421	82	0.073481	0.953635	0.070074
28	0.000400	1.123640	0.000449	83	0.081960	0.956231	0.078373
29	0.000420	1.141477	0.000479	84	0.091452	0.959099	0.087712
30	0.000450	1.159590	0.000522	85	0.102044	0.961926	0.098159
31	0.000470	1.177326	0.000553	86	0.113820	0.964663	0.109798
32	0.000500	1.193992	0.000597	87	0.126859	0.967164	0.122693
33	0.000530	1.209312	0.000641	88	0.141232	0.969475	0.136921
34	0.000560	1.222464	0.000685	89	0.157002	0.971669	0.152554
35	0.000590	1.232972	0.000727	90	0.174219	0.973354	0.169577
36	0.000620	1.239817	0.000769	91	0.192921	0.974724	0.188045
37	0.000660	1.242887	0.000820	92	0.213135	0.975556	0.207925
38	0.000690	1.241228	0.000856	93	0.234873	0.975752	0.229178
39	0.000730	1.234941	0.000902	94	0.258139	0.975434	0.251798
40	0.000780	1.223726	0.000955	95	0.282929	0.974382	0.275681
41	0.000820	1.208100	0.000991	96	0.309235	0.974504	0.301351
42	0.000870	1.188579	0.001034	97	0.337048	0.974895	0.328586
43	0.000920	1.166037	0.001073	98	0.366363	0.975262	0.357300
44	0.000970	1.141018	0.001107	99	0.397175	0.975948	0.387622
45	0.001020	1.114962	0.001137	100	0.429480	0.976781	0.419508
46	0.001080	1.089051	0.001176	101	0.463277	0.977836	0.453009
47	0.001140	1.063462	0.001212	102	0.498564	0.979137	0.488162
48	0.001210	1.039592	0.001258	103	0.535340	0.980513	0.524908
49	0.001280	1.018257	0.001303	104	0.573605	0.982112	0.563344
50	0.001350	0.999792	0.001350	105	0.613358	0.983393	0.603172
51	0.002548	0.984668	0.002509	106	0.655889	0.984897	0.645983
52	0.003747	0.973205	0.003647	107	0.708086	0.986577	0.698581
53	0.004945	0.965634	0.004775	108	0.775748	0.987962	0.766409
54	0.006144	0.961541	0.005908	109	0.868542	0.989472	0.859398
				110	1.000000	n/a	1.000000

**TABLE 4: Employees' Retirement System Female Laborer Service Retiree Mortality  
Effective 4/1/2024 (For Valuation Purposes Only)**

Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>	Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>
0	0.000190	1.062788	0.000202	55	0.003525	0.946609	0.003337
1	0.000190	1.062788	0.000202	56	0.004275	0.955941	0.004087
2	0.000190	1.062788	0.000202	57	0.004979	0.966442	0.004812
3	0.000190	1.062788	0.000202	58	0.005637	0.977605	0.005511
4	0.000190	1.062788	0.000202	59	0.006254	0.987866	0.006178
5	0.000190	1.062788	0.000202	60	0.006834	0.996381	0.006809
6	0.000190	1.062788	0.000202	61	0.007388	1.001985	0.007403
7	0.000190	1.062788	0.000202	62	0.007925	1.004380	0.007960
8	0.000190	1.062788	0.000202	63	0.008457	1.003395	0.008486
9	0.000190	1.062788	0.000202	64	0.008999	0.999006	0.008990
10	0.000190	1.062788	0.000202	65	0.009570	0.992044	0.009494
11	0.000190	1.062788	0.000202	66	0.010190	0.982971	0.010016
12	0.000190	1.062788	0.000202	67	0.010884	0.972693	0.010587
13	0.000190	1.062788	0.000202	68	0.011682	0.962722	0.011247
14	0.000190	1.062788	0.000202	69	0.012617	0.953173	0.012026
15	0.000190	1.062788	0.000202	70	0.013716	0.945230	0.012965
16	0.000200	1.062788	0.000213	71	0.015003	0.938933	0.014087
17	0.000220	1.062788	0.000234	72	0.016497	0.934582	0.015418
18	0.000230	1.062788	0.000244	73	0.018216	0.932202	0.016981
19	0.000240	1.062788	0.000255	74	0.020179	0.931497	0.018797
20	0.000260	1.062788	0.000276	75	0.022412	0.932511	0.020899
21	0.000270	1.065761	0.000288	76	0.024947	0.934492	0.023313
22	0.000290	1.070111	0.000310	77	0.027835	0.937493	0.026095
23	0.000300	1.075799	0.000323	78	0.031141	0.940906	0.029301
24	0.000320	1.082630	0.000346	79	0.034945	0.944664	0.033011
25	0.000340	1.091375	0.000371	80	0.039337	0.948625	0.037316
26	0.000360	1.101209	0.000396	81	0.044415	0.952864	0.042321
27	0.000380	1.112812	0.000423	82	0.050273	0.957096	0.048116
28	0.000400	1.125541	0.000450	83	0.056995	0.961174	0.054782
29	0.000420	1.138394	0.000478	84	0.064646	0.965025	0.062385
30	0.000450	1.150950	0.000518	85	0.073273	0.968694	0.070979
31	0.000470	1.162639	0.000546	86	0.082903	0.971959	0.080578
32	0.000500	1.172521	0.000586	87	0.093547	0.975137	0.091221
33	0.000530	1.179613	0.000625	88	0.105204	0.977979	0.102887
34	0.000560	1.183266	0.000663	89	0.117868	0.980288	0.115545
35	0.000590	1.183248	0.000698	90	0.131538	0.981986	0.129169
36	0.000620	1.178662	0.000731	91	0.146218	0.983268	0.143771
37	0.000660	1.169865	0.000772	92	0.161917	0.983910	0.159312
38	0.000690	1.157128	0.000798	93	0.178643	0.984206	0.175822
39	0.000730	1.141058	0.000833	94	0.196403	0.983467	0.193156
40	0.000780	1.121913	0.000875	95	0.215200	0.982309	0.211393
41	0.000820	1.100832	0.000903	96	0.239529	0.982309	0.235291
42	0.000870	1.078718	0.000938	97	0.264642	0.982383	0.259980
43	0.000920	1.056135	0.000972	98	0.289756	0.982530	0.284694
44	0.000970	1.034232	0.001003	99	0.314870	0.982703	0.309424
45	0.001020	1.013319	0.001034	100	0.339983	0.983245	0.334287
46	0.001080	0.994105	0.001074	101	0.366666	0.983960	0.360785
47	0.001140	0.976672	0.001113	102	0.395704	0.984971	0.389757
48	0.001210	0.961892	0.001164	103	0.428666	0.985910	0.422626
49	0.001280	0.950077	0.001216	104	0.467121	0.986997	0.461047
50	0.001350	0.941138	0.001271	105	0.512639	0.988061	0.506518
51	0.001785	0.935645	0.001670	106	0.568360	0.989125	0.562179
52	0.002220	0.933406	0.002072	107	0.637422	0.990315	0.631249
53	0.002655	0.934822	0.002482	108	0.726105	0.991382	0.719847
54	0.003090	0.939338	0.002903	109	0.843040	0.992449	0.836674
				110	1.000000	n/a	1.000000

**TABLE 5: Employees' Retirement System Male Disability Retiree Mortality**  
**Effective 4/1/2024 (For Valuation Purposes Only)**

Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>	Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>
0	0.001900	1.049369	0.001994	55	0.019747	0.960621	0.018969
1	0.001900	1.049369	0.001994	56	0.020273	0.962574	0.019514
2	0.001900	1.049369	0.001994	57	0.020958	0.966786	0.020262
3	0.001900	1.049369	0.001994	58	0.021756	0.972670	0.021161
4	0.001900	1.049369	0.001994	59	0.022415	0.979298	0.021951
5	0.001900	1.049369	0.001994	60	0.023078	0.986360	0.022763
6	0.001900	1.049369	0.001994	61	0.023986	0.992748	0.023812
7	0.001900	1.049369	0.001994	62	0.024796	0.998275	0.024753
8	0.001900	1.049369	0.001994	63	0.025585	1.002455	0.025648
9	0.001900	1.049369	0.001994	64	0.026329	1.004543	0.026449
10	0.001900	1.049369	0.001994	65	0.027349	1.004678	0.027477
11	0.001900	1.049369	0.001994	66	0.028422	1.002581	0.028495
12	0.001900	1.049369	0.001994	67	0.029547	0.998338	0.029498
13	0.001900	1.049369	0.001994	68	0.030844	0.992468	0.030612
14	0.001900	1.049369	0.001994	69	0.032439	0.985512	0.031969
15	0.001900	1.049369	0.001994	70	0.034461	0.977957	0.033701
16	0.002000	1.049369	0.002099	71	0.036696	0.970499	0.035613
17	0.002200	1.049369	0.002309	72	0.039382	0.963427	0.037942
18	0.002300	1.049369	0.002414	73	0.042397	0.957411	0.040591
19	0.002400	1.049369	0.002518	74	0.045826	0.952554	0.043652
20	0.002600	1.049369	0.002728	75	0.049728	0.949225	0.047203
21	0.002700	1.050097	0.002835	76	0.054175	0.947027	0.051305
22	0.002900	1.053118	0.003054	77	0.059245	0.946001	0.056046
23	0.003000	1.058602	0.003176	78	0.064984	0.946192	0.061487
24	0.003200	1.067161	0.003415	79	0.071465	0.947170	0.067690
25	0.003400	1.078133	0.003666	80	0.078654	0.948604	0.074611
26	0.003600	1.091209	0.003928	81	0.086410	0.951045	0.082180
27	0.003800	1.106834	0.004206	82	0.095026	0.953635	0.090620
28	0.004000	1.123640	0.004495	83	0.104369	0.956231	0.099801
29	0.004200	1.141477	0.004794	84	0.114448	0.959099	0.109767
30	0.004500	1.159590	0.005218	85	0.125068	0.961926	0.120306
31	0.004700	1.177326	0.005533	86	0.137334	0.964663	0.132481
32	0.005000	1.193992	0.005970	87	0.150178	0.967164	0.145247
33	0.005300	1.209312	0.006409	88	0.162252	0.969475	0.157299
34	0.005600	1.222464	0.006846	89	0.176289	0.971669	0.171295
35	0.005900	1.232972	0.007275	90	0.191767	0.973354	0.186657
36	0.006677	1.239817	0.008278	91	0.207896	0.974724	0.202641
37	0.007454	1.242887	0.009264	92	0.226604	0.975556	0.221065
38	0.008230	1.241228	0.010215	93	0.243525	0.975752	0.237620
39	0.009007	1.234941	0.011123	94	0.264342	0.975434	0.257848
40	0.009784	1.223726	0.011973	95	0.281410	0.974382	0.274201
41	0.010427	1.208100	0.012597	96	0.303686	0.974504	0.295943
42	0.010710	1.188579	0.012730	97	0.326681	0.974895	0.318480
43	0.011405	1.166037	0.013299	98	0.349676	0.975262	0.341026
44	0.012238	1.141018	0.013964	99	0.372671	0.975948	0.363708
45	0.012836	1.114962	0.014312	100	0.395666	0.976781	0.386479
46	0.013298	1.089051	0.014482	101	0.420098	0.977836	0.410787
47	0.013950	1.063462	0.014835	102	0.446686	0.979137	0.437367
48	0.014410	1.039592	0.014981	103	0.476866	0.980513	0.467573
49	0.015279	1.018257	0.015558	104	0.512077	0.982112	0.502917
50	0.016265	0.999792	0.016262	105	0.553756	0.983393	0.544560
51	0.017056	0.984668	0.016795	106	0.604776	0.984897	0.595642
52	0.017894	0.973205	0.017415	107	0.668011	0.986577	0.659044
53	0.018594	0.965634	0.017955	108	0.749212	0.987962	0.740193
54	0.019243	0.961541	0.018503	109	0.856282	0.989472	0.847267
				110	1.000000	n/a	1.000000

**TABLE 6: Employees' Retirement System Female Disability Retiree Mortality**  
**Effective 4/1/2024 (For Valuation Purposes Only)**

Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>	Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>
0	0.001900	1.062788	0.002019	55	0.022539	0.946609	0.021336
1	0.001900	1.062788	0.002019	56	0.022533	0.955941	0.021540
2	0.001900	1.062788	0.002019	57	0.022537	0.966442	0.021781
3	0.001900	1.062788	0.002019	58	0.022546	0.977605	0.022041
4	0.001900	1.062788	0.002019	59	0.022608	0.987866	0.022334
5	0.001900	1.062788	0.002019	60	0.022726	0.996381	0.022644
6	0.001900	1.062788	0.002019	61	0.022925	1.001985	0.022970
7	0.001900	1.062788	0.002019	62	0.023228	1.004380	0.023330
8	0.001900	1.062788	0.002019	63	0.023641	1.003395	0.023721
9	0.001900	1.062788	0.002019	64	0.024197	0.999006	0.024173
10	0.001900	1.062788	0.002019	65	0.024864	0.992044	0.024666
11	0.001900	1.062788	0.002019	66	0.025679	0.982971	0.025242
12	0.001900	1.062788	0.002019	67	0.026586	0.972693	0.025860
13	0.001900	1.062788	0.002019	68	0.027637	0.962722	0.026607
14	0.001900	1.062788	0.002019	69	0.028838	0.953173	0.027488
15	0.001900	1.062788	0.002019	70	0.030154	0.945230	0.028502
16	0.002000	1.062788	0.002126	71	0.031562	0.938933	0.029635
17	0.002200	1.062788	0.002338	72	0.033176	0.934582	0.031006
18	0.002300	1.062788	0.002444	73	0.034970	0.932202	0.032599
19	0.002400	1.062788	0.002551	74	0.036958	0.931497	0.034426
20	0.002600	1.062788	0.002763	75	0.039229	0.932511	0.036581
21	0.002700	1.065761	0.002878	76	0.041819	0.934492	0.039080
22	0.002900	1.070111	0.003103	77	0.044710	0.937493	0.041915
23	0.003000	1.075799	0.003227	78	0.048307	0.940906	0.045452
24	0.003200	1.082630	0.003464	79	0.052303	0.944664	0.049409
25	0.003400	1.091375	0.003711	80	0.056767	0.948625	0.053851
26	0.003600	1.101209	0.003964	81	0.062062	0.952864	0.059137
27	0.003800	1.112812	0.004229	82	0.068109	0.957096	0.065187
28	0.004000	1.125541	0.004502	83	0.074894	0.961174	0.071986
29	0.004200	1.138394	0.004781	84	0.082566	0.965025	0.079678
30	0.004500	1.150950	0.005179	85	0.091216	0.968694	0.088360
31	0.004700	1.162639	0.005464	86	0.100820	0.971959	0.097993
32	0.005000	1.172521	0.005863	87	0.111356	0.975137	0.108587
33	0.005300	1.179613	0.006252	88	0.123017	0.977979	0.120308
34	0.005600	1.183266	0.006626	89	0.135400	0.980288	0.132731
35	0.005900	1.183248	0.006981	90	0.149661	0.981986	0.146965
36	0.007452	1.178662	0.008783	91	0.164311	0.983268	0.161562
37	0.009004	1.169865	0.010533	92	0.182022	0.983910	0.179093
38	0.010555	1.157128	0.012213	93	0.199471	0.984206	0.196321
39	0.012107	1.141058	0.013815	94	0.218169	0.983467	0.214562
40	0.013659	1.121913	0.015324	95	0.234947	0.982309	0.230790
41	0.015211	1.100832	0.016745	96	0.258664	0.982309	0.254088
42	0.016763	1.078718	0.018083	97	0.283145	0.982383	0.278157
43	0.018315	1.056135	0.019343	98	0.307627	0.982530	0.302253
44	0.019866	1.034232	0.020546	99	0.332109	0.982703	0.326364
45	0.021418	1.013319	0.021703	100	0.356590	0.983245	0.350615
46	0.022970	0.994105	0.022835	101	0.382602	0.983960	0.376465
47	0.022990	0.976672	0.022454	102	0.410909	0.984971	0.404734
48	0.023096	0.961892	0.022216	103	0.443041	0.985910	0.436798
49	0.023024	0.950077	0.021875	104	0.480529	0.986997	0.474281
50	0.022770	0.941138	0.021430	105	0.524902	0.988061	0.518635
51	0.022645	0.935645	0.021188	106	0.579221	0.989125	0.572922
52	0.022625	0.933406	0.021118	107	0.646546	0.990315	0.640284
53	0.022604	0.934822	0.021131	108	0.732997	0.991382	0.726680
54	0.022544	0.939338	0.021176	109	0.846989	0.992449	0.840594
				110	1.000000	n/a	1.000000



**TABLE 7: Police & Fire Retirement System Service Retiree Mortality**  
**Effective 4/1/2024 (For Valuation Purposes Only)**

Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>	Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>
0	0.000100	1.049369	0.000105	55	0.002572	0.960621	0.002471
1	0.000100	1.049369	0.000105	56	0.002687	0.962574	0.002586
2	0.000100	1.049369	0.000105	57	0.002821	0.966786	0.002727
3	0.000100	1.049369	0.000105	58	0.002982	0.972670	0.002901
4	0.000100	1.049369	0.000105	59	0.003183	0.979298	0.003117
5	0.000100	1.049369	0.000105	60	0.003438	0.986360	0.003391
6	0.000100	1.049369	0.000105	61	0.003762	0.992748	0.003735
7	0.000100	1.049369	0.000105	62	0.004166	0.998275	0.004159
8	0.000100	1.049369	0.000105	63	0.004664	1.002455	0.004675
9	0.000100	1.049369	0.000105	64	0.005267	1.004543	0.005291
10	0.000100	1.049369	0.000105	65	0.005991	1.004678	0.006019
11	0.000100	1.049369	0.000105	66	0.006859	1.002581	0.006877
12	0.000100	1.049369	0.000105	67	0.007899	0.998338	0.007886
13	0.000100	1.049369	0.000105	68	0.009137	0.992468	0.009068
14	0.000100	1.049369	0.000105	69	0.010593	0.985512	0.010440
15	0.000100	1.049369	0.000105	70	0.012283	0.977957	0.012012
16	0.000100	1.049369	0.000105	71	0.014217	0.970499	0.013798
17	0.000110	1.049369	0.000115	72	0.016400	0.963427	0.015800
18	0.000110	1.049369	0.000115	73	0.018842	0.957411	0.018040
19	0.000120	1.049369	0.000126	74	0.021558	0.952554	0.020535
20	0.000130	1.049369	0.000136	75	0.024579	0.949225	0.023331
21	0.000140	1.050097	0.000147	76	0.027951	0.947027	0.026470
22	0.000140	1.053118	0.000147	77	0.031733	0.946001	0.030019
23	0.000150	1.058602	0.000159	78	0.035996	0.946192	0.034059
24	0.000160	1.067161	0.000171	79	0.040820	0.947170	0.038663
25	0.000170	1.078133	0.000183	80	0.046285	0.948604	0.043906
26	0.000180	1.091209	0.000196	81	0.052472	0.951045	0.049903
27	0.000190	1.106834	0.000210	82	0.059458	0.953635	0.056701
28	0.000200	1.123640	0.000225	83	0.067314	0.956231	0.064368
29	0.000210	1.141477	0.000240	84	0.076109	0.959099	0.072996
30	0.000220	1.159590	0.000255	85	0.085898	0.961926	0.082628
31	0.000240	1.177326	0.000283	86	0.096732	0.964663	0.093314
32	0.000250	1.193992	0.000298	87	0.108654	0.967164	0.105086
33	0.000260	1.209312	0.000314	88	0.121701	0.969475	0.117986
34	0.000280	1.222464	0.000342	89	0.135910	0.971669	0.132060
35	0.000290	1.232972	0.000358	90	0.151312	0.973354	0.147280
36	0.000310	1.239817	0.000384	91	0.167932	0.974724	0.163687
37	0.000330	1.242887	0.000410	92	0.185789	0.975556	0.181248
38	0.000350	1.241228	0.000434	93	0.204895	0.975752	0.199927
39	0.000370	1.234941	0.000457	94	0.225256	0.975434	0.219722
40	0.000390	1.223726	0.000477	95	0.246879	0.974382	0.240554
41	0.000536	1.208100	0.000648	96	0.270225	0.974504	0.263335
42	0.000682	1.188579	0.000811	97	0.294325	0.974895	0.286936
43	0.000828	1.166037	0.000965	98	0.318425	0.975262	0.310548
44	0.000974	1.141018	0.001111	99	0.342525	0.975948	0.334287
45	0.001353	1.114962	0.001509	100	0.366625	0.976781	0.358112
46	0.001532	1.089051	0.001668	101	0.392231	0.977836	0.383537
47	0.001695	1.063462	0.001803	102	0.420097	0.979137	0.411332
48	0.001841	1.039592	0.001914	103	0.451728	0.980513	0.442925
49	0.001970	1.018257	0.002006	104	0.488631	0.982112	0.479890
50	0.002084	0.999792	0.002084	105	0.532312	0.983393	0.523472
51	0.002186	0.984668	0.002152	106	0.585783	0.984897	0.576936
52	0.002281	0.973205	0.002220	107	0.652058	0.986577	0.643305
53	0.002374	0.965634	0.002292	108	0.737161	0.987962	0.728287
54	0.002469	0.961541	0.002374	109	0.849376	0.989472	0.840434
				110	1.000000	n/a	1.000000

**TABLE 8: Police & Fire Retirement System Disability Retiree Mortality**  
**Effective 4/1/2024 (For Valuation Purposes Only)**

Age	q <sub>x</sub>	MP-2021 Factor	2023 Val q <sub>x</sub>	Age	q <sub>x</sub>	MP-2021 Factor	2023 Val q <sub>x</sub>
0	0.000400	1.049369	0.000420	55	0.005554	0.960621	0.005335
1	0.000400	1.049369	0.000420	56	0.005894	0.962574	0.005673
2	0.000400	1.049369	0.000420	57	0.006256	0.966786	0.006048
3	0.000400	1.049369	0.000420	58	0.006641	0.972670	0.006460
4	0.000400	1.049369	0.000420	59	0.007047	0.979298	0.006901
5	0.000400	1.049369	0.000420	60	0.007480	0.986360	0.007378
6	0.000400	1.049369	0.000420	61	0.007944	0.992748	0.007886
7	0.000400	1.049369	0.000420	62	0.008448	0.998275	0.008433
8	0.000400	1.049369	0.000420	63	0.009005	1.002455	0.009027
9	0.000400	1.049369	0.000420	64	0.009630	1.004543	0.009674
10	0.000400	1.049369	0.000420	65	0.010343	1.004678	0.010391
11	0.000400	1.049369	0.000420	66	0.011168	1.002581	0.011197
12	0.000400	1.049369	0.000420	67	0.012130	0.998338	0.012110
13	0.000400	1.049369	0.000420	68	0.013256	0.992468	0.013156
14	0.000400	1.049369	0.000420	69	0.014581	0.985512	0.014370
15	0.000400	1.049369	0.000420	70	0.016140	0.977957	0.015784
16	0.000400	1.049369	0.000420	71	0.017975	0.970499	0.017445
17	0.000440	1.049369	0.000462	72	0.020131	0.963427	0.019395
18	0.000440	1.049369	0.000462	73	0.022648	0.957411	0.021683
19	0.000480	1.049369	0.000504	74	0.025568	0.952554	0.024355
20	0.000520	1.049369	0.000546	75	0.028924	0.949225	0.027455
21	0.000560	1.050097	0.000588	76	0.032745	0.947027	0.031010
22	0.000560	1.053118	0.000590	77	0.037050	0.946001	0.035049
23	0.000600	1.058602	0.000635	78	0.041856	0.946192	0.039604
24	0.000640	1.067161	0.000683	79	0.047172	0.947170	0.044680
25	0.000680	1.078133	0.000733	80	0.053002	0.948604	0.050278
26	0.000720	1.091209	0.000786	81	0.059347	0.951045	0.056442
27	0.000760	1.106834	0.000841	82	0.066204	0.953635	0.063134
28	0.000800	1.123640	0.000899	83	0.073570	0.956231	0.070350
29	0.000840	1.141477	0.000959	84	0.081442	0.959099	0.078111
30	0.000880	1.159590	0.001020	85	0.089816	0.961926	0.086396
31	0.000960	1.177326	0.001130	86	0.098689	0.964663	0.095202
32	0.001000	1.193992	0.001194	87	0.108654	0.967164	0.105086
33	0.001040	1.209312	0.001258	88	0.121701	0.969475	0.117986
34	0.001120	1.222464	0.001369	89	0.135910	0.971669	0.132060
35	0.001160	1.232972	0.001430	90	0.151312	0.973354	0.147280
36	0.001399	1.239817	0.001735	91	0.167932	0.974724	0.163687
37	0.001639	1.242887	0.002037	92	0.185789	0.975556	0.181248
38	0.001878	1.241228	0.002331	93	0.204895	0.975752	0.199927
39	0.002118	1.234941	0.002616	94	0.225256	0.975434	0.219722
40	0.002357	1.223726	0.002884	95	0.246879	0.974382	0.240554
41	0.002597	1.208100	0.003137	96	0.270225	0.974504	0.263335
42	0.002836	1.188579	0.003371	97	0.294325	0.974895	0.286936
43	0.003075	1.166037	0.003586	98	0.318425	0.975262	0.310548
44	0.003315	1.141018	0.003782	99	0.342525	0.975948	0.334287
45	0.003554	1.114962	0.003963	100	0.366625	0.976781	0.358112
46	0.003794	1.089051	0.004132	101	0.392231	0.977836	0.383537
47	0.004033	1.063462	0.004289	102	0.420097	0.979137	0.411332
48	0.004273	1.039592	0.004442	103	0.451728	0.980513	0.442925
49	0.004289	1.018257	0.004367	104	0.488631	0.982112	0.479890
50	0.004371	0.999792	0.004370	105	0.532312	0.983393	0.523472
51	0.004514	0.984668	0.004445	106	0.585783	0.984897	0.576936
52	0.004713	0.973205	0.004587	107	0.652058	0.986577	0.643305
53	0.004957	0.965634	0.004787	108	0.737161	0.987962	0.728287
54	0.005240	0.961541	0.005038	109	0.849376	0.989472	0.840434
				110	1.000000	n/a	1.000000



