Public Employees' Retirement System of Mississippi

Experience Study for the Four-Year Period Ending June 30, 2024

Prepared as of June 30, 2024

CavMac
Actuarial Consulting Services

April 16, 2025

The Board of Trustees
Public Employees' Retirement System of Mississippi
429 Mississippi Street
Jackson, MS 39201

Members of the Board:

We are pleased to submit the results of an investigation of the economic and demographic experience for the Public Employees' Retirement System (PERS) and the Municipal Retirement Systems (MRS) for the four-year period from July 1, 2020 to June 30, 2024. The study was based on the data submitted by PERS for the annual valuation. In preparing this report, we relied, without audit, on the data provided.

The results of the experience study are the basis for recommended changes in the actuarial assumptions, which if adopted by the Board, will be first used for the June 30, 2025 valuation. With the Board's approval of the recommendations in the report, we believe the actuarial condition of the System will be more accurately portrayed. We would like to acknowledge the help in the preparation of the data for this investigation given by the PERS staff.

The purpose of the investigation was to assess the reasonability of the current PERS economic assumptions and demographic actuarial assumptions for each Retirement System. Actuarial assumptions are used to measure and budget future costs. Changing assumptions will not change the actual cost of future benefits. Once the assumptions have been adopted, the actuarial valuation measures the adequacy of the fixed contribution rate.

All recommended rates of separation, mortality and salary increase at each age or service level are shown in the attached tables in Appendix D of this report. In the actuary's judgment, the rates recommended are suitable for use until further experience indicates that modifications are desirable.

In order to prepare the measurement of the impact on liabilities in this report, we have utilized actuarial models that we developed to measure liabilities and develop actuarial costs. These models include tools that we have produced and tested, along with commercially available valuation software that we have reviewed to confirm the appropriateness and accuracy of the output. In utilizing these models, we develop and use input parameters and assumptions about future contingent events along with recognized actuarial approaches to develop the needed results.

We hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board (ASB) and the Code of Professional Conduct and Qualification Standards for Public Statements of Actuarial Opinion of the American Academy of Actuaries.

In particular, we have prepared the assumptions developed in this report in keeping with our understanding of Actuarial Standards of Practice No. 27 (Selection of Assumptions for Measuring Pension Obligations).

We note that as we prepare this report, the world has been in a pandemic during much of the experience study period. We have taken this into consideration as we reviewed the experience, particularly regarding mortality, retirement, termination and disability patterns. While we do not believe that there is yet sufficient data to warrant the significant modification of any of our assumptions specifically due to COVID-19, we will continue to monitor the situation and advise the Board in the future of any adjustments that we believe would be appropriate.

The experience investigation was performed by, and under the supervision of, independent actuaries who are members of the American Academy of Actuaries with experience in performing valuations for public retirement systems. The undersigned meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,

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Chief Executive Officer

Ben Mobley, ASA, FCA, MAAA
Consulting Actuary

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SECTION I – EXECUTIVE SUMMARY

The purpose of an actuarial valuation is to provide a timely best estimate of the ultimate costs of a retirement system. Actuarial valuations of the Mississippi Public Employees' Retirement System (PERS) and the Mississippi Municipal Retirement System (MRS) are prepared annually to determine the actuarial contribution rate required to fund them on an actuarial reserve basis, (i.e. the current assets plus future contributions, along with investment earnings will be sufficient to provide the benefits promised by the System). The valuation requires the use of certain assumptions with respect to the occurrence of future events, such as rates of death, termination of employment, retirement age, and salary changes to estimate the obligations of the System.

The basic purpose of an experience study is to determine whether the actuarial assumptions currently in use have adequately anticipated the actual emerging experience. This information, along with the professional judgment of system personnel and advisors, is used to evaluate the appropriateness of continued use of the current actuarial assumptions. When analyzing experience and assumptions, it is important to recognize that actual experience is reported in the short-term while assumptions are intended to be long-term estimates of experience. Therefore, actual experience is expected to vary from study period to study period, without necessarily indicating a change in assumptions is needed.

Cavanaugh Macdonald Consulting, LLC (CavMac) has performed a study of the experience for PERS and MRS for the four-year period ending June 30, 2024. This report presents the results, analysis, and resulting recommendations of our study. It is anticipated that the changes, if approved, will first be reflected in the June 30, 2025 actuarial valuation.

These assumptions have been developed in accordance with generally recognized and accepted actuarial principles and practices that are consistent with the applicable Actuarial Standards of Practice adopted by the Actuarial Standards Board (ASB). While the recommended assumptions represent our best estimate of future experience, there are other reasonable assumption sets that could be supported by the results of this experience study. Those other sets of reasonable assumptions could produce liabilities and costs that are either higher or lower.

Our Philosophy

Similar to an actuarial valuation, the calculation of actual and expected experience is a fairly mechanical process, and differences between actuaries in this area are generally minor. However, the setting of assumptions differs, as it is more art than science. In this report, we have recommended changes to certain assumptions. To explain our thought process, we offer a brief summary of our philosophy:

- **Do Not Overreact**: When we see significant changes in experience, we generally do not adjust our rates to reflect the entire difference. We will typically recommend rates somewhere between the old rates and the new experience. If the experience during the next study period shows the same result, we will probably recognize the trend at that point in time or at least move further in the direction of the observed experience. On the other hand, if experience returns closer to its prior level, we will not have overreacted, possibly causing volatility in the actuarial contribution rates.

- **Anticipate Trends**: If there is an identified trend that is expected to continue, we believe that this should be recognized. An example is the retiree mortality assumption. It is an established trend that people are living longer, outside of the recent pandemic. Therefore, we believe the best estimate of liabilities in the valuation should reflect the expected increase in life expectancy.

- **Simplify**: In general, we attempt to identify which factors are significant and eliminate or ignore the ones that do not materially improve the accuracy of the liability projections.

The following summarizes the findings and recommendations with regard to the assumptions utilized for PERS. Detailed explanations for the recommendations are found in the sections that follow.

Recommended Economic Assumption Changes

Economic assumptions are some of the most visible and significant assumptions used in the valuation process. The items in the broad economy modeled by these assumptions can be very volatile over short periods of time, as clearly seen in the economic recovery from the pandemic in 2021 followed by the downward trend in global markets in 2022. Our goal is to try to find the emerging long-term trends in the midst of this volatility so that we can then apply reasonable assumptions.

Most of the economic assumptions used by actuaries are developed through a building-block approach. For example, the expected return on assets is based on the expectation for inflation plus the expected real return on assets. At the core of the economic assumptions is the inflation assumption. As we discuss later in the report, although recently we have experienced higher inflation following the recovery from the pandemic, we believe that long-term inflation will settle back down in the 2.40% to 2.50% range. So therefore, **we are recommending that the price inflation assumption remain at 2.40%**.

We are also recommending that the long-term expected return on assets assumption remain at 7.00%, reflecting the 2.40% inflation assumption and a 4.60% real rate of return assumption. This will be discussed in detail later in this report, but a real rate of return of 4.60% is supported by the forecasting models developed using the Board's investment consultant's capital market assumptions and the Board's target asset allocation. Further analysis of the 42 sets of capital market assumptions included in the Horizon Actuarial Services, LLC. Survey conducted in 2024 and the Board's target asset allocation also support this recommendation.

Finally, we are recommending that the general wage inflation (payroll growth) assumption used as the underlying payroll growth for active members and used in the level percent of payroll amortization method remain at 2.65%.

The following table summarizes the current and proposed economic assumptions:

Item	Current	Proposed
Price Inflation	2.40%	2.40%
Investment Return*	7.00%	7.00%
Wage Inflation (Payroll Growth)	2.65%	2.65%

* Net of investment expenses only.

We recognize there may be other sets of economic assumptions that are also reasonable for purposes of funding PERS. For example, we have typically reflected conservatism to the degree we would classify as moderate. Actuarial Standards of Practice allow for this difference in approaches and perspective, as long as the assumptions are reasonable and consistent.

Please note that for the Municipal Retirement System (MRS), we recommend continuation of the investment return assumption methodology that has been in place for the past two years. The calculation of the millage rates for each of the municipalities is determined by a projected cash flow analysis, using the current market value of assets as of each valuation date, an assumption that assessed property values remain level over time, and an assumption methodology on investment earnings. The current methodology utilizes a 1.50% differential between the current long-term investment return assumption used for PERS. The 5.50% assumption is 1.50% less than the current assumption used by PERS (7.00%). As MRS is closed to new members, we are assuming a more conservative assumption even though assets are commingled with PERS' assets.

Recommended Demographic Assumption Changes

In the experience study, actual experience for the study period is compared to that expected based on the current actuarial assumption. Comparing the actual incidence of the event to what was expected (called the Actual-to-Expected ratio, or A/E ratio) then provides the basis for our analysis.

The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying in recent years. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 27, *Selection of Assumptions for Measuring Pension Obligations*. This ASOP requires the pension actuary to make and disclose a specific recommendation with respect to future improvements in mortality after the valuation date. There have been significant improvements in longevity in the past, although there are different opinions about future expectations. We believe it is prudent to anticipate that the trend will continue to some degree in the future. Therefore, we believe it is appropriate to reflect future mortality improvement as part of the mortality assumption.

PERS currently uses a generational mortality approach that directly anticipates future improvements in mortality by using a different set of mortality rates for each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain "built-in" mortality improvements, e.g., a member who turns age 65 in 2055 has a longer life expectancy than a member who turns age 65 in 2025. When using generational mortality, the A/E ratios for the observed experience are set near 100% as future mortality improvements will be taken into account directly in the actuarial valuation process.

In this experience study, we also analyzed recent experience on a benefit-weighted basis where the exposures and deaths are multiplied by the monthly retirement benefit amount. This helps to reflect any differences that arise from better mortality experience among those with larger benefits. Because a valuation is designed to measure the amount and timing of future benefit payments (liability) rather than simply the number of retirees leaving pay status, this benefit-weighted approach is an important factor in valuing plan obligations. For mortality, the Actual to Expected Ratios on the benefit-weighted basis were much closer to 1.0 than the count basis over the past four years, which explains why the annual gain/loss experience over the past four valuations has shown very little volatility in the movement of the unfunded actuarial accrued liability. In this study, we have performed this benefit-weighted approach for all demographic assumptions for PERS.

The current post-retirement mortality assumption for healthy lives is a generational mortality approach using the Pub-2010 Mortality Tables. These tables, released in 2019, were developed using public pension plan mortality experience only. In the 2020 experience study, we adopted this family of mortality tables and the generational mortality approach and adjusted these tables to better match the mortality experience of the State of Mississippi and the membership of PERS. Over the past two valuations (2023 and 2024), PERS has experienced very minor gains in our valuation review of assumed to actual experience for post-retirement mortality and the actual to expected ratios have been very close to 100%. The number of deaths has been deemed credible enough to make a determination.

Mortality is typically the most significant demographic assumption. As we discuss in the report, we are recommending that PERS retain the Society of Actuaries Pub-2010 family of mortality tables issued in 2019 based on public retirement plan data. However, we note that we are recommending some slight adjustments in all four mortality tables, such as using the benefit-weighted tables rather than the headcount-weighted tables as prescribed by the Society of Actuaries. We do recommend the continued use of generational mortality, a technique in which mortality rates are assumed to improve slightly each year in the future.

More information will be discussed in the demographic section of this report.

The following is a general list of the other recommended changes to the demographic assumptions for PERS.

- **Retirement: Recommend minor adjustments in the rates of retirement to better match experience of the System.**
- **Disability: Decrease rates of disability retirement at some ages to better match experience of the System.**
- **Withdrawal: Decrease rates of withdrawal that better match experience of the System based on an age by service matrix table broken down by tier.**
- **Merit Salary Scale: No change in the merit salary at this time.**

Section IV of this report will provide more detail to these recommended demographic changes.

Actuarial Methods

The basic actuarial methodologies used in the valuation process include the actuarial cost method, the asset valuation method and the unfunded actuarial accrued liability (UAAL) amortization methodology. Generally, these methods are:

- Cost Method – Entry Age Normal
- Asset Valuation – Five-year recognition of gains and losses with a 20% corridor
- Amortization method – Layered bases with new experience bases amortized over a closed 25-year period as a level percentage of payroll.

Based on our review, discussed in full detail in Section III of this report, we recommend no changes in these actuarial methods at this time.

Other Assumptions

Another assumption that is included in the PERS valuation is the determination of administrative expense component that is added to the total normal cost each year. The current assumption is 0.26% of payroll. **After reviewing the total amount of administrative expenses for the past four years and the percentage of payroll, we are recommending reducing this assumption to 0.25% of payroll.** The following table shows actual percentages over the past four years:

($ in Thousands)

Year Ending June 30	Administrative Expenses	Annual Payroll	Percentage
2021	$15,691	$6,246,077	0.25%
2022	$15,926	$6,454,760	0.25%
2023	$16,446	$7,065,419	0.23%
2024	$18,251	$7,245,824	0.25%

Financial Impact

Although the assumption changes, if approved, will first be reflected in the 2025 valuations, we have provided the following table which highlights the impact of the recommended changes on the unfunded accrued liability (UAL), funded ratio, actuarially determined employer contribution (ADEC), and projected funding ratio on the 2024 valuation and projection results.

($ in Millions)

	Before All Changes	After All Changes
2024 Valuation Unfunded Accrued Liability (UAL)	$26,498	$26,184
2024 Funded Ratio	55.9%	56.2%
2024 Actuarially Determined Employer Contribution (ADEC)	25.92%	25.59%
Projected Funding Ratio 2047*	53.7%	55.4%

* Statutory Contribution Rate (SCR) of 19.90% assumed.

It should be noted that since the recommended changes in the post-retirement mortality table are minor, the financial impact to the MRS valuation results will be minimal.

SECTION II – ECONOMIC ASSUMPTIONS

There are four economic assumptions used in the actuarial valuation performed for PERS. They are:

- Price Inflation
- Investment Return
- Wage Inflation
- Payroll Growth for Amortization Method

Note that future price inflation has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return and wage inflation. However, it is not directly used in the valuation process.

Unlike demographic assumptions, economic assumptions do not lend themselves to analysis largely on the basis of internal historical patterns because economic assumptions are impacted by external forces in the economy. The investment return and general wage increase assumptions are selected on the basis of expectations in an inflation-free environment and then increased by the long-term expectation for inflation, called the "building block" approach.

Sources of data considered in the analysis and selection of the economic assumptions included:

- The 2024 Social Security Trustees Report
- Future expectations of PERS investment consultant, Callan
- Future expectations of other investment consultants (2024 Horizon Survey)
- U.S. Department of the Treasury bond rates
- Assumptions used by other large public retirement systems, based on the Public Fund Survey, published by the National Association of State Retirement Administrators (NASRA)
- Historical observations of price and wage growth statistics and investment returns

Guidance regarding the selection of economic assumptions for measuring pension obligations is provided by Actuarial Standard of Practice (ASOP) No. 27, *Selection of Assumptions for Measuring Pension Obligations*. Because no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment.

ASOP 27 requires the actuary to select a "reasonable" assumption. For this purpose, an assumption is reasonable if it has the following characteristics:

- It is appropriate for the purpose of the measurement;
- It reflects the actuary's professional judgment;
- It takes into account historical and current economic data that is relevant as of the measurement date;
- It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
- It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed, or when alternative assumptions are used for the assessment of risk.

SECTION II – ECONOMIC ASSUMPTIONS

With respect to relevant data, the standard recommends the actuary review appropriate recent and long-term historical economic data but advises the actuary not to give undue weight to recent experience. Furthermore, it advises the actuary to consider that some historical economic data may not be appropriate for use in developing assumptions for future periods due to changes in the underlying environment. In addition, with respect to any particular valuation, each economic assumption should be consistent with all other economic assumptions over the measurement period.

ASOP 27 recognizes that economic data and analyses are available from a variety of sources, including representatives of the plan sponsor, investment advisors, economists, and other professionals. The actuary is permitted to incorporate the views of experts, but the selection or advice must reflect the actuary's professional judgment.

The standard also discusses a "range of reasonable assumptions" which in part states "the actuary should also recognize that different actuaries will apply professional judgment and may choose different reasonable assumptions. As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice."

In our opinion, the economic assumptions recommended in this report have been developed in accordance with ASOP No. 27. The following table shows our recommendations followed by detailed discussions of each assumption.

Item	Current Assumptions	Proposed Assumptions
Price Inflation	2.40%	2.40%
Real Rate of Return*	4.60	4.60
Investment Return	7.00%	7.00%
Price Inflation	2.40%	2.40%
Real Wage Growth	0.25	0.25
Wage Inflation	2.65%	2.65%
Payroll Growth	2.65%	2.65%

* net of investment expenses.

Price Inflation

Background

As can be seen from the table on the previous page, assumed price inflation is used as the basis for both the investment return assumption and the wage inflation assumption. These latter two assumptions will be discussed in detail in the following sections.

It is important that the price inflation assumption be consistently applied throughout the economic assumptions utilized in an actuarial valuation. This is called for in ASOP No. 27 and is also required to meet the parameters for determining pension liabilities and expense under Governmental Accounting Standards Board (GASB) Statements No. 67 and 68. The long-term relationship between price inflation and investment return has long been recognized by economists. The basic principle is that the investor demands a more or less level "real return" – the excess of actual investment return over price inflation. If inflation rates are expected to be high, investment return rates are also expected to be high, while low inflation rates are expected to result in lower expected investment returns, at least in the long run.

The current price inflation assumption is 2.40% per year, which was recommended and adopted in the last experience study.

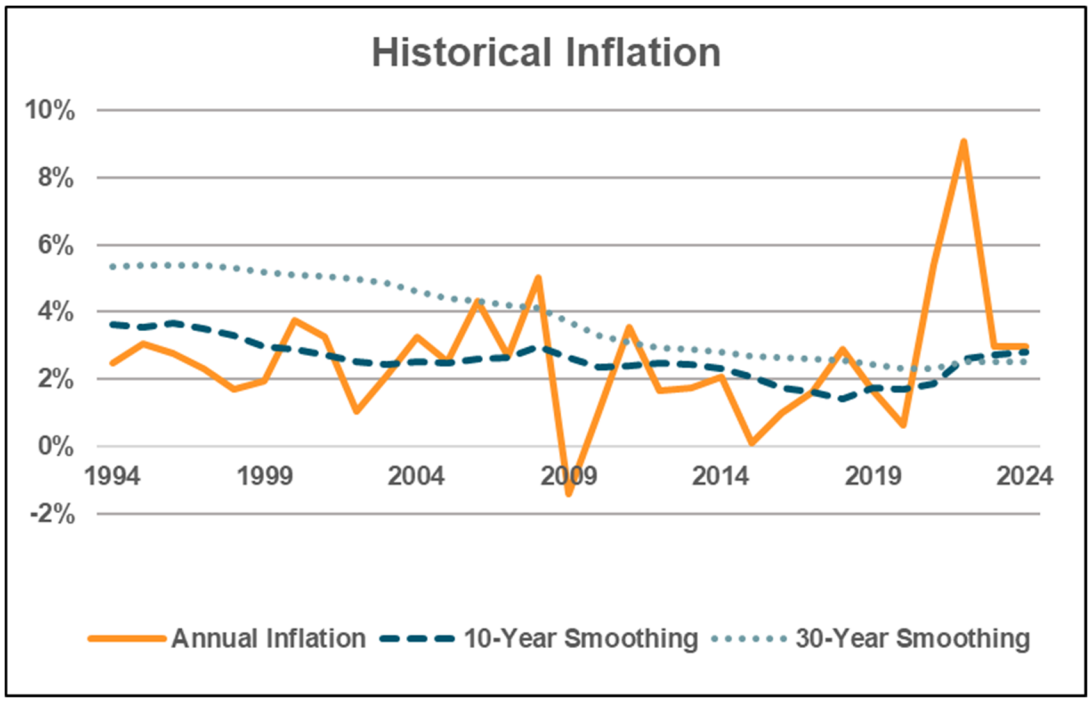
Past Experience

The Consumer Price Index, US City Average, All Urban Consumers, CPI (U), has been used as the basis for reviewing historical levels of price inflation. The table below provides historical annualized rates and annual standard deviation of the CPI-U over periods ending June 30th.

Period	Number of Years	Annualized Rate of Inflation	Annual Standard Deviation
1926 – 2024	98	2.96%	4.02%
1964 – 2024	60	3.94%	2.89%
1974 – 2024	50	3.79%	2.94%
1984 – 2024	40	2.81%	1.75%
1994 – 2024	30	2.54%	1.86%
2004 – 2024	20	2.55%	2.23%
2014 – 2024	10	2.80%	2.66%

The following graph illustrates the historical levels of price inflation measured as of June 30th of each of the last 50 years and compared to the current 2.40% annual rate currently assumed.

Annual Rate of CPI (U) Increases



As can be seen from the table on the previous page, over the last 30 years, the average annual rate of increase in the CPI-U has been just over 2.50%. The higher annual rates over the past few years have increased this average. In the last experience study in 2022, the 30-year average of price inflation was approximately 2.53%.

Forecasts

Additional information to consider in formulating this assumption is obtained from measuring the spread on Treasury Inflation Protected Securities (TIPS) and from the prevailing economic forecasts. The spread between the nominal yield on treasury securities (bonds) and the inflation indexed yield on TIPS of the same maturity is referred to as the "breakeven rate of inflation" and represents the bond market's expectation of inflation over the period to maturity.

The table below provides the calculation of the breakeven rate of inflation as of December 31, 2024.

Years to Maturity	Nominal Bond Yield	TIPS Yield	Breakeven Rate of Inflation
5	4.38%	2.00%	2.38%
10	4.58	2.24	2.34
20	4.86	2.41	2.45
30	4.78	2.48	2.30

As this data indicates, the bond market is anticipating very low inflation of 2.3% to 2.5% for both the short and long term. The bond market expectations may be heavily influenced by the expectations of actions by the Federal Reserve Bank. Whether inflation returns to the higher rates observed historically remains to be seen. We note that measures can move fairly significantly over just a few months.

Based upon information contained in the "Survey of Professional Forecasters" for the fourth quarter of 2024 as published by the Philadelphia Federal Reserve Bank, the median expected annual rate of inflation for the next ten years is 2.23%. Although 10 years of future expectation is too short of a period for the basis of our inflation assumption, the information does provide some evidence that the consensus expectations of these experts are for rates of inflation very close to our current assumption of 2.40% for the near-term future.

PERS' investment consultant, Callan, also has an inflation forecast in their capital market assumptions. Their short-term assumption (10 years) is 2.50%. Horizon Actuarial Services surveys a significant portion of the major investment advisors and publishes their assumptions. For the 2024 study, the long-term inflation assumption was 2.44%.

Social Security Administration

Although many economists forecast lower inflation than the assumption used by most retirement plans, they are generally looking at a shorter time horizon than is appropriate for a pension valuation. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the 2024 annual report, the projected ultimate average annual increase in the CPI over the next 75 years was estimated to be 2.40%, under the intermediate (best estimate) cost assumption. The range of inflation assumptions used in the Social Security 75-year modeling, which includes a low and high-cost scenario, in addition to the intermediate cost projection, was 1.80% to 3.00%. These rates remained unchanged from their 2022 annual report.

Peer Comparison

While we do not recommend the selection of any assumption based on what other systems use, it does provide another set of relevant information to consider. Based on the Public Plan Database (a survey of over 125+ state and local retirement systems maintained by a collaboration between the Center for Retirement Research at Boston College, the Center for State and Local Government Excellence, and the National Association of State Retirement Administrators), the average inflation assumption for governmental plans is 2.46%. This data is largely based on actuarial valuations prepared with measurement dates in 2023. Based on our experience, we believe the inflation assumption has been steady for most systems over the last year.

Recommendation

It is difficult to predict inflation accurately. Inflation's short-term volatility is illustrated by comparing its average rate over the last 10, 30 and 50 year history. Although the 30-year average of 2.54% is closer to the System's assumed rate of 2.40%, the longer 50-year average of 3.79% is much higher and it includes the very high rates of inflation from the late 1970s and early 1980s. Those high rates will not be part of the 50-year average for much longer.

Although we have experienced higher inflation over the last few years following the recovery from the COVID-19 pandemic, current economic forecasts suggest annual inflation rates closer to 2.40% over the short-term and long-term, respectively. We concur with these forecasts and recommend maintaining the inflation assumption for PERS at 2.40%.

Price Inflation Assumption	
Current	2.40%
Recommended	2.40%

Investment Return

Background

The investment return assumption reflects anticipated returns on the current and future assets. The assumed investment return is one of the most significant assumptions in the annual actuarial valuation process as it is used to discount the expected benefit payments for all active, inactive and retired members. Minor changes in this assumption can have a major impact on valuation results. The investment return assumption should reflect the asset allocation target for the funds set by the Board of Trustees.

The current rate recommended by the actuary is 7.00%, consisting of a price inflation assumption of 2.40% and a real rate of return assumption of 4.60%.

Long Term Perspective

Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon in order to make prudent choices regarding how to invest the trust funds. For actuarial calculations, we typically consider very long periods of time. For example, a newly, hired employee in PERS who is 25 years old may work for 35 years, to age 60, and live another 30 years, to age 90 (or longer). The retirement system would receive contributions for the first 35 years and then pay out benefits for the next 30 years. During the entire 65-year period, the system is investing assets related to the member. For such a typical career employee, more than one-half of the investment income earned on assets accumulated to pay benefits is received after the employee retires. In addition, in an open, ongoing system like PERS, the stream of benefit payments is continually increasing as new hires replace current members who leave covered employment due to death, termination of employment, and retirement. This difference in the time horizon used by actuaries and investment consultants is frequently a source of debate and confusion when setting economic assumptions.

Past Experience

One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the timeframe used, especially if the year-to-year results vary widely. In addition, the asset allocation can also impact the investment returns so comparing results over long periods when different asset allocations were in place may not be meaningful.

The assets for PERS are valued using a widely accepted asset-smoothing methodology that fully recognizes the expected investment income and also recognizes 20% of each year's investment gain or loss (the difference between actual and expected investment income). The recent experience over the last five years is shown in the table below.

Year Ending 6/30	Actuarial Value	Market Value
2020	6.72%	3.11%
2021	12.47	32.17
2022	8.49	(8.64)
2023	6.85	7.43
2024	7.28	10.41
Geometric Average	8.34%	8.11%

While important to review and analyze, historical returns over such a short time period are not credible for the purpose of setting the long-term assumed future rate of return.

Future Expectation Analysis

ASOP 27 provides that the actuary may rely on outside experts in setting economic assumptions. PERS utilizes the services of Callan to assist them in developing investment strategies and providing capital market assumptions for the PERS portfolio. As part of their duties, Callan periodically performs asset-liability studies, along with comprehensive reviews of the expected return of the various asset classes in which the PERS portfolio is invested. We believe it is appropriate to consider the results of Callan's work as one factor in assessing expected future returns.

We also recognize that there can be differences of opinion among investment professionals regarding future return expectations. Horizon Actuarial Services prepares an annual study in which they survey various investment advisors (42 were included in the 2024 study with a 10-year horizon) and provide ranges of results as well as averages. This information provides an additional perspective on what a broad group of investment experts anticipate for future investment returns.

Our forward-looking analysis used the real rates of return in Callan's capital market assumptions for 2025-2034 and PERS' target asset allocation. Using statistical projections that assume investment returns approximately follow a lognormal distribution with no correlation between years, produces an expected range of real rates of return over a 50-year time horizon. Looking at one year's results produces a mean real return of 5.77%, but also has a high standard deviation or measurement of volatility. By expanding the time horizon, the real return does not change, but the volatility declines significantly. The table below provides a summary of results.

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	5.77%	13.26%	-14.49%	-3.47%	5.01%	14.24%	28.96%
5	5.11%	5.88%	-4.21%	1.13%	5.01%	9.04%	15.12%
10	5.03%	4.15%	-1.59%	2.25%	5.01%	7.85%	12.06%
20	4.99%	2.93%	0.30%	3.05%	5.01%	7.01%	9.95%
30	4.97%	2.39%	1.14%	3.41%	5.01%	6.64%	9.02%
40	4.97%	2.07%	1.65%	3.62%	5.01%	6.42%	8.48%
50	4.96%	1.85%	2.00%	3.77%	5.01%	6.27%	8.11%

The percentile results are the percentages of random returns over the time span shown that are expected to be less than the amount indicated. For example, for the 10-year time span, 5% of the resulting real rates of return will be below -1.59% and 95% will be above that. As the time span increases, the results begin to converge. Over a 50-year time span, the results indicate there will be a 25% chance that real returns will be below 3.77% and a 25% chance they will be above 6.27%. In other words, there is a 50% chance the real returns will be between 3.77% and 6.27%.

For a broader view of expected returns, we also reviewed the 2024 Survey of Capital Market Assumptions produced by Horizon Actuarial Services, LLC to see what other investment professionals are currently using for capital market assumptions. The Horizon survey includes both 10-year horizon and 20-year horizon capital market assumptions. We applied the same statistical analysis to these survey results as we did the capital market assumption of PERS investment advisor with the following real return results for the 10-year horizon and 20-year horizon:

Horizon Survey 10-year horizon

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	5.40%	13.25%	-14.83%	-3.83%	4.64%	13.86%	28.57%
5	4.74%	5.87%	-4.565	0.77%	4.64%	8.67%	14.74%
10	4.66%	4.15%	-1.95%	1.89%	4.64%	7.48%	11.69%
20	4.62%	2.93%	-0.06%	2.69%	4.64%	6.64%	9.58%
30	4.61%	2.39%	0.78%	3.04%	4.64%	6.27%	8.65%
40	4.60%	2.07%	1.29%	3.26%	4.64%	6.05%	8.11%
50	4.60%	1.85%	1.64%	3.40%	4.64%	5.90%	7.74%

Horizon Survey 20-year horizon

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	5.76%	13.25%	-14.48%	-3.47%	5.00%	14.22%	28.93%
5	5.10%	5.87%	-4.20%	1.13%	5.00%	9.03%	15.10%
10	5.02%	4.15%	-1.59%	2.25%	5.00%	7.84%	12.05%
20	4.98%	2.93%	0.29%	3.05%	5.00%	7.00%	9.94%
30	4.97%	2.39%	1.14%	3.40%	5.00%	6.63%	9.01%
40	4.96%	2.07%	1.65%	3.62%	5.00%	6.41%	8.47%
50	4.95%	1.85%	2.00%	3.76%	5.00%	6.26%	8.10%

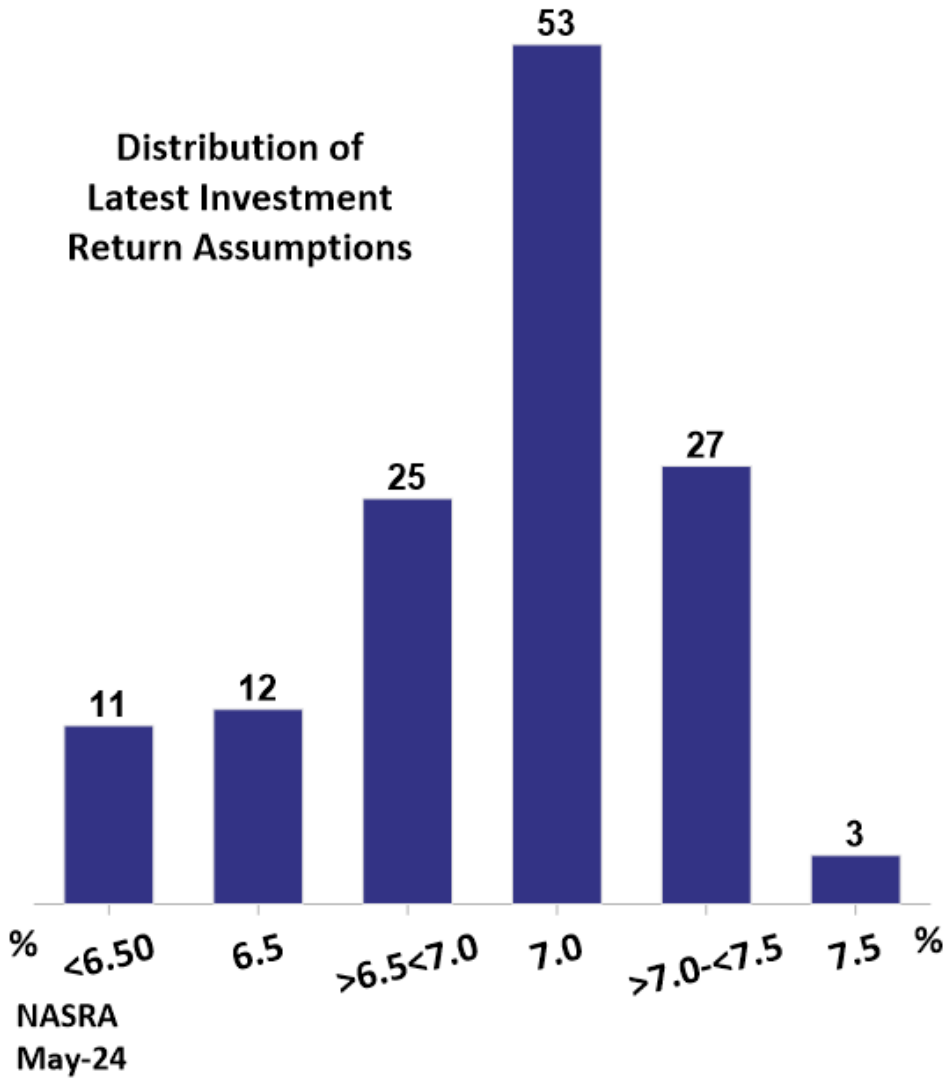
As you can see from the two tables above, setting a real return assumption depends on the time horizon a plan seeks. The 20-year horizon is approximately 0.36% higher at all percentiles than the 10-year horizon. While PERS is a long-term vehicle expected to pay benefits to its retirees for many years in the future, a high percentage of the present value of the benefits is determined within the next ten to fifteen years, so the real return recommendation should fall near the 50th percentile columns in the three tables above.

Using a 2.40% inflation assumption, the current investment return assumption of 7.00% utilizes a 4.60% real rate of return (using the "building block" methodology). Based on the table directly above, 4.60% falls into the 42nd percentile. While it is slightly below thresholds that we recommend for a long-term assumption, it is still a reasonable assumption, as it falls within the 40-60th percentile range.

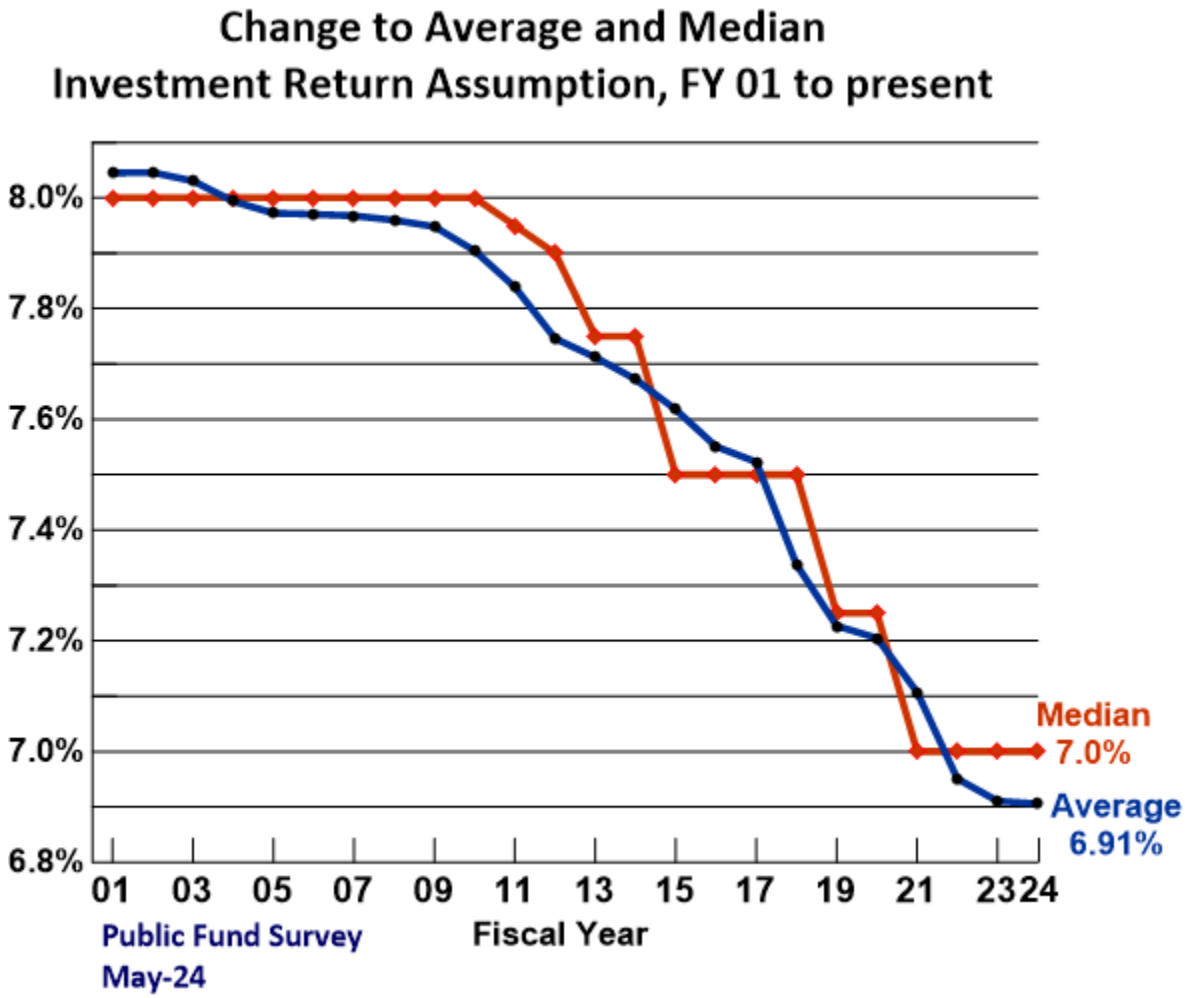
Peer Comparison

Public retirement systems have historically compared their investment performance to their peer group. While we believe there is some merit in assessing the movement in the assumed rate of return for other systems, this is not an appropriate basis for setting this assumption in our opinion. For example, different plans have different plan dynamics, including varying asset allocations, which will impact their choice of the assumed investment return. This peer group information merely provides another set of relevant data to consider as long as we recognize that asset allocation varies from system to system.

The following chart shows the nominal investment return assumptions of 131 plans in the National Association of State Retirement Administrators (NASRA). The assumptions shown below are as of May 2024 and are updated frequently by the NASRA staff.



The following chart shows the changes in expected investment return assumption from the NASRA public plan survey over the last 23 years from 2001.



Recommendation

By actuarial standards, we are required to maintain a long-term perspective in setting all assumptions, including the investment return assumption. Therefore, we believe we must be careful not to let recent experience or short-term expectations impact our judgment regarding the appropriateness of the current assumption over the long term.

Based on our analysis of Callan's capital market assumptions and the Horizon Survey capital market assumptions, we are recommending continuation of a real return assumption of 4.60%. We acknowledge that this real return assumption is just slightly below Horizon Survey's anticipated return over the next 10 years of 4.64%. Based on our recommended inflation assumption of 2.40% and real return assumption of 4.60%, we are recommending continuation of the 7.00% expected long term nominal rate of return assumption.

Investment Return Assumption		
	Current	**Recommended**
Real Rate of Return*	4.60%	4.60%
Inflation	2.40%	2.40%
Net Investment Return	7.00%	7.00%

* net of investment expenses.

Wage Inflation

Background

Wage inflation, thought of as the "across the board" rate of salary increases, is composed of the price inflation assumption combined with an assumption for the real rate of wage increases. In constructing the individual salary increase assumption, the wage inflation assumption is further combined with an assumption for age- or service-based salary increases (called a merit scale). The merit scale assumption is discussed later in this report.

Currently, the wage inflation assumption is 2.65%, which implies an assumed real rate of wage increase or real wage inflation of 0.25% (2.65% less the current inflation assumption of 2.40%). The excess of wage inflation over price inflation represents the increase in the standard of living, also called productivity growth. There has been debate on the issue of whether public sector employees will receive, over the long term, the same rewards for productivity as employees in the private sector, where productivity is more readily measurable. To our knowledge, no definitive research has been completed on this topic. Nevertheless, it is our opinion that public sector employees will eventually be rewarded with the same productivity increases as those participating in the remainder of the economy, even if there is a time lag.

Past Experience

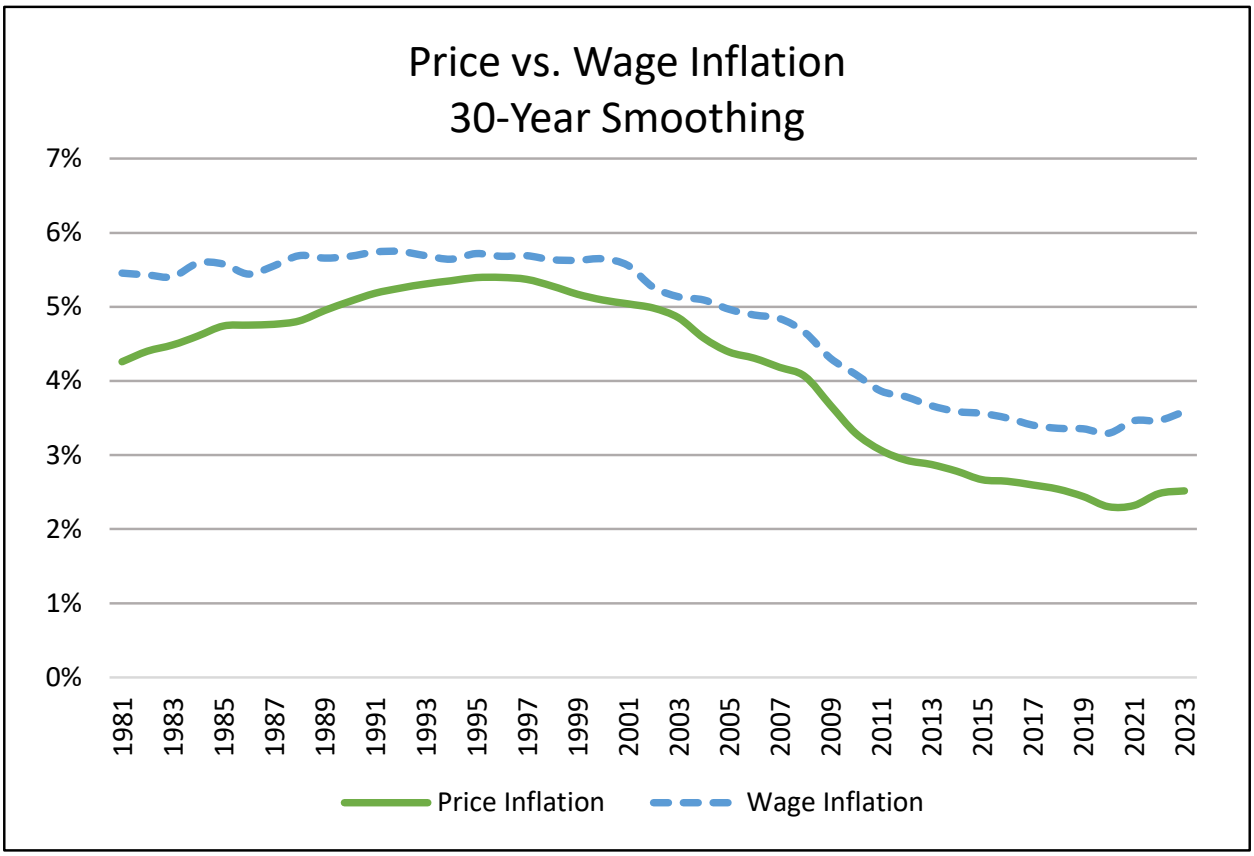
The Social Security Administration publishes data on wage growth in the United States (see Appendix C). While this is the most comprehensive data available, it is based on all wage earners in the country so it can be influenced by the mix of jobs as well as by changes in certain sectors of the workforce that may not be seen by all segments.

