



Pennsylvania Public School Employees' Retirement System

Actuarial Valuation Report
June 30, 2019



August 5, 2020

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 annual actuarial valuation of the Pennsylvania Public School Employees' Retirement System (Retirement System or PSERS) as of June 30, 2019.

The valuation takes into account all of the promised benefits to which members are entitled as of June 30, 2019, including pension and survivor benefits, and as required by the Public School Employees' Retirement Code, 24 Pa. C.S. §8101 et. seq. (Retirement Code) is the basis for the contribution rate for fiscal year 2020/2021. In addition, the contribution rate indicated in the report includes a rate for anticipated employer contributions to the Pennsylvania Employees' Defined Contribution plan (DC Plan) for anticipated Class T-G, Class T-H and Class DC participants on or after July 1, 2020 and prior to July 1, 2021.

As required under Section 8502(j) of the Retirement Code, experience studies are performed once in every five-year period. This valuation was prepared on the basis of the demographic and economic assumptions that were recommended on the basis of an Experience Review covering the period from July 1, 2010 to June 30, 2015 and adopted by the Board of Trustees at their June 10, 2016 meeting. As mandated by the Retirement Code, these assumptions will remain in effect for valuation purposes until such time as the Board of Trustees adopts revised assumptions.

Reporting requirements of GASB Statements No. 67 and No. 68 took effect for PSERS at the June 30, 2014 and June 30, 2015 reporting dates, respectively. Also, reporting requirements of GASB Statements No. 74 and No. 75 took effect for PSERS at the June 30, 2017 and June 30, 2018 reporting dates, respectively. These requirements are addressed in separate reports.

Assets and Membership Data

The Retirement System provided the individual data for members used in the valuation. While we did not verify the data at their source, we did perform tests for internal consistency and reasonableness. The amount of assets in the trust fund taken into account in the valuation was based on statements prepared by the Retirement System. The accuracy of the results presented in this report is dependent on the accuracy of the data.

Funding Adequacy

The valuation results indicate that the employer contribution rate for fiscal year 2020/2021 is 34.51%. This rate includes a rate of .18% for employer contributions to the DC Plan. The 0.18% Act 5 DC contribution rate is an estimated average DC contribution rate. The actual employer DC contribution rate will be based on each employer's Class T-G, Class T-H, and Class DC only membership.

As of June 30, 2019, the total funded ratio of the plan (for Pensions and Health Insurance Premium Assistance combined) is 58.1%, based on the accrued liability and actuarial value of assets calculated under the funding requirements of Section 8328 of the Retirement Code.

For the fifth consecutive year, the PSERS Board has certified the full employer contribution rate calculated by the actuary. This follows 15 years in which contributions to the System were constrained to be less than the actuarially determined amounts. This is an essential step to bring PSERS back to a fully funded status. Full actuarial funding from employers along with member contributions and investment income are necessary sources of funds that will pay down the unfunded liability of the System.

Unless stated otherwise, references to “funded ratio” and “unfunded accrued liability” are measured on an actuarial value of assets basis. It should be noted that if the same measurements were made using the market value of assets, different funded ratios and unfunded accrued liabilities would result. Moreover, the funded ratio presented is appropriate for evaluating the need and level of future contributions but makes no assessment regarding the funded status of the Retirement System if the Retirement System were to settle (i.e., purchase annuities to cover) a portion or all of its liabilities. Assuming contributions are made at the level indicated in the actuarial valuation and no future Retirement System experience gains or losses, future expected plan contributions are expected to remain relatively level as a percent of payroll and the funded status is expected to increase.

Financial Results and Membership Data

Detailed summaries of the financial results of the valuation and membership data used in preparing the valuation are shown in the valuation report. The actuaries prepared supporting schedules included in the Actuarial and Statistical Section of the PSERS Comprehensive Annual Financial Report (CAFR) and also provided historical data schedules included in the Financial Section of the CAFR.

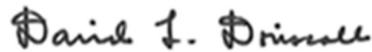
Actuarial Standard of Practice No. 51 (ASOP 51) applies to funding calculations such as those presented in this report and requires certain disclosures of potential risks. Exhibit VIII contains an assessment of the key risks applicable to the Retirement System.

Future actuarial measurements may differ significantly from current measurements due to Retirement System 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 Retirement System provisions or applicable law. Liability models necessarily rely on the use of approximations and estimates and are sensitive to changes in these approximations and estimates. Small variations in these approximations and estimates may lead to significant changes in actuarial measurements. An analysis of the potential range of such future differences is beyond the scope of this valuation.

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.

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.


Buck Global, LLC



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



Edward Quinn, EA, MAAA, FCA
Director, Retirement Actuary



Salvador Nakar, EA, MAAA, FCA
Senior Consultant, Actuary

Pennsylvania Public School Employees' Retirement System

Table of Contents

Table/Exhibit

Executive Summary	1
Table 1 - Summary of Results of Actuarial Valuation as of June 30, 2019	11
Table 2 - Summary of Sources of Employer Contribution Rate as of June 30, 2019.....	12
Table 3 - Determination of Health Insurance Premium Assistance Contribution Rate for Fiscal Year 2020/2021	13
Table 4 - Summary of Market Value of Plan Assets as of June 30, 2019.....	14
Table 5 - Derivation of Actuarial Value of Assets as of June 30, 2019	15
Table 6 - Analysis of Change in Unfunded Accrued Liability as of June 30, 2019.....	16
Table 7 - Schedules of Funding Progress	17
Table 8 - Solvency Test - Comparative Summary of Accrued Liability and Actuarial Value of Assets..	17
Table 9 - Schedule of Employer Contributions	18
Table 10 - History of Contribution Rates and Funded Ratios.....	19
Table 11 - History and Projection of Annuitants, Beneficiaries, Survivor Annuitants and Active Members	20
Table 12 - Description of Actuarial Assumptions and Methods.....	21
Table 13 - Summary of Benefit and Contribution Provisions.....	25
Table 14 - Summary of Membership Data as of June 30, 2019.....	31
Exhibit I - Active Membership Data as of June 30, 2019 - Number and Average Annual Salary	35
Exhibit II - The Number and Average Annual Annuity as of June 30, 2019 – Retired on Account of Superannuation, Early Retirement and Those in Receipt of Withdrawal Annuities	36
Exhibit III - The Number and Average Annual Annuity as of June 30, 2019 – Beneficiaries and Survivor Annuitants.....	37
Exhibit IV - The Number and Average Annual Annuity as of June 30, 2019 – Retired on Account of Disability.....	38
Exhibit V - Annuitant and Beneficiary Membership Data as of June 30, 2019.....	39
Exhibit VI - 10-Year History of Membership Data.....	40
Exhibit VII - Detailed Tabulations of the Data.....	42
Exhibit VIII – ASOP 51 Disclosures	54
Exhibit IX - Glossary	58

Executive Summary

This report presents the actuarial valuation as of June 30, 2019 for the Pennsylvania Public School Employees' Retirement System.

The principal valuation results include:

- The employer contribution rate for fiscal year 2020/2021, which is 34.51% (33.51% Pension plus 0.82% Premium Assistance plus 0.18% Act 5 DC contribution).
- The 0.18% Act 5 DC contribution rate is an estimated average DC contribution rate. The actual employer DC contribution rate will be based on each employer's Class T-G, Class T-H, and Class DC only membership.
- The unfunded accrued liability as of June 30, 2019 is \$44.1 billion. The decrease in the unfunded accrued liability from \$44.9 billion in the June 30, 2018 valuation is the first decrease in over a decade.
- The total funded ratio of the Retirement System determined as of June 30, 2019 under the funding requirements of Section 8328 of the Retirement Code is 58.1%, which is based on the accrued liability and the actuarial value of assets for Pensions and Health Insurance Premium Assistance as of that date. The funded ratio as of June 30, 2018 was 56.5%. This is the first significant increase in the funded ratio in over a decade.
- The determination and analysis of actuarial experience in the year ending June 30, 2019, which consisted of a net experience gain of \$528 million.
- The asset loss from 2008/2009 (Great Recession) was fully recognized in the June 30, 2018 valuation.
- The Act 120 minimum employer pension rate is the normal cost rate of 7.37%.
- For the fifth consecutive year, the PSERS Board has certified the full employer contribution rate calculated by the actuary. This follows 15 years in which contributions to the System were constrained to be less than the actuarially determined amounts. This is an essential step to bring PSERS back to a fully funded status. Full actuarial funding from employers along with member contributions and investment income are necessary sources of funds that will pay down the unfunded liability of the System.
- The next Class T-E, Class T-F, Class T-G and Class T-H shared-risk valuation is to be performed for the nine-year period ending June 30, 2020. The Act 5-2017 member shared-risk contribution rates are discussed on page 8.
- Annual disclosures as of June 30, 2019 in accordance with the Governmental Accounting Standards Board (GASB) Statements No. 67 and 68 for Pensions and Statements No. 74 and 75 for the Health Insurance Premium Assistance Program have been provided in separate reports.

The valuation was completed based upon membership and financial data submitted by the Retirement System. Detailed summaries of the financial results of the valuation and membership data used in preparing the valuation are included in the valuation report. The actuaries prepared supporting schedules included in the Actuarial and Statistical Section of the PSERS Comprehensive Annual Financial Report (CAFR) and also provided historical data schedules included in the Financial Section of the CAFR.

Changes Since Last Year

Legislative and Administrative Changes

The benefit provisions and contribution provisions are summarized in Table 13. There were no legislative or administrative changes since the prior valuation.

Actuarial Assumptions and Methods

The actuarial assumptions and methods are outlined in Table 12.

As required under Section 8502(j) of the Retirement Code, experience studies are performed once in every five-year period. This valuation was prepared using demographic and economic assumptions that were recommended on the basis of the Experience Review covering the period from July 1, 2010 to June 30, 2015 and adopted by the Board at their June 10, 2016 meeting.

There have been no changes in the actuarial assumptions and methods from those used in the prior valuation.

We have reviewed the assumptions and methods used in completing the June 30, 2019 actuarial valuation and believe that they are reasonable and in compliance with the applicable standards.

Contribution Rates

The results of the valuation as of June 30, 2019 determine the employer contribution rate for fiscal year 2020/2021. The calculated employer contribution rate for the 2020/2021 fiscal year is 34.51% and the Board of Trustees certified this rate at their December 6, 2019 meeting. The 34.51% Employer rate includes a rate of 0.18% for employer DC contributions. This is an average estimated rate based on the assumptions outlined in Table 12 for future Class T-G, Class T-H and Class DC only membership. Actual employer DC contributions will be based on each employer's actual Class T-G, Class T-H and Class DC only membership.

The average contribution rate payable by the members is 7.61%. The average member contribution rate of 7.61% is a pay-weighted average of member rates that vary based on date of hire and Class membership. Effective January 1, 2002, the employee contribution rate for members who elected to have prior school service and intervening military service converted to Class T-D service increased by 1.25% to 7.50%. Anyone who enrolled after July 1, 2001 and before July 1, 2011 is a member of Class T-D. Any employee who becomes a member after June 30, 2011 is a Class T-E member or, alternatively, may elect to become a Class T-F member. The base contribution rate for Class T-E members is 7.50% of compensation. The base contribution rate for Class T-F members is 10.30% of compensation. Any employee who becomes a member after June 30, 2019 is a Class T-G member or, alternatively may elect to become a Class T-H member or a DC only member. The base contribution rate for Class T-G members is 5.5% and for Class T-H members is 4.5%. Class T-E, Class T-F, Class T-G and Class T-H members are subject to a "shared-risk" employee contribution rate, as discussed on page 8.

Reasons for Change in the Rate Calculated by the Actuary

The employer contribution rate calculated by the actuary increased from 34.29% for fiscal year 2019/2020 to 34.51% for fiscal year 2020/2021. The reconciliation of the employer contribution rates by source is as follows:

¹ Reflects increase in total employer payroll and liability gains.

Summary of Principal Results

Summarized below are the principal financial results for the Public School Employees' Retirement System based upon the actuarial valuation as of June 30, 2019. Comparable results from the June 30, 2018 valuation are also shown.

Item	June 30, 2019	June 30, 2018
Demographics		
Active Members		
• Number	255,749	256,362
• Average Annual Pay	\$ 53,458	\$ 52,188
Annuitants		
• Number ¹	237,339	233,288
• Average Annual Benefit Payment	\$ 25,498	\$ 25,405
Contribution Rates (as a Percentage of Payroll)		
	(Fiscal Year 2020/2021)	(Fiscal Year 2019/2020)
Employer Contribution Rate:		
• Total Pension Rate Calculated by Actuary ²	33.51%	33.36%
• Health Insurance Premium Assistance Contribution Rate	0.82	0.84
• Act 5 DC Employer Contribution Rate ³	<u>0.18</u>	<u>0.09</u>
• Total Contribution Rate	34.51%	34.29%
• Total Contribution Rate Certified by Board	34.51%	34.29%
• Member Average Contribution Rate	<u>7.61</u>	<u>7.59</u>
• Total Rate	42.12%	41.88%
Funded Status⁴		
• Accrued Liability	\$ 105,324.7 Mil	\$ 103,113.6 Mil
• Actuarial Value of Assets	61,190.5	58,258.3
• Market Value of Assets	58,859.1	56,486.4
• Unfunded Accrued Liability		
• Actuarial Value of Assets	\$ 44,134.2	\$ 44,855.3
• Market Value of Assets	46,465.6	46,627.2
• Funded Ratio		
• Actuarial Value of Assets	58.1%	56.5%
• Market Value of Assets	55.9%	54.8%

1. Excludes 1,595 and 1,752 beneficiaries as of June 30, 2019 and June 30, 2018, respectively, who are only entitled to a pending lump sum distribution.
2. The Act 120 minimum pension rate for the June 30, 2019 valuation is 7.37% and for the June 30, 2018 valuation is 7.49%.
3. Average DC contribution rate. Actual rate will vary by employer based on Class T-G, Class T-H, and Class DC only memberships.
4. Pensions and Health Insurance Premium Assistance combined.

