Commonwealth

Actuarial Valuation Report

January 1, 2022

PUBLIC EMPLOYEE RETIREMENT ADMINISTRATION
COMMISSION COMMONWEALTH OF MASSACHUSETTS

COMMONWEALTH ACTUARIAL VALUATION REPORT

January 1, 2022

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1. INTRODUCTION & CERTIFICATION

This report presents the results of the actuarial valuation of the pension benefits that are the obligation of the Commonwealth of Massachusetts. The four components are:

- State Employees' Retirement System (SRS)
- Massachusetts Teachers' Retirement System (TRS)
- Boston Teachers
- Cost of Living Allowance Reimbursements to Local Systems

The valuation was performed as of January 1, 2022 pursuant to Chapter 32 of the General Laws of the Commonwealth of Massachusetts, and is based on the plan provisions in effect at that time. The actuarial assumptions used to calculate the actuarial accrued liability and the normal cost primarily reflect our latest experience studies of SRS and TRS issued in 2014 and our most recent analysis of retiree mortality. The actuarial assumptions used in this valuation are the same as those used in the January 1, 2021 actuarial valuation. The Boston Retirement Board increased its COLA base to $15,000 effective FY22.

This valuation is based on member data as of December 31, 2021, which was supplied by the State, Massachusetts Teachers', and Boston Retirement Boards. We performed a number of tests on the data to ensure reasonableness and made specific assumptions for a number of TRS and Boston Teachers data items. Asset information as of December 31, 2021 was provided by the Pension Reserves Investment Management (PRIM) Board. We reviewed both the membership data and financial information for reasonableness but we did not audit this information.

This report was prepared by PERAC for the exclusive use of the State, Massachusetts Teachers' and Boston Retirement Boards, their staff and their auditors. The report was performed to determine the funded status of the Systems and the contribution requirements to ensure that System assets along with the contributions are sufficient to provide the prescribed benefits. Use of this report by other parties may not be appropriate and may result in mistaken conclusions because of the failure to understand applicable assumptions, methods or the inapplicability of the report for purposes other than those intended. PERAC should be asked to review any statement to be made based on the results presented in this report. PERAC will accept no responsibility for any such statement made without its prior review.

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of natural operation of the methodology used for these measurements such as additional contribution requirements based on the plan's funded status; and changes in plan provisions or applicable law. As part of this valuation, we have not performed an analysis of the potential range of future measurements.

We, the undersigned actuaries, meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained in this report. In our opinion, the actuarial assumptions used in this report are reasonable, are related to plan experience and expectations, and represent our best estimate of anticipated experience. We believe this report represents an accurate appraisal of the actuarial status of the Commonwealth's total pension obligation performed in accordance with generally accepted actuarial principles and practices relating to pension plans.

Respectfully submitted,
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2. EXECUTIVE SUMMARY

A | PRINCIPAL VALUATION RESULTS

The provisions of Chapter 32, Section 22C mandate the establishment of a funding schedule for the Commonwealth of Massachusetts' pension obligation. The SRS, TRS, liabilities for Boston Teachers, and State reimbursements to local systems to reflect COLAs granted from 1982 through 1996 (determined on an actuarial basis) have been the components of the Commonwealth schedule. Beginning in FY18, Chapter 5 of the Acts of 2017 required that several additional items that are included in the development of the Commonwealth funding schedule be shown separately. These items include the administrative expenses of the Public Employee Retirement Administration Commission (PERAC), the payment to the Optional Retirement Plan (ORP) under Section 40 of Chapter 15A, and a modification to the COLA reimbursement to local systems described above to reflect actual reimbursements. The schedule, as mandated by law, calls for payment of the Normal Cost plus an amortization payment on the Unfunded Actuarial Liability (UAL).

The Commonwealth's current funding schedule was filed in January, 2020 and was based on the results of the January 1, 2019 Commonwealth Actuarial Valuation. The FY23 appropriation under the schedule is $3.744 billion. The total appropriation under the schedule increases 9.63% each year until FY35 with a final amortization payment in FY36. The amortization of the 2015 Early Retirement Incentive (ERI) will be completed in FY27. The next funding schedule is expected to be adopted in early 2023 based on the results of this actuarial valuation.

