



Pennsylvania Public School Employees' Retirement System

**Experience Review for the Period
July 1, 2015 to June 30, 2020**



July 13, 2022

Board of Trustees
Pennsylvania Public School Employees'
Retirement System
5 North 5th Street
Harrisburg, PA 17101

Ladies and Gentlemen:

This report presents the results of the actuarial review of the demographic and economic experience of the active members, annuitants, beneficiaries, and survivors covered under the Pennsylvania Public School Employees' Retirement System (PSERS or System) for the five-year period July 1, 2015 to June 30, 2020.

This experience review was prepared in accordance with Section 8502(j) of the Retirement Code, which requires the actuary for PSERS to make an actuarial investigation into the mortality, service and compensation experience of the members and beneficiaries covered under the System at least once in each five-year period.

The attached report describes the actuarial process employed and identifies the significant results of the study.

Summary of Recommendations

The findings of this experience study and the corresponding recommendations were delivered to the Board of the Retirement System in four installments:

1. We presented our report on the Five-Year Demographic Experience Review Prepared as of June 30, 2020 at the Board's March 4, 2021 Budget/Finance Committee meeting. The report presented the results of the System's non-mortality related demographic experience review for the period July 1, 2015 through June 30, 2020, which included:
 - Withdrawal
 - Retirement
 - Disability
 - Withdrawal Annuity Benefit Commencement
 - Optional Forms of Payment Elections

PSERB Resolution 2021-03: At the March 5, 2021 Board meeting, the Board's Budget/Finance Committee endorsed, and the Board accepted, the Five-Year Demographic Experience Review Prepared as of June 30, 2020 report recommendations, which were first reflected in the June 30, 2021 actuarial valuation.
2. We presented our report on the Five-Year Mortality Experience Review Prepared as of June 30, 2020 at the Board's June 10, 2021 Budget/Finance Committee meeting. The report presented the results of the System's mortality experience review for the period July 1, 2015 through June 30, 2020, which included:
 - Mortality Experience among the System's Annuitants
 - Mortality Experience among the System's Active Membership

PSERB Resolution 2021-18: At the June 11, 2021 Board meeting, the Board's Budget/Finance Committee endorsed, and the Board accepted, the Five-Year Mortality Experience Review Prepared as of June 30, 2020 report recommendations, which were first reflected in the June 30, 2021 actuarial valuation.

3. We presented our report on an Update of Administrative Option Factors at the Board's August 5, 2021 Budget/Finance Committee meeting. The report presents our review, analysis, and recommendation to update the System administrative option factors to reflect the applicable demographic and economic assumptions, which were implemented beginning with the June 30, 2021 actuarial valuation.

PSERB Resolution 2021-32: At the August 6, 2021 Board meeting, the Board's Budget/Finance Committee endorsed, and the Board accepted, the Update of Administrative Option Factors report recommendations, which will be effective July 1, 2022 and first reflected in the June 30, 2021 actuarial valuation.

4. We presented our report on the Five-Year Economic Experience Review Prepared as of June 30, 2020 at the Board's August 5, 2021 Budget/Finance Committee meeting. The report presented the results of the System's economic experience review for the period July 1, 2015 through June 30, 2020, which included:

- Investment Return
- Inflation
- Individual Salary Increases
- Payroll Growth

It should be noted that Aon is the PSERS' Board investment consultant. We are not investment professionals and our opinion in reviewing the investment return and inflation assumptions are limited to ensuring that they do not significantly differ from what we deem as reasonable in order to comply with applicable Actuarial Standards of Practice; our analyses of the investment return and inflation assumptions were made in relation to current underlying economic conditions.

PSERB Resolution 2021-33: At the August 6, 2021 Board meeting, the Board's Budget/Finance Committee endorsed, and the Board accepted, the Five-Year Economic Experience Review Prepared as of June 30, 2020 report recommendations, which were first reflected in the June 30, 2021 actuarial valuation.

A detailed analysis is included in the report. The financial impact of adopting the recommended assumptions is shown in the table below.

**Financial Impact of the Recommended Assumptions
 As of the June 30, 2020 Valuation
 (\$ Amounts in Thousands)**

Item	Unfunded Accrued Liability ¹	Employer Pension Contribution Rate ²
1. Current Assumptions	\$ 44,034,462	33.99%
2. Impact of Change in Assumptions	<u>2,785,475</u>	<u>(0.10)</u>
3. Revised Assumptions	\$ 46,819,937	33.89%

1. Actuarial value of assets basis.

2. Does not include the health insurance rate, which is 0.80% for the June 30, 2020 valuation. Note that the recommended assumptions would reduce the health insurance rate to 0.78%.

**Projected Financial Impact of Adopting Recommended Assumptions
 As of the June 30, 2021 Valuation
 (\$ Amounts in Thousands)**

Item	Unfunded Accrued Liability ³	Employer Pension Contribution Rate ⁴
1. Current Assumptions	\$ 43,716,429	34.34%
2. Impact of Change in Assumptions	<u>2,805,557</u>	<u>0.42</u>
3. Revised Assumptions	\$ 46,521,986	34.76%

3. Actuarial value of assets basis.

4. Does not include the health insurance rate.

The potential impact of the recommended assumptions on the June 30, 2021 valuation was estimated using the same data, actuarial methods and assumptions that were used in the June 30, 2020 actuarial valuation, as well as the following assumptions with respect to the June 30, 2021 valuation:

- a. The recommended assumptions are first reflected in the June 30, 2021 valuation.
- b. The active workforce size is assumed to remain constant over the projection period.
- c. Future new employees have similar characteristics (age/gender/salary) to new employees for the period July 1, 2017 through June 30, 2020. Among new school employees hired on or after July 1, 2020, 98% will become Class T-G members, 1% will elect Class T-H membership, and 1% will elect Class DC participation.
- d. Based on preliminary reports from PSERS, we assume that the Retirement System earned a fiscal year 2021 investment return of 22.03%.
- e. Based on preliminary reports from PSERS, we assume that the Retirement System will cover a fiscal year 2023 appropriation payroll of \$14.499 billion.

It should be noted that it is difficult to estimate the potential cost of the recommended assumptions. The projected fiscal year 2021 results may be different from actual results that will be determined during the June 30, 2021 valuation due to demographic and financial experience different from that assumed. Accordingly, the information should not be used for any purpose other than providing the user with an estimate of future employer pension cost obligations based on the above parameters.

Further, the above estimates are limited to the effect of the changes in assumptions on future funding contributions of the System. They do not provide any information with regard to the impact such changes may have on financial disclosures and expense under GASB.

Buck performed the experience review based on data supplied by the System to perform the annual actuarial valuations. While we did not verify the data at their source, we did perform tests for internal consistency and reasonableness. The results of this review are dependent on the accuracy of the data.

Use of Models

Actuarial Standard of Practice No. 56 (ASOP 56) provides guidance to actuaries when performing actuarial services with respect to designing, developing, selecting, modifying, using, reviewing, or evaluating models. For this presentation Buck used the following:

- internally developed and third-party model to compare actual versus assumed experience and determine proposed assumptions to use for valuing the liabilities in the third-party software

- models were used to analyze the investment return assumption as discussed in Buck's Expected Return on Assets Analysis presentation during the Board's Budget/Finance Committee August 5, 2021 meeting
- third-party software to calculate the liabilities associated with the System based on current and proposed assumptions
- an internally developed model that applies applicable funding methods and policies to the liabilities derived from the output of the third-party software and other inputs, such as System assets and contributions, to determine the contribution rates

Buck has an extensive review process for annual valuations in which the results of the liability calculations are checked using detailed sample output, changes from year to year are summarized by source, and significant deviations from expectations are investigated. Other outputs and the internal model are similarly reviewed in detail and at a high level for accuracy, reasonability, and consistency with prior results. The models used for annual valuations are used for this report and any adaptations for this report are checked and reviewed by experts within the company who are familiar with applicable funding methods as well as the manner in which the model generates its output. If significant changes are made to the internal model, extra checking and review are completed.

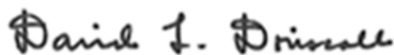
Actuarial Standard of Practice No. 51 (ASOP 51) applies to funding calculations such as those presented in this report and requires certain disclosures of potential risks. Exhibit IX contains an assessment of the key risks applicable to the System.

This report was prepared to summarize for the Board and Staff of PSERS the experience review prepared as of June 30, 2020, in accordance with Section 8502(j) of the Retirement Code. Use of this report for any other purpose, or by anyone other than the Board of Trustees or the staff of PSERS or employers or its auditors, may not be appropriate and may result in mistaken conclusions because of failure to understand applicable assumptions, methods, or inapplicability of the report for that purpose. Buck should be asked to review any statement to be made on the basis of the results contained in this report. Buck will accept no liability for any such statement made without prior review by Buck.

To the best of our knowledge, this experience investigation report is complete and accurate. Future actuarial measurements may differ significantly from current measurements due to plan experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in plan provisions or applicable law. An analysis of the potential range of future results is beyond the scope of this assignment.

This report was prepared under our supervision. David L. Driscoll is a Fellow of the Society of Actuaries and a Member of the American Academy of Actuaries. Edward Quinn and Salvador Nakar are Members of the American Academy of Actuaries. We meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and we are available to answer questions concerning it.


Sincerely,



David L. Driscoll, FSA, MAAA, EA
Principal, Consulting Actuary



Edward Quinn, MAAA, EA
Director, Retirement Actuary



Salvador Nakar, MAAA, EA
Senior Consultant, Actuary

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Pennsylvania Public School Employees' Retirement System Experience Review for the Period July 1, 2015 to June 30, 2020

Section I - Introduction

Section 8502(j) of the Retirement Code provides that in every five-year period, the actuary of the System is to make an actuarial investigation and evaluation of the mortality, service and compensation experience of the members and beneficiaries covered under the System during the preceding five years. This report presents the results of the experience review of the System for the five-year period July 1, 2015 through June 30, 2020.

The objectives of the investigation are to:

- Determine appropriate rates to anticipate the following events among active members:
 - withdrawal from employment;
 - death in active service;
 - disability retirement;
 - early retirement; and
 - superannuation retirement
- Determine the appropriate ultimate retirement age.
- Determine appropriate rates to anticipate withdrawing member benefit commencement elections.
- Determine appropriate rates to anticipate member elections for optional forms of benefit payment upon retirement.
- Determine appropriate rates to anticipate mortality among annuitants, survivor annuitants, beneficiaries, and disability annuitants.
- Determine appropriate updates to the System's administrative option factors used to determine member benefits at retirement.
- Determine appropriate economic assumptions to anticipate future trends in active members' salary increases, System's payroll growth and the investment return assumption in relation to the current underlying economic conditions.

Methodology

Data is supplied annually to the actuary by the System for purposes of the annual actuarial valuation. This data includes demographic characteristics of the current and past membership, including any changes in the members' status or relationship with the System. The data also includes a salary history for active members and System asset information. These demographic changes and economic history are the basis for the experience review.

For demographic assumptions other than mortality, tabulations were compiled which show the distribution by age of the number of members who were **exposed** during the five-year period to the events of withdrawal from employment, retirement, death, and disability. A member is considered exposed to an event if the member meets the age and service requirements for that event. The assumed rates of occurrence for each event, which are currently used in the annual actuarial valuations, were then applied to the number of members exposed to determine the number of members **expected** to separate from service for each category.

The **actual** number of members who separated from service due to withdrawal from employment, retirement, or disability was then compared to the expected number. The results were then expressed as a ratio of actual experience over expected experience. A ratio of actual to expected of 100% means the

actual occurrence of the event is exactly as anticipated, higher than 100% means actual occurrence of the event was more than expected, and less than 100% means fewer actual incidence of the event occurred than expected. In some instances, a high ratio is favorable for the financial experience of the System and in others, a high ratio is unfavorable. Data is generally grouped by age in five-year increments to provide statistically significant results.

The same approach was used to analyze the mortality-related demographic assumptions, except that salary and benefit amounts were used to determine the ratios between the **actual** and **expected amounts released due to death** to the amounts **exposed** among the active and retired members, respectively.

The expected and actual salaries as of the end of each year were also compared to actual salaries as of the end of each previous year. The comparisons show an average annual total increase in both expected and actual salaries for the five-year period.

The assumptions for the ultimate retirement age, benefit commencement upon leaving active employment and optional forms of benefit elections at retirement were also analyzed based on information accumulated during the study period and data provided by PSERS' staff.

The System's fund performance was also examined by the System's investment advisor, Aon. We are not investment professionals and our opinion in reviewing the investment return and inflation assumptions are limited to ensuring that they do not significantly differ from what we deem as reasonable in order to comply with applicable Actuarial Standards of Practice; our analysis of the investment return and inflation assumptions were in relation to the current underlying economic conditions.

The results of the experience review are the basis for the actuary's recommendation of assumption changes. In recommending assumptions, the actuary must also take into account special plan benefits as well as past economic factors.

In addition to comparing actual to expected experience and adjusting the results for special plan benefits and economic conditions, the actuary must consider future expectations of experience due to future plan changes or changes in the economy.

To summarize, the actuary's recommendation of assumptions is based on the following:

- comparison of actual to expected experience,
- adjustment for special plan benefits and past economic conditions,
- adjustment for future plan changes and economic conditions,
- adherence to industry standards, such as the Actuarial Standards of Practice

Generally, actuarial assumptions are selected with a slight margin for adverse experience so that the financial strength of the System can be maintained.

Summary of Experience Review

The summaries included in Section VII show the comparisons and results of the experience investigation for:

- the actual and expected cases of separation from active service,
- the actual and expected mortality among healthy annuitants, disability annuitants, beneficiaries and survivor annuitants, and members in active service,
- the annual rates of return on assets,
- the average annual increases in salaries among active members and
- payroll growth

Recommendations

Based on the results of our investigation, we recommended and the Board adopted revisions to the following assumptions:

Non-mortality Assumptions	Males	Females
Withdrawal		
<ul style="list-style-type: none"> • Non-Vested 	Net increase in rates	Net increase in rates
<ul style="list-style-type: none"> • Vested 	Net increase in rates	Net increase in rates
Early Retirement	Net decrease in rates	Net decrease in rates
Normal Retirement (Superannuation)	Net decrease in rates	Net decrease in rates
Ultimate Retirement Age	Increase to age 80	
Withdrawal Annuity Benefit Commencement	Reduce immediate commencement percentage, increase deferrals to Superannuation age	
Optional Forms of Payment Elections		
<ul style="list-style-type: none"> • Annuity Payments 	Adjust the optional form of benefit payment election assumption to reflect recent experience	
<ul style="list-style-type: none"> • Option 4 – Withdrawal of Accumulated Deductions at Retirement 	Decrease the percentage assumed to withdraw accumulated deductions upon retirement	

Mortality Assumptions	Males	Females
Mortality		
<ul style="list-style-type: none"> • Retirees 	Blended table based on 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Amount-Weighted Male Tables, with a 99.7% adjustment, generationally projected with Buck Modified scale MP-2020	Blended table based on 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Amount-Weighted Female Tables, with a 95.4% adjustment, generationally projected with Buck Modified scale MP-2020
<ul style="list-style-type: none"> • Disabled Retirees 	Pub-2010 Disability Mortality Non-Safety Amount-Weighted Male Table, with a 105.4% adjustment, generationally projected with Buck Modified scale MP-2020	Pub-2010 Disability Mortality Non-Safety Amount-Weighted Female Table, with a 95.0% adjustment, generationally projected with Buck Modified scale MP-2020
<ul style="list-style-type: none"> • Beneficiaries 	Pub-2010 Contingent Survivor Amount-Weighted Male Table, with a 106.0% adjustment, generationally projected with Buck Modified scale MP-2020	Pub-2010 Contingent Survivor Amount-Weighted Female Table, with a 116.2% adjustment, generationally projected with Buck Modified scale MP-2020
<ul style="list-style-type: none"> • Active Members 	Blended table based on 50% PubT-2010 Employee (Total Teacher dataset) and 50% PubG-2010 Employee (Total General Employees dataset) Amount-Weighted Male Tables, with a 99.0% adjustment, generationally projected with Buck Modified scale MP-2020	Blended table based on 50% PubT-2010 Employee (Total Teacher dataset) and 50% PubG-2010 Employee (Total General Employees dataset) Amount-Weighted Female Tables, with an 88.6% adjustment, generationally projected with Buck Modified scale MP-2020

Administrative Option Factors

Mortality based on a blend of the Board-approved annuitant base mortality tables to be used for actuarial valuations beginning June 30, 2021, generationally projected to 2025 with the Buck Modified 2020 improvement scale assuming the population consists of 25% males and 75% females

Economic Assumptions	Current Assumption	Revised Assumption
Payroll Growth	3.50% per annum	3.25% per annum
Rate of Inflation	2.75% per annum	2.50% per annum
Investment Return	7.25% per annum	7.00% per annum
Salary Increase	Effective average of 5.00% per annum	Effective average of 4.50% per annum

Financial Impact

We have determined the financial impact on the System of adopting the recommended set of assumptions. The calculations are based on the results of the June 30, 2020 actuarial valuation and are shown in the table below.