Five-Year History of Principal Financial Results

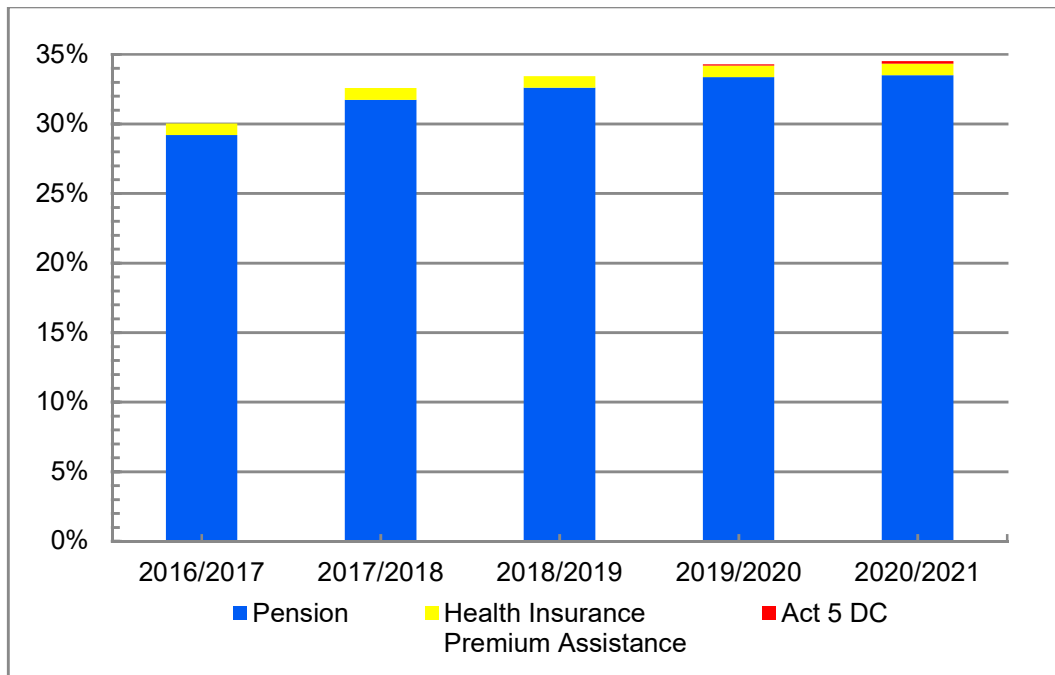
Five-Year History of Contribution Rates (As a % of Payroll)

Fiscal Year	Member Contributions	Employer Contributions					
		Normal Cost	Unfunded Accrued Liability	Health Insurance Premium Assistance	Act 5 DC Employer Rate ¹	Preliminary Employer Contribution	Final Employer Contribution ²
2020/2021	7.61%	7.37%	26.14%	0.82%	0.18%	34.51%	34.51%
2019/2020	7.59	7.49	25.87	0.84	0.09	34.29	34.29
2018/2019	7.57	7.59	25.01	0.83	N/A	33.43	33.43
2017/2018	7.54	7.70	24.04	0.83	N/A	32.57	32.57
2016/2017	7.52	8.31	20.89	0.83	N/A	30.03	30.03

1. Average DC contribution rate. Actual rate will vary by employer based on Class T-G, Class T-H and Class DC only membership.
2. Certified by the Board.

The following chart shows a five-year history of employer contribution rates:

Five-Year History of Employer Contribution Rates



Funded Ratio

The financing objective of the Retirement System is to:

- Fully fund all current costs based on the normal contribution rate determined under the funding method; and
- Liquidate the unfunded accrued liability based on level-percent-of-pay amortization schedules required by the Retirement Code as amended by 2010-120, 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.
- Fully fund the employer contribution to the Defined Contribution Plan
- As directed by Act 2010-120, the minimum employer pension contribution rate will be the normal cost rate.

The total contribution rate of 34.51% of payroll payable by employers, when taken together with the contributions payable by the members, current assets, and expected future asset returns, is sufficient to achieve the financing objective.

The Retirement System's total funded ratio on this funding basis is measured by comparing the actuarial value of assets (based on a 10-year moving average market value) to the accrued liability. The accrued liability for pensions is the present value of benefits accumulated to date under the Retirement System's funding method and reflects future pay increases for active employees. The accrued liability for Health Insurance Premium Assistance equals the assets in the Health Insurance account.

On this basis, the Retirement System's total funded ratio (for Pensions and Health Insurance Premium Assistance combined) is 58.1% as of June 30, 2019. This funded ratio is based on an actuarial value of assets of \$61.19 billion and an accrued liability of \$105.33 billion. The funded ratio for Pensions alone is 58.0% as of June 30, 2019, based on an actuarial value of assets of \$61.07 billion and an accrued liability of \$105.20 billion.

Reasons for Change in the Total Funded Ratio

The total funded ratio increased from 56.5% as of June 30, 2018 to 58.1% as of June 30, 2019. This increase is due to a net actuarial gain on demographic experience, which offset the loss incurred due to investment returns below expected levels on assets measured at actuarial value, which is a 10-year moving average of the market value. Table 6 provides an analysis of the change in the unfunded accrued liability as of June 30, 2019.

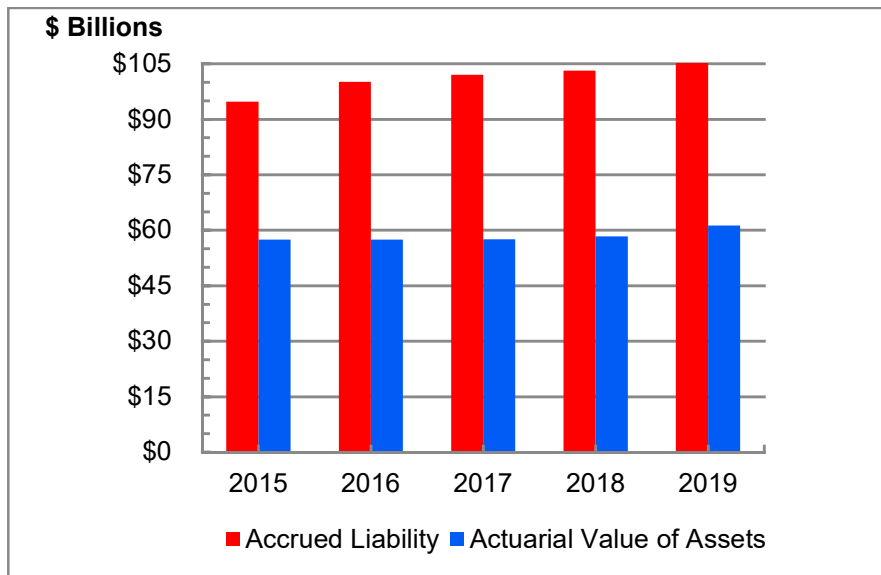
Five-Year History of Total Funded Ratio¹
(\$ Amounts in Millions)

Valuation as of June 30	Accrued Liability	Actuarial Value of Assets	Unfunded Accrued Liability	Funded Ratio
2019	\$ 105,324.7	\$ 61,190.5	\$ 44,134.2	58.1%
2018	103,113.6	58,258.3	44,855.3	56.5
2017	101,972.6	57,460.6	44,512.0	56.3
2016	100,114.0	57,390.1	42,723.9	57.3
2015	94,697.4	57,361.6	37,335.8	60.6

1. For Pensions and Health Insurance Premium Assistance (under the funding provisions of the Retirement Code).

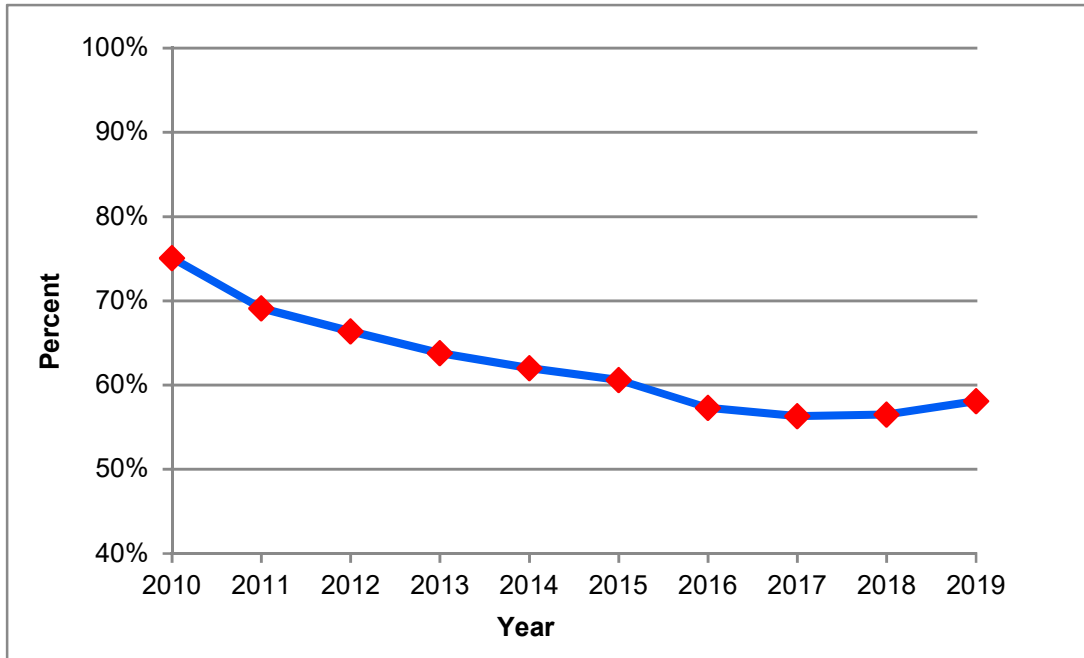
The following chart shows a five-year history of the accrued liability and the actuarial value of assets:

Five-Year History of Accrued Liability and Actuarial Value of Assets



The following chart shows a ten-year history of the total funded ratio based on actuarial value of assets for Pensions and Health Insurance Premium Assistance:

Ten-Year History of Total Funded Ratio (2010 – 2019)



Act 5-2017 Class T-E, Class T-F, Class T-G and Class T-H shared risk contributions

Commencing with the annual actuarial valuation for the period ending June 30, 2014, and every three years thereafter, the Board compares the actual investment rate of return, net of fees, to the annual interest rate adopted by the Board for the calculation of the normal contribution rate, based on the market value of assets, for the prior ten-year period. Until the Retirement System has accumulated a ten-year period of investment rate of return experience following June 30, 2011, the look-back period used in this calculation will begin not earlier than June 30, 2011.

The shared risk contribution rates of Class T-E, Class T-F, Class T-G, and Class T-H members are determined as follows:

- If the actual time-weighted investment rate of return, net of fees, is less than the annual interest rate adopted by the Board by an amount of 1% or more, the shared risk contribution rate of Class T-E and T-F members will increase by 0.5% and the shared risk contribution rate for Class T-G and Class T-H members will increase by .75%.

If the actual time-weighted investment rate of return, net of fees, is equal to or exceeds the annual interest rate adopted by the Board by less than 1%, the shared risk contribution rate of Class T-E and T-F members will decrease by 0.5% and the shared risk contribution rate for Class T-G and Class T-H members will decrease by .75% provided the total member contribution rate on the date of the actuarial valuation is above the member's basic contribution rate.

- If the actual time-weighted investment rate of return, net of fees, is more than the annual interest rate adopted by the Board by an amount of 1% or more, the shared risk contribution rate of Class T-E and T-F members will decrease by 0.5% and the shared risk contribution rate for Class T-G and Class T-H members will decrease by .75%.

If the actual time-weighted investment rate of return, net of fees, is equal to or below the annual interest rate adopted by the Board by less than 1%, the shared risk contribution rate of Class T-E and T-F members will increase by 0.5% and the shared risk contribution rate for Class T-G and Class T-H members will increase by .75% provided the total member contribution rate on the date of the actuarial valuation is below the member's basic contribution rate.

The total member contribution rate for Class T-E members shall not be less than 5.5%, nor more than 9.5%. The total member contribution rate for Class T-F members shall not be less than 8.3%, nor more than 12.3%. The total member contribution rate for Class T-G members shall not be less than 2.5% nor more than 8.5% and the total member contribution rate for class T-H members shall not be less than 1.5% nor more than 7.5%.

If the Retirement System's total funded ratio based on the actuarial value of assets is at least 100% as of the measurement date, the shared risk contribution rate shall not be greater than zero. If the annual interest rate adopted by the Board for the calculation of the normal contribution rate is changed during the period used to determine the shared risk contribution rate, the Board, with the advice of the actuary, shall determine the applicable rate during the entire period, expressed as an annual rate. For any fiscal year in which the employer contribution rate is lower than the final contribution rate under section 8328(h), the total member contribution rate for Class T-E, T-F, T-G and T-H members shall be prospectively reset to the basic contribution rate provided the total member contribution rate is at or above the basic contribution rate. There shall be no increase in the member contribution rate if there has not been an equivalent increase to the employer contribution rate over the previous three-year period.

The next Class T-E, Class T-F, Class T-G and Class T-H "shared-risk" valuation is to be performed for the nine-year period ending June 30, 2020.

Rate of Return

The investment return of the trust fund (i.e., total return including both realized and unrealized gains and losses) for fiscal years 2009/2010 through 2018/2019 is shown in the table below.

The rate of return on market value reflects the investment earnings on the market value of assets from the beginning of the fiscal year to the end of the fiscal year.

Fiscal Year	Rate of Return Based on Market Value ¹
2018/2019	6.7%
2017/2018	9.3
2016/2017	10.2
2015/2016	1.3
2014/2015	3.4
2013/2014	14.8
2012/2013	8.0
2011/2012	3.4
2010/2011	20.4
2009/2010	14.6

1. Provided by PSERS' investment consultants (Aon for fiscal years 2013/2014 - 2018/2019 and Wilshire Associates for prior years).