In the 2014 and prior actuarial valuations, the Annual Required Contribution (ARC) was developed under GASB 27 for accounting purposes. The ARC was developed using the minimum allowable schedule for local systems under Chapter 32 (UAL amortized on a 4.0% annual increasing basis to FY40). This ARC calculation is no longer applicable for GASB purposes, but we show it for comparison. Using the ARC basis and the January 1, 2022 valuation results, the FY23 appropriation would be approximately $3.95 billion. Therefore, the FY23 appropriation is 94.8% of the ARC ($3.744B/$3.95B). Based on the 2021 valuation results, the FY22 appropriation was 80.7% of the ARC. We expect this percentage to generally increase each year until ultimately the appropriation exceeds the ARC, although changes to the actuarial assumptions and actuarial gains or losses could affect this result.

The principal results of the January 1, 2022 actuarial valuation are as follows (in thousands):

Total Normal Cost	$2,243,803
Expected Employee Contributions	$1,476,575
Net Normal Cost	$767,228
Total Expenses and Transfers	$126,900
Net Normal Cost Plus Expenses	$894,128

Total Actuarial Liability	$112,194,901
Assets	$72,168,013
Unfunded Actuarial Liability	$40,026,888
Funded Ratio	64.3%

2. EXECUTIVE SUMMARY *(continued)*

B | COMPARISON WITH PRIOR VALUATION AND EXPERIENCE ANALYSIS

A comparison of the results of this valuation and the January 1, 2021 valuation is shown below (in thousands).

	1/1/22	1/1/21	Increase (Decrease)	% Increase (Decrease)
Total Normal Cost	$2,243,803	$2,225,903	$17,900	0.8%
Expected Employee Contributions	$1,476,575	$1,454,588	$21,987	1.5%
Net Normal Cost	$767,228	$771,315	($4,087)	(0.5%)
Administrative Expenses	$89,700	$77,700	$12,000	15.4%
Optional Retirement Plan Payment	$14,700	$14,600	$100	0.7%
3(8)(c) Amounts Transferred to Other Systems	$22,500	$25,200	($2,700)	(10.7%)
Total Expenses and Transfers	$126,900	$117,500	$9,400	8.0%
Net Normal Cost Plus Expenses and Transfers	$894,128	$888,815	$5,313	0.6%
Actuarial Liability				
Actives	$47,077,024	$46,196,250	$880,774	1.9%
Retirees and Inactives	$65,117,877	$62,785,522	$2,332,355	3.7%
Total	$112,194,901	$108,981,772	$3,213,129	2.9%
Assets (Actuarial Value)	$72,168,013	$63,406,551	$8,761,462	13.8%
Unfunded Actuarial Liability	$40,026,888	$45,575,221	($5,548,333)	(12.2%)
Funded Ratio	64.3%	58.2%	6.1%	

Total Expenses and Transfers

Administrative expenses (including PERAC's administrative expenses) reflect the expenses from the most recent Annual Statements excluding investment related expenses and the Optional Retirement Plan (ORP) payment which is shown separately for the SRS. The ORP payment is the amount transferred by statute from the Commonwealth (previously from SRS) to the ORP for higher education employees. By including this payment as part of the normal cost, we have treated it as a reimbursement to the pension trust fund. Finally, $22.5 million is included for amounts transferred to other systems under Section 3(8)(c) for members with SRS and TRS service who retired from another system. Section 3(8)(c) receipts from other systems are transferred to the State's general account. By including the Section 3(8)(c) disbursements with normal cost, the net Section 3(8)(c) cash flow is zero for funding purposes.

2. EXECUTIVE SUMMARY *(continued)*

B | COMPARISON WITH PRIOR VALUATION AND EXPERIENCE ANALYSIS *(continued)*

Gain/(Loss) and Change in Unfunded Actuarial Liability (UAL)
The development of the actuarial gain/(loss) is shown in Section 4. During 2021, there was an overall actuarial gain of $6.465 billion. There was a non-investment related gain on actuarial liability of approximately $414 million. This gain is quite small and reflects that the assumptions are reasonable. There was a gain on assets (on an actuarial value basis) of approximately $6.051 billion. The return on assets for 2021 was approximately 16.7% on an AVA basis compared to 20.5% on a market value basis.