**TABLE 9: Retirement System Male Beneficiary Mortality**  
**Effective 4/1/2024 (For Valuation Purposes Only)**

Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>	Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>
0	0.000190	1.049369	0.000199	55	0.005477	0.960621	0.005261
1	0.000190	1.049369	0.000199	56	0.006302	0.962574	0.006066
2	0.000190	1.049369	0.000199	57	0.007128	0.966786	0.006891
3	0.000190	1.049369	0.000199	58	0.007953	0.972670	0.007736
4	0.000190	1.049369	0.000199	59	0.008779	0.979298	0.008597
5	0.000190	1.049369	0.000199	60	0.009604	0.986360	0.009473
6	0.000190	1.049369	0.000199	61	0.009737	0.992748	0.009666
7	0.000190	1.049369	0.000199	62	0.009976	0.998275	0.009959
8	0.000190	1.049369	0.000199	63	0.010343	1.002455	0.010368
9	0.000190	1.049369	0.000199	64	0.010864	1.004543	0.010913
10	0.000190	1.049369	0.000199	65	0.011561	1.004678	0.011615
11	0.000190	1.049369	0.000199	66	0.012454	1.002581	0.012486
12	0.000190	1.049369	0.000199	67	0.013552	0.998338	0.013529
13	0.000190	1.049369	0.000199	68	0.014860	0.992468	0.014748
14	0.000190	1.049369	0.000199	69	0.016383	0.985512	0.016146
15	0.000190	1.049369	0.000199	70	0.018123	0.977957	0.017724
16	0.000200	1.049369	0.000210	71	0.020087	0.970499	0.019494
17	0.000220	1.049369	0.000231	72	0.022287	0.963427	0.021472
18	0.000230	1.049369	0.000241	73	0.024747	0.957411	0.023693
19	0.000240	1.049369	0.000252	74	0.027496	0.952554	0.026191
20	0.000260	1.049369	0.000273	75	0.030575	0.949225	0.029023
21	0.000270	1.050097	0.000284	76	0.034031	0.947027	0.032228
22	0.000290	1.053118	0.000305	77	0.037919	0.946001	0.035871
23	0.000300	1.058602	0.000318	78	0.042302	0.946192	0.040026
24	0.000320	1.067161	0.000341	79	0.047244	0.947170	0.044748
25	0.000340	1.078133	0.000367	80	0.052814	0.948604	0.050100
26	0.000360	1.091209	0.000393	81	0.059084	0.951045	0.056192
27	0.000380	1.106834	0.000421	82	0.066124	0.953635	0.063058
28	0.000400	1.123640	0.000449	83	0.074005	0.956231	0.070766
29	0.000420	1.141477	0.000479	84	0.082792	0.959099	0.079406
30	0.000450	1.159590	0.000522	85	0.092533	0.961926	0.089010
31	0.000470	1.177326	0.000553	86	0.103254	0.964663	0.099605
32	0.000500	1.193992	0.000597	87	0.114959	0.967164	0.111184
33	0.000530	1.209312	0.000641	88	0.127626	0.969475	0.123730
34	0.000560	1.222464	0.000685	89	0.141213	0.971669	0.137212
35	0.000590	1.232972	0.000727	90	0.155657	0.973354	0.151509
36	0.000620	1.239817	0.000769	91	0.170886	0.974724	0.166567
37	0.000660	1.242887	0.000820	92	0.186820	0.975556	0.182253
38	0.000690	1.241228	0.000856	93	0.203383	0.975752	0.198451
39	0.000730	1.234941	0.000902	94	0.220506	0.975434	0.215089
40	0.000780	1.223726	0.000955	95	0.238128	0.974382	0.232028
41	0.000820	1.208100	0.000991	96	0.261746	0.974504	0.255072
42	0.000870	1.188579	0.001034	97	0.286126	0.974895	0.278943
43	0.000920	1.166037	0.001073	98	0.310506	0.975262	0.302825
44	0.000970	1.141018	0.001107	99	0.334885	0.975948	0.326830
45	0.001020	1.114962	0.001137	100	0.359265	0.976781	0.350923
46	0.001080	1.089051	0.001176	101	0.385169	0.977836	0.376632
47	0.001140	1.063462	0.001212	102	0.413358	0.979137	0.404734
48	0.001210	1.039592	0.001258	103	0.445357	0.980513	0.436678
49	0.001280	1.018257	0.001303	104	0.482689	0.982112	0.474055
50	0.001350	0.999792	0.001350	105	0.526877	0.983393	0.518127
51	0.002175	0.984668	0.002142	106	0.580970	0.984897	0.572196
52	0.003001	0.973205	0.002921	107	0.648015	0.986577	0.639317
53	0.003826	0.965634	0.003695	108	0.734107	0.987962	0.725270
54	0.004652	0.961541	0.004473	109	0.847626	0.989472	0.838702
				110	1.000000	n/a	1.000000

**TABLE 10: Retirement System Female Beneficiary Mortality**  
**Effective 4/1/2024 (For Valuation Purposes Only)**

Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>	Age	q <sub>x</sub>	MP-2021 Factor	2024 Val q <sub>x</sub>
0	0.000190	1.062788	0.000202	55	0.004166	0.946609	0.003944
1	0.000190	1.062788	0.000202	56	0.004377	0.955941	0.004184
2	0.000190	1.062788	0.000202	57	0.004599	0.966442	0.004445
3	0.000190	1.062788	0.000202	58	0.004837	0.977605	0.004729
4	0.000190	1.062788	0.000202	59	0.005101	0.987866	0.005039
5	0.000190	1.062788	0.000202	60	0.005400	0.996381	0.005380
6	0.000190	1.062788	0.000202	61	0.005742	1.001985	0.005753
7	0.000190	1.062788	0.000202	62	0.006139	1.004380	0.006166
8	0.000190	1.062788	0.000202	63	0.006601	1.003395	0.006623
9	0.000190	1.062788	0.000202	64	0.007136	0.999006	0.007129
10	0.000190	1.062788	0.000202	65	0.007754	0.992044	0.007692
11	0.000190	1.062788	0.000202	66	0.008462	0.982971	0.008318
12	0.000190	1.062788	0.000202	67	0.009268	0.972693	0.009015
13	0.000190	1.062788	0.000202	68	0.010178	0.962722	0.009799
14	0.000190	1.062788	0.000202	69	0.011203	0.953173	0.010678
15	0.000190	1.062788	0.000202	70	0.012353	0.945230	0.011676
16	0.000200	1.062788	0.000213	71	0.013643	0.938933	0.012810
17	0.000220	1.062788	0.000234	72	0.015090	0.934582	0.014103
18	0.000230	1.062788	0.000244	73	0.016717	0.932202	0.015584
19	0.000240	1.062788	0.000255	74	0.018551	0.931497	0.017280
20	0.000260	1.062788	0.000276	75	0.020625	0.932511	0.019233
21	0.000270	1.065761	0.000288	76	0.022977	0.934492	0.021472
22	0.000290	1.070111	0.000310	77	0.025651	0.937493	0.024048
23	0.000300	1.075799	0.000323	78	0.028695	0.940906	0.026999
24	0.000320	1.082630	0.000346	79	0.032163	0.944664	0.030383
25	0.000340	1.091375	0.000371	80	0.036116	0.948625	0.034261
26	0.000360	1.101209	0.000396	81	0.040616	0.952864	0.038702
27	0.000380	1.112812	0.000423	82	0.045731	0.957096	0.043769
28	0.000400	1.125541	0.000450	83	0.051526	0.961174	0.049525
29	0.000420	1.138394	0.000478	84	0.058068	0.965025	0.056037
30	0.000450	1.150950	0.000518	85	0.065416	0.968694	0.063368
31	0.000470	1.162639	0.000546	86	0.073622	0.971959	0.071558
32	0.000500	1.172521	0.000586	87	0.082729	0.975137	0.080672
33	0.000530	1.179613	0.000625	88	0.092771	0.977979	0.090728
34	0.000560	1.183266	0.000663	89	0.103772	0.980288	0.101726
35	0.000590	1.183248	0.000698	90	0.115743	0.981986	0.113658
36	0.000620	1.178662	0.000731	91	0.128689	0.983268	0.126536
37	0.000660	1.169865	0.000772	92	0.142603	0.983910	0.140308
38	0.000690	1.157128	0.000798	93	0.157474	0.984206	0.154987
39	0.000730	1.141058	0.000833	94	0.173285	0.983467	0.170420
40	0.000780	1.121913	0.000875	95	0.190016	0.982309	0.186654
41	0.000820	1.100832	0.000903	96	0.215125	0.982309	0.211319
42	0.000870	1.078718	0.000938	97	0.241045	0.982383	0.236798
43	0.000920	1.056135	0.000972	98	0.266964	0.982530	0.262300
44	0.000970	1.034232	0.001003	99	0.292884	0.982703	0.287818
45	0.001020	1.013319	0.001034	100	0.318803	0.983245	0.313461
46	0.001080	0.994105	0.001074	101	0.346343	0.983960	0.340788
47	0.001140	0.976672	0.001113	102	0.376312	0.984971	0.370657
48	0.001210	0.961892	0.001164	103	0.410332	0.985910	0.404550
49	0.001280	0.950077	0.001216	104	0.450021	0.986997	0.444169
50	0.001350	0.941138	0.001271	105	0.497000	0.988061	0.491066
51	0.001913	0.935645	0.001790	106	0.554509	0.989125	0.548479
52	0.002477	0.933406	0.002312	107	0.625787	0.990315	0.619726
53	0.003040	0.934822	0.002842	108	0.717316	0.991382	0.711134
54	0.003603	0.939338	0.003384	109	0.838003	0.992449	0.831675
				110	1.000000	n/a	1.000000