Table 1

Summary of Results of Actuarial Valuation as of June 30, 2019
(\$ Amounts in Thousands)

Item	June 30, 2019	June 30, 2018
Member Data		
1. Number of Members		
a) Active Members	255,749	256,362
b) Vestees ¹	25,514	25,117
c) Annuitants, Beneficiaries and Survivor Annuitants ²	237,339	233,288
d) Total	518,602	514,767
2. Annualized Salaries (\$ Amounts in Thousands) ³	\$ 13,671,927	\$ 13,379,041
3. Annual Annuities (\$ Amounts in Thousands)	\$ 6,051,632	\$ 5,926,658
Valuation Results		
4. Present Value of Future Pension Benefits		
a) Active Members	\$ 64,673,835	\$ 63,249,952
b) Inactive Members and Vestees	2,258,815	2,092,376
c) Annuitants, Beneficiaries and Survivor Annuitants	57,413,088	56,742,925
d) Total	\$ 124,345,738	\$ 122,085,253
5. Present Value of Future Pension Normal Cost		
a) Active Members	\$ 10,182,324	\$ 10,008,621
b) Employer	8,963,909	9,085,724
c) Total	\$ 19,146,233	\$ 19,094,345
6. Pension Accrued Liability		
a) Active Members (4a) - (5c)	\$ 45,527,602	\$ 44,155,607
b) Inactive Members and Vestees	2,258,815	2,092,376
c) Annuitants, Beneficiaries and Survivor Annuitants	57,413,088	56,742,925
d) Total	\$ 105,199,505	\$ 102,990,908
7. Health Insurance Assets for Premium Assistance	\$ 125,185	\$ 122,734
8. Total Accrued Liability for Funding (6) + (7)	\$ 105,324,690	\$ 103,113,642
9. Actuarial Value of Assets	\$ 61,190,489	\$ 58,258,273
10. Funded Status (9) / (8)	58.1 %	56.5 %
11. Unfunded Accrued Liability (8) - (9)	\$ 44,134,201	\$ 44,855,369
12. Total Normal Cost Rate	14.98 %	15.08 %
13. Member Contribution Rate	7.61 %	7.59 %
14. Employer Normal Cost Rate (12) - (13)	7.37 %	7.49 %
Employer Annual Funding Requirement		
15. Employer Contribution Rate Calculated by Actuary	Fiscal 2020/2021	Fiscal 2019/2020
a) Normal Cost	7.37 %	7.49 %
b) Unfunded Accrued Liability	26.14	25.87
c) Preliminary Pension Rate	33.51 %	33.36 %
d) Health Insurance Premium Assistance	0.82	0.84
e) Act 5 DC ⁴	0.18	0.09
f) Total Rate ⁵ = (15c) + (15d) + (15e)	34.51 %	34.29 %
<p>1. Excludes 132,854 and 127,136 inactive members and non-members as of June 30, 2019 and June 30, 2018, respectively, who are no longer participating and are valued for their accumulated deductions only.</p> <p>2. Excludes 1,595 and 1,752 beneficiaries as of June 30, 2019 and June 30, 2018, respectively, who are only entitled to a pending lump sum distribution.</p> <p>3. The salaries shown represent an annual rate of pay for members who were in active service on the valuation date.</p> <p>4. Average DC contribution rate. Actual rate will vary by employer based on Class T-G, Class T-H, and Class DC only memberships.</p> <p>5. The Act 120 minimum pension rate for the June 30, 2019 valuation is 7.37% and for the June 30, 2018 valuation is 7.49%.</p>		

Table 2

Summary of Sources of Employer Contribution Rate as of June 30, 2019
(\$ Amounts in Thousands)

	Funding Period (Years)	Beginning July 1	Initial Liability	6/30/2019 Outstanding Balance	Annual Payment	
					Amount	Percent ¹
1. Amortization of:						
a) Act 120 Fresh Start Unfunded Accrued Liability and Asset Method Change	24	2011	\$ 16,279,283	\$ 17,743,980	\$ 1,586,231	11.27 %
b) 2010 Experience	24	2011	3,419,297	3,712,636	331,893	2.36 %
c) 2011 Experience	24	2012	564,642	612,995	52,411	0.37 %
d) 2011 Assumption Changes	24	2012	4,592,397	4,985,673	426,272	3.03 %
e) 2012 Experience	24	2013	2,372,550	2,590,985	212,586	1.51 %
f) 2013 Experience	24	2014	2,707,494	2,965,448	234,189	1.66 %
g) 2014 Experience	24	2015	2,170,432	2,377,871	181,230	1.29 %
h) 2015 Experience	24	2016	1,941,277	2,122,327	156,481	1.11 %
i) 2016 Experience	24	2017	2,666,236	2,895,739	206,994	1.47 %
j) 2016 Assumption Changes	24	2017	2,521,326	2,738,355	195,744	1.39 %
k) 2017 Experience	24	2018	1,433,915	1,548,964	107,558	0.76 %
l) 2017 Act 5	24	2018	(6,867)	(7,418)	(515)	0.00 %
m) 2018 Experience	24	2019	348,881	374,175	25,285	0.18 %
n) 2019 Experience	24	2020	(527,527)	(527,529)	(36,939)	(0.26)%
Total Amortization Payments				\$ 44,134,201	\$ 3,679,420	26.14 %
2. Employer Normal Cost Rate						<u>7.37 %</u>
3. Pension Rate (1) + (2) ²						33.51 %
4. Health Insurance Premium Assistance Rate						0.82 %
5. Act 5 DC Rate ³						<u>0.18 %</u>
6. Final Total Employer Contribution Rate Calculated by Actuary: (3) + (4) + (5)						34.51 %

1. Based on Estimated Employer Payroll for Fiscal Year Ending 2021 of \$ 14,078,000.

2. Cannot be less than the Act 120 Fiscal Year 2020 Minimum Employer Pension Rate (Employer Normal Cost Rate) of 7.37%.

3. Average DC contribution rate. Actual rate will vary by employer based on Class T-G, Class T-H, and Class DC only memberships.

Table 3

Determination of Health Insurance Premium Assistance Contribution Rate for Fiscal Year
2020/2021

(\$ Amounts in Thousands)

Item			
1. June 30, 2019 Balance in Health Insurance Premium Assistance Account			\$ 125,185
2. Estimated Fiscal 2019/2020 Contribution			
(a) Contribution Rate Certified in 2018 Valuation			0.84%
(b) Estimated Fiscal 2019/2020 payroll			<u>\$ 13,880,000</u>
(c) Estimated Contribution = (a) x (b)			\$ 116,592
3. Estimated Number of Annuitants who:	Are Eligible	Elect Coverage	
(a) Fiscal 2019/2020	152,600	96,138	
(b) Fiscal 2020/2021	154,700	97,461	
(c) Fiscal 2021/2022	156,500	98,595	
4. Estimated Disbursements:	Administration	Assistance	Total
(a) Fiscal 2019/2020	\$ 1,967	\$ 115,366	\$ 117,333
(b) Fiscal 2020/2021	2,001	116,953	118,954
(c) Fiscal 2021/2022	<u>2,101</u>	<u>118,314</u>	<u>120,415</u>
(d) Total	\$ 6,069	\$ 350,633	\$ 356,702
5. Required Fiscal 2020/2021 Contribution (4d) - (1) - (2c)			\$ 114,925
6. Required Health Insurance Premium Assistance Contribution Rate			
(a) Estimated 2020/2021 Payroll			\$ 14,078,000
(b) Required Health Insurance Premium Assistance Contribution Rate (5) / (6a) (rounded up)			0.82%

Notes:

1. Current estimates of fiscal 2019/2020 membership payroll and administrative expenses, and of fiscal 2020/2021 administrative expenses, were provided by PSERS staff.
2. 63% of eligible annuitants are assumed to elect coverage. This is the same coverage election rate used in the prior valuation.
3. Premium Assistance payments equal \$100 per month per eligible annuitant.

Table 4

Summary of Market Value of Plan Assets as of June 30, 2019
 (\$ Amounts in Thousands)

Market Value	
1. Market Value of Assets as of June 30, 2018	\$ 56,486,448
2. Contributions During Fiscal 2018/2019	5,666,392
3. Disbursements During Fiscal 2018/2019	6,873,949
4. Investment Return During Fiscal 2018/2019	
a) Investment Return (Net of Investment Expenses)	\$ 3,631,023
b) Administrative Expenses	<u>50,845</u>
c) Investment Return After Expenses (a) - (b)	\$ 3,580,178
5. Market Value of Assets as of June 30, 2019 (1) + (2) - (3) + (4c)	\$ 58,859,069
6. Rate of Return (per Aon)	6.68 %
Asset Allocation by Account	
1. Members' Savings Account	\$ 16,839,956
2. Annuity Reserve Account	57,413,088
3. State Accumulation Account	(15,519,160)
4. Health Insurance Account	<u>125,185</u>
5. Total (1) + (2) + (3) + (4)	\$ 58,859,069

Table 5

Derivation of Actuarial Value of Assets as of June 30, 2019
(\$ Amounts in Thousands)

1. Market Value of Assets as of June 30, 2019							\$ 58,859,069
2. Determination of Deferred Gain (Loss)							
Fiscal	Return on Assets			Recognized		Deferred	
<u>Year</u>	<u>Actual</u>	<u>Expected</u>	<u>Difference</u>	<u>Amount</u>	<u>% Deferred³</u>	<u>Amount</u>	
2018/2019	\$ 3,580,178	\$ 4,179,951	\$ (599,773)	\$ (59,977)	90.00%	\$ (539,796)	
2017/2018	4,666,466	4,115,904	550,562	55,056	80.00%	440,450	
2016/2017	4,948,659	4,101,830	846,829	84,683	70.00%	592,780	
2015/2016	426,974	4,220,500	(3,793,526)	(379,353)	60.00%	(2,276,116)	
2014/2015	1,284,258	4,202,212	(2,917,954)	(291,795)	50.00%	(1,458,977)	
2013/2014	7,057,089	4,193,490	2,863,599	286,360	40.00%	1,145,440	
2012/2013	4,086,520	4,239,172	(152,652)	(15,265)	30.00%	(45,796)	
2011/2012	1,057,435	4,303,637	(3,246,202)	(324,620)	20.00%	(649,240)	
2010/2011	9,207,766	4,609,422	4,598,344	459,834	10.00%	459,835	
2009/2010	6,100,499	4,651,504	1,448,995	144,899	0.00%	0	
			\$ (401,778)	\$ (40,178)		\$ (2,331,420)	
3. Preliminary Actuarial Value of Assets ^{1,2} (1) - (2)							\$ 61,190,489
4. 70% of the Market Value of Assets (1) x 70%							\$ 41,201,348
5. 130% of the Market Value of Assets (1) x 130%							\$ 76,516,790
6. Actuarial Value of Assets: (3) not less than (4) and not greater than (5)							\$ 61,190,489

1. The amounts reported include assets for both Pension and Health Insurance Premium Assistance.
2. The rate of return on the actuarial value of assets was 7.18%. This investment return is based on the change in the actuarial value of assets from the June 30, 2018 valuation to the June 30, 2019 valuation. The actuarial value of assets developed above is a rolling ten-year average. The impact of investment gains and losses is not fully realized in the year the gain or loss arose but is smoothed in over a ten-year period.
3. The percentage amounts shown are rounded. The corresponding Deferred Amounts reflect the use of unrounded percentages.

Table 6

Analysis of Change in Unfunded Accrued as of June 30, 2019¹
(\$ Amounts in Thousands)

Item	Amount
1. Unfunded Accrued Liability at June 30, 2018	\$ 44,855,369
2. Interest Credit to June 30, 2019	3,252,014
3. Expected Contributions Toward Unfunded Accrued Liability	<u>3,445,655</u>
4. Expected Unfunded Accrued Liability at June 30, 2019 (1) + (2) - (3)	\$ 44,661,728
5. Actual Unfunded Accrued Liability at June 30, 2019	<u>44,134,201</u>
6. Increase (Decrease) from Expected (5) - (4)	\$ (527,527)
7. Reasons for Increase (Decrease)	
(a) Experience Losses (Gains)	
(i) Loss from Investment Return on Actuarial Value of Assets	\$ 40,178
(ii) Loss from New Entrants and Pickups	250,111
(iii) Gain from Salary Increases Less than Expected	(575,468)
(iv) Gain from Mortality Experience	(9,591)
(v) Gain Terminations (retirement/disability/terminations) Experience	(114,172)
(vi) Gain from Data/Miscellaneous	<u>(118,585)</u>
Total	\$ (527,527)

1. The amounts reported include assets and liabilities for Pensions only.

Table 7

Schedule of Funding Progress for Pensions¹
 (\$ Amounts in Thousands)

Valuation as of June 30	Actuarial Value of Assets	Actuarial Accrued Liability	Unfunded Actuarial Accrued Liability	Funded Ratio	Covered Payroll ²	Unfunded Accrued Liability as a Percentage of Covered Payroll
2019	\$ 61,065,304	\$ 105,199,505	\$ 44,134,201	58.0 %	\$ 13,671,927	322.8 %
2018	58,135,539	102,990,908	44,855,369	56.4	13,379,041	335.3
2017	57,336,856	101,848,817	44,511,961	56.3	13,033,919	341.5
2016	57,265,506	99,989,401	42,723,895	57.3	12,851,289	332.4
2015	57,240,946	94,576,710	37,335,764	60.5	12,678,213	294.5
2014	57,231,799	92,352,983	35,121,184	62.0	12,620,862	278.3

1. The amounts reported above include assets and liabilities for Pensions.
2. The salaries shown represent an annual rate of pay for the year ended June 30th for members who were in active service on June 30th.

The above schedule is not required by current GASB standards for pension plans. The information is provided for historical perspective as PSERS has transitioned to GASB Statement No. 67.

Table 8

Solvency Test for Pensions
Comparative Summary of Accrued Liability and Actuarial Value of Assets
 (\$ Amounts in Thousands)

Valuation as of June 30	(1) Active Member Contributions	(2) Retirees and Beneficiaries	(3) Active Member Employer Financed	Actuarial Value of Assets	Portion of Accrued Liability Covered by Valuation Assets		
					(1)	(2)	(3)
2019	\$ 16,839,956	\$ 57,413,088	\$ 30,946,461	\$ 61,065,304	100%	77%	0%
2018	16,120,538	56,742,925	30,127,445	58,135,539	100	74	0
2017	15,500,215	56,184,146	30,164,456	57,336,856	100	74	0
2016	14,907,731	55,314,858	29,766,812	57,265,506	100	77	0
2015	14,079,658	52,739,489	27,757,563	57,240,946	100	82	0
2014	13,554,229	51,425,295	27,373,459	57,231,799	100	85	0

Table 9

Schedule of Employer Contributions For Pensions
(\$ Amounts in Thousands)

Fiscal Year Ended June 30	Actuarially Determined Contribution	Actual Contributions Related to the Actuarially Determined Contribution	Contribution Deficiency (Excess)	Percentage Contributed
2019	\$ 4,478,236	\$ 4,478,236	\$ 0	100.0%
2018	4,243,328	4,243,328	0	100.0%
2017	3,824,908	3,824,908	0	100.0%
2016	3,540,304	3,181,438	358,866	89.9%
2015	3,289,615	2,596,731	692,884	78.9%

Valuation date: Actuarially determined contributions are calculated as of the June 30 preceding the fiscal year in which contributions are made. That is, the contribution calculated as of the June 30, 2019 actuarial valuation will be made during the fiscal year ended June 30, 2021.

Schedule of Employer Contributions For Postemployment Benefits Other Than Pensions
(\$ Amounts in Thousands)

Fiscal Year Ended June 30	Actuarially Determined Contribution	Actual Contributions Related to the Actuarially Determined Contribution	Contribution Deficiency (Excess)	Percentage Contributed
2019	\$ 139,484	\$ 114,571	\$ 24,913	82.1%
2018	134,607	111,724	22,883	83.0%
2017	125,694	110,985	14,709	88.3%
2016	129,494	113,307	16,187	87.5%

Valuation date: Actuarially determined contributions are calculated as of the June 30 preceding the fiscal year in which contributions are made. That is, the contribution calculated as of the June 30, 2019 actuarial valuation will be made during the fiscal year ended June 30, 2021.