Pennsylvania Public School Employees' Retirement System
Financial Impact of Recommended Assumptions
As of the June 30, 2020 Valuation
(\$ Amounts in Thousands)

Item	Unfunded Accrued Liability ¹	Employer Pension Contribution Rate ²
1. Current Assumptions	\$ 44,034,462	33.99%
2. Impact of Change:		
• Non-mortality assumptions (approved by the Board March 4)	(926,084)	(1.37)
• Mortality assumptions (approved by the Board June 10)	1,283,554	0.74
• Administrative Option Factors (approved by the Board August 6)	770,066	0.59
• Economic Assumptions (approved by the Board August 6)	<u>1,657,939</u>	<u>(0.06)</u>
3. Revised Assumptions (1) + (2)	\$ 46,819,937	33.89%

1. Actuarial value of assets basis.

2. Does not include the health insurance rate, which is 0.80% for the fiscal year ending June 30, 2022. The change in the demographic assumptions noted above would reduce this rate to 0.78%. Note that the recommended assumptions became effective with the June 30, 2021 actuarial valuation.

We have also estimated the potential financial impact on the June 30, 2021 actuarial valuation and the results are shown in the table below.

Pennsylvania Public School Employees' Retirement System
Financial Impact of Adopting Recommended Assumptions
As of the June 30, 2021 Valuation³
 (\$ Amounts in Thousands)

Item	Unfunded Accrued Liability ⁴	Employer Pension Contribution Rate ⁵
1. Current Assumptions	\$ 43,716,429	34.34%
2. Impact of Change in Assumptions	<u>2,805,557</u>	<u>0.42</u>
3. Revised Assumptions	\$ 46,521,986	34.76%

- 3. The caveats outlined in the certification letter continue to apply to this information.
- 4. Actuarial value of assets basis.
- 5. Does not include the health insurance rate.

Section II – Discussion of Experience Review: Non-Mortality Demographic Assumptions for Active Members

Tables 1 through 4 included in Section VII summarize the actual and expected headcount based separations from active service due to withdrawal from employment, disability, early retirement, and superannuation retirement during the five-year period ended June 30, 2020.

The following discuss the results of the experience study with respect to the demographic factors, along with our recommendations for modifying the assumptions.

Act 2010-120 Memberships

Act 2010-120 (Act 120) created the Class T-E and an optional Class T-F membership groups. Any employee who becomes a member of the Retirement System between June 30, 2011 and July 1, 2019 would become a Class T-E member. A Class T-E member would be eligible for an annuity based upon an annual benefit accrual rate of 2% and would have a corresponding employee contribution requirement equal to 7.5% of compensation. Any employee who becomes a member of the Retirement System between June 30, 2011 and July 1, 2019 would have the option of electing Class T-F membership within 45 days of becoming a member. A Class T-F member would be eligible for an annuity based upon an annual benefit accrual rate of 2.5% and would have a corresponding employee contribution requirement equal to 10.3% of compensation. Act 120 also:

- Increased the superannuation requirements for Class T-E and Class T-F members to i) age 65 with a minimum of three years of service credit, or ii) any combination of age and service that totals 92 with at least 35 years of credited service.
- Increased the vesting eligibility requirement for Class T-E and Class T-F members to ten years of service credit.
- Made Class T-E and Class T-F members ineligible to receive a lump sum payment of member contributions; Act 2017-5 subsequently changed this provision.
- Made Class T-E and Class T-F members subject to “shared-risk” contributions if investment returns do not meet certain thresholds.

Since the June 30, 2012 actuarial valuation, the actuarial valuation applied the same demographic assumptions used for legacy Classes T-C and T-D members to Classes T-E and T-F members. One difficulty in the estimation of liabilities due the new Act 120 membership classes is that we would expect a change in retirement patterns to result since the benefit entitlements were reduced. In general, decreasing benefits may lead to postponed retirements among affected members, who may need to remain in service longer than would have previously been necessary to earn sufficient benefits to meet their financial needs in retirement. However, the nature and extent of such postponements will not be identified until the new Act 120 members retire under the new benefit design and credible data is accumulated for analysis.

As of the June 30, 2020 actuarial valuation, there were 64,458 Class T-E members with average service of 3.6 years and 14,559 Class T-F members with average service of 4.1 years. We believe:

- There is enough credible experience information for non-vested withdrawal prior to 10 years of Service and for Superannuation (age 65 with 3 years of service).
- The accumulated data does not provide credible information to examine experience for vested withdrawal after 10 years of Service and vested withdrawal after age 55 with 25 years of Service. The Class T-E and Class T-F experience will be reviewed when the next scheduled study is prepared as of June 30, 2025 and changes, if warranted, will be recommended at that time.

Act 2017-5

Act 5 of 2017 was passed in June of 2017. Under this legislation, any employee who becomes a member of the Retirement System on or after July 1, 2019 becomes a Class T-G member. Any employee who becomes a member on or after July 1, 2019 has the option to elect Class T-H membership or Class DC only participation within 90 days of becoming a member. Current active members and former PSERS members returning to active service are also eligible to elect Class T-G or Class T-H membership or Class DC participation. In addition, Act 5 of 2017 established a defined contribution plan for future new members effective July 1, 2019.

The Act 5 System provisions are as follows.

- A Class T-G member is eligible for an annuity based upon an annual benefit accrual rate of 1.25% and is subject to a corresponding employee contribution requirement of 5.5% of compensation. A Class T-H member is eligible for an annuity based upon an annual benefit accrual rate of 1.00% and is subject to a corresponding employee contribution requirement of 4.5% of compensation.
- The superannuation requirements for Class T-G and Class T-H members were increased to i) age 67 with a minimum of three years of service credit, or, for Class T-G only, ii) any combination of age and service that totals 97 with at least 35 years of credited service.
- Class T-G and Class T-H members vest after ten years of service and are eligible to apply for immediate commencement of benefits. Benefits of members with less than 25 years of service electing to commence payment at or after age 62 but prior to superannuation eligibility are reduced by the PSERS' actuarial equivalence factors based on an interest rate of 4.0%. Benefits of members electing to commence prior to age 62 are reduced from superannuation to age 62 using the PSERS' actuarial equivalence factors based on an interest rate of 4.0% and further reduced from age 62 to commencement age using the PSERS' actuarial equivalence factors based on an interest rate equal to the assumed rate of return on assets adopted by the Board.
- Class T-G members who terminate upon or after attaining 25 years of service are able to commence benefits immediately. Benefits commencing prior to eligibility for superannuation and on or after age 57 are reduced by 3% for each year by which commencement occurs prior to superannuation eligibility. Benefits commencing prior to age 57 are reduced by the PSERS' actuarial equivalence factors based on an interest rate of 4.0%. Class T-H members are subject to the same provisions except that age 55 is the age-related threshold.
- Class T-G and Class T-H members with five years of service are eligible for disability benefits based on a 2.0% accrual rate.
- Class T-G and Class T-H members are eligible to elect a cost-neutral Option 4 partial or full lump-sum distribution of accumulated deductions at benefit commencement.
- Class T-G and Class T-H members are subject to a shared risk/gain provision, under which the member contribution rate is not more than 3% below or 3% above the member's basic contribution rate, with rate increases or decreases made in increments of 0.75%.
- Class T-G and Class T-H members became DC plan participants. Class T-G member contributions are 2.75% of pay and plan employer contribution are 2.25% of pay. Class T-H member contributions are 3.00% of pay and plan employer contribution are 2.00% of pay.
- Class T-G and Class T-H members are eligible for the Health Care Premium assistance program.
- Class T-E and Class T-F members are eligible to elect a cost-neutral Option 4 partial or full lump-sum distribution of accumulated deductions at benefit commencement.
- Class T-E and Class T-F members are subject to a shared risk/gain provision, under which the member contribution rate will be no more than 2% below or 2% above the member's basic contribution rate, with increases or decreases in the rate in increments of 0.50%.

The June 30, 2020 actuarial valuation applied the same demographic assumptions used for Classes T-E and T-F members to Classes T-G and T-H members; there were 15,122 Class T-G members with average service of 0.4 years and 91 Class T-H members with average service of 0.5 years. Similar to the Act 120 memberships, we expect a change in retirement patterns to result since the benefit entitlements were reduced. However, the nature and extent of such postponements will not be identified until the new Act 5 members retire under the new benefit design and credible data is accumulated for analysis.

We believe that there is insufficient Class T-G and Class T-H data accumulated to develop demographic assumptions solely for Class T-G and Class T-H active members. The experience of Class T-G and Class T-H members was excluded from the study. The Class T-G and Class T-H experience will be reviewed when the next scheduled study is prepared as of (June 30, 2025) and changes, if warranted, will be recommended at that time.

The following table summarizes the ratio of actual to expected cases of separation from active service based on current assumptions.

Summary Comparison of Actual to Expected Cases Males and Females

Class T-C and Class T-D:

Event	Ratio of Actual To Expected Experience	
	Males	Females
Withdrawal from Employment		
• With Less than Five Years of Service	128%	120%
• Withdrawals with at least Five but less than Ten Years of Service	125%	116%
• With at least Ten Years of Service	112%	109%
Early Retirement	79%	79%
Superannuation Retirement	81%	72%

Class T-E and Class T-F:

Event	Ratio of Actual To Expected Experience	
	Males	Females
Withdrawal from Employment		
• Withdrawals with less than Ten Years of Service	120%	108%
Early Retirement	Insufficient data	Insufficient data
Superannuation Retirement	63%	70%

Class T-G and Class T-H:

Event	Ratio of Actual To Expected Experience	
	Males	Females
Withdrawal from Employment		
• Withdrawals with less than Ten Years of Service	Insufficient data	Insufficient data
Early Retirement	Insufficient data	Insufficient data
Superannuation Retirement	Insufficient data	Insufficient data

Rates of Withdrawal from Employment

For Class T-C and Class T-D, we examined the actual experience of terminations separately for members with less than five years of service, members with at least five but less than ten years of service, and members with at least ten years of service. The results of the study still show differences between the withdrawal rates for all three categories. For this reason, we recommend the continued use of separate rates of withdrawal.

Table 1(a) shows that during the five-year period, the actual rate of termination of males with less than five years of service was 128% of what was expected. Among females, the ratio was 120%. Therefore, we recommend the following adjustments to the withdrawal rates to reflect the experience.

- Male members: Increase the rates since the total incidence of actual withdrawals was higher than expected.
- Female members: Increase the rates since the total incidence of actual withdrawals was higher than expected.

Table 1(b) shows that during the five-year period, the actual rates of termination of members with at least five but less than ten years of service were higher than expected. Among males, the ratio of actual to expected experience was 125%. Among females, the ratio was 116%. Therefore, we recommend the following adjustments to the withdrawal rates to reflect the experience.

- Male members: Increase the rates since the total incidence of actual withdrawals was higher than expected.
- Female members: Actual withdrawals were less than expected for the central age 30 group, and we recommend decreasing the rates. Actual withdrawals for the older age groups were higher than expected and we recommend increasing the rates at these ages.

Table 1(c) shows that during the five-year period, the actual rates of termination of members with at least ten years of service were greater than expected. Among males, the ratio of actual to expected experience was 112%. Among females, the ratio was 109%. However, the ratio of actual to expected experience varied by age for both genders. Therefore, we recommend the following adjustments to the withdrawal rates to reflect the experience.

- Male members: Actual withdrawals were higher than expected for all ages, except age 50, and we recommend increasing the rate at these ages. Actual withdrawals at age 50 were lower than expected and we recommend decreasing the rates.
- Female members: Actual total withdrawals were higher than expected at age 40 and for all ages after age 45. We recommend an increase to the rates at these ages. Actual experience at age 45 and under age 40 were lower than expected and we recommend decreasing the rate.

For Class T-E and Class T-F, withdrawal rates currently assume those for Class T-C and Class T-D. We examined the actual experience of terminations separately for members with less than ten years of service while there is insufficient data to analyze for members with at least ten years of service. For this reason, we recommend the continued use of separate rates of withdrawal, using the actual experience for those with less than ten years of service and continuing to apply the withdrawal probabilities determined for Class T-C and Class T-D to those with at least ten years of service.

Table 1(d) shows that during the five-year period, the actual rate of termination of males with less than ten years of service was 120% of what was expected. Among females, the ratio was 108%. Therefore, we recommend the following adjustments to the withdrawal rates to reflect the experience for those with less than ten years of service.

- Male members: Increase the rates since the total incidence of actual non-vested withdrawals is higher than expected.

- Female members: Increase the rates since the total incidence of actual non-vested withdrawals is higher than expected.

For Class T-G and Class T-H, assumed withdrawal rates are currently those assumed for Class T-E and Class T-F. While we can reasonably expect a difference in the withdrawal rates between the Act 5 and Act 120 class memberships, there is insufficient data for Class T-G and Class T-H to analyze whether a different withdrawal pattern can be identified. For this reason, we recommend the continued use of the withdrawal probabilities determined for Class T-E and Class T-F.

Early Retirement

Table 3 shows a comparison of actual cases of early retirement to that expected for Class T-C and Class T-D. For males, the actual cases of early retirement were 21% less than expected. For females, the actual cases of early retirement were 21% less than expected. Therefore, we recommend the following adjustments to the active early retirement rates to reflect the experience.

- Male members: Actual retirements were lower than expected for all ages lower than age 61 and we recommend decreasing the rates. Actual retirements were higher than expected at 61 and we recommend increasing the rate.
- Female members: Actual total retirements were lower than expected at all ages. We recommend a decrease to the rates at all ages.

As of June 30, 2020, the Class T-E, Class T-F, Class T-G and Class T-H data accumulated is insufficient to establish early retirement after age 55 with 25 years of Service.

Superannuation Retirement

Table 4(a) shows the summary of experience for superannuation retirement for Class T-C and Class T-D. For males, the ratio of actual to expected experience was 81%. For females, the ratio was 72%. Therefore, we recommend the following adjustments to the active superannuation rates to reflect the experience.

- Male members: There is insufficient experience at ages under 53 to justify a change in the assumed rates at those ages. Actual retirements at ages 55 and 60 were lower than expected and we recommend a decrease to the assumed rates at these ages. Actual retirements after age 60 were higher than expected and we recommend an increase to the assumed rates at those ages.
- Female members: There is insufficient experience at ages under 53 to justify a change in the assumed rates at those ages. Actual retirements at ages 55, 60 and after age 69 were lower than expected and we recommend a decrease to the assumed rates at these ages. Actual retirements after age 60 but prior to age 70 were higher than expected and we recommend increases to the assumed rates at those ages.

For Class T-E and Class T-F, superannuation retirement rates currently assume those for Class T-C and Class T-D. Table 4(b) shows the summary of experience for superannuation retirement for Class T-E and Class T-F. For males, the ratio of actual to expected experience was 63%. For females, the ratio was 70%. Therefore, we recommend the following adjustments to the active superannuation rates to reflect the experience.

- Male members: Total actual retirements were lower than expected and we recommend decreasing the assumed rates.

- Female members: Total actual retirements were lower than expected and we recommend decreasing the assumed rates.

For Class T-G and Class T-H, assumed superannuation retirement rates are currently the same as those assumed for Class T-E and Class T-F, as applicable. While we can reasonably expect a difference in the superannuation retirement rates between the Act 5 and Act 120 class memberships, there is insufficient data for Class T-G and Class T-H to analyze whether a different retirement pattern can be identified. For this reason, we recommend the continued use of the withdrawal probabilities determined for Class T-E and Class T-F.