As with our analysis of inflation, we provide below wage inflation and a comparison with price inflation over various time periods. Currently, this wage data is only available through calendar year 2023. We remove the rate of price inflation for each year from the data to result in the historical real rate of wage inflation.

Period	Wage Inflation	Price Inflation	Real Wage Growth
2013-2023	4.03%	2.79%	1.24%
2003-2023	3.41%	2.58%	0.83%
1993-2023	3.59%	2.51%	1.08%
1983-2023	3.76%	2.81%	0.95%
1973-2023	4.44%	3.86%	0.58%

Thus, over the last 50 years, annual real wage growth has averaged 0.58%.

Similar information over rolling thirty-year periods is shown in the following graph:



Public Sector Compensation and Wages

The Bureau of Labor Statistics publishes the Employment Cost Index, including detail for real (net of inflation) total compensation and wages and salaries. Further, this index is also broken down for state and local government workers. From 2005 through 2024, real compensation grew by at an annualized rate of 2.85%, while wages and salaries grew at a rate of 2.47%. This difference is a reflection that state and local government workers have had much of their compensation increase delivered through benefits rather than wages and salaries. While it is certainly reasonable to anticipate that total compensation will continue to increase faster than wages and salaries, it is also reasonable to anticipate that the difference between the two will moderate over time.

Recommendation

Based, on all the information discussed, we recommend that the plan maintain a 0.25% real wage growth inflation assumption and a total wage inflation growth of 2.65%.

Wage Inflation Assumption		
	Current	**Recommended**
Price Inflation	2.40%	2.40%
Real Wage Growth	0.25%	0.25%
Wage Inflation	2.65%	2.65%

Payroll Growth

Background

The assumed future rate of payroll growth increase in the total payroll of PERS' active members is an assumption used in the level percentage of payroll amortization method that affects the calculation of the amortization period required to fully amortize the unfunded actuarial accrued liability and the actuarially determined employer contribution. The total payroll growth is impacted by individual member's increases and population growth. The current assumption is 2.65% per year which is comprised of the inflation assumption of 2.40% and real wage growth of 0.25%.

Past Experience

The following table shows the actual PERS' payroll growth experienced over different time periods.

Period	Number of Years	Annual Payroll Growth	Annual Active Membership Growth	Net Payroll Growth
2004 – 2024	20	2.28%	-0.35%	2.64%
2009 – 2024	15	1.46%	-0.90%	2.38%
2014 – 2024	10	2.19%	-1.01%	3.23%
2019 – 2024	5	3.35%	-0.65%	4.02%

Recommendation

The table above shows annual payroll growth has been higher than assumed and the active membership growth has declined significantly since the financial crisis of 2008/2009. The net growth recently has been averaging above the current assumption of 2.65% but most of that is due to the larger than expected pay raises that were granted during the 2023 valuation. We anticipate the annual growth to come down to more normal levels in the future. **Therefore, we are recommending we maintain the payroll growth assumption of 2.65%, which is equal to the recommended wage inflation assumption.**

ACTUARIAL COST METHOD

The systematic financing of a pension plan requires that contributions be made in an orderly fashion while a member is actively employed, so that the accumulation of these contributions, together with investment earnings should be sufficient to provide promised benefits and cover administration expenses. The actuarial valuation is the process used to determine when money should be contributed, i.e., as part of the budgeting process.

The actuarial valuation will not impact the amount of benefits paid or the actual cost of those benefits. In the long run, actuaries cannot change the costs of the pension plan, regardless of the funding method used or the assumptions selected. However, actuaries will influence the incidence of costs by their choice of methods and assumptions.

The valuation or determination of the present value of all future benefits to be paid by the funds reflects the assumptions that best describe anticipated future experience. The choice of a funding method does not impact the determination of the present value of future benefits. The funding method determines only the incidence of cost. In other words, the purpose of the funding method is to allocate the present value of future benefits determination into annual costs. In order to do this allocation, it is necessary for the funding method to "break down" the present value of future benefits into two components: (1) that which is attributable to the past, (2) and that which is attributable to the future. The excess of that portion attributable to the past over the plan assets is then amortized over a period of years. Actuarial terminology calls the part attributable to the past the "past service liability" or the "actuarial accrued liability". The portion of the present value of future benefits allocated to the future is commonly known as "the present value of future normal costs", with the specific piece of it allocated to the current year being called "the normal cost". The difference between the plan assets and actuarial accrued liability is called the "unfunded actuarial accrued liability".

Two key points should be noted. First, there is no single "correct" funding method, since different funding methods simply change the timing of the funding. Second, the allocation of the present value of future benefits and hence cost to the past for amortization and to the future for annual normal cost payments is not necessarily in a one-to-one relationship with service earned in the past and future service to be earned.

Entry Age Normal

There are various actuarial cost methods, each of which has different characteristics, advantages and disadvantages. However, Governmental Accounting Standard Board Statement Numbers 67 and 68 require that the Entry Age Normal cost method be used for financial reporting. Most retirement systems will not want to use a different actuarial cost method for funding and financial reporting. In addition, the Entry Age Normal method has been the most popular funding method for public systems for many years. This is the cost method currently used by PERS for all plans.

The rationale of the entry age normal (EAN) funding method is that the cost of each member's benefit is determined to be a level percentage of salary from date of hire to the end of employment. This level percentage multiplied by the member's annual salary is referred to as the normal cost and is that portion of the total cost of the employee's benefit which is allocated to the current year. The portion of the present value of future benefits allocated to the future is determined by multiplying this percentage times the present value of the member's assumed earnings for all future years including the current year. The entry age normal actuarial accrued liability is then developed by subtracting from the present value of future benefits that portion of costs allocated to the future. To determine the unfunded actuarial accrued liability, the actuarial value of plan assets is subtracted from the entry age normal actuarial accrued liability. The current year's cost to amortize the unfunded actuarial accrued liability is developed by applying an amortization factor based on the funding policy.

It is to be expected that future events will not occur exactly as predicted by the actuarial assumptions in each year. Actuarial gains/losses from experience under this actuarial cost method can be directly calculated and are reflected as a decrease/increase in the unfunded actuarial accrued liability. Consequently, the gain/loss results in a decrease/increase in the amortization payment, and therefore the contribution rate or amount.

Recommendation

Considering that the Entry Age Normal cost method is the most commonly used cost method by public plans, that it develops a normal cost rate that tends to be stable and is the required cost method under calculations required by Governmental Accounting Standard Numbers 67 and 68, **we recommend the Entry Age Normal actuarial cost method be retained by PERS for all plans.** Note that because of GASB 67 and 68 requirements, the Entry Age Normal method will also be used by the plans for accounting disclosures.

ACTUARIAL VALUE OF ASSETS

In preparing an actuarial valuation, the actuary must assign a value to the assets of the fund. An adjusted market value is often used to smooth out the volatility that is reflected in the market value of assets. This is because most employers would rather have annual costs remain relatively smooth, as a percentage of payroll or in actual dollars, as opposed to a cost pattern that is extremely volatile.

The actuary does not have complete freedom in assigning this value. The Actuarial Standards Board also has basic principles regarding the calculation of a smoothed asset value, Actuarial Standard of Practice No. 44 (ASOP 44), *Selection and Use of Asset Valuation Methods for Pension Valuations.*

ASOP 44 provides that the asset valuation method should bear a reasonable relationship to the market value. Furthermore, the asset valuation method should be likely to satisfy both of the following:

- Produce values within a reasonable range around market value, AND
- Recognize differences from market value in a reasonable amount of time.

In lieu of both of the above, the standard will be met if either of the following requirements is satisfied:

- There is a sufficiently narrow range around the market value, OR
- The method recognizes differences from market value in a sufficiently short period.

These rules or principles prevent the asset valuation methodology from being used to manipulate annual funding patterns. No matter what asset valuation method is used, it is important to note that, like a cost method or actuarial assumptions, the asset valuation method does not affect the true cost of the plan; it only impacts the incidence of cost.

Recommendation

Currently, the actuarial value of assets recognizes a portion of the difference between the market value of assets and the expected market value of assets, based on the assumed valuation rate of return. The amount recognized each year is 20% of the difference between market value and expected market value. **We recommend no change in this methodology.**

AMORTIZATION OF THE UNFUNDED ACTUARIAL ACCRUED LIABILITY

The actuarial accrued liability is the portion of the actuarial present value of future benefits that are not included in future normal costs. Thus, it represents the liability that, in theory, should have been funded through normal costs for past service. Unfunded actuarial accrued liability (UAAL) exists when the actuarial accrued liability exceeds the actuarial value of plan assets. These deficiencies can result from:

(i) plan improvements that have not been completely paid for,
(ii) experience that is less favorable than expected,
(iii) assumption changes that increase liabilities, or
(iv) contributions that are less than the actuarial contribution rate.

There are a variety of different methods that can be used to amortize the UAAL. Each method results in a different payment stream and, therefore, has cost implications. For each methodology, there are three characteristics:

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

Amortization Period: The amortization period can be either closed or open. If it is a closed amortization period, the number of years remaining in the amortization period declines by one in each future valuation. Alternatively, if the amortization period is an open or rolling period, the amortization period does not decline but is reset to the same number each year. This approach essentially "refinances" the System's debt (UAAL) every year.

Amortization Payment: The level dollar amortization method is similar to the method in which a homeowner pays off a mortgage. The liability, once calculated, is financed by a constant fixed dollar amount, based on the amortization period until the liability is extinguished. This results in the liability steadily decreasing while the payments, though remaining level in dollar terms, in all probability decrease as a percentage of payroll. (Even if a plan sponsor's population is not growing, inflationary salary increases will usually be sufficient to increase the aggregate covered payroll).

The rationale behind the level percentage of payroll amortization method is that since normal costs are calculated to be a constant percentage of pay, the unfunded actuarial accrued liability should be paid off in the same manner. When this method of amortizing the unfunded actuarial accrued liability is adopted, the initial amortization payments are lower than they would be under a level dollar amortization payment method, but the payments increase at a fixed rate each year so that ultimately the annual payment far exceeds the level dollar payment. The expectation is that total payroll will increase at the same rate so that the amortization payments will remain constant, as a percentage of payroll. In the initial years, the level percentage of payroll amortization payment is often less than the interest accruing on the unfunded actuarial accrued liability meaning that even if there are no experience losses, the dollar amount of the unfunded actuarial accrued liability will grow (called negative amortization). This is particularly true if the plan sponsor is paying off the unfunded actuarial accrued liability over a long period, such as 20 or more years.

Amortization Bases: The UAAL can be amortized either as one single amount or as components or "layers", each with a separate amortization base, payment and period. If the UAAL is amortized as one amount, the UAAL is recalculated each year in the valuation and experience gains/losses or other changes in the UAAL are folded into the single UAAL amortization base. The amortization payment is then the total UAAL divided by an amortization factor for the applicable amortization period.

If separate amortization bases are maintained, the UAAL is composed of multiple amortization bases, each with its own payment schedule and remaining amortization period. In each valuation, the unexpected change in the UAAL is established as a new amortization base over the appropriate amortization period beginning on that valuation date. The UAAL is then the sum of all of the outstanding amortization bases on the valuation date and the UAAL payment is the sum of all of the amortization payments on the existing amortization bases. This approach provides transparency in that the current UAAL is paid off over a fixed period of time and the remaining components of the UAAL are clearly identified. Adjustments to the UAAL in future years are also separately identified in each future year. One downside of this approach is that it can create some discontinuities in contribution rates when UAAL layers/components are fully paid off. If this occurs, it likely would be far in the future, with adequate time to address any adjustments needed.

Recommendation

In the current PERS Board funding policy, an actuarially determined employer contribution (ADEC) is calculated during each annual valuation and the ADEC is compared to the Fixed Contribution Rate adopted by the Board as one of its Signal Light metrics. The methodology in calculating the ADEC is as follows:

- Amortization Period – Closed period with period of 25 years for new bases
- Amortization Payment – Level Percentage of Payroll
- Amortization Bases – Separate bases for all experience gains and losses, assumption changes or benefit changes

We recommend no changes in these methods.

SECTION IV – DEMOGRAPHIC ASSUMPTIONS

Actuarial Standard of Practice (ASOP) No. 27 provides guidance to actuaries regarding the selection of demographic and other non-economic assumptions for measuring pension obligations. ASOP 27 states that the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the defined benefit plan that is the subject of the measurement. A reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

Each individual demographic assumption should satisfy the criteria of ASOP 27. In selecting demographic assumptions, the actuary should also consider: the internal consistency between the assumptions, materiality, cost effectiveness, and the combined effect of all assumptions. At each measurement date, the actuary should consider whether the selected assumptions continue to be reasonable, but the actuary is not required to do a complete assumption study at each measurement date. In addition, the actuary should include a specific assumption with respect to expected mortality improvements after the measurement date. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP 27.

Overview of Analysis

The purpose of a study of demographic experience is to compare what actually happened to the individual members of the System during the study period (July 1, 2020 through June 30, 2024) with what was expected to happen based on the actuarial assumptions.

Studies of demographic experience generally involve three steps:

- First, the number of members changing membership status, called decrements, during the study is tabulated by age, duration, gender, group, and membership class (active, retired, etc.).
- Next, the number of members expected to change status is calculated by multiplying certain membership statistics, called exposure, by the expected rates of decrement.
- Finally, the number of actual decrements is compared with the number of expected decrements. The comparison is called the Actual-to-Expected ratio (A/E Ratio) and is expressed as a percentage.

In general, if the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements, or rates of decrement, by age, sex, or duration deviates significantly from the expected pattern, new assumptions are considered. Recommended revisions are normally not an exact representation of the experience during the observation period. Judgment is required to anticipate future experience from past trends and current evidence, including a determination of the amount of weight to assign to the most recent experience.

SECTION IV – DEMOGRAPHIC ASSUMPTIONS

For most of the decrements we analyze the experience using a liability-weighted approach. This is approximated by using the member's compensation and years of service to estimate the member's benefit level. For retirees, the benefit is determined directly from the data. The exposure and actual occurrences are then multiplied by the benefit level to provide the liability-weighted experience. This approach is particularly insightful when analyzing experience from a non-homogenous group. While we reviewed experience on both a headcount and liability-weighted basis, we generally used the liability-weighted results to evaluate experience and develop new assumptions, if necessary.

Revised rates of decrement are tested by using them to recalculate the expected number of decrements during the study period, and the results are shown as revised Actual-to-Expected Ratios.

It takes a fair amount of data to perform a credible study of demographic assumptions. Because the membership or certain subsets of the membership are relatively small, some assumptions have been selected based more on our professional judgment of reasonable future outcomes than actual experience.

Because much of the past four years of experience overlapped the worldwide Covid pandemic, we recognize that the actual demographic experience captured in this study may be influenced by the presence of the disease, by decisions the various employers made to manage their workforces through this period, and by choices employees may have made in response to actual or perceived changes in the world around them. Further, it is possible that some of these changes will reflect a new reality and show up in future years, while other changes will likely revert back quickly to the previous norms. Consequently, we believe caution is warranted in this study before making significant changes based on the recent data only.

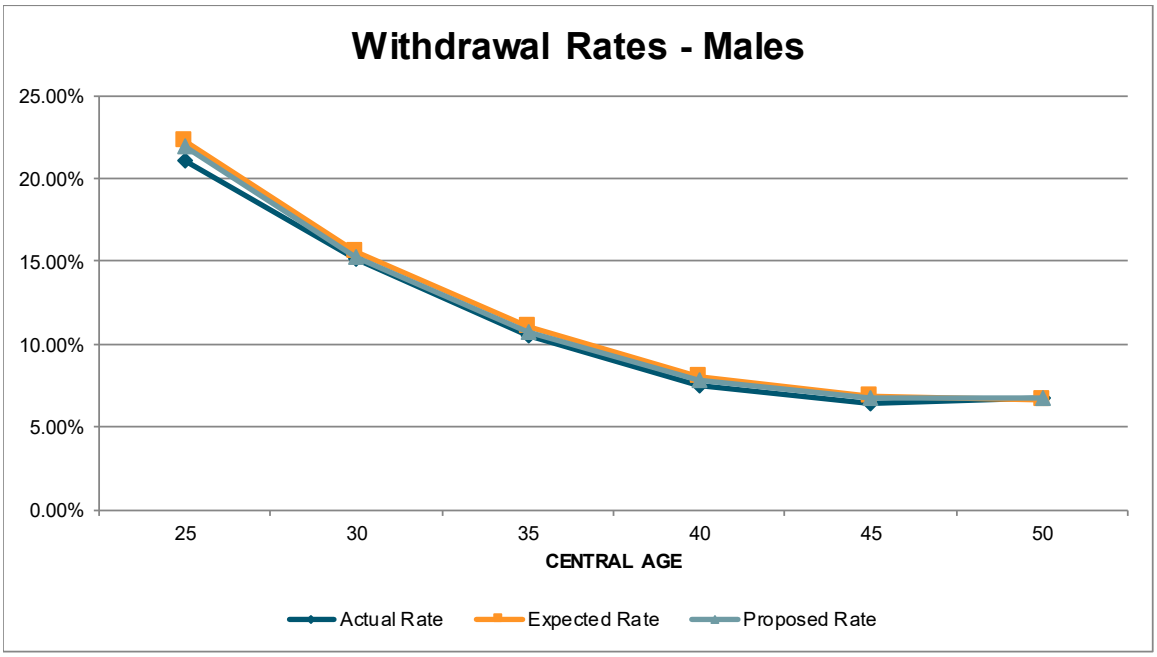
RATES OF WITHDRAWAL

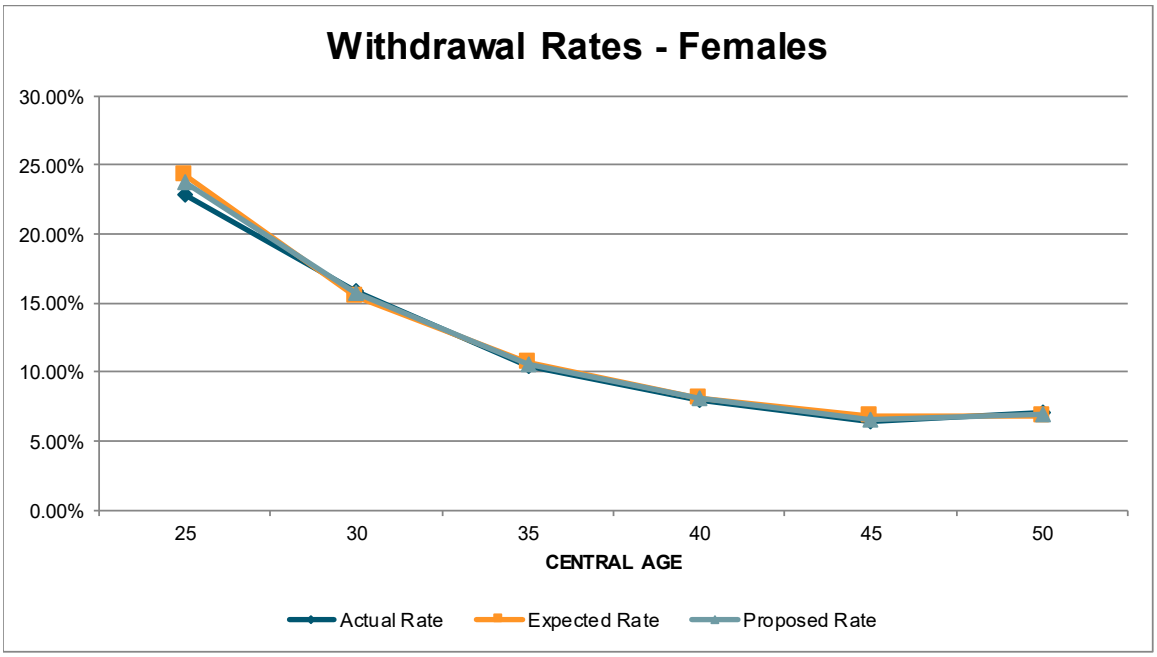
Withdrawal Headcount Basis				
	Exposures	**Actual**	**Expected**	**A/E Ratio**
Males	177,824	22,735	21,196	107%
Females	323,540	39,444	36,902	107%

Withdrawal Liability-Weighted Basis ($ in thousands)				
	Exposures	**Actual**	**Expected**	**A/E Ratio**
Males	$8,265,091	$807,833	$836,273	97%
Females	$13,403,084	$1,324,899	$1,329,848	100%

The following graphs show a comparison of the present, actual and proposed rates of withdrawal.

RATES OF WITHDRAWAL FOR ACTIVE MEMBERS





The rates of withdrawal adopted by the Board are used to determine the expected number of separations from active service which will occur as a result of resignation or dismissal. The assumed rates of withdrawal include both those members leaving PERS and taking a refund and those who leave PERS but leave their employee contributions in the System and potentially will receive a pension in the future. A separate assumption is used to determine the percentage of vested employees who take a refund vs. leaving their money in PERS. See Section IV - Other Assumptions on page 54 for this explanation.

The results of our four-year study indicate that, in aggregate, the actual number of withdrawals on a headcount basis was 7% more than expected for both males and females. However, on a liability-weighted basis, the results showed that the actual amount of liability released due to withdrawals was slightly less than expected for both males and females but nearly perfect for females. And as you can see from the graphs, the actual and expected rates are very similar, in aggregate and follow a similar pattern. Therefore, we are only recommending fine-tuning the rates of withdrawal based on the liability-weighted amounts that will hopefully better match experience in the future. Please see Appendix D for a full listing of each rate of withdrawal by age and service.

The following tables show a comparison between the actual withdrawals and the proposed withdrawals.

Withdrawal
Headcount Basis

	Exposures	Actual	Proposed	A/E Ratio
Males	177,824	22,735	20,690	110%
Females	323,540	39,444	36,818	107%

Withdrawal
Liability-Weighted Basis
($ in thousands)

	Exposures	Actual	Proposed	A/E Ratio
Males	$8,265,091	$807,833	$820,393	98%
Females	$13,403,084	$1,324,899	$1,330,221	100%

RATES OF DISABILITY RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED DISABILITY RETIREMENTS

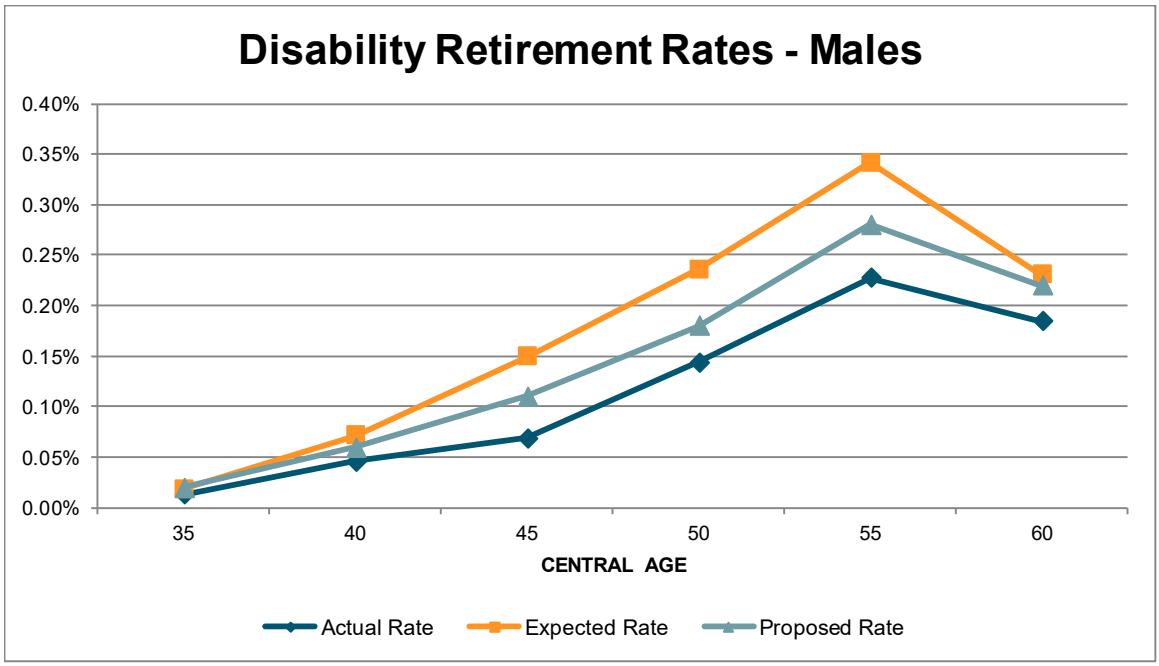
Disability
Headcount Basis

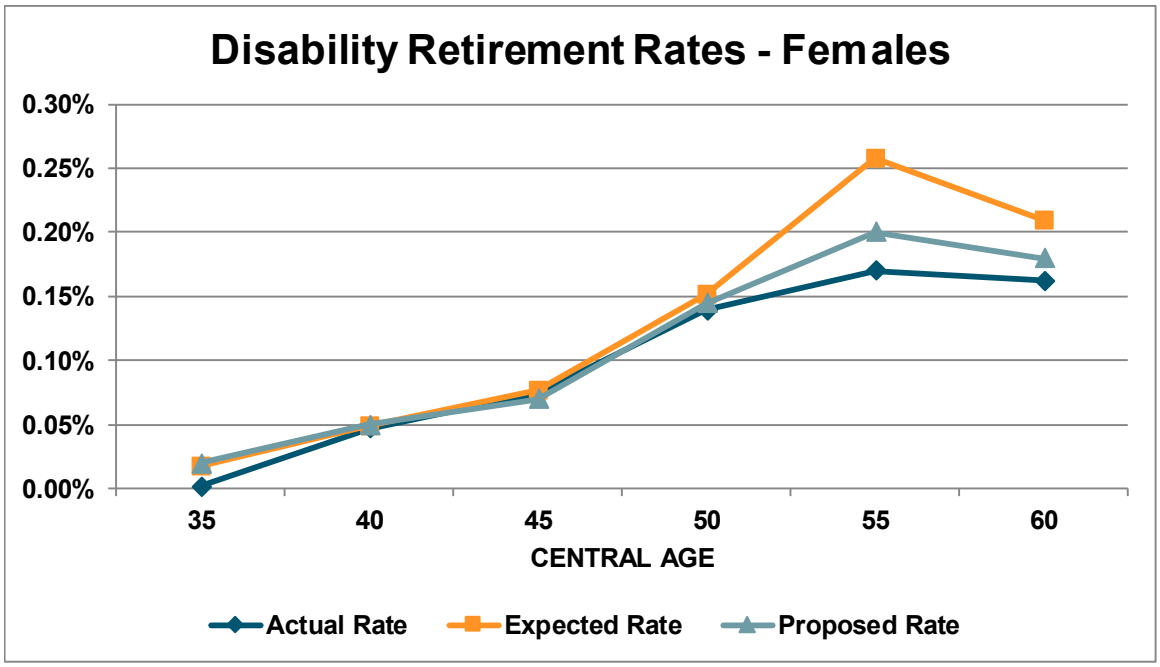
	Exposures	Actual	Expected	A/E Ratio
Males	209,951	270	320	84%
Females	375,978	323	420	77%

Disability
Liability-Weighted Basis
($ in thousands)

	Exposures	Actual	Expected	A/E Ratio
Males	$10,106,881	$10,662	$16,001	67%
Females	$15,946,817	$12,388	$18,096	68%

The following graphs show a comparison of the present and actual rates of disability retirements.





As can be seen from the table and the graphs on the previous pages, the actual rates of disability retirement are less than expected for both males and females at all ages and for both a headcount and liability-weighted basis. The number of disabilities has significantly declined during the last four years of this study period. **Therefore, we recommend a decrease in the rates of disability retirement to better match experience.**

COMPARISON OF ACTUAL AND PROPOSED DISABILITY RETIREMENTS

Disability Headcount Basis				
	Exposures	**Actual**	**Proposed**	**A/E Ratio**
Males	209,951	270	270	100%
Females	375,978	323	370	87%

Disability Liability-Weighted Basis ($ in thousands)				
	Exposures	**Actual**	**Proposed**	**A/E Ratio**
Males	$10,106,881	$10,662	$13,528	79%
Females	$15,946,817	$12,388	$16,052	77%

RATES OF RETIREMENT

We separately analyzed the retirement rates for members with less than 25 years of service and those with greater than 25 years of service. The results are summarized below:

Retirement – Less than 25 years of Service
Headcount Basis

	Exposures	Actual	Expected	A/E Ratio
Males	16,567	3,083	3,176	97%
Females	25,929	5,266	4,970	106%

Retirement – Less than 25 years of Service
Liability-Weighted Basis
($ in thousands)

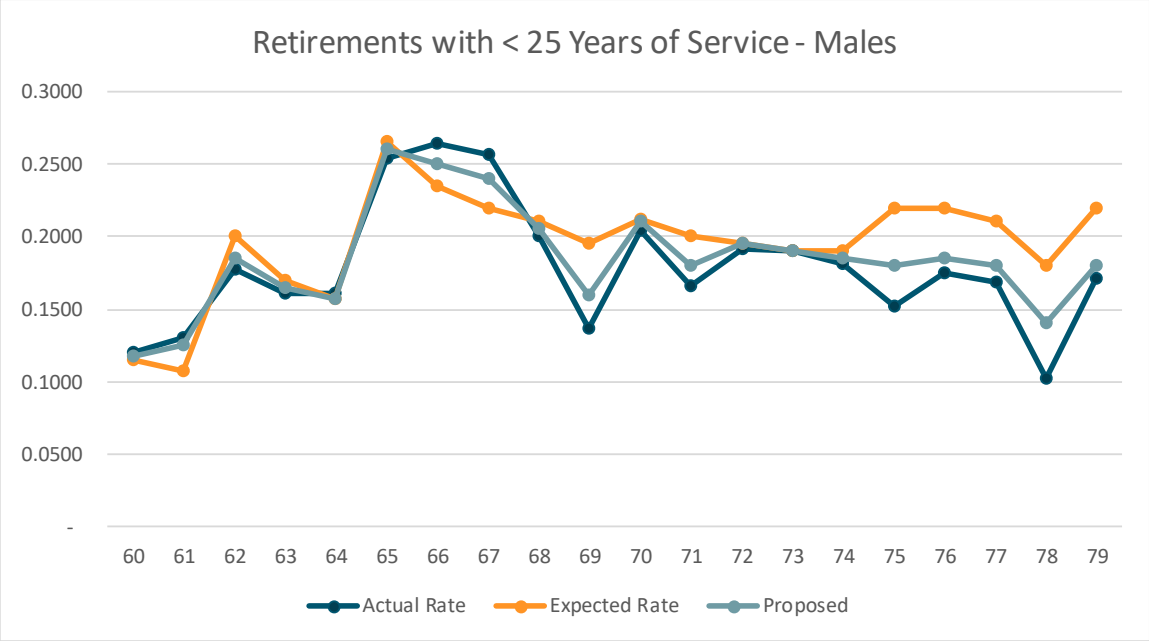
	Exposures	Actual	Expected	A/E Ratio
Males	$784,272	$137,766	$147,357	94%
Females	$1,054,443	$212,826	$198,922	107%

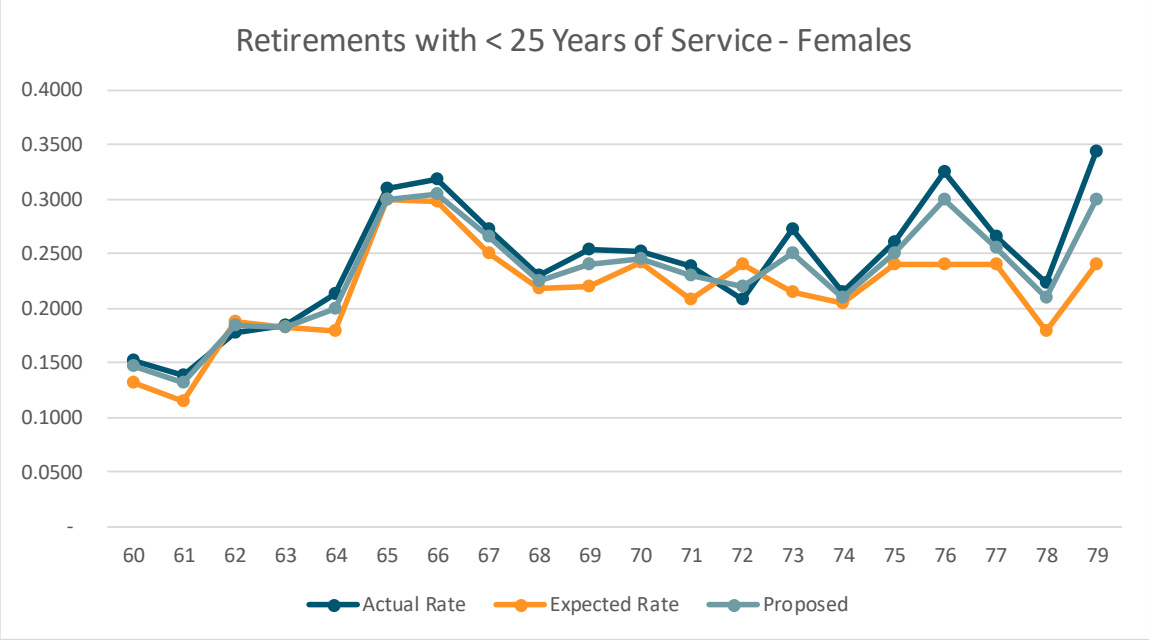
Retirement – Greater than or equal to 25 years of Service Headcount Basis				
	Exposures	**Actual**	**Expected**	**A/E Ratio**
Males	15,560	3,335	3,409	98%
Females	26,509	5,796	5,902	98%

Retirement – Greater than or equal to 25 years of Service Liability-Weighted Basis ($ in thousands)				
	Exposures	**Actual**	**Expected**	**A/E Ratio**
Males	$1,057,518	$222,448	$230,202	97%
Females	$1,489,291	$324,991	$325,415	100%

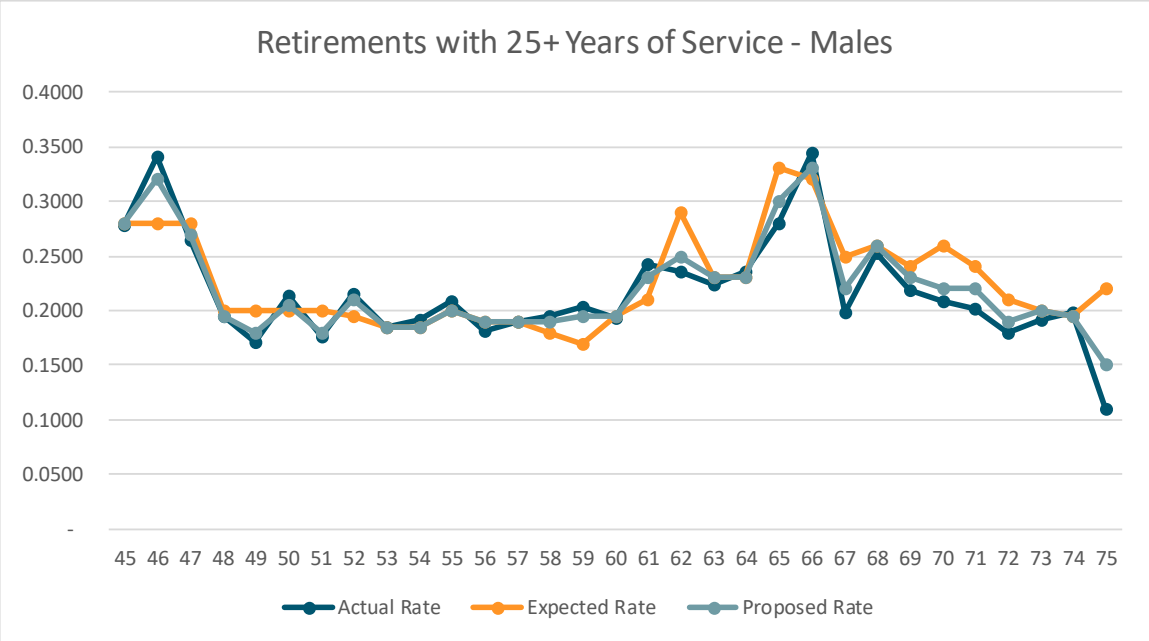
The following graphs show a comparison of the present, actual, and proposed rates of service retirements.

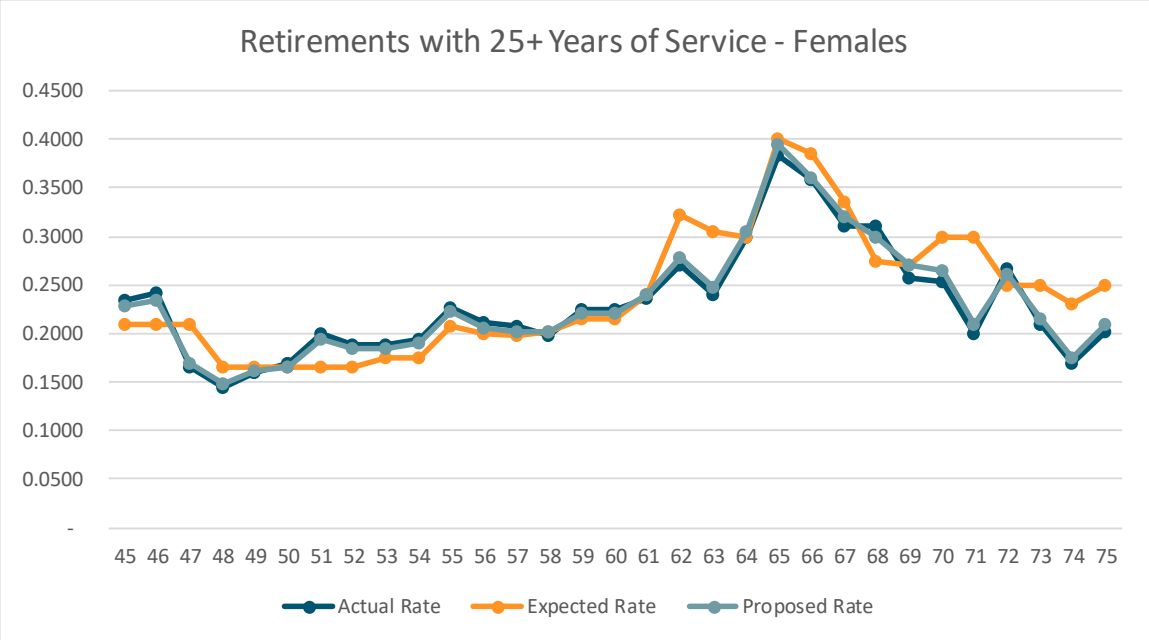
RATES OF RETIREMENT FOR ACTIVE MEMBERS WITH LESS THAN 25 YEARS OF SERVICE





RATES OF RETIREMENT FOR ACTIVE MEMBERS WITH 25 OR MORE YEARS OF SERVICE





As can be seen from the previous 4 pages, the actual rates of service retirement, for both under 25 years of service and for 25 and over years of service are reasonably close to expected at most ages. In fact, the A/E Ratios are extremely close to 100% in aggregate on both a headcount and liability-weighted basis. The only group outside of a 5% range are females retiring with less than 25 years of service. **We do note some movement up and down in the graphs at various ages and, therefore, recommend some slight adjustments in the rates of retirement, especially at the later ages, to better match anticipated experience going forward.**

The following table shows a comparison between the present retirement rates and the proposed rates.

Retirement – Less than 25 years of Service
Headcount Basis

	Exposures	Actual	Proposed	A/E Ratio
Males	16,567	3,083	3,146	98%
Females	25,929	5,266	5,223	101%

Retirement – Less than 25 years of Service
Liability-Weighted Basis
($ in thousands)

	Exposures	Actual	Proposed	A/E Ratio
Males	$784,272	$137,766	$146,148	94%
Females	$1,054,443	$212,826	$209,162	102%

Retirement – Greater than or equal to 25 years of Service Headcount Basis				
	Exposures	**Actual**	**Proposed**	**A/E Ratio**
Males	15,560	3,335	3,370	99%
Females	26,509	5,796	5,891	98%

Retirement – Greater than or equal to 25 years of Service Liability-Weighted Basis ($ in thousands)				
	Exposures	**Actual**	**Proposed**	**A/E Ratio**
Males	$1,057,518	$222,448	$228,531	97%
Females	$1,489,291	$324,991	$325,802	100%

RATES OF POST-RETIREMENT MORTALITY

One of the most important demographic assumptions in the valuation is mortality because it projects how long benefit payments will be made. The longer members live, the greater the true cost of future benefit obligations will be.