PERAC values system assets using a smoothing technique which spreads gains and losses over short periods (5 years) and employs a "corridor" so that the actuarial value is within 10% of the market value of assets. The calculated AVA as of January 1, 2022 is 87.2% of the market value. We adjusted the AVA to the 90% corridor limit.

The UAL decreased from $45.6 billion as of January 1, 2021 to $40.0 billion as of January 1, 2022.

Actuarial Assumptions

Investment Return

The January 1, 2022 valuation reflects a 7.0% investment return assumption (the same as the January 1, 2021 assumption). The investment return assumption has decreased several times since January 1, 2012 (see detail on page 9). As part of this valuation, we considered whether to maintain the 7.0% assumption or reduce it further. Although a case could be made to reduce this assumption, the Commission decided to maintain this assumption.

Early this year, NEPC, PRIT's investment consultant, provided figures for 30-year expected return projections using a building block approach and the target allocation and expected long term returns by asset class. The expected annual return is 6.9% (6.4% if we assume expenses of 50 basis points and the expected return reflects a gross return) in this study. This figure is 10 basis points greater than the figure from the 2021 study. Note that the 6.9% average expected return does not mean that the expected return each year will be 6.9%. In fact, over the shorter term (10 years) the average expected return is 5.7% (10 basis points less than last year). Greater expected returns in later years determined NEPC's long-term projection. The NEPC projected returns are the first measure we review to determine the long-term investment return assumption.

2. EXECUTIVE SUMMARY *(continued)*

B | COMPARISON WITH PRIOR VALUATION AND EXPERIENCE ANALYSIS *(continued)*

A comparison of recent expected return projections as well as historical PRIT returns is shown below.

	Expected Annual Return (gross)						
	2016	2017	2018	2019	2020	2021	2022
10 year expected return*	6.8%	6.8%	6.6%	6.8%	6.2%	5.8%	5.7%
30 year expected return	7.8%	7.8%	7.7%	7.9%	7.3%	6.8%	6.9%

* In years prior to 2020, NEPC's short-term horizon was 5-7 years

Actual Returns as of December 31, 2021	
2021	20.5%
5 years (2017-2021)	12.9%
10 years (2012-2021)	11.0%
20 years (2002-2021)	8.6%
37 years (1985-2021)	9.9%

In addition to the NEPC analysis, we review other capital market studies for comparison. One report that we review is the Horizon Actuarial Services Survey of Capital Market Assumptions. This study compares the projections of 39 different investment consultants, including NEPC. The Horizon study used in our analysis was published in August 2021. Since it reflects 2021 capital market projections, there is a lag between the Horizon results and the 2022 NEPC study. However, the Horizon study continued to show the trend of decreasing expected investment returns. Other studies we reviewed showed results consistent with this trend.

In addition to the NEPC and other capital market analyses, NASRA periodically publishes a study of investment return assumptions used by over 100 large public plans. In its study as of January 2022, the average investment return assumption was 7.04%, a decrease from the 7.18% figure published in February 2021. Although this study does not take into account different asset allocations between the plans, it demonstrates the continuing reduction in this assumption.

We recommended a range for this assumption of 6.85% - 7.0% to the Commission. The Commission decided to maintain the 7.0% assumption for this valuation.

2. EXECUTIVE SUMMARY *(continued)*

B | COMPARISON WITH PRIOR VALUATION AND EXPERIENCE ANALYSIS *(continued)*

Mortality

In our 2011 actuarial valuation, we began reflecting future mortality improvement (longer life expectancy). Each year we modified this assumption as we moved closer to a fully generational mortality assumption (a two-dimensional table based on a member's age and calendar year that includes all expected future mortality improvements). Based on our analysis of SRS and TRS retiree mortality from 2012-2014, we adopted a fully generational assumption in the 2015 valuation. In 2017, we analyzed retiree mortality experience during 2015 and 2016 and we adopted updated assumptions. For SRS, we adopted a blue collar version of the RP-2014 table for superannuation retirees as it best matched our experience. For TRS and Boston teachers, we adopted the RP-2014 White Collar table. For TRS and Boston Teachers, we performed additional analysis in 2020 and adopted the most recently released Society of Actuaries public plan mortality tables (SOA Pub-2010 Teachers (headcount weighted) tables). For SRS, we maintained the base mortality table and the MP-2020 mortality improvement scale in this valuation. For the TRS and Boston teachers we maintained the base mortality table and the MP-2020 mortality improvement scale in this valuation.