Disability Retirement

Event	Ratio of Actual To Expected Experience	
	Males	Females
Disability Retirement	60%	66%

Table 2 shows the summary of disability retirement experience among all active members who had completed at least five years of service. The five-year study shows that actual incidence of disability retirements among males and females were fewer than what was expected. For males, the ratio of actual to expected experience was 60%. For females, the ratio was 66%. Therefore, we recommend the following adjustments to the active disability rates to reflect the experience.

- Male members: Decrease rates since the incidence of actual disability retirements is lower than expected.
- Female members: Decrease rates since the incidence of actual disability retirements is lower than expected.

Ultimate Retirement Age

The valuation currently assumes that all active members will retire no later than age 74. Retirement information during the examination period shows that the active population who continue to remain active past age 74 decreases annually by approximately 25%. Therefore, we recommend changing the ultimate retirement assumption to assume that all active members will retire no later than age 80.

Withdrawing Member Benefit Commencement

Members may elect to commence benefit immediately upon vested withdrawal from the System and receive a reduced annuity, which has an early retirement factor applied.

- For Class T-C, Class T-D, Class T-E and Class T-F members, early retirement factors are based on the statutory interest rate of 4% per annum.
- For Class T-G and T-H members, early retirement factors from age 62 to superannuation are based on the statutory interest rate of 4% per annum. From commencement age to age 62, early retirement factors are based on the assumed long-term return on System assets as adopted by the Board

The valuation currently assumes that 90% of members commence payment immediately while 10% will defer payment to superannuation age. Withdrawal after vesting information during the examination period was compared to the retired member data used for the annual valuations and shows approximately 37% of the withdrawals commenced benefits immediately. Therefore, we recommend using an assumption that 50% will commence immediately and 50% will defer to superannuation age.

Optional Forms of Benefit Payment at Retirement: Annuity Payments

Per Section 8345(a) of the PSERS Retirement Code, any member who retires on a Withdrawal, Early or a Superannuation Annuity may apply for and elect to receive either a Maximum Single Life Annuity (MSLA), or a reduced annuity that is actuarially equivalent to the MSLA in accordance with the following options:

- Option 1. A life annuity to the member with a guaranteed total payment equal to the present value of the MSLA on the effective date of retirement with the provision that if, at the member's death, the member has received less than such present value, the unpaid balance shall be payable to the beneficiary.
- Option 2. A joint and 100% survivor annuity payable during the lifetime of the member with the full amount of such annuity payable thereafter to the member's survivor annuitant, if living at the time of the member's death.
- Option 3. A joint and 50% survivor annuity payable during the lifetime of the member with one-half of such annuity payable thereafter to the member's survivor annuitant, if living at the time of the member's death.
- Option 4. Some other benefit, which shall be certified by the actuary to be actuarially equivalent to the MSLA (subject to certain restrictions).

The current valuation assumption assumes the following optional form election probabilities for all eligible retirements:

- 50% will elect MSLA
- 20% will elect Option 1
- 20% will elect Option 2 (assuming males are 3 years older than females)
- 10% will elect Option 3 (assuming males are 3 years older than females)
- 0% will elect Option 4

However, the data during the examination period resulted with the following distribution of retiring members' election to receive a monthly annuity under one of the available optional forms of payment:

- 47.0% elected MSLA
- 23.1% elected Option 1
- 19.7% elected Option 2
- 8.9% elected Option 3
- 1.3% elected Option 4

The System's optional forms of payment factors are based on the statutory interest crediting rate, per Section 8102 of the PSERS Retirement Code, of 4% per annum. While the System's annual valuation currently uses a 7.25% rate of investment return. The current assumption then anticipates benefit payments that are greater than what the actual member retirement data produces.

Therefore, we recommend that the System's annual actuarial valuation recognize the prevalence of retiring member elections for annuity payments other than an MSLA and update the assumption to distribute anticipated active member retirements election for an optional form of annuity payment as follows:

- 45% will elect MSLA
- 25% will elect Option 1
- 20% will elect Option 2 (assuming males are 3 years older than females)
- 10% will elect Option 3 (assuming males are 3 years older than females)

- 0% will elect Option 4

The recommendation will better anticipate benefits payable from the System and should lessen any liability gains or losses experienced by the System over time.

Optional Forms of Benefit Payment at Retirement: Option 4 – Withdrawal of Accumulated Deductions at Retirement

In accordance with the provisions of Section 8345 of the PSERS Retirement Code, members may elect an Option 4 Lump Sum. Under this option, the member receives a lump sum that is less than or equal to the member's accumulated deductions at retirement and the balance of the present value of the MSLA is paid as a single life annuity to the member or under an optional form of annuity payment.

The current valuation assumption assumes 80% of all eligible retirements will elect to withdraw all accumulated deductions under an Option 4 form of payment.

The System's withdrawal of accumulated deductions conversion factors are based on the statutory interest crediting rate of 4% per annum for Class T-C and Class T-D members and, per Act 2017-5, based on an interest rate equal to the expected rate of return on assets assumption as adopted by the Board, currently 7.25% per annum, for Class T-E, Class T-F, Class T-G and Class T-H members. The System's annual valuation currently uses a 7.25% annual rate of investment return.

The annual valuation data provided to Buck does not contain information on withdrawal of accumulated deductions upon retirement. However, the data provided for retired members include information on the balance of a member's accumulated deductions. As of the June 30, 2020, 72% of retired member records report no remaining balance for the accumulated deductions.

Also, PSERS' staff communicated that their in-house data show:

- 72% of recent Class T-C and Class T-D retirements elect to receive a partial or full withdrawal of the member's accumulated deductions
- 48% of recent Class T-E and Class T-F retirements elect to receive a partial or full withdrawal of the member's accumulated deductions
- No information is available for Class T-G and Class T-H retirements

Therefore, we recommend updating the System's annual actuarial valuation assumption for Option 4 withdrawal of accumulated deductions payments from 80% to:

- 75% of all eligible Class T-C and Class T-D retirements
- 50% of all eligible Class T-E, Class T-F, Class T-G and Class T-H retirements

The recommendation will better anticipate benefits payable from the System and should lessen any liability gains or losses experienced by the System over time.

Section III – Discussion of Experience Review: Mortality Assumptions

Tables 5 through 8 included in Section VII summarize the amount-based mortality experience for annuitants, disability annuitants, beneficiaries and survivor annuitants, and members in active service. The tables show the ratio of actual to expected experience under each current assumption. We have also presented the same information under the recommended change for each of the assumptions. Separate summaries for males and females are presented for all of the categories.

As noted in prior experience studies, we have seen continued and steady improvement in mortality rates over time. This trend is expected to continue into the future. In fact, Actuarial Standard of Practice No. 35 (ASOP No. 35) states that the actuary should “include an assumption as to expected mortality improvement after the measurement date.”

The current assumptions anticipate future improvements in mortality using a generational approach for both active and inactive members. The projection of mortality improvements on a generational basis results in a separate table for each year of birth. The assumed rates of mortality decrease as the year of birth increases. For example, a participant born in 1960 will have a higher assumed probability of death at each age than a participant born in 1965. The mortality table for birth year 1965 will reflect five more years of mortality improvement than the table for birth year 1960.

To create this dynamic mortality table, we will select a base mortality table that represents the current experience of the System. Each year after the measurement date, this base table will be projected with an additional year of improvement. The resulting generational mortality table will better reflect expected future mortality improvements.

The following table demonstrates the impact of the generational mortality improvement for female members. It compares the expected age at death for members of various ages before and after incorporating the recommended mortality projections. The base table is the proposed mortality assumption for female members retired on account of service retirement which is the Blended table based on 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Amount-Weighted Female Tables, with a 95.4% adjustment, generationally projected with the Buck Modified scale MP-2020 to June 30, 2020.

Age at Measurement Date	Expected Age at Death	
	Zero Future Mortality Improvement	Generational Mortality Improvement
50	87.2	89.2
55	87.5	89.2
60	87.9	89.4
65	88.4	89.6

Rates of Mortality Among Annuitants

Tables 5 through 7 included in Section VII summarize the benefit amount based mortality experience among service-based retirement annuitants, disability retirements, and beneficiaries and survivor annuitants during the five-year period ended June 30, 2020. The mortality experience is shown separately for males and females.

A summary of the results is shown in the table below:

**Overall Ratios of Actual to Expected Benefit Amount-Based Mortality Experience
Service Retirements, Beneficiaries and Survivor Annuitants,
Disability Annuitants and Members in Active Service**

Death After	Males	Females
Service Retirement	84%	81%
Disability Retirement	102%	97%
Beneficiary and Survivor annuitant	122%	123%
Members in Active Service	85%	80%

For purposes of the comparison, the ratio of the actual to expected experience is expressed as a percentage for each type of event. A percentage in excess of 100% indicates that the actual experience was greater than the expected experience, whereas a percentage of less than 100% indicates that the actual experience was less than expected.

For example, regarding mortality among all healthy female annuitants, Table 5 on page 47 indicates that the total actual benefits released was only 81% of the total expected benefits to be released (\$245,358,299 / \$302,870,292). This means that during the five-year experience review period, the actual amount of benefits released for healthy female annuitants who died was less than the currently assumed expected amount within the group by 19% (i.e., 81% minus 100%).

The experience study showed the following concerning service retirements, disability annuitants, and beneficiary and survivor annuitants:

- The actual amounts of benefits released among male and female service retirements were less than expected.
- The actual amounts of benefits released among disability annuitants were slightly more than expected for males and slightly less than expected for females.
- The actual amounts of benefits released among beneficiary and survivor annuitants were more than expected for males and females.
- In general, the System is large enough to generate statistically credible mortality experience. This enables Buck to adjust the probabilities found in a standard table to reflect the experience of the System, where necessary. The credibility for male and female retirees and for female beneficiaries and survivors is 100% while there is only partial credibility for disability retirees, male beneficiaries and survivors and active members.
- Annual valuation data provided to Buck does not contain information on members' job description. PSERS staff communicated that current in-house data indicates that 48% to 58% of System active members are teachers and/or certified staff.

In January 2015, the Society of Actuaries (SOA) and the Retirement Plans Experience Committee initiated a mortality study of public pension plans. The primary focus of this study was a comprehensive review of recent mortality experience of public retirement plans in the United States.

In January 2019, the SOA published the Pub-2010 Public Retirement Plans Mortality Tables Report with the results of the study. The Pub-2010 mortality tables were developed based on data between 2008 and 2013, with a central year of July 1, 2010 through June 30, 2011. The dataset included approximately 46 million life-years of exposure and 580,000 deaths. The analysis produced several versions of the table based on job types (Public Safety, Teachers and General Employees) and income levels (above and below median). In addition, gender-specific tables were developed on both an amount-weighted and headcount-weighted basis.

According to the report, the availability of an amount-weighted or headcount-weighted tables should produce the “most appropriate result for the particular application at hand”. The Amount-Weighted tables (salary for actives and benefit amounts for those in receipt of a benefit) generally produce the most appropriate results for the measuring of pension obligations related to income. While the headcount-weighted tables may be more appropriate for measuring obligations unrelated to income, such as the Premium Assistance program for retired members.

Further, the report cites ASOP 35, “the actuary should select a mortality assumption that is appropriate for the purpose of the measurement”. Accordingly, the use of the amount-weighted tables to measure the System’s obligations and the corresponding headcount-weighted tables to measure the Premium Assistance program obligations is not necessarily inconsistent even if the two plans cover the same members.

Mortality improvement during the 20th century is well-documented. Recognizing this, along with the fact that experts hold widely differing expectations for the degree to which mortality rates will continue to improve, a number of different mortality improvement projection scales have been developed and used over the years. These improvement projection scales include: Scale AA, Scale BB, and annual scales MP-2014 through MP-2020.

It should be noted that although, at the publication date of this report, the SOA has published the MP-2021 mortality improvement scale, it was not available during the presentation of the results of the System’s mortality experience to the Board in June 2021 and was not considered.

In October 2020, the SOA released the updated improvement scale, MP-2020. The MP-2020 improvement scale is a two-dimensional table (with rates of improvement varying by age and calendar year). The MP-2020 improvement scale reflects data that is available from the Social Security Administration (SSA). Given the U.S. Social Security experience is based on a broad population, mortality improvement for specific retirement plan and employee populations potentially may be better modeled by alternative projection models.

There are many who believe that the SOA’s MP-2020 scale is unduly conservative with unrealistic mortality improvement rates. Emerging experience since the data was collected by the SOA seems to support the contention. Therefore, Buck has published an alternative mortality improvement scale, the Buck Modified MP-2020 Improvement Scale. The Buck Modified 2020 Improvement Scale uses the same data and algorithm as the MP-2020 improvement scale, but trends to an ultimate improvement rate of 0.75% at most ages, achieving the ultimate rate over a fifteen year period following the end of the historic data used to construct MP-2020 improvement scale. The change was made to bring the ultimate rate of improvement more in line with recent data published by the SSA, including the SSA’s Intermediate Alternative for mortality improvement from the 2020 Trustee’s Report. The SSA data/assumptions indicate a lower level of improvement than was forecasted by the MP-2020 improvement scale.

Recommendations:

- Update the male annuitant mortality table to a blended table based on 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Amount-Weighted Male Tables, with a 99.7% adjustment, generationally projected with Buck Modified scale MP-2020.

- Update the female annuitant mortality table to a blended table based on 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Amount-Weighted Female Tables, with a 95.4% adjustment, generationally projected with Buck Modified scale MP-2020.
- Update the male disabled annuitant mortality table to the Pub-2010 Disability Mortality Non-Safety Amount-Weighted Male Table, with a 105.4% adjustment, generationally projected with Buck Modified scale MP-2020.
- Update the female disabled annuitant mortality table to the Pub-2010 Disability Mortality Non-Safety Amount-Weighted Female Table, with a 95.0% adjustment, generationally projected with Buck Modified scale MP-2020.
- Update the male beneficiary and survivor annuitant mortality to the Pub-2010 Contingent Survivor Amount-Weighted Male Table, with a 106.0% adjustment, generationally projected with Buck Modified scale MP-2020.
- Update the female beneficiary and survivor annuitant mortality to the Pub-2010 Contingent Survivor Amount-Weighted Female Table, with a 116.2% adjustment, generationally projected with Buck Modified scale MP-2020.
- Update the Health Care Premium Assistance information required for Governmental Accounting Standards Board Statement Nos. 74 and 75 reporting to be based on the corresponding headcount-weighted tables.

Rates of Mortality Among Active Members

Table 8 shows the actual salary amounts released due to deaths in active service were less than expected for both males and females. For males, the ratio of the actual to expected experience was 85%. Among females, the ratio was 80%.

Therefore, we recommend the following updates to the active member mortality rates to reflect recent experience and anticipate future improvements in mortality.

- Update the male active member mortality table to a blended table based on 50% PubT-2010 Employee (Total Teacher dataset) and 50% PubG-2010 Employee (Total General Employees dataset) Amount-Weighted Male Tables, with a 99.0% adjustment, generationally projected with Buck Modified scale MP-2020.
- Update the female active member mortality table to a blended table based on 50% PubT-2010 Employee (Total Teacher dataset) and 50% PubG-2010 Employee (Total General Employees dataset) Amount-Weighted Female Tables, with an 88.6% adjustment, generationally projected with Buck Modified scale MP-2020.

The recommended mortality assumptions among annuitants and active members are appropriate for purposes of the valuation. The recommended assumptions are reasonably related to the experience of the System and are reasonable long-term expectations. They fulfill the guidance on the selection of mortality assumptions provided in ASOP No. 35.

Section IV – Discussion of Experience Review: Option Factors

Members can elect to receive their retirement annuity for their lifetime only (i.e., MSLA) or under various optional forms of payment that would provide a death benefit. Under the Option 4 lump sum option, the member receives a refund of the accumulated deductions together with an annuity that has been reduced by the amount of monthly annuity that could have been provided by the accumulated deductions.

When a member elects to receive an annuity under an optional form of payment that provides a death benefit, the MSLA is reduced to reflect the cost of providing the death benefit. When a member elects to retire early by commencing the annuity before superannuation age, the annuity is reduced to reflect the longer time period of retirement.

Option factors are used to:

1. Reduce the MSLA to pay for the cost of providing the death benefit,
2. Determine the monthly annuity that could be provided by a member's accumulated deductions, and
3. Convert the benefit payable at superannuation age to the benefit paid at withdrawal or early retirement.

The option factors are based on two assumptions – mortality and statutory interest.