**TABLE 11: Employees' Retirement System Death and Disability Central Rates of Decrement  
Effective 4/1/2020**

<b>Age</b>	<b>Ordinary Death</b>	<b>Accidental Death</b>	<b>Ordinary Disability</b>	<b>Accidental Disability Tiers 1, 2</b>	<b>Accidental Disability Tiers 3, 4, 5, 6</b>
15	0.00019	0.00001	0.00006	0.00020	0.00001
16	0.00020	0.00001	0.00006	0.00020	0.00001
17	0.00022	0.00001	0.00007	0.00020	0.00001
18	0.00023	0.00001	0.00008	0.00020	0.00001
19	0.00024	0.00001	0.00009	0.00020	0.00001
20	0.00026	0.00001	0.00010	0.00020	0.00001
21	0.00027	0.00001	0.00011	0.00020	0.00001
22	0.00029	0.00001	0.00012	0.00020	0.00001
23	0.00030	0.00001	0.00014	0.00020	0.00001
24	0.00032	0.00001	0.00015	0.00020	0.00001
25	0.00034	0.00001	0.00017	0.00020	0.00001
26	0.00036	0.00001	0.00019	0.00020	0.00001
27	0.00038	0.00001	0.00021	0.00020	0.00001
28	0.00040	0.00001	0.00023	0.00020	0.00001
29	0.00042	0.00001	0.00025	0.00020	0.00001
30	0.00045	0.00001	0.00028	0.00020	0.00001
31	0.00047	0.00001	0.00031	0.00020	0.00001
32	0.00050	0.00001	0.00035	0.00020	0.00001
33	0.00053	0.00001	0.00039	0.00020	0.00001
34	0.00056	0.00001	0.00043	0.00020	0.00001
35	0.00059	0.00001	0.00048	0.00020	0.00001
36	0.00062	0.00001	0.00053	0.00020	0.00001
37	0.00066	0.00001	0.00059	0.00020	0.00001
38	0.00069	0.00001	0.00066	0.00020	0.00001
39	0.00073	0.00001	0.00073	0.00020	0.00001
40	0.00078	0.00001	0.00081	0.00020	0.00001
41	0.00082	0.00001	0.00090	0.00020	0.00001
42	0.00087	0.00001	0.00100	0.00020	0.00001
43	0.00092	0.00001	0.00111	0.00020	0.00004
44	0.00097	0.00001	0.00124	0.00020	0.00004
45	0.00102	0.00001	0.00137	0.00020	0.00004
46	0.00108	0.00001	0.00153	0.00020	0.00004
47	0.00114	0.00001	0.00170	0.00020	0.00004
48	0.00121	0.00001	0.00189	0.00020	0.00004
49	0.00128	0.00001	0.00210	0.00020	0.00004
50	0.00135	0.00001	0.00233	0.00020	0.00004
51	0.00143	0.00001	0.00259	0.00020	0.00004
52	0.00151	0.00001	0.00288	0.00020	0.00004
53	0.00160	0.00001	0.00320	0.00020	0.00004
54	0.00169	0.00001	0.00355	0.00020	0.00004
55	0.00178	0.00001	0.00395	0.00015	0.00004
56	0.00189	0.00001	0.00438	0.00015	0.00004
57	0.00199	0.00001	0.00487	0.00015	0.00004
58	0.00211	0.00001	0.00541	0.00015	0.00004
59	0.00223	0.00001	0.00602	0.00015	0.00004
60	0.00236	0.00001	0.00668	0.00015	0.00004
61	0.00249	0.00001	0.00743	0.00015	0.00004
62	0.00263	0.00001	0.00825	0.00015	0.00004
63	0.00278	0.00001	0.00917	0.00015	0.00004
64	0.00294	0.00001	0.01019	0.00015	0.00004
65	0.00324	0.00001	0.01121	0.00015	0.00004
66	0.00356	0.00001	0.01233	0.00015	0.00004
67	0.00392	0.00001	0.01356	0.00015	0.00004
68	0.00431	0.00001	0.01492	0.00015	0.00004
69	0.00474	0.00001	0.01641	0.00015	0.00004
70	0.00000	0.00000	0.00000	0.00000	0.00000

**TABLE 12: Employees' Retirement System Withdrawal Central Rates of Decrement (blended over all tiers)  
Effective 4/1/2020**

Age	0 ≤ Service < 2	2 ≤ Service < 3	3 ≤ Service < 4	4 ≤ Service < 5	5 ≤ Service < 10	10 ≤ Service
15	0.19800	0.12105	0.08625	0.06565	0.05530	0.02160
16	0.19800	0.12105	0.08625	0.06565	0.05530	0.02160
17	0.19800	0.12105	0.08625	0.06565	0.05530	0.02160
18	0.23699	0.12105	0.08625	0.06565	0.05530	0.02160
19	0.25824	0.12105	0.08625	0.06565	0.05530	0.02160
20	0.26455	0.12105	0.08625	0.06565	0.05530	0.02160
21	0.26061	0.12105	0.08625	0.06565	0.05530	0.02160
22	0.25065	0.12105	0.08625	0.06565	0.05530	0.02160
23	0.23716	0.12105	0.08625	0.06565	0.05530	0.02160
24	0.22128	0.13032	0.09636	0.07120	0.05587	0.02160
25	0.20403	0.13556	0.10074	0.07480	0.05598	0.02160
26	0.18697	0.13799	0.10186	0.07686	0.05561	0.02160
27	0.17211	0.13796	0.10159	0.07820	0.05482	0.02160
28	0.16086	0.13539	0.10077	0.07949	0.05379	0.02160
29	0.15327	0.13034	0.09957	0.08098	0.05274	0.02155
30	0.14830	0.12340	0.09792	0.08243	0.05186	0.02147
31	0.14471	0.11562	0.09574	0.08331	0.05124	0.02133
32	0.14175	0.10824	0.09300	0.08305	0.05087	0.02115
33	0.13924	0.10222	0.08972	0.08131	0.05069	0.02094
34	0.13728	0.09780	0.08598	0.07814	0.05059	0.02072
35	0.13595	0.09459	0.08202	0.07401	0.05047	0.02052
36	0.13506	0.09198	0.07824	0.06962	0.05021	0.02035
37	0.13432	0.08950	0.07511	0.06567	0.04975	0.02020
38	0.13346	0.08700	0.07295	0.06259	0.04901	0.02003
39	0.13237	0.08456	0.07174	0.06044	0.04802	0.01983
40	0.13114	0.08239	0.07112	0.05897	0.04685	0.01961
41	0.12986	0.08066	0.07054	0.05786	0.04562	0.01941
42	0.12861	0.07946	0.06955	0.05687	0.04445	0.01927
43	0.12745	0.07878	0.06796	0.05592	0.04345	0.01921
44	0.12641	0.07850	0.06593	0.05506	0.04261	0.01915
45	0.12556	0.07846	0.06379	0.05430	0.04187	0.01896
46	0.12502	0.07850	0.06189	0.05360	0.04112	0.01845
47	0.12487	0.07846	0.06044	0.05290	0.04027	0.01758
48	0.12516	0.07827	0.05950	0.05214	0.03930	0.01644
49	0.12583	0.07794	0.05897	0.05134	0.03830	0.01527
50	0.12675	0.07746	0.05871	0.05060	0.03737	0.01428
51	0.12775	0.07684	0.05857	0.05007	0.03658	0.01359
52	0.12864	0.07603	0.05844	0.04987	0.03583	0.01316
53	0.12935	0.07502	0.05828	0.05005	0.03490	0.01292
54	0.12990	0.07387	0.05814	0.05063	0.03346	0.01280
55	0.13047	0.07277	0.05818	0.05166	0.03138	0.01274
56	0.13139	0.07204	0.05864	0.05322	0.02888	0.01273
57	0.13308	0.07204	0.05978	0.05550	0.02670	0.01274
58	0.13597	0.07310	0.06183	0.05865	0.02568	0.01279
59	0.14039	0.07542	0.06486	0.06276	0.02633	0.01285
60	0.14640	0.07900	0.06887	0.06781	0.02856	0.01292
61	0.15365	0.08365	0.07372	0.07366	0.03185	0.01300
62	0.16121	0.08885	0.07915	0.07994	0.03563	0.01307
63	0.16746	0.09364	0.08469	0.08600	0.03964	0.01312
64	0.16746	0.09364	0.08469	0.08600	0.03964	0.01312
65	0.16746	0.09364	0.08469	0.08600	0.03964	0.01312
66	0.16746	0.09364	0.08469	0.08600	0.03964	0.01312
67	0.16746	0.09364	0.08469	0.08600	0.03964	0.01312
68	0.16746	0.09364	0.08469	0.08600	0.03964	0.01312
69	0.16746	0.09364	0.08469	0.08600	0.03964	0.01312
70	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Note: Vesting Schedule Adjustment factors apply to these blended withdrawal rates. See the first page of Appendix B for details.