The Actuarially Determined Contribution is based on the Entry Age Normal Accrued Liability and assets as of the valuation date and a 30-year amortization of the unfunded accrued liability. See the Information Required Under Governmental Accounting Standards Board Statement No. 74 as of June 30, 2019 (published September 18, 2019) for additional information.

Table 10

History of Contribution Rates and Funded Ratios

Fiscal Year Ending June	Budgeted Total Employer Payroll (thousands)	Contribution Rates ¹								Funded Ratio
		Employee	Employer Normal Cost	Employer Unfunded Liability	Preliminary Employer Pension	Final Employer Pension ²	Act 5 Employer DC ⁷	Employer Health Insurance	Total Employer	
2010 ³	\$ 12,899,000	7.32 %	7.35 %	(3.72) %	3.63 %	3.63 %		0.78 %	4.78 %	75.1 %
2011 ^{3,4}	13,510,000	7.34	8.08	(0.50)	7.58	7.58		0.64	5.64	69.1
2012	14,112,000	7.37	8.12	10.15	18.27	18.27		0.65	8.65	66.4
2013 ⁵	14,297,000	7.40	8.66	12.99	21.65	21.65		0.86	12.36	63.8
2014	13,720,000	7.43	8.57	15.25	23.82	23.82		0.93	16.93	62.0
2015	13,482,000	7.46	8.46	17.51	25.97	25.97		0.90	21.40	60.6
2016	13,375,000	7.49	8.38	19.44	27.82	27.82		0.84	25.84	57.3
2017	13,549,000	7.52	8.31	20.89	29.20	29.20		0.83	30.03	56.3
2018 ⁶	13,449,000	7.54	7.70	24.04	31.74	31.74		0.83	32.57	56.5
2019	13,775,000	7.57	7.59	25.01	32.60	32.60		0.83	33.43	58.1
2020	13,880,000	7.59	7.49	25.87	33.36	33.36	0.09 %	0.84	34.29	
2021	14,078,000	7.61	7.37	26.14	33.51	33.51	0.18	0.82	34.51	

- In general, the Preliminary Employer Pension Rate equals the sum of the rates for the Employer Normal Cost and the Unfunded Liability; and the Final Employer Pension Rate is the greater of the Preliminary Pension Rate and any Pension Rate Floor or Collar stated in the Retirement Code. The Total Employer Rate is the sum of the Final Employer Pension Rate, Act 5 Employer DC Rate and the Employer Health Insurance Premium Assistance Rate.
- The Final Employer Pension rate is limited by the Act 2010-120 pension rate collars for fiscal years 2012 through 2016.
- At its January 2009 meeting, the Board voted to reduce the interest rate from 8.50% to 8.25% for the June 30, 2008 valuation and to 8.00% for subsequent valuations.
- Act 2010-46 recertified the fiscal year ended June 30, 2011 pension rate from 7.58% to 5.00%.
- Revised actuarial assumptions based on a five-year experience review ended June 30, 2010 were used to determine the contributions for the fiscal year ending June 30, 2013 and thereafter, which include an interest rate of 7.50%.
- Revised actuarial assumptions based on a five-year experience review ended June 30, 2015 were used to determine the contributions for the fiscal year ending June 30, 2018 and thereafter, which include an interest rate of 7.25%.
- It is assumed that new members through June 30, 2019 are Class T-E members and after June 30, 2019, it is assumed that 65% of new members elect Class T-G membership, 30% elect Class T-H membership and 5% elect DC Only participation under Act 5. In addition, the above rate is an average DC contribution rate. Actual rate will vary by employer based on Class T-G, Class T-H, and Class DC only memberships.

Table 11

History of Annuitants, Beneficiaries, Survivor Annuitants and Active Members

Valuation as of June 30	Annuitants at End of Year	Beneficiaries and Survivor Annuitants at End of Year	Total Annuitants, Beneficiaries and Survivor Annuitants	Active Members
2010	176,210	8,724	184,934	282,041
2011	183,665	10,957	194,622	279,152
2012	190,560	11,455	202,015	273,504
2013	197,735	11,469	209,204	267,428
2014	203,756	10,144	213,900	263,312
2015	209,266	10,509	219,775	259,868
2016	214,019	10,809	224,828	257,080
2017	218,886	11,128	230,014	255,945
2018	221,879	11,409	233,288	256,362
2019	225,479	11,860	237,339	255,749

Table 12

Description of Actuarial Assumptions and Methods

Assumptions

Interest Rate: 7.25% per annum, compounded annually (adopted as of June 30, 2016). 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-TE and Class T-F 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 (adopted as of June 30, 2016).

Age	Annual Rate of:						
	Withdrawal less than 5 Years of Service	Withdrawal		Death ¹	Disability	Early Retirement ²	Superannuation Retirement
		Between 5 and 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	.115		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 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 adjusted for credibility. This base mortality table will then be projected on a generational basis using the Buck Modified 2015 projection scale from 2013 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 from 2013 to the valuation date with the Buck Modified 2015 projection scale.

The above base mortality tables are projected on a fully 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 (adopted as of June 30, 2016). The components are 2.75% for inflation, and 2.25% for real wage growth and 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:

Annuity Optional Forms Assumption for Retiring Active Members:

- 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

Option 4 Lump Sum Elections: 80% of Class T-C, Class T-D, Class T-E and Class T-F 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.

Health Insurance Premium Assistance:

Elections: 63% of eligible retirees are assumed to elect premium assistance.

Administrative Expenses: Assumed equal to \$1,967,000 for fiscal year 2019/2020, \$2,001,000 for fiscal year 2020/2021 and \$2,101,000 for Fiscal year 2021/2022.

Summary of Changes since the June 30, 2018 Valuation:

Assumed administrative expenses for the Health Insurance Premium Assistance Plan changed from \$2,065,000 for fiscal year 2020/2021 to \$2,001,000, and the amount of \$2,101,000 was added for the fiscal year 2021/2022.

Methods

Calculations: The actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures, based on the current provisions of the retirement system, and on actuarial assumptions that are internally consistent and reasonable based on the actual experience of the System.

Asset Valuation Method: A ten-year moving market average (five-year moving market average prior to June 30, 2010) value of assets that recognizes the 7.25% (7.50% prior to June 30, 2016, 8.25% prior to June 30, 2009, and 8.50% prior to June 30, 2008) actuarial expected investment return immediately and spreads the difference between the actual return on the market value of assets and the expected return on the actuarial value of assets over a period of ten years. The actuarial value of assets can be no less than 70% and no more than 130% of the market value of assets.

Actuarial Cost Method for Pension Funding: Entry Age Normal Cost Method (modified slightly as of June 30, 2005 to use a pay-weighted average normal contribution rate). The results of each June 30 valuation normally determine the employer contribution rate for the second succeeding fiscal year. Act 120 revised the funding method effective with the June 30, 2010 valuation. Act 120 mandated that the outstanding balance of the unfunded accrued liability as of June 30, 2010, including changes in the unfunded accrued liability due to the funding reforms of Act 120, be amortized over a 24-year period, as a level percent of pay, beginning July 1, 2011. Future valuation gains and losses, and changes in the unfunded accrued liability resulting from changes in actuarial assumptions and methods, are amortized over a 24-year period, as a level percent of pay. As provided by Act 5-2017, future increases in the unfunded accrued liability due to benefit enhancement legislation will be amortized over 10-year periods, as a level percent of pay. Act 120 also modified the employer pension contribution requirements by imposing collars on the rate for fiscal years ending June 30, 2012, June 30, 2013, and on or after June 30, 2014; the pension contribution rate was limited to 3%, 3.5% and 4.5%, respectively, of total compensation of all active members, greater than the prior year's final contribution rate. Beginning with the fiscal year ending June 30, 2017, the actuarially required contribution rate was less than the collared rate and the final contribution rate was the actuarially determined contribution rate. However, as provided by Act 120-2010, the final contribution rate cannot be less than the employer normal contribution rate.

Actuarial Cost Method for Health Insurance Premium Assistance Funding: The actuarial liability equals the assets in the health insurance account, and the results of the June 30 valuation determine the contribution rate for the second succeeding fiscal year. The rate so determined is the rate necessary to establish reserves sufficient to cover administrative expenses and provide premium assistance payments for all participating eligible annuitants during the third fiscal year that follows the valuation date.

Data

Census and Assets: The pension valuation was based on members of the Retirement System as of June 30, 2019 and does not take into account future members. All census data was supplied by the Retirement System and was subject to reasonable consistency checks. The actuaries adjust the data to account for service and pay earned by members on or before the valuation that is not reported by the Retirement System until after the actuarial valuation is performed. Asset data was supplied by the Retirement System.

For employer DC contributions, it is assumed among new employees hired on or after July 1, 2019 that 65% will become Class T-G members, 30% will become Class T-H members and 5% will become Class DC only participants. These are the same assumption used in the development of the Cost Note (published May 23, 2017) for the passage of Act 5 of 2017. This assumption may be updated for the June 30, 2020 valuation of the System after the actual Class T-G, Class T-H and Class DC only elections are known for the period July 1, 2019 to June 30, 2020.

Table 13

Summary of Benefit and Contribution Provisions

Membership

For valuation purposes, all employees are considered to be full coverage members. All employees who become members on and after January 1, 1966 are members of the dual coverage group. Dual coverage members contribute to both PSERS and to Social Security.

Benefits

Superannuation Annuity

Eligibility

Age 62, or age 60 with 30 years of service, or 35 years of service regardless of age. For Class T-E and Class T-F members, age 65 with a minimum of three years of service credit, or any combination of age and service that totals 92 with at least 35 years of credited service. For Class T-G members, age 67 with a minimum of three years of service, or any combination of age and service that totals 97 with at least 35 years of credited service. For Class T-H members, age 67 with a minimum of three years of service credit.

Amount

Class	Accrual	Final Average Salary
T-C	2.00%	For any 3 years of service
T-D	2.50%	For any 3 years of service
T-E	2.00%	For any 3 years of service
T-F	2.50%	For any 3 years of service
T-G	1.25%	For any 5 years of service
T-H	1.00%	For any 5 years of service

Based on the above table, Accrual Rate times the Final Average Salary times years of school service and intervening military service. Minimum of \$100 per year of service. The "final average salary" means the highest average annual salary.

Annual salary is subject to a limit of \$200,000, as adjusted under Section 401(a)(17) of the Internal

Revenue Code. As of June 30, 2019, the adjusted limit is \$280,000.

For members who elect coverage under Class T-D, the maximum benefit is equal to the limit established by Section 415 of the Internal Revenue Code.

For Class T-E, Class T-F, Class T-G and Class T-H members, the maximum benefit is equal to the lesser of the limit established by Section 415 of the Internal Revenue Code or 100% of final average salary.

Early Retirement Annuity

Eligibility

Age 55 with 25 years of service. For Class T-G members, age 57 with 25 years of service.

Amount

Accrued benefit as of date of retirement, reduced 1/4% for each month by which commencement of payments precedes Superannuation Age.

For members who elect coverage under Class T-D, the maximum benefit is equal to the limit established by Section 415 of the Internal Revenue Code.

For Class T-E, Class T-F, Class T-G and Class T-H members, the maximum benefit is equal to the lesser of the limit established by Section 415 of the Internal Revenue Code or 100% of final average salary.

Withdrawal Annuity

Eligibility

5 years of service. For Class T-E, Class T-F, Class T-G and Class T-H members, ten years of service.

Amount

Accrued benefit deferred to superannuation retirement age or an actuarially reduced benefit payable immediately. For Class T-C, Class T-D, Class T-E and Class T-F members, PSERS early retirement factors are based on the statutory interest rate of 4%. For Class T-G and T-H members, PSERS early retirement factors from age 62 to superannuation are based on the statutory interest rate of 4%. From commencement age to age 62, PSERS early retirement factors are based on the assumed long term return on plan assets as adopted by the Board.

Disability Annuity

Eligibility

5 years of service.

Amount

The standard single life annuity if the total number of years of credited service is greater than 16.667,

otherwise the standard single life annuity multiplied by the lesser of the following ratios: (Y^*/Y) or $(16.667/Y)$ where Y is the number of years of credited service and Y* is the total years of credited service if the member were to continue as a school employee until superannuation retirement age (or at current age, if later). For Class T-G and Class T-H members, the standard single life annuity for this provision is based on a 2.0% accrual rate. Minimum of \$100 per year of service.

Return of Contributions

Eligibility	Death or separation from service and member does not qualify for other benefits.
Amount	Refund of accumulated deductions includes interest (less annuity payments received prior to death in the case of a retired member).

Death Benefit

Eligibility	Death of an active member or vestee who was eligible to receive an annuity.
Amount	The present value of the annuity that would have been effective if the member retired on the day before death. Option 1 assumed payable if no other option elected.

Normal and Optional Forms of Benefits

Normal Form (Maximum):	Life annuity with a guaranteed payment equal to member contributions with interest.
Option 1:	Reduced benefit with refund of balance of present value of annuity at retirement over payments received. If balance is less than \$5,000, benefit is paid in lump sum; otherwise, beneficiary may elect annuity and/or lump sum.
Option 2:	Joint and 100% survivorship annuity.
Option 3:	Joint and 50% survivorship annuity.
Option 4:	Benefit of equivalent actuarial value, including lump sum payment of member contributions.

Health Insurance Premium Assistance

Eligibility	Retired members who: (a) have 24½ or more years of service, or (b) are disability annuitants, or
-------------	--

- (c) have 15 or more years of service and who both terminated school service and retired after attaining superannuation age and
- (d) participate in the PSERS health options program or in an employer-sponsored health insurance program.

DC Only participants who terminate employment, are eligible for Medicare, have received all or part of their individual investment account and who:

- (a) have 24½ or more eligibility points, or
- (b) have 15 or more eligibility points and who both terminated school service and retired after attaining age 67 and
- (c) participate in the PSERS health options program or in an employer-sponsored health insurance program.

Amount

Participating eligible annuitants receive health insurance premium assistance payments from the Health Insurance Account equal to the lesser of \$100 per month or the actual monthly premium. All administrative expenses necessary to operate the health insurance premium assistance program are to be funded by the Health Insurance Account. The Health Insurance Account is credited with contributions of the Commonwealth and the employers.

Contributions

By Members

Regular member contribution:

Class	Enrollment	Contribution Rate
Members who did not elect Class T-D	Prior to July 22, 1983	5.25%
Members who did not elect Class T-D	After to July 21, 1983 but prior to July 1, 2001	6.25%
T-D	Prior to July 22, 1983	6.50%
T-D	After to July 21, 1983	7.50%
T-E		7.50%
T-F		10.30%
T-G		5.50%
T-H		4.50%

Shared-Risk contribution:

Class T-E, Class T-F, Class T-G and Class T-H members are subject to a “shared-risk” employee contribution rate. Members benefit when investments of the fund are doing well and share some of the risk when investments underperform. The member contribution rate will stay within the specified range allotted for Class T-E, Class T-F, Class T-G or Class T-H members, but could increase or decrease every three years starting July 1, 2015 depending on investment performance.