For SRS disabled retirees, in our 2019 valuation, we assumed the mortality would reflect the same assumption as for superannuation retirees, but with an age set forward of one year. We maintained that assumption this year.

Job groups

We noted several issues relating to job group as part of the valuation data we received from SRS and made adjustments as we have in the past. As we have done in previous years, we changed the job group for several University of Massachusetts Police members (from Group 1 to Group 2).

In the 2017 valuation, we analyzed costs for certain members of the Department of Mental Health (DMH) and Social Services who were coded as job Group 1. We determined plan liabilities for these members based on both Group 1 and Group 2 status. DMH members with certain titles and Social Services workers with 10 years of service in certain capacities are eligible to be in Group 2. Based on our discussions with SRS, most of these members will ultimately be eligible for Group 2 status. By assuming these members will ultimately be in Group 2, we are being somewhat conservative. We used the results of our 2017 work to estimate the increase in actuarial liability due to this adjustment to be approximately $140 million in this valuation.

B | COMPARISON WITH PRIOR VALUATION AND EXPERIENCE ANALYSIS *(continued)*

Other Chapter 176 issues

There are several other changes under Chapter 176 that we have discussed in previous valuations that have the most impact on decreasing plan liabilities over the longer term. These include an increase in the normal retirement age by two years (for example, from age 65 to age 67 for Group 1 members), an increase in the age (early retirement) reduction factors for ages below the maximum age (from a 4.0% to a 6.0% annual reduction), and an increase in the period for determining a member's average annual compensation (from 3 years to 5 years). These changes are effective only for members hired after April 1, 2012.

As of January 1, 2022, there were approximately 91,000 members hired after April 1, 2012. The employer normal cost is approximately $138 million lower than it would have been if the prior provisions were in place for these members. The actuarial liability is approximately $1.2 billion lower than it would have been if the prior provisions were in place.

COLA Base

This valuation reflects a COLA base of $15,000 for the Boston teachers. The 2020 valuation reflected a $14,000 base. This change increased the normal cost by approximately $520,000 and the actuarial liability by approximately $22.5 million.

Teachers

We have detailed a number of the assumptions we made for missing or questionable data for active members of the TRS in Part C of Section 7.

2. EXECUTIVE SUMMARY *(continued)*

C | FUNDING PROGRESS

The UAL and funded ratio are measures of the plan's funded status. These measures reflect the plan's position as of January 1, 2022. We believe these measures alone are not appropriate for assessing the sufficiency of assets to cover the estimated cost of settling the Commonwealth's benefit obligations or assessing the need for or the amount of future contributions. However, we believe these measures, in conjunction with maintaining the appropriations required under the Commonwealth funding schedule, are appropriate for assessing the amount of future contributions.

The nature of actuarial funding is that assets gradually catch up to the actuarial liability. When pension funding was adopted in 1987, the initial amortization period was established as 40 years. Based on the amortization basis of the schedules adopted, the UAL was expected to increase for a period of time. However, due to actual investment returns significantly exceeding the expected return in the 1990's, the UAL actually decreased until January 1, 2000.

It is important to note that plan assets have grown faster than plan liabilities, despite recent assumption changes and plan amendments (outlined on the next page) that have increased plan liabilities. As of January 1, 1990, the actuarial liability was $20.0 billion and assets were $7.8 billion. The difference of $12.2 billion was the UAL. As of January 1, 2022, the actuarial liability is $112.2 billion and the actuarial value of assets is $72.2 billion. The difference of $40.0 billion is the UAL. The actuarial liability has grown 5.61 times over this period ($112.2B / $20.0B). But assets have grown 9.26 times over this same period ($72.2B / $7.8B). For this reason, we believe the funded ratio represents a better measure of the Commonwealth's progress.