**TABLE 13: Employees' Retirement System Age-Based Plans Retirement Central Rates of Decrement Effective 4/1/2020**

Age	Tier 1			Tiers 2, 3, 4		
	Service < 20	20 ≤ Srv < 30	30 ≤ Service	Service < 20	20 ≤ Srv < 30	30 ≤ Service
55	0.16985	0.34977	0.77499	0.05895	0.08590	0.47092
56	0.09286	0.13929	0.26808	0.03780	0.04952	0.18857
57	0.07541	0.11619	0.23320	0.03780	0.05216	0.17845
58	0.09055	0.12956	0.21587	0.03960	0.05491	0.17183
59	0.10371	0.15469	0.21164	0.04386	0.06162	0.18384
60	0.10331	0.17394	0.21365	0.04829	0.07343	0.19365
61	0.13785	0.21229	0.24184	0.07578	0.16592	0.23334
62	0.19152	0.34528	0.35390	0.13825	0.35571	0.29639
63	0.15155	0.25017	0.23024	0.10753	0.22081	0.21538
64	0.17236	0.29052	0.23115	0.11760	0.21617	0.20854
65	0.22845	0.29262	0.26254	0.16671	0.28793	0.24495
66	0.23898	0.31788	0.26292	0.19340	0.31970	0.29280
67	0.19844	0.28362	0.22238	0.16763	0.27857	0.24846
68	0.15865	0.31095	0.20547	0.15500	0.25117	0.21412
69	0.19512	0.26244	0.18605	0.16490	0.26427	0.21208
70	2.00000	2.00000	2.00000	2.00000	2.00000	2.00000

Age	Tier 5			Tiers 6		
	Service < 20	20 ≤ Srv < 30	30 ≤ Service	Service < 20	20 ≤ Srv < 30	30 ≤ Service
55	0.04716	0.06872	0.08590	0.04716	0.06872	0.08590
56	0.03024	0.03962	0.04952	0.03024	0.03962	0.04952
57	0.03024	0.04173	0.05216	0.03024	0.04173	0.05216
58	0.03168	0.04393	0.05491	0.03168	0.04393	0.05491
59	0.03509	0.04930	0.06162	0.03509	0.04930	0.06162
60	0.03863	0.05874	0.07343	0.03863	0.05874	0.07343
61	0.06062	0.13274	0.16592	0.06062	0.13274	0.16592
62	0.18825	0.45571	1.09639	0.08825	0.15571	0.19639
63	0.10753	0.22081	0.21538	0.20753	0.52081	1.11538
64	0.11760	0.21617	0.20854	0.11760	0.21617	0.20854
65	0.16671	0.28793	0.24495	0.16671	0.28793	0.24495
66	0.19340	0.31970	0.29280	0.19340	0.31970	0.29280
67	0.16763	0.27857	0.24846	0.16763	0.27857	0.24846
68	0.15500	0.25117	0.21412	0.15500	0.25117	0.21412
69	0.16490	0.26427	0.21208	0.16490	0.26427	0.21208
70	2.00000	2.00000	2.00000	2.00000	2.00000	2.00000

The Tier 5 rates and Tier 6 rates listed above are defined using adjustments to the Tiers 2, 3, 4 rates as described below.

Age	Tier 5		
	Service < 20	20 ≤ Srv < 30	30 ≤ Service*
<62	Service < 20 rate * 0.80	20 ≤ Srv < 30 rate * 0.80	20 ≤ Srv < 30 rate "as is"
=62	Service < 20 rate + 0.05	20 ≤ Srv < 30 rate + 0.10	30 ≤ Service rate + 0.8
>62	Service < 20 rate "as is"	20 ≤ Srv < 30 rate "as is"	30 ≤ Service rate "as is"

\* except that Tier 5 Unified Court Peace Officers with 30 ≤ Service use the Tiers 2, 3, 4 30 ≤ Service rate "as is" at all ages.

Age	Tier 6		
	Service < 20	20 ≤ Srv < 30	30 ≤ Service
<62	Service < 20 rate * 0.80	20 ≤ Srv < 30 rate * 0.80	20 ≤ Srv < 30 rate "as is"
=62	Service < 20 rate - 0.05	20 ≤ Srv < 30 rate - 0.20	30 ≤ Service rate - 0.10
=63	Service < 20 rate + 0.10	20 ≤ Srv < 30 rate + 0.30	30 ≤ Service rate + 0.90
>63	Service < 20 rate "as is"	20 ≤ Srv < 30 rate as is	30 ≤ Service rate "as is"

**TABLE 14: Employees' Retirement System Service-Based Plans Retirement Central Rates of Decrement  
Effective 4/1/2020**

<b>Service</b>	<b>State Corrections Officers 25 Year Plan Tiers 1, 2</b>	<b>State Corrections Officers 25 Year Plan Tiers 3, 5, 6</b>	<b>County Corrections Officers 25 Year Plan All Tiers</b>
25	0.20915	0.35143	0.39788
26	0.22135	0.20590	0.13927
27	0.22418	0.17710	0.12715
28	0.21834	0.17526	0.06190
29	0.20314	0.18232	0.12518
30	0.18023	0.25008	0.31048
31	0.15638	0.24101	0.22222
32	0.15787	0.22845	0.22744
33	0.18173	0.19237	0.29032
34	0.20559	0.21389	0.41606
35	0.23067	0.23796	0.39785
36	0.27093	0.29235	0.39785
37	0.33205	0.33040	0.39785
38	0.38247	0.33040	0.39785
39	0.39053	0.33040	0.39785
40	0.39053	0.33040	0.39785
41	0.39053	0.33040	0.39785
42	0.39053	0.33040	0.39785
43	0.39053	0.33040	0.39785
44	0.39053	0.33040	0.39785
45	0.39053	0.33040	0.39785
46	0.39053	0.33040	0.39785
47	0.39053	0.33040	0.39785
48	0.39053	0.33040	0.39785
49	0.39053	0.33040	0.39785
50	0.39053	0.33040	0.39785
51	0.39053	0.33040	0.39785
52	0.39053	0.33040	0.39785
53	0.39053	0.33040	0.39785
54	0.39053	0.33040	0.39785
55	2.00000	2.00000	2.00000

**TABLE 15: Police & Fire Retirement System Death and Disability Central Rates of Decrement  
Effective 4/1/2020**

<b>Age</b>	<b>Ordinary Death</b>	<b>Accidental Death</b>	<b>Ordinary Disability</b>	<b>Performance of Duty Disability</b>	<b>Accidental Disability</b>
15	0.00010	0.00001	0.00001	0.00020	0.00020
16	0.00010	0.00001	0.00001	0.00020	0.00020
17	0.00011	0.00001	0.00001	0.00020	0.00020
18	0.00011	0.00001	0.00002	0.00020	0.00020
19	0.00012	0.00001	0.00002	0.00020	0.00020
20	0.00013	0.00001	0.00002	0.00020	0.00020
21	0.00014	0.00001	0.00002	0.00020	0.00020
22	0.00014	0.00001	0.00002	0.00020	0.00020
23	0.00015	0.00001	0.00003	0.00020	0.00020
24	0.00016	0.00001	0.00003	0.00020	0.00020
25	0.00017	0.00001	0.00003	0.00020	0.00020
26	0.00018	0.00001	0.00004	0.00020	0.00020
27	0.00019	0.00001	0.00004	0.00020	0.00020
28	0.00020	0.00001	0.00005	0.00020	0.00020
29	0.00021	0.00001	0.00005	0.00020	0.00020
30	0.00022	0.00001	0.00006	0.00020	0.00020
31	0.00024	0.00001	0.00006	0.00020	0.00020
32	0.00025	0.00001	0.00007	0.00020	0.00020
33	0.00026	0.00001	0.00008	0.00020	0.00020
34	0.00028	0.00001	0.00009	0.00020	0.00020
35	0.00029	0.00001	0.00010	0.00020	0.00020
36	0.00031	0.00001	0.00011	0.00050	0.00050
37	0.00033	0.00001	0.00012	0.00080	0.00080
38	0.00035	0.00001	0.00013	0.00110	0.00110
39	0.00037	0.00001	0.00015	0.00140	0.00140
40	0.00039	0.00001	0.00016	0.00170	0.00170
41	0.00041	0.00001	0.00018	0.00200	0.00200
42	0.00043	0.00001	0.00020	0.00230	0.00230
43	0.00046	0.00004	0.00022	0.00260	0.00260
44	0.00048	0.00004	0.00025	0.00290	0.00290
45	0.00051	0.00004	0.00027	0.00320	0.00320
46	0.00054	0.00004	0.00031	0.00320	0.00320
47	0.00057	0.00004	0.00034	0.00320	0.00320
48	0.00060	0.00004	0.00038	0.00320	0.00320
49	0.00064	0.00004	0.00042	0.00320	0.00320
50	0.00068	0.00004	0.00047	0.00320	0.00320
51	0.00071	0.00004	0.00052	0.00320	0.00320
52	0.00076	0.00004	0.00058	0.00320	0.00320
53	0.00080	0.00004	0.00064	0.00320	0.00320
54	0.00084	0.00004	0.00071	0.00320	0.00320
55	0.00089	0.00004	0.00079	0.00320	0.00320
56	0.00094	0.00004	0.00088	0.00320	0.00320
57	0.00100	0.00004	0.00097	0.00320	0.00320
58	0.00105	0.00004	0.00108	0.00320	0.00320
59	0.00111	0.00004	0.00120	0.00320	0.00320
60	0.00118	0.00004	0.00134	0.00320	0.00320
61	0.00125	0.00004	0.00149	0.00320	0.00320
62	0.00132	0.00004	0.00165	0.00320	0.00320
63	0.00139	0.00004	0.00183	0.00320	0.00320
64	0.00147	0.00004	0.00204	0.00320	0.00320
65	0.00162	0.00004	0.00224	0.00320	0.00320
66	0.00178	0.00004	0.00247	0.00320	0.00320
67	0.00196	0.00004	0.00271	0.00320	0.00320
68	0.00215	0.00004	0.00298	0.00320	0.00320
69	0.00237	0.00004	0.00328	0.00320	0.00320
70	0.00000	0.00000	0.00000	0.00000	0.00000