1. If the investment rate of return (less investment fees) is equal to or exceeds the assumed rate of return by more than 1.0% based on the prior ten-year period:

Class	Decrease in Contribution Rate	Minimum Contribution Rate
T-E	0.50%	5.50%
T-F	0.50%	8.30%
T-G	0.75%	2.5%
T-H	0.75%	1.5%

Provided the total member contribution rate is less than the member’s basic contribution rate, if the investment rate of return (less investment fees) is less than the assumed rate of return by less than 1.0% based on the prior ten-year period:

Class	Increase in Contribution Rate
T-E	0.50%
T-F	0.50%
T-G	0.75%
T-H	0.75%

2. If the investment rate of return (less investment fees) is less than assumed rate of return by more than 1.0% based on the prior ten-year period:

Class	Increase in Contribution Rate	Maximum Contribution Rate
T-E	0.50%	9.50%
T-F	0.50%	12.30%
T-G	0.75%	8.5%
T-H	0.75%	7.5%

Provided the total member contribution rate is greater than the member's basic contribution rate, if the investment rate of return (less investment fees) is equal to or exceeds the assumed rate of return by less than 1.0% based on the prior ten-year period:

Class	Decrease in Contribution Rate
T-E	0.50%
T-F	0.50%
T-G	0.75%
T-H	0.75%

If the Retirement System is fully funded at the time of the comparison, the increase in member contribution rate shall not be greater than zero. There shall be no increase in the member contribution rate if there has not been an equivalent increase in the employer contribution rate over the previous three-year period.

Until a full ten-year look back period is available, the investment return measurement period will begin on July 1, 2011.

By Commonwealth and School Districts

Balance of required contribution determined as normal contribution, accrued liability contribution, supplemental annuity contribution, experience adjustment factor and premium assistance contribution and the DC Plan contribution, is funded by the Commonwealth and the School District.

Table 14

Summary of Membership Data as of June 30, 2019
(\$ Amounts in Thousands)

Total Active Members¹

Item	Male	Female	Total
Number of Members	69,749	186,000	255,749
Total Annual Salaries ⁶	\$ 4,112,387	\$ 9,559,540	\$ 13,671,927
Average Age ⁷	45.3	45.5	45.4
Average Service ⁷	12.0	11.6	11.7

^{1.} Excludes 158,368 inactive members, non-members and vestees.

Class T-C Members²

Item	Male	Female	Total
Number of Members	741	2,269	3,010
Total Annual Salaries ⁶	\$ 51,531	\$ 117,748	\$ 169,279
Average Age ⁷	51.5	54.0	53.4
Average Service ⁷	22.6	20.8	21.3

^{2.} Excludes 27,968 inactive members, non-members and vestees.

Class T-D Members³

Item	Male	Female	Total
Number of Members	44,714	122,404	167,118
Total Annual Salaries ⁶	\$ 3,209,811	\$ 7,402,552	\$ 10,612,363
Average Age ⁷	48.0	48.6	48.5
Average Service ⁷	16.8	15.8	16.1

^{3.} Excludes 78,927 inactive members, non-members and vestees.

^{6.} The salaries shown in the table above represent an annual rate of pay for the year ended June 30, 2019 for members who were in active service on June 30, 2019.

^{7.} Average completed years of age and service.

Table 14
(Continued)

Summary of Membership Data as of June 30, 2019
(\$ Amounts in Thousands)

Class T-E Members⁴

Item	Male	Female	Total
Number of Members	19,987	50,534	70,521
Total Annual Salaries ⁶	\$ 650,829	\$ 1,590,853	\$ 2,241,682
Average Age ⁷	40.4	39.0	39.4
Average Service ⁷	2.6	2.8	2.7

⁴. Excludes 48,754 inactive members and non-members.

Class T-F Members⁵

Item	Male	Female	Total
Number of Members	4,307	10,793	15,100
Total Annual Salaries ⁶	\$ 200,216	\$ 448,387	\$ 648,603
Average Age ⁷	40.0	37.7	38.3
Average Service ⁷	3.3	3.2	3.2

⁵. Excludes 2,719 inactive members and non-members.

⁶. The salaries shown in the table above represent an annual rate of pay for the year ended June 30, 2019 for members who were in active service on June 30, 2019.

⁷. Average completed years of age and service.

**Table 14
(Continued)**

Summary of Membership Data as of June 30, 2019
(\$ Amounts in Thousands)

Total Annuitants and Beneficiaries¹

Item	Number	Annual Annuities ²	Average Annuities	Average Age
Annuitants (Normal, Early and Withdrawal)	216,326	\$ 5,689,297	\$ 26,300	71.3
Survivors and Beneficiaries	11,860	176,091	\$ 14,847	76.0
Disabled Annuitants	<u>9,153</u>	<u>186,244</u>	\$ 20,348	65.5
Total	237,339	\$ 6,051,632	\$ 25,498	71.3

New Annuitants and Beneficiaries
Who Retired Between July 1, 2018 and June 30, 2019

Item	Number ³	Annual Annuities ²	Average Annuities	Average Age
Annuitants (Normal, Early and Withdrawal)	9,075	\$ 221,685	\$ 24,428	61.8
Survivors and Beneficiaries	2,590	17,790	\$ 17,808	67.7
Disabled Annuitants	<u>284</u>	<u>7,109</u>	\$ 25,031	54.7
Total	11,949	\$ 246,584	\$ 23,806	62.9

1. The median annual benefit payable to all annuitants and beneficiaries is \$20,590.
2. The annuities shown in the tables above represent the annual amount payable as of July 1, 2019 for participants who were in payment on June 30, 2019.
3. Excludes 216 members who retired after June 30, 2018 but died prior to June 30, 2019.

**Table 14
(Continued)**

**Distribution of Annuitants, Beneficiaries, and Survivors by Annual Pension Amount
As of June 30, 2019**

1. All annuitants, beneficiaries, and survivors

Annual Pension Amount	Number	Average Years of Service
Under \$10,000	83,776	12
\$10,000 - \$19,999	33,311	21
\$20,000 - \$29,999	26,575	26
\$30,000 - \$39,999	29,263	30
\$40,000 - \$49,999	28,466	32
\$50,000 - \$59,999	19,064	34
\$60,000 - \$69,999	9,469	35
\$70,000 - \$79,999	4,229	36
\$80,000 - \$89,999	1,602	37
\$90,000 - \$99,999	735	37
\$100,000 or more	849	38
Total	237,339	23

2. Excludes annuitants, beneficiaries, and survivors with no service on file

Annual Pension Amount	Number	Average Years of Service
Under \$10,000	80,320	13
\$10,000 - \$19,999	31,107	22
\$20,000 - \$29,999	25,431	27
\$30,000 - \$39,999	28,708	30
\$40,000 - \$49,999	28,122	33
\$50,000 - \$59,999	18,877	34
\$60,000 - \$69,999	9,394	35
\$70,000 - \$79,999	4,201	36
\$80,000 - \$89,999	1,593	37
\$90,000 - \$99,999	729	37
\$100,000 or more	841	38
Total	229,323	24

Exhibit I

Active Membership Data as of June 30, 2019

Number and Average Annual Salary

Age	Service									Total	
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40+		
Under 25	6,470 \$26,352	46 \$32,783									6,516 \$26,397
25-29	14,726 \$37,860	4,071 \$52,601	39 \$37,394								18,836 \$41,045
30-34	9,259 \$35,953	11,585 \$56,851	5,624 \$64,682	20 \$56,668							26,488 \$51,208
35-39	7,745 \$30,632	5,710 \$54,018	15,276 \$68,909	4,910 \$77,862	24 \$61,929						33,665 \$58,878
40-44	7,743 \$25,893	4,151 \$46,567	6,738 \$66,364	12,319 \$80,875	3,271 \$87,914	15 \$62,886					34,237 \$62,090
45-49	7,753 \$24,329	4,714 \$39,153	5,496 \$56,154	6,840 \$75,822	10,389 \$88,527	2,334 \$89,674	44 \$65,495				37,570 \$62,079
50-54	6,218 \$24,267	4,569 \$34,430	5,837 \$46,763	5,355 \$61,322	5,213 \$80,164	5,987 \$88,081	1,825 \$85,159	35 \$56,979			35,039 \$57,427
55-59	4,902 \$22,751	3,763 \$31,898	5,586 \$40,762	6,210 \$51,053	4,514 \$63,689	3,005 \$76,565	3,183 \$85,731	502 \$75,350	34 \$49,231		31,699 \$50,672
60-64	3,390 \$19,889	2,566 \$30,612	3,506 \$39,409	4,406 \$47,541	3,862 \$56,161	2,060 \$63,076	1,153 \$70,305	577 \$80,912	199 \$72,353		21,719 \$45,241
Over 64	2,886 \$15,154	1,653 \$23,446	1,519 \$32,860	1,355 \$40,514	1,053 \$50,298	711 \$53,381	419 \$55,735	164 \$62,583	220 \$78,808		9,980 \$32,983
Total	71,092 \$28,988	42,828 \$45,653	49,621 \$57,685	41,415 \$67,805	28,326 \$77,103	14,112 \$80,467	6,624 \$80,857	1,278 \$75,720	453 \$73,752		255,749 \$53,458

Exhibit II

The Number of Average Annual Annuity as of June 30, 2019

**Retired on Account of Superannuation, Early Retirement and Those
in Receipt of Withdrawal Annuities**

Age	Years of Service									Total
	0-4 ¹	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40+	
Under 50		4,732	1,563	446	122	20	1			6,884
		\$919	\$2,783	\$6,872	\$13,073	\$21,938	\$8,382			\$2,005
50-54		1,780	1,054	472	236	166	44	10	1	3,763
		\$1,150	\$2,965	\$7,428	\$15,078	\$23,020	\$43,697	\$42,560	\$9,498	\$4,893
55-59		1,872	1,572	939	580	889	1,589	583	7	8,031
		\$1,561	\$3,336	\$8,217	\$15,089	\$33,486	\$47,398	\$56,025	\$45,033	\$20,254
60-64	68	2,531	3,156	2,725	2,623	3,106	5,101	3,588	234	23,132
	\$7,989	\$2,703	\$5,579	\$12,092	\$21,871	\$34,106	\$48,960	\$58,792	\$58,882	\$30,068
65-69	519	3,639	5,806	5,457	5,684	6,627	10,949	10,002	982	49,665
	\$1,825	\$3,711	\$6,393	\$13,738	\$22,519	\$33,182	\$46,049	\$58,803	\$67,045	\$32,870
70-74	1,272	3,128	5,757	4,852	4,783	5,836	13,223	10,939	1,383	51,173
	\$1,370	\$3,660	\$5,401	\$11,690	\$20,101	\$29,564	\$41,044	\$54,714	\$67,732	\$31,354
75-79	1,254	2,019	3,506	3,396	3,206	3,761	8,633	5,675	960	32,410
	\$1,012	\$3,062	\$4,806	\$9,574	\$16,138	\$24,956	\$34,813	\$46,525	\$60,874	\$25,467
80-84	773	1,159	2,411	2,229	2,526	2,859	4,084	3,108	825	19,974
	\$799	\$2,433	\$4,022	\$7,487	\$12,593	\$20,299	\$29,759	\$37,577	\$48,177	\$19,913
85-89	428	702	1,584	1,580	1,864	2,012	2,242	1,595	723	12,730
	\$730	\$2,010	\$3,470	\$6,297	\$11,130	\$17,768	\$26,031	\$36,221	\$42,732	\$17,336
Over 89	325	461	1,203	1,334	1,496	1,404	1,067	876	398	8,564
	\$965	\$1,748	\$3,399	\$6,383	\$10,866	\$16,427	\$22,542	\$28,834	\$39,632	\$13,793
Total	4,639	22,023	27,612	23,430	23,120	26,680	46,933	36,376	5,513	216,326
	\$1,239	\$2,376	\$4,877	\$10,523	\$17,988	\$27,853	\$40,022	\$52,081	\$57,765	\$26,300

1. Includes 32 annuitant records with no service information provided

Exhibit III

The Number and Average Annual Annuity as of June 30, 2019

Beneficiaries and Survivor Annuitants

Age	Years of Service								Total
	0-9 ¹	10-14	15-19	20-24	25-29	30-34	35-39	40+	
Under 50	222	20	16	13	18	9	7	1	306
	\$11,849	\$3,899	\$6,603	\$3,894	\$8,679	\$15,346	\$16,551	\$23,464	\$7,022
50-54	164	9	12	12	9	8	4	2	220
	\$23,686	\$3,010	\$3,873	\$8,795	\$6,359	\$14,519	\$14,706	\$22,956	\$8,663
55-59	330	12	14	16	11	14	4	5	406
	\$24,042	\$6,462	\$6,735	\$9,338	\$12,548	\$11,175	\$34,567	\$15,577	\$12,126
60-64	629	32	35	33	30	21	17	11	808
	\$36,515	\$7,149	\$4,466	\$7,828	\$13,908	\$19,214	\$15,666	\$14,993	\$14,999
65-69	1,136	30	33	44	41	74	49	9	1,416
	\$25,204	\$5,086	\$6,234	\$7,882	\$14,013	\$14,069	\$20,593	\$17,326	\$18,941
70-74	1,487	41	36	42	55	143	118	20	1,942
	\$29,797	\$3,081	\$6,115	\$7,822	\$13,246	\$18,498	\$21,990	\$13,489	\$19,807
75-79	1,285	55	68	65	65	167	150	34	1,889
	\$20,276	\$3,527	\$6,197	\$9,329	\$13,075	\$18,108	\$22,041	\$19,189	\$16,776
80-84	1,148	94	73	80	74	143	130	68	1,810
	\$15,559	\$3,107	\$5,198	\$7,881	\$12,424	\$15,136	\$19,412	\$20,084	\$13,357
85-89	929	74	94	69	88	141	111	80	1,586
	\$14,029	\$3,400	\$4,394	\$7,406	\$10,115	\$12,310	\$15,856	\$21,762	\$11,966
Over 89	696	96	86	111	115	121	171	81	1,477
	\$13,124	\$2,749	\$4,098	\$6,693	\$8,334	\$10,759	\$12,401	\$18,246	\$10,064
Total ²	8,026	463	467	485	506	841	761	311	11,860
	\$16,196	\$3,654	\$5,128	\$7,691	\$11,244	\$15,133	\$18,257	\$19,212	\$14,847