For many years, rates of mortality have been declining, meaning people, in general, are living longer. Consequently, we anticipate that mortality tables will need to be updated periodically. Because of potential differences in mortality, we break down our study by gender (males and females) and by status (healthy retirees, beneficiaries, disabled retirees, and active members).

Because of the substantial amount of data required to construct a mortality table, actuaries usually rely on standard tables published by the Society of Actuaries. Actuaries then use various adjustments such as age or scaling adjustments to the standard, published mortality tables in order to better match the observed mortality rates of a specific group.

The first of these adjustments is an age adjustment that can be either a “setback” or a “set forward”. A one-year age setback treats all members as if they were one year younger than they truly are when applying the rates in the mortality table. For example, a one year setback would treat a 61-year old retiree as if he will exhibit the mortality of a 60-year old in the standard mortality table.

The second adjustment that can be used to adjust the mortality rates in a standard table to better fit actual experience is to “scale” a mortality table by multiplying the probabilities of death by factors less than one (to reflect better mortality) or factors greater than one (to reflect poorer mortality). Scaling factors can be applied to an entire table or a portion of the table. Of course, if needed, actuaries may use both of these methods to develop an appropriate table to model the mortality of the specific plan population.

In 2019, the Society of Actuaries released a family of mortality tables named the Pub-2010 tables. While prior pension mortality tables have been based solely on private corporate and union retirement plans, these new tables are based entirely on public sector plan data. These tables are split by three membership types: Safety, Teachers, and General to reflect the observed differences in mortality patterns related to the three groups. Tables are further split for healthy retirees, disabled retirees, contingent beneficiaries, and employees. There are still other breakdowns in these tables for at, above or below median annuity values.

The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying and monitoring. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 27, *Selection of Assumptions for Measuring Pension Obligations*. This ASOP requires the pension actuary to make and disclose a specific recommendation with respect to future improvements in mortality after the valuation date, although it does not require that an actuary assume there will be future improvements. There have been significant improvements in longevity in the past, although there are different opinions about future expectations, and thus there is a subjective component in the estimation of future mortality improvement. We believe it is prudent to anticipate that the trend will continue to some degree in the future and that it is appropriate to reflect some future mortality improvement as part of the mortality assumption.

PERS currently uses generational mortality approach that directly anticipates future improvements in mortality by using a different set of mortality rates for each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain "built-in" mortality improvements, e.g., a member who turns age 65 in 2035 has a longer life expectancy than a member who turns age 65 in 2020. When using generational mortality, the A/E ratios for the observed experience are set near 100% as future mortality improvements will be taken into account directly in the actuarial valuation process.

The generational approach is our preferred method for recognizing future mortality improvements in the valuation process because it is more direct and results in longer life expectancy for members who are younger, consistent with what we believe is more likely to occur. Over the last ten to fifteen years, this method has become quite common as computing power has increased.

In this experience study, we also analyzed recent experience on a benefit-weighted basis where the exposures and deaths are multiplied by the monthly retirement benefit amount. This helps to reflect any differences that arise from better mortality experience among those with larger benefits. Because a valuation is designed to measure the amount and timing of future benefit payments (liability) rather than simply the number of retirees leaving pay status, this benefit-weighted approach is an important factor in valuing plan obligations. For mortality, the Actual to Expected Ratios on the benefit-weighted basis were much closer to 1.0 than the count basis over the past four years, which explains why the annual gain/loss experience over the past four valuations has shown very little volatility in the movement of the unfunded actuarial accrued liability.

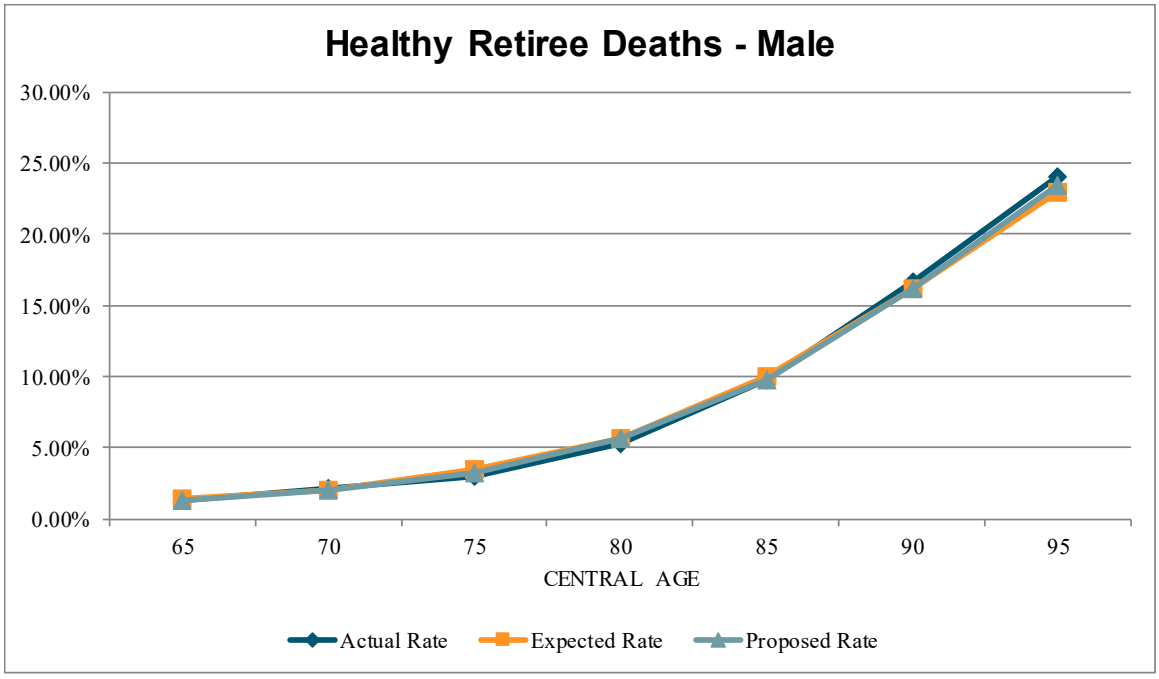
COMPARISON OF ACTUAL AND EXPECTED CASES OF POST-RETIREMENT DEATHS

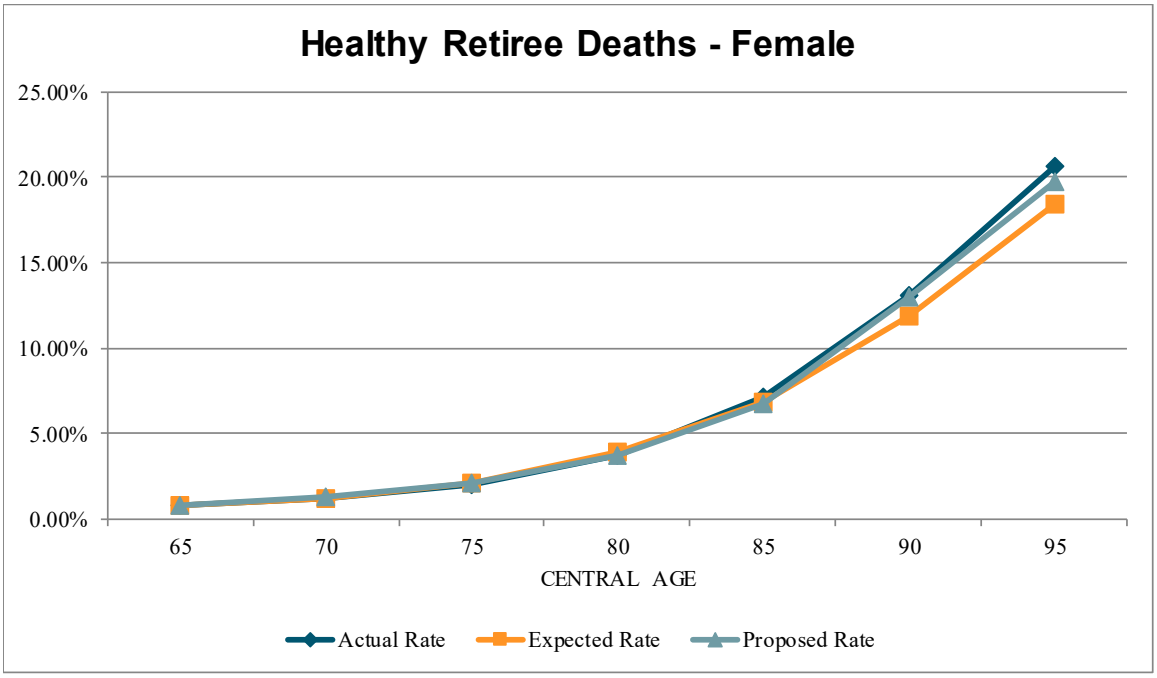
Post-Retirement Deaths Headcount Basis				
	Exposures	**Actual**	**Expected**	**A/E Ratio**
Service Retirements				
Males	130,430	5,272	4,778	110%
Females	248,213	6,863	6,259	110%
Beneficiaries				
Males	11,845	480	354	136%
Females	36,634	1,923	1,635	118%
Disability Retirements				
Males	10,304	524	493	106%
Females	14,965	617	539	114%

Post-Retirement Deaths Liability- Weighted Basis ($ in thousands)				
	Exposures	**Actual**	**Expected**	**A/E Ratio**
Service Retirements				
Males	$4,002,555	$146,691	$152,696	96%
Females	$6,304,884	$152,750	$149,689	102%
Beneficiaries				
Males	$172,205	$8,017	$6,076	132%
Females	$755,684	$42,777	$39,530	108%
Disability Retirements				
Males	$219,745	$9,971	$10,501	95%
Females	$300,043	$11,242	$10,479	107%

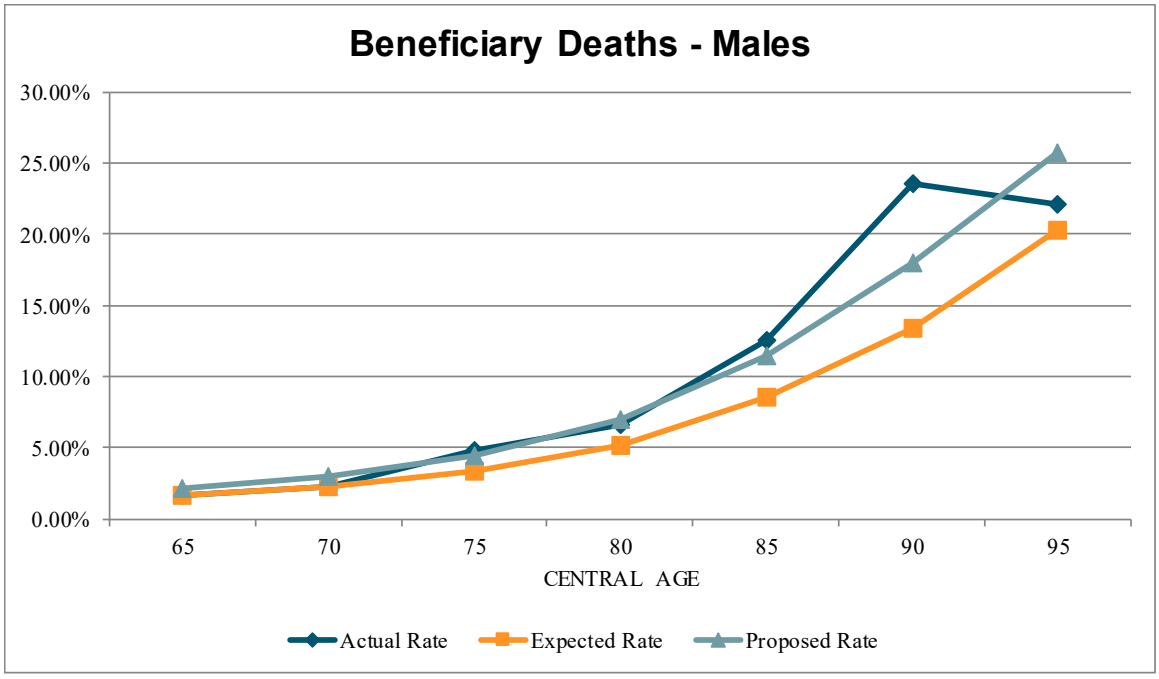
The following graphs show a comparison of the present, actual and proposed number of post-retirement deaths.

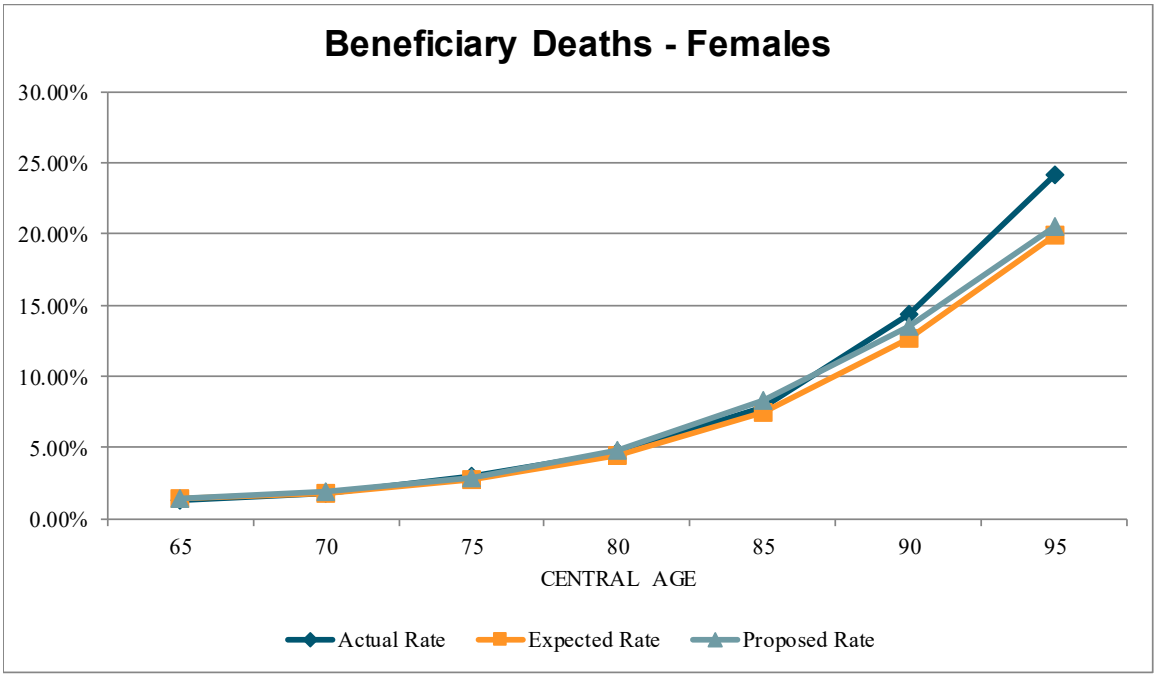
POST-RETIREMENT DEATHS
SERVICE RETIREMENTS



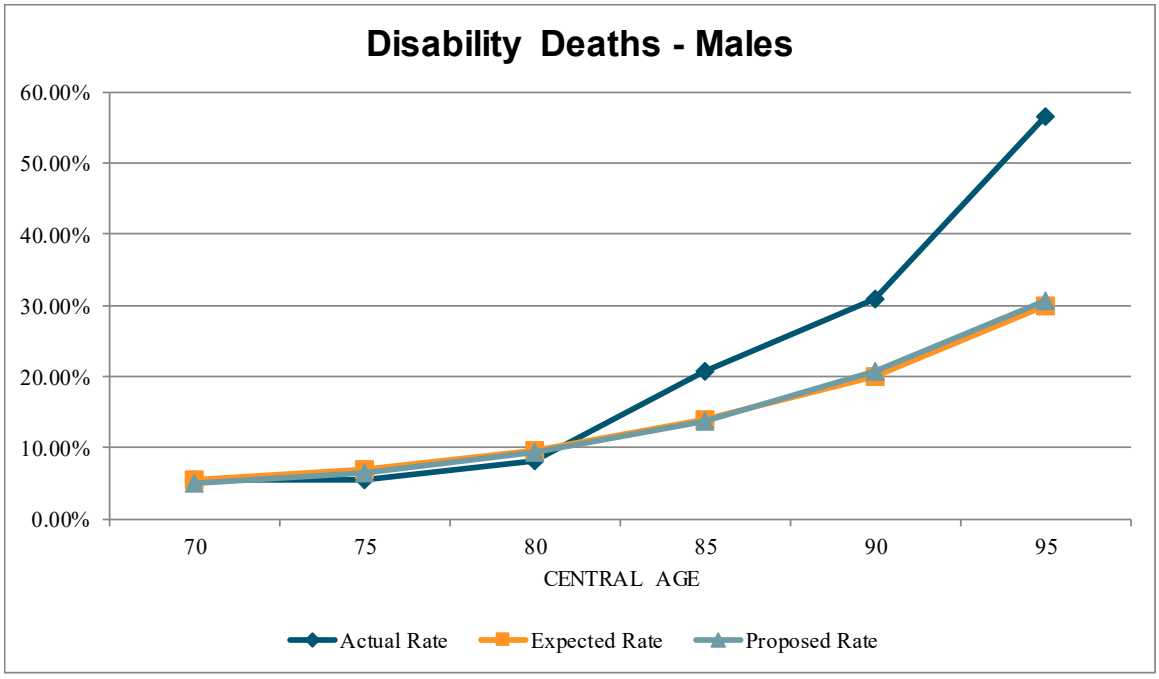


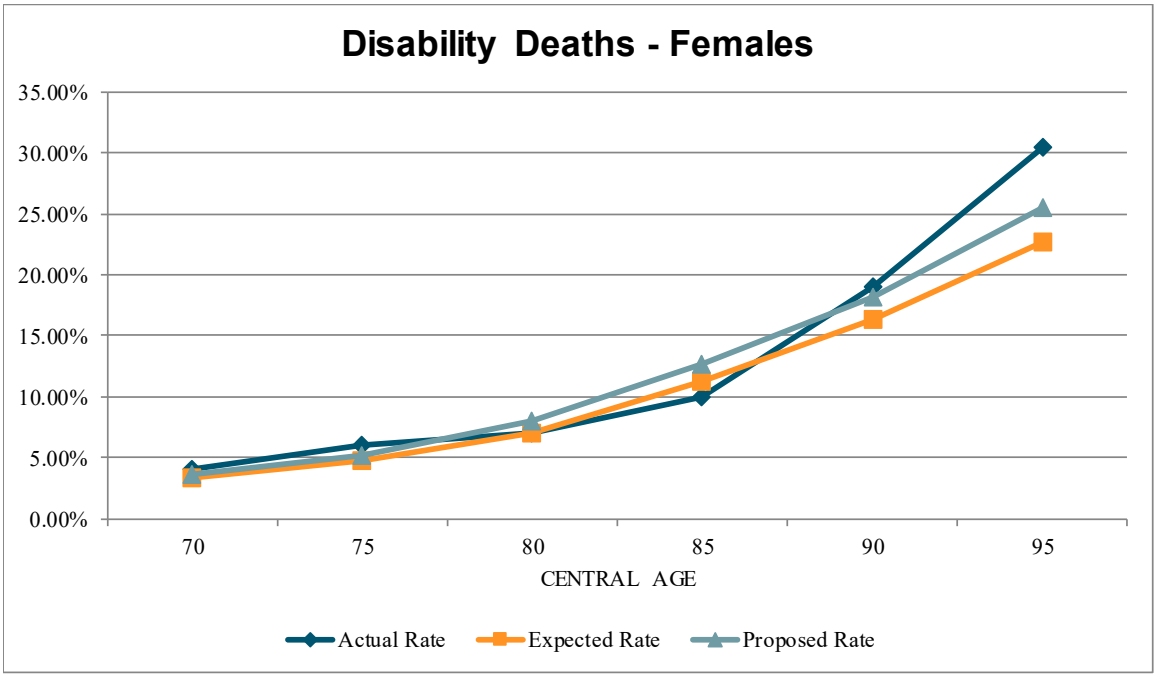
POST-RETIREMENT DEATHS
BENEFICIARIES





POST-RETIREMENT DEATHS
DISABILITY RETIREMENTS





The actuarial gain/loss analysis performed during the 2023 and 2024 valuations for PERS has indicated that the current mortality table that was adopted after the last experience study fits nicely into the actual mortality experience of PERS' service retirees, beneficiaries, and disabled retirees. The ratio of actual to expected experience on a benefit-weighted basis shown on page 46 and the actuarial gain/loss analysis performed during the past four valuations for PERS has indicated more deaths are occurring than expected, especially for beneficiaries (also called Contingent Annuitants).

Therefore, we have decided to change the membership table to the Pub-2010 Public Safety Amount-Weighted Mortality Tables. We are also recommending similar adjustments or refinements for service retirees and beneficiaries from the current table and an update to the most recent projection scale, MP-2021.

Service Retirees (Proposed Table)

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Retiree	None	Male: 107% for all ages Female: 97% up to age 82, 100% for ages 83 to 87, and 110% for ages above 87	MP-2021

Contingent Annuitants (Proposed Table)

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Contingent Annuitant	Male: Set forward 2 years Female: Set forward 3 years	None	MP-2021

Disabled Retirees (Proposed Table)

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubG.H-2010 Disabled	Male: Set forward 1 year Female: Set forward 2 years	Male: 134% for all ages Female: 125% for all ages	MP-2021

COMPARISON OF ACTUAL AND PROPOSED CASES OF POST-RETIREMENT DEATHS

Post-Retirement Deaths Headcount Basis				
	Exposures	**Actual**	**Proposed**	**A/E Ratio**
Service Retirements				
Males	130,430	5,272	4,642	114%
Females	248,213	6,863	6,391	107%
Beneficiaries				
Males	11,845	480	464	103%
Females	36,634	1,923	1,745	110%
Disability Retirements				
Males	10,304	524	471	111%
Females	14,965	617	580	106%

Post-Retirement Deaths Liability- Weighted Basis ($ in thousands)				
	Exposures	**Actual**	**Proposed**	**A/E Ratio**
Service Retirements				
Males	$4,002,555	$146,691	$148,633	99%
Females	$6,304,884	$152,750	$152,664	100%
Beneficiaries				
Males	$172,205	$8,017	$8,005	100%
Females	$755,684	$42,777	$42,292	101%
Disability Retirements				
Males	$219,745	$9,971	$10,050	99%
Females	$300,043	$11,242	$11,237	100%

RATES OF PRE-RETIREMENT MORTALITY

The active member mortality assumption models eligibility for death benefits prior to retirement. Therefore, it has a much smaller impact on the valuation results than the post-retirement mortality assumption.

It is difficult to isolate the mortality for active members as it may be impacted by active members first terminating or moving to disabled status before death. The data collection methods used in this study do not fully capture known deaths, and so sometimes this can be misleading. Finally, the probability of active death is very small so volatility is not uncommon. Consequently, we prefer to set this assumption by utilizing the more reliable analysis performed on the retiree data.

COMPARISON OF ACTUAL AND EXPECTED PRE-RETIREMENT DEATHS

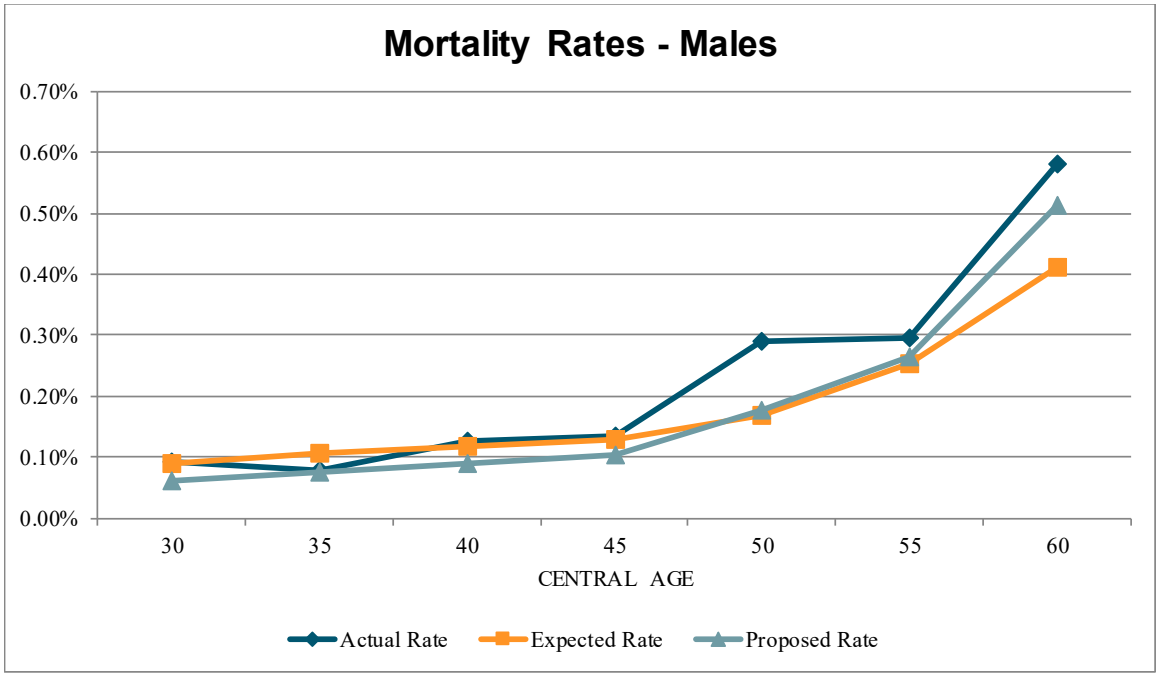
Pre-Retirement Deaths
Headcount Basis

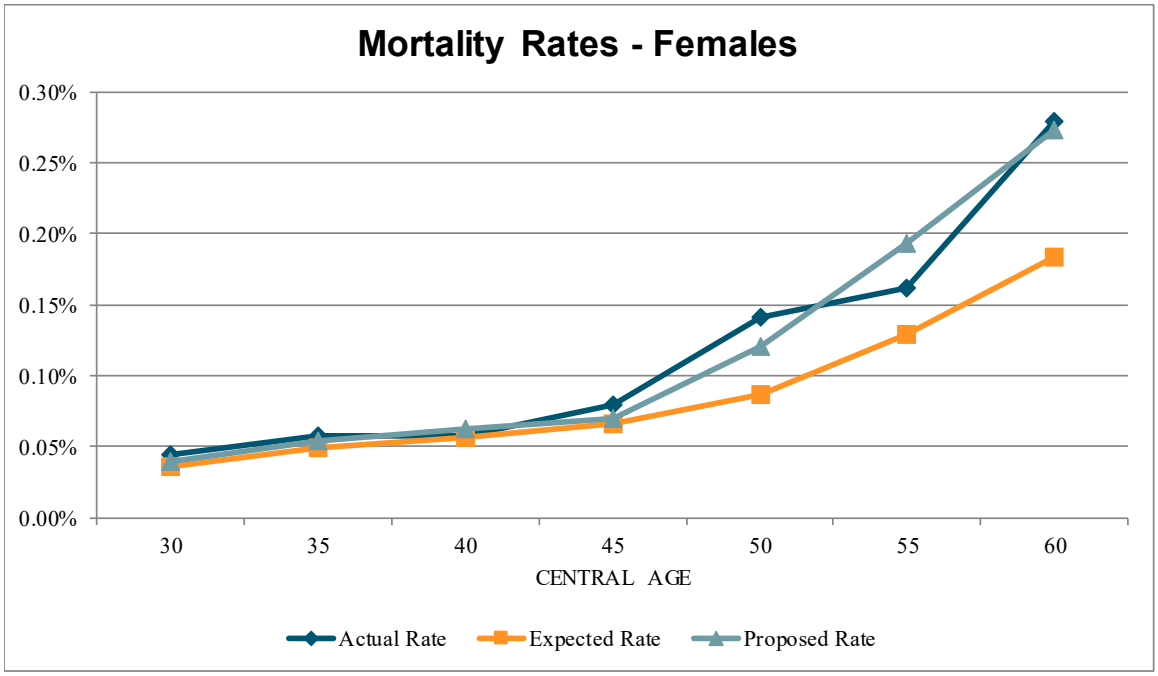
	Exposures	Actual	Expected	A/E Ratio
Males	209,951	698	518	135%
Females	375,978	573	365	157%

Pre-Retirement Deaths
Liability-Weighted Basis
($ in thousands)

	Exposures	Actual	Expected	A/E Ratio
Males	$10,106,881	$29,567	$24,722	120%
Females	$15,946,817	$21,566	$15,346	140%

The following graphs show a comparison of the present, actual, and proposed rates of pre-retirement mortality.


Mortality Rates - Males
0.70%
0.60%
0.50%
0.40%
0.30%
0.20%
0.10%
0.00%
30
35
40
45
50
55
60
CENTRAL AGE
Actual Rate
Expected Rate
Proposed Rate


Mortality Rates - Females
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
30
35
40
45
50
55
60
CENTRAL AGE
Actual Rate
Expected Rate
Proposed Rate

As can be seen from the table and graphs on the previous pages, the number of actual pre-retirement deaths was higher than expected on both a headcount and liability-weighted basis. When we break down the 4-year period, we find that the number of pre-retirement deaths are fairly uniform over the 4-year period and just slightly weighted more during the first two years of the study period, which were more of the pandemic years.

Therefore, we recommend slight change in the current pre-retirement mortality table at this time to match the post-retirement experience.

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Employee	Male: Set forward 2 years Female: Set forward 1 year	Male: 75% up to age 47, 100% for ages 48 to 57, and 120% for ages above 58 Female: 75% up to age 47, 100% for ages 48 to 52, and 110% for ages above 53	MP-2021

COMPARISON OF ACTUAL AND PROPOSED PRE-RETIREMENT DEATHS

Pre-Retirement Deaths
Headcount Basis

	Exposures	Actual	Proposed	A/E Ratio
Males	209,951	698	584	120%
Females	375,978	573	507	113%

Pre-Retirement Deaths
Liability-Weighted Basis
($ in thousands)

	Exposures	Actual	Proposed	A/E Ratio
Males	$10,106,881	$29,567	$27,722	107%
Females	$15,946,817	$21,566	$21,171	102%

RATES OF SALARY INCREASE

COMPARISON OF ACTUAL AND EXPECTED SALARIES OF ACTIVE MEMBERS

SERVICE	SALARIES AT END OF YEAR ($ in Millions)		
	Actual	Expected	Ratio of Actual to Expected
Less than 5	5,923	5,763	102.8%
5-9	5,216	5,048	103.3%
10-14	4,179	4,064	102.8%
15-19	3,947	3,857	102.3%
20-24	3,115	3,053	102.0%
25 & Over	2,085	2,046	101.9%
TOTAL	**24,465**	**23,831**	**102.7%**

As can be seen from the table above, actual rates of salary increase has been more than expected at all service breakdowns. However, if we break down the four year-periods and remove the second and third years of the period (2021-2023), which experienced much higher than expected salary increases and resulted in an actuarial losses in the 2022 valuation and 2023 valuation of $377 million and $935 million, respectively, then the actual to expected ratio drops from 1.027 to 1.005 and all service breakdowns are within 1% of expected. We believe these two years of the study are skewing the results and is not a full representation of actual salary increases going forward. **Therefore, we recommend no change in the merit salary scale at this time.**

OTHER ASSUMPTIONS

DEFERRED VESTEDS: Currently, the valuation assumes 65% of participants that leave the System as deferred vested will receive a deferred benefit upon attaining the eligibility requirements for retirement. During the last two investigation periods, the plan actually experienced an estimated 65% and 66% of participants receiving a deferred benefit, respectively. **Therefore, we recommend no change in our assumption at this time.**

LINE OF DUTY DEATH ASSUMPTION: Currently, it is assumed that 4% of active member deaths are in the line of duty and 96% of active member deaths are not in the line of duty. For the past six years, approximately 2.2% of active member deaths were in the line of duty. There has definitely been a downward trend for this assumption. **Therefore, we recommend a decrease in the assumption from 4% to 2%.**

LINE OF DUTY DISABILITY ASSUMPTION: Currently, it is assumed that 12% of active member disabilities are in the line of duty and 88% of active member disabilities are not in the line of duty. During the experience investigation period, an average of about 10% of disabilities each year were in the line of duty. During the last experience study, the average for the period was 13%. **Therefore, we recommend that the assumption be maintained at 12% of active member disabilities are assumed to be in the line of duty**.

PERCENT MARRIED: Currently, 85% of active members are assumed to be married and elect a joint & survivor payment form. We are not provided with marital status on the census data. **However, we believe the current assumption is fairly conservative and recommend no change at this time.**

SPOUSE AGE DIFFERENCE: Currently, for married members, it is assumed a male is two years older than his spouse. We have reviewed this assumption during this experience period and found that the age difference between males and females in PERS is about 2.2 years. In the previous study period, the age difference was about 2.3 years. **Therefore, we recommend no change in this assumption.**

UNUSED LEAVE: Currently, we assume that participants will have on average 0.55 years of unused leave (sick and personal) at retirement. We reviewed this assumption for those participants who retired during this four-year period and the average number of years of unused leave was 0.57 years. In the last experience study, the average was 0.67 years. The average settled back to our expectations from the last study. **Therefore, we recommend no change in this assumption at this time.**

FINAL AVERAGE COMPENSATION: We compared the actual final average compensation used to determine retiree benefits with the compensation predicted by our pension software. Based on our findings, **we recommend a continuation of the 0.25% load on the final average compensation produced by our valuation software.**

MILITARY SERVICE: Currently, we assume that participants will have on average 0.20 years of military service at retirement. We reviewed this assumption for those participants who retired during this four-year period and the average number of years of military service was 0.21 years. In the last experience study, the average was 0.21 years. **Therefore, we recommend no change in this assumption at this time.**

ASSUMED INTEREST RATE ON EMPLOYEE CONTRIBUTIONS: This assumption is adopted by the Board each year, but **2.00% remains a reasonable assumption at this time.**

OTHER ASSUMPTION LOADS: Varying loads for pre-retirement dependent children option and for disability dependent child's options are made to the liabilities to account for the number of children possibly covered. **We recommend no change at this time in these loads.**

OPTION FACTORS: The option factors, currently in use by all of the Retirement Systems, are based on the mortality table and investment rate of return (discount rate) used in the valuation. **We will review the changes in the mortality table as discussed earlier and determined in a change in the factors is needed at this time.**

MUNICIPAL RETIREMENT SYSTEMS

SUMMARY OF RESULTS

Since this is a closed System with only retired members remaining, the only demographic assumption to review is post-retirement mortality. Over the period of this investigation, we have found the following observations:

Since the MRS does not have enough mortality data by itself to warrant credible data, we recommend that each of the Systems have the same mortality table. As mentioned in the PERS section of this report, we recommend that the rates of mortality for post-retirements be unchanged as outlined below:

Service Retirees (Proposed Table)

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Retiree	None	Male: 107% for all ages Female: 97% up to age 82, 100% for ages 83 to 87, and 110% for ages above 87	MP-2021

Contingent Annuitants (Proposed Table)

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Contingent Annuitant	Male: Set forward 2 years Female: Set forward 3 years	None	MP-2021

Disabled Retirees (Proposed Table)

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubG.H-2010 Disabled	Male: Set forward 1 year Female: Set forward 2 years	Male: 134% for all ages Female: 125% for all ages	MP-2021

APPENDIX A – HISTORICAL JUNE CPI (U) INDEX

Year	CPI (U)	Year	CPI (U)
1963	30.6	1994	148.0
1964	31.0	1995	152.5
1965	31.6	1996	156.7
1966	32.4	1997	160.3
1967	33.3	1998	163.0
1968	35.7	1999	166.2
1969	34.7	2000	172.4
1970	38.8	2001	178.0
1971	40.6	2002	179.9
1972	41.7	2003	183.7
1973	44.2	2004	189.7
1974	49.0	2005	194.5
1975	53.6	2006	202.9
1976	56.8	2007	208.352
1977	60.7	2008	218.815
1978	65.2	2009	215.693
1979	72.3	2010	217.965
1980	82.7	2011	225.722
1981	90.6	2012	229.478
1982	97.0	2013	233.504
1983	99.5	2014	238.343
1984	103.7	2015	238.638
1985	107.6	2016	241.018
1986	109.5	2017	244.955
1987	113.5	2018	251.989
1988	118.0	2019	256.143
1989	124.1	2020	257.797
1990	129.9	2021	271.696
1991	136.0	2022	296.311
1992	140.2	2023	305.109
1993	144.4	2024	314.069

Callan's Capital Market Assumptions and
PERS' Board of Trustees Target Asset Allocation

Geometric Real Rates of Return and Standard Deviations by Asset Class

Asset Class	Expected Real Rate of Return	Standard Deviation
Domestic Equity	4.75%	17.00%
International Equity	4.75	20.15
Global Equity	4.95	21.25
Fixed Income	2.25	4.40
Real Estate	3.75	14.00
Private Equity	6.00	27.60
Cash Equivalents	0.50	0.90

Asset Allocation Targets

Asset Class	Asset Allocation
Domestic Equity	27.00%
International Equity	20.00
Global Equity	12.00
Fixed Income	20.00
Real Estate	10.00
Private Equity	10.00
Cash Equivalents	1.00

APPENDIX C – SOCIAL SECURITY ADMINISTRATION WAGE INDEX

Year	Wage Index	Annual Increase	Year	Wage Index	Annual Increase
1962	$4,291.40	5.01%	1993	$23,132.67	0.86%
1963	4,396.64	2.45	1994	23,753.53	2.68
1964	4,576.32	4.09	1995	24,705.66	4.01
1965	4,658.72	1.80	1996	25,913.90	4.89
1966	4,938.36	6.00	1997	27,426.00	5.84
1967	5,213.44	5.57	1998	28,861.44	5.23
1968	5,571.76	6.87	1999	30,469.84	5.57
1969	5,893.76	5.78	2000	32,154.82	5.53
1970	6,186.24	4.96	2001	32,921.92	2.39
1971	6,497.08	5.02	2002	33,252.09	1.00
1972	7,133.80	9.80	2003	34,064.95	2.44
1973	7,580.16	6.26	2004	35,648.55	4.65
1974	8,030.76	5.94	2005	36,952.94	3.66
1975	8,630.92	7.47	2006	38,651.41	4.60
1976	9,226.48	6.90	2007	40,405.48	4.54
1977	9,779.44	5.99	2008	41,334.97	2.30
1978	10,556.03	7.94	2009	40,711.61	-1.51
1979	11,479.46	8.75	2010	41,673.83	2.36
1980	12,513.46	9.01	2011	42,979.61	3.13
1981	13,773.10	10.07	2012	44,321.67	3.12
1982	14,531.34	5.51	2013	44,888.16	1.28
1983	15,239.24	4.87	2014	46,481.52	3.55
1984	16,135.07	5.88	2015	48,098.63	3.48
1985	16,822.51	4.26	2016	48,642.15	1.13
1986	17,321.82	2.97	2017	50,321.89	3.45
1987	18,426.51	6.38	2018	52,145.80	3.62
1988	19,334.04	4.93	2019	54,099.99	3.75
1989	20,099.55	3.96	2020	55,628.60	2.83
1990	21,027.98	4.62	2021	60,575.07	8.89
1991	21,811.60	3.73	2022	63,795.13	5.31
1992	22,935.42	5.15	2023	66,621.80	4.43

TABLE 1(a)
RATES OF SEPARATION FROM ACTIVE SERVICE – MALES

AGE	RATES OF DEATH*	RATES OF DISABILITY	RATES OF RETIREMENT	
			LESS THAN 25 YRS OF SERVICE**	25 OR MORE YEARS OF SERVICE**
20	0.000360	0.00020		
21	0.000368	0.00020		
22	0.000368	0.00020		
23	0.000375	0.00020		
24	0.000383	0.00020		
25	0.000390	0.00020		
26	0.000398	0.00020		
27	0.000405	0.00020		
28	0.000413	0.00020		
29	0.000420	0.00020		
30	0.000428	0.00020		
31	0.000443	0.00020		
32	0.000450	0.00020		
33	0.000465	0.00020		
34	0.000480	0.00020		
35	0.000503	0.00020		
36	0.000525	0.00028		
37	0.000555	0.00036		
38	0.000585	0.00044		
39	0.000623	0.00052		
40	0.000660	0.00060		0.2800
41	0.000713	0.00070		0.2800
42	0.000758	0.00080		0.2800
43	0.000818	0.00090		0.2800
44	0.000878	0.00100		0.2800
45	0.000945	0.00110		0.2800
46	0.001020	0.00124		0.3200
47	0.001103	0.00138		0.2700
48	0.001590	0.00152		0.1950
49	0.001720	0.00166		0.1800
50	0.001850	0.00180		0.2050
51	0.002000	0.00200		0.1800
52	0.002160	0.00220		0.2100
53	0.002330	0.00240		0.1850
54	0.002520	0.00260		0.1850
55	0.002730	0.00280		0.2000
56	0.002960	0.00268		0.1900
57	0.003230	0.00256		0.1900
58	0.004212	0.00244		0.1900
59	0.004596	0.00232		0.1950
60	0.005016	0.00220	0.1175	0.1950
61	0.005484	0.00216	0.1250	0.2300
62	0.005988	0.00212	0.1850	0.2500
63	0.006540	0.00208	0.1650	0.2300
64	0.007404	0.00204	0.1575	0.2300
65	0.008400	0.00200	0.2600	0.3000
66	0.009516	0.00200	0.2500	0.3300
67	0.010776	0.00200	0.2400	0.2200
68	0.012216	0.00200	0.2050	0.2600
69	0.013848	0.00200	0.1600	0.2300
70	0.015684	0.00200	0.2100	0.2200
71	0.017772	0.00200	0.1800	0.2200
72	0.020148	0.00200	0.1950	0.1900
73	0.022824	0.00200	0.1900	0.2000
74	0.025872	0.00200	0.1850	0.1950
75	0.029316	0.00200	0.1800	0.1500
76	0.033216	0.00200	0.1850	0.1800
77	0.037644	0.00200	0.1800	0.1500
78	0.042660	0.00200	0.1400	0.1200
79	0.078576	0.00200	0.1800	0.2200
80	0.087648	0.00200	1.0000	1.0000

* Adjusted Base rates

**For Tier 4 members, 30 years of service.

TABLE 1(b)
RATES OF SEPARATION FROM ACTIVE SERVICE – MALES (continued)

AGE	Rates of Withdrawal - Males																								
	SERVICE																								
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+
15	0.4000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
16	0.4000	0.3300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
17	0.4000	0.3300	0.2600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.4000	0.3300	0.2600	0.1800	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.4000	0.3300	0.2600	0.1800	0.1500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.4000	0.3300	0.2600	0.1800	0.1500	0.1250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
21	0.4000	0.3300	0.2600	0.1800	0.1500	0.1250	0.1200	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
22	0.4000	0.3300	0.2600	0.1800	0.1500	0.1250	0.1200	0.0800	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
23	0.3300	0.2700	0.2100	0.1750	0.1500	0.1250	0.1200	0.0800	0.0825	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.3300	0.2700	0.2100	0.1750	0.1500	0.1250	0.1200	0.0800	0.0825	0.0850	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
25	0.3300	0.2700	0.2100	0.1750	0.1500	0.1250	0.1200	0.0800	0.0825	0.0850	0.0650	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.3300	0.2700	0.2100	0.1750	0.1500	0.1250	0.1200	0.0800	0.0825	0.0850	0.0650	0.0600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
27	0.3300	0.2700	0.2100	0.1750	0.1500	0.1250	0.1200	0.0800	0.0825	0.0850	0.0650	0.0600	0.0600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
28	0.3300	0.2600	0.2100	0.1600	0.1400	0.1250	0.1000	0.0800	0.0825	0.0850	0.0650	0.0600	0.0600	0.0550	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
29	0.3300	0.2600	0.2100	0.1600	0.1400	0.1250	0.1000	0.0800	0.0825	0.0850	0.0650	0.0600	0.0600	0.0550	0.0400	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
30	0.3300	0.2600	0.2100	0.1600	0.1400	0.1250	0.1000	0.0800	0.0825	0.0850	0.0650	0.0600	0.0600	0.0550	0.0400	0.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
31	0.3300	0.2600	0.2100	0.1600	0.1400	0.1250	0.1000	0.0800	0.0825	0.0850	0.0650	0.0600	0.0600	0.0550	0.0400	0.0350	0.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.3300	0.2600	0.2100	0.1600	0.1400	0.1250	0.1000	0.0800	0.0825	0.0850	0.0650	0.0600	0.0600	0.0550	0.0400	0.0350	0.0350	0.0275	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
33	0.3300	0.2400	0.1750	0.1600	0.1400	0.1200	0.1000	0.0800	0.0850	0.0700	0.0600	0.0600	0.0550	0.0450	0.0400	0.0350	0.0350	0.0275	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	0.3300	0.2400	0.1750	0.1600	0.1400	0.1200	0.1000	0.0800	0.0850	0.0700	0.0600	0.0600	0.0550	0.0450	0.0400	0.0350	0.0350	0.0275	0.0250	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
35	0.3300	0.2400	0.1750	0.1600	0.1400	0.1200	0.1000	0.0800	0.0850	0.0700	0.0600	0.0600	0.0550	0.0450	0.0400	0.0350	0.0350	0.0275	0.0250	0.0250	0.0400	0.0000	0.0000	0.0000	0.0000	0.0000
36	0.3300	0.2400	0.1750	0.1600	0.1400	0.1200	0.1000	0.0800	0.0850	0.0700	0.0600	0.0600	0.0550	0.0450	0.0400	0.0350	0.0350	0.0275	0.0250	0.0250	0.0400	0.0400	0.0000	0.0000	0.0000	0.0000
37	0.3300	0.2400	0.1750	0.1600	0.1400	0.1200	0.1000	0.0800	0.0850	0.0700	0.0600	0.0600	0.0550	0.0450	0.0400	0.0350	0.0350	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0000	0.0000	0.0000
38	0.3200	0.2350	0.1600	0.1450	0.1150	0.1050	0.0850	0.0825	0.0750	0.0750	0.0600	0.0550	0.0475	0.0550	0.0400	0.0350	0.0325	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
39	0.3200	0.2350	0.1600	0.1450	0.1150	0.1050	0.0850	0.0825	0.0750	0.0750	0.0600	0.0550	0.0475	0.0550	0.0400	0.0350	0.0325	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
40	0.3200	0.2350	0.1600	0.1450	0.1150	0.1050	0.0850	0.0825	0.0750	0.0750	0.0600	0.0550	0.0475	0.0550	0.0400	0.0350	0.0325	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
41	0.3200	0.2350	0.1600	0.1450	0.1150	0.1050	0.0850	0.0825	0.0750	0.0750	0.0600	0.0550	0.0475	0.0550	0.0400	0.0350	0.0325	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
42	0.3200	0.2350	0.1600	0.1450	0.1150	0.1050	0.0850	0.0825	0.0750	0.0750	0.0600	0.0550	0.0475	0.0550	0.0400	0.0350	0.0325	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
43 - 47	0.3200	0.2100	0.1500	0.1225	0.1150	0.1050	0.0750	0.0850	0.0750	0.0750	0.0600	0.0525	0.0475	0.0425	0.0400	0.0350	0.0325	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
48 - 52	0.2700	0.1900	0.1600	0.1150	0.1050	0.0900	0.0700	0.0850	0.0600	0.0600	0.0650	0.0525	0.0475	0.0425	0.0400	0.0350	0.0325	0.0300	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
53 - 79	0.2300	0.1800	0.1300	0.1250	0.1100	0.0850	0.0700	0.0800	0.0650	0.0600	0.0600	0.0500	0.0500	0.0450	0.0400	0.0350	0.0325	0.0300	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
80+	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

*Rates stop at eligibility for retirement. For Tier 4, rates at 24 years of service are extended out to 29 years of service.