Prior to Act 2017-5, the PSERS Code requires the option factors to be based on the 4% statutory interest. Act 2017-5 amended the Code to use actuarial equivalence factors based on an interest rate equal to the expected rate of return on assets assumption as adopted by the Board to determine a cost-neutral Option 4 withdrawal of accumulated deductions for Class T-E, Class T-F, Class T-G and Class T-H members and Class T-G and Class T-H members early commencement factors prior to age 62.

The current mortality basis is the Board-approved annuitant base mortality tables currently used for actuarial valuations beginning June 30, 2016, generationally projected to 2020 with the Buck Modified 2015 improvement scale assuming the population consists of 25% males and 75% females.

We recommend that the mortality table be updated to a blend of the Board-approved annuitant base mortality tables to be used for actuarial valuations beginning June 30, 2021, generationally projected to 2025 with the Buck Modified 2020 improvement scale assuming the population consists of 25% males and 75% females.

Updating the mortality table used in the option factors produces:

- Minimal increase in benefits for members who withdraw from the System electing to receive benefits prior to superannuation;
- Slightly greater Option 1, 2 and 3 benefits;
- A lesser annuity offset due to the Option 4 – refund of accumulated deductions, resulting in greater residual benefits;
- Additional cost to the System primarily due to the Option 4 – refund of accumulated deductions which result in greater residual benefits payable

In accordance with discussions with PSERS staff, it is also recommended that the updated option factors are to be effective for retirements after June 30, 2022, if administratively possible, for efficiency of its operational transitioning.

Section V – Discussion of Experience Review: Economic Assumptions

Tables 9, 10 and 11 in Section VII summarize the actual results for the key economic factors affecting the operation of the System during the five-year period ended June 30, 2020. Table 9 shows a historical summary of market value annual investment rates of return for fiscal years ending June 30, 2001 to June 30, 2020. Table 10 shows a comparison of actual and expected salaries of active full-time members. Table 11 shows the historical appropriation payrolls for fiscal years ending June 30, 2015 to June 30, 2020.

Rates of Investment Return

The rate of investment return assumption used for the System’s annual actuarial valuation is chosen by the Board of the System based on recommendations from its investment advisor and actuary.

System Historical Annual Rate of Investment Return Assumption

June 30 Valuation	Annual Rate of Investment Return Assumption
Before 2008	8.50%
2008	8.25%
2009 - 2010	8.00%
2011 - 2015	7.50%
2016 - 2020	7.25%

The current interest rate assumption is 7.25% per annum, which includes an inflation component of 2.75% and a real rate of return component of 4.50%.

At the Board’s direction, Aon, the System’s investment advisor, Verus and Buck performed individual Expected Return on Assets Analysis (EROA) based on the current PSERS asset allocation and the following summarizes each consultant’s 30-year expected geometric EROAs compared to a hypothetical global 60%/40% portfolio.

	Aon	Verus	Buck*	60%/40% Portfolio
EROA	6.99%	6.40%	6.79%	5.75%
Standard Deviation	11.92%	12.60%	9.89%	11.28%
Sharpe Ratio	0.402	0.500	0.489	0.315

* Interested parties may refer to Buck’s Expected Return on Assets Analysis presentation during the Board’s Budget/Finance Committee August 5, 2021 meeting for a detailed explanation regarding data, assumptions, and methods.

The System’s investment advisor, Aon, believes the System would have to accept increased volatility and risk-bearing in order to achieve the current assumed 7.25% annual return. In their study, they report that under the current 30-year Capital Market Assumptions, the current PSERS asset allocation’s expected annual return is 6.99%.

The average annual increase in the CPI-U and rates of investment return during the five-year period ended June 30, 2020 are shown below. The actual returns on the market value of assets fluctuated during the five-year study period. The five-year average return on the market value of assets underperformed the expected annual return of 7.25%.

Fiscal Year	CPI-U	Return on Market Value of Assets*
2015/2016	1.0%	1.33%
2016/2017	1.8	10.20
2017/2018	2.9	9.26
2018/2019	1.6	6.66
2019/2020	0.1	1.11
Geometric Average		
5-Year	1.50%	5.64%
10-Year	--	7.67%
15-Year	--	6.08%
20-Year	--	5.57%
25-Year	--	7.46%
Current Assumption	2.75%	7.25%

* Provided by PSERS' investment consultant

The table above shows the annual increase in the CPI-U during the five-year period ending June 30, 2020. The average increase in the CPI-U was 1.50%.

Also shown are the historic investment rates of return, measured on a market value basis. The return on the market value of assets was volatile during the five years that ended June 30, 2020. The return on the market value exceeded the 7.25% assumed return rate during fiscal years 2017 and 2018 but underperformed during the other fiscal years. The geometric average rate of return on investments based on the market value of assets during the five-year examination period was equal to 5.64%.

The historical returns on the funds should not be the sole basis for selecting the assumed interest rate for calculating costs in future years. The reason for this is that the interest rate is an assumption that is used to fund the present value of benefits payable many years into the future, in some instances, for as long as 80 years. Thus, while a review of past experience is useful and indicates that the actual rate of investment return over the past five years was short of the assumed rate of 7.25%, we do not believe that these investment returns signal a major change in the long-term earnings prospects of the System. However, we do believe that the 2.75% inflation assumption is high based on historical increases in the CPI-U.

There is increased scrutiny of both public fund assumptions and aggressive risk taking. In addition, public systems' investment advisors believe that long-term capital market assumptions are declining. This has caused public systems to adopt a more conservative long-term investment expectation. Current surveys of public funds show a trend towards lower investment return assumptions as a prudent measure against added volatility and risk.

In view of these observations, we recommended, and the Board adopted, an inflation assumption of 2.50% (reduced from the current 2.75%) and an interest rate assumption of 7.00% (reduced from the current 7.25%). This means that the real return assumption will be maintained at the current 4.50%. The following table shows the current and revised components of the interest rate assumption:

Components of Interest Rate Assumption

Item	Current Assumptions	Revised Assumptions
Inflation	2.75%	2.50%
Real Return	<u>4.50</u>	<u>4.50</u>
Total	7.25%	7.00%

We believe that the revised interest rate assumption is appropriate for purposes of the valuation. This assumption is reasonably related to the experience of the System and represents a reasonable long-term expectation.

Rates of Salary Increase

The growth in average annual salary is presented in Table 10 of Section VII. The assumed salary increase assumption is an effective average of 5.00%. Table 10 shows that the actual average annual salary increase over the examination period for all age groups was 3.7%. However, Table 10 also shows that the 10-year and 15-year salary increase for all age groups were 3.8% and 4.8%, respectively.

The salary increase assumption should be selected with an eye towards past experience and with considerable emphasis placed on judgment concerning future expectations. The salary increase assumption should be consistent with the interest rate assumption as both assumptions are based on a long-term inflation assumption. The updated long-term inflation assumption is 2.50%.

The Board adopted a decrease in the current average 5.00% salary increase assumption to 4.50%. The reduction reflects the 0.25% decrease in the long-term inflation assumption (from 2.75% to 2.50%) and a decrease in the real wage growth of 0.25% (from 2.25% to 2.00%).

It is generally accepted in actuarial practice that a reasonable spread between the investment return assumption and the salary increase assumption falls in the range of 2% to 3%. We believe the recommended use of a salary scale averaging 4.50%, along with a gross investment return assumption of 7.00%, represents a proper balance between a realistic assessment of future annual pay increases and the long-term investment returns on the assets of the Fund.

Components of Average Salary Increase Assumption

Item	Current Assumptions	Revised Assumptions
Inflation	2.75%	2.50%
Real wage growth	<u>2.25</u>	<u>2.00</u>
Total	5.00%	4.50%

Payroll Growth

The amortization of the System's unfunded accrued liability uses a level percentage of payroll method which produces a payment stream that is designed to increase based on the expected growth in payroll.

The historical growth of payroll is presented in Table 11 of Section VII. The assumed payroll growth increase assumption is 3.50%. Table 11 shows that the actual annual payroll growth during the study period was less than the assumed 3.50%.

Similar to the salary increase assumption, the payroll growth assumption should be selected with an eye towards past experience and with considerable emphasis placed on judgment concerning future expectations.

PSERS' staff communicated that their in-house data show salary surveys from employers anticipate a 3.50% growth in payroll for fiscal year ending 2022 and an estimated 2.50% thereafter with recent increase in charter school payrolls.

The uncertainty of the pandemic triggered a lot of people to leave teaching, which created labor shortages in areas like teachers of specialty subjects, food service and transportation.

The payroll growth assumption is also related to the assumed Rate of Investment Return through the common element of the inflation component.

We recommend that the current 3.50% payroll growth assumption be reduced by 0.25% to 3.25%. The reduction reflects the 0.25% decrease in the long-term inflation assumption (from 2.75% to 2.50%). In addition, recent historical payroll growth and data collected by PSERS with regard to future employer payrolls indicate a decrease in this assumption.

Section VI – Financial Impact of Recommended Assumptions

Based on the results of the experience review, we recommend revisions to the following assumptions:

- Mortality among annuitants
- Mortality among active members
- Disability
- Withdrawal
- Early retirement
- Superannuation retirement
- Ultimate Retirement Age
- Withdrawing Member Benefit Commencement
- Optional Forms of Benefit Payment at Retirement: Annuity forms of payment and withdrawal of accumulated deductions

The Board adopted an inflation assumption of 2.50% (reduced from the current 2.75%), an interest rate assumption of 7.00% (reduced from the current 7.25%), an average salary increase assumption of 4.50% (reduced from the current 5.0%) and a payroll growth assumption of 3.25% (reduced from the current 3.50%).

Financial Impact of Recommended Assumption Changes on the Fiscal Year 2022 Employer Contribution Rate

The table below shows the impact on the fiscal year 2022 employer contribution rate for each recommended assumption change assuming the recommended assumptions were in effect for the June 30, 2020 actuarial valuation. The cost effect of each proposed assumption is subject to change depending on the order in which they are reflected.

Increase (Decrease) in Employer Contribution Rate

Assumption	Normal Rate	Total Contribution Rate*
Demographic Changes		
Post-retirement mortality	0.12%	0.77%
Death in-service	(0.01)	(0.03)
Disability retirement	(0.04)	(0.05)
Withdrawal prior to Retirement	(0.38)	(0.28)
Retirement (Early, Superannuation and Late)	(0.19)	(0.60)
Optional forms of benefit payment	<u>(0.31)</u>	<u>(0.44)</u>
Total Demographic Changes	(0.81)%	(0.63)%
Economic Changes		
Administrative Option Factors	0.21%	0.59%
Interest Rate	0.79	1.68
Annual Salary Increases	<u>(1.15)</u>	<u>(1.74)</u>
Total Economic Change	(0.15)%	0.53%
Total Change	(0.96)%	(0.10)%

* Without regard to the Act 5 DC contribution and Premium Assistance.

In addition, the changes in demographic assumptions would decrease the Premium Assistance contribution rate for fiscal year 2021/2022 from 0.80% to 0.78%.

A summary of the current assumptions is as follows:

Current Assumptions

Interest Rate: 7.25% per annum, compounded annually. The components are 2.75% for inflation and 4.50% for the real rate of return. Actuarial equivalent benefits are determined based on an interest rate of 4% per year (since 1960) except, in accordance with Act 5-2017, an interest rate of 7.25% per year is used for Class T-E, Class T-F, Class T-G and Class T-H members' Option 4 partial withdrawal of accumulated member contributions.

Separation from Service: Illustrative rates of assumed separation from service are shown in the following table.

Age	Annual Rate of:						
	Withdrawal			Death ¹	Disability	Early Retirement ²	Superannuation Retirement
	Less Than Five Years of Service	Five Years but Less Than 10 Years of Service	10 or More Years of Service				
MALES							
25	14.85%	5.70%	2.57%	.041%	.020%		
30	12.74	3.37	2.57	.039	.020		
35	13.39	3.21	1.50	.044	.058		
40	14.49	3.97	1.34	.050	.116		
45	14.42	4.53	1.37	.084	.160		19.16%
50	14.31	4.45	1.92	.138	.284		19.16
55	12.17	4.43	3.38	.233	.442	18.57%	26.59
60	12.43	5.58	5.57	.379	.582	14.42	30.87
65				.700	.087		21.39
69				1.067	.135		19.34
FEMALES							
25	13.41%	7.47%	5.02%	.013%	.018%		
30	13.81	6.05	4.02	.017	.023		
35	14.22	5.53	2.85	.024	.055		
40	11.79	4.87	1.60	.032	.096		
45	11.54	4.51	1.65	.051	.135		15.00%
50	11.66	4.43	2.06	.088	.229		15.00
55	11.75	4.38	3.11	.133	.368	18.59%	10.02
60	12.25	5.97	6.40	.196	.360	17.05	35.77
65				.327	.082		22.23
69				.443	.118		22.79

1. These base mortality tables will then be projected on a generational basis using the Buck Modified 2015 projection scale from 2013 to the valuation date and thereafter.
2. Early Retirement – Age 55 with 25 years of service, but not eligible for Superannuation retirement.

Death after Retirement:

Male annuitants: RP-2014 male mortality table adjusted backward to 2006 with the MP-2014 mortality improvement scale and projected to the valuation date with the Buck Modified 2015 projection scale.

Female annuitants: RP-2014 female mortality table adjusted backward to 2006 with the MP-2014 mortality improvement scale, projected to 2013 with the Buck Modified 2015 projection scale and adjusted for credibility. This base mortality table will then be projected on a generational basis using the Buck Modified 2015 projection scale to the valuation date.

Disabled annuitants: RP-2014 male and female disabled mortality tables adjusted backward to 2006 with the MP-2014 mortality improvement scale and projected to the valuation date with the Buck Modified 2015 projection scale.

These base mortality tables will then be projected on a generational basis using the Buck Modified 2015 projection scale from the valuation date.

For determination of actuarial equivalence, a unisex table based on the above base tables, with weightings of 25% of male and 75% of female mortality probabilities, is utilized. This table is then projected on a generational basis to 2020 using the Buck Modified 2015 projection scale.

Salary Increase: Effective average of 5.00% per annum, compounded annually. The components are 2.75% for inflation and 2.25% for real wage growth and for merit or seniority increases. Representative values are as follows:

Age	Annual Rate of Salary Increase
20	10.25%
30	7.75
40	5.75
50	3.75
55	3.25
60	3.25
65	3.25
70	3.25

Payroll Growth: A 3.50% per annum payroll growth assumption is used to liquidate the unfunded accrued liability based on level-percent-of-pay amortization schedules required by the Retirement Code as amended by Act 2010-120 and Act 2017-5, i.e., a schedule of 24 years for the unfunded accrued liability as of June 30, 2010 and each change in the unfunded accrued liability due to actuarial experience after the June 30, 2010 valuation. Any legislation after June 30, 2010 that increases the liability due to benefit enhancements will be funded over 10 years based on level-percent-of-pay amortization.

MISCELLANEOUS:

Option 4 - Refund of Contributions Elections: 80% of Class T-C, Class T-D, Class T-E, Class T-F, Class T-G and Class T-H members are assumed to elect a refund of contributions and a reduced annuity.

Withdrawal Annuity: 90% of members are assumed to commence payment immediately and 10% are assumed to defer payment to superannuation age.

Optional Forms of Annuity Payment at Retirement: Anticipated active member elections of optional forms of payment at retirement as follows:

- 50% will elect Maximum Straight Life Annuity (MSLA)
- 20% will elect OPTION 1 (Straight life annuity with guaranteed payments equal to present value of MSLA)
- 20% will elect OPTION 2 (100% Joint and Survivor with males 3 years older than females)
- 10% will elect OPTION 3 (50% Joint and Survivor with males 3 years older than females)
- 0% will elect OPTION 4 annuity

Optional Forms of Payment Factors: Actuarial equivalent benefits are determined based on a statutorily specified interest rate of 4% per year (since 1960). The mortality basis is a blend of the healthy annuitant base mortality tables to be used for the June 30, 2016 actuarial valuation projected to 2020 with the Buck Modified 2015 improvement scale assuming the population consists of 25% males and 75% females.

A summary of the recommended assumptions is as follows. A complete set of the recommended assumptions is presented in Section VIII.

Recommended Assumptions

Interest Rate: 7.00% per annum, compounded annually. The components are 2.50% for inflation and 4.50% for the real rate of return. Actuarial equivalent benefits are determined based on an interest rate of 4% per year (since 1960) except, in accordance with Act 5-2017, an interest rate of 7.00% per year is used for Class T-E, Class T-F, Class T-G and Class T-H members' Option 4 partial withdrawal of accumulated member contributions.