**TABLE 16: Police & Fire Retirement System Withdrawal Central Rates of Decrement  
Effective 4/1/2020**

<b>Service</b>	<b>Withdrawal</b>
0	0.07328
1	0.04003
2	0.02114
3	0.01340
4	0.01142
5	0.01133
6	0.01112
7	0.01043
8	0.00937
9	0.00811
10	0.00673
11	0.00544
12	0.00432
13	0.00351
14	0.00300
15	0.00268
16	0.00230
17	0.00186
18	0.00160
19	0.00160
20	0.00160
21	0.00160
22	0.00160
23	0.00160
24	0.00160
25	0.00160
26	0.00160
27	0.00160
28	0.00160
29	0.00160
30	0.00160
31	0.00160
32	0.00160
33	0.00160
34	0.00160
35	0.00160
36	0.00160
37	0.00160
38	0.00160
39	0.00160
40	0.00160
41	0.00160
42	0.00160
43	0.00160
44	0.00160
45	0.00160
46	0.00160
47	0.00160
48	0.00160
49	0.00160
50	0.00160
51	0.00160
52	0.00160
53	0.00160
54	0.00160
55	0.00000



**TABLE 17: Police & Fire Retirement System Age-Based Plans Retirement Central Rates of Decrement  
Effective 4/1/2020**

Age	Tier 1			Tiers 2, 5		
	Service < 20	20 ≤ Srv < 30	30 ≤ Service	Service < 20	20 ≤ Srv < 30	30 ≤ Service
55	0.16985	0.34977	0.77499	0.05895	0.08590	0.08590
56	0.09286	0.13929	0.26808	0.03780	0.04952	0.04952
57	0.07541	0.11619	0.23320	0.03780	0.05216	0.05216
58	0.09055	0.12956	0.21587	0.03960	0.05491	0.05491
59	0.10371	0.15469	0.21164	0.04386	0.06162	0.06162
60	0.10331	0.17394	0.21365	0.04829	0.07343	0.07343
61	0.13785	0.21229	0.24184	0.07578	0.16592	0.16592
62	0.19152	0.34528	0.35390	0.13825	0.35571	0.35571
63	0.15155	0.25017	0.23024	0.10753	0.22081	0.22081
64	0.17236	0.29052	0.23115	0.11760	0.21617	0.21617
65	0.22845	0.29262	0.26254	0.16671	0.28793	0.28793
66	0.23898	0.31788	0.26292	0.19340	0.31970	0.31970
67	0.19844	0.28362	0.22238	0.16763	0.27857	0.27857
68	0.15865	0.31095	0.20547	0.15500	0.25117	0.25117
69	0.19512	0.26244	0.18605	0.16490	0.26427	0.26427
70	2.00000	2.00000	2.00000	2.00000	2.00000	2.00000

Age	Tiers 6		
	Service < 20	20 ≤ Srv < 30	30 ≤ Service
55			0.04716
56			0.03024
57			0.03024
58			0.03168
59			0.03509
60			0.03863
61			0.06062
62			0.08825
63			0.35753
64			0.11760
65			0.16671
66			0.19340
67			0.16763
68			0.15500
69			0.16490
70			2.00000

Age-based retirement plans make up less than 1% of all PFRS by salary. Therefore, the PFRS service retirement rates are selected to correspond with the ERS assumption reflecting the same early age reduction factors, as described below.

PFRS Tier 1 rates above are identical to ERS Tier 1 across all service groupings.

PFRS Tier 2, 5 rates above use the ERS Tier 2, 3, 4 rates as follows

- PFRS Tiers 2, 5 Service < 20 uses ERS Tier 2, 3, 4 Service < 20
- PFRS Tiers 2, 5 20 ≤ Srv < 30 uses ERS Tier 2, 3, 4 20 ≤ Srv < 30
- PFRS Tiers 2, 5 30 ≤ Service uses ERS Tier 2, 3, 4 20 ≤ Srv < 30

PFRS Tier 6 rates above are identical to ERS Tier 6 across all service groupings.

**TABLE 18: Police & Fire Retirement System Service-Based Plans Retirement Central Rates of Decrement  
Effective 4/1/2020**

<b>Service</b>	<b>20-Year Plan (no additional 60ths beyond 20 years)</b>	<b>20-Year Plan (plus additional 60ths beyond 20 years)</b>	<b>State Police 20-Year Plan</b>	<b>Article 14 20-Year Plan</b>
20	0.31492	0.10607	0.10032	0.10000
21	0.14905	0.06366	0.07433	0.10000
22	0.12749	0.05857	0.07743	0.10000
23	0.13002	0.06826	0.06716	0.10000
24	0.10300	0.08483	0.09944	0.10000
25	0.10031	0.09264	0.12625	0.80000
26	0.07680	0.08322	0.11564	0.50000
27	0.11734	0.09188	0.13445	0.50000
28	0.09717	0.12632	0.12134	0.50000
29	0.08140	0.12838	0.14570	0.50000
30	0.07559	0.17748	0.21896	0.50000
31	0.12715	0.27831	0.40367	0.50000
32	0.15484	0.38048	0.53202	0.50000
33	0.12245	0.28649	0.48511	0.50000
34	0.12376	0.27901	0.30769	0.50000
35	0.15385	0.25410	0.32558	0.50000
36	0.14063	0.33438	0.32558	0.50000
37	0.13853	0.29008	0.32558	0.50000
38	0.13853	0.29008	0.32558	0.50000
39	0.13853	0.29008	0.32558	0.50000
40	0.13853	0.29008	0.32558	0.50000
41	0.13853	0.29008	0.32558	0.50000
42	0.13853	0.29008	0.32558	0.50000
43	0.13853	0.29008	0.32558	0.50000
44	0.13853	0.29008	0.32558	0.50000
45	0.13853	0.29008	0.32558	0.50000
46	0.13853	0.29008	0.32558	0.50000
47	0.13853	0.29008	0.32558	0.50000
48	0.13853	0.29008	0.32558	0.50000
49	0.13853	0.29008	0.32558	0.50000
50	0.13853	0.29008	0.32558	0.50000
51	0.13853	0.29008	0.32558	0.50000
52	0.13853	0.29008	0.32558	0.50000
53	0.13853	0.29008	0.32558	0.50000
54	0.13853	0.29008	0.32558	0.50000
55	2.00000	2.00000	2.00000	2.00000

**TABLE 19: Employees' Retirement System Salary Scale  
Effective 4/1/2018**

<b>Service</b>	<b>Increase</b>
0	1.0880
1	1.0880
2	1.0770
3	1.0660
4	1.0550
5	1.0495
6	1.0462
7	1.0451
8	1.0440
9	1.0429
10	1.0418
11	1.0407
12	1.0396
13	1.0385
14	1.0374
15	1.0363
16	1.0352
17	1.0341
18	1.0330
19	1.0330
20	1.0330
21	1.0330
22	1.0330
23	1.0330
24	1.0330
25	1.0330
26	1.0330
27	1.0330
28	1.0330
29	1.0330
30	1.0330
31	1.0330
32	1.0330
33	1.0330
34	1.0330
35	1.0330
36	1.0330
37	1.0330
38	1.0330
39	1.0330
40	1.0330
41	1.0330
42	1.0330
43	1.0330
44	1.0330
45	1.0330
46	1.0330
47	1.0330
48	1.0330
49	1.0330
50	1.0330
51	1.0330
52	1.0330
53	1.0330
54	1.0330
55	1.0330

**TABLE 20: Police & Fire Retirement System Salary Scale  
Effective 4/1/2021**

Service	Increase
0	1.2800
1	1.2800
2	1.1800
3	1.1300
4	1.1100
5	1.0800
6	1.0600
7	1.0500
8	1.0400
9	1.0400
10	1.0400
11	1.0400
12	1.0400
13	1.0400
14	1.0400
15	1.0400
16	1.0400
17	1.0400
18	1.0400
19	1.0400
20	1.0400
21	1.0400
22	1.0400
23	1.0400
24	1.0400
25	1.0400
26	1.0300
27	1.0300
28	1.0300
29	1.0300
30	1.0300
31	1.0300
32	1.0300
33	1.0300
34	1.0300
35	1.0300
36	1.0300
37	1.0300
38	1.0300
39	1.0300
40	1.0300
41	1.0300
42	1.0300
43	1.0300
44	1.0300
45	1.0300
46	1.0300
47	1.0300
48	1.0300
49	1.0300
50	1.0300
51	1.0300
52	1.0300
53	1.0300
54	1.0300
55	1.0300

# Appendix D: Additional Considerations in Setting the Liability Discount Rate (and the Investment Rate of Return Assumption)

The AA Policy analysis is heavily reliant upon the asset class return assumptions developed by RVK. While the target asset allocation is typically reviewed in five-year cycles, the forecasted asset class return assumptions are updated annually. Generally, the annual update of capital market assumptions is less scrutinized than those used to set the AA Policy. A shift in expectations may reflect a divergence from the risk/reward balance preferred by the Trustee, which would be corrected with the next quinquennial review of the AA Policy. Therefore, while informative and deserving mention, the annual updates do not necessarily change the long-term expectation.