TABLE 2(a)
RATES OF SEPARATION FROM ACTIVE SERVICE – FEMALES

AGE	RATES OF DEATH*	RATES OF DISABILITY	RATES OF RETIREMENT	
			LESS THAN 25 YRS OF SERVICE**	25 OR MORE YEARS OF
20	0.000150	0.00020		
21	0.000158	0.00020		
22	0.000173	0.00020		
23	0.000188	0.00020		
24	0.000195	0.00020		
25	0.000210	0.00020		
26	0.000225	0.00020		
27	0.000240	0.00020		
28	0.000255	0.00020		
29	0.000270	0.00020		
30	0.000285	0.00020		
31	0.000308	0.00020		
32	0.000323	0.00020		
33	0.000345	0.00020		
34	0.000368	0.00020		
35	0.000390	0.00020		
36	0.000413	0.00026		
37	0.000443	0.00032		
38	0.000465	0.00038		
39	0.000495	0.00044		
40	0.000533	0.00050		0.2275
41	0.000563	0.00054		0.2275
42	0.000600	0.00058		0.2275
43	0.000638	0.00062		0.2275
44	0.000675	0.00066		0.2275
45	0.000720	0.00070		0.2275
46	0.000765	0.00085		0.2350
47	0.000818	0.00100		0.1700
48	0.001150	0.00115		0.1475
49	0.001230	0.00130		0.1625
50	0.001310	0.00145		0.1650
51	0.001390	0.00156		0.1950
52	0.001480	0.00167		0.1850
53	0.001727	0.00178		0.1850
54	0.001837	0.00189		0.1900
55	0.001947	0.00200		0.2225
56	0.002079	0.00196		0.2050
57	0.002211	0.00192		0.2025
58	0.002343	0.00188		0.2025
59	0.002497	0.00184		0.2200
60	0.002651	0.00180	0.1475	0.2200
61	0.002827	0.00180	0.1325	0.2400
62	0.003003	0.00180	0.1850	0.2775
63	0.003190	0.00180	0.1825	0.2475
64	0.003388	0.00180	0.2000	0.3050
65	0.003894	0.00180	0.3000	0.3950
66	0.004466	0.00180	0.3050	0.3600
67	0.005126	0.00180	0.2650	0.3200
68	0.005885	0.00180	0.2250	0.3000
69	0.006754	0.00180	0.2400	0.2700
70	0.007744	0.00180	0.2450	0.2650
71	0.008888	0.00180	0.2300	0.2100
72	0.010197	0.00180	0.2200	0.2600
73	0.011704	0.00180	0.2500	0.2150
74	0.013431	0.00180	0.2100	0.1750
75	0.015411	0.00180	0.2500	0.2100
76	0.017688	0.00180	0.3000	0.2500
77	0.020295	0.00180	0.2550	0.3000
78	0.023298	0.00180	0.2100	0.2500
79	0.026730	0.00180	0.3000	0.3000
80	0.052041	0.00180	1.0000	1.0000

*Adjusted Base Rates
**For Tier 4 members, 30 years of service.

TABLE 2(b)
RATES OF SEPARATION FROM ACTIVE SERVICE – FEMALES (Continued)

AGE	Rates of Withdrawal - Females																								
	SERVICE																								
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+
15	0.4550	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
16	0.4550	0.4000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
17	0.4550	0.4000	0.3200	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.4550	0.4000	0.3200	0.2700	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.4550	0.4000	0.3200	0.2700	0.1800	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.4550	0.4000	0.3200	0.2700	0.1800	0.1350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
21	0.4550	0.4000	0.3200	0.2700	0.1800	0.1350	0.1000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
22	0.4550	0.4000	0.3200	0.2700	0.1800	0.1350	0.1000	0.0900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
23	0.3500	0.2700	0.2300	0.1800	0.1550	0.1350	0.1000	0.0900	0.0900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.3500	0.2700	0.2300	0.1800	0.1550	0.1350	0.1000	0.0900	0.0900	0.0800	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
25	0.3500	0.2700	0.2300	0.1800	0.1550	0.1350	0.1000	0.0900	0.0900	0.0800	0.0700	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.3500	0.2700	0.2300	0.1800	0.1550	0.1350	0.1000	0.0900	0.0900	0.0800	0.0700	0.0600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
27	0.3500	0.2700	0.2300	0.1800	0.1550	0.1350	0.1000	0.0900	0.0900	0.0800	0.0700	0.0600	0.0600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
28	0.3400	0.2675	0.2150	0.1700	0.1450	0.1250	0.1000	0.0825	0.0850	0.0750	0.0700	0.0600	0.0600	0.0525	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
29	0.3400	0.2675	0.2150	0.1700	0.1450	0.1250	0.1000	0.0825	0.0850	0.0750	0.0700	0.0600	0.0600	0.0525	0.0450	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
30	0.3400	0.2675	0.2150	0.1700	0.1450	0.1250	0.1000	0.0825	0.0850	0.0750	0.0700	0.0600	0.0600	0.0525	0.0450	0.0400	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
31	0.3400	0.2675	0.2150	0.1700	0.1450	0.1250	0.1000	0.0825	0.0850	0.0750	0.0700	0.0600	0.0600	0.0525	0.0450	0.0400	0.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.3400	0.2675	0.2150	0.1700	0.1450	0.1250	0.1000	0.0825	0.0850	0.0750	0.0700	0.0600	0.0600	0.0525	0.0450	0.0400	0.0350	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
33	0.2950	0.2200	0.1850	0.1450	0.1300	0.1200	0.0950	0.0800	0.0775	0.0750	0.0600	0.0600	0.0500	0.0425	0.0450	0.0400	0.0350	0.0250	0.0300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	0.2950	0.2200	0.1850	0.1450	0.1300	0.1200	0.0950	0.0800	0.0775	0.0750	0.0600	0.0600	0.0500	0.0425	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
35	0.2950	0.2200	0.1850	0.1450	0.1300	0.1200	0.0950	0.0800	0.0775	0.0750	0.0600	0.0600	0.0500	0.0425	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000
36	0.2950	0.2200	0.1850	0.1450	0.1300	0.1200	0.0950	0.0800	0.0775	0.0750	0.0600	0.0600	0.0500	0.0425	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0000	0.0000	0.0000	0.0000
37	0.2950	0.2200	0.1850	0.1450	0.1300	0.1200	0.0950	0.0800	0.0775	0.0750	0.0600	0.0600	0.0500	0.0425	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0250	0.0000	0.0000	0.0000
38	0.2750	0.2200	0.1750	0.1450	0.1150	0.0950	0.0925	0.0775	0.0850	0.0750	0.0600	0.0600	0.0500	0.0450	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0250	0.0250	0.0000	0.0000
39	0.2750	0.2200	0.1750	0.1450	0.1150	0.0950	0.0925	0.0775	0.0850	0.0750	0.0600	0.0600	0.0500	0.0450	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0250	0.0250	0.0250	0.0000
40	0.2750	0.2200	0.1750	0.1450	0.1150	0.0950	0.0925	0.0775	0.0850	0.0750	0.0600	0.0600	0.0500	0.0450	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0250	0.0250	0.0250	0.0000
41	0.2750	0.2200	0.1750	0.1450	0.1150	0.0950	0.0925	0.0775	0.0850	0.0750	0.0600	0.0600	0.0500	0.0450	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0250	0.0250	0.0250	0.0000
42	0.2750	0.2200	0.1750	0.1450	0.1150	0.0950	0.0925	0.0775	0.0850	0.0750	0.0600	0.0600	0.0500	0.0450	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0250	0.0250	0.0250	0.0000
43 - 47	0.2600	0.2100	0.1500	0.1275	0.1050	0.0875	0.0875	0.0725	0.0750	0.0675	0.0600	0.0600	0.0500	0.0500	0.0450	0.0400	0.0350	0.0325	0.0300	0.0300	0.0300	0.0300	0.0300	0.0300	0.0300	0.0000
48 - 52	0.2600	0.2000	0.1450	0.1275	0.1100	0.0950	0.0825	0.0800	0.0750	0.0675	0.0600	0.0600	0.0500	0.0500	0.0450	0.0400	0.0350	0.0300	0.0300	0.0300	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
53 - 79	0.2300	0.1900	0.1450	0.1325	0.1100	0.0949	0.0825	0.0900	0.0700	0.0700	0.0600	0.0600	0.0650	0.0500	0.0400	0.0400	0.0350	0.0350	0.0350	0.0350	0.0450	0.0450	0.0450	0.0450	0.0450	0.0000
80+	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

*Rates stop at eligibility for retirement. For Tier 4, rates at 24 years of service are extended out to 29 years of service.

TABLE 3
RATES OF ANTICIPATED SALARY INCREASES*
(For Both Males and Females)

SERVICE	
0	0.1790
1	0.0790
2	0.0540
3	0.0440
4	0.0390
5	0.0340
6	0.0340
7	0.0340
8	0.0290
9	0.0290
10	0.0290
11	0.0290
12	0.0290
13	0.0290
14	0.0290
15	0.0290
16	0.0290
17	0.0290
18	0.0290
19	0.0290
20	0.0290
21	0.0290
22	0.0290
23	0.0290
24	0.0290
25	0.0290
26	0.0290
27	0.0290
28	0.0265
29	0.0265
30	0.0265
31	0.0265
32	0.0265
33	0.0265
34	0.0265
35	0.0265
36	0.0265
37	0.0265
38	0.0265
39	0.0265
40	0.0265

* Includes wage inflation of 2.65%

TABLE 4
BASE RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF SERVICE*

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000449	0.000155	71	0.023315	0.015384
20	0.000482	0.000175	72	0.026022	0.017169
21	0.000503	0.000194	73	0.029051	0.019148
22	0.000514	0.000204	74	0.032432	0.021359
23	0.000524	0.000223	75	0.036198	0.023823
24	0.000524	0.000243	76	0.040414	0.026578
25	0.000535	0.000252	77	0.045111	0.029643
26	0.000546	0.000272	78	0.050365	0.033067
27	0.000556	0.000291	79	0.056229	0.036879
28	0.000567	0.000310	80	0.062777	0.041138
29	0.000578	0.000330	81	0.070064	0.045891
30	0.000589	0.000349	82	0.078153	0.051187
31	0.000599	0.000369	83	0.087087	0.058860
32	0.000610	0.000398	84	0.096931	0.065660
33	0.000631	0.000417	85	0.107728	0.073240
34	0.000642	0.000446	86	0.119562	0.081690
35	0.000663	0.000475	87	0.132509	0.091120
36	0.000685	0.000504	88	0.146654	0.111804
37	0.000717	0.000534	89	0.162105	0.124718
38	0.000749	0.000572	90	0.178947	0.139117
39	0.000792	0.000601	91	0.195949	0.154077
40	0.000835	0.000640	92	0.212470	0.169103
41	0.000888	0.000689	93	0.228295	0.184085
42	0.000942	0.000728	94	0.243607	0.199133
43	0.001017	0.000776	95	0.258780	0.214566
44	0.001081	0.000825	96	0.274348	0.230791
45	0.002547	0.000902	97	0.290847	0.248193
46	0.002739	0.000999	98	0.308684	0.267113
47	0.002953	0.001116	99	0.328083	0.287672
48	0.003178	0.001251	100	0.348916	0.309760
49	0.003413	0.001387	101	0.370605	0.332915
50	0.003670	0.001552	102	0.392048	0.356202
51	0.003948	0.001727	103	0.413063	0.379434
52	0.004248	0.001930	104	0.433478	0.402391
53	0.004569	0.002153	105	0.453166	0.424875
54	0.004922	0.002406	106	0.472009	0.446699
55	0.005307	0.002677	107	0.489910	0.467709
56	0.005725	0.002988	108	0.506795	0.487751
57	0.006195	0.003337	109	0.522620	0.506737
58	0.006709	0.003715	110	0.535000	0.524590
59	0.007287	0.004152	111	0.535000	0.541255
60	0.007918	0.004627	112	0.535000	0.550000
61	0.008624	0.005160	113	0.535000	0.550000
62	0.009395	0.005752	114	0.535000	0.550000
63	0.010240	0.006421	115	0.535000	0.550000
64	0.011171	0.007159	116	0.535000	0.550000
65	0.012187	0.007993	117	0.535000	0.550000
66	0.013546	0.008914	118	0.535000	0.550000
67	0.015076	0.009943	119	0.535000	0.550000
68	0.016799	0.011087	120	1.000000	1.000000
69	0.018725	0.012368			
70	0.020886	0.013793			

*Adjusted Base Rates

TABLE 5
BASE RATES OF MORTALITY FOR BENEFICIARIES OF DECEASED MEMBERS*

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000480	0.000200	71	0.035160	0.022750
20	0.000490	0.000210	72	0.038360	0.024760
21	0.000490	0.000230	73	0.041830	0.026990
22	0.000500	0.000250	74	0.045590	0.029460
23	0.000510	0.000260	75	0.049710	0.032200
24	0.000520	0.000280	76	0.054240	0.035270
25	0.000530	0.000300	77	0.059260	0.038700
26	0.000540	0.000320	78	0.064860	0.042580
27	0.000550	0.000340	79	0.071100	0.046980
28	0.000560	0.000360	80	0.078020	0.051970
29	0.000570	0.000380	81	0.085690	0.057620
30	0.000590	0.000410	82	0.094140	0.064020
31	0.000600	0.000430	83	0.103440	0.071270
32	0.000620	0.000460	84	0.113610	0.079450
33	0.000640	0.000490	85	0.124680	0.088570
34	0.000670	0.000520	86	0.136760	0.098570
35	0.000700	0.000550	87	0.151110	0.109330
36	0.000740	0.000590	88	0.166730	0.120640
37	0.000780	0.000620	89	0.183000	0.132580
38	0.000830	0.000660	90	0.199560	0.145230
39	0.000880	0.000710	91	0.216290	0.158700
40	0.000950	0.000750	92	0.233230	0.173100
41	0.001010	0.000800	93	0.250530	0.188520
42	0.007330	0.000850	94	0.268370	0.205030
43	0.007600	0.004640	95	0.286890	0.222660
44	0.007880	0.004790	96	0.306160	0.241380
45	0.008160	0.004930	97	0.326090	0.261090
46	0.008450	0.005080	98	0.346360	0.281600
47	0.009110	0.005230	99	0.366400	0.302650
48	0.009350	0.005370	100	0.386040	0.323820
49	0.009600	0.005670	101	0.405120	0.344940
50	0.009850	0.005990	102	0.423520	0.365810
51	0.010120	0.006320	103	0.441130	0.386250
52	0.010420	0.006670	104	0.457860	0.406090
53	0.010730	0.007040	105	0.473640	0.425190
54	0.011080	0.007420	106	0.488430	0.443410
55	0.011470	0.007820	107	0.500000	0.460670
56	0.011920	0.008250	108	0.500000	0.476900
57	0.012430	0.008710	109	0.500000	0.492050
58	0.013020	0.009210	110	0.500000	0.500000
59	0.013710	0.009750	111	0.500000	0.500000
60	0.014500	0.010340	112	0.500000	0.500000
61	0.015430	0.010980	113	0.500000	0.500000
62	0.016500	0.011680	114	0.500000	0.500000
63	0.017760	0.012430	115	0.500000	0.500000
64	0.019210	0.013320	116	0.500000	0.500000
65	0.020860	0.014290	117	1.000000	0.500000
66	0.022710	0.015350	118	1.000000	1.000000
67	0.024760	0.016530	119	1.000000	1.000000
68	0.027030	0.017840	120	1.000000	1.000000
69	0.029500	0.019310			
70	0.032210	0.020940			

*Adjusted Base Rates

TABLE 6
BASE RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF DISABILITY*

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.005521	0.002688	71	0.058210	0.043300
20	0.005172	0.002425	72	0.061627	0.046475
21	0.004717	0.002200	73	0.065392	0.050038
22	0.004234	0.002050	74	0.069573	0.054025
23	0.003873	0.002050	75	0.074196	0.058475
24	0.003725	0.002238	76	0.079341	0.063438
25	0.003913	0.002450	77	0.085050	0.068963
26	0.004100	0.002688	78	0.091415	0.075088
27	0.004301	0.002938	79	0.098463	0.081875
28	0.004516	0.003212	80	0.106249	0.089375
29	0.004744	0.003513	81	0.114771	0.097638
30	0.004985	0.003837	82	0.124071	0.106700
31	0.005239	0.004200	83	0.134134	0.116638
32	0.005507	0.004588	84	0.144921	0.127038
33	0.005816	0.005013	85	0.156485	0.137675
34	0.006137	0.005475	86	0.168907	0.148475
35	0.006512	0.005988	87	0.182280	0.159462
36	0.006941	0.006550	88	0.199137	0.170812
37	0.007437	0.007175	89	0.217790	0.182713
38	0.008000	0.007863	90	0.236925	0.195438
39	0.008643	0.008613	91	0.256288	0.209250
40	0.009380	0.009425	92	0.275879	0.224437
41	0.010224	0.010313	93	0.295845	0.241225
42	0.011176	0.011275	94	0.316468	0.259800
43	0.012274	0.012312	95	0.338028	0.280550
44	0.013494	0.013413	96	0.360782	0.302825
45	0.014861	0.014588	97	0.384888	0.326688
46	0.016361	0.015838	98	0.410362	0.352000
47	0.017983	0.017162	99	0.436961	0.378312
48	0.019698	0.018538	100	0.464122	0.404775
49	0.021507	0.019188	101	0.490976	0.431175
50	0.022941	0.019837	102	0.517294	0.457263
51	0.024361	0.020500	103	0.542861	0.482813
52	0.025741	0.021150	104	0.567517	0.507613
53	0.027068	0.021775	105	0.591114	0.531488
54	0.028328	0.022363	106	0.613532	0.554263
55	0.029493	0.022913	107	0.634678	0.575838
56	0.030552	0.023425	108	0.654496	0.596125
57	0.031557	0.023925	109	0.670000	0.615063
58	0.032535	0.024450	110	0.670000	0.625000
59	0.033540	0.025000	111	0.670000	0.625000
60	0.034626	0.025638	112	0.670000	0.625000
61	0.035872	0.026375	113	0.670000	0.625000
62	0.037319	0.027225	114	0.670000	0.625000
63	0.038967	0.028200	115	0.670000	0.625000
64	0.040790	0.029325	116	0.670000	0.625000
65	0.042786	0.030625	117	0.670000	0.625000
66	0.044930	0.032113	118	0.670000	1.000000
67	0.047222	0.033825	119	1.000000	1.000000
68	0.049660	0.035775	120	1.000000	1.000000
69	0.052273	0.037988			
70	0.055114	0.040488			

*Adjusted Base Rates

Supplemental Legislative Retirement Plan of Mississippi

Experience Study for the Four-Year Period Ending June 30, 2024

Prepared as of June 30, 2024

CavMac
Actuarial Consulting Services

April 13, 2025

The Board of Trustees
Public Employees' Retirement System of Mississippi
429 Mississippi Street
Jackson, MS 39201

Members of the Board:

We are pleased to submit the results of an investigation of the economic and demographic experience for the Supplemental Legislative Retirement Plan for Mississippi (SLRP) for the four-year period from July 1, 2020 to June 30, 2024. The study was based on the data submitted by the Public Employees' Retirement System (PERS) for the annual valuation. In preparing this report, we relied, without audit, on the data provided.

The results of the experience study are the basis for recommended changes in the actuarial assumptions, which if adopted by the Board, will be first used for the June 30, 2025 valuation. With the Board's approval of the recommendations in the report, we believe the actuarial condition of the System will be more accurately portrayed. We would like to acknowledge the help in the preparation of the data for this investigation given by the PERS staff.

The purpose of the investigation was to assess the reasonability of the current SLRP economic assumptions and demographic actuarial assumptions for each Retirement System. Actuarial assumptions are used to measure and budget future costs. Changing assumptions will not change the actual cost of future benefits. Once the assumptions have been adopted, the actuarial valuation measures the adequacy of the fixed contribution rate.

All recommended rates of separation, mortality and salary increase at each age or service level are shown in the attached tables in Appendix D of this report. In the actuary's judgment, the rates recommended are suitable for use until further experience indicates that modifications are desirable.

In order to prepare the measurement of the impact on liabilities in this report, we have utilized actuarial models that we developed to measure liabilities and develop actuarial costs. These models include tools that we have produced and tested, along with commercially available valuation software that we have reviewed to confirm the appropriateness and accuracy of the output. In utilizing these models, we develop and use input parameters and assumptions about future contingent events along with recognized actuarial approaches to develop the needed results.

We hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board (ASB) and the Code of Professional Conduct and Qualification Standards for Public Statements of Actuarial Opinion of the American Academy of Actuaries.

In particular, we have prepared the assumptions developed in this report in keeping with our understanding of Actuarial Standards of Practice No. 27 (Selection of Assumptions for Measuring Pension Obligations).

We note that as we prepare this report, the world has been in a pandemic during much of the experience study period. We have taken this into consideration as we reviewed the experience, particularly regarding mortality, retirement, termination and disability patterns. While we do not believe that there is yet sufficient data to warrant the significant modification of any of our assumptions specifically due to COVID-19, we will continue to monitor the situation and advise the Board in the future of any adjustments that we believe would be appropriate.

The experience investigation was performed by, and under the supervision of, independent actuaries who are members of the American Academy of Actuaries with experience in performing valuations for public retirement systems. The undersigned meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,

Edward J. Koebel, EA, FCA, MAAA
Chief Executive Officer

Ben Mobley, ASA, FCA, MAAA
Consulting Actuary

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SECTION I – EXECUTIVE SUMMARY

The purpose of an actuarial valuation is to provide a timely best estimate of the ultimate costs of a retirement system. Actuarial valuations of the Supplemental Legislative Retirement Plan for Mississippi (SLRP) are prepared annually to determine the actuarial contribution rate required to fund them on an actuarial reserve basis, (i.e. the current assets plus future contributions, along with investment earnings will be sufficient to provide the benefits promised by the system). The valuation requires the use of certain assumptions with respect to the occurrence of future events, such as rates of death, termination of employment, retirement age, and salary changes to estimate the obligations of the system.

The basic purpose of an experience study is to determine whether the actuarial assumptions currently in use have adequately anticipated the actual emerging experience. This information, along with the professional judgment of system personnel and advisors, is used to evaluate the appropriateness of continued use of the current actuarial assumptions. When analyzing experience and assumptions, it is important to recognize that actual experience is reported in the short-term while assumptions are intended to be long-term estimates of experience. Therefore, actual experience is expected to vary from study period to study period, without necessarily indicating a change in assumptions is needed.

Cavanaugh Macdonald Consulting, LLC (CavMac) has performed a study of the experience for SLRP for the four-year period ending June 30, 2024. This report presents the results, analysis, and resulting recommendations of our study. It is anticipated that the changes, if approved, will first be reflected in the June 30, 2025 actuarial valuation.

These assumptions have been developed in accordance with generally recognized and accepted actuarial principles and practices that are consistent with the applicable Actuarial Standards of Practice adopted by the Actuarial Standards Board (ASB). While the recommended assumptions represent our best estimate of future experience, there are other reasonable assumption sets that could be supported by the results of this experience study. Those other sets of reasonable assumptions could produce liabilities and costs that are either higher or lower.

Our Philosophy

Similar to an actuarial valuation, the calculation of actual and expected experience is a fairly mechanical process, and differences between actuaries in this area are generally minor. However, the setting of assumptions differs, as it is more art than science. In this report, we have recommended changes to certain assumptions. To explain our thought process, we offer a brief summary of our philosophy:

- **Do Not Overreact**: When we see significant changes in experience, we generally do not adjust our rates to reflect the entire difference. We will typically recommend rates somewhere between the old rates and the new experience. If the experience during the next study period shows the same result, we will probably recognize the trend at that point in time or at least move further in the direction of the observed experience. On the other hand, if experience returns closer to its prior level, we will not have overreacted, possibly causing volatility in the actuarial contribution rates.

- **Anticipate Trends**: If there is an identified trend that is expected to continue, we believe that this should be recognized. An example is the retiree mortality assumption. It is an established trend that people are living longer, outside of the recent pandemic. Therefore, we believe the best estimate of liabilities in the valuation should reflect the expected increase in life expectancy.

- **Simplify**: In general, we attempt to identify which factors are significant and eliminate or ignore the ones that do not materially improve the accuracy of the liability projections.

The following summarizes the findings and recommendations with regard to the assumptions utilized for SLRP. Detailed explanations for the recommendations are found in the sections that follow.

Recommended Economic Assumption Changes

Economic assumptions are some of the most visible and significant assumptions used in the valuation process. The items in the broad economy modeled by these assumptions can be very volatile over short periods of time, as clearly seen in the economic recovery from the pandemic in 2021 followed by the downward trend in global markets in 2022. Our goal is to try to find the emerging long-term trends in the midst of this volatility so that we can then apply reasonable assumptions.

Most of the economic assumptions used by actuaries are developed through a building-block approach. For example, the expected return on assets is based on the expectation for inflation plus the expected real return on assets. At the core of the economic assumptions is the inflation assumption. As we discuss later in the report, although recently we have experienced higher inflation following the recovery from the pandemic, we believe that long-term inflation will settle back down in the 2.40% to 2.50% range. So therefore, **we are recommending that the price inflation assumption remain at 2.40%**.

We are also recommending that the long-term expected return on assets assumption remain at 7.00%, reflecting the 2.40% inflation assumption and a 4.60% real rate of return assumption. This will be discussed in detail later in this report, but a real rate of return of 4.60% is supported by the forecasting models developed using the Board's investment consultant's capital market assumptions and the Board's target asset allocation. Further analysis of the 42 sets of capital market assumptions included in the Horizon Actuarial Services, LLC. Survey conducted in 2024 and the Board's target asset allocation also support this recommendation.

Finally, we are recommending that the general wage inflation (payroll growth) assumption used as the underlying payroll growth for active members and used in the level percent of payroll amortization method remain at 2.65%.

The following table summarizes the current and proposed economic assumptions:

Item	Current	Proposed
Price Inflation	2.40%	2.40%
Investment Return*	7.00%	7.00%
Wage Inflation (Payroll Growth)	2.65%	2.65%

* Net of investment expenses only.

We recognize there may be other sets of economic assumptions that are also reasonable for purposes of funding SLRP. For example, we have typically reflected conservatism to the degree we would classify as moderate. Actuarial Standards of Practice allow for this difference in approaches and perspective, as long as the assumptions are reasonable and consistent.

Recommended Demographic Assumption Changes

In the experience study, actual experience for the study period is compared to that expected based on the current actuarial assumption. Comparing the actual incidence of the event to what was expected (called the Actual-to-Expected ratio, or A/E ratio) then provides the basis for our analysis.

The major demographic assumptions include mortality, retirement, disability, terminations, and salary merit increases. There are some additional minor assumptions that are required as well. For each of these assumptions, we considered the observed behavior patterns during the study period to determine what adjustments might be appropriate. We note that the study period overlapped substantially with the onset of and then recovery from the Covid-19 pandemic, and so we are intentionally cautious in making changes based on the study period alone.

Mortality is typically the most significant demographic assumption. As we discuss in the report, we are recommending that SLRP retain the Society of Actuaries Pub-2010 family of mortality tables issued in 2019 based on public retirement plan data. However, we note that we are recommending some slight adjustments in all four mortality tables. We do recommend the continued use of generational mortality, a technique in which mortality rates are assumed to improve slightly each year in the future.

More information will be discussed in the demographic section of this report.

The following is a general list of the other recommended changes to the demographic assumptions for SLRP.

- **Retirement: Recommend lowering the rates of retirement during election years to better match experience of the System.**
- **Disability: No change to rates of disability at this time.**
- **Withdrawal: Recommend decreasing rates of withdrawal during election years that better match experience of the System.**
- **Merit Salary Scale: No change in the merit salary at this time.**

Section IV of this report will provide more detail to these recommended demographic changes.

Actuarial Methods

The basic actuarial methodologies used in the valuation process include the actuarial cost method, the asset valuation method and the unfunded actuarial accrued liability (UAAL) amortization methodology. Generally, these methods are:

- Cost Method – Entry Age Normal
- Asset Valuation – Five-year recognition of gains and losses with a 20% corridor
- Amortization method – Layered bases with new experience bases amortized over a closed 25-year period as a level percentage of payroll.

Based on our review, discussed in full detail in Section III of this report, we recommend no changes in these actuarial methods at this time.

Other Assumptions

Another assumption that is included in the SLRP valuation is the determination of administrative expense component that is added to the total normal cost each year. The current assumption is 0.15% of payroll. **After reviewing the total amount of administrative expenses for the past four years and the percentage of payroll, we are recommending continuation of the current assumption.** The following table shows actual percentages over the past four years:

Year Ending June 30	Administrative Expenses	Annual Payroll	Percentage
2021	$12,000	$8,029,670	0.15%
2022	$12,000	$8,179,673	0.15%
2023	$13,000	$8,425,049	0.15%
2024	$13,000	$9,090,777	0.14%

Financial Impact

Although the assumption changes, if approved, will first be reflected in the 2025 valuations, we have provided the following table which highlights the impact of the recommended changes on the unfunded accrued liability (UAL), funded ratio, actuarially determined employer contribution (ADEC), and projected funding ratio on the 2024 valuation and projection results.

($ in Thousands)

	Before All Changes	After All Changes
2024 Valuation Unfunded Accrued Liability (UAL)	$7,442	$7,000
2024 Funded Ratio	74.7%	75.9%
2024 Actuarially Determined Employer Contribution (ADEC)	8.53%	8.18%
Projected Funding Ratio 2047*	86.9%	92.8%

* Assumes that the Fixed Contribution Rate (FCR) of 8.40% is continued and that the Plan is still open to new members.

SECTION II – ECONOMIC ASSUMPTIONS

There are four economic assumptions used in the actuarial valuation performed for SLRP. They are:

- Price Inflation
- Investment Return
- Wage Inflation
- Payroll Growth for Amortization Method

Note that future price inflation has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return and wage inflation. However, it is not directly used in the valuation process.

Unlike demographic assumptions, economic assumptions do not lend themselves to analysis largely on the basis of internal historical patterns because economic assumptions are impacted by external forces in the economy. The investment return and general wage increase assumptions are selected on the basis of expectations in an inflation-free environment and then increased by the long-term expectation for inflation, called the "building block" approach.

Sources of data considered in the analysis and selection of the economic assumptions included:

- The 2024 Social Security Trustees Report
- Future expectations of PERS investment consultant, Callan
- Future expectations of other investment consultants (2024 Horizon Survey)
- U.S. Department of the Treasury bond rates
- Assumptions used by other large public retirement systems, based on the Public Fund Survey, published by the National Association of State Retirement Administrators (NASRA)
- Historical observations of price and wage growth statistics and investment returns

Guidance regarding the selection of economic assumptions for measuring pension obligations is provided by Actuarial Standard of Practice (ASOP) No. 27, *Selection of Assumptions for Measuring Pension Obligations*. Because no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment.

ASOP 27 requires the actuary to select a "reasonable" assumption. For this purpose, an assumption is reasonable if it has the following characteristics:

- It is appropriate for the purpose of the measurement;
- It reflects the actuary's professional judgment;
- It takes into account historical and current economic data that is relevant as of the measurement date;
- It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
- It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed, or when alternative assumptions are used for the assessment of risk.

With respect to relevant data, the standard recommends the actuary review appropriate recent and long-term historical economic data but advises the actuary not to give undue weight to recent experience. Furthermore, it advises the actuary to consider that some historical economic data may not be appropriate for use in developing assumptions for future periods due to changes in the underlying environment. In addition, with respect to any particular valuation, each economic assumption should be consistent with all other economic assumptions over the measurement period.

ASOP 27 recognizes that economic data and analyses are available from a variety of sources, including representatives of the plan sponsor, investment advisors, economists, and other professionals. The actuary is permitted to incorporate the views of experts, but the selection or advice must reflect the actuary's professional judgment.

The standard also discusses a "range of reasonable assumptions" which in part states "the actuary should also recognize that different actuaries will apply professional judgment and may choose different reasonable assumptions." As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice.

In our opinion, the economic assumptions recommended in this report have been developed in accordance with ASOP No. 27. The following table shows our recommendations followed by detailed discussions of each assumption.

Item	Current Assumptions	Proposed Assumptions
Price Inflation	2.40%	2.40%
Real Rate of Return*	4.60	4.60
Investment Return	7.00%	7.00%
Price Inflation	2.40%	2.40%
Real Wage Growth	0.25	0.25
Wage Inflation	2.65%	2.65%
Payroll Growth	2.65%	2.65%

* net of investment expenses.

Price Inflation

Background

As can be seen from the table on the previous page, assumed price inflation is used as the basis for both the investment return assumption and the wage inflation assumption. These latter two assumptions will be discussed in detail in the following sections.

It is important that the price inflation assumption be consistently applied throughout the economic assumptions utilized in an actuarial valuation. This is called for in ASOP No. 27 and is also required to meet the parameters for determining pension liabilities and expense under Governmental Accounting Standards Board (GASB) Statements No. 67 and 68. The long-term relationship between price inflation and investment return has long been recognized by economists. The basic principle is that the investor demands a more or less level "real return" – the excess of actual investment return over price inflation. If inflation rates are expected to be high, investment return rates are also expected to be high, while low inflation rates are expected to result in lower expected investment returns, at least in the long run.

The current price inflation assumption is 2.40% per year, which was recommended and adopted in the last experience study.

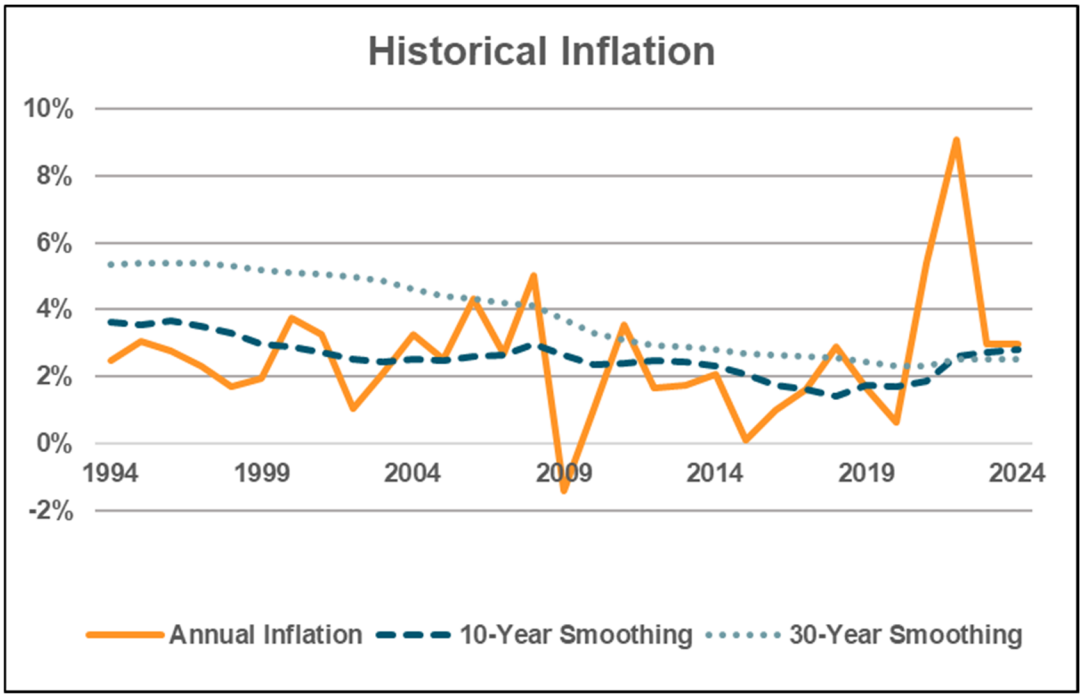
Past Experience

The Consumer Price Index, US City Average, All Urban Consumers, CPI (U), has been used as the basis for reviewing historical levels of price inflation. The table below provides historical annualized rates and annual standard deviation of the CPI-U over periods ending June 30th.

Period	Number of Years	Annualized Rate of Inflation	Annual Standard Deviation
1926 – 2024	98	2.96%	4.02%
1964 – 2024	60	3.94%	2.89%
1974 – 2024	50	3.79%	2.94%
1984 – 2024	40	2.81%	1.75%
1994 – 2024	30	2.54%	1.86%
2004 – 2024	20	2.55%	2.23%
2014 – 2024	10	2.80%	2.66%

The following graph illustrates the historical levels of price inflation measured as of June 30th of each of the last 50 years and compared to the current 2.40% annual rate currently assumed.

Annual Rate of CPI (U) Increases



As can be seen from the table on the previous page, over the last 30 years, the average annual rate of increase in the CPI-U has been just over 2.50%. The higher annual rates over the past few years have increased this average. In the last experience study in 2022, the 30-year average of price inflation was approximately 2.53%.