1. Includes 7,903 beneficiary or survivor annuitant records with no service information provided.

2. In addition, there are 1,595 beneficiaries who are only entitled to a pending lump sum distribution.

Exhibit IV

**The Number and Average Annual Annuity as of June 30, 2019
Retired on Account of Disability**

Age	Years of Service									Total
	0-4	5-9 ¹	10-14	15-19	20-24	25-29	30-34	35-39	40+	
Under 50	153	153	109	53	5					473
	\$16,005	\$21,394	\$27,211	\$38,415	\$55,354					\$23,257
50-54	142	157	135	104	58	6				602
	\$13,914	\$17,216	\$24,599	\$34,429	\$48,479	\$54,506				\$24,370
55-59	270	311	243	201	164	51	2			1,242
	\$11,786	\$13,622	\$19,580	\$31,200	\$42,681	\$53,275	\$44,071			\$22,748
60-64	374	441	392	342	230	98	1	1		1,879
	\$9,837	\$13,892	\$18,343	\$28,000	\$38,139	\$46,673	\$39,632	\$39,130		\$21,266
65-69	338	428	329	333	335	170	3	1		1,937
	\$8,783	\$12,806	\$17,568	\$25,024	\$36,603	\$46,314	\$45,223	\$35,628		\$22,123
70-74	239	285	237	261	311	169	5	3		1,510
	\$6,968	\$9,957	\$13,881	\$22,073	\$31,515	\$43,031	\$30,263	\$22,697		\$20,428
75-79	117	192	159	162	120	30	1			781
	\$5,972	\$8,166	\$10,520	\$17,648	\$26,172	\$35,145	\$49,704			\$14,139
80-84	69	101	89	73	51	17	2	1		403
	\$4,830	\$7,145	\$9,307	\$15,036	\$20,331	\$30,624	\$42,997	\$10,189		\$11,500
85-89	36	58	57	34	28	5	1			219
	\$3,759	\$5,786	\$8,291	\$12,160	\$20,779	\$18,653	\$43,179			\$9,476
Over 89	24	37	19	16	8	2		1		107
	\$3,359	\$6,562	\$8,232	\$11,702	\$18,922	\$18,207		\$54,601		\$8,501
Total	1,762	2,163	1,769	1,579	1,310	548	15	7		9,153
	\$9,743	\$12,726	\$17,205	\$25,388	\$34,951	\$44,650	\$39,576	\$29,663		\$20,348

1. Includes 4 annuitant record with no service information provided.

Exhibit V

Annuitant and Beneficiary Membership Data as of June 30, 2019

Number and Average Annual Benefit
Excludes Partial Lump Sum Payments

Age Last Birthday	Number	Annual Benefit (Thousands)	Average Annual Benefit
Annuitants (Normal, Early and Withdrawal)			
Under 60	18,678	\$ 194,875	\$ 10,433
60 - 64	23,132	695,537	30,068
65 - 69	49,665	1,632,466	32,870
70 - 74	51,173	1,604,466	31,354
75 - 79	32,410	825,397	25,467
Over 79	41,268	736,556	17,848
Total	216,326	\$ 5,689,297	\$ 26,300
Survivors and Beneficiaries			
Under 60	932	\$ 8,978	\$ 9,633
60 - 64	808	12,119	14,999
65 - 69	1,416	26,820	18,941
70 - 74	1,942	38,464	19,806
75 - 79	1,889	31,690	16,776
Over 79	4,873	58,020	11,906
Total	11,860	\$ 176,091	\$ 14,847
Disabled Annuitants			
Under 60	2,317	\$ 53,924	\$ 23,273
60 - 64	1,879	39,959	21,266
65 - 69	1,937	42,852	22,123
70 - 74	1,510	30,847	20,428
75 - 79	781	11,043	14,140
Over 79	729	7,619	10,451
Total	9,153	\$ 186,244	\$ 20,348
Grand Total Average Annual Benefit			
	237,339	\$ 6,051,632	\$ 25,498

Exhibit VI

10-Year History of Membership Data

Active Members

Valuation as of June 30	Number of Active Members	Percentage Change in Membership	Total Annualized Payroll (Thousands) ¹	Percentage Change in Payroll
2019	255,749	(0.24%)	\$ 13,671,927	2.19%
2018	256,362	0.16%	13,379,041	2.65%
2017	255,945	(0.44%)	13,033,919	1.42%
2016	257,080	(1.07%)	12,851,289	1.37%
2015	259,868	(1.31%)	12,678,213	0.45%
2014	263,312	(1.54%)	12,620,862	0.35%
2013	267,428	(2.22%)	12,577,105	(1.08%)
2012	273,504	(2.02%)	12,714,371	(1.52%)
2011	279,152	(1.02%)	12,910,043	0.95%
2010	282,041	0.84%	12,788,847	2.11%

1. The salaries shown represent an annual rate of pay for the year ending June 30th for members who were in active service on June 30th.

Exhibit VI
(Continued)

10-Year History of Membership Data

The Number and Annual Annuities of Annuitant and Survivor Annuitant Members

Year Ended June 30	Number	Annual Annuities ¹ (Millions)	Average Annual Annuities	Additions	Annual Annuities (Millions)	Deletions	Annual Annuities (Millions)	Percentage Change in Membership	Percentage Change in Annuities
2019	237,339	\$ 6,051.6	\$ 25,498	10,553	\$ 246.6	6,502	\$ 107.0	1.74%	2.11%
2018	233,288	5,926.7	25,405	11,806	235.3	8,532	98.6	1.42%	1.90%
2017	230,014	5,816.4	25,287	12,876	274.2	7,690	102.1	2.31%	2.65%
2016	224,828	5,666.4	25,203	12,686	267.1	7,633	93.5	2.30%	2.64%
2015	219,775	5,520.6	25,119	15,017	297.3	9,142	91.7	2.75%	3.39%
2014	213,900	5,339.5	24,962	15,225	300.5	8,878	84.9	3.06%	3.74%
2013	207,553	5,147.1	24,800	16,404	377.6	10,866	83.7	2.74%	5.63%
2012	202,015	4,872.9	24,121	14,579	332.7	7,186	66.6	3.80%	4.78%
2011	194,622	4,650.8	23,897	16,228	453.7	6,540	76.4	5.24%	7.17%
2010	184,934	4,339.6	23,466	12,649	372.8	5,678	77.6	3.92%	8.59%

1. The annual annuities added and deleted are for the annuitants and survivor annuitants who were added and deleted. Changes in annuities for continuing payees may also occur due to finalization of benefit calculations and due to the commencement of supplemental annuity payments.

10-Year History of Membership Data

The Number and Annual Annuities of Annuitant Members

Year Ended June 30	Number	Annual Annuities ² (Millions)	Average Annual Annuities	Additions	Annual Annuities (Millions)	Deletions	Annual Annuities (Millions)	Percentage Change in Membership	Percentage Change in Annuities
2019	225,479	\$ 5,875.5	\$ 26,058	9,575	\$ 228.8	5,975	\$ 104.0	1.62%	1.97%
2018	221,879	5,762.3	25,970	10,911	220.2	7,918	93.0	1.37%	1.80%
2017	218,886	5,660.4	25,860	11,942	257.9	7,075	95.8	2.27%	2.54%
2016	214,019	5,520.0	25,792	11,807	249.8	7,054	88.1	2.27%	2.54%
2015	209,266	5,383.3	25,725	12,624	279.2	7,114	86.5	2.70%	3.30%
2014	203,756	5,211.4	25,577	12,915	283.9	6,894	80.0		

2. The annual annuities added and deleted are for the annuitants who were added and deleted. Changes in annuities for continuing payees may also occur due to finalization of benefit calculations and due to the commencement of supplemental annuity payments.

Exhibit VII

Detailed Tabulations of the Data

Table 1

**The Number and Annual Salaries of Members in Active Service Distributed
by Age as of June 30, 2019**

Age	Male		Female		Total	
	Number	Salaries	Number	Salaries	Number	Salaries
17	14	\$ 117,297	9	\$ 72,568	23	\$ 189,865
18	30	318,093	26	292,805	56	610,898
19	112	1,438,943	134	1,473,823	246	2,912,766
20	194	2,836,424	198	2,355,915	392	5,192,339
21	276	4,278,379	271	3,787,334	547	8,065,713
22	345	6,332,490	516	11,164,932	861	17,497,422
23	516	12,926,339	1,339	39,691,011	1,855	52,617,350
24	730	21,832,572	1,806	63,084,655	2,536	84,917,227
25	825	26,954,441	2,165	80,884,224	2,990	107,838,665
26	984	33,044,752	2,438	97,528,559	3,422	130,573,311
27	987	37,387,759	2,765	117,047,711	3,752	154,435,470
28	1,109	44,638,712	3,055	133,708,696	4,164	178,347,408
29	1,224	52,555,082	3,284	149,373,954	4,508	201,929,036
30	1,206	53,015,402	3,366	157,569,548	4,572	210,584,950
31	1,273	61,101,230	3,553	173,515,711	4,826	234,616,941
32	1,427	74,740,067	3,914	199,421,810	5,341	274,161,877
33	1,558	84,167,628	4,179	219,473,090	5,737	303,640,718
34	1,672	95,232,869	4,340	238,172,449	6,012	333,405,318
35	1,647	96,866,629	4,506	250,104,199	6,153	346,970,828
36	1,705	102,659,948	4,832	272,892,869	6,537	375,552,817
37	1,887	119,523,101	5,000	288,372,367	6,887	407,895,468
38	1,923	123,400,795	5,086	295,842,850	7,009	419,243,645
39	1,934	129,277,540	5,145	303,181,082	7,079	432,458,622
40	1,948	131,030,687	5,071	297,233,587	7,019	428,264,274
41	1,906	130,911,172	4,888	288,745,035	6,794	419,656,207
42	1,991	137,996,635	4,967	294,554,708	6,958	432,551,343
43	1,933	138,620,991	4,764	282,116,842	6,697	420,737,833
44	1,913	135,208,298	4,856	289,342,650	6,769	424,550,948
45	1,920	139,177,581	4,897	285,977,777	6,817	425,155,358
46	1,974	143,252,032	4,991	292,732,064	6,965	435,984,096
47	2,122	153,988,395	5,484	317,273,724	7,606	471,262,119
48	2,254	162,969,547	6,033	350,145,717	8,287	513,115,264
49	2,035	147,078,460	5,860	339,727,248	7,895	486,805,708
50	1,980	141,866,215	5,451	306,645,201	7,431	448,511,416
51	1,851	131,643,617	5,219	284,236,133	7,070	415,879,750
52	1,827	123,847,023	5,121	273,657,027	6,948	397,504,050
53	1,877	125,380,449	4,881	255,400,782	6,758	380,781,231
54	1,706	112,042,457	5,126	257,460,582	6,832	369,503,039
55	1,726	112,517,582	5,000	244,046,842	6,726	356,564,424
56	1,584	98,998,882	4,788	231,130,617	6,372	330,129,499

Table 1
(Continued)

**The Number and Annual Salaries of Members in Active Service Distributed
by Age as of June 30, 2019**

Age	Male		Female		Total	
	Number	Salaries	Number	Salaries	Number	Salaries
57	1,515	\$ 89,053,865	4,787	\$ 229,423,059	6,302	\$ 318,476,924
58	1,565	91,770,550	4,851	227,467,959	6,416	319,238,509
59	1,417	79,691,940	4,466	202,141,842	5,883	281,833,782
60	1,377	73,461,444	4,130	186,869,032	5,507	260,330,476
61	1,288	67,210,504	3,967	176,081,342	5,255	243,291,846
62	1,064	54,376,625	3,228	137,944,481	4,292	192,321,106
63	946	44,174,621	2,630	112,461,438	3,576	156,636,059
64	883	40,107,945	2,206	89,900,364	3,089	130,008,309
65	654	27,408,836	1,521	59,756,495	2,175	87,165,331
66	491	20,424,384	1,042	40,379,302	1,533	60,803,686
67	432	14,675,433	816	28,506,820	1,248	43,182,253
68	337	11,598,698	643	20,331,951	980	31,930,649
69	297	10,113,367	503	15,215,747	800	25,329,114
70	240	7,004,711	397	10,106,219	637	17,110,930
71	224	6,609,288	332	8,762,387	556	15,371,675
72	203	5,998,791	301	7,423,227	504	13,422,018
73	124	3,217,816	167	4,058,987	291	7,276,803
74	121	3,572,697	134	2,796,677	255	6,369,374
75	105	2,518,620	119	2,452,629	224	4,971,249
76	92	2,388,906	105	2,054,870	197	4,443,776
77	61	1,636,872	95	1,805,317	156	3,442,189
78	48	871,127	66	1,129,067	114	2,000,194
79	40	895,489	39	875,395	79	1,770,884
80	27	690,904	30	581,691	57	1,272,595
81	22	592,542	34	595,376	56	1,187,918
82	17	372,110	22	283,499	39	655,609
83	10	285,660	14	177,443	24	463,103
84	10	186,506	10	176,609	20	363,115
85	9	179,278	15	173,510	24	352,788
86	3	84,505	5	156,951	8	241,456
87	2	36,017	1	12,052	3	48,069
Total	69,749	\$ 4,112,386,566	186,000	\$ 9,559,540,436	255,749	\$ 13,671,927,002

Table 2

**The Number and Annual Salaries of Members in Active Service Distributed by
Years of Credited Service as of June 30, 2019**

Service	Male		Female		Total	
	Number	Salaries	Number	Salaries	Number	Salaries
0	5,255	\$ 77,202,514	8,257	\$ 122,106,105	13,512	\$ 199,308,619
1	5,465	147,632,449	14,324	385,884,545	19,789	533,516,994
2	3,913	133,597,372	10,508	327,483,532	14,421	461,080,904
3	3,111	122,416,190	9,440	326,703,723	12,551	449,119,913
4	2,661	112,697,813	8,158	305,119,344	10,819	417,817,157
5	2,447	112,521,294	7,447	298,619,225	9,894	411,140,519
6	2,352	115,465,009	6,708	286,209,097	9,060	401,674,106
7	1,882	94,555,692	5,884	258,451,966	7,766	353,007,658
8	1,838	97,074,916	5,666	259,931,723	7,504	357,006,639
9	2,095	117,556,953	6,509	314,835,064	8,604	432,392,017
10	2,228	131,933,102	7,109	362,813,246	9,337	494,746,348
11	2,427	149,379,602	7,652	408,582,136	10,079	557,961,738
12	2,449	158,661,099	7,843	431,339,091	10,292	590,000,190
13	2,400	161,120,525	7,631	440,728,995	10,031	601,849,519
14	2,449	172,086,417	7,433	445,751,448	9,882	617,837,864
15	2,533	184,607,959	7,030	438,016,339	9,563	622,624,298
16	2,120	159,243,792	6,105	387,251,719	8,225	546,495,511
17	2,083	161,945,774	6,040	390,094,287	8,123	552,040,061
18	2,004	157,713,086	5,814	384,737,323	7,818	542,450,410
19	1,876	152,755,582	5,810	391,772,742	7,686	544,528,325
20	2,275	193,266,418	5,285	370,658,181	7,560	563,924,599
21	1,902	161,720,315	4,344	313,840,755	6,246	475,561,070
22	1,828	161,063,483	3,830	281,933,355	5,658	442,996,838
23	1,443	126,250,460	3,226	241,638,442	4,669	367,888,902
24	1,270	112,105,201	2,923	221,529,854	4,193	333,635,055
25	1,073	94,219,225	2,492	192,211,221	3,565	286,430,446
26	1,275	113,591,361	2,278	175,674,613	3,553	289,265,974
27	795	68,705,071	1,700	133,182,300	2,495	201,887,371
28	702	59,445,989	1,606	123,398,630	2,308	182,844,619
29	715	60,248,606	1,476	114,871,347	2,191	175,119,953
30	669	56,244,100	1,274	98,675,995	1,943	154,920,095
31	509	44,854,017	1,083	85,700,378	1,592	130,554,395
32	446	38,137,375	870	68,339,170	1,316	106,476,545
33	353	30,248,150	690	54,783,334	1,043	85,031,484
34	256	21,686,611	474	36,924,714	730	58,611,325
35	168	13,992,000	274	20,450,183	442	34,442,183
36	114	8,216,922	157	12,060,577	271	20,277,499
37	87	6,324,978	113	8,443,393	200	14,768,371
38	79	5,768,066	123	9,344,316	202	15,112,382
39	59	4,769,491	104	7,399,821	163	12,169,312