Separation from Service: Illustrative rates of assumed separation from service are shown in the following table.

Age	Class T-C and Class T-D Annual Rate of:						
	Withdrawal			Death ¹	Disability	Early Retirement ²	Superannuation Retirement
	Less Than Five Years of Service	Five Years but Less Than 10 Years of Service	10 or More Years of Service				
MALES							
25	21.83%	9.22%	4.55%	.022%	.01%		
30	14.93	3.84	4.55	.029	.01		
35	15.17	3.77	1.68	.038	.04		
40	16.04	4.44	1.42	.053	.06		
45	15.12	5.17	1.41	.082	.11		19.0%
50	15.81	4.96	1.89	.129	.23		19.0
55	15.54	4.96	3.63	.194	.37	14.5%	25.0
60	13.85	6.37	5.49	.289	.37	14.5	29.0
65				.447	.11		23.0
70				.699	.08		20.0
75				1.076	.08		25.0
79				1.701	.08		25.0
FEMALES							
25	18.33%	7.47%	3.90%	.008%	.01%		
30	15.16	5.92	3.90	.013	.02		
35	14.66	5.68	2.83	.019	.03		
40	12.86	5.16	1.67	.030	.06		
45	12.82	5.25	1.60	.046	.11		16.0%
50	13.02	5.23	2.08	.069	.18		16.0
55	13.43	5.31	3.66	.102	.29	14.5%	16.0
60	13.81	7.53	5.94	.154	.24	15.0	31.0
65				.251	.07		28.0
70				.431	.09		23.0
75				.766	.09		25.0
79				1.239	.09		25.0

1. These base mortality tables will then be projected on a generational basis using the Buck Modified scale MP-2020. Refer to the pre-retirement mortality description below.
2. Early Retirement – Age 55 with 25 years of service, but not eligible for Superannuation retirement.

Age	Class T-E, Class T-F, Class T-G and Class T-H Annual Rate of:					
	Withdrawal		Death ¹	Disability	Early Retirement ²	Superannuation Retirement
	Less Than 10 Years of Service	10 or More Years of Service				
MALES						
25	17.02%	4.55%	.022%	.01%		
30	11.25	4.55	.029	.01		
35	12.09	1.68	.038	.04		
40	13.14	1.42	.053	.06		
45	13.87	1.41	.082	.11		
50	13.67	1.89	.129	.23		
55	11.91	3.63	.194	.37	14.5%	
60	11.19	5.49	.289	.37	14.5	16.3%
65	11.19		.447	.11		16.3
70	11.19		.699	.08		16.3
75	11.19		1.076	.08		16.3
79	11.19		1.701	.08		16.3
FEMALES						
25	14.54%	3.90%	.008%	.01%		
30	11.68	3.90	.013	.02		
35	12.39	2.83	.019	.03		
40	11.53	1.67	.030	.06		
45	10.99	1.60	.046	.11		
50	10.72	2.08	.069	.18		
55	10.75	3.66	.102	.29	14.5%	19.5%
60	11.62	5.94	.154	.24	15.0	19.5
65	11.62		.251	.07		19.5
70	11.62		.431	.09		19.5
75	11.62		.766	.09		19.5
79	11.62		1.239	.09		19.5

1. These base mortality tables will then be projected on a generational basis using the Buck Modified scale MP-2020. Refer to the pre-retirement mortality description below.
2. Early Retirement – prior to eligibility for Superannuation retirement.

Death before Retirement:

Male participants: 50% PubT-2010 Employee (Total Teacher dataset) and 50% PubG-2010 Employee (Total General Employees dataset) Amount-Weighted Male Tables, with a 99.0% adjustment, generationally projected with Buck Modified scale MP-2020.

Female participants: 50% PubT-2010 Employee (Total Teacher dataset) and 50% PubG-2010 Employee (Total General Employees dataset) Amount-Weighted Female Tables, with an 88.6% adjustment, generationally projected with Buck Modified scale MP-2020.

Death after Retirement:

Male annuitants: 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Amount-Weighted Male Tables, with a 99.7% adjustment, generationally projected with Buck Modified scale MP-2020.

Female annuitants: 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Amount-Weighted Female Tables, with a 95.4% adjustment, generationally projected with Buck Modified scale MP-2020.

Male disabled annuitants: Pub-2010 Disability Mortality Non-Safety Amount-Weighted Male Table, with a 105.4% adjustment, generationally projected with Buck Modified scale MP-2020.

Female disabled annuitants: Pub-2010 Disability Mortality Non-Safety Amount-Weighted Female Table, with a 95.0% adjustment, generationally projected with Buck Modified scale MP-2020.

Male contingent survivors: Pub-2010 Contingent Survivor Amount-Weighted Male Table, with a 106.0% adjustment, generationally projected with Buck Modified scale MP-2020.*

Female contingent survivors: Pub-2010 Contingent Survivor Amount-Weighted Female Table, with a 116.2% adjustment, generationally projected with Buck Modified scale MP-2020.*

For determination of actuarial equivalence, a unisex table based on 25% males and 75% females blend of the Board approved base mortality tables to be used for actuarial valuations beginning June 30, 2021, generationally projected to 2025 with the Buck Modified MP-2020 improvement scale.

* Payments to a contingent survivors are valued using member mortality while the member is alive.

Salary Increase: Effective average of 4.50% per annum, compounded annually. The components are 2.50% for inflation, and 2.00% for real wage growth and merit or seniority increases. Representative values are as follows:

Age	Annual Rate of Salary Increase
20	9.65%
30	7.15
40	5.15
50	3.15
55	2.75
60	2.75
65	2.75
Over 65	2.75

Payroll Growth: A 3.25% per annum payroll growth assumption is used to liquidate the unfunded accrued liability based on level-percent-of-pay amortization schedules required by the Retirement Code as amended by Act 2010-120 and Act 2017-5, i.e., a schedule of 24 years for the unfunded accrued liability as of June 30, 2010 and each change in the unfunded accrued liability due to actuarial experience after the June 30, 2010 valuation. Any legislation after June 30, 2010 that increases the liability due to benefit enhancements will be funded over 10 years based on level-percent-of-pay amortization.

MISCELLANEOUS:

Option 4 - Refund of Contributions Elections: 75% of Class T-C and Class T-D and 50% of Class T-E, Class T-F, Class T-G and Class T-H members are assumed to elect a refund of contributions and a reduced annuity.

Withdrawal Annuity: 50% of members are assumed to commence payment immediately and 50% are assumed to defer payment to superannuation age.

Optional Forms of Annuity Payment at Retirement: Anticipated active member elections of optional forms of payment at retirement as follows:

- 45% will elect Maximum Straight Life Annuity (MSLA)
- 25% will elect OPTION 1 (Straight life annuity with guaranteed payments equal to present value of MSLA)
- 20% will elect OPTION 2 (100% Joint and Survivor with males 3 years older than females)
- 10% will elect OPTION 3 (50% Joint and Survivor with males 3 years older than females)
- 0% will elect OPTION 4 annuity

Optional Forms of Payment Factors: Actuarial equivalent benefits are determined based on a statutorily specified interest rate of 4% per year or 7.00% per annum, as applicable. The mortality basis is a blend of 25% males and 75% females blend of the Board approved base mortality tables to be used for actuarial valuations beginning June 30, 2021, generationally projected to 2025 with the Buck Modified MP-2020 improvement scale

Section VII

Comparison of Actual and Expected Experience from July 1, 2015 through June 30, 2020

Table 1(a)

Summary of Experience for Termination from Employment Before Retirement

Class T-C and T-D

Non-vested Withdrawals with Less than Five Years of Service

**Males
2015 – 2020**

Central Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Expected			Current	Proposed
		Current	Proposed			
20	2	1	1	5	200%	200%
25	112	63	93	426	178	120
30	326	239	281	1,879	136	116
35	314	248	280	1,849	127	112
40	265	218	241	1,505	122	110
45	262	238	250	1,652	110	105
50	302	250	276	1,745	121	109
55	312	220	266	1,709	142	117
60	186	144	165	1,189	129	113
Total	2,081	1,621	1,853	11,959	128%	112%

Recommendation: Increase the rates since the total incidence of actual withdrawals with less than five years of service is higher than expected.

Table 1(a) (continued)

Summary of Experience for Termination from Employment Before Retirement

Class T-C and T-D

Non-vested Withdrawals with Less than Five Years of Service

**Females
2015 – 2020**

Central Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Expected			Current	Proposed
		Current	Proposed			
20	2	0	0	2	0%	0%
25	110	82	111	608	134	99
30	656	549	602	3,974	119	109
35	551	515	532	3,631	107	104
40	538	485	512	3,980	111	105
45	701	572	635	4,953	123	110
50	695	547	611	4,690	127	114
55	576	449	513	3,822	128	112
60	366	293	330	2,392	125	111
Total	4,195	3,492	3,846	28,052	120%	109%

Recommendation: Increase the rates since the total incidence of actual withdrawals with less than five years of service is more than expected.

Table 1(b)

Summary of Experience for Termination from Employment Before Retirement

Class T-C and T-D

Vested Withdrawals with at Least Five but Less Than Ten Years of Service

**Males
2015 – 2020**

Central Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Expected			Current	Proposed
		Current	Proposed			
Under 28	63	35	56	609	180%	113%
30	428	373	425	11,060	115	101
35	405	307	360	9,561	132	113
40	237	193	216	4,856	123	110
45	217	169	193	3,728	128	112
50	189	153	171	3,448	124	111
55	205	166	185	3,739	123	111
60	217	169	193	3,036	128	112
Total	1,961	1,565	1,799	40,037	125%	109%

Recommendation: Actual withdrawals were higher than expected for all ages and we recommend increasing the rates.

Table 1(b) (continued)

Summary of Experience for Termination from Employment Before Retirement

Class T-C and T-D

Vested Withdrawals with at Least Five but Less Than Ten Years of Service

**Females
2015 – 2020**

Central Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Expected			Current	Proposed
		Current	Proposed			
Under 28	86	70	70	943	123%	123%
30	1,840	2,001	1,958	33,082	92	94
35	1,444	1,368	1,406	24,746	106	103
40	748	667	707	13,695	112	106
45	994	751	875	16,661	132	114
50	1,139	835	986	18,846	136	116
55	1,002	704	853	16,073	142	117
60	779	526	663	8,811	148	117
Total	8,032	6,922	7,518	132,857	116%	107%

Recommendation: Actual withdrawals were higher than expected for all ages after age 30 and we recommend increasing the rates at these ages. Actual withdrawals at age 30 were lower than expected and we recommend decreasing the rates. There is a very small number of members younger than age 30 and we expect no one to remain in this age group; no change is recommended.

Table 1(c)

Summary of Experience for Termination from Employment Before Retirement

Class T-C and T-D

Vested Withdrawals with at Least Ten Years of Service

**Males
2015 – 2020**

Central Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Expected Current	Expected Proposed		Current	Proposed
Under 33	46	41	42	1,594	112%	110%
35	350	324	348	21,610	108	101
40	475	439	465	32,772	108	102
45	535	500	514	36,466	107	104
50	578	644	634	33,546	90	91
55	794	569	674	21,496	140	118
60	941	802	863	11,939	117	109
Total	3,719	3,319	3,540	159,423	112%	105%

Recommendation: Actual withdrawals were higher than expected for all ages, except age 50, and we recommend increasing the rate at these ages. Actual withdrawals at age 50 were lower than expected and we recommend decreasing the rates.

Table 1(c) (continued)

Summary of Experience for Termination from Employment Before Retirement

Class T-C and T-D

Vested Withdrawals with at Least Ten Years of Service

**Females
2015 – 2020**

Central Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Current	Proposed		Current	Proposed
Under 33	130	139	135	3,449	94%	96%
35	1,502	1,565	1,554	54,924	96	97
40	1,248	1,136	1,185	70,979	110	105
45	1,230	1,300	1,261	78,791	95	98
50	1,794	1,747	1,764	84,797	103	102
55	2,896	2,344	2,565	77,716	124	113
60	4,158	3,710	3,933	53,078	112	106
Total	12,958	11,941	12,397	423,734	109%	105%

Recommendation: Actual total withdrawals were higher than expected at age 40 and for all ages after age 45. We recommend an increase to the rates at these ages. Actual experience at age 45 and under age 40 were lower than expected and we recommend decreasing the rate.

Table 1(d)

Summary of Experience for Termination from Employment Before Retirement

Class T-E and T-F

Non-vested Withdrawals with Less than Ten Years of Service

**Males
2015 – 2020**

Central Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Current	Proposed		Current	Proposed
20	1,144	810	968	3,734	141%	118%
25	3,531	2,731	3,220	18,920	129	110
30	2,281	1,898	2,075	18,447	120	110
35	1,357	1,139	1,252	10,357	119	108
40	1,033	948	992	7,547	109	104
45	1,113	984	1,047	7,549	113	106
50	1,146	1,014	1,080	7,900	113	106
55	932	867	898	7,537	107	104
60	790	759	775	6,928	104	102
Total	13,327	11,150	12,307	88,919	120%	108%

Recommendation: Increase the rates since the total incidence of actual non-vested withdrawals is higher than expected.

Table 1(d) (continued)

Summary of Experience for Termination from Employment Before Retirement

Class T-E and T-F

Non-vested Withdrawals with Less than Ten Years of Service

**Females
2015 – 2020**

Central Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Current	Expected Proposed		Current	Proposed
20	1,169	790	971	3,537	148%	120%
25	7,310	6,501	7,159	49,237	112	102
30	5,768	5,587	5,691	48,721	103	101
35	3,289	3,277	3,283	26,501	100	100
40	3,042	2,827	2,935	25,457	108	104
45	3,137	2,849	2,994	27,246	110	105
50	2,610	2,424	2,516	23,471	108	104
55	1,809	1,693	1,752	16,300	107	103
60	1,305	1,205	1,262	10,860	108	103
Total	29,439	27,153	28,563	231,330	108%	103%

Recommendation: Increase the rates since the total incidence of actual non-vested withdrawals is higher than expected.

Table 2

Summary of Experience for Disability Retirement with at Least Five Years of Service

**Males
2015 – 2020**

Central Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Expected			Current	Proposed
		Current	Proposed			
Under 33	0	5	2	18,955	0%	0%
35	6	20	13	33,613	30	46
40	13	43	23	39,019	30	57
45	31	70	45	41,256	44	69
50	75	110	88	38,176	68	82
55	107	152	128	34,491	70	85
60	88	134	104	28,055	66	85
65	13	17	14	12,853	76	93
70	2	6	4	4,772	33	50
Total	335	557	421	251,190	60%	80%

Recommendation: Decrease rates since the incidence of actual disability retirements is lower than expected.

Table 2 (continued)

Summary of Experience for Disability Retirement with at Least Five Years of Service

**Females
2015 – 2020**

Central Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Expected			Current	Proposed
		Current	Proposed			
Under 33	8	12	11	53,901	67%	73%
35	12	47	26	85,225	26	46
40	29	85	53	88,458	34	55
45	90	134	110	99,661	67	82
50	155	247	194	107,979	63	80
55	291	367	323	111,325	79	90
60	199	303	231	96,398	66	86
65	23	31	26	37,204	74	88
70	8	10	8	8,501	80	100
Total	815	1,236	982	688,652	66%	83%

Recommendation: Decrease rates since the incidence of actual disability retirements is lower than expected.

Table 3

Summary of Experience for Early Retirement

Class T-C and T-D

Age 55 with at Least 25 Years of Service, but Ineligible for Superannuation

Males

2015 – 2020

Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Current	Proposed		Current	Proposed
55	270	492	384	2,648	55%	70%
56	330	432	363	2,504	76	91
57	277	359	306	2,107	77	91
58	248	312	261	1,803	79	95
59	343	346	344	1,594	99	100
60	109	111	112	771	98	97
61	198	191	193	666	104	103
Total	1,775	2,243	1,963	12,093	79%	90%

Recommendation: Actual retirements were lower than expected for all ages lower than age 61 and we recommend decreasing the rates. Actual retirements were higher than expected at 61 and we recommend increasing the rate.