Forecasts

Additional information to consider in formulating this assumption is obtained from measuring the spread on Treasury Inflation Protected Securities (TIPS) and from the prevailing economic forecasts. The spread between the nominal yield on treasury securities (bonds) and the inflation indexed yield on TIPS of the same maturity is referred to as the "breakeven rate of inflation" and represents the bond market's expectation of inflation over the period to maturity.

The table below provides the calculation of the breakeven rate of inflation as of December 31, 2024.

Years to Maturity	Nominal Bond Yield	TIPS Yield	Breakeven Rate of Inflation
5	4.38%	2.00%	2.38%
10	4.58	2.24	2.34
20	4.86	2.41	2.45
30	4.78	2.48	2.30

As this data indicates, the bond market is anticipating very low inflation of 2.3% to 2.5% for both the short and long term. The bond market expectations may be heavily influenced by the expectations of actions by the Federal Reserve Bank. Whether inflation returns to the higher rates observed historically remains to be seen. We note that measures can move fairly significantly over just a few months.

Based upon information contained in the "Survey of Professional Forecasters" for the fourth quarter of 2024 as published by the Philadelphia Federal Reserve Bank, the median expected annual rate of inflation for the next ten years is 2.23%. Although 10 years of future expectation is too short of a period for the basis of our inflation assumption, the information does provide some evidence that the consensus expectations of these experts are for rates of inflation very close to our current assumption of 2.40% for the near-term future.

PERS' investment consultant, Callan, also has an inflation forecast in their capital market assumptions. Their short-term assumption (10 years) is 2.50%. Horizon Actuarial Services surveys a significant portion of the major investment advisors and publishes their assumptions. For the 2024 study, the long-term inflation assumption was 2.44%.

Social Security Administration

Although many economists forecast lower inflation than the assumption used by most retirement plans, they are generally looking at a shorter time horizon than is appropriate for a pension valuation. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the 2024 annual report, the projected ultimate average annual increase in the CPI over the next 75 years was estimated to be 2.40%, under the intermediate (best estimate) cost assumption. The range of inflation assumptions used in the Social Security 75-year modeling, which includes a low and high-cost scenario, in addition to the intermediate cost projection, was 1.80% to 3.00%. These rates remained unchanged from their 2022 annual report.

Peer Comparison

While we do not recommend the selection of any assumption based on what other systems use, it does provide another set of relevant information to consider. Based on the Public Plan Database (a survey of over 125+ state and local retirement systems maintained by a collaboration between the Center for Retirement Research at Boston College, the Center for State and Local Government Excellence, and the National Association of State Retirement Administrators), the average inflation assumption for governmental plans is 2.46%. This data is largely based on actuarial valuations prepared with measurement dates in 2023. Based on our experience, we believe the inflation assumption has been steady for most systems over the last year.

Recommendation

It is difficult to predict inflation accurately. Inflation's short-term volatility is illustrated by comparing its average rate over the last 10, 30 and 50 year history. Although the 30-year average of 2.54% is closer to the System's assumed rate of 2.40%, the longer 50-year average of 3.79% is much higher and it includes the very high rates of inflation from the late 1970s and early 1980s. Those high rates will not be part of the 50-year average for much longer.

Although we have experienced higher inflation over the last few years following the recovery from the COVID-19 pandemic, current economic forecasts suggest annual inflation rates closer to 2.40% over the short-term and long-term, respectively. We concur with these forecasts and recommend maintaining the inflation assumption for SLRP at 2.40%.

Price Inflation Assumption	
Current	2.40%
Recommended	2.40%

Investment Return

Background

The investment return assumption reflects anticipated returns on the current and future assets. The assumed investment return is one of the most significant assumptions in the annual actuarial valuation process as it is used to discount the expected benefit payments for all active, inactive and retired members. Minor changes in this assumption can have a major impact on valuation results. The investment return assumption should reflect the asset allocation target for the funds set by the Board of Trustees.

The current rate recommended by the actuary is 7.00%, consisting of a price inflation assumption of 2.40% and a real rate of return assumption of 4.60%.

Long Term Perspective

Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon in order to make prudent choices regarding how to invest the trust funds. For actuarial calculations, we typically consider very long periods of time. For example, a newly, hired employee in SLRP who is 25 years old may work for 30 years, to age 55, and live another 30 years, to age 85 (or longer). The retirement system would receive contributions for the first 30 years and then pay out benefits for the next 30 years. During the entire 60-year period, the system is investing assets related to the member. For such a typical career employee, more than one-half of the investment income earned on assets accumulated to pay benefits is received after the employee retires. In addition, in an open, ongoing system like SLRP, the stream of benefit payments is continually increasing as new hires replace current members who leave covered employment due to death, termination of employment, and retirement. This difference in the time horizon used by actuaries and investment consultants is frequently a source of debate and confusion when setting economic assumptions.

Past Experience

One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the timeframe used, especially if the year-to-year results vary widely. In addition, the asset allocation can also impact the investment returns so comparing results over long periods when different asset allocations were in place may not be meaningful.

The assets for SLRP are valued using a widely accepted asset-smoothing methodology that fully recognizes the expected investment income and also recognizes 20% of each year's investment gain or loss (the difference between actual and expected investment income). The recent experience over the last five years is shown in the table below.

Year Ending 6/30	Actuarial Value	Market Value
2020	6.72%	3.11%
2021	12.47	32.17
2022	8.49	(8.64)
2023	6.85	7.43
2024	7.28	10.41
Geometric Average	8.34%	8.11%

While important to review and analyze, historical returns over such a short time period are not credible for the purpose of setting the long-term assumed future rate of return.

Future Expectation Analysis

ASOP 27 provides that the actuary may rely on outside experts in setting economic assumptions. PERS utilizes the services of Callan to assist them in developing investment strategies and providing capital market assumptions for the PERS portfolio. As part of their duties, Callan periodically performs asset-liability studies, along with comprehensive reviews of the expected return of the various asset classes in which the PERS portfolio is invested. We believe it is appropriate to consider the results of Callan's work as one factor in assessing expected future returns.

We also recognize that there can be differences of opinion among investment professionals regarding future return expectations. Horizon Actuarial Services prepares an annual study in which they survey various investment advisors (42 were included in the 2024 study with a 10-year horizon) and provide ranges of results as well as averages. This information provides an additional perspective on what a broad group of investment experts anticipate for future investment returns.

SECTION II – ECONOMIC ASSUMPTIONS

Our forward-looking analysis used the real rates of return in Callan's capital market assumptions for 2025-2034 and PERS' target asset allocation. Using statistical projections that assume investment returns approximately follow a lognormal distribution with no correlation between years, produces an expected range of real rates of return over a 50-year time horizon. Looking at one year's results produces a mean real return of 5.77%, but also has a high standard deviation or measurement of volatility. By expanding the time horizon, the real return does not change, but the volatility declines significantly. The table below provides a summary of results.

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	5.77%	13.26%	-14.49%	-3.47%	5.01%	14.24%	28.96%
5	5.11%	5.88%	-4.21%	1.13%	5.01%	9.04%	15.12%
10	5.03%	4.15%	-1.59%	2.25%	5.01%	7.85%	12.06%
20	4.99%	2.93%	0.30%	3.05%	5.01%	7.01%	9.95%
30	4.97%	2.39%	1.14%	3.41%	5.01%	6.64%	9.02%
40	4.97%	2.07%	1.65%	3.62%	5.01%	6.42%	8.48%
50	4.96%	1.85%	2.00%	3.77%	5.01%	6.27%	8.11%

The percentile results are the percentages of random returns over the time span shown that are expected to be less than the amount indicated. For example, for the 10-year time span, 5% of the resulting real rates of return will be below -1.59% and 95% will be above that. As the time span increases, the results begin to converge. Over a 50-year time span, the results indicate there will be a 25% chance that real returns will be below 3.77% and a 25% chance they will be above 6.27%. In other words, there is a 50% chance the real returns will be between 3.77% and 6.27%.

For a broader view of expected returns, we also reviewed the 2024 Survey of Capital Market Assumptions produced by Horizon Actuarial Services, LLC to see what other investment professionals are currently using for capital market assumptions. The Horizon survey includes both 10-year horizon and 20-year horizon capital market assumptions. We applied the same statistical analysis to these survey results as we did the capital market assumption of PERS investment advisor with the following real return results for the 10-year horizon and 20-year horizon:

Horizon Survey 10-year horizon

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	5.40%	13.25%	-14.83%	-3.83%	4.64%	13.86%	28.57%
5	4.74%	5.87%	-4.565	0.77%	4.64%	8.67%	14.74%
10	4.66%	4.15%	-1.95%	1.89%	4.64%	7.48%	11.69%
20	4.62%	2.93%	-0.06%	2.69%	4.64%	6.64%	9.58%
30	4.61%	2.39%	0.78%	3.04%	4.64%	6.27%	8.65%
40	4.60%	2.07%	1.29%	3.26%	4.64%	6.05%	8.11%
50	4.60%	1.85%	1.64%	3.40%	4.64%	5.90%	7.74%

Horizon Survey 20-year horizon

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	5.76%	13.25%	-14.48%	-3.47%	5.00%	14.22%	28.93%
5	5.10%	5.87%	-4.20%	1.13%	5.00%	9.03%	15.10%
10	5.02%	4.15%	-1.59%	2.25%	5.00%	7.84%	12.05%
20	4.98%	2.93%	0.29%	3.05%	5.00%	7.00%	9.94%
30	4.97%	2.39%	1.14%	3.40%	5.00%	6.63%	9.01%
40	4.96%	2.07%	1.65%	3.62%	5.00%	6.41%	8.47%
50	4.95%	1.85%	2.00%	3.76%	5.00%	6.26%	8.10%

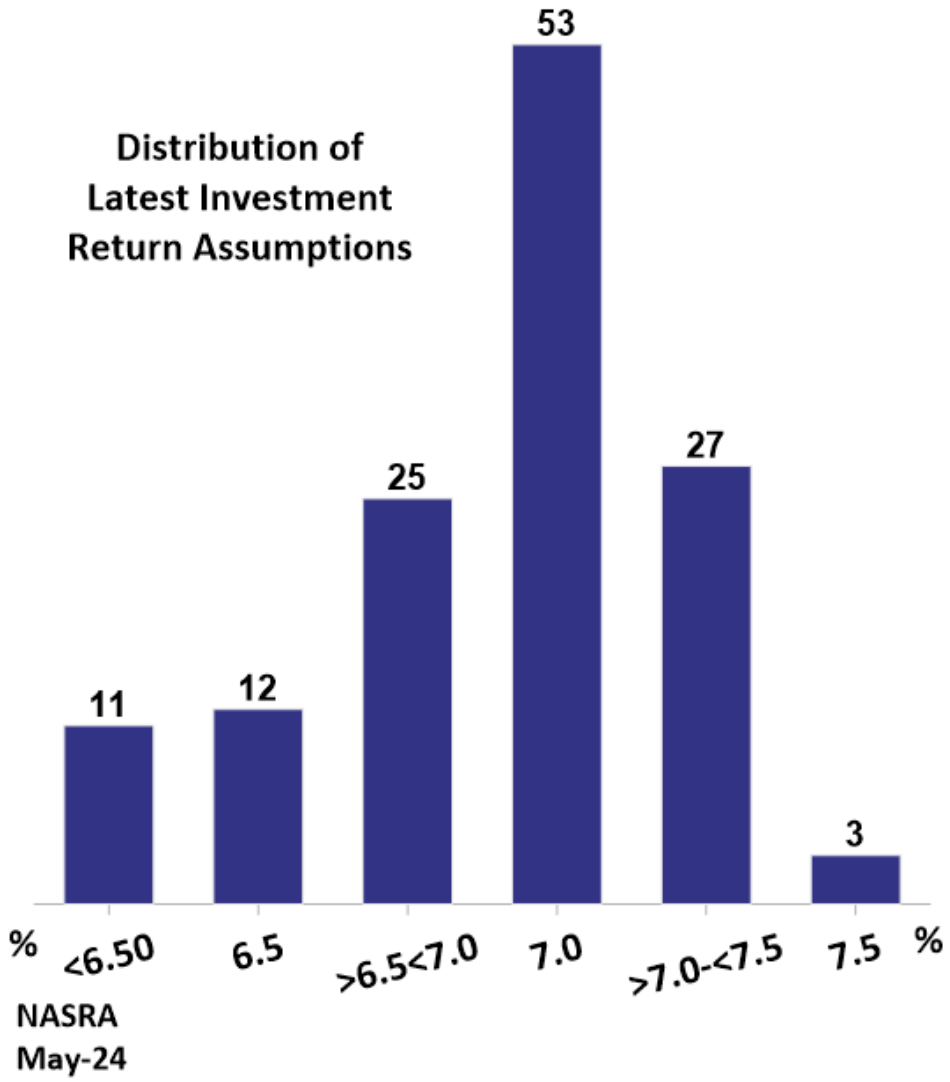
As you can see from the two tables above, setting a real return assumption depends on the time horizon a plan seeks. The 20-year horizon is approximately 0.36% higher at all percentiles than the 10-year horizon. While PERS is a long-term vehicle expected to pay benefits to its retirees for many years in the future, a high percentage of the present value of the benefits is determined within the next ten to fifteen years, so the real return recommendation should fall near the 50th percentile columns in the three tables above.

Using a 2.40% inflation assumption, the current investment return assumption of 7.00% utilizes a 4.60% real rate of return (using the "building block" methodology). Based on the table directly above, 4.60% falls into the 42nd percentile. While it is slightly below thresholds that we recommend for a long-term assumption, it is still a reasonable assumption, as it falls within the 40-60th percentile range.

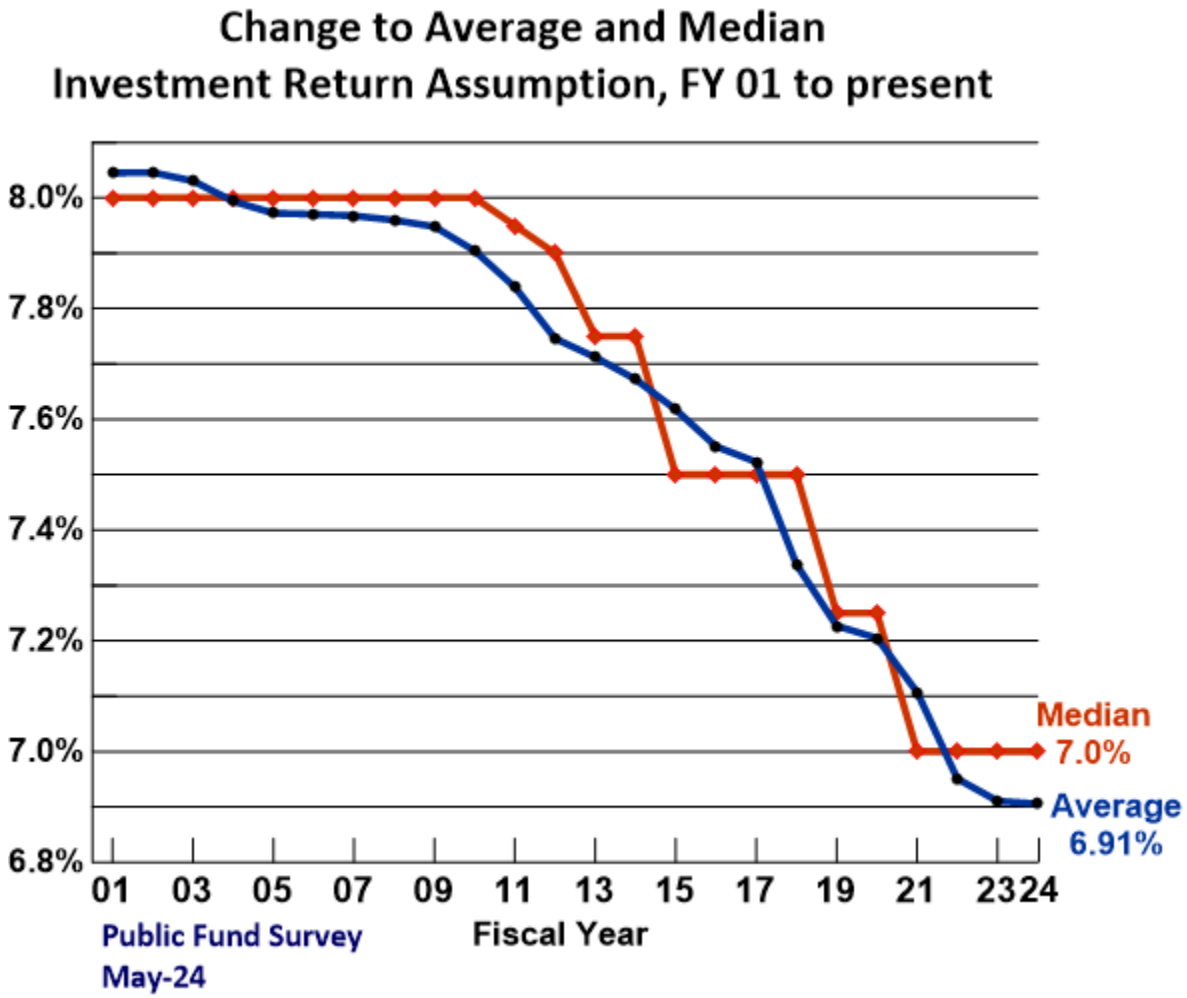
Peer Comparison

Public retirement systems have historically compared their investment performance to their peer group. While we believe there is some merit in assessing the movement in the assumed rate of return for other systems, this is not an appropriate basis for setting this assumption in our opinion. For example, different plans have different plan dynamics, including varying asset allocations, which will impact their choice of the assumed investment return. This peer group information merely provides another set of relevant data to consider as long as we recognize that asset allocation varies from system to system.

The following chart shows the nominal investment return assumptions of 131 plans in the National Association of State Retirement Administrators (NASRA). The assumptions shown below are as of May 2024 and are updated frequently by the NASRA staff.



The following chart shows the changes in expected investment return assumption from the NASRA public plan survey over the last 23 years from 2001.



Recommendation

By actuarial standards, we are required to maintain a long-term perspective in setting all assumptions, including the investment return assumption. Therefore, we believe we must be careful not to let recent experience or short-term expectations impact our judgment regarding the appropriateness of the current assumption over the long term.

Based on our analysis of Callan's capital market assumptions and the Horizon Survey capital market assumptions, we are recommending continuation of a real return assumption of 4.60%. We acknowledge that this real return assumption is just slightly below Horizon Survey's anticipated return over the next 10 years of 4.64%. Based on our recommended inflation assumption of 2.40% and real return assumption of 4.60%, we are recommending continuation of the 7.00% expected long term nominal rate of return assumption.

Investment Return Assumption		
	Current	**Recommended**
Real Rate of Return*	4.60%	4.60%
Inflation	2.40%	2.40%
Net Investment Return	7.00%	7.00%

* net of investment expenses.

Wage Inflation

Background

Wage inflation, thought of as the "across the board" rate of salary increases, is composed of the price inflation assumption combined with an assumption for the real rate of wage increases. In constructing the individual salary increase assumption, the wage inflation assumption is further combined with an assumption for age- or service-based salary increases (called a merit scale). The merit scale assumption is discussed later in this report.

Currently, the wage inflation assumption is 2.65%, which implies an assumed real rate of wage increase or real wage inflation of 0.25% (2.65% less the current inflation assumption of 2.40%). The excess of wage inflation over price inflation represents the increase in the standard of living, also called productivity growth. There has been debate on the issue of whether public sector employees will receive, over the long term, the same rewards for productivity as employees in the private sector, where productivity is more readily measurable. To our knowledge, no definitive research has been completed on this topic. Nevertheless, it is our opinion that public sector employees will eventually be rewarded with the same productivity increases as those participating in the remainder of the economy, even if there is a time lag.

Past Experience

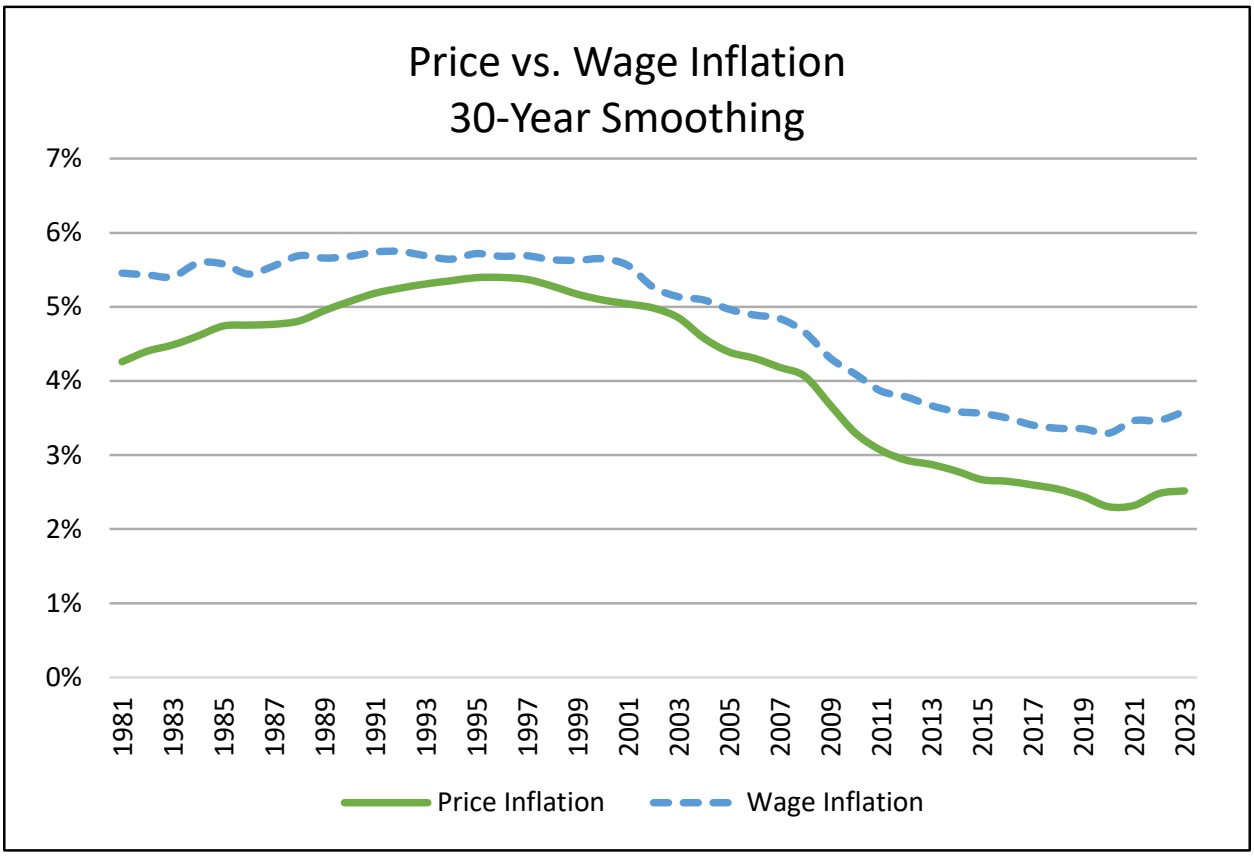
The Social Security Administration publishes data on wage growth in the United States (see Appendix C). While this is the most comprehensive data available, it is based on all wage earners in the country so it can be influenced by the mix of jobs as well as by changes in certain sectors of the workforce that may not be seen by all segments.

As with our analysis of inflation, we provide below wage inflation and a comparison with price inflation over various time periods. Currently, this wage data is only available through calendar year 2023. We remove the rate of price inflation for each year from the data to result in the historical real rate of wage inflation.

Period	Wage Inflation	Price Inflation	Real Wage Growth
2013-2023	4.03%	2.79%	1.24%
2003-2023	3.41%	2.58%	0.83%
1993-2023	3.59%	2.51%	1.08%
1983-2023	3.76%	2.81%	0.95%
1973-2023	4.44%	3.86%	0.58%

Thus, over the last 50 years, annual real wage growth has averaged 0.58%.

Similar information over rolling thirty-year periods is shown in the following graph:



Public Sector Compensation and Wages

The Bureau of Labor Statistics publishes the Employment Cost Index, including detail for real (net of inflation) total compensation and wages and salaries. Further, this index is also broken down for state and local government workers. From 2005 through 2024, real compensation grew by at an annualized rate of 2.85%, while wages and salaries grew at a rate of 2.47%. This difference is a reflection that state and local government workers have had much of their compensation increase delivered through benefits rather than wages and salaries. While it is certainly reasonable to anticipate that total compensation will continue to increase faster than wages and salaries, it is also reasonable to anticipate that the difference between the two will moderate over time.

Recommendation

Based, on all the information discussed, we recommend that the plan maintain a 0.25% real wage growth inflation assumption and a total wage inflation growth of 2.65%.

Wage Inflation Assumption		
	Current	Recommended
Price Inflation	2.40%	2.40%
Real Wage Growth	0.25%	0.25%
Wage Inflation	2.65%	2.65%

Payroll Growth

Background

The assumed future rate of payroll growth increase in the total payroll of SLRP' active members is an assumption used in the level percentage of payroll amortization method that affects the calculation of the amortization period required to fully amortize the unfunded actuarial accrued liability and the actuarially determined employer contribution. The total payroll growth is impacted by individual member's increases and population growth. The current assumption is 2.65% per year which is comprised of the inflation assumption of 2.40% and real wage growth of 0.25%.

Recommendation

As we did for PERS, we are recommending we maintain the payroll growth assumption of 2.65%, which is equal to the recommended wage inflation assumption.

ACTUARIAL COST METHOD

The systematic financing of a pension plan requires that contributions be made in an orderly fashion while a member is actively employed, so that the accumulation of these contributions, together with investment earnings should be sufficient to provide promised benefits and cover administration expenses. The actuarial valuation is the process used to determine when money should be contributed, i.e., as part of the budgeting process.

The actuarial valuation will not impact the amount of benefits paid or the actual cost of those benefits. In the long run, actuaries cannot change the costs of the pension plan, regardless of the funding method used or the assumptions selected. However, actuaries will influence the incidence of costs by their choice of methods and assumptions.

The valuation or determination of the present value of all future benefits to be paid by the funds reflects the assumptions that best describe anticipated future experience. The choice of a funding method does not impact the determination of the present value of future benefits. The funding method determines only the incidence of cost. In other words, the purpose of the funding method is to allocate the present value of future benefits determination into annual costs. In order to do this allocation, it is necessary for the funding method to "break down" the present value of future benefits into two components: (1) that which is attributable to the past, (2) and that which is attributable to the future. The excess of that portion attributable to the past over the plan assets is then amortized over a period of years. Actuarial terminology calls the part attributable to the past the "past service liability" or the "actuarial accrued liability". The portion of the present value of future benefits allocated to the future is commonly known as "the present value of future normal costs", with the specific piece of it allocated to the current year being called "the normal cost". The difference between the plan assets and actuarial accrued liability is called the "unfunded actuarial accrued liability".

Two key points should be noted. First, there is no single "correct" funding method since different funding methods simply change the timing of the funding. Second, the allocation of the present value of future benefits and hence cost to the past for amortization and to the future for annual normal cost payments is not necessarily in a one-to-one relationship with service earned in the past and future service to be earned.

Entry Age Normal

There are various actuarial cost methods, each of which has different characteristics, advantages and disadvantages. However, Governmental Accounting Standard Board Statement Numbers 67 and 68 require that the Entry Age Normal cost method be used for financial reporting. Most retirement systems will not want to use a different actuarial cost method for funding and financial reporting. In addition, the Entry Age Normal method has been the most popular funding method for public systems for many years. This is the cost method currently used by PERS for all plans.

The rationale of the entry age normal (EAN) funding method is that the cost of each member's benefit is determined to be a level percentage of salary from date of hire to the end of employment. This level percentage multiplied by the member's annual salary is referred to as the normal cost and is that portion of the total cost of the employee's benefit which is allocated to the current year. The portion of the present value of future benefits allocated to the future is determined by multiplying this percentage times the present value of the member's assumed earnings for all future years including the current year. The entry age normal actuarial accrued liability is then developed by subtracting from the present value of future benefits that portion of costs allocated to the future. To determine the unfunded actuarial accrued liability, the actuarial value of plan assets is subtracted from the entry age normal actuarial accrued liability. The current year's cost to amortize the unfunded actuarial accrued liability is developed by applying an amortization factor based on the funding policy.

It is to be expected that future events will not occur exactly as predicted by the actuarial assumptions in each year. Actuarial gains/losses from experience under this actuarial cost method can be directly calculated and are reflected as a decrease/increase in the unfunded actuarial accrued liability. Consequently, the gain/loss results in a decrease/increase in the amortization payment, and therefore the contribution rate or amount.

Recommendation

Considering that the Entry Age Normal cost method is the most commonly used cost method by public plans, that it develops a normal cost rate that tends to be stable and is the required cost method under calculations required by Governmental Accounting Standard Numbers 67 and 68, **we recommend the Entry Age Normal actuarial cost method be retained by PERS for all plans.** Note that because of GASB 67 and 68 requirements, the Entry Age Normal method will also be used by the plans for accounting disclosures.

ACTUARIAL VALUE OF ASSETS

In preparing an actuarial valuation, the actuary must assign a value to the assets of the fund. An adjusted market value is often used to smooth out the volatility that is reflected in the market value of assets. This is because most employers would rather have annual costs remain relatively smooth, as a percentage of payroll or in actual dollars, as opposed to a cost pattern that is extremely volatile.

The actuary does not have complete freedom in assigning this value. The Actuarial Standards Board also has basic principles regarding the calculation of a smoothed asset value, Actuarial Standard of Practice No. 44 (ASOP 44), *Selection and Use of Asset Valuation Methods for Pension Valuations.*

ASOP 44 provides that the asset valuation method should bear a reasonable relationship to the market value. Furthermore, the asset valuation method should be likely to satisfy both of the following:

- Produce values within a reasonable range around market value, AND
- Recognize differences from market value in a reasonable amount of time.

In lieu of both of the above, the standard will be met if either of the following requirements is satisfied:

- There is a sufficiently narrow range around the market value, OR
- The method recognizes differences from market value in a sufficiently short period.

These rules or principles prevent the asset valuation methodology from being used to manipulate annual funding patterns. No matter what asset valuation method is used, it is important to note that, like a cost method or actuarial assumptions, the asset valuation method does not affect the true cost of the plan; it only impacts the incidence of cost.

Recommendation

Currently, the actuarial value of assets recognizes a portion of the difference between the market value of assets and the expected market value of assets, based on the assumed valuation rate of return. The amount recognized each year is 20% of the difference between market value and expected market value. **We recommend no change in this methodology.**

AMORTIZATION OF THE UNFUNDED ACTUARIAL ACCRUED LIABILITY

The actuarial accrued liability is the portion of the actuarial present value of future benefits that are not included in future normal costs. Thus, it represents the liability that, in theory, should have been funded through normal costs for past service. Unfunded actuarial accrued liability (UAAL) exists when the actuarial accrued liability exceeds the actuarial value of plan assets. These deficiencies can result from:

(i) plan improvements that have not been completely paid for,
(ii) experience that is less favorable than expected,
(iii) assumption changes that increase liabilities, or
(iv) contributions that are less than the actuarial contribution rate.

There are a variety of different methods that can be used to amortize the UAAL. Each method results in a different payment stream and, therefore, has cost implications. For each methodology, there are three characteristics:

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

Amortization Period: The amortization period can be either closed or open. If it is a closed amortization period, the number of years remaining in the amortization period declines by one in each future valuation. Alternatively, if the amortization period is an open or rolling period, the amortization period does not decline but is reset to the same number each year. This approach essentially "refinances" the System's debt (UAAL) every year.

Amortization Payment: The level dollar amortization method is similar to the method in which a homeowner pays off a mortgage. The liability, once calculated, is financed by a constant fixed dollar amount, based on the amortization period until the liability is extinguished. This results in the liability steadily decreasing while the payments, though remaining level in dollar terms, in all probability decrease as a percentage of payroll. (Even if a plan sponsor's population is not growing, inflationary salary increases will usually be sufficient to increase the aggregate covered payroll).

The rationale behind the level percentage of payroll amortization method is that since normal costs are calculated to be a constant percentage of pay, the unfunded actuarial accrued liability should be paid off in the same manner. When this method of amortizing the unfunded actuarial accrued liability is adopted, the initial amortization payments are lower than they would be under a level dollar amortization payment method, but the payments increase at a fixed rate each year so that ultimately the annual payment far exceeds the level dollar payment. The expectation is that total payroll will increase at the same rate so that the amortization payments will remain constant, as a percentage of payroll. In the initial years, the level percentage of payroll amortization payment is often less than the interest accruing on the unfunded actuarial accrued liability meaning that even if there are no experience losses, the dollar amount of the unfunded actuarial accrued liability will grow (called negative amortization). This is particularly true if the plan sponsor is paying off the unfunded actuarial accrued liability over a long period, such as 20 or more years.

Amortization Bases: The UAAL can be amortized either as one single amount or as components or "layers", each with a separate amortization base, payment and period. If the UAAL is amortized as one amount, the UAAL is recalculated each year in the valuation and experience gains/losses or other changes in the UAAL are folded into the single UAAL amortization base. The amortization payment is then the total UAAL divided by an amortization factor for the applicable amortization period.

If separate amortization bases are maintained, the UAAL is composed of multiple amortization bases, each with its own payment schedule and remaining amortization period. In each valuation, the unexpected change in the UAAL is established as a new amortization base over the appropriate amortization period beginning on that valuation date. The UAAL is then the sum of all of the outstanding amortization bases on the valuation date and the UAAL payment is the sum of all of the amortization payments on the existing amortization bases. This approach provides transparency in that the current UAAL is paid off over a fixed period of time and the remaining components of the UAAL are clearly identified. Adjustments to the UAAL in future years are also separately identified in each future year. One downside of this approach is that it can create some discontinuities in contribution rates when UAAL layers/components are fully paid off. If this occurs, it likely would be far in the future, with adequate time to address any adjustments needed.

Recommendation

In the current SLRP Board funding policy, an actuarially determined employer contribution (ADEC) is calculated during each annual valuation and the ADEC is compared to the Fixed Contribution Rate adopted by the Board as one of its Signal Light metrics. The methodology in calculating the ADEC is as follows:

- Amortization Period – Closed period with period of 25 years for new bases
- Amortization Payment – Level Percentage of Payroll
- Amortization Bases – Separate bases for all experience gains and losses, assumption changes or benefit changes

We recommend no changes in these methods.

SECTION IV – DEMOGRAPHIC ASSUMPTIONS

Actuarial Standard of Practice (ASOP) No. 27 provides guidance to actuaries regarding the selection of demographic and other non-economic assumptions for measuring pension obligations. ASOP 27 states that the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the defined benefit plan that is the subject of the measurement. A reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

Each individual demographic assumption should satisfy the criteria of ASOP 27. In selecting demographic assumptions, the actuary should also consider: the internal consistency between the assumptions, materiality, cost effectiveness, and the combined effect of all assumptions. At each measurement date, the actuary should consider whether the selected assumptions continue to be reasonable, but the actuary is not required to do a complete assumption study at each measurement date. In addition, the actuary should include a specific assumption with respect to expected mortality improvements after the measurement date. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP 27.

Overview of Analysis

The purpose of a study of demographic experience is to compare what actually happened to the individual members of the System during the study period (July 1, 2020 through June 30, 2024) with what was expected to happen based on the actuarial assumptions.

Studies of demographic experience generally involve three steps:

- First, the number of members changing membership status, called decrements, during the study is tabulated by age, duration, gender, group, and membership class (active, retired, etc.).
- Next, the number of members expected to change status is calculated by multiplying certain membership statistics, called exposure, by the expected rates of decrement.
- Finally, the number of actual decrements is compared with the number of expected decrements. The comparison is called the Actual-to-Expected ratio (A/E Ratio) and is expressed as a percentage.

In general, if the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements, or rates of decrement, by age, sex, or duration deviates significantly from the expected pattern, new assumptions are considered. Recommended revisions are normally not an exact representation of the experience during the observation period. Judgment is required to anticipate future experience from past trends and current evidence, including a determination of the amount of weight to assign to the most recent experience.

SECTION IV – DEMOGRAPHIC ASSUMPTIONS

Revised rates of decrement are tested by using them to recalculate the expected number of decrements during the study period, and the results are shown as revised Actual-to-Expected Ratios.

It takes a fair amount of data to perform a credible study of demographic assumptions. Because the membership or certain subsets of the membership are relatively small, some assumptions have been selected based more on our professional judgment of reasonable future outcomes than actual experience.

Because much of the past four years of experience overlapped the worldwide Covid pandemic, we recognize that the actual demographic experience captured in this study may be influenced by the presence of the disease, by decisions the various employers made to manage their workforces through this period, and by choices employees may have made in response to actual or perceived changes in the world around them. Further, it is possible that some of these changes will reflect a new reality and show up in future years, while other changes will likely revert back quickly to the previous norms. Consequently, we believe caution is warranted in this study before making significant changes based on the recent data only.

RATES OF WITHDRAWAL

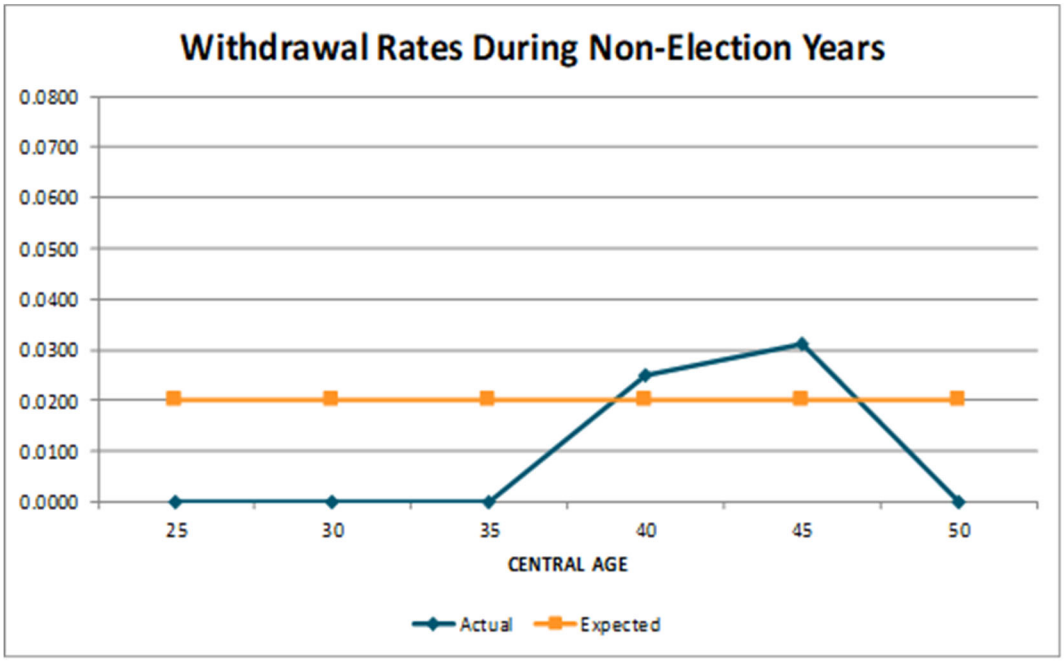
COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE

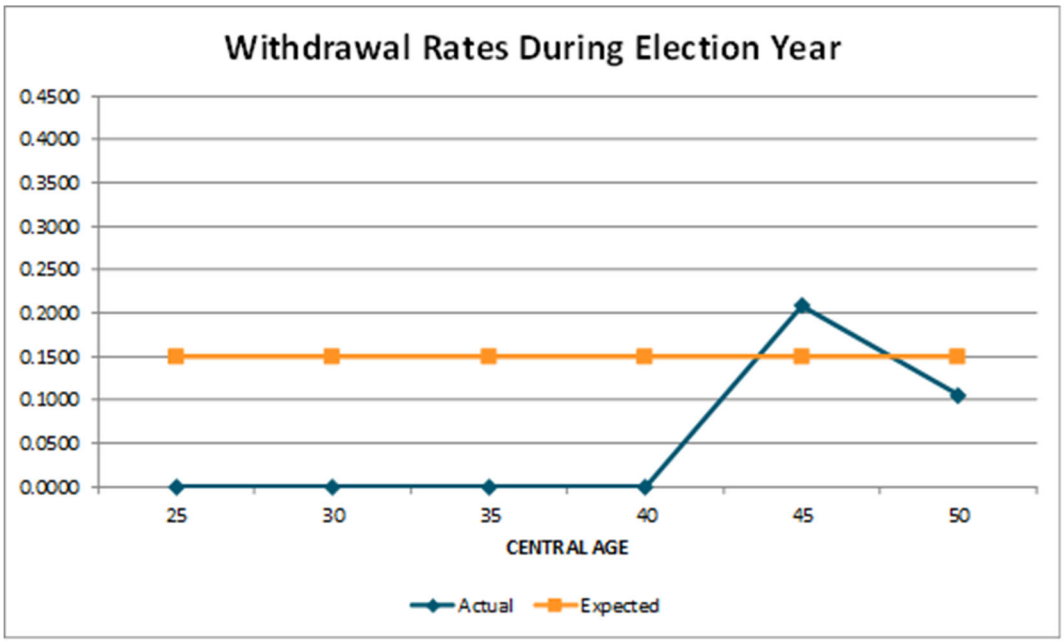
CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS DURING NON-ELECTION YEARS		
	Actual	Expected	Ratio of Actual to Expected
20	0	0	0.000
25	0	0	0.000
30	0	0	0.000
35	0	0	0.000
40	1	1	1.000
45	2	1	2.000
50	0	1	0.000
53 & over	3	3	0.000
TOTAL	**6**	**6**	**1.000**

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS DURING ELECTION YEAR		
	Actual	Expected	Ratio of Actual to Expected
20	0	0	0.000
25	0	0	0.000
30	0	0	0.000
35	0	1	0.000
40	0	1	0.000
45	5	4	1.250
50	2	3	0.667
53 & over	3	6	0.500
TOTAL	**10**	**15**	**0.667**

The following graphs show a comparison of the present, actual and proposed rates of withdrawal.

RATES OF WITHDRAWAL FOR ACTIVE MEMBERS





The rates of withdrawal adopted by the Board are used to determine the expected number of separations from active service which will occur as a result of resignation or dismissal. The results of our four-year study indicate that, in aggregate, the actual number of withdrawals was just slightly less than expected during election years.