**Table 2
(Continued)**

**The Number and Annual Salaries of Members in Active Service Distributed by
Years of Credited Service as of June 30, 2019**

Service	Male		Female		Total	
	Number	Salaries	Number	Salaries	Number	Salaries
40	49	\$ 3,477,465	86	\$ 6,188,510	135	\$ 9,665,975
41	26	2,376,716	53	3,830,021	79	6,206,737
42	17	1,356,042	34	2,265,956	51	3,621,998
43	18	1,363,833	29	1,988,310	47	3,352,143
44	4	302,571	28	1,678,374	32	1,980,945
45	8	587,104	21	1,783,296	29	2,370,400
46	6	528,408	18	1,589,478	24	2,117,886
47	6	542,298	9	692,862	15	1,235,160
48	3	278,397	8	566,551	11	844,948
49	1	49,522	7	302,301	8	351,823
50			7	467,482	7	467,482
51			2	173,999	2	173,999
52	1	42,172	3	188,102	4	230,274
53	1	97,295	2	80,519	3	177,814
54	1	147,945	3	252,446	4	400,391
58	1	116,895			1	116,895
60	1	94,924			1	94,924
Total	69,749	\$4,112,386,566	186,000	\$9,559,540,436	255,749	\$ 13,671,927,002

Table 3

The Number and Annual Annuities of Annuitants on the Retired List
as of June 30, 2019

Retired on Account of Superannuation, Early Retirement and
Those in Receipt of Withdrawal Annuities

Age	Male		Female		Total	
	Number	Annunities	Number	Annunities	Number	Annunities
24	1	\$ 1,574			1	\$ 1,574
26			1	\$ 3,017	1	3,017
27	1	859	1	245	2	1,104
28	1	267	3	6,859	4	7,126
29	13	8,199	7	1,870	20	10,069
30	16	9,426	9	5,762	25	15,188
31	26	24,680	32	26,509	58	51,189
32	26	25,859	57	43,209	83	69,068
33	58	57,238	82	59,686	140	116,924
34	71	68,892	108	81,384	179	150,276
35	63	62,411	116	107,688	179	170,099
36	69	79,991	174	169,777	243	249,768
37	117	133,638	170	175,821	287	309,459
38	110	153,498	196	279,374	306	432,872
39	140	259,400	193	266,659	333	526,059
40	135	236,550	263	392,902	398	629,452
41	156	299,800	264	422,864	420	722,664
42	147	333,033	264	464,669	411	797,702
43	134	251,547	305	540,635	439	792,182
44	140	341,658	316	576,579	456	918,237
45	140	387,413	348	675,340	488	1,062,753
46	156	530,455	361	855,311	517	1,385,766
47	186	632,301	358	829,256	544	1,461,557
48	194	616,440	459	1,151,982	653	1,768,422
49	205	892,551	492	1,254,641	697	2,147,192
50	217	1,053,396	498	1,846,926	715	2,900,322
51	181	932,539	492	1,954,634	673	2,887,173
52	219	1,328,599	525	2,067,888	744	3,396,487
53	242	1,614,797	551	2,463,479	793	4,078,276
54	232	2,055,759	606	3,094,035	838	5,149,794
55	290	4,522,209	767	7,166,172	1,057	11,688,381
56	396	7,702,775	946	14,441,912	1,342	22,144,687
57	466	11,655,730	1,134	20,040,125	1,600	31,695,855
58	541	15,518,068	1,320	27,783,494	1,861	43,301,562
59	649	19,258,096	1,522	34,574,360	2,171	53,832,456
60	776	25,780,633	1,823	47,159,298	2,599	72,939,931
61	938	32,358,520	2,327	65,171,193	3,265	97,529,713
62	1,254	45,982,370	3,449	98,906,609	4,703	144,888,979
63	1,488	52,235,525	4,473	124,845,887	5,961	177,081,412
64	1,636	58,062,968	4,968	145,033,523	6,604	203,096,491
65	1,949	66,733,520	5,887	174,233,457	7,836	240,966,977
66	2,360	86,616,804	6,935	214,796,176	9,295	301,412,980
67	2,717	98,909,936	7,792	248,934,434	10,509	347,844,370
68	3,099	116,179,519	8,186	262,217,402	11,285	378,396,921
69	3,032	115,705,569	7,708	248,140,583	10,740	363,846,152

**Table 3
(Continued)**

**The Number and Annual Annuities of Annuitants on the Retired List
as of June 30, 2019**

**Retired on Account of Superannuation, Early Retirement and
Those in Receipt of Withdrawal Annuities**

Age	Male		Female		Total	
	Number	Annunities	Number	Annunities	Number	Annunities
70	3,378	\$ 128,649,618	7,518	\$ 233,826,116	10,896	\$ 362,475,734
71	3,612	132,982,085	7,309	222,973,469	10,921	355,955,554
72	4,152	146,783,229	7,800	226,634,084	11,952	373,417,313
73	3,573	121,789,536	6,174	169,484,946	9,747	291,274,482
74	2,861	93,365,234	4,796	127,977,580	7,657	221,342,814
75	2,689	84,652,976	4,555	113,960,985	7,244	198,613,961
76	2,775	85,552,450	4,603	108,339,583	7,378	193,892,033
77	2,683	82,075,749	4,250	95,432,136	6,933	177,507,885
78	2,087	58,971,006	3,753	81,077,518	5,840	140,048,524
79	1,779	49,735,111	3,236	65,599,674	5,015	115,334,785
80	1,610	40,487,618	3,023	57,746,920	4,633	98,234,538
81	1,480	37,733,231	2,873	52,473,853	4,353	90,207,084
82	1,399	34,932,185	2,553	43,807,804	3,952	78,739,989
83	1,254	31,004,052	2,439	39,974,692	3,693	70,978,744
84	1,112	25,664,048	2,231	33,914,277	3,343	59,578,325
85	997	23,249,032	1,963	29,652,455	2,960	52,901,487
86	890	20,933,638	1,766	25,258,856	2,656	46,192,494
87	850	20,181,582	1,776	25,428,392	2,626	45,609,974
88	711	17,365,933	1,708	25,321,706	2,419	42,687,639
89	621	13,437,588	1,448	19,863,180	2,069	33,300,768
90	485	10,145,907	1,264	16,630,698	1,749	26,776,605
91	361	7,701,991	1,171	14,721,900	1,532	22,423,891
92	310	6,442,407	1,002	12,498,915	1,312	18,941,322
93	247	4,902,785	800	9,960,985	1,047	14,863,770
94	189	3,581,266	592	6,799,621	781	10,380,887
95	136	2,668,812	499	5,337,496	635	8,006,308
96	88	1,456,380	367	3,674,082	455	5,130,462
97	51	794,503	304	2,863,182	355	3,657,685
98	26	452,919	205	2,142,837	231	2,595,756
99	20	354,584	150	1,585,000	170	1,939,584
100	11	200,815	92	957,673	103	1,158,488
101	12	112,754	74	878,852	86	991,606
102	5	83,554	44	428,373	49	511,927
103	3	13,611	22	246,344	25	259,955
104	2	42,712	14	157,444	16	200,156
105	1	2,792	7	95,071	8	97,863
106			3	57,385	3	57,385
107			3	64,173	3	64,173
108	1	15,242	2	25,789	3	41,031
110			1	25,679	1	25,679
Total	67,448	\$ 2,058,133,947	148,878	\$ 3,631,163,351	216,326	\$ 5,689,297,298

**Table 3
(Continued)**

**The Number and Annual Annuities of Annuitants on the Retired List
as of June 30, 2019**

**Retired on Account of Superannuation, Early Retirement and
Those in Receipt of Withdrawal Annuities**

<u>OPTION</u>	<u>MALE</u>		<u>FEMALE</u>	
Maximum	31,594	\$ 955,856,419	84,982	\$ 2,062,559,942
1	10,818	253,881,832	34,100	656,125,626
2	16,095	479,887,258	17,864	485,003,164
3	7,429	296,743,704	10,910	385,304,344
4	<u>1,512</u>	<u>71,764,734</u>	<u>1,022</u>	<u>42,170,275</u>
	67,448	\$ 2,058,133,947	148,878	\$ 3,631,163,351

DEFINITIONS OF OPTIONS

Option 1 A life annuity to the member with a guaranteed payment to the beneficiary equal to the present value of the total maximum single life annuity less any amounts paid to the member prior to death.

Option 2 A joint and one hundred percent (100%) survivor annuity payable during the lifetime of the member with the full amount of such annuity payable thereafter to the designated survivor annuitant, if living at the member's death.

Option 3 A joint and fifty percent (50%) survivor annuity payable during the lifetime of the member with one-half of such annuity payable thereafter to the designated survivor annuitant, if living at the member's death.

Option 4 A life annuity to the member with a special death benefit other than the normal option 1, 2, or 3 death benefit.

Note: The Option 4 totals above only reflect annuity elections that differ from the Maximum annuity or Options 1, 2 or 3. The Option 4 totals do not reflect Option 4 elections to withdraw accumulated deductions.

Table 4

The Number and Annual Annuities of Beneficiaries and Survivor Annuitants
as of June 30, 2019

Age	Male		Female		Total	
	Number	Annuities	Number	Annuities	Number	Annuities
9	1	\$ 1,534			1	\$ 1,534
13	1	3,741	1	\$ 1,534	2	5,275
16			1	21,875	1	21,875
18	2	4,036			2	4,036
19	1	1,898	2	10,923	3	12,821
20			2	4,388	2	4,388
21	2	11,957	2	14,723	4	26,680
22	2	3,275	1	8,672	3	11,947
23	1	9,869	1	10,040	2	19,909
24			2	4,814	2	4,814
25	3	22,827	1	9,942	4	32,769
26			2	9,620	2	9,620
27	2	2,899	4	34,730	6	37,629
28	3	19,923	2	18,704	5	38,627
29	2	18,108	5	22,941	7	41,049
30	5	24,013	4	22,733	9	46,746
31	2	5,832	2	6,266	4	12,098
32	9	96,008	3	25,735	12	121,743
33	2	2,839	1	5,316	3	8,155
34	3	25,457	7	87,104	10	112,561
35	6	24,021	5	73,065	11	97,086
36	4	18,257	4	45,835	8	64,092
37	5	59,285	4	25,667	9	84,952
38	6	44,562	4	16,443	10	61,005
39	7	43,959	2	9,340	9	53,299
40	5	22,780	7	63,063	12	85,843
41	12	93,089	7	28,882	19	121,971
42	8	65,623	9	32,317	17	97,940
43	3	9,392	11	70,030	14	79,422
44	7	102,070	11	87,213	18	189,283
45	7	27,200	11	76,847	18	104,047
46	6	23,376	12	79,152	18	102,528
47	5	42,751	8	66,087	13	108,838
48	4	12,413	21	153,313	25	165,726
49	8	43,860	13	114,718	21	158,578
50	8	96,525	24	220,985	32	317,510
51	16	94,696	23	161,460	39	256,156
52	16	84,202	34	275,199	50	359,401
53	14	92,010	34	308,459	48	400,469
54	11	119,341	40	453,011	51	572,352
55	15	74,415	71	760,790	86	835,205
56	21	290,163	43	423,019	64	713,182
57	15	176,287	50	512,172	65	688,459
58	22	207,986	66	953,443	88	1,161,429
59	25	328,319	78	1,196,680	103	1,524,999

Table 4
(Continued)

The Number and Annual Annuities of Beneficiaries and Survivor Annuitants
as of June 30, 2019

Age	Male		Female		Total	
	Number	Annuities	Number	Annuities	Number	Annuities
60	27	\$ 343,683	92	\$ 972,056	119	\$ 1,315,739
61	30	343,711	108	1,606,768	138	1,950,479
62	42	455,554	124	1,793,432	166	2,248,986
63	51	732,912	120	2,094,269	171	2,827,181
64	48	867,632	166	2,908,857	214	3,776,489
65	55	878,129	174	3,043,623	229	3,921,752
66	72	1,157,745	197	3,512,649	269	4,670,394
67	92	2,034,392	202	3,522,675	294	5,557,067
68	101	2,012,208	210	4,213,017	311	6,225,225
69	88	1,633,694	225	4,812,287	313	6,445,981
70	103	2,165,927	256	5,384,642	359	7,550,569
71	104	2,263,240	274	5,618,207	378	7,881,447
72	131	2,788,879	334	6,205,685	465	8,994,564
73	109	2,057,166	290	5,443,598	399	7,500,764
74	80	1,545,271	261	4,991,759	341	6,537,030
75	95	1,976,485	225	4,335,560	320	6,312,045
76	99	1,730,197	303	4,704,100	402	6,434,297
77	103	1,976,579	295	4,711,037	398	6,687,616
78	94	1,812,251	300	4,940,655	394	6,752,906
79	65	1,106,063	310	4,396,678	375	5,502,741
80	69	1,030,844	278	4,169,537	347	5,200,381
81	76	1,268,166	304	4,024,451	380	5,292,617
82	66	674,086	286	3,738,779	352	4,412,865
83	66	1,004,585	318	3,948,546	384	4,953,131
84	64	599,380	283	3,718,529	347	4,317,909
85	55	706,325	277	3,319,526	332	4,025,851
86	44	506,736	264	3,200,937	308	3,707,673
87	54	628,293	248	3,248,979	302	3,877,272
88	55	663,809	287	3,414,207	342	4,078,016
89	50	553,600	252	2,735,984	302	3,289,584
90	43	485,160	223	2,641,370	266	3,126,530
91	27	275,466	220	2,139,808	247	2,415,274
92	32	369,852	204	2,003,278	236	2,373,130
93	36	312,473	159	1,547,315	195	1,859,788
94	29	324,810	123	1,272,174	152	1,596,984
95	14	140,766	102	937,898	116	1,078,664
96	14	124,457	64	613,456	78	737,913
97	12	131,717	50	403,823	62	535,540
98	4	85,741	42	417,692	46	503,433
99	3	41,051	27	242,599	30	283,650
100	3	25,847	16	84,662	19	110,509
101			10	87,603	10	87,603
102			9	58,664	9	58,664
103	2	9,895	3	27,592	5	37,487
104	1	10,411	1	20,335	2	30,746
105			3	12,270	3	12,270
108			1	16,032	1	16,032
Total	2,705	\$ 42,305,986	9,155	\$ 133,784,850	11,860	\$ 176,090,836