Table 3 (continued)

Summary of Experience for Early Retirement

Class T-C and T-D

Age 55 with at Least 25 Years of Service, but Ineligible for Superannuation

**Females
2015 – 2020**

Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Current	Proposed		Current	Proposed
55	572	909	709	4,892	63%	81%
56	539	776	669	4,613	69	81
57	571	735	647	4,315	78	88
58	549	699	603	4,021	79	91
59	762	800	775	3,744	95	98
60	318	387	341	2,270	82	93
61	671	710	687	2,369	95	98
Total	3,982	5,016	4,431	26,224	79%	90%

Recommendation: Actual retirements were lower than expected for all ages and we recommend decreasing the rates.

Table 4(a)

Summary of Experience for Superannuation

Class T-C and T-D

Age 62, Age 60 with 30 Years, or 35 Years

Males

2015 – 2020

Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Expected			Current	Proposed
		Current	Proposed			
Under 53	2	1	1	4	200%	200%
55	184	227	198	763	81	93
60	1,685	3,137	2,395	7,203	54	70
65	2,946	2,887	2,811	12,885	102	105
68	254	236	246	1,228	108	103
69	<u>248</u>	<u>203</u>	<u>210</u>	<u>1,051</u>	122	118
Subtotal under 70	5,319	6,691	5,861	23,134	79%	91%
70+	532	502	519	2,596	106	103
Total All Ages	5,851	7,193	6,380	25,730	81%	92%

Recommendation: There is insufficient experience at ages under 53 to justify a change in the assumed rates at those ages. Actual retirements at ages 55 and 60 were lower than expected and we recommend a decrease to the rates for these ages. Actual retirements after age 60 were higher than expected and we recommend an increase to these rates.

Table 4(a) (continued)

Summary of Experience for Superannuation

Class T-C and T-D

Age 62, Age 60 with 30 Years, or 35 Years

Females

2015 – 2020

Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Expected			Current	Proposed
		Current	Proposed			
Under 53	0	1	1	5	0%	0%
55	157	176	163	689	89	96
60	4,841	11,215	6,367	20,585	43	76
65	9,161	9,063	9,073	37,761	101	101
68	583	584	578	2,629	100	101
69	<u>498</u>	<u>467</u>	<u>472</u>	<u>2,050</u>	107	106
Subtotal under 70	15,240	21,506	16,654	63,719	71%	92%
70+	917	943	911	4,329	97	101
Total All Ages	16,157	22,449	17,565	68,048	72%	92%

Recommendation: There is insufficient experience at ages under 53 to justify a change in the assumed rates at those ages. Actual retirements at ages 55, 60 and after age 69 were lower than expected and we recommend a decrease to the rates for these ages. Actual retirements after age 60 but prior to age 70 were higher than expected and we recommend an increase to these rates.

Table 4(b)

Summary of Experience for Superannuation

Class T-E and T-F

Age 65 with 3 Years

Males

2015 – 2020

Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Current	Proposed		Current	Proposed
65	71	93	71	433	76%	100%
66	48	78	59	363	62	81
67	30	61	52	316	49	58
68	33	54	46	282	61	72
69	<u>34</u>	<u>48</u>	<u>36</u>	<u>248</u>	71	94
Subtotal under 70	216	334	264	1,642	65%	82%
70+	78	131	111	681	60	70
Total All Ages	294	465	375	2,323	63%	78%

Recommendation: Total actual retirements were lower than expected and we recommend decreasing the rates.

Table 4(b) (continued)

Summary of Experience for Superannuation

Class T-E and T-F

Age 65 with 3 Years

Females

2015 – 2020

Age	Number of Separations			Exposed	Ratio of Actual to Expected Experience	
	Actual	Current	Proposed		Current	Proposed
65	82	106	93	476	77%	88%
66	60	97	68	350	62	88
67	35	58	51	262	60	69
68	35	53	47	240	66	74
69	<u>32</u>	<u>44</u>	<u>37</u>	<u>192</u>	73	86
Subtotal under 70	244	358	296	1,520	68%	82%
70+	85	114	102	522	75	83
Total All Ages	329	472	398	2,042	70%	83%

Recommendation: Total actual retirements were lower than expected and we recommend decreasing the rates.

Table 5

Summary of Mortality Experience Among Annuitants

Superannuation, Early and Withdrawal Annuitants

Males

2015 – 2020

Central Age	Benefits Released			
	Actual	Expected		Exposed
		Current	Proposed	
Under 35	3,855	193	170	453,950
35	8,417	1,037	1,036	2,098,478
40	6,354	3,131	3,277	5,267,486
45	51,790	9,752	8,608	10,248,457
50	109,731	72,685	39,257	21,859,351
55	588,719	816,734	483,740	137,778,799
60	4,412,208	6,588,485	4,377,225	831,419,354
65	15,776,325	25,782,590	18,030,802	2,316,304,628
70	34,322,820	50,882,750	37,699,201	3,067,362,581
75	39,530,936	50,021,929	40,476,696	1,888,314,503
80	38,456,545	42,636,807	37,834,677	950,380,684
85	42,688,516	43,396,879	41,141,181	558,638,437
90	27,237,973	30,031,072	24,888,297	201,956,615
Over 93	18,111,198	12,003,216	16,321,220	82,757,426
Total	221,305,387	262,247,260	221,305,387	10,074,840,749
Actual/Expected		84.4%	100.0%	

Recommendation: Blended table based on 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Amount-Weighted Male Tables, with a 99.7% adjustment, generationally projected with Buck Modified scale MP-2020.

Table 5 (continued)

Summary of Mortality Experience Among Annuitants

Superannuation, Early and Withdrawal Annuitants

**Females
2015 – 2020**

Central Age	Benefits Released			Exposed
	Actual	Expected Current	Expected Proposed	
Under 35	10,271	113	48	295,760
35	3,386	833	583	2,397,344
40	20,939	2,834	2,232	6,671,898
45	69,953	9,839	6,687	14,466,623
50	87,951	75,833	32,569	32,317,588
55	616,990	841,607	318,919	139,261,316
60	3,157,081	9,273,790	4,095,888	1,253,659,116
65	16,737,281	40,266,638	21,404,962	4,634,957,203
70	34,664,219	57,887,698	38,451,701	5,355,747,001
75	34,166,601	46,775,511	36,209,501	2,817,483,390
80	34,104,317	39,862,063	34,166,135	1,403,197,857
85	37,871,997	41,777,141	36,781,615	785,118,713
90	43,141,821	38,547,957	39,454,419	457,527,438
Over 93	40,705,452	27,548,434	34,432,998	204,742,767
Total	245,358,259	302,870,292	245,358,259	17,107,844,014
Actual/Expected		81.0%	100.0%	

Recommendation: Blended table based on 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Amount-Weighted Female Tables, with a 95.4% adjustment, generationally projected with Buck Modified scale MP-2020.

Table 6

Summary of Mortality Experience Among Annuitants

Disability

Males

2015 – 2020

Central Age	Benefits Released			Exposed
	Actual	Expected		
		Current	Proposed	
Under 35	0	0	0	0
35	19,260	8,177	3,909	654,685
40	89,598	22,795	13,161	1,762,037
45	77,666	93,295	45,039	4,458,302
50	257,793	343,832	225,896	14,980,829
55	587,676	864,414	689,764	32,619,281
60	1,601,300	1,687,433	1,586,899	59,842,552
65	2,126,335	2,225,899	2,255,630	72,392,619
70	1,787,530	2,087,927	2,186,266	58,940,629
75	1,597,381	1,048,787	1,162,933	24,805,769
80	793,603	624,869	634,329	9,595,045
85	454,530	370,974	390,923	3,999,601
90	409,165	301,997	316,124	2,116,805
Over 93	75,858	13,325	34,050	161,568
Total	9,877,695	9,693,724	9,544,922	286,329,722
Actual/Expected		101.8%	103.5%	

Recommendation: Pub-2010 Disability Mortality Non-Safety Amount-Weighted Male Table, with a 105.4% adjustment, generationally projected with Buck Modified scale MP-2020.

Table 6 (continued)

Summary of Mortality Experience Among Annuitants

Disability

**Females
2015 – 2020**

Central Age	Benefits Released			Exposed
	Actual	Expected		
		Current	Proposed	
Under 35	0	908	276	86,024
35	24,677	7,868	6,634	1,518,088
40	32,935	45,470	39,146	6,255,580
45	189,195	158,247	134,105	15,449,937
50	341,561	467,303	438,387	34,374,593
55	1,118,783	1,197,012	1,201,841	72,216,576
60	2,187,339	2,295,745	2,351,313	123,392,793
65	2,900,298	3,246,743	3,173,648	156,391,742
70	2,424,424	2,958,814	2,907,456	123,019,861
75	2,114,154	1,731,538	1,672,735	51,960,748
80	1,145,535	1,152,422	1,075,569	21,902,690
85	824,848	877,435	830,432	10,782,629
90	685,414	527,417	571,309	4,981,610
Over 93	454,557	298,268	337,156	1,835,186
Total	14,443,720	14,965,189	14,740,006	624,168,057
Actual/Expected		96.5%	98.0%	

Recommendation: Pub-2010 Disability Mortality Non-Safety Amount-Weighted Female Table, with a 95.0% adjustment, generationally projected with Buck Modified scale MP-2020.

Table 7

Summary of Mortality Experience Among Annuitants

Beneficiaries and Survivor Annuitants

Males

2015 – 2020

Central Age	Benefits Released			Exposed
	Actual	Expected Current	Expected Proposed	
Under 35	0	517	476	1,163,201
35	9,589	374	423	713,401
40	0	578	717	946,247
45	4,997	684	1,939	808,951
50	7,406	5,102	9,235	1,372,337
55	20,237	16,565	19,806	2,344,131
60	85,893	61,938	67,223	6,233,403
65	428,006	281,625	298,704	21,000,689
70	664,168	589,082	691,311	34,814,519
75	976,100	814,536	981,009	32,341,190
80	868,061	824,613	991,286	20,699,893
85	1,223,599	986,206	1,029,971	12,972,259
90	1,333,476	1,174,174	1,239,668	9,485,150
Over 93	1,257,710	869,470	1,194,392	5,456,358
Total	6,879,242	5,625,466	6,526,159	150,351,729
Actual/Expected		122.3%	105.4%	

Recommendation: Pub-2010 Contingent Survivor Amount-Weighted Male Table, with a 106.0% adjustment, generationally projected with Buck Modified scale MP-2020.

Table 7 (continued)

Summary of Mortality Experience Among Annuitants

Beneficiaries and Survivor Annuitants

**Females
2015 – 2020**

Central Age	Benefits Released			Exposed
	Actual	Expected		
		Current	Proposed	
Under 35	11,574	192	153	911,580
35	0	195	240	793,645
40	3,296	312	313	719,351
45	7,165	981	2,500	1,433,818
50	21,638	9,166	13,235	3,746,634
55	131,003	37,045	43,787	8,525,580
60	334,336	154,230	182,557	25,263,981
65	903,912	424,663	473,788	49,387,084
70	1,570,907	1,030,863	1,109,797	81,576,422
75	1,769,190	1,589,089	1,733,270	81,589,566
80	2,476,382	2,442,154	2,701,949	75,453,819
85	3,470,061	3,794,892	4,191,478	65,889,978
90	5,129,264	4,472,476	5,652,894	50,392,833
Over 93	5,240,829	3,157,845	4,963,595	24,732,741
Total	21,069,557	17,114,103	21,069,557	470,417,032
Actual/Expected		123.1%	100.0%	

Recommendation: Pub-2010 Contingent Survivor Amount-Weighted Female Table, with a 116.2% adjustment, generationally projected with Buck Modified scale MP-2020.

Table 8**Summary of Experience for Death in Active Service****Males****2015 – 2020**

Central Age	Salary Released			Exposed
	Actual	Expected		
		Current	Proposed	
20	20,126	19,804	16,811	51,772,380
25	172,321	217,568	176,635	659,648,799
30	391,834	553,199	583,941	1,599,745,651
35	945,581	1,032,231	1,286,740	2,648,931,666
40	1,460,428	1,603,004	1,983,614	3,236,451,744
45	3,254,092	2,526,021	2,935,130	3,599,671,307
50	3,185,996	4,146,094	3,967,723	3,259,411,242
55	6,695,994	5,835,793	5,144,674	2,678,969,649
60	4,890,021	7,011,729	5,760,912	1,944,279,209
65	2,958,622	5,098,792	3,009,865	712,394,932
Over 68	3,371,987	4,242,882	2,657,444	387,638,908
Total	27,347,002	32,287,117	27,523,489	20,778,915,487
Actual/Expected		84.7%	99.4%	

Recommendation: Blended table based on 50% PubT-2010 Employee (Total Teacher dataset) and 50% PubG-2010 Employee (Total General Employees dataset) Amount-Weighted Male Tables, with a 99.0% adjustment, generationally projected with Buck Modified scale MP-2020.

Table 8 (continued)

Summary of Experience for Death in Active Service

**Females
2015 – 2020**

Central Age	Salary Released			Exposed
	Actual	Expected		
		Current	Proposed	
20	0	6,647	5,074	45,604,641
25	102,941	264,280	198,111	1,943,670,527
30	339,880	756,469	721,600	4,476,065,290
35	1,013,383	1,473,913	1,491,839	6,317,681,943
40	1,310,776	2,245,226	2,220,015	6,840,107,303
45	3,098,186	3,586,715	3,370,274	7,430,400,358
50	4,196,604	5,820,842	4,763,798	7,059,425,635
55	6,546,851	8,156,585	6,633,473	6,258,597,023
60	8,926,191	9,571,400	8,002,487	5,045,270,855
65	3,742,790	5,087,333	3,737,206	1,664,799,017
Over 68	2,104,572	2,394,666	2,247,738	557,355,432
Total	31,382,174	39,364,076	33,391,615	47,638,978,024
Actual/Expected		79.7%	94.0%	

Recommendation: Blended table based on 50% PubT-2010 Employee (Total Teacher dataset) and 50% PubG-2010 Employee (Total General Employees dataset) Amount-Weighted Female Tables, with a 88.6% adjustment, generationally projected with Buck Modified scale MP-2020.

Table 9**Market Value of Assets Return History - 2000 to 2020***

Fiscal Year Ending June 30	Market Value Return	Fiscal Year Ending June 30	Market Value Return
2001	-7.4%	2011	20.4%
2002	-5.3%	2012	3.4%
2003	2.7%	2013	8.0%
2004	19.7%	2014	14.8%
2005	12.9%	2015	3.1%
2006	15.3%	2016	1.3%
2007	22.9%	2017	10.2%
2008	-2.8%	2018	9.3%
2009	-26.5%	2019	6.7%
2010	14.6%	2020	1.1%

* Provided by System's investment consultant.