As seen on the table on page 31, there were 16 actual withdrawals versus 21 expected withdrawals over the four-year period of this investigation. This period included one election year and three non-election year. In the prior investigation period, we noted that the actual withdrawals were very close to expected. During the current investigation period, there was a slightly larger difference between actual and expected. The entirety of this difference was due to the election year. **Therefore, we recommend a reduction in the rates of withdrawal for legislative years that will hopefully better match experience in the future. We recommend no change in rates of withdrawal for non-election years.**

The following tables show a comparison between the current withdrawal rates and a sample of the proposed withdrawal rates.

COMPARATIVE RATES OF WITHDRAWAL DURING ELECTION YEAR

AGE	Current	Proposed
20	0.1500	0.1250
25	0.1500	0.1250
30	0.1500	0.1250
35	0.1500	0.1250
40	0.1500	0.1250
45	0.1500	0.1250
50	0.1500	0.1250
53 & over	0.1500	0.1250

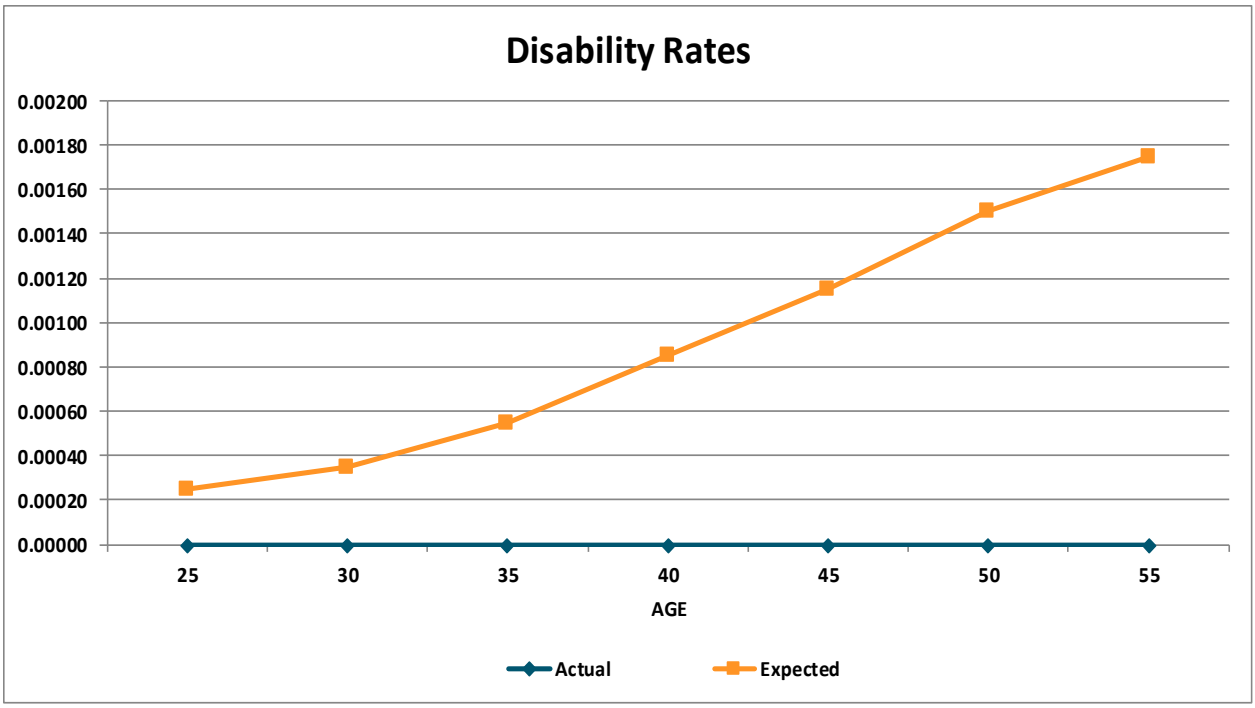
COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE BASED ON PROPOSED RATES

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS DURING NON-ELECTION YEARS		
	Actual	Expected	Ratio of Actual to Expected
20	0	0	0
25	0	0	0
30	0	0	0
35	0	0	0
40	1	1	1
45	2	1	2
50	0	1	0
53 & over	3	3	0
TOTAL	**6**	**6**	**1.000**

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS DURING ELECTION YEAR		
	Actual	Expected	Ratio of Actual to Expected
20	0	0	0.000
25	0	0	0.000
30	0	0	0.000
35	0	1	0.000
40	0	1	0.000
45	5	3	1.667
50	2	2	1.000
53 & over	3	5	0.600
TOTAL	**10**	**12**	**0.833**

RATES OF DISABILITY RETIREMENT

There were no disability retirements over the four-year period of this investigation or the prior study period. In fact, this Plan has not had a disability retirement in the past 14 years. Since the rates of disability retirement were lowered in the last experience study, **we recommend no change in the rates of disability at this time.**



RATES OF RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS

CENTRAL AGE OF GROUP	NUMBER OF RETIREMENTS DURING NON-ELECTION YEARS		
	Actual	Expected	Ratio of Actual to Expected
50	1	0	0.000
55	0	0	0.000
60	0	1	0.000
65	3	2	1.500
70	0	1	0.000
75	1	1	1.000
Subtotal	**5**	**5**	**1.000**
80 and Over	0	13	0.000
GRAND TOTAL	**5**	**18**	**0.278**

CENTRAL AGE OF GROUP	NUMBER OF RETIREMENTS DURING ELECTION YEAR		
	Actual	Expected	Ratio of Actual to Expected
50	1	1	1.000
55	0	2	0.000
60	6	5	1.200
65	3	5	0.600
70	3	4	0.750
75	1	4	0.250
Subtotal	**14**	**21**	**0.667**
80 and Over	3	7	0.429
GRAND TOTAL	**17**	**28**	**0.607**

As you can see from the table on the previous page, during non-election years, there were 5 actual retirements versus 18 expected retirements over the four-year period of this investigation. However, this aggregate result is deceiving as the actual number of retirements before the age of 80 was exactly as expected.

During the election year, there were 17 actual retirements, which was less than expected (28 retirements). This result was close for all ages but we believe we should lower the rates of retirements during election years since this is the 2nd election year with similar experience.

Therefore, we only recommend a decrease in the election year retirement rates from 30% to 25% for ages before age 80 to better match experience.

COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS BASED ON PROPOSED RATES

CENTRAL AGE OF GROUP	NUMBER OF RETIREMENTS DURING NON-ELECTION YEARS		
	Actual	Expected	Ratio of Actual to Expected
50	1	0	0.000
55	0	0	0.000
60	0	1	0.000
65	3	2	1.500
70	0	1	0.000
75	1	1	1.000
Subtotal	**5**	**5**	**1.000**
80 and Over	0	13	0.000
GRAND TOTAL	**5**	**18**	**0.278**

CENTRAL AGE OF GROUP	NUMBER OF RETIREMENTS DURING ELECTION YEAR		
	Actual	Expected	Ratio of Actual to Expected
50	1	1	1.000
55	0	1	0.000
60	6	4	1.500
65	3	4	0.750
70	3	3	1.000
75	1	4	0.250
Subtotal	**14**	**17**	**0.824**
80 and Over	3	7	0.429
TOTAL	**17**	**24**	**0.708**

RATES OF POST-RETIREMENT MORTALITY

One of the most important demographic assumptions in the valuation is mortality because it projects how long benefit payments will be made. The longer members live, the greater the true cost of future benefit obligations will be.

For many years, rates of mortality have been declining, meaning people, in general, are living longer. Consequently, we anticipate that mortality tables will need to be updated periodically. Because of potential differences in mortality, we break down our study by gender (males and females) and by status (healthy retirees, beneficiaries, disabled retirees, and active members).

Because of the substantial amount of data required to construct a mortality table, actuaries usually rely on standard tables published by the Society of Actuaries. Actuaries then use various adjustments such as age or scaling adjustments to the standard, published mortality tables in order to better match the observed mortality rates of a specific group.

The first of these adjustments is an age adjustment that can be either a “setback” or a “set forward”. A one-year age setback treats all members as if they were one year younger than they truly are when applying the rates in the mortality table. For example, a one year setback would treat a 61-year old retiree as if he will exhibit the mortality of a 60-year old in the standard mortality table.

The second adjustment that can be used to adjust the mortality rates in a standard table to better fit actual experience is to “scale” a mortality table by multiplying the probabilities of death by factors less than one (to reflect better mortality) or factors greater than one (to reflect poorer mortality). Scaling factors can be applied to an entire table or a portion of the table. Of course, if needed, actuaries may use both of these methods to develop an appropriate table to model the mortality of the specific plan population.

In 2019, the Society of Actuaries released a family of mortality tables named the Pub-2010 tables. While prior pension mortality tables have been based solely on private corporate and union retirement plans, these new tables are based entirely on public sector plan data. These tables are split by three membership types: Safety, Teachers, and General to reflect the observed differences in mortality patterns related to the three groups. Tables are further split for healthy retirees, disabled retirees, contingent beneficiaries, and employees. There are still other breakdowns in these tables for at, above or below median annuity values.

The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying and monitoring. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 27, *Selection of Assumptions for Measuring Pension Obligations*. This ASOP requires the pension actuary to make and disclose a specific recommendation with respect to future improvements in mortality after the valuation date, although it does not require that an actuary assume there will be future improvements. There have been significant improvements in longevity in the past, although there are different opinions about future expectations, and thus there is a subjective component in the estimation of future mortality improvement. We believe it is prudent to anticipate that the trend will continue to some degree in the future and that it is appropriate to reflect some future mortality improvement as part of the mortality assumption.

PERS currently uses generational mortality approach that directly anticipates future improvements in mortality by using a different set of mortality rates for each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain "built-in" mortality improvements, e.g., a member who turns age 65 in 2035 has a longer life expectancy than a member who turns age 65 in 2020. When using generational mortality, the A/E ratios for the observed experience are set near 100% as future mortality improvements will be taken into account directly in the actuarial valuation process.

The generational approach is our preferred method for recognizing future mortality improvements in the valuation process because it is more direct and results in longer life expectancy for members who are younger, consistent with what we believe is more likely to occur. Over the last ten to fifteen years, this method has become quite common as computing power has increased.

COMPARISON OF ACTUAL AND EXPECTED CASES OF POST-RETIREMENT DEATHS

CENTRAL AGE OF GROUP	NUMBER OF POST-RETIREMENT DEATHS		
	MALES AND FEMALES		
	Actual	Expected	Ratio of Actual to Expected
SERVICE RETIREMENTS			
57 & Under	0	0	0.000
60	0	0	0.000
65	1	2	0.625
70	1	3	0.294
75	6	6	1.091
80	5	6	0.821
85	9	7	1.343
90	4	4	0.895
93 & Over	2	3	0.712
Total	**28**	**31**	**0.904**
SURVIVORS			
57 & Under	0	0	0.000
60	0	0	0.000
65	0	0	0.000
70	0	0	0.000
75	1	1	1.000
80	1	2	0.500
85	1	2	0.500
90	7	3	2.333
93 & Over	0	0	0.000
Total	**10**	**8**	**1.250**

As can be seen from the table on the previous page, the number of actual post-retirement deaths was fairly close to the expected number during the last four-year period. However, the SLRP does not have enough mortality data by itself to warrant credible data.

Therefore, we recommend that the rates of mortality for post-retirements match the PERS mortality tables which we recommended a change to the amount-weighted mortality tables for all three post-retirement mortality tables (from the headcount-weighted), adjustments or refinements for service retirees and beneficiaries from the current table, and an update to the most recent MP-2021 projection scale from the MP-2020 scale.

Service Retirees (Proposed Table)

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Retiree	None	Male: 107% for all ages Female: 97% up to age 82, 100% for ages 83 to 87, and 110% for ages above 87	MP-2021

Contingent Annuitants (Proposed Table)

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Contingent Annuitant	Male: Set forward 2 years Female: Set forward 3 years	None	MP-2021

Disabled Retirees (Proposed Table)

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubG.H-2010 Disabled	Male: Set forward 1 year Female: Set forward 2 years	Male: 134% for all ages Female: 125% for all ages	MP-2021

RATES OF PRE-RETIREMENT MORTALITY

The active member mortality assumption models eligibility for death benefits prior to retirement. Therefore, it has a much smaller impact on the valuation results than the post-retirement mortality assumption.

It is difficult to isolate the mortality for active members as it may be impacted by active members first terminating or moving to disabled status before death. The data collection methods used in this study do not fully capture known deaths, and so sometimes this can be misleading. Finally, the probability of active death is very small so volatility is not uncommon.

For the four-year period ending June 30, 2024, there were 2 active deaths. Obviously, the lack of data makes this set not credible so we prefer to set this assumption by utilizing the more reliable analysis performed on the PERS data.

To be consistent with PERS and similar to the post-retirement mortality recommendations, **we recommend a change to the amount-weighted mortality tables for the pre-retirement mortality table (from the headcount-weighted), an adjustment in the current pre-retirement mortality table at this time to a set forward of 1 year on rates and the change to the most updated projection scale table, MP-2021.**

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Employee	Male: Set forward 2 years Female: Set forward 1 year	Male: 75% up to age 47, 100% for ages 48 to 57, and 120% for ages above 58 Female: 75% up to age 47, 100% for ages 48 to 52, and 110% for ages above 53	MP-2021

RATES OF SALARY INCREASE

COMPARISON OF ACTUAL AND EXPECTED SALARIES OF ACTIVE MEMBERS

Age of Group	SALARIES AT END OF YEAR		
	MALES AND FEMALES		
	Actual	Expected	Ratio of Actual to Expected
20	$0	$0	0.000
25	182,264	174,179	1.046
30	986,385	951,838	1.036
35	837,439	816,094	1.026
40	2,519,913	2,431,791	1.036
45	4,104,496	3,957,063	1.037
50	4,727,170	4,487,075	1.054
55	5,262,925	5,070,777	1.038
60	4,543,179	4,395,465	1.034
65	3,151,537	3,044,284	1.035
68 & Over	5,270,927	5,105,520	1.032
TOTAL	**$31,586,235**	**$30,434,086**	**1.038**

Actual rates of salary increase, in aggregate, were higher than expected over the four-year period by approximately 3.8%. In the prior investigation, they were more than we expected by approximately 2.3% in aggregate. In this Plan, salaries are determined by the number of days spent in legislative session and in 2021 (1st year of this study period), the number of hours was much higher than in other years and provided the members with significantly higher salary increases during that year. **We do not foresee an increase like that in the future, therefore, we recommend no change in the merit salary scale at this time.**

OTHER ASSUMPTIONS

PERCENT MARRIED: Currently, 100% of active members are assumed to be married and elect a joint & survivor payment form. We are not provided with marital status on the census data. **However, we believe the current assumption is fairly conservative and recommend no change at this time.**

SPOUSE AGE DIFFERENCE: Currently, for married members, it is assumed a male is three years older than his spouse. **We have reviewed this assumption and recommend no change at this time.**

OPTION FACTORS: The option factors, currently in use by all of the Retirement Systems, are based on the mortality table and investment rate of return (discount rate) used in the valuation. **We will review our recommend change in the mortality projection scale and determine if a change in the factors is needed at this time.**

APPENDIX A – HISTORICAL JUNE CPI (U) INDEX

Year	CPI (U)	Year	CPI (U)
1963	30.6	1994	148.0
1964	31.0	1995	152.5
1965	31.6	1996	156.7
1966	32.4	1997	160.3
1967	33.3	1998	163.0
1968	35.7	1999	166.2
1969	34.7	2000	172.4
1970	38.8	2001	178.0
1971	40.6	2002	179.9
1972	41.7	2003	183.7
1973	44.2	2004	189.7
1974	49.0	2005	194.5
1975	53.6	2006	202.9
1976	56.8	2007	208.352
1977	60.7	2008	218.815
1978	65.2	2009	215.693
1979	72.3	2010	217.965
1980	82.7	2011	225.722
1981	90.6	2012	229.478
1982	97.0	2013	233.504
1983	99.5	2014	238.343
1984	103.7	2015	238.638
1985	107.6	2016	241.018
1986	109.5	2017	244.955
1987	113.5	2018	251.989
1988	118.0	2019	256.143
1989	124.1	2020	257.797
1990	129.9	2021	271.696
1991	136.0	2022	296.311
1992	140.2	2023	305.109
1993	144.4	2024	314.069

Callan's Capital Market Assumptions and
PERS' Board of Trustees Target Asset Allocation

Geometric Real Rates of Return and Standard Deviations by Asset Class

Asset Class	Expected Real Rate of Return	Standard Deviation
Domestic Equity	4.75%	17.00%
International Equity	4.75	20.15
Global Equity	4.95	21.25
Fixed Income	2.25	4.40
Real Estate	3.75	14.00
Private Equity	6.00	27.60
Cash Equivalents	0.50	0.90

Asset Allocation Targets

Asset Class	Asset Allocation
Domestic Equity	27.00%
International Equity	20.00
Global Equity	12.00
Fixed Income	20.00
Real Estate	10.00
Private Equity	10.00
Cash Equivalents	1.00

APPENDIX C – SOCIAL SECURITY ADMINISTRATION WAGE INDEX

Year	Wage Index	Annual Increase	Year	Wage Index	Annual Increase
1962	$4,291.40	5.01%	1993	$23,132.67	0.86%
1963	4,396.64	2.45	1994	23,753.53	2.68
1964	4,576.32	4.09	1995	24,705.66	4.01
1965	4,658.72	1.80	1996	25,913.90	4.89
1966	4,938.36	6.00	1997	27,426.00	5.84
1967	5,213.44	5.57	1998	28,861.44	5.23
1968	5,571.76	6.87	1999	30,469.84	5.57
1969	5,893.76	5.78	2000	32,154.82	5.53
1970	6,186.24	4.96	2001	32,921.92	2.39
1971	6,497.08	5.02	2002	33,252.09	1.00
1972	7,133.80	9.80	2003	34,064.95	2.44
1973	7,580.16	6.26	2004	35,648.55	4.65
1974	8,030.76	5.94	2005	36,952.94	3.66
1975	8,630.92	7.47	2006	38,651.41	4.60
1976	9,226.48	6.90	2007	40,405.48	4.54
1977	9,779.44	5.99	2008	41,334.97	2.30
1978	10,556.03	7.94	2009	40,711.61	-1.51
1979	11,479.46	8.75	2010	41,673.83	2.36
1980	12,513.46	9.01	2011	42,979.61	3.13
1981	13,773.10	10.07	2012	44,321.67	3.12
1982	14,531.34	5.51	2013	44,888.16	1.28
1983	15,239.24	4.87	2014	46,481.52	3.55
1984	16,135.07	5.88	2015	48,098.63	3.48
1985	16,822.51	4.26	2016	48,642.15	1.13
1986	17,321.82	2.97	2017	50,321.89	3.45
1987	18,426.51	6.38	2018	52,145.80	3.62
1988	19,334.04	4.93	2019	54,099.99	3.75
1989	20,099.55	3.96	2020	55,628.60	2.83
1990	21,027.98	4.62	2021	60,575.07	8.89
1991	21,811.60	3.73	2022	63,795.13	5.31
1992	22,935.42	5.15	2023	66,621.80	4.43

TABLE 1
RATES OF SEPARATION* FROM ACTIVE SERVICE

AGE	ADJUSTED BASE RATES OF DEATH		RATES OF DISABILITY
	MALES	FEMALES	
20	0.000360	0.000150	0.000169
21	0.000368	0.000158	0.000169
22	0.000368	0.000173	0.000169
23	0.000375	0.000188	0.000191
24	0.000383	0.000195	0.000191
25	0.000390	0.000210	0.000191
26	0.000398	0.000225	0.000191
27	0.000405	0.000240	0.000225
28	0.000413	0.000255	0.000225
29	0.000420	0.000270	0.000236
30	0.000428	0.000285	0.000259
31	0.000443	0.000308	0.000270
32	0.000450	0.000323	0.000304
33	0.000465	0.000345	0.000338
34	0.000480	0.000368	0.000349
35	0.000503	0.000390	0.000383
36	0.000525	0.000413	0.000394
37	0.000555	0.000443	0.000428
38	0.000585	0.000465	0.000450
39	0.000623	0.000495	0.000473
40	0.000660	0.000533	0.000506
41	0.000713	0.000563	0.000529
42	0.000758	0.000600	0.000574
43	0.000818	0.000638	0.000596
44	0.000878	0.000675	0.000641
45	0.000945	0.000720	0.000675
46	0.001020	0.000765	0.000743
47	0.001103	0.000818	0.000810
48	0.001590	0.001150	0.000866
49	0.001720	0.001230	0.000956
50	0.001850	0.001310	0.001035
51	0.002000	0.001390	0.001136
52	0.002160	0.001480	0.001260
53	0.002330	0.001727	0.001406
54	0.002520	0.001837	0.001541
55	0.002730	0.001947	0.001744
56	0.002960	0.002079	0.002003
57	0.003230	0.002211	0.002250
58	0.004212	0.002343	0.002543
59	0.004596	0.002497	0.002914
60	0.005016	0.002651	0.002914
61	0.005484	0.002827	0.000000

* Withdrawal and Vesting: 12.5% in an election year, 2% in a non-election year.
* Service Retirement: 25% in an election year, 3.5% in a non-election year. All members assumed to retire no later than age 80.

TABLE 2
RATES OF ANTICIPATED SALARY INCREASES*
(For Both Males and Females)

SERVICE	RATE
0	0.0500
1	0.0500
2	0.0500
3	0.0500
4	0.0500
5	0.0475
6	0.0475
7	0.0475
8	0.0425
9	0.0425
10	0.0425
11	0.0425
12	0.0425
13	0.0425
14	0.0400
15	0.0400
16	0.0400
17	0.0400
18	0.0400
19	0.0400
20	0.0400
21	0.0375
22	0.0375
23	0.0375
24	0.0375
25	0.0350

* Includes wage inflation of 2.65%

TABLE 3
BASE RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF SERVICE*

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000449	0.000155	71	0.023315	0.015384
20	0.000482	0.000175	72	0.026022	0.017169
21	0.000503	0.000194	73	0.029051	0.019148
22	0.000514	0.000204	74	0.032432	0.021359
23	0.000524	0.000223	75	0.036198	0.023823
24	0.000524	0.000243	76	0.040414	0.026578
25	0.000535	0.000252	77	0.045111	0.029643
26	0.000546	0.000272	78	0.050365	0.033067
27	0.000556	0.000291	79	0.056229	0.036879
28	0.000567	0.000310	80	0.062777	0.041138
29	0.000578	0.000330	81	0.070064	0.045891
30	0.000589	0.000349	82	0.078153	0.051187
31	0.000599	0.000369	83	0.087087	0.058860
32	0.000610	0.000398	84	0.096931	0.065660
33	0.000631	0.000417	85	0.107728	0.073240
34	0.000642	0.000446	86	0.119562	0.081690
35	0.000663	0.000475	87	0.132509	0.091120
36	0.000685	0.000504	88	0.146654	0.111804
37	0.000717	0.000534	89	0.162105	0.124718
38	0.000749	0.000572	90	0.178947	0.139117
39	0.000792	0.000601	91	0.195949	0.154077
40	0.000835	0.000640	92	0.212470	0.169103
41	0.000888	0.000689	93	0.228295	0.184085
42	0.000942	0.000728	94	0.243607	0.199133
43	0.001017	0.000776	95	0.258780	0.214566
44	0.001081	0.000825	96	0.274348	0.230791
45	0.002547	0.000902	97	0.290847	0.248193
46	0.002739	0.000999	98	0.308684	0.267113
47	0.002953	0.001116	99	0.328083	0.287672
48	0.003178	0.001251	100	0.348916	0.309760
49	0.003413	0.001387	101	0.370605	0.332915
50	0.003670	0.001552	102	0.392048	0.356202
51	0.003948	0.001727	103	0.413063	0.379434
52	0.004248	0.001930	104	0.433478	0.402391
53	0.004569	0.002153	105	0.453166	0.424875
54	0.004922	0.002406	106	0.472009	0.446699
55	0.005307	0.002677	107	0.489910	0.467709
56	0.005725	0.002988	108	0.506795	0.487751
57	0.006195	0.003337	109	0.522620	0.506737
58	0.006709	0.003715	110	0.535000	0.524590
59	0.007287	0.004152	111	0.535000	0.541255
60	0.007918	0.004627	112	0.535000	0.550000
61	0.008624	0.005160	113	0.535000	0.550000
62	0.009395	0.005752	114	0.535000	0.550000
63	0.010240	0.006421	115	0.535000	0.550000
64	0.011171	0.007159	116	0.535000	0.550000
65	0.012187	0.007993	117	0.535000	0.550000
66	0.013546	0.008914	118	0.535000	0.550000
67	0.015076	0.009943	119	0.535000	0.550000
68	0.016799	0.011087	120	1.000000	1.000000
69	0.018725	0.012368			
70	0.020886	0.013793			

* Adjusted Base Rates

TABLE 4
BASE RATES OF MORTALITY FOR BENEFICIARIES OF DECEASED MEMBERS*

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000480	0.000200	71	0.035160	0.022750
20	0.000490	0.000210	72	0.038360	0.024760
21	0.000490	0.000230	73	0.041830	0.026990
22	0.000500	0.000250	74	0.045590	0.029460
23	0.000510	0.000260	75	0.049710	0.032200
24	0.000520	0.000280	76	0.054240	0.035270
25	0.000530	0.000300	77	0.059260	0.038700
26	0.000540	0.000320	78	0.064860	0.042580
27	0.000550	0.000340	79	0.071100	0.046980
28	0.000560	0.000360	80	0.078020	0.051970
29	0.000570	0.000380	81	0.085690	0.057620
30	0.000590	0.000410	82	0.094140	0.064020
31	0.000600	0.000430	83	0.103440	0.071270
32	0.000620	0.000460	84	0.113610	0.079450
33	0.000640	0.000490	85	0.124680	0.088570
34	0.000670	0.000520	86	0.136760	0.098570
35	0.000700	0.000550	87	0.151110	0.109330
36	0.000740	0.000590	88	0.166730	0.120640
37	0.000780	0.000620	89	0.183000	0.132580
38	0.000830	0.000660	90	0.199560	0.145230
39	0.000880	0.000710	91	0.216290	0.158700
40	0.000950	0.000750	92	0.233230	0.173100
41	0.001010	0.000800	93	0.250530	0.188520
42	0.007330	0.000850	94	0.268370	0.205030
43	0.007600	0.004640	95	0.286890	0.222660
44	0.007880	0.004790	96	0.306160	0.241380
45	0.008160	0.004930	97	0.326090	0.261090
46	0.008450	0.005080	98	0.346360	0.281600
47	0.009110	0.005230	99	0.366400	0.302650
48	0.009350	0.005370	100	0.386040	0.323820
49	0.009600	0.005670	101	0.405120	0.344940
50	0.009850	0.005990	102	0.423520	0.365810
51	0.010120	0.006320	103	0.441130	0.386250
52	0.010420	0.006670	104	0.457860	0.406090
53	0.010730	0.007040	105	0.473640	0.425190
54	0.011080	0.007420	106	0.488430	0.443410
55	0.011470	0.007820	107	0.500000	0.460670
56	0.011920	0.008250	108	0.500000	0.476900
57	0.012430	0.008710	109	0.500000	0.492050
58	0.013020	0.009210	110	0.500000	0.500000
59	0.013710	0.009750	111	0.500000	0.500000
60	0.014500	0.010340	112	0.500000	0.500000
61	0.015430	0.010980	113	0.500000	0.500000
62	0.016500	0.011680	114	0.500000	0.500000
63	0.017760	0.012430	115	0.500000	0.500000
64	0.019210	0.013320	116	0.500000	0.500000
65	0.020860	0.014290	117	1.000000	0.500000
66	0.022710	0.015350	118	1.000000	1.000000
67	0.024760	0.016530	119	1.000000	1.000000
68	0.027030	0.017840	120	1.000000	1.000000
69	0.029500	0.019310			
70	0.032210	0.020940			

* Adjusted Base Rates

TABLE 5
BASE RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF DISABILITY*

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.005521	0.002688	71	0.058210	0.043300
20	0.005172	0.002425	72	0.061627	0.046475
21	0.004717	0.002200	73	0.065392	0.050038
22	0.004234	0.002050	74	0.069573	0.054025
23	0.003873	0.002050	75	0.074196	0.058475
24	0.003725	0.002238	76	0.079341	0.063438
25	0.003913	0.002450	77	0.085050	0.068963
26	0.004100	0.002688	78	0.091415	0.075088
27	0.004301	0.002938	79	0.098463	0.081875
28	0.004516	0.003212	80	0.106249	0.089375
29	0.004744	0.003513	81	0.114771	0.097638
30	0.004985	0.003837	82	0.124071	0.106700
31	0.005239	0.004200	83	0.134134	0.116638
32	0.005507	0.004588	84	0.144921	0.127038
33	0.005816	0.005013	85	0.156485	0.137675
34	0.006137	0.005475	86	0.168907	0.148475
35	0.006512	0.005988	87	0.182280	0.159462
36	0.006941	0.006550	88	0.199137	0.170812
37	0.007437	0.007175	89	0.217790	0.182713
38	0.008000	0.007863	90	0.236925	0.195438
39	0.008643	0.008613	91	0.256288	0.209250
40	0.009380	0.009425	92	0.275879	0.224437
41	0.010224	0.010313	93	0.295845	0.241225
42	0.011176	0.011275	94	0.316468	0.259800
43	0.012274	0.012312	95	0.338028	0.280550
44	0.013494	0.013413	96	0.360782	0.302825
45	0.014861	0.014588	97	0.384888	0.326688
46	0.016361	0.015838	98	0.410362	0.352000
47	0.017983	0.017162	99	0.436961	0.378312
48	0.019698	0.018538	100	0.464122	0.404775
49	0.021507	0.019188	101	0.490976	0.431175
50	0.022941	0.019837	102	0.517294	0.457263
51	0.024361	0.020500	103	0.542861	0.482813
52	0.025741	0.021150	104	0.567517	0.507613
53	0.027068	0.021775	105	0.591114	0.531488
54	0.028328	0.022363	106	0.613532	0.554263
55	0.029493	0.022913	107	0.634678	0.575838
56	0.030552	0.023425	108	0.654496	0.596125
57	0.031557	0.023925	109	0.670000	0.615063
58	0.032535	0.024450	110	0.670000	0.625000
59	0.033540	0.025000	111	0.670000	0.625000
60	0.034626	0.025638	112	0.670000	0.625000
61	0.035872	0.026375	113	0.670000	0.625000
62	0.037319	0.027225	114	0.670000	0.625000
63	0.038967	0.028200	115	0.670000	0.625000
64	0.040790	0.029325	116	0.670000	0.625000
65	0.042786	0.030625	117	0.670000	0.625000
66	0.044930	0.032113	118	0.670000	1.000000
67	0.047222	0.033825	119	1.000000	1.000000
68	0.049660	0.035775	120	1.000000	1.000000
69	0.052273	0.037988			
70	0.055114	0.040488			

* Adjusted Base Rates

Mississippi Highway Safety Patrol Retirement System

Experience Study for the Four-Year Period Ending June 30, 2024

Prepared as of June 30, 2024

CavMac
Actuarial Consulting Services

April 14, 2025

The Board of Trustees
Public Employees' Retirement System of Mississippi
The Administrative Board of the Highway Safety Patrol
429 Mississippi Street
Jackson, MS 39201

Members of the Board:

We are pleased to submit the results of an investigation of the economic and demographic experience for the Mississippi Highway Safety Patrol Retirement System (HSPRS) for the four-year period from July 1, 2020 to June 30, 2024. The study was based on the data submitted by the Public Employees' Retirement System (PERS) for the annual valuation. In preparing this report, we relied, without audit, on the data provided.

The results of the experience study are the basis for recommended changes in the actuarial assumptions, which if adopted by the Board, will be first used for the June 30, 2025 valuation. With the Board's approval of the recommendations in the report, we believe the actuarial condition of the System will be more accurately portrayed. We would like to acknowledge the help in the preparation of the data for this investigation given by the PERS staff.

The purpose of the investigation was to assess the reasonability of the current HSPRS economic assumptions and demographic actuarial assumptions for each Retirement System. Actuarial assumptions are used to measure and budget future costs. Changing assumptions will not change the actual cost of future benefits. Once the assumptions have been adopted, the actuarial valuation measures the adequacy of the fixed contribution rate.

All recommended rates of separation, mortality and salary increase at each age or service level are shown in the attached tables in Appendix D of this report. In the actuary's judgment, the rates recommended are suitable for use until further experience indicates that modifications are desirable.

In order to prepare the measurement of the impact on liabilities in this report, we have utilized actuarial models that we developed to measure liabilities and develop actuarial costs. These models include tools that we have produced and tested, along with commercially available valuation software that we have reviewed to confirm the appropriateness and accuracy of the output. In utilizing these models, we develop and use input parameters and assumptions about future contingent events along with recognized actuarial approaches to develop the needed results.

We hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board (ASB) and the Code of Professional Conduct and Qualification Standards for Public Statements of Actuarial Opinion of the American Academy of Actuaries.

In particular, we have prepared the assumptions developed in this report in keeping with our understanding of Actuarial Standards of Practice No. 27 (Selection of Assumptions for Measuring Pension Obligations).

We note that as we prepare this report, the world has been in a pandemic during much of the experience study period. We have taken this into consideration as we reviewed the experience, particularly regarding mortality, retirement, termination and disability patterns. While we do not believe that there is yet sufficient data to warrant the significant modification of any of our assumptions specifically due to COVID-19, we will continue to monitor the situation and advise the Board in the future of any adjustments that we believe would be appropriate.

The experience investigation was performed by, and under the supervision of, independent actuaries who are members of the American Academy of Actuaries with experience in performing valuations for public retirement systems. The undersigned meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,

Edward J. Koebel, EA, FCA, MAAA
Chief Executive Officer

Ben Mobley, ASA, FCA, MAAA
Consulting Actuary

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SECTION I – EXECUTIVE SUMMARY

The purpose of an actuarial valuation is to provide a timely best estimate of the ultimate costs of a retirement system. Actuarial valuations of the Mississippi Highway Safety Patrol Retirement System (HSPRS) are prepared annually to determine the actuarial contribution rate required to fund them on an actuarial reserve basis, (i.e. the current assets plus future contributions, along with investment earnings will be sufficient to provide the benefits promised by the System). The valuation requires the use of certain assumptions with respect to the occurrence of future events, such as rates of death, termination of employment, retirement age, and salary changes to estimate the obligations of the System.

The basic purpose of an experience study is to determine whether the actuarial assumptions currently in use have adequately anticipated the actual emerging experience. This information, along with the professional judgment of system personnel and advisors, is used to evaluate the appropriateness of continued use of the current actuarial assumptions. When analyzing experience and assumptions, it is important to recognize that actual experience is reported in the short-term while assumptions are intended to be long-term estimates of experience. Therefore, actual experience is expected to vary from study period to study period, without necessarily indicating a change in assumptions is needed.

Cavanaugh Macdonald Consulting, LLC (CavMac) has performed a study of the experience for HSPRS for the four-year period ending June 30, 2024. This report presents the results, analysis, and resulting recommendations of our study. It is anticipated that the changes, if approved, will first be reflected in the June 30, 2025 actuarial valuation.

These assumptions have been developed in accordance with generally recognized and accepted actuarial principles and practices that are consistent with the applicable Actuarial Standards of Practice adopted by the Actuarial Standards Board (ASB). While the recommended assumptions represent our best estimate of future experience, there are other reasonable assumption sets that could be supported by the results of this experience study. Those other sets of reasonable assumptions could produce liabilities and costs that are either higher or lower.

Our Philosophy

Similar to an actuarial valuation, the calculation of actual and expected experience is a fairly mechanical process, and differences between actuaries in this area are generally minor. However, the setting of assumptions differs, as it is more art than science. In this report, we have recommended changes to certain assumptions. To explain our thought process, we offer a brief summary of our philosophy:

- **Do Not Overreact**: When we see significant changes in experience, we generally do not adjust our rates to reflect the entire difference. We will typically recommend rates somewhere between the old rates and the new experience. If the experience during the next study period shows the same result, we will probably recognize the trend at that point in time or at least move further in the direction of the observed experience. On the other hand, if experience returns closer to its prior level, we will not have overreacted, possibly causing volatility in the actuarial contribution rates.

- **Anticipate Trends**: If there is an identified trend that is expected to continue, we believe that this should be recognized. An example is the retiree mortality assumption. It is an established trend that people are living longer, outside of the recent pandemic. Therefore, we believe the best estimate of liabilities in the valuation should reflect the expected increase in life expectancy.

- **Simplify**: In general, we attempt to identify which factors are significant and eliminate or ignore the ones that do not materially improve the accuracy of the liability projections.

The following summarizes the findings and recommendations with regard to the assumptions utilized for HSPRS. Detailed explanations for the recommendations are found in the sections that follow.

Recommended Economic Assumption Changes

Economic assumptions are some of the most visible and significant assumptions used in the valuation process. The items in the broad economy modeled by these assumptions can be very volatile over short periods of time, as clearly seen in the economic recovery from the pandemic in 2021 followed by the downward trend in global markets in 2022. Our goal is to try to find the emerging long-term trends in the midst of this volatility so that we can then apply reasonable assumptions.

Most of the economic assumptions used by actuaries are developed through a building-block approach. For example, the expected return on assets is based on the expectation for inflation plus the expected real return on assets. At the core of the economic assumptions is the inflation assumption. As we discuss later in the report, although recently we have experienced higher inflation following the recovery from the pandemic, we believe that long-term inflation will settle back down in the 2.40% to 2.50% range. So therefore, **we are recommending that the price inflation assumption remain at 2.40%**.

We are also recommending that the long-term expected return on assets assumption remain at 7.00%, reflecting the 2.40% inflation assumption and a 4.60% real rate of return assumption. This will be discussed in detail later in this report, but a real rate of return of 4.60% is supported by the forecasting models developed using the Board's investment consultant's capital market assumptions and the Board's target asset allocation. Further analysis of the 42 sets of capital market assumptions included in the Horizon Actuarial Services, LLC. Survey conducted in 2024 and the Board's target asset allocation also support this recommendation.

Finally, we are recommending that the general wage inflation (payroll growth) assumption used as the underlying payroll growth for active members and used in the level percent of payroll amortization method remain at 2.65%.

The following table summarizes the current and proposed economic assumptions:

Item	Current	Proposed
Price Inflation	2.40%	2.40%
Investment Return*	7.00%	7.00%
Wage Inflation (Payroll Growth)	2.65%	2.65%

* Net of investment expenses only.

We recognize there may be other sets of economic assumptions that are also reasonable for purposes of funding HSPRS. For example, we have typically reflected conservatism to the degree we would classify as moderate. Actuarial Standards of Practice allow for this difference in approaches and perspective, as long as the assumptions are reasonable and consistent.

Recommended Demographic Assumption Changes

In the experience study, actual experience for the study period is compared to that expected based on the current actuarial assumption. Comparing the actual incidence of the event to what was expected (called the Actual-to-Expected ratio, or A/E ratio) then provides the basis for our analysis.

The major demographic assumptions include mortality, retirement, disability, terminations, and salary merit increases. There are some additional minor assumptions that are required as well. For each of these assumptions, we considered the observed behavior patterns during the study period to determine what adjustments might be appropriate. We note that the study period overlapped substantially with the onset of and then recovery from the Covid-19 pandemic, and so we are intentionally cautious in making changes based on the study period alone.

Mortality is typically the most significant demographic assumption. As we discuss in the report, we are recommending that HSPRS retain the Society of Actuaries Pub-2010 family of mortality tables issued in 2019 based on public retirement plan data. However, we note that we are recommending some slight adjustments in all four mortality tables. We do recommend the continued use of generational mortality, a technique in which mortality rates are assumed to improve slightly each year in the future.

More information will be discussed in the demographic section of this report.

The following is a general list of the other recommended changes to the demographic assumptions for HSPRS.

- **Retirement: Recommend minor adjustments in the rates of retirement to better match experience of the System.**
- **Disability: No change to rates of disability at this time.**
- **Withdrawal: Increase the rates of withdrawal at most service levels to better match the experience of the System.**
- **Merit Salary Scale: No change in the merit salary at this time.**

Section IV of this report will provide more detail to these recommended demographic changes.

Actuarial Methods

The basic actuarial methodologies used in the valuation process include the actuarial cost method, the asset valuation method and the unfunded actuarial accrued liability (UAAL) amortization methodology. Generally, these methods are:

- Cost Method – Entry Age Normal
- Asset Valuation – Five-year recognition of gains and losses with a 20% corridor
- Amortization method – Layered bases with new experience bases amortized over a closed 25-year period as a level percentage of payroll.

Based on our review, discussed in full detail in Section III of this report, we recommend no changes in these actuarial methods at this time.

Other Assumptions

Another assumption that is included in the HSPRS valuation is the determination of administrative expense component that is added to the total normal cost each year. The current assumption is 1.00% of payroll. **After reviewing the total amount of administrative expenses for the past four years and the percentage of payroll, we are recommending continuation of the current assumption.** The following table shows actual percentages over the past four years:

Year Ending June 30	Administrative Expenses	Annual Payroll	Percentage
2021	$320,000	$31,012,146	1.03%
2022	$319,000	$33,581,298	0.95%
2023	$359,000	$34,748,851	1.03%
2024	$350,000	$34,573,388	1.01%

Financial Impact

Although the assumption changes, if approved, will first be reflected in the 2025 valuations, we have provided the following table which highlights the impact of the recommended changes on the unfunded accrued liability (UAL), funded ratio, actuarially determined employer contribution (ADEC), and projected funding ratio on the 2024 valuation and projection results.

($ in Thousands)

	Before All Changes	After All Changes
2024 Valuation Unfunded Accrued Liability (UAL)	$231,089	$233,561
2024 Funded Ratio	65.55%	65.31%
2024 Actuarially Determined Employer Contribution (ADEC)	53.09%	52.43%
Projected Funding Ratio 2047*	80.5%	80.4%

* Fixed Contribution Rate (FCR) of 49.08% assumed.

SECTION II – ECONOMIC ASSUMPTIONS

There are four economic assumptions used in the actuarial valuation performed for HSPRS. They are:

- Price Inflation
- Investment Return
- Wage Inflation
- Payroll Growth for Amortization Method

Note that future price inflation has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return and wage inflation. However, it is not directly used in the valuation process.