For the fiscal year ending March 31, 2024, the new AA Policy and most recent capital market assumptions result in an expected arithmetic return of 7.15% with a standard deviation of 10.89%, for a geometric return of 6.60%.

It is prudent to be mindful of other financial advisors’ capital market assumptions. By looking outside the organization, we can make two comparisons:

First, we compare to other forecasters’ median return expectations for different portfolio compositions. The composition of the CRF falls between 75/25 (meaning 75% volatile investments and 25% fixed return assets) and 80/20 (meaning 80% volatile investments and 20% fixed return assets).

Investment Firms’ Capital Market Assumption Sets (CMAs)*	75/25	80/20
1	4.46%	4.55%
2	4.63%	4.87%
3	5.15%	5.30%
4	5.19%	5.35%
5	5.20%	5.37%
6	5.23%	5.52%
7	5.42%	5.55%
8	5.47%	5.57%
9	5.63%	5.83%
10	5.91%	6.00%
11	6.46%	6.43%
12	6.57%	6.86%
<b>2022 Consensus Average</b>	<b>5.44%</b>	<b>5.60%</b>

\* Investment Firms’ CMAs published for 2022. Investment Firms do not rank the same across all asset allocations. Some rank a little higher in some asset allocations than they do in others. Nevertheless, they are listed here from 1 through 12.

The 2023 estimates from RVK are higher than most estimates provided by other investment firms.

Second, we can compare PICM’s and RVK’s capital market assumptions by asset class to the Horizon Survey, which averages the capital market assumptions across a diverse collection of financial advisors.

<b>Asset Class</b>	<b>2019 RVK</b>	<b>2023 RVK</b>	<b>2023 Horizon Survey</b>
Domestic equity	5.35%	5.61%	6.90%
Fixed Income	3.58%	3.88%	4.70%
Private equity	7.06%	8.23%	9.50%
International equity	6.94%	7.79%	7.50%
Real estate	5.82%	5.88%	5.70%
Credit	5.89%	7.22%	6.00%
Real assets	7.25%	7.03%	5.70%
Opportunistic/Absolute Return Strategy	6.66%	6.94%	6.00%
Cash	2.96%	2.48%	3.50%

Relative to the average financial advisor, RVK has a history of below-average return estimates for traditional pension investments (domestic equity, bonds, and cash) and above-average return estimates for alternative investments (private equity, international equity, credit, real assets, and opportunistic assets).

We close this appendix with two sidebar discussions that aim to illuminate technical information and situational context.

## Sidebar: Understanding the difference between Arithmetic Return and Geometric Return

A full discussion comparing the arithmetic return and the geometric return is beyond the scope of this report. But the geometric return is generally regarded as the appropriate target for the assumed investment rate of return to be consistent with the application of compound interest.

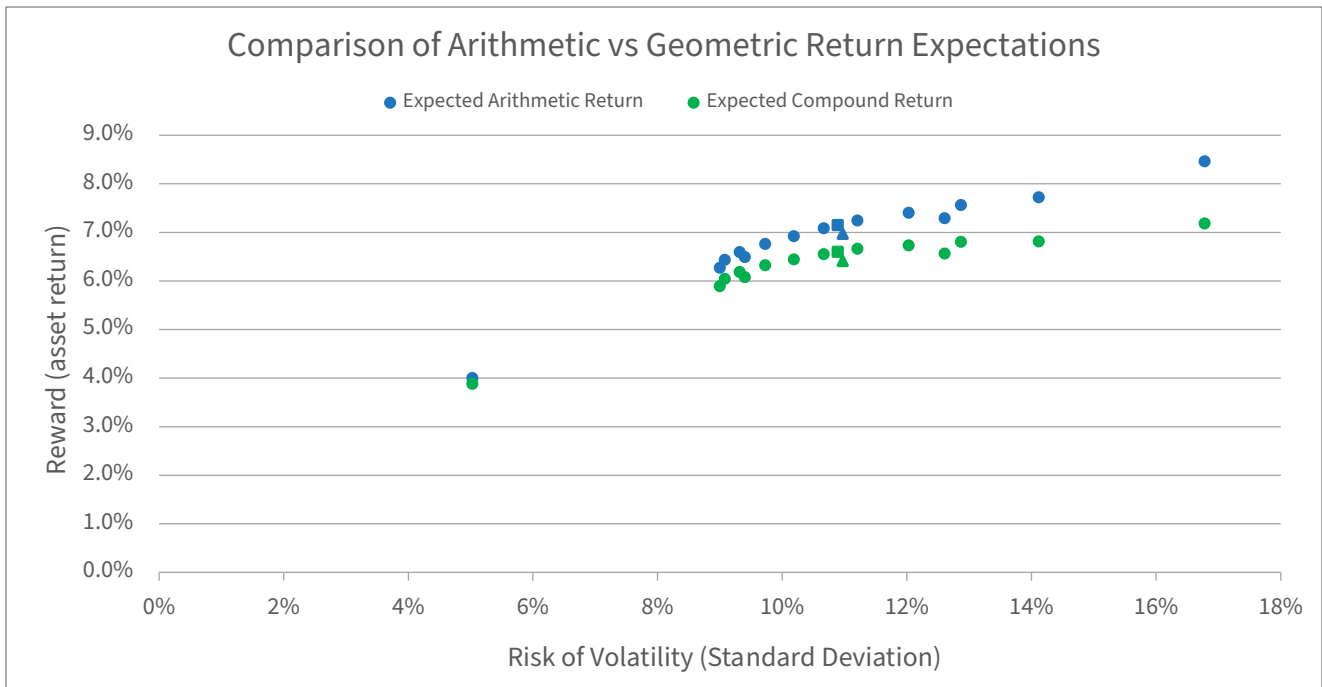
Arithmetic Return (AR) is the average of each year’s annual return over a number of years.

Geometric Return (GR) is the annualized compound return expected over a number of years.

The different meaning of AR versus GR is best illustrated by example. In FY 2009, NYSLRS investment return was -26.4%. In the year that followed it was 25.9%. The arithmetic average of these two years is approximately 0%. This does not mean, however, that FY 2010 recouped all the FY 2009 losses. The GR for the two years was  $(1 - 26.4\%) * (1 + 25.9\%) - 1 = -7.3\%$ , or -3.7% annually. This better characterizes the change in asset value over the two years.

The geometric return is always less than the arithmetic return. The more volatile the annual returns, the greater the difference. The arithmetic return “rewards” risk-taking more than the geometric return. To visualize this, the graph below plots both returns for 10 asset allocations presented in the 2024 AA Policy. The square marker represents the 2024 trustee-approved AA Policy and the triangle marker represents the 2020 AA Policy. All possible portfolios reflect the most up-to-date capital market assumptions.

Notice how the geometric return is flatter than the arithmetic return as the risk increases.



## Sidebar: Understanding How the Assumed Rate of Return is Developed

### CHIEF INVESTMENT OFFICER (CIO)

The **CIO** periodically analyzes the investment landscape to determine the optimal asset allocation. Their recommendation is guided by internal staff, external consultants, and the Investment Advisory Committee, and must be mindful of projected benefit payouts and the sensitivity of employer contributions to investment performance.



Feedback

Following **Comptroller** approval of the recommended rate of return assumption, the **CIO** is so informed. After each annual actuarial valuation, the **Actuary** provides the projected benefit payouts for retirees and beneficiaries.

Following **Comptroller** approval of the AA Policy, the **Actuary** is informed of the AA Policy and the asset class capital market assumptions and correlations.



Stimulus

### ACTUARY

Using stochastic modeling, the **Actuary** determines/confirms the assumed rate of return of the AA Policy given the asset class capital market assumptions and correlations. The recommendation for the liability discount rate is guided by internal staff, an external consultant, and the AAC, and must be mindful of the impact on employer contributions and the objective of smooth contribution rates.



Office of the New York State Comptroller  
Thomas P. DiNapoli