Table 10**Salary Increase Rates of Active Members****1. 2015 – 2020 Examination Period****Males and Females**

Central Age	Actual Increase						Expected Increase	Proposed Increase
	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	Total		
20	23.4%	22.9%	14.4%	15.1%	11.6%	18.1%	10.10%	9.50%
25	9.9	8.5	7.4	8.2	5.9	8.1	9.19	8.59
30	5.7	5.2	5.2	5.6	5.1	5.3	7.81	7.21
35	4.8	4.3	4.6	4.8	4.7	4.6	6.75	6.15
40	4.3	4.2	4.1	4.3	4.1	4.2	5.75	5.15
45	3.5	3.3	3.1	3.3	2.9	3.2	4.75	4.15
50	3.0	3.0	2.8	2.9	2.5	2.8	3.81	3.21
55	2.7	2.8	2.9	2.9	2.6	2.7	3.31	2.77
60	2.6	2.8	2.9	2.9	2.7	2.7	3.25	2.75
65	2.4	2.7	2.9	2.6	2.4	2.5	3.25	2.75
Over 70	2.8	2.8	2.5	3.1	2.3	2.6	3.25	2.75
Total	3.9%	3.8%	3.8%	3.9%	3.5%	3.7%	5.00%	4.50%

Table 10 (continued)

Salary Increase Rates of Active Members

2. Historical Average Actual Salary Experience Males and Females

Average Age	Five Year Average (2015 – 2020)	Ten Year Average (2010 – 2020)	Fifteen Year Average (2005 – 2020)
	18.1%	16.5%	17.0%
25	8.1%	8.1%	8.7%
30	5.3%	5.2%	6.0%
35	4.6%	4.6%	5.2%
40	4.2%	4.2%	4.7%
45	3.2%	3.3%	3.9%
50	2.8%	2.9%	3.4%
55	2.7%	2.7%	3.1%
60	2.7%	2.6%	3.0%
65	2.5%	2.4%	2.7%
70+	2.6%	2.4%	3.0%
Total	3.7%	3.8%	4.3%

Table 11

Historical Appropriation Payrolls

2015 - 2020

FYE	2015	2016	2017	2018	2019	2020
Active #	259,868	257,080	255,945	256,362	255,749	256,246
Total PSERS Payroll	\$12,866,473	\$12,954,778	\$13,313,900	\$13,466,526	\$13,791,197	\$14,036,006
Increase in Total Payroll		0.7%	2.8%	1.1%	2.4%	1.8%

Section VIII

Recommended Demographic and Active Salary Increase Assumptions

Active Service Termination Assumptions

Age	Class TC & Class TD						Class TE, Class TF, Class TG & Class TH			
	Non-Vested with less than Five Years of Service		Vested with at least Five but less than Ten Years of Service		Vested with at least Ten Years of Service		Vested with less than Ten Years of Service *		Vested with at least Ten Years of Service	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
19	0.2183	0.1833	0.0922	0.0747	0.0455	0.0390	0.2593	0.2746	0.0455	0.0390
20	0.2183	0.1833	0.0922	0.0747	0.0455	0.0390	0.2593	0.2746	0.0455	0.0390
21	0.2183	0.1833	0.0922	0.0747	0.0455	0.0390	0.2593	0.2746	0.0455	0.0390
22	0.2183	0.1833	0.0922	0.0747	0.0455	0.0390	0.2593	0.2746	0.0455	0.0390
23	0.2183	0.1833	0.0922	0.0747	0.0455	0.0390	0.1702	0.1454	0.0455	0.0390
24	0.2183	0.1833	0.0922	0.0747	0.0455	0.0390	0.1702	0.1454	0.0455	0.0390
25	0.2183	0.1833	0.0922	0.0747	0.0455	0.0390	0.1702	0.1454	0.0455	0.0390
26	0.2183	0.1833	0.0922	0.0747	0.0455	0.0390	0.1702	0.1454	0.0455	0.0390
27	0.2183	0.1833	0.0922	0.0747	0.0455	0.0390	0.1702	0.1454	0.0455	0.0390
28	0.1493	0.1516	0.0384	0.0592	0.0455	0.0390	0.1125	0.1168	0.0455	0.0390
29	0.1493	0.1516	0.0384	0.0592	0.0455	0.0390	0.1125	0.1168	0.0455	0.0390
30	0.1493	0.1516	0.0384	0.0592	0.0455	0.0390	0.1125	0.1168	0.0455	0.0390
31	0.1493	0.1516	0.0384	0.0592	0.0455	0.0390	0.1125	0.1168	0.0455	0.0390
32	0.1493	0.1516	0.0384	0.0592	0.0168	0.0390	0.1125	0.1168	0.0168	0.0390
33	0.1517	0.1466	0.0377	0.0568	0.0168	0.0283	0.1209	0.1239	0.0168	0.0283
34	0.1517	0.1466	0.0377	0.0568	0.0168	0.0283	0.1209	0.1239	0.0168	0.0283
35	0.1517	0.1466	0.0377	0.0568	0.0168	0.0283	0.1209	0.1239	0.0168	0.0283
36	0.1517	0.1466	0.0377	0.0568	0.0168	0.0283	0.1209	0.1239	0.0168	0.0283
37	0.1517	0.1466	0.0377	0.0568	0.0142	0.0283	0.1209	0.1239	0.0142	0.0283
38	0.1604	0.1286	0.0444	0.0516	0.0142	0.0167	0.1314	0.1153	0.0142	0.0167
39	0.1604	0.1286	0.0444	0.0516	0.0142	0.0167	0.1314	0.1153	0.0142	0.0167
40	0.1604	0.1286	0.0444	0.0516	0.0142	0.0167	0.1314	0.1153	0.0142	0.0167
41	0.1604	0.1286	0.0444	0.0516	0.0142	0.0167	0.1314	0.1153	0.0142	0.0167
42	0.1604	0.1286	0.0444	0.0516	0.0142	0.0167	0.1314	0.1153	0.0142	0.0167
43	0.1512	0.1282	0.0517	0.0525	0.0141	0.0160	0.1387	0.1099	0.0141	0.0160
44	0.1512	0.1282	0.0517	0.0525	0.0141	0.0160	0.1387	0.1099	0.0141	0.0160
45	0.1512	0.1282	0.0517	0.0525	0.0141	0.0160	0.1387	0.1099	0.0141	0.0160
46	0.1512	0.1282	0.0517	0.0525	0.0141	0.0160	0.1387	0.1099	0.0141	0.0160
47	0.1512	0.1282	0.0517	0.0525	0.0141	0.0160	0.1387	0.1099	0.0141	0.0160
48	0.1581	0.1302	0.0496	0.0523	0.0189	0.0208	0.1367	0.1072	0.0189	0.0208
49	0.1581	0.1302	0.0496	0.0523	0.0189	0.0208	0.1367	0.1072	0.0189	0.0208
50	0.1581	0.1302	0.0496	0.0523	0.0189	0.0208	0.1367	0.1072	0.0189	0.0208
51	0.1581	0.1302	0.0496	0.0523	0.0189	0.0208	0.1367	0.1072	0.0189	0.0208
52	0.1581	0.1302	0.0496	0.0523	0.0189	0.0208	0.1367	0.1072	0.0189	0.0208
53	0.1554	0.1343	0.0496	0.0531	0.0189	0.0208	0.1191	0.1075	0.0189	0.0208
54	0.1554	0.1343	0.0496	0.0531	0.0363	0.0366	0.1191	0.1075	0.0363	0.0366
55	0.1554	0.1343	0.0496	0.0531	0.0363	0.0366	0.1191	0.1075	0.0363	0.0366
56	0.1554	0.1343	0.0496	0.0531	0.0363	0.0366	0.1191	0.1075	0.0363	0.0366
57	0.1554	0.1343	0.0496	0.0531	0.0363	0.0366	0.1191	0.1075	0.0363	0.0366
58	0.1385	0.1381	0.0637	0.0753	0.0363	0.0455	0.1119	0.1162	0.0363	0.0455
59	0.1385	0.1381	0.0637	0.0753	0.0549	0.0594	0.1119	0.1162	0.0549	0.0594
60	0.1385	0.1381	0.0637	0.0753	0.0549	0.0594	0.1119	0.1162	0.0549	0.0594
61	0.1385	0.1381	0.0637	0.0753	0.1475	0.1394	0.1119	0.1162	0.0549	0.0594
62							0.1119	0.1162	0.0549	0.0594
63							0.1119	0.1162	0.0549	0.0594
64							0.1119	0.1162	0.0549	0.0594

* For members with less than three years of service, the rates at age 64 are applied to older ages before age 80.

Active Service Termination Assumptions (continued)

Age	Class TC & Class TD				Class TE & Class TF				Class TG & Class TH			
	Early Retirement		Superannuation		Early Retirement		Superannuation		Early Retirement *		Superannuation	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
45			0.1900	0.1600								
46			0.1900	0.1600								
47			0.1900	0.1600								
48			0.1900	0.1600								
49			0.1900	0.1600								
50			0.1900	0.1600								
51			0.1900	0.1600								
52			0.1900	0.1600								
53			0.1900	0.1600								
54			0.2500	0.1600			0.1630	0.1950			0.1630	0.1950
55	0.1450	0.1450	0.2500	0.1600	0.1450	0.1450	0.1630	0.1950	0.1450	0.1450	0.1630	0.1950
56	0.1450	0.1450	0.2500	0.2000	0.1450	0.1450	0.1630	0.1950	0.1450	0.1450	0.1630	0.1950
57	0.1450	0.1500	0.2800	0.2800	0.1450	0.1500	0.1630	0.1950	0.1450	0.1500	0.1630	0.1950
58	0.1450	0.1500	0.2800	0.3000	0.1450	0.1500	0.1630	0.1950	0.1450	0.1500	0.1630	0.1950
59	0.2160	0.2070	0.2800	0.3000	0.2160	0.2070	0.1630	0.1950	0.2160	0.2070	0.1630	0.1950
60	0.1450	0.1500	0.2900	0.3100	0.1450	0.1500	0.1630	0.1950	0.1450	0.1500	0.1630	0.1950
61	0.2900	0.2900	0.2900	0.3100	0.2900	0.2900	0.1630	0.1950	0.2900	0.2900	0.1630	0.1950
62			0.3600	0.3100	0.2900	0.2900	0.1630	0.1950	0.2900	0.2900	0.1630	0.1950
63			0.2100	0.2000	0.2900	0.2900	0.1630	0.1950	0.2900	0.2900	0.1630	0.1950
64			0.2200	0.2500	0.2900	0.2900	0.1630	0.1950	0.2900	0.2900	0.1630	0.1950
65			0.2300	0.2800			0.1630	0.1950	0.2900	0.2900	0.1630	0.1950
66			0.2300	0.2700			0.1630	0.1950	0.2900	0.2900	0.1630	0.1950
67			0.2000	0.2300			0.1630	0.1950			0.1630	0.1950
68			0.2000	0.2200			0.1630	0.1950			0.1630	0.1950
69			0.2000	0.2300			0.1630	0.1950			0.1630	0.1950
70			0.2000	0.2300			0.1630	0.1950			0.1630	0.1950
71			0.2000	0.2000			0.1630	0.1950			0.1630	0.1950
72			0.2000	0.2000			0.1630	0.1950			0.1630	0.1950
73			0.2000	0.2000			0.1630	0.1950			0.1630	0.1950
74			0.2500	0.2500			0.1630	0.1950			0.1630	0.1950
75			0.2500	0.2500			0.1630	0.1950			0.1630	0.1950
76			0.2500	0.2500			0.1630	0.1950			0.1630	0.1950
77			0.2500	0.2500			0.1630	0.1950			0.1630	0.1950
78			0.2500	0.2500			0.1630	0.1950			0.1630	0.1950
79			0.2500	0.2500			0.1630	0.1950			0.1630	0.1950
80			1.0000	1.0000			1.0000	1.0000			1.0000	1.0000

* The rates at ages 55 and 56 are not applicable to Class T-G members.

Active Service Termination Assumptions (continued)

Age	Disability Retirement *		Death in Active Service ¹		Age	Disability Retirement *		Death in Active Service ¹	
	Male	Female	Male	Female		Male	Female	Male	Female
19	0.0001	0.0001	0.0004	0.0001	50	0.0023	0.0018	0.0013	0.0007
20	0.0001	0.0001	0.0004	0.0001	51	0.0023	0.0018	0.0014	0.0008
21	0.0001	0.0001	0.0003	0.0001	52	0.0023	0.0018	0.0015	0.0008
22	0.0001	0.0001	0.0003	0.0001	53	0.0037	0.0029	0.0017	0.0009
23	0.0001	0.0001	0.0003	0.0001	54	0.0037	0.0029	0.0018	0.0009
24	0.0001	0.0001	0.0002	0.0001	55	0.0037	0.0029	0.0019	0.0010
25	0.0001	0.0001	0.0002	0.0001	56	0.0037	0.0029	0.0021	0.0011
26	0.0001	0.0001	0.0002	0.0001	57	0.0037	0.0029	0.0023	0.0012
27	0.0001	0.0001	0.0002	0.0001	58	0.0037	0.0024	0.0025	0.0013
28	0.0001	0.0002	0.0003	0.0001	59	0.0037	0.0024	0.0027	0.0014
29	0.0001	0.0002	0.0003	0.0001	60	0.0037	0.0024	0.0029	0.0015
30	0.0001	0.0002	0.0003	0.0001	61	0.0037	0.0024	0.0031	0.0017
31	0.0001	0.0002	0.0003	0.0001	62	0.0037	0.0024	0.0034	0.0019
32	0.0001	0.0002	0.0003	0.0002	63	0.0011	0.0007	0.0037	0.0020
33	0.0004	0.0003	0.0003	0.0002	64	0.0011	0.0007	0.0041	0.0023
34	0.0004	0.0003	0.0004	0.0002	65	0.0011	0.0007	0.0045	0.0025
35	0.0004	0.0003	0.0004	0.0002	66	0.0011	0.0007	0.0049	0.0028
36	0.0004	0.0003	0.0004	0.0002	67	0.0011	0.0007	0.0054	0.0031
37	0.0004	0.0003	0.0004	0.0002	68	0.0008	0.0009	0.0059	0.0035
38	0.0006	0.0006	0.0005	0.0003	69	0.0008	0.0009	0.0064	0.0039
39	0.0006	0.0006	0.0005	0.0003	70	0.0008	0.0009	0.0070	0.0043
40	0.0006	0.0006	0.0005	0.0003	71	0.0008	0.0009	0.0076	0.0048
41	0.0006	0.0006	0.0006	0.0003	72	0.0008	0.0009	0.0083	0.0054
42	0.0006	0.0006	0.0006	0.0004	73	0.0008	0.0009	0.0091	0.0061
43	0.0011	0.0011	0.0007	0.0004	74	0.0008	0.0009	0.0099	0.0068
44	0.0011	0.0011	0.0007	0.0004	75	0.0008	0.0009	0.0108	0.0077
45	0.0011	0.0011	0.0008	0.0005	76	0.0008	0.0009	0.0121	0.0086
46	0.0011	0.0011	0.0009	0.0005	77	0.0008	0.0009	0.0135	0.0097
47	0.0011	0.0011	0.0010	0.0006	78	0.0008	0.0009	0.0152	0.0110
48	0.0023	0.0018	0.0011	0.0006	79	0.0008	0.0009	0.0170	0.0124
49	0.0023	0.0018	0.0012	0.0006					

* For members with five or more years of service.

1. Males: Blended table based on 50% PubT-2010 Employee (Total Teacher dataset) and 50% PubG-2010 Employee (Total General Employees dataset) Amount-Weighted Male Tables, with a 99.0% adjustment, generationally projected with Buck Modified scale MP-2020. Females: Blended table based on 50% PubT-2010 Employee (Total Teacher dataset) and 50% PubG-2010 (Total General Employees dataset) Amount-Weighted Female Tables, with a 88.6% adjustment, generationally projected with Buck Modified scale MP-2020.

Post-Retirement Mortality Assumptions

Age	Healthy ¹		Disability ²		Beneficiary & Survivor Annuitant ³	
	Male	Female	Male	Female	Male	Female
50	0.00204	0.00141	0.01692	0.01409	0.00743	0.00372
51	0.00221	0.00149	0.01804	0.01458	0.00767	0.00397
52	0.00239	0.00158	0.01916	0.01508	0.00792	0.00425
53	0.00258	0.00167	0.02025	0.01558	0.00817	0.00454
54	0.00279	0.00177	0.02129	0.01607	0.00845	0.00485
55	0.00326	0.00228	0.02228	0.01655	0.00873	0.00518
56	0.00353	0.00243	0.02320	0.01700	0.00905	0.00553
57	0.00382	0.00259	0.02403	0.01741	0.00940	0.00590
58	0.00413	0.00277	0.02482	0.01780	0.00979	0.00631
59	0.00448	0.00297	0.02559	0.01818	0.01023	0.00675
60	0.00485	0.00320	0.02638	0.01858	0.01073	0.00723
61	0.00525	0.00347	0.02724	0.01900	0.01131	0.00775
62	0.00572	0.00378	0.02822	0.01948	0.01198	0.00833
63	0.00623	0.00415	0.02935	0.02005	0.01274	0.00897
64	0.00682	0.00456	0.03065	0.02069	0.01363	0.00968
65	0.00750	0.00505	0.03208	0.02143	0.01467	0.01045
66	0.00830	0.00560	0.03365	0.02229	0.01587	0.01131
67	0.00923	0.00623	0.03534	0.02328	0.01726	0.01224
68	0.01030	0.00695	0.03714	0.02441	0.01883	0.01328
69	0.01153	0.00779	0.03906	0.02571	0.02060	0.01443
70	0.01294	0.00874	0.04112	0.02719	0.02257	0.01572
71	0.01454	0.00984	0.04335	0.02887	0.02475	0.01717
72	0.01637	0.01108	0.04579	0.03077	0.02716	0.01881
73	0.01843	0.01250	0.04847	0.03291	0.02980	0.02065
74	0.02078	0.01412	0.05144	0.03532	0.03269	0.02269
75	0.02344	0.01595	0.05472	0.03803	0.03585	0.02499
76	0.02646	0.01803	0.05836	0.04106	0.03928	0.02755
77	0.02986	0.02037	0.06241	0.04444	0.04304	0.03043
78	0.03370	0.02303	0.06690	0.04821	0.04717	0.03367
79	0.03805	0.02604	0.07190	0.05241	0.05173	0.03735
80	0.04297	0.02947	0.07745	0.05707	0.05682	0.04152
81	0.04854	0.03338	0.08357	0.06223	0.06251	0.04631
82	0.05485	0.03783	0.09028	0.06793	0.06888	0.05177

1. Males: Blended table based on 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Amount-Weighted Male Tables, with a 99.7% adjustment, generationally projected with Buck Modified scale MP-2020.