Unlike demographic assumptions, economic assumptions do not lend themselves to analysis largely on the basis of internal historical patterns because economic assumptions are impacted by external forces in the economy. The investment return and general wage increase assumptions are selected on the basis of expectations in an inflation-free environment and then increased by the long-term expectation for inflation, called the "building block" approach.

Sources of data considered in the analysis and selection of the economic assumptions included:

- The 2024 Social Security Trustees Report
- Future expectations of PERS investment consultant, Callan
- Future expectations of other investment consultants (2024 Horizon Survey)
- U.S. Department of the Treasury bond rates
- Assumptions used by other large public retirement systems, based on the Public Fund Survey, published by the National Association of State Retirement Administrators (NASRA)
- Historical observations of price and wage growth statistics and investment returns

Guidance regarding the selection of economic assumptions for measuring pension obligations is provided by Actuarial Standard of Practice (ASOP) No. 27, *Selection of Assumptions for Measuring Pension Obligations*. Because no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment.

ASOP 27 requires the actuary to select a "reasonable" assumption. For this purpose, an assumption is reasonable if it has the following characteristics:

- It is appropriate for the purpose of the measurement;
- It reflects the actuary's professional judgment;
- It takes into account historical and current economic data that is relevant as of the measurement date;
- It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
- It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed, or when alternative assumptions are used for the assessment of risk.

SECTION II – ECONOMIC ASSUMPTIONS

With respect to relevant data, the standard recommends the actuary review appropriate recent and long-term historical economic data but advises the actuary not to give undue weight to recent experience. Furthermore, it advises the actuary to consider that some historical economic data may not be appropriate for use in developing assumptions for future periods due to changes in the underlying environment. In addition, with respect to any particular valuation, each economic assumption should be consistent with all other economic assumptions over the measurement period.

ASOP 27 recognizes that economic data and analyses are available from a variety of sources, including representatives of the plan sponsor, investment advisors, economists, and other professionals. The actuary is permitted to incorporate the views of experts, but the selection or advice must reflect the actuary's professional judgment.

The standard also discusses a "range of reasonable assumptions" which in part states "the actuary should also recognize that different actuaries will apply professional judgment and may choose different reasonable assumptions." As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice.

In our opinion, the economic assumptions recommended in this report have been developed in accordance with ASOP No. 27. The following table shows our recommendations followed by detailed discussions of each assumption.

Item	Current Assumptions	Proposed Assumptions
Price Inflation	2.40%	2.40%
Real Rate of Return*	4.60	4.60
Investment Return	7.00%	7.00%
Price Inflation	2.40%	2.40%
Real Wage Growth	0.25	0.25
Wage Inflation	2.65%	2.65%
Payroll Growth	2.65%	2.65%

* net of investment expenses.

Price Inflation

Background

As can be seen from the table on the previous page, assumed price inflation is used as the basis for both the investment return assumption and the wage inflation assumption. These latter two assumptions will be discussed in detail in the following sections.

It is important that the price inflation assumption be consistently applied throughout the economic assumptions utilized in an actuarial valuation. This is called for in ASOP No. 27 and is also required to meet the parameters for determining pension liabilities and expense under Governmental Accounting Standards Board (GASB) Statements No. 67 and 68. The long-term relationship between price inflation and investment return has long been recognized by economists. The basic principle is that the investor demands a more or less level "real return" – the excess of actual investment return over price inflation. If inflation rates are expected to be high, investment return rates are also expected to be high, while low inflation rates are expected to result in lower expected investment returns, at least in the long run.

The current price inflation assumption is 2.40% per year, which was recommended and adopted in the last experience study.

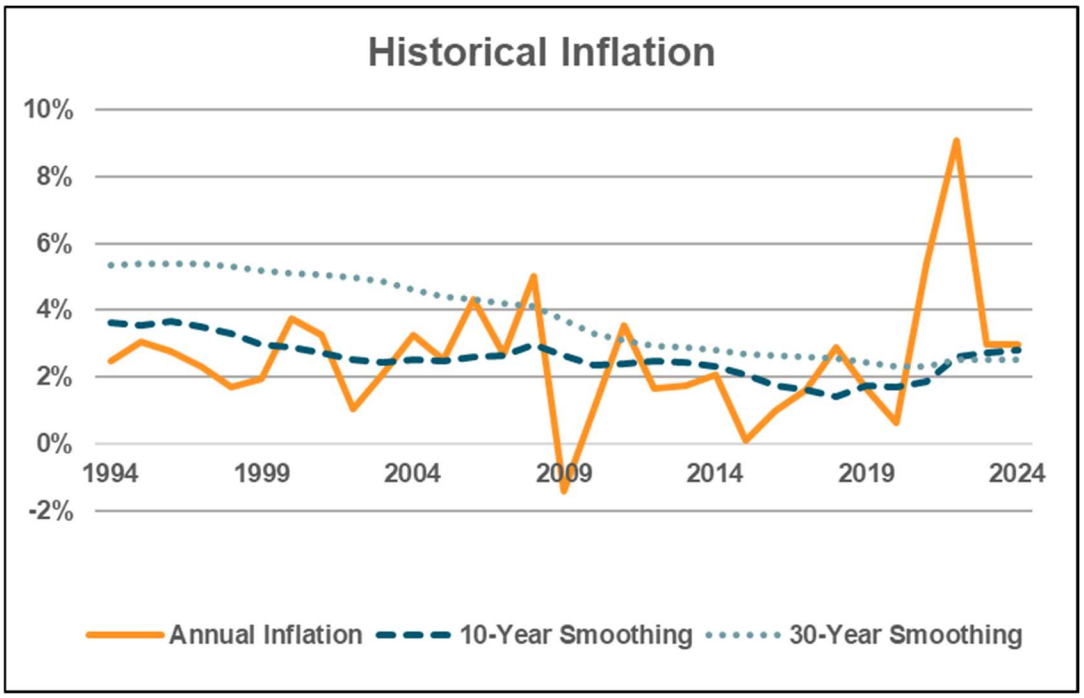
Past Experience

The Consumer Price Index, US City Average, All Urban Consumers, CPI (U), has been used as the basis for reviewing historical levels of price inflation. The table below provides historical annualized rates and annual standard deviation of the CPI-U over periods ending June 30th.

Period	Number of Years	Annualized Rate of Inflation	Annual Standard Deviation
1926 – 2024	98	2.96%	4.02%
1964 – 2024	60	3.94%	2.89%
1974 – 2024	50	3.79%	2.94%
1984 – 2024	40	2.81%	1.75%
1994 – 2024	30	2.54%	1.86%
2004 – 2024	20	2.55%	2.23%
2014 – 2024	10	2.80%	2.66%

The following graph illustrates the historical levels of price inflation measured as of June 30th of each of the last 50 years and compared to the current 2.40% annual rate currently assumed.

Annual Rate of CPI (U) Increases



As can be seen from the table on the previous page, over the last 30 years, the average annual rate of increase in the CPI-U has been just over 2.50%. The higher annual rates over the past few years have increased this average. In the last experience study in 2022, the 30-year average of price inflation was approximately 2.53%.

Forecasts

Additional information to consider in formulating this assumption is obtained from measuring the spread on Treasury Inflation Protected Securities (TIPS) and from the prevailing economic forecasts. The spread between the nominal yield on treasury securities (bonds) and the inflation indexed yield on TIPS of the same maturity is referred to as the "breakeven rate of inflation" and represents the bond market's expectation of inflation over the period to maturity.

The table below provides the calculation of the breakeven rate of inflation as of December 31, 2024.

Years to Maturity	Nominal Bond Yield	TIPS Yield	Breakeven Rate of Inflation
5	4.38%	2.00%	2.38%
10	4.58	2.24	2.34
20	4.86	2.41	2.45
30	4.78	2.48	2.30

As this data indicates, the bond market is anticipating very low inflation of 2.3% to 2.5% for both the short and long term. The bond market expectations may be heavily influenced by the expectations of actions by the Federal Reserve Bank. Whether inflation returns to the higher rates observed historically remains to be seen. We note that measures can move fairly significantly over just a few months.

Based upon information contained in the "Survey of Professional Forecasters" for the fourth quarter of 2024 as published by the Philadelphia Federal Reserve Bank, the median expected annual rate of inflation for the next ten years is 2.23%. Although 10 years of future expectation is too short of a period for the basis of our inflation assumption, the information does provide some evidence that the consensus expectations of these experts are for rates of inflation very close to our current assumption of 2.40% for the near-term future.

PERS' investment consultant, Callan, also has an inflation forecast in their capital market assumptions. Their short-term assumption (10 years) is 2.50%. Horizon Actuarial Services surveys a significant portion of the major investment advisors and publishes their assumptions. For the 2024 study, the long-term inflation assumption was 2.44%.

Social Security Administration

Although many economists forecast lower inflation than the assumption used by most retirement plans, they are generally looking at a shorter time horizon than is appropriate for a pension valuation. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the 2024 annual report, the projected ultimate average annual increase in the CPI over the next 75 years was estimated to be 2.40%, under the intermediate (best estimate) cost assumption. The range of inflation assumptions used in the Social Security 75-year modeling, which includes a low and high-cost scenario, in addition to the intermediate cost projection, was 1.80% to 3.00%. These rates remained unchanged from their 2022 annual report.

Peer Comparison

While we do not recommend the selection of any assumption based on what other systems use, it does provide another set of relevant information to consider. Based on the Public Plan Database (a survey of over 125+ state and local retirement systems maintained by a collaboration between the Center for Retirement Research at Boston College, the Center for State and Local Government Excellence, and the National Association of State Retirement Administrators), the average inflation assumption for governmental plans is 2.46%. This data is largely based on actuarial valuations prepared with measurement dates in 2023. Based on our experience, we believe the inflation assumption has been steady for most systems over the last year.

Recommendation

It is difficult to predict inflation accurately. Inflation's short-term volatility is illustrated by comparing its average rate over the last 10, 30 and 50 year history. Although the 30-year average of 2.54% is closer to the System's assumed rate of 2.40%, the longer 50-year average of 3.79% is much higher and it includes the very high rates of inflation from the late 1970s and early 1980s. Those high rates will not be part of the 50-year average for much longer.

Although we have experienced higher inflation over the last few years following the recovery from the COVID-19 pandemic, current economic forecasts suggest annual inflation rates closer to 2.40% over the short-term and long-term, respectively. We concur with these forecasts and recommend maintaining the inflation assumption for HSPRS at 2.40%.

Price Inflation Assumption	
Current	2.40%
Recommended	2.40%

Investment Return

Background

The investment return assumption reflects anticipated returns on the current and future assets. The assumed investment return is one of the most significant assumptions in the annual actuarial valuation process as it is used to discount the expected benefit payments for all active, inactive and retired members. Minor changes in this assumption can have a major impact on valuation results. The investment return assumption should reflect the asset allocation target for the funds set by the Board of Trustees.

The current rate recommended by the actuary is 7.00%, consisting of a price inflation assumption of 2.40% and a real rate of return assumption of 4.60%.

Long Term Perspective

Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon in order to make prudent choices regarding how to invest the trust funds. For actuarial calculations, we typically consider very long periods of time. For example, a newly, hired employee in HSPRS who is 25 years old may work for 30 years, to age 55, and live another 30 years, to age 85 (or longer). The retirement system would receive contributions for the first 30 years and then pay out benefits for the next 30 years. During the entire 60-year period, the system is investing assets related to the member. For such a typical career employee, more than one-half of the investment income earned on assets accumulated to pay benefits is received after the employee retires. In addition, in an open, ongoing system like HSPRS, the stream of benefit payments is continually increasing as new hires replace current members who leave covered employment due to death, termination of employment, and retirement. This difference in the time horizon used by actuaries and investment consultants is frequently a source of debate and confusion when setting economic assumptions.

Past Experience

One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the timeframe used, especially if the year-to-year results vary widely. In addition, the asset allocation can also impact the investment returns so comparing results over long periods when different asset allocations were in place may not be meaningful.

The assets for HSPRS are valued using a widely accepted asset-smoothing methodology that fully recognizes the expected investment income and also recognizes 20% of each year's investment gain or loss (the difference between actual and expected investment income). The recent experience over the last five years is shown in the table below.

Year Ending 6/30	Actuarial Value	Market Value
2020	6.72%	3.11%
2021	12.47	32.17
2022	8.49	(8.64)
2023	6.85	7.43
2024	7.28	10.41
Geometric Average	8.34%	8.11%

While important to review and analyze, historical returns over such a short time period are not credible for the purpose of setting the long-term assumed future rate of return.

Future Expectation Analysis

ASOP 27 provides that the actuary may rely on outside experts in setting economic assumptions. PERS utilizes the services of Callan to assist them in developing investment strategies and providing capital market assumptions for the PERS portfolio. As part of their duties, Callan periodically performs asset-liability studies, along with comprehensive reviews of the expected return of the various asset classes in which the PERS portfolio is invested. We believe it is appropriate to consider the results of Callan's work as one factor in assessing expected future returns.

We also recognize that there can be differences of opinion among investment professionals regarding future return expectations. Horizon Actuarial Services prepares an annual study in which they survey various investment advisors (42 were included in the 2024 study with a 10-year horizon) and provide ranges of results as well as averages. This information provides an additional perspective on what a broad group of investment experts anticipate for future investment returns.

SECTION II – ECONOMIC ASSUMPTIONS

Our forward-looking analysis used the real rates of return in Callan's capital market assumptions for 2025-2034 and PERS' target asset allocation. Using statistical projections that assume investment returns approximately follow a lognormal distribution with no correlation between years, produces an expected range of real rates of return over a 50-year time horizon. Looking at one year's results produces a mean real return of 5.77%, but also has a high standard deviation or measurement of volatility. By expanding the time horizon, the real return does not change, but the volatility declines significantly. The table below provides a summary of results.

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	5.77%	13.26%	-14.49%	-3.47%	5.01%	14.24%	28.96%
5	5.11%	5.88%	-4.21%	1.13%	5.01%	9.04%	15.12%
10	5.03%	4.15%	-1.59%	2.25%	5.01%	7.85%	12.06%
20	4.99%	2.93%	0.30%	3.05%	5.01%	7.01%	9.95%
30	4.97%	2.39%	1.14%	3.41%	5.01%	6.64%	9.02%
40	4.97%	2.07%	1.65%	3.62%	5.01%	6.42%	8.48%
50	4.96%	1.85%	2.00%	3.77%	5.01%	6.27%	8.11%

The percentile results are the percentages of random returns over the time span shown that are expected to be less than the amount indicated. For example, for the 10-year time span, 5% of the resulting real rates of return will be below -1.59% and 95% will be above that. As the time span increases, the results begin to converge. Over a 50-year time span, the results indicate there will be a 25% chance that real returns will be below 3.77% and a 25% chance they will be above 6.27%. In other words, there is a 50% chance the real returns will be between 3.77% and 6.27%.

For a broader view of expected returns, we also reviewed the 2024 Survey of Capital Market Assumptions produced by Horizon Actuarial Services, LLC to see what other investment professionals are currently using for capital market assumptions. The Horizon survey includes both 10-year horizon and 20-year horizon capital market assumptions. We applied the same statistical analysis to these survey results as we did the capital market assumption of PERS investment advisor with the following real return results for the 10-year horizon and 20-year horizon:

Horizon Survey 10-year horizon

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	5.40%	13.25%	-14.83%	-3.83%	4.64%	13.86%	28.57%
5	4.74%	5.87%	-4.565	0.77%	4.64%	8.67%	14.74%
10	4.66%	4.15%	-1.95%	1.89%	4.64%	7.48%	11.69%
20	4.62%	2.93%	-0.06%	2.69%	4.64%	6.64%	9.58%
30	4.61%	2.39%	0.78%	3.04%	4.64%	6.27%	8.65%
40	4.60%	2.07%	1.29%	3.26%	4.64%	6.05%	8.11%
50	4.60%	1.85%	1.64%	3.40%	4.64%	5.90%	7.74%

Horizon Survey 20-year horizon

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	5.76%	13.25%	-14.48%	-3.47%	5.00%	14.22%	28.93%
5	5.10%	5.87%	-4.20%	1.13%	5.00%	9.03%	15.10%
10	5.02%	4.15%	-1.59%	2.25%	5.00%	7.84%	12.05%
20	4.98%	2.93%	0.29%	3.05%	5.00%	7.00%	9.94%
30	4.97%	2.39%	1.14%	3.40%	5.00%	6.63%	9.01%
40	4.96%	2.07%	1.65%	3.62%	5.00%	6.41%	8.47%
50	4.95%	1.85%	2.00%	3.76%	5.00%	6.26%	8.10%

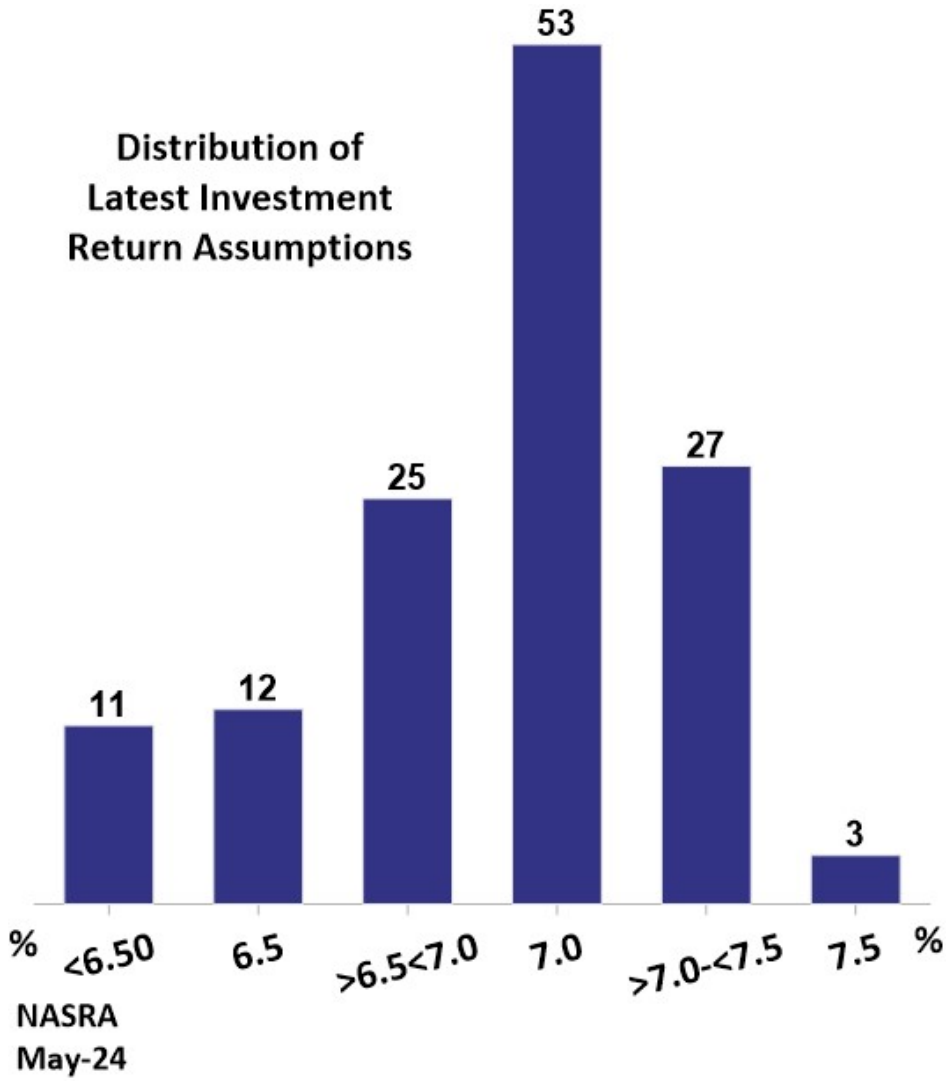
As you can see from the two tables above, setting a real return assumption depends on the time horizon a plan seeks. The 20-year horizon is approximately 0.36% higher at all percentiles than the 10-year horizon. While PERS is a long-term vehicle expected to pay benefits to its retirees for many years in the future, a high percentage of the present value of the benefits is determined within the next ten to fifteen years, so the real return recommendation should fall near the 50th percentile columns in the three tables above.

Using a 2.40% inflation assumption, the current investment return assumption of 7.00% utilizes a 4.60% real rate of return (using the "building block" methodology). Based on the table directly above, 4.60% falls into the 42nd percentile. While it is slightly below thresholds that we recommend for a long-term assumption, it is still a reasonable assumption, as it falls within the 40-60th percentile range.

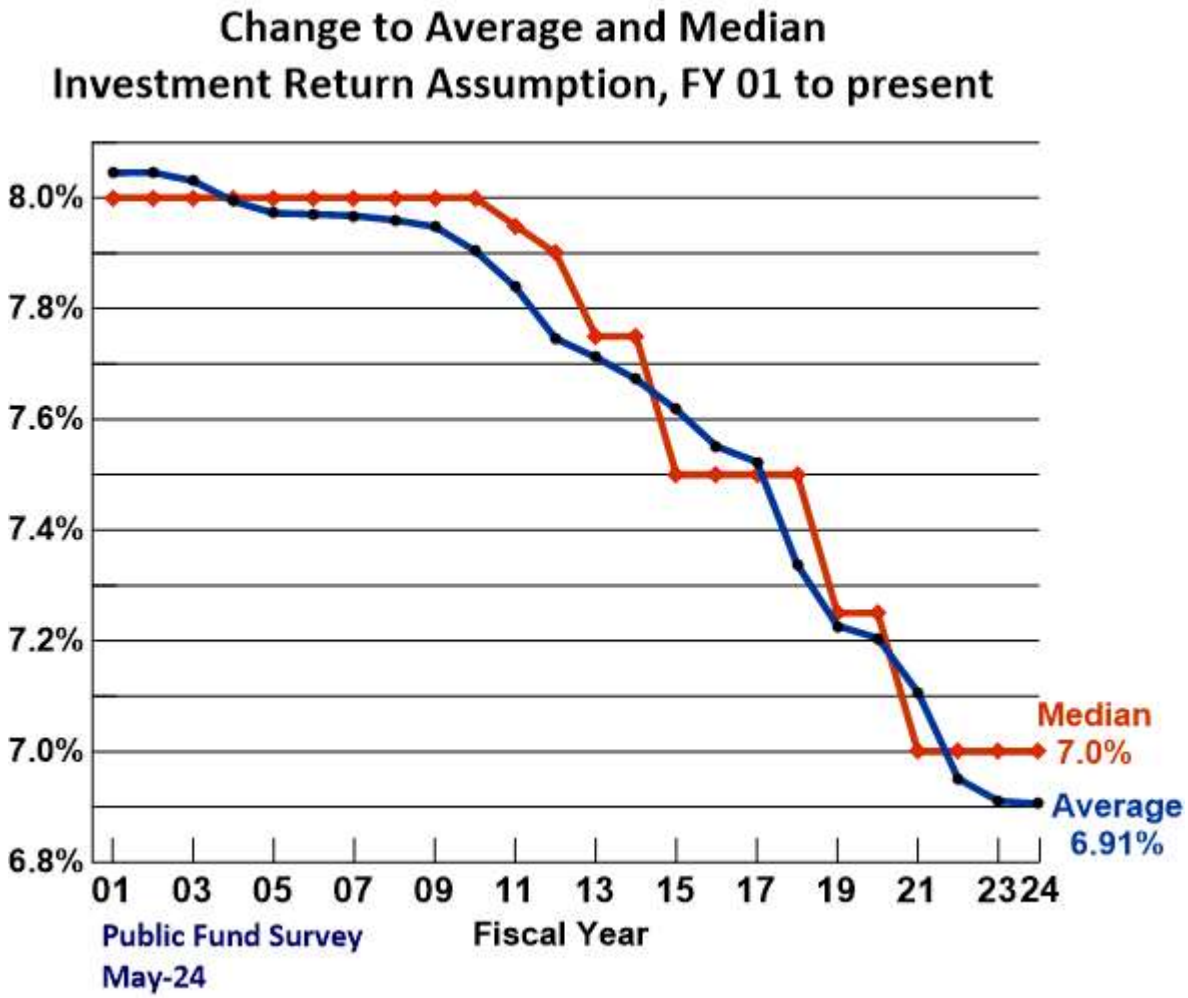
Peer Comparison

Public retirement systems have historically compared their investment performance to their peer group. While we believe there is some merit in assessing the movement in the assumed rate of return for other systems, this is not an appropriate basis for setting this assumption in our opinion. For example, different plans have different plan dynamics, including varying asset allocations, which will impact their choice of the assumed investment return. This peer group information merely provides another set of relevant data to consider as long as we recognize that asset allocation varies from system to system.

The following chart shows the nominal investment return assumptions of 131 plans in the National Association of State Retirement Administrators (NASRA). The assumptions shown below are as of May 2024 and are updated frequently by the NASRA staff.



The following chart shows the changes in expected investment return assumption from the NASRA public plan survey over the last 23 years from 2001.



Recommendation

By actuarial standards, we are required to maintain a long-term perspective in setting all assumptions, including the investment return assumption. Therefore, we believe we must be careful not to let recent experience or short-term expectations impact our judgment regarding the appropriateness of the current assumption over the long term.

Based on our analysis of Callan's capital market assumptions and the Horizon Survey capital market assumptions, we are recommending continuation of a real return assumption of 4.60%. We acknowledge that this real return assumption is just slightly below Horizon Survey's anticipated return over the next 10 years of 4.64%. Based on our recommended inflation assumption of 2.40% and real return assumption of 4.60%, we are recommending continuation of the 7.00% expected long term nominal rate of return assumption.

Investment Return Assumption		
	Current	Recommended
Real Rate of Return*	4.60%	4.60%
Inflation	2.40%	2.40%
Net Investment Return	7.00%	7.00%

* net of investment expenses.

Wage Inflation

Background

Wage inflation, thought of as the "across the board" rate of salary increases, is composed of the price inflation assumption combined with an assumption for the real rate of wage increases. In constructing the individual salary increase assumption, the wage inflation assumption is further combined with an assumption for age- or service-based salary increases (called a merit scale). The merit scale assumption is discussed later in this report.

Currently, the wage inflation assumption is 2.65%, which implies an assumed real rate of wage increase or real wage inflation of 0.25% (2.65% less the current inflation assumption of 2.40%). The excess of wage inflation over price inflation represents the increase in the standard of living, also called productivity growth. There has been debate on the issue of whether public sector employees will receive, over the long term, the same rewards for productivity as employees in the private sector, where productivity is more readily measurable. To our knowledge, no definitive research has been completed on this topic. Nevertheless, it is our opinion that public sector employees will eventually be rewarded with the same productivity increases as those participating in the remainder of the economy, even if there is a time lag.

Past Experience

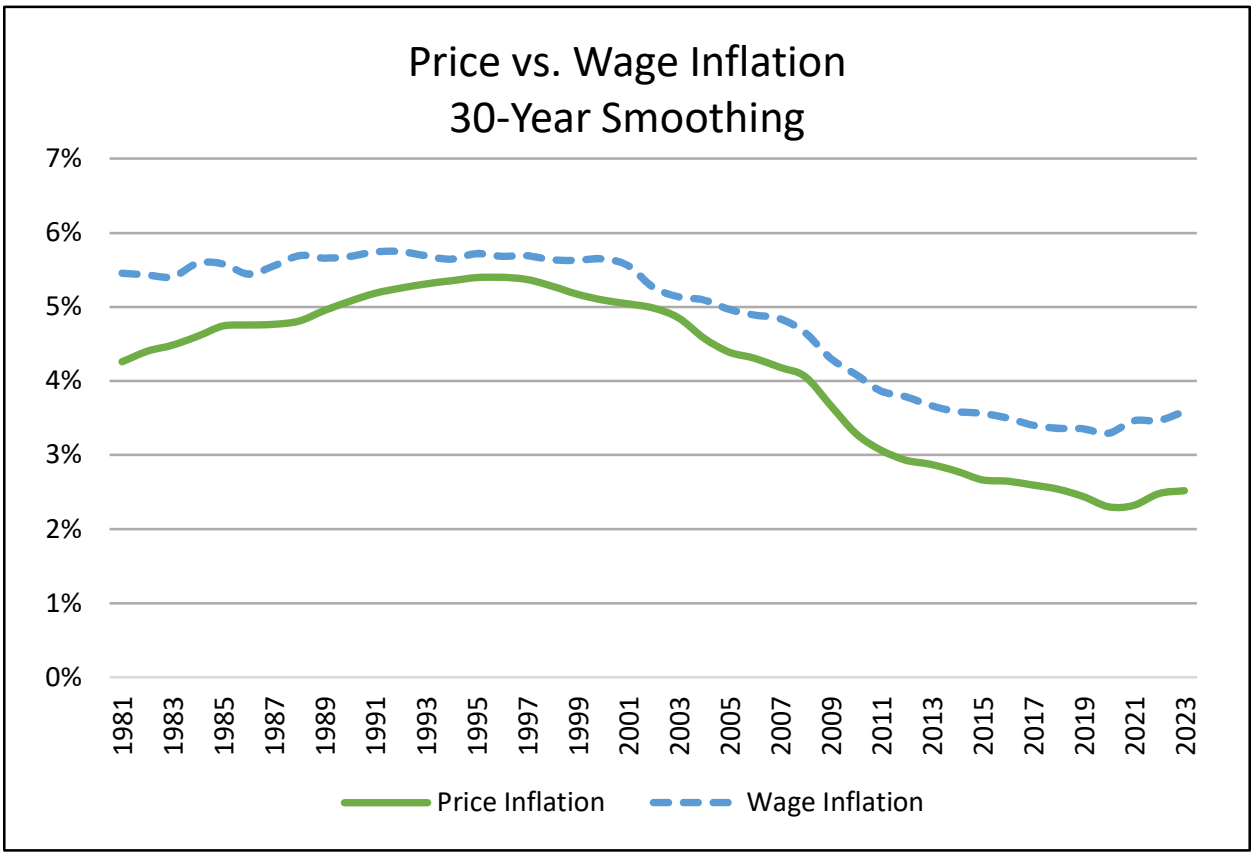
The Social Security Administration publishes data on wage growth in the United States (see Appendix C). While this is the most comprehensive data available, it is based on all wage earners in the country so it can be influenced by the mix of jobs as well as by changes in certain sectors of the workforce that may not be seen by all segments.

As with our analysis of inflation, we provide below wage inflation and a comparison with price inflation over various time periods. Currently, this wage data is only available through calendar year 2023. We remove the rate of price inflation for each year from the data to result in the historical real rate of wage inflation.

Period	Wage Inflation	Price Inflation	Real Wage Growth
2013-2023	4.03%	2.79%	1.24%
2003-2023	3.41%	2.58%	0.83%
1993-2023	3.59%	2.51%	1.08%
1983-2023	3.76%	2.81%	0.95%
1973-2023	4.44%	3.86%	0.58%

Thus, over the last 50 years, annual real wage growth has averaged 0.58%.

Similar information over rolling thirty-year periods is shown in the following graph:



Public Sector Compensation and Wages

The Bureau of Labor Statistics publishes the Employment Cost Index, including detail for real (net of inflation) total compensation and wages and salaries. Further, this index is also broken down for state and local government workers. From 2005 through 2024, real compensation grew by at an annualized rate of 2.85%, while wages and salaries grew at a rate of 2.47%. This difference is a reflection that state and local government workers have had much of their compensation increase delivered through benefits rather than wages and salaries. While it is certainly reasonable to anticipate that total compensation will continue to increase faster than wages and salaries, it is also reasonable to anticipate that the difference between the two will moderate over time.

Recommendation

Based, on all the information discussed, we recommend that the plan maintain a 0.25% real wage growth inflation assumption and a total wage inflation growth of 2.65%.

Wage Inflation Assumption		
	Current	Recommended
Price Inflation	2.40%	2.40%
Real Wage Growth	0.25%	0.25%
Wage Inflation	2.65%	2.65%

Payroll Growth

Background

The assumed future rate of payroll growth increase in the total payroll of HSPRS' active members is an assumption used in the level percentage of payroll amortization method that affects the calculation of the amortization period required to fully amortize the unfunded actuarial accrued liability and the actuarially determined employer contribution. The total payroll growth is impacted by individual member's increases and population growth. The current assumption is 2.65% per year which is comprised of the inflation assumption of 2.40% and real wage growth of 0.25%.

Recommendation

As we did for PERS, we are recommending we maintain the payroll growth assumption of 2.65%, which is equal to the recommended wage inflation assumption.

ACTUARIAL COST METHOD

The systematic financing of a pension plan requires that contributions be made in an orderly fashion while a member is actively employed, so that the accumulation of these contributions, together with investment earnings should be sufficient to provide promised benefits and cover administration expenses. The actuarial valuation is the process used to determine when money should be contributed, i.e., as part of the budgeting process.

The actuarial valuation will not impact the amount of benefits paid or the actual cost of those benefits. In the long run, actuaries cannot change the costs of the pension plan, regardless of the funding method used or the assumptions selected. However, actuaries will influence the incidence of costs by their choice of methods and assumptions.

The valuation or determination of the present value of all future benefits to be paid by the funds reflects the assumptions that best describe anticipated future experience. The choice of a funding method does not impact the determination of the present value of future benefits. The funding method determines only the incidence of cost. In other words, the purpose of the funding method is to allocate the present value of future benefits determination into annual costs. In order to do this allocation, it is necessary for the funding method to "break down" the present value of future benefits into two components: (1) that which is attributable to the past, (2) and that which is attributable to the future. The excess of that portion attributable to the past over the plan assets is then amortized over a period of years. Actuarial terminology calls the part attributable to the past the "past service liability" or the "actuarial accrued liability". The portion of the present value of future benefits allocated to the future is commonly known as "the present value of future normal costs", with the specific piece of it allocated to the current year being called "the normal cost". The difference between the plan assets and actuarial accrued liability is called the "unfunded actuarial accrued liability".

Two key points should be noted. First, there is no single "correct" funding method since different funding methods simply change the timing of the funding. Second, the allocation of the present value of future benefits and hence cost to the past for amortization and to the future for annual normal cost payments is not necessarily in a one-to-one relationship with service earned in the past and future service to be earned.

Entry Age Normal

There are various actuarial cost methods, each of which has different characteristics, advantages and disadvantages. However, Governmental Accounting Standard Board Statement Numbers 67 and 68 require that the Entry Age Normal cost method be used for financial reporting. Most retirement systems will not want to use a different actuarial cost method for funding and financial reporting. In addition, the Entry Age Normal method has been the most popular funding method for public systems for many years. This is the cost method currently used by PERS for all plans.

The rationale of the entry age normal (EAN) funding method is that the cost of each member's benefit is determined to be a level percentage of salary from date of hire to the end of employment. This level percentage multiplied by the member's annual salary is referred to as the normal cost and is that portion of the total cost of the employee's benefit which is allocated to the current year. The portion of the present value of future benefits allocated to the future is determined by multiplying this percentage times the present value of the member's assumed earnings for all future years including the current year. The entry age normal actuarial accrued liability is then developed by subtracting from the present value of future benefits that portion of costs allocated to the future. To determine the unfunded actuarial accrued liability, the actuarial value of plan assets is subtracted from the entry age normal actuarial accrued liability. The current year's cost to amortize the unfunded actuarial accrued liability is developed by applying an amortization factor based on the funding policy.

It is to be expected that future events will not occur exactly as predicted by the actuarial assumptions in each year. Actuarial gains/losses from experience under this actuarial cost method can be directly calculated and are reflected as a decrease/increase in the unfunded actuarial accrued liability. Consequently, the gain/loss results in a decrease/increase in the amortization payment, and therefore the contribution rate or amount.

Recommendation

Considering that the Entry Age Normal cost method is the most commonly used cost method by public plans, that it develops a normal cost rate that tends to be stable and is the required cost method under calculations required by Governmental Accounting Standard Numbers 67 and 68, **we recommend the Entry Age Normal actuarial cost method be retained by PERS for all plans.** Note that because of GASB 67 and 68 requirements, the Entry Age Normal method will also be used by the plans for accounting disclosures.

ACTUARIAL VALUE OF ASSETS

In preparing an actuarial valuation, the actuary must assign a value to the assets of the fund. An adjusted market value is often used to smooth out the volatility that is reflected in the market value of assets. This is because most employers would rather have annual costs remain relatively smooth, as a percentage of payroll or in actual dollars, as opposed to a cost pattern that is extremely volatile.

The actuary does not have complete freedom in assigning this value. The Actuarial Standards Board also has basic principles regarding the calculation of a smoothed asset value, Actuarial Standard of Practice No. 44 (ASOP 44), *Selection and Use of Asset Valuation Methods for Pension Valuations.*

ASOP 44 provides that the asset valuation method should bear a reasonable relationship to the market value. Furthermore, the asset valuation method should be likely to satisfy both of the following:

- Produce values within a reasonable range around market value, AND
- Recognize differences from market value in a reasonable amount of time.

In lieu of both of the above, the standard will be met if either of the following requirements is satisfied:

- There is a sufficiently narrow range around the market value, OR
- The method recognizes differences from market value in a sufficiently short period.

These rules or principles prevent the asset valuation methodology from being used to manipulate annual funding patterns. No matter what asset valuation method is used, it is important to note that, like a cost method or actuarial assumptions, the asset valuation method does not affect the true cost of the plan; it only impacts the incidence of cost.

Recommendation

Currently, the actuarial value of assets recognizes a portion of the difference between the market value of assets and the expected market value of assets, based on the assumed valuation rate of return. The amount recognized each year is 20% of the difference between market value and expected market value. **We recommend no change in this methodology.**

AMORTIZATION OF THE UNFUNDED ACTUARIAL ACCRUED LIABILITY

The actuarial accrued liability is the portion of the actuarial present value of future benefits that are not included in future normal costs. Thus, it represents the liability that, in theory, should have been funded through normal costs for past service. Unfunded actuarial accrued liability (UAAL) exists when the actuarial accrued liability exceeds the actuarial value of plan assets. These deficiencies can result from:

(i) plan improvements that have not been completely paid for,
(ii) experience that is less favorable than expected,
(iii) assumption changes that increase liabilities, or
(iv) contributions that are less than the actuarial contribution rate.

There are a variety of different methods that can be used to amortize the UAAL. Each method results in a different payment stream and, therefore, has cost implications. For each methodology, there are three characteristics:

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

Amortization Period: The amortization period can be either closed or open. If it is a closed amortization period, the number of years remaining in the amortization period declines by one in each future valuation. Alternatively, if the amortization period is an open or rolling period, the amortization period does not decline but is reset to the same number each year. This approach essentially "refinances" the System's debt (UAAL) every year.

Amortization Payment: The level dollar amortization method is similar to the method in which a homeowner pays off a mortgage. The liability, once calculated, is financed by a constant fixed dollar amount, based on the amortization period until the liability is extinguished. This results in the liability steadily decreasing while the payments, though remaining level in dollar terms, in all probability decrease as a percentage of payroll. (Even if a plan sponsor's population is not growing, inflationary salary increases will usually be sufficient to increase the aggregate covered payroll).

The rationale behind the level percentage of payroll amortization method is that since normal costs are calculated to be a constant percentage of pay, the unfunded actuarial accrued liability should be paid off in the same manner. When this method of amortizing the unfunded actuarial accrued liability is adopted, the initial amortization payments are lower than they would be under a level dollar amortization payment method, but the payments increase at a fixed rate each year so that ultimately the annual payment far exceeds the level dollar payment. The expectation is that total payroll will increase at the same rate so that the amortization payments will remain constant, as a percentage of payroll. In the initial years, the level percentage of payroll amortization payment is often less than the interest accruing on the unfunded actuarial accrued liability meaning that even if there are no experience losses, the dollar amount of the unfunded actuarial accrued liability will grow (called negative amortization). This is particularly true if the plan sponsor is paying off the unfunded actuarial accrued liability over a long period, such as 20 or more years.

Amortization Bases: The UAAL can be amortized either as one single amount or as components or "layers", each with a separate amortization base, payment and period. If the UAAL is amortized as one amount, the UAAL is recalculated each year in the valuation and experience gains/losses or other changes in the UAAL are folded into the single UAAL amortization base. The amortization payment is then the total UAAL divided by an amortization factor for the applicable amortization period.

If separate amortization bases are maintained, the UAAL is composed of multiple amortization bases, each with its own payment schedule and remaining amortization period. In each valuation, the unexpected change in the UAAL is established as a new amortization base over the appropriate amortization period beginning on that valuation date. The UAAL is then the sum of all of the outstanding amortization bases on the valuation date and the UAAL payment is the sum of all of the amortization payments on the existing amortization bases. This approach provides transparency in that the current UAAL is paid off over a fixed period of time and the remaining components of the UAAL are clearly identified. Adjustments to the UAAL in future years are also separately identified in each future year. One downside of this approach is that it can create some discontinuities in contribution rates when UAAL layers/components are fully paid off. If this occurs, it likely would be far in the future, with adequate time to address any adjustments needed.

Recommendation

In the current HSPRS Board funding policy, an actuarially determined employer contribution (ADEC) is calculated during each annual valuation and the ADEC is compared to the Fixed Contribution Rate adopted by the Board as one of its Signal Light metrics. The methodology in calculating the ADEC is as follows:

- Amortization Period – Closed period with period of 25 years for new bases
- Amortization Payment – Level Percentage of Payroll
- Amortization Bases – Separate bases for all experience gains and losses, assumption changes or benefit changes

We recommend no changes in these methods.

SECTION IV – DEMOGRAPHIC ASSUMPTIONS

Actuarial Standard of Practice (ASOP) No. 27 provides guidance to actuaries regarding the selection of demographic and other non-economic assumptions for measuring pension obligations. ASOP 27 states that the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the defined benefit plan that is the subject of the measurement. A reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

Each individual demographic assumption should satisfy the criteria of ASOP 27. In selecting demographic assumptions, the actuary should also consider: the internal consistency between the assumptions, materiality, cost effectiveness, and the combined effect of all assumptions. At each measurement date, the actuary should consider whether the selected assumptions continue to be reasonable, but the actuary is not required to do a complete assumption study at each measurement date. In addition, the actuary should include a specific assumption with respect to expected mortality improvements after the measurement date. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP 27.

Overview of Analysis

The purpose of a study of demographic experience is to compare what actually happened to the individual members of the System during the study period (July 1, 2020 through June 30, 2024) with what was expected to happen based on the actuarial assumptions.