Table 5

The Number and Annual Annuities of Annuitants on the Retired List
as of June 30, 2019

Retired on Account of Disability

Age	Male		Female		Total	
	Number	Annuities	Number	Annuities	Number	Annuities
31			1	\$ 21,989	1	\$ 21,989
32			3	60,471	3	60,471
34			4	72,538	4	72,538
35	1	\$ 22,414	5	116,311	6	138,725
36	2	33,661	4	83,034	6	116,695
37	6	87,950	4	94,351	10	182,301
38	2	42,469	5	118,758	7	161,227
39	4	63,281	8	189,821	12	253,102
40	4	60,421	12	298,720	16	359,141
41	3	61,629	15	352,905	18	414,534
42	7	189,948	21	496,940	28	686,888
43	14	258,642	21	414,536	35	673,178
44	4	107,403	28	663,276	32	770,679
45	4	55,389	35	756,405	39	811,794
46	14	298,978	36	752,663	50	1,051,641
47	14	292,196	40	876,185	54	1,168,381
48	10	335,732	50	1,176,975	60	1,512,707
49	24	625,831	68	1,918,936	92	2,544,767
50	21	535,016	82	1,738,992	103	2,274,008
51	43	1,002,486	61	1,463,339	104	2,465,825
52	26	743,978	87	2,132,866	113	2,876,844
53	36	795,578	88	2,388,795	124	3,184,373
54	43	1,069,960	115	2,799,586	158	3,869,546
55	61	1,601,876	155	3,400,335	216	5,002,211
56	61	1,421,919	172	3,817,711	233	5,239,630
57	77	1,822,769	165	3,785,578	242	5,608,347
58	60	1,531,520	189	4,024,099	249	5,555,619
59	76	2,130,747	226	4,716,027	302	6,846,774
60	127	3,184,835	236	4,869,520	363	8,054,355
61	100	2,209,273	264	5,722,633	364	7,931,906
62	114	2,636,513	249	5,170,563	363	7,807,076
63	127	2,608,370	266	5,150,104	393	7,758,474
64	121	2,677,939	275	5,729,054	396	8,406,993
65	111	2,490,250	302	6,338,455	413	8,828,705
66	132	2,792,469	288	5,868,769	420	8,661,238
67	114	2,740,429	277	6,105,525	391	8,845,954
68	106	2,616,472	262	6,207,520	368	8,823,992
69	93	1,950,571	252	5,741,098	345	7,691,669
70	134	3,180,100	251	5,411,238	385	8,591,338
71	90	2,104,431	231	4,862,233	321	6,966,664
72	97	2,326,160	239	4,549,432	336	6,875,592
73	79	1,498,970	198	3,554,018	277	5,052,988
74	51	1,117,534	140	2,242,820	191	3,360,354
75	50	1,048,301	110	1,752,825	160	2,801,126

Table 5
(Continued)

**The Number and Annual Annuities of Annuitants on the Retired List
as of June 30, 2019**

Retired on Account of Disability

Age	Male		Female		Total	
	Number	Annuities	Number	Annuities	Number	Annuities
76	60	\$ 989,577	133	\$ 1,814,213	193	\$ 2,803,790
77	39	586,760	139	1,837,287	178	2,424,047
78	27	351,426	98	1,203,629	125	1,555,055
79	31	478,800	94	980,179	125	1,458,979
80	30	477,101	64	769,637	94	1,246,738
81	27	331,262	71	768,008	98	1,099,270
82	22	253,629	63	719,104	85	972,733
83	17	225,734	43	518,010	60	743,744
84	13	129,363	53	442,712	66	572,075
85	14	158,191	46	443,043	60	601,234
86	14	166,756	32	263,196	46	429,952
87	5	51,946	42	459,464	47	511,410
88	11	109,429	28	208,232	39	317,661
89	1	25,639	26	189,268	27	214,907
90	6	95,985	17	142,363	23	238,348
91	6	81,757	30	226,664	36	308,421
92	2	40,855	10	48,321	12	89,176
93			10	79,008	10	79,008
94	1	3,312	7	40,857	8	44,169
95			6	44,319	6	44,319
96			4	27,924	4	27,924
97			2	16,029	2	16,029
99			1	5,731	1	5,731
100			1	2,321	1	2,321
101			2	36,414	2	36,414
103			2	17,743	2	17,743
Total	2,589	\$ 56,931,932	6,564	\$ 129,311,625	9,153	\$ 186,243,557

Exhibit VIII : ASOP 51 Disclosures

Funding future retirement benefits prior to when those benefits become due involves assumptions regarding future economic and demographic experience. These assumptions are applied to calculate actuarial liabilities, current contribution requirements and the funded status of the plan. However, to the extent future experience deviates from the assumptions used, variations will occur in these calculated values. These variations create risk to the plan. Understanding the risks to the funding of the plan is important. Therefore, a new Actuarial Standard of Practice (ASOP) has been adopted. Actuarial Standard of Practice No. 51 (ASOP 51) requires certain disclosures of potential risks to the plan and provides useful information for intended users of actuarial reports that determine plan contributions or evaluate the adequacy of specified contribution levels to support benefit provisions.

Under ASOP 51, risk is defined as the potential of actual future measurements deviating from expected future measurements resulting from actual future experience deviating from actuarially assumed experience.

It is important to note that not all risk is negative, but all risk should be understood and accepted based on knowledge, judgement and educated decisions. Future measurements may deviate in ways that produce positive or negative financial impacts to the Retirement System.

In the actuary's professional judgment, the following risks may reasonably be anticipated to significantly affect the Retirement System's future financial condition:

- Investment risk – potential that the investment return will be different than the 7.25% expected in the actuarial valuation
- Salary increases – potential that salary increases will be different from that assumed for the actuarial valuation
- Longevity risk – potential that participants live longer than expected from the valuation mortality assumptions
- Declining workforce – potential that future employer contribution rates will be different from expected
- Contribution risk – potential that the contribution will be different than the recommended contribution in the actuarial valuation

The following information is provided to comply with ASOP 51 and furnish beneficial information on potential risks to the plan. This list is not all-inclusive; it is an attempt to identify the most significant risks and how those risks might affect the results shown in this report.

Note that ASOP 51 does not require the actuary to evaluate the ability or willingness of the Retirement System employers to make contributions to the Retirement System when due, or to assess the likelihood or consequences of potential future changes in law. In addition, this valuation report is not intended to provide investment advice or to provide guidance on the management or reduction of risk. Buck welcomes the opportunity to assist in such matters as part of a separate project or projects utilizing the appropriate staff and resources for those objectives.

Exhibit VIII: ASOP 51 Disclosures (continued)

Investment Risk

Retirement System costs are very sensitive to the market return. Any lower than assumed return on assets will increase costs.

- The lower return will cause the assets to be lower than expected. This decrease in assets will increase the Retirement System cost.
- The Retirement System uses an actuarial value of assets that smooths gains and losses on market returns over a ten-year period to help control some of the volatility in costs due to investment risk.
- Historical experience of actual returns is shown on page 11. This historical experience illustrates how returns can vary over time.

Salary increases

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.

Longevity Risk

Retirement System costs will be increased as participants are expected to live longer. This is because:

- Benefits are paid over a longer lifetime when life expectancy is expected to increase. The longer duration of payments leads to higher liabilities.
- Health care has been improving which increases the life expectancy of participants. As health care improves, Retirement System costs will increase.
- The mortality assumption for the Retirement System does assume future improvement in mortality. Any improvement in future mortality greater than that expected by the current mortality assumption would lead to increased Retirement System costs.

Declining workforce

Employer contributions are based on a percentage of participants' salaries. If the required dollar amount of contributions remains level or increases, a declining active workforce will result in higher contribution rates in order to meet required contribution levels.

Contribution Risk

The Retirement System contribution is a budgeted amount. There is a risk associated with the employer's contribution when the budgeted amount and recommended amount differ. This is because:

- When the budgeted contribution is lower than the recommended contribution the Retirement System may not be sustainable in the long term.
- Any underpayment of the contribution will increase future contribution amounts to help pay off the additional Unfunded Actuarial Accrued Liability associated with any lower than recommended contribution amounts.
- Historical comparison of actuarially determined contributions to actual contributions are shown on page 19. This history shows action has been taken to mitigate this risk by contributing the actuarially determined contribution for pensions since the fiscal year ending June 30, 2017.

Exhibit VIII: ASOP 51 Disclosures (continued)

Other Risk Considerations

Other possible risks (but not an exhaustive list) to be considered that may impact the Retirement System funding:

- The valuation assumes 80% of members at benefit commencement will elect an option 4 lump sum of their member contributions with interest. Actual experience from this assumption could effect the liquidity of the Retirement System if more retirees are electing a lump sum than are expected in the valuation.
- Investment risk is mitigated to some extent based on the “shared risk” provisions of the Retirement System possibly impacting 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.
- Members who retire after 25 years of service and are at least age 55 (age 57 for Class T-G members) may commence their benefits prior to their superannuation date with subsidized early retirement factors. If more retirees retire and commence their benefits under this early retirement provision than are assumed based on the assumptions outlined on page 22, the Retirement System may pay out subsidized benefits for a longer period of time thus increasing liabilities and costs.

Plan Maturity Measures

There are certain measures that may aid in understanding the significant risks to the Retirement System.

Ratio of Retired Liability to Total Liability (Pension Only)	June 30, 2018 (000)	June 30, 2019 (000)
1. Retirees and Beneficiaries	56,742,925	57,413,088
2. Total Accrued Liability	102,990,908	105,199,505
3. Ratio [(1) / (2)]	55.1%	54.6%

A high percentage of liability concentrated in retirees indicates a mature plan. An increasing percentage may indicate a need for less risky and / or more liquid asset allocation which may lead to increased investment risk, a need to lower the long-term return on asset assumption, and increased costs.

Exhibit VIII: ASOP 51 Disclosures (continued)

Ratio of Cash Flow to Assets (Pension Only)	June 30, 2018 (000)	June 30, 2019 (000)
1. Total Contributions	5,275,986	5,551,563
2. Benefit Payments	6,655,146	6,761,173
3. Cash Flow [(1) – (2)]	(1,379,160)	(1,209,609)
4. Market Value of Assets	56,363,714	58,733,884
5. Ratio [(3) / (4)]	(2.4%)	(2.1%)

When this cash flow ratio is negative more cash is being paid out than deposited in the Retirement System fund. Negative cash flow means the fund needs to rely on investment returns to cover benefit payments and at the same time may need to invest in more liquid assets to cover the benefit payments. More liquid assets may not garner the same returns as less liquid assets and therefore increase the investment risk. However, the low magnitude of the ratio implies there may already be enough liquid assets to cover the benefit payments, less investment return is needed to cover the shortfall, or only a small portion of assets will need to be converted to cash. Therefore, the investment risk is likely not amplified at this time. This maturity measure should be monitored for continual negative trend with greater magnitude.

Contribution Volatility (Pension Only)	June 30, 2018 (000)	June 30, 2019 (000)
1. Market Value of Assets	56,363,714	58,733,884
2. Payroll	13,379,041	13,671,927
3. Asset Volatility Ratio (AVR) [(1) / (2)]	4.2	4.3
4. Accrued Liability	102,990,908	105,199,505
5. Liability Volatility Ratio (LVR) [(4) / (2)]	7.7	7.7

Plans that have higher asset-to-payroll ratios experience more volatile employer contributions (as a percentage of payroll) due to investment return. For example, a plan with an asset-to-payroll ratio of 10 may experience twice the contribution volatility due to investment return volatility than a plan with an asset-to-payroll ratio of 5. Plans that have higher liability-to-payroll ratios experience more volatile employer contributions (as a percentage of payroll) due to changes in liability. For example, if an assumption change increases the liability of two plans by the same percent the plan with a liability-to-payroll ratio of 10 may experience twice the contribution volatility than a plan with a liability-to-payroll ratio of 5.

Exhibit IX

Glossary

Accrued Liability	The difference between (a) the present value of future plan benefits, and (b) the present value of future normal cost. It is the portion of the present value of future plan benefits attributable to service accrued as of the valuation date. Sometimes referred to as “actuarial accrued liability”.
Accrued Service	The service credited under the plan that was rendered before the date of the actuarial valuation.
Actuarial Assumptions	Estimates of future plan experience with respect to rates of mortality, disability, turnover, retirement, rate or rates of investment income and salary increases. Decrement assumptions (rates of mortality, disability, turnover and retirement) are generally based on past experience, often modified for projected changes in conditions. Economic assumptions (salary increases and investment income) consist of an underlying rate in an inflation-free environment plus a provision for a long-term average rate of inflation.
Actuarial Cost Method	A mathematical budgeting procedure for allocating the dollar amount of the “present value of future plan benefits” between the present value of future normal cost and the accrued liability. Sometimes referred to as the “actuarial funding method”.
Actuarial Equivalent	A series of payments is called an actuarial equivalent of another series of payments if the two series have the same actuarial present value.
Actuarial Value of Assets	The value of current plan assets recognized for valuation purposes. Based on a smoothed market value that recognizes investment gains and losses over a period of ten years.
Amortization	Paying off an interest-bearing liability by means of periodic payments of interest and principal, as opposed to paying it off with a lump sum payment.
Experience Gain (Loss)	A measure of the difference between actual experience and that expected based upon a set of actuarial assumptions during the period between two actuarial valuation dates, in accordance with the actuarial cost method being used.
Normal Cost	The annual cost assumed, under the actuarial funding method, for current and subsequent plan years. Sometimes referred to as “current service cost”.
Present Value	The amount of funds presently required to provide a payment or series of payments in the future. The present value is determined by discounting the future payments at a predetermined rate of interest, taking into account the probability of payment.
Unfunded Accrued Liability	The difference between the actuarial accrued liability and actuarial value of assets.