Females: Blended table based on 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Amount-Weighted Female Tables, with a 95.4% adjustment, generationally projected with Buck Modified scale MP-2020 .

2. Males: Pub-2010 Disability Mortality Non-Safety Amount-Weighted Male Table, with a 105.4% adjustment, generationally projected with Buck Modified scale MP-2020.

Females: Pub-2010 Disability Mortality Non-Safety Amount-Weighted Female Table, with a 95.0% adjustment, generationally projected with Buck Modified scale MP-2020.

3. Males: Pub-2010 Contingent Survivor Amount-Weighted Male Table, with a 106.0% adjustment, generationally projected with Buck Modified scale MP-2020.

Females: Pub-2010 Contingent Survivor Amount-Weighted Female Table, with a 116.2% adjustment, generationally projected with Buck Modified scale MP-2020.

Post-Retirement Mortality Assumptions (continued)

Age	Healthy ¹		Disability ²		Beneficiary & Survivor Annuitant ³	
	Male	Female	Male	Female	Male	Female
83	0.06197	0.04291	0.09759	0.07420	0.07599	0.05803
84	0.06996	0.04870	0.10551	0.08109	0.08390	0.06520
85	0.07890	0.05529	0.11399	0.08864	0.09268	0.07339
86	0.08880	0.06278	0.12309	0.09655	0.10237	0.08276
87	0.09973	0.07123	0.13286	0.10463	0.11305	0.09331
88	0.11174	0.08071	0.14338	0.11284	0.12474	0.10506
89	0.12490	0.09126	0.15663	0.12119	0.13757	0.11790
90	0.13924	0.10292	0.17131	0.12982	0.15283	0.13164
91	0.15468	0.11562	0.18636	0.13886	0.16904	0.14637
92	0.17111	0.12929	0.20159	0.14853	0.18608	0.16212
93	0.18844	0.14390	0.21700	0.15903	0.20390	0.17896
94	0.20655	0.15941	0.23270	0.17057	0.22245	0.19691
95	0.22533	0.17579	0.24892	0.18333	0.24168	0.21602
96	0.24467	0.19299	0.26588	0.19745	0.26154	0.23626
97	0.26444	0.21097	0.28378	0.21322	0.28197	0.25760
98	0.28453	0.22963	0.30274	0.23015	0.30288	0.27997
99	0.30480	0.24890	0.32278	0.24828	0.32416	0.30325
100	0.32511	0.26865	0.34370	0.26752	0.34566	0.32722
101	0.34532	0.28873	0.36506	0.28752	0.36714	0.35168
102	0.36530	0.30892	0.38619	0.30763	0.38838	0.37628
103	0.38488	0.32907	0.40689	0.32769	0.40920	0.40082
104	0.40390	0.34898	0.42700	0.34752	0.42943	0.42507
105	0.42225	0.36848	0.44639	0.36694	0.44893	0.44882
106	0.43981	0.38741	0.46495	0.38579	0.46760	0.47188
107	0.45649	0.40563	0.48258	0.40393	0.48533	0.49407
108	0.47222	0.42301	0.49922	0.42124	0.50206	0.51524
109	0.48696	0.43948	0.51481	0.43764	0.51774	0.53530
110	0.49850	0.45496	0.52700	0.45306	0.53000	0.55416
111	0.49850	0.46942	0.52700	0.46745	0.53000	0.57176
112	0.49850	0.47700	0.52700	0.47500	0.53000	0.58100
113	0.49850	0.47700	0.52700	0.47500	0.53000	0.58100
114	0.49850	0.47700	0.52700	0.47500	0.53000	0.58100
115	0.49850	0.47700	0.52700	0.47500	0.53000	0.58100

1. Males: Blended table based on 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Amount-Weighted Male Tables, with a 99.7% adjustment, generationally projected with Buck Modified scale MP-2020.

Females: Blended table based on 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Amount-Weighted Female Tables, with a 95.4% adjustment, generationally projected with Buck Modified scale MP-2020.

2. Males: Pub-2010 Disability Mortality Non-Safety Amount-Weighted Male Table, with a 105.4% adjustment, generationally projected with Buck Modified scale MP-2020.

Females: Pub-2010 Disability Mortality Non-Safety Amount-Weighted Female Table, with a 95.0% adjustment, generationally projected with Buck Modified scale MP-2020.

3. Males: Pub-2010 Contingent Survivor Amount-Weighted Male Table, with a 106.0% adjustment, generationally projected with Buck Modified scale MP-2020.

Females: Pub-2010 Contingent Survivor Amount-Weighted Female Table, with a 116.2% adjustment, generationally projected with Buck Modified scale MP-2020.

Active Salary Increase Assumptions

Age	Salary Increase	Age	Salary Increase
19	9.65%	50	3.15%
20	9.65%	51	3.05%
21	9.45%	52	2.95%
22	9.25%	53	2.85%
23	9.05%	54	2.75%
24	8.85%	55	2.75%
25	8.65%	56	2.75%
26	8.35%	57	2.75%
27	8.05%	58	2.75%
28	7.75%	59	2.75%
29	7.45%	60	2.75%
30	7.15%	61	2.75%
31	6.95%	62	2.75%
32	6.75%	63	2.75%
33	6.55%	64	2.75%
34	6.35%	65	2.75%
35	6.15%	66	2.75%
36	5.95%	67	2.75%
37	5.75%	68	2.75%
38	5.55%	69	2.75%
39	5.35%	70	2.75%
40	5.15%	71	2.75%
41	4.95%	72	2.75%
42	4.75%	73	2.75%
43	4.55%	74	2.75%
44	4.35%	75	2.75%
45	4.15%	76	2.75%
46	3.95%	77	2.75%
47	3.75%	78	2.75%
48	3.55%	79	2.75%
49	3.35%		

Healthcare Premium Assistance GASB 74 and 75 Accounting

Active Mortality Assumptions

Age	Active Death		Age	Active Death	
	Male	Female		Male	Female
19	0.00037	0.00012	50	0.00147	0.00076
20	0.00037	0.00012	51	0.00160	0.00082
21	0.00035	0.00011	52	0.00174	0.00088
22	0.00033	0.00010	53	0.00189	0.00096
23	0.00030	0.00009	54	0.00205	0.00103
24	0.00029	0.00009	55	0.00220	0.00111
25	0.00028	0.00010	56	0.00238	0.00121
26	0.00029	0.00011	57	0.00257	0.00130
27	0.00031	0.00011	58	0.00277	0.00140
28	0.00033	0.00012	59	0.00301	0.00153
29	0.00034	0.00014	60	0.00325	0.00166
30	0.00036	0.00015	61	0.00353	0.00182
31	0.00038	0.00015	62	0.00383	0.00199
32	0.00040	0.00017	63	0.00418	0.00219
33	0.00042	0.00019	64	0.00456	0.00241
34	0.00044	0.00021	65	0.00499	0.00266
35	0.00046	0.00021	66	0.00545	0.00293
36	0.00049	0.00024	67	0.00597	0.00325
37	0.00051	0.00026	68	0.00653	0.00360
38	0.00055	0.00028	69	0.00715	0.00398
39	0.00059	0.00031	70	0.00782	0.00442
40	0.00063	0.00033	71	0.00854	0.00491
41	0.00068	0.00036	72	0.00930	0.00545
42	0.00073	0.00039	73	0.01015	0.00607
43	0.00080	0.00043	74	0.01105	0.00680
44	0.00086	0.00047	75	0.01204	0.00762
45	0.00094	0.00050	76	0.01346	0.00858
46	0.00103	0.00055	77	0.01506	0.00965
47	0.00113	0.00060	78	0.01688	0.01088
48	0.00123	0.00065	79	0.01892	0.01225
49	0.00135	0.00070			

Males: Blended table based on 50% PubT-2010 Employee (Total Teacher dataset) and 50% PubG-2010 Employee (Total General Employees dataset) Headcount-Weighted Male Tables, adjusted for credibility and generationally projected with Buck Modified scale MP-2020.

Females: Blended table based on 50% PubT-2010 Employee (Total Teacher dataset) and 50% PubG-2010 (Total General Employees dataset) Headcount-Weighted Female Tables, adjusted for credibility and generationally projected with Buck Modified scale MP-2020.

Healthcare Premium Assistance GASB 74 and 75 Accounting

Post-Retirement Mortality Assumption

Age	Healthy ¹		Disability ²		Age	Healthy ¹		Disability ²	
	Male	Female	Male	Female		Male	Female	Male	Female
35	0.00043	0.00023	0.00526	0.00388	76	0.02723	0.01839	0.06147	0.04469
36	0.00046	0.00026	0.00556	0.00423	77	0.03062	0.02075	0.06569	0.04819
37	0.00049	0.00028	0.00592	0.00459	78	0.03442	0.02341	0.07038	0.05210
38	0.00052	0.00031	0.00632	0.00500	79	0.03868	0.02640	0.07558	0.05646
39	0.00056	0.00033	0.00677	0.00548	80	0.04346	0.02978	0.08134	0.06132
40	0.00060	0.00036	0.00729	0.00600	81	0.04882	0.03364	0.08766	0.06671
41	0.00064	0.00039	0.00787	0.00657	82	0.05485	0.03804	0.09456	0.07269
42	0.00069	0.00043	0.00853	0.00719	83	0.06162	0.04309	0.10205	0.07931
43	0.00075	0.00046	0.00926	0.00787	84	0.06920	0.04888	0.11010	0.08658
44	0.00082	0.00051	0.01010	0.00861	85	0.07765	0.05554	0.11869	0.09457
45	0.00089	0.00055	0.01103	0.00940	86	0.08706	0.06317	0.12782	0.10295
46	0.00097	0.00059	0.01206	0.01024	87	0.09749	0.07182	0.13755	0.11153
47	0.00106	0.00065	0.01318	0.01113	88	0.10899	0.08157	0.14793	0.12024
48	0.00116	0.00070	0.01441	0.01209	89	0.12161	0.09243	0.15903	0.12911
49	0.00127	0.00076	0.01573	0.01310	90	0.13540	0.10437	0.17093	0.13825
50	0.00289	0.00217	0.01714	0.01416	91	0.15020	0.11740	0.18368	0.14782
51	0.00305	0.00221	0.01817	0.01464	92	0.16585	0.13146	0.19862	0.15801
52	0.00323	0.00224	0.01923	0.01514	93	0.18225	0.14652	0.21457	0.16903
53	0.00341	0.00229	0.02031	0.01565	94	0.19927	0.16251	0.23069	0.18108
54	0.00359	0.00234	0.02139	0.01614	95	0.21680	0.17936	0.24710	0.19436
55	0.00426	0.00305	0.02246	0.01662	96	0.23471	0.19697	0.26399	0.20897
56	0.00449	0.00312	0.02351	0.01713	97	0.25289	0.21524	0.28151	0.22501
57	0.00474	0.00321	0.02450	0.01769	98	0.27125	0.23407	0.29981	0.24244
58	0.00501	0.00332	0.02547	0.01825	99	0.28967	0.25332	0.31888	0.26113
59	0.00530	0.00346	0.02644	0.01884	100	0.30803	0.27287	0.33860	0.28082
60	0.00563	0.00362	0.02744	0.01946	101	0.32624	0.29258	0.35862	0.30110
61	0.00599	0.00383	0.02852	0.02013	102	0.34416	0.31231	0.37831	0.32140
62	0.00641	0.00410	0.02972	0.02084	103	0.36166	0.33187	0.39756	0.34153
63	0.00690	0.00441	0.03106	0.02164	104	0.37863	0.35108	0.41620	0.36131
64	0.00746	0.00480	0.03255	0.02250	105	0.39494	0.36980	0.43414	0.38057
65	0.00813	0.00527	0.03417	0.02344	106	0.41052	0.38787	0.45126	0.39916
66	0.00894	0.00582	0.03590	0.02449	107	0.42530	0.40515	0.46750	0.41696
67	0.00988	0.00648	0.03773	0.02566	108	0.43921	0.42157	0.48279	0.43385
68	0.01097	0.00724	0.03963	0.02697	109	0.45224	0.43703	0.49712	0.44976
69	0.01222	0.00811	0.04162	0.02843	110	0.45850	0.45150	0.50400	0.46465
70	0.01365	0.00909	0.04373	0.03006	111	0.45850	0.46350	0.50400	0.47700
71	0.01528	0.01020	0.04600	0.03188	112	0.45850	0.46350	0.50400	0.47700
72	0.01712	0.01146	0.04847	0.03392	113	0.45850	0.46350	0.50400	0.47700
73	0.01920	0.01288	0.05121	0.03619	114	0.45850	0.46350	0.50400	0.47700
74	0.02156	0.01449	0.05426	0.03871	115	0.45850	0.46350	0.50400	0.47700
75	0.02423	0.01632	0.05767	0.04154	116	0.45850	0.46350	0.50400	0.47700

1. Males: Blended table based on 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Headcount-Weighted Male Tables, adjusted for credibility and generationally projected with Buck Modified scale MP-2020.

Females: Blended table based on 50% PubT-2010 Retiree (Total Teacher dataset) and 50% PubG-2010 Retiree (Total General Employees dataset) Headcount-Weighted Female Tables, adjusted for credibility and generationally projected with Buck Modified scale MP-2020.

2. Males: Pub-2010 Disability Mortality Non-Safety Headcount-Weighted Male Table, adjusted for credibility and generationally projected with Buck Modified scale MP-2020.

Females: Pub-2010 Disability Mortality Non-Safety Headcount-Weighted Female Table, adjusted for credibility and generationally projected with Buck Modified scale MP-2020.

Section IX

Actuarial Standard of Practice No. 51 (ASOP 51)

Consideration of Risk

- ASOP 51 risk - actual future measurements deviating from expected future measurements due to actual experience deviating from actuarial assumptions
- Experience studies attempt to mitigate this risk by re-evaluating the actuarial assumptions compared to past experience on a regular basis
 - Use combination of past experience and professional judgement
- Demographic experience study addresses the risk that actual demographic experience will be different than assumed
 - Longevity risk – Members living longer than assumed increases costs
 - Mortality assumption addresses this risk
 - Risk due to Option 4 withdrawal of accumulated deductions at retirement - more retirees are electing a lump sum than assumed
 - possible liquidity issues increasing investment risk
 - For Class T-C and T-D difference in interest versus investment return rate presents an additional liability
 - Retirement risk - more retirees commence their benefits earlier than assumed generally increases costs
 - May pay out subsidized early and superannuation benefits for a longer period of time than assumed
 - May be offset some by lower accrued benefits at retirement due to lower salary and service at retirement than assumed
 - Withdrawal prior to retirement risk – less members withdraw than assumed generally increases the costs
- Economic assumptions study addresses the risk that actual economic experience will be different than assumed
 - Investment risk – the risk that assets will not return as expected
 - Expected Return on Assets Analysis addresses this risk
 - Investment risk is mitigated to some extent by the “shared-risk” provisions of the Retirement System and its potential impact on the member contribution rates for Class T-E, Class T-F, Class T-G and Class T-H members. Poor asset returns over a period of time could trigger increased member contributions for these classes of members. These increased member contributions would offset some of the poor asset returns for the Retirement System.
 - Salary Increase - retirement system costs are sensitive to salary increases since benefits at retirement are pay related.
 - Salaries greater than expected would lead to higher liabilities, larger unfunded liabilities and larger employer contributions.
 - Salaries less than expected would lead to lower liabilities but may increase employer contribution rates due to lower employer payroll.
 - Payroll growth risk –Employer contributions are based on a percentage of members' salaries. If the required dollar amount of contributions remains level or increases, a declining payroll will result in higher contribution rates in order to meet required contribution levels.
- Contribution risk – actuarial assumption out of line with actual experience may create losses that make contributions more volatile and expensive at times when the System sponsor is less able to afford the costs. This increases the risk of not contributing an actuarially determined contribution.