Studies of demographic experience generally involve three steps:

- First, the number of members changing membership status, called decrements, during the study is tabulated by age, duration, gender, group, and membership class (active, retired, etc.).
- Next, the number of members expected to change status is calculated by multiplying certain membership statistics, called exposure, by the expected rates of decrement.
- Finally, the number of actual decrements is compared with the number of expected decrements. The comparison is called the Actual-to-Expected ratio (A/E Ratio) and is expressed as a percentage.

In general, if the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements, or rates of decrement, by age, sex, or duration deviates significantly from the expected pattern, new assumptions are considered. Recommended revisions are normally not an exact representation of the experience during the observation period. Judgment is required to anticipate future experience from past trends and current evidence, including a determination of the amount of weight to assign to the most recent experience.

SECTION IV – DEMOGRAPHIC ASSUMPTIONS

Revised rates of decrement are tested by using them to recalculate the expected number of decrements during the study period, and the results are shown as revised Actual-to-Expected Ratios.

It takes a fair amount of data to perform a credible study of demographic assumptions. Because the membership or certain subsets of the membership are relatively small, some assumptions have been selected based more on our professional judgment of reasonable future outcomes than actual experience.

Because much of the past four years of experience overlapped the worldwide Covid pandemic, we recognize that the actual demographic experience captured in this study may be influenced by the presence of the disease, by decisions the various employers made to manage their workforces through this period, and by choices employees may have made in response to actual or perceived changes in the world around them. Further, it is possible that some of these changes will reflect a new reality and show up in future years, while other changes will likely revert back quickly to the previous norms. Consequently, we believe caution is warranted in this study before making significant changes based on the recent data only.

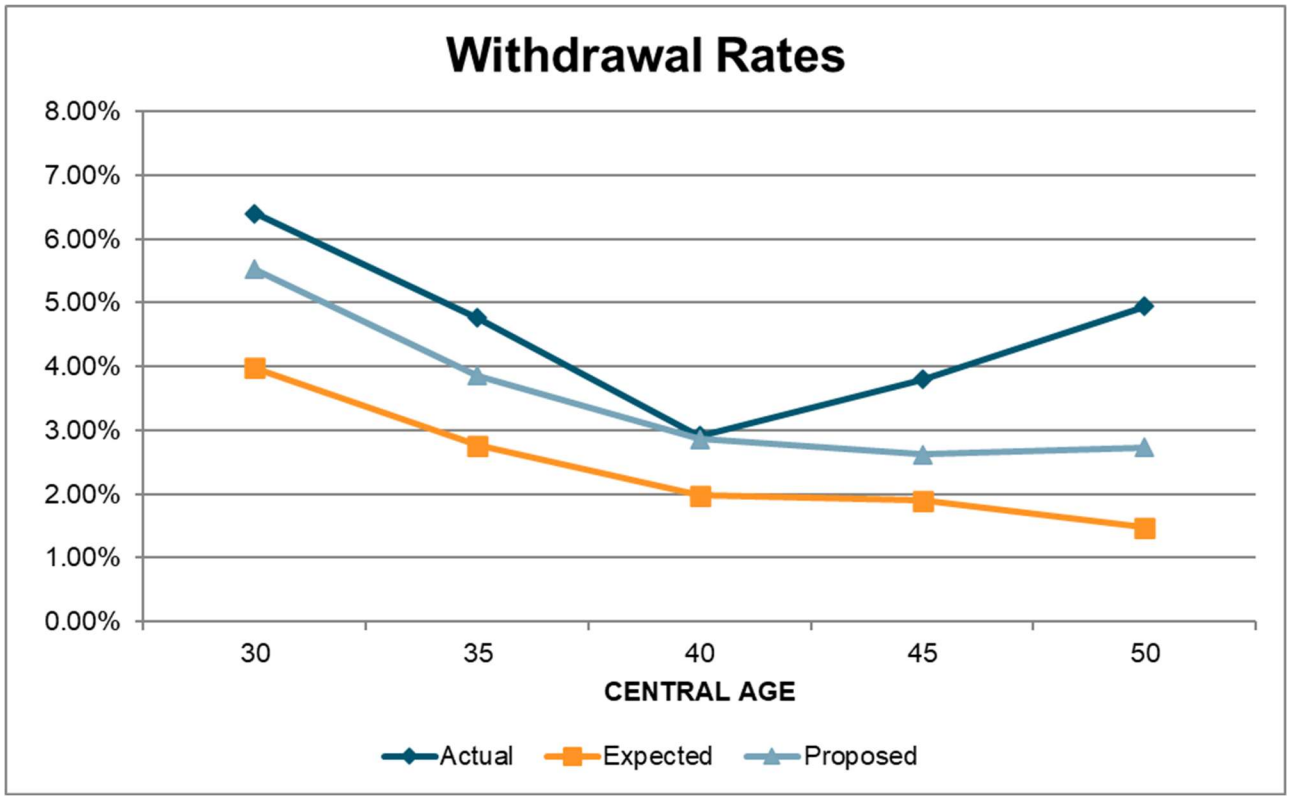
RATES OF WITHDRAWAL

COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
20	0	1	0.000
25	6	11	0.545
30	16	10	1.600
35	13	8	1.625
40	10	7	1.429
45	10	5	2.000
50	8	2	4.000
53 & over	1	0	0.000
TOTAL	**64**	**44**	**1.455**

The following graph shows a comparison of the present, actual and proposed rates of withdrawal.

RATES OF WITHDRAWAL FOR ACTIVE MEMBERS



The rates of withdrawal adopted by the Board are used to determine the expected number of separations from active service which will occur as a result of resignation or dismissal. The results of our four-year study indicate that, in aggregate, the actual number of withdrawals was significantly more than expected.

As seen on the table on page 31, there were 64 actual withdrawals versus 44 expected withdrawals over the four-year period of this investigation. As seen on the graph on the previous page, significant differences between actual and expected rates were seen at most ages. During the current investigation period, there were larger than expected numbers of withdrawals at every age group greater than or equal to 30. **Therefore, at this time, we recommend changes in the rates of withdrawal that recognize the upward trend of withdrawal rates and will hopefully better match experience in the future.**

The following tables show a comparison between the current withdrawal rates and a sample of the proposed withdrawal rates.

COMPARATIVE RATES OF WITHDRAWAL

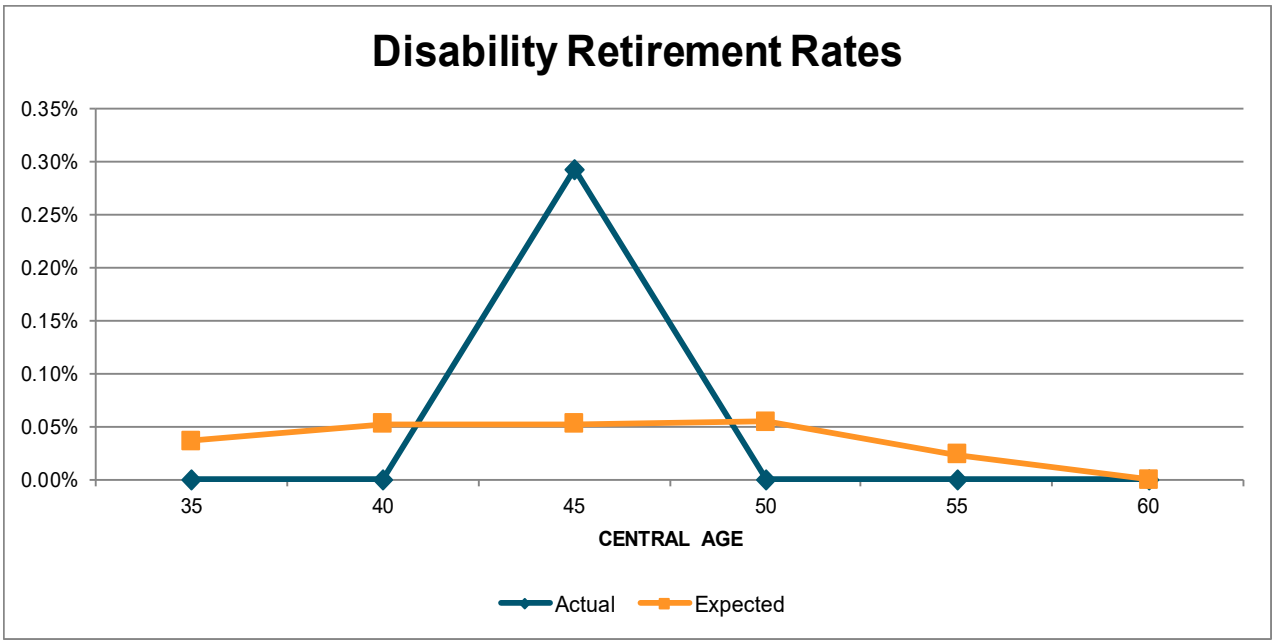
CENTRAL AGE	Current	Proposed
25	0.0700	0.0600
30	0.0400	0.0550
35	0.0275	0.0375
40	0.0200	0.0300
45	0.0200	0.0275
50	0.0200	0.0275
53 & over	0.0000	0.0000

COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE BASED ON PROPOSED RATES

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
20	0	0	0.000
25	6	11	0.545
30	16	14	1.143
35	13	11	1.182
40	10	10	1.000
45	10	7	1.429
50	8	4	2.000
53 & over	1	1	0.000
TOTAL	**64**	**58**	**1.103**

RATES OF DISABILITY RETIREMENT

There was only one disability retirement over the four-year period of this investigation or the prior study period. In fact, this Plan has only had 2 disability retirement in the past 14 years. Since the rates of disability retirement were lowered in the last experience study, **we recommend no change in the rates of disability at this time.**

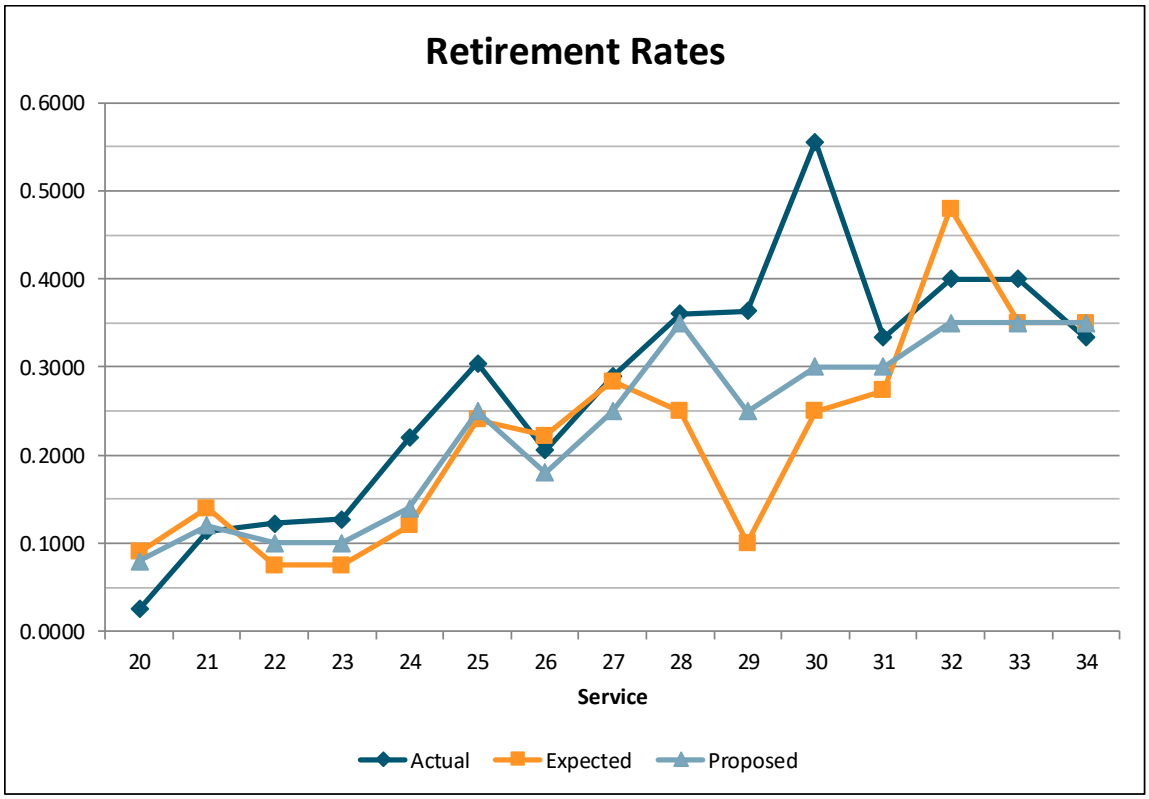


RATES OF RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS

YEARS OF SERVICE	NUMBER OF RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
Under 20	2	1	2.000
20	1	4	0.250
21	5	6	0.833
22	7	4	1.750
23	7	4	1.750
24	11	6	1.833
25	14	11	1.273
26	8	9	0.889
27	13	13	1.000
28	9	6	1.500
29	4	1	4.000
30	5	2	2.500
31	1	1	1.000
32	2	2	1.000
33	2	2	1.000
34	2	2	1.000
Subtotal	**93**	**74**	**1.257**
35	1	1	1.000
36	1	0	0.000
37	0	0	0.000
38	2	2	1.000
39	0	0	0.000
40 & over	1	1	1.000
GRAND TOTAL	**98**	**78**	**1.256**

The following graph shows a comparison of the present, actual, and proposed rates of service retirements.



As you can see from the table on page 36, in aggregate, there were 98 actual retirements versus 78 expected retirements over the four-year period of this investigation. Reviewing the retirement experience, we see that more actual retirements than expected occurred at years of service from 22 to 25 (39 vs. 25) and at years of service from 28 to 30 (18 vs. 9).

Therefore, we recommend a change in the rates of retirement to better match experience by lowering the rate at 20 years of service and raising rates at years of service from 22 to 25 and again from 28 to 30.

The following table shows a comparison between the present retirement rates and the proposed rates.

Service	Current Rates of Retirement*	Proposed Rates of Retirement*
5	0.075	0.075
6	0.075	0.075
7	0.075	0.075
8	0.075	0.075
9	0.075	0.075
10	0.075	0.075
11	0.075	0.075
12	0.075	0.075
13	0.075	0.075
14	0.075	0.075
15	0.075	0.075
16	0.075	0.075
17	0.075	0.075
18	0.075	0.075
19	0.075	0.075
20	0.090	0.080
21	0.120	0.120
22	0.075	0.100
23	0.075	0.100
24	0.120	0.140
25	0.240	0.250
26	0.180	0.180
27	0.250	0.250
28	0.250	0.350
29	0.100	0.250
30	0.250	0.300
31	0.275	0.300
32	0.350	0.350
33	0.350	0.350
34	0.350	0.350
35	0.350	0.350
36	0.350	0.350
37	0.350	0.350
38	0.500	0.500
39	0.500	0.500
40+	1.000	1.000

* The annual rate of service retirement is 100% at age 63

COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS
BASED ON PROPOSED RATES

YEARS OF SERVICE	NUMBER OF RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
Under 20	2	1	2.000
20	1	3	0.333
21	5	6	0.833
22	7	6	1.167
23	7	6	1.167
24	11	7	1.571
25	14	12	1.167
26	8	9	0.889
27	13	13	1.000
28	9	9	1.000
29	4	3	1.333
30	5	3	1.667
31	1	1	1.000
32	2	2	1.000
33	2	2	1.000
34	2	2	1.000
Subtotal	**93**	**85**	**1.094**
35	1	1	1.000
36	1	0	0.000
37	0	0	0.000
38	2	2	1.000
39	0	0	0.000
40 & over	1	1	1.000
TOTAL	**98**	**89**	**1.101**

RATES OF POST-RETIREMENT MORTALITY

One of the most important demographic assumptions in the valuation is mortality because it projects how long benefit payments will be made. The longer members live, the greater the true cost of future benefit obligations will be.

For many years, rates of mortality have been declining, meaning people, in general, are living longer. Consequently, we anticipate that mortality tables will need to be updated periodically. Because of potential differences in mortality, we break down our study by gender (males and females) and by status (healthy retirees, beneficiaries, disabled retirees, and active members).

Because of the substantial amount of data required to construct a mortality table, actuaries usually rely on standard tables published by the Society of Actuaries. Actuaries then use various adjustments such as age or scaling adjustments to the standard, published mortality tables in order to better match the observed mortality rates of a specific group.

The first of these adjustments is an age adjustment that can be either a “setback” or a “set forward”. A one-year age setback treats all members as if they were one year younger than they truly are when applying the rates in the mortality table. For example, a one year setback would treat a 61-year old retiree as if he will exhibit the mortality of a 60-year old in the standard mortality table.

The second adjustment that can be used to adjust the mortality rates in a standard table to better fit actual experience is to “scale” a mortality table by multiplying the probabilities of death by factors less than one (to reflect better mortality) or factors greater than one (to reflect poorer mortality). Scaling factors can be applied to an entire table or a portion of the table. Of course, if needed, actuaries may use both of these methods to develop an appropriate table to model the mortality of the specific plan population.

In 2019, the Society of Actuaries released a family of mortality tables named the Pub-2010 tables. While prior pension mortality tables have been based solely on private corporate and union retirement plans, these new tables are based entirely on public sector plan data. These tables are split by three membership types: Safety, Teachers, and General to reflect the observed differences in mortality patterns related to the three groups. Tables are further split for healthy retirees, disabled retirees, contingent beneficiaries, and employees. There are still other breakdowns in these tables for at, above or below median annuity values.

The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying and monitoring. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 27, *Selection of Assumptions for Measuring Pension Obligations*. This ASOP requires the pension actuary to make and disclose a specific recommendation with respect to future improvements in mortality after the valuation date, although it does not require that an actuary assume there will be future improvements. There have been significant improvements in longevity in the past, although there are different opinions about future expectations, and thus there is a subjective component in the estimation of future mortality improvement. We believe it is prudent to anticipate that the trend will continue to some degree in the future and that it is appropriate to reflect some future mortality improvement as part of the mortality assumption.

PERS currently uses generational mortality approach that directly anticipates future improvements in mortality by using a different set of mortality rates for each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain "built-in" mortality improvements, e.g., a member who turns age 65 in 2045 has a longer life expectancy than a member who turns age 65 in 2025. When using generational mortality, the A/E ratios for the observed experience are set near 100% as future mortality improvements will be taken into account directly in the actuarial valuation process.

The generational approach is our preferred method for recognizing future mortality improvements in the valuation process because it is more direct and results in longer life expectancy for members who are younger, consistent with what we believe is more likely to occur. Over the last ten to fifteen years, this method has become quite common as computing power has increased.

COMPARISON OF ACTUAL AND EXPECTED CASES OF POST-RETIREMENT DEATHS

CENTRAL AGE OF GROUP	NUMBER OF POST-RETIREMENT DEATHS		
	MALES AND FEMALES		
	Actual	Expected	Ratio of Actual to Expected
SERVICE RETIREMENTS			
57 & Under	0	1	0.000
60	7	3	2.229
65	6	7	0.861
70	8	9	0.939
75	10	12	0.820
80	10	13	0.784
85	17	10	1.655
90	7	6	1.176
93 & Over	4	2	2.105
Total	**69**	**63**	**1.095**
SURVIVORS			
57 & Under	1	0	3.571
60	0	0	0.000
65	0	0	0.000
70	2	1	1.351
75	1	4	0.267
80	10	6	1.626
85	6	8	0.770
90	11	9	1.275
93 & Over	12	10	1.245
Total	**43**	**38**	**1.123**

As can be seen from the table on the previous page, the number of actual post-retirement deaths was fairly close to the expected number during the last four-year period. However, the HSPRS does not have enough mortality data by itself to warrant credible data.

Therefore, we recommend that the rates of mortality for post-retirements match the PERS mortality tables which we recommended a change to the amount-weighted mortality tables for all three post-retirement mortality tables (from the headcount-weighted), adjustments or refinements for service retirees and beneficiaries from the current table, and an update to the most recent MP-2021 projection scale from the MP-2020 scale.

Service Retirees (Proposed Table)

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Retiree	None	Male: 107% for all ages Female: 97% up to age 82, 100% for ages 83 to 87, and 110% for ages above 87	MP-2021

Contingent Annuitants (Proposed Table)

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Contingent Annuitant	Male: Set forward 2 years Female: Set forward 3 years	None	MP-2021

Disabled Retirees (Proposed Table)

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubG.H-2010 Disabled	Male: Set forward 1 year Female: Set forward 2 years	Male: 134% for all ages Female: 125% for all ages	MP-2021

RATES OF PRE-RETIREMENT MORTALITY

The active member mortality assumption models eligibility for death benefits prior to retirement. Therefore, it has a much smaller impact on the valuation results than the post-retirement mortality assumption.

It is difficult to isolate the mortality for active members as it may be impacted by active members first terminating or moving to disabled status before death. The data collection methods used in this study do not fully capture known deaths, and so sometimes this can be misleading. Finally, the probability of active death is very small so volatility is not uncommon.

For the four-year period ending June 30, 2024, there were 3 active deaths and these all took place during the 2020/2021 fiscal year. Obviously, the lack of data makes this set not credible so we prefer to set this assumption by utilizing the more reliable analysis performed on the PERS data.

To be consistent with PERS and similar to the post-retirement mortality recommendations, **we recommend a change to the amount-weighted mortality tables for the pre-retirement mortality table (from the headcount-weighted), an adjustment in the current pre-retirement mortality table at this time to a set forward of 1 year on rates and the change to the most updated projection scale table, MP-2021.**

Membership Table	Set Forward (+)/ Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Employee	Male: Set forward 2 years Female: Set forward 1 year	Male: 75% up to age 47, 100% for ages 48 to 57, and 120% for ages above 58 Female: 75% up to age 47, 100% for ages 48 to 52, and 110% for ages above 53	MP-2021

RATES OF SALARY INCREASE

COMPARISON OF ACTUAL AND EXPECTED SALARIES OF ACTIVE MEMBERS

Service	SALARIES AT END OF YEAR MALES AND FEMALES		
	Actual	Expected	Ratio of Actual to Expected
< 1	$6,695,758	$6,396,993	1.047
1	6,668,106	6,612,697	1.008
2	6,786,937	6,816,652	0.996
3	5,535,969	5,355,471	1.034
4	5,187,978	4,953,432	1.047
5	4,362,634	4,365,020	0.999
6	2,100,071	2,106,441	0.997
7	2,220,834	2,086,797	1.064
8	3,765,079	3,723,628	1.011
9	2,224,675	2,261,444	0.984
10	2,612,061	2,358,426	1.108
11	2,611,874	2,661,043	0.982
12	2,496,629	2,504,581	0.997
13	5,868,173	5,866,769	1.000
14	7,990,415	7,834,569	1.020
15	8,095,071	7,801,465	1.038
16	7,319,792	7,217,657	1.014
17	3,865,958	3,798,428	1.018
18	2,067,973	1,994,719	1.037
19	4,188,157	4,350,135	0.963
20	4,178,729	4,043,554	1.033
21	4,781,701	4,746,255	1.007
22	4,423,716	4,397,794	1.006
23	3,265,727	3,308,658	0.987
24	2,793,024	2,751,784	1.015
25+	9,646,865	9,688,714	0.996
TOTAL	**$121,753,906**	**$120,003,126**	**1.015**

Actual rates of salary increase were within 5% of expected at all service levels except for 7 years of service over the four-year period. Additionally, in the aggregate, salaries were within 1.5% of expected which is a slight improvement over the prior experience investigation even though it includes the period 2021 to 2023 which experienced much higher than expected salary increases. **Since the 2024 salary increases returned to match our expectations, we recommend no change to the salary increase rates at this time.**

See Appendix D for the full set of rates of salary increases.

OTHER ASSUMPTIONS

PERCENT MARRIED: Currently, 100% of active members are assumed to be married and elect a joint & survivor payment form. We are not provided with marital status on the census data. **However, we believe the current assumption is fairly conservative and recommend no change at this time.**

SPOUSE AGE DIFFERENCE: Currently, for married members, it is assumed a male is three years older than his spouse. **We have reviewed this assumption and recommend no change at this time.**

UNUSED LEAVE AND MILITARY SERVICE: Currently, we assume that participants will have on average 2.25 total years of unused leave (sick and personal) and military service at retirement. We reviewed this assumption for retired participants for each of the past four years and the average number of years of unused leave is 1.78 years and the average number of military years is 0.61 years. There has definitely been an increase in these service amounts at retirement during this period. **Therefore, we recommend increasing this assumption to 2.50 years.**

Year	Military Service	Unused Leave	Total
2021	0.57	1.64	2.21
2022	0.60	1.75	2.35
2023	0.63	1.82	2.45
2024	0.65	1.89	2.54
Average	0.61	1.78	2.39

OPTION FACTORS: The option factors, currently in use by all of the Retirement Systems, are based on the mortality table and investment rate of return (discount rate) used in the valuation. **We will review our recommend change in the mortality tables and projection scale and determine if a change in the factors is needed at this time.**

APPENDIX A – HISTORICAL JUNE CPI (U) INDEX

Year	CPI (U)	Year	CPI (U)
1963	30.6	1994	148.0
1964	31.0	1995	152.5
1965	31.6	1996	156.7
1966	32.4	1997	160.3
1967	33.3	1998	163.0
1968	35.7	1999	166.2
1969	34.7	2000	172.4
1970	38.8	2001	178.0
1971	40.6	2002	179.9
1972	41.7	2003	183.7
1973	44.2	2004	189.7
1974	49.0	2005	194.5
1975	53.6	2006	202.9
1976	56.8	2007	208.352
1977	60.7	2008	218.815
1978	65.2	2009	215.693
1979	72.3	2010	217.965
1980	82.7	2011	225.722
1981	90.6	2012	229.478
1982	97.0	2013	233.504
1983	99.5	2014	238.343
1984	103.7	2015	238.638
1985	107.6	2016	241.018
1986	109.5	2017	244.955
1987	113.5	2018	251.989
1988	118.0	2019	256.143
1989	124.1	2020	257.797
1990	129.9	2021	271.696
1991	136.0	2022	296.311
1992	140.2	2023	305.109
1993	144.4	2024	314.069

Callan's Capital Market Assumptions and
PERS' Board of Trustees Target Asset Allocation

Geometric Real Rates of Return and Standard Deviations by Asset Class

Asset Class	Expected Real Rate of Return	Standard Deviation
Domestic Equity	4.75%	17.00%
International Equity	4.75	20.15
Global Equity	4.95	21.25
Fixed Income	2.25	4.40
Real Estate	3.75	14.00
Private Equity	6.00	27.60
Cash Equivalents	0.50	0.90

Asset Allocation Targets

Asset Class	Asset Allocation
Domestic Equity	27.00%
International Equity	20.00
Global Equity	12.00
Fixed Income	20.00
Real Estate	10.00
Private Equity	10.00
Cash Equivalents	1.00

APPENDIX C – SOCIAL SECURITY ADMINISTRATION WAGE INDEX

Year	Wage Index	Annual Increase	Year	Wage Index	Annual Increase
1962	$4,291.40	5.01%	1993	$23,132.67	0.86%
1963	4,396.64	2.45	1994	23,753.53	2.68
1964	4,576.32	4.09	1995	24,705.66	4.01
1965	4,658.72	1.80	1996	25,913.90	4.89
1966	4,938.36	6.00	1997	27,426.00	5.84
1967	5,213.44	5.57	1998	28,861.44	5.23
1968	5,571.76	6.87	1999	30,469.84	5.57
1969	5,893.76	5.78	2000	32,154.82	5.53
1970	6,186.24	4.96	2001	32,921.92	2.39
1971	6,497.08	5.02	2002	33,252.09	1.00
1972	7,133.80	9.80	2003	34,064.95	2.44
1973	7,580.16	6.26	2004	35,648.55	4.65
1974	8,030.76	5.94	2005	36,952.94	3.66
1975	8,630.92	7.47	2006	38,651.41	4.60
1976	9,226.48	6.90	2007	40,405.48	4.54
1977	9,779.44	5.99	2008	41,334.97	2.30
1978	10,556.03	7.94	2009	40,711.61	-1.51
1979	11,479.46	8.75	2010	41,673.83	2.36
1980	12,513.46	9.01	2011	42,979.61	3.13
1981	13,773.10	10.07	2012	44,321.67	3.12
1982	14,531.34	5.51	2013	44,888.16	1.28
1983	15,239.24	4.87	2014	46,481.52	3.55
1984	16,135.07	5.88	2015	48,098.63	3.48
1985	16,822.51	4.26	2016	48,642.15	1.13
1986	17,321.82	2.97	2017	50,321.89	3.45
1987	18,426.51	6.38	2018	52,145.80	3.62
1988	19,334.04	4.93	2019	54,099.99	3.75
1989	20,099.55	3.96	2020	55,628.60	2.83
1990	21,027.98	4.62	2021	60,575.07	8.89
1991	21,811.60	3.73	2022	63,795.13	5.31
1992	22,935.42	5.15	2023	66,621.80	4.43

TABLE 1
RATES OF SEPARATION FROM ACTIVE SERVICE

AGE	RATES OF WITHDRAWAL		RATES OF DEATH* MALES	RATES OF DEATH* FEMALES	RATES OF DISABILITY
	Less than 20 Years of Service	20 or More Years of Service			
20	0.06000	0.03000	0.000360	0.000150	0.000169
21	0.06000	0.03000	0.000368	0.000158	0.000169
22	0.06000	0.03000	0.000368	0.000173	0.000169
23	0.06000	0.03000	0.000375	0.000188	0.000191
24	0.06000	0.03000	0.000383	0.000195	0.000191
25	0.06000	0.03000	0.000390	0.000210	0.000191
26	0.06000	0.03000	0.000398	0.000225	0.000191
27	0.06000	0.03000	0.000405	0.000240	0.000225
28	0.06000	0.03000	0.000413	0.000255	0.000225
29	0.05750	0.02875	0.000420	0.000270	0.000236
30	0.05500	0.02750	0.000428	0.000285	0.000259
31	0.05500	0.02750	0.000443	0.000308	0.000270
32	0.05000	0.02500	0.000450	0.000323	0.000304
33	0.04750	0.02375	0.000465	0.000345	0.000338
34	0.04000	0.02000	0.000480	0.000368	0.000349
35	0.03750	0.01875	0.000503	0.000390	0.000383
36	0.03500	0.01750	0.000525	0.000413	0.000394
37	0.03250	0.01625	0.000555	0.000443	0.000428
38	0.03000	0.01500	0.000585	0.000465	0.000450
39	0.03000	0.01500	0.000623	0.000495	0.000473
40	0.03000	0.01500	0.000660	0.000533	0.000506
41	0.02750	0.01375	0.000713	0.000563	0.000529
42	0.02750	0.01375	0.000758	0.000600	0.000574
43	0.02750	0.01375	0.000818	0.000638	0.000596
44	0.02750	0.01375	0.000878	0.000675	0.000641
45	0.02750	0.01375	0.000945	0.000720	0.000675
46	0.02750	0.01375	0.001020	0.000765	0.000743
47	0.02750	0.01375	0.001103	0.000818	0.000810
48	0.02750	0.01375	0.001590	0.001150	0.000866
49	0.02750	0.01375	0.001720	0.001230	0.000956
50	0.02750	0.01375	0.001850	0.001310	0.001035
51	0.02750	0.01375	0.002000	0.001390	0.001136
52	0.02750	0.01375	0.002160	0.001480	0.001260
53	0.02750	0.01375	0.002330	0.001727	0.001406
54	0.02750	0.01375	0.002520	0.001837	0.001541
55	0.00000	0.00000	0.002730	0.001947	0.001744
56			0.002960	0.002079	0.002003
57			0.003230	0.002211	0.002250
58			0.004212	0.002343	0.002543
59			0.004596	0.002497	0.002914
60			0.005016	0.002651	0.002914
61			0.005484	0.002827	0.000000

SERVICE	RATES OF RETIREMENT**
0	0.000
1	0.000
2	0.000
3	0.000
4	0.000
5	0.075
6	0.075
7	0.075
8	0.075
9	0.075
10	0.075
11	0.075
12	0.075
13	0.075
14	0.075
15	0.075
16	0.075
17	0.075
18	0.075
19	0.075
20	0.080
21	0.120
22	0.100
23	0.100
24	0.140
25	0.250
26	0.180
27	0.250
28	0.350
29	0.250
30	0.300
31	0.300
32	0.350
33	0.350
34	0.350
35	0.350
36	0.350
37	0.350
38	0.500
39	0.500
40+	1.000

* Adjusted Base rates

** The annual rate of service is 100% at age 63.

TABLE 2
RATES OF ANTICIPATED SALARY INCREASES*
(For Both Males and Females)

SERVICE	RATE
0	0.0500
1	0.0500
2	0.0500
3	0.0500
4	0.0500
5	0.0475
6	0.0475
7	0.0475
8	0.0425
9	0.0425
10	0.0425
11	0.0425
12	0.0425
13	0.0425
14	0.0400
15	0.0400
16	0.0400
17	0.0400
18	0.0400
19	0.0400
20	0.0400
21	0.0375
22	0.0375
23	0.0375
24	0.0375
25	0.0350

TABLE 3
BASE RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF SERVICE*

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000449	0.000155	71	0.023315	0.015384
20	0.000482	0.000175	72	0.026022	0.017169
21	0.000503	0.000194	73	0.029051	0.019148
22	0.000514	0.000204	74	0.032432	0.021359
23	0.000524	0.000223	75	0.036198	0.023823
24	0.000524	0.000243	76	0.040414	0.026578
25	0.000535	0.000252	77	0.045111	0.029643
26	0.000546	0.000272	78	0.050365	0.033067
27	0.000556	0.000291	79	0.056229	0.036879
28	0.000567	0.000310	80	0.062777	0.041138
29	0.000578	0.000330	81	0.070064	0.045891
30	0.000589	0.000349	82	0.078153	0.051187
31	0.000599	0.000369	83	0.087087	0.058860
32	0.000610	0.000398	84	0.096931	0.065660
33	0.000631	0.000417	85	0.107728	0.073240
34	0.000642	0.000446	86	0.119562	0.081690
35	0.000663	0.000475	87	0.132509	0.091120
36	0.000685	0.000504	88	0.146654	0.111804
37	0.000717	0.000534	89	0.162105	0.124718
38	0.000749	0.000572	90	0.178947	0.139117
39	0.000792	0.000601	91	0.195949	0.154077
40	0.000835	0.000640	92	0.212470	0.169103
41	0.000888	0.000689	93	0.228295	0.184085
42	0.000942	0.000728	94	0.243607	0.199133
43	0.001017	0.000776	95	0.258780	0.214566
44	0.001081	0.000825	96	0.274348	0.230791
45	0.002547	0.000902	97	0.290847	0.248193
46	0.002739	0.000999	98	0.308684	0.267113
47	0.002953	0.001116	99	0.328083	0.287672
48	0.003178	0.001251	100	0.348916	0.309760
49	0.003413	0.001387	101	0.370605	0.332915
50	0.003670	0.001552	102	0.392048	0.356202
51	0.003948	0.001727	103	0.413063	0.379434
52	0.004248	0.001930	104	0.433478	0.402391
53	0.004569	0.002153	105	0.453166	0.424875
54	0.004922	0.002406	106	0.472009	0.446699
55	0.005307	0.002677	107	0.489910	0.467709
56	0.005725	0.002988	108	0.506795	0.487751
57	0.006195	0.003337	109	0.522620	0.506737
58	0.006709	0.003715	110	0.535000	0.524590
59	0.007287	0.004152	111	0.535000	0.541255
60	0.007918	0.004627	112	0.535000	0.550000
61	0.008624	0.005160	113	0.535000	0.550000
62	0.009395	0.005752	114	0.535000	0.550000
63	0.010240	0.006421	115	0.535000	0.550000
64	0.011171	0.007159	116	0.535000	0.550000
65	0.012187	0.007993	117	0.535000	0.550000
66	0.013546	0.008914	118	0.535000	0.550000
67	0.015076	0.009943	119	0.535000	0.550000
68	0.016799	0.011087	120	1.000000	1.000000
69	0.018725	0.012368			
70	0.020886	0.013793			

* Adjusted Base Rates

TABLE 4
BASE RATES OF MORTALITY FOR BENEFICIARIES OF DECEASED MEMBERS*

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000480	0.000200	71	0.035160	0.022750
20	0.000490	0.000210	72	0.038360	0.024760
21	0.000490	0.000230	73	0.041830	0.026990
22	0.000500	0.000250	74	0.045590	0.029460
23	0.000510	0.000260	75	0.049710	0.032200
24	0.000520	0.000280	76	0.054240	0.035270
25	0.000530	0.000300	77	0.059260	0.038700
26	0.000540	0.000320	78	0.064860	0.042580
27	0.000550	0.000340	79	0.071100	0.046980
28	0.000560	0.000360	80	0.078020	0.051970
29	0.000570	0.000380	81	0.085690	0.057620
30	0.000590	0.000410	82	0.094140	0.064020
31	0.000600	0.000430	83	0.103440	0.071270
32	0.000620	0.000460	84	0.113610	0.079450
33	0.000640	0.000490	85	0.124680	0.088570
34	0.000670	0.000520	86	0.136760	0.098570
35	0.000700	0.000550	87	0.151110	0.109330
36	0.000740	0.000590	88	0.166730	0.120640
37	0.000780	0.000620	89	0.183000	0.132580
38	0.000830	0.000660	90	0.199560	0.145230
39	0.000880	0.000710	91	0.216290	0.158700
40	0.000950	0.000750	92	0.233230	0.173100
41	0.001010	0.000800	93	0.250530	0.188520
42	0.007330	0.000850	94	0.268370	0.205030
43	0.007600	0.004640	95	0.286890	0.222660
44	0.007880	0.004790	96	0.306160	0.241380
45	0.008160	0.004930	97	0.326090	0.261090
46	0.008450	0.005080	98	0.346360	0.281600
47	0.009110	0.005230	99	0.366400	0.302650
48	0.009350	0.005370	100	0.386040	0.323820
49	0.009600	0.005670	101	0.405120	0.344940
50	0.009850	0.005990	102	0.423520	0.365810
51	0.010120	0.006320	103	0.441130	0.386250
52	0.010420	0.006670	104	0.457860	0.406090
53	0.010730	0.007040	105	0.473640	0.425190
54	0.011080	0.007420	106	0.488430	0.443410
55	0.011470	0.007820	107	0.500000	0.460670
56	0.011920	0.008250	108	0.500000	0.476900
57	0.012430	0.008710	109	0.500000	0.492050
58	0.013020	0.009210	110	0.500000	0.500000
59	0.013710	0.009750	111	0.500000	0.500000
60	0.014500	0.010340	112	0.500000	0.500000
61	0.015430	0.010980	113	0.500000	0.500000
62	0.016500	0.011680	114	0.500000	0.500000
63	0.017760	0.012430	115	0.500000	0.500000
64	0.019210	0.013320	116	0.500000	0.500000
65	0.020860	0.014290	117	1.000000	0.500000
66	0.022710	0.015350	118	1.000000	1.000000
67	0.024760	0.016530	119	1.000000	1.000000
68	0.027030	0.017840	120	1.000000	1.000000
69	0.029500	0.019310			
70	0.032210	0.020940			

* Adjusted Base Rates

TABLE 5
BASE RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF DISABILITY*

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000480	0.000200	71	0.035160	0.022750
20	0.000490	0.000210	72	0.038360	0.024760
21	0.000490	0.000230	73	0.041830	0.026990
22	0.000500	0.000250	74	0.045590	0.029460
23	0.000510	0.000260	75	0.049710	0.032200
24	0.000520	0.000280	76	0.054240	0.035270
25	0.000530	0.000300	77	0.059260	0.038700
26	0.000540	0.000320	78	0.064860	0.042580
27	0.000550	0.000340	79	0.071100	0.046980
28	0.000560	0.000360	80	0.078020	0.051970
29	0.000570	0.000380	81	0.085690	0.057620
30	0.000590	0.000410	82	0.094140	0.064020
31	0.000600	0.000430	83	0.103440	0.071270
32	0.000620	0.000460	84	0.113610	0.079450
33	0.000640	0.000490	85	0.124680	0.088570
34	0.000670	0.000520	86	0.136760	0.098570
35	0.000700	0.000550	87	0.151110	0.109330
36	0.000740	0.000590	88	0.166730	0.120640
37	0.000780	0.000620	89	0.183000	0.132580
38	0.000830	0.000660	90	0.199560	0.145230
39	0.000880	0.000710	91	0.216290	0.158700
40	0.000950	0.000750	92	0.233230	0.173100
41	0.001010	0.000800	93	0.250530	0.188520
42	0.007330	0.000850	94	0.268370	0.205030
43	0.007600	0.004640	95	0.286890	0.222660
44	0.007880	0.004790	96	0.306160	0.241380
45	0.008160	0.004930	97	0.326090	0.261090
46	0.008450	0.005080	98	0.346360	0.281600
47	0.009110	0.005230	99	0.366400	0.302650
48	0.009350	0.005370	100	0.386040	0.323820
49	0.009600	0.005670	101	0.405120	0.344940
50	0.009850	0.005990	102	0.423520	0.365810
51	0.010120	0.006320	103	0.441130	0.386250
52	0.010420	0.006670	104	0.457860	0.406090
53	0.010730	0.007040	105	0.473640	0.425190
54	0.011080	0.007420	106	0.488430	0.443410
55	0.011470	0.007820	107	0.500000	0.460670
56	0.011920	0.008250	108	0.500000	0.476900
57	0.012430	0.008710	109	0.500000	0.492050
58	0.013020	0.009210	110	0.500000	0.500000
59	0.013710	0.009750	111	0.500000	0.500000
60	0.014500	0.010340	112	0.500000	0.500000
61	0.015430	0.010980	113	0.500000	0.500000
62	0.016500	0.011680	114	0.500000	0.500000
63	0.017760	0.012430	115	0.500000	0.500000
64	0.019210	0.013320	116	0.500000	0.500000
65	0.020860	0.014290	117	1.000000	0.500000
66	0.022710	0.015350	118	1.000000	1.000000
67	0.024760	0.016530	119	1.000000	1.000000
68	0.027030	0.017840	120	1.000000	1.000000
69	0.029500	0.019310			
70	0.032210	0.020940			

* Adjusted Base Rates