There have been a number of plan and assumption changes since 2009 that have increased the actuarial liability. These changes include five other separate reductions in the investment return assumption, annual adjustments to the mortality assumption prior to the change to a fully generational assumption as of January 1, 2015, with subsequent adjustments in 2017, 2018, and 2021. The other changes include the adoption of a $13,000 COLA base, the transfer of active members of sheriff departments in six counties to the SRS, the transfer of former members of the Massachusetts Turnpike Authority Retirement System to the SRS, the transfer of ORP members to the SRS, the 2015 ERI, the 2016 ERI for toll collectors, and the adoption of a $14,000 COLA base in 2018 and the adoption of a $15,000 COLA base in 2022 for Boston Teachers. Including the changes as of January 1, 2022, the unfunded actuarial liability is approximately $15.9 billion greater than it would have been using the 2009 valuation assumptions and plan provisions. Therefore, on a comparable basis with the 2009 assumptions and plan provisions, the UAL on January 1, 2022 would be $24.1 billion and the funded ratio would be approximately 75%.

2. EXECUTIVE SUMMARY *(continued)*

C | FUNDING PROGRESS *(continued)*

Change in Unfunded Actuarial Liability since 2009 Valuation (in billions)

	State	Mass. Teachers	Boston Teachers	Total
Assumption Changes	$4.72	$9.05	$0.72	$14.49
Plan Amendments	1.14	0.15	0.17	1.46
Total	$5.86	$9.20	$0.89	$15.95

Assumption changes (with valuation date reflected)	(in millions)
Reduction in investment return assumption from 8.25% to 8.0% (2013)	$1,670
Reduction in investment return assumption from 8.0% to 7.75% (2015)	1,947
Reduction in investment return assumption from 7.75% to 7.50% (2016)	2,218
Reduction in investment return assumption from 7.50% to 7.35% (2018)	1,520
Reduction in investment return assumption from 7.35% to 7.25% (2019)	1,053
Reduction in investment return assumption from 7.25% to 7.0% (2021)	2,846
Adoption of fully generational mortality assumption (2015)	1,700
Other mortality adjustments (2012, 2013, 2014)	1,050
Mortality adjustment (2017)	1,574
Mortality adjustment (2018)	9
Mortality adjustment (2021)	(759)
Other experience study changes (2013)	(335)
Total	$14,493

Plan amendments (with valuation date reflected)	
Transfer of Massachusetts Turnpike Authority (2010)	$136
Transfer of sheriff departments (2011)	225
Boston Teachers (2011)	127
$13,000 COLA base (2012)	298
$14,000 COLA base for Boston Teachers (2018)	14
Early Retirement Incentive (2016)	230
Transfer of ORP members (2016)	400
Early Retirement Incentive for toll collectors (2017)	10
$15,000 COLA base for Boston Teachers (2022)	23
Total	$1,463

2. EXECUTIVE SUMMARY *(continued)*

D | RISK

Risk is defined as the potential for differences in future plan measurements resulting from actual future experience deviating from actuarial assumed experience. The plan is subject to a number of risks that could affect its future financial condition. Examples of risks include the following:

Investment risk- the potential that investment returns will be different than expected;

Asset/liability mismatch risk- the potential that changes in asset values are not matched by changes in the value of liabilities;

Interest rate risk- the potential that interest rates will be different than expected;

Longevity and demographic risk- the potential that mortality or other demographic experience will be different than expected;

Contribution risk- the potential that employer contributions to the plan will not be made, or will not be made at the assumed level.

In this section, we provide a brief analysis of several risk measures that we believe are most significant for SRS and TRS. A more detailed risk assessment that includes further scenario testing (assessing the impact of one or several events on the plan's financial condition, for example projecting plan investment returns), stress testing (assessing the impact of an adverse change in one or several factors), sensitivity testing (assessing the impact of a change in an actuarial assumption), or stochastic modeling (generating numerous possible outcomes by allowing for random variations in input items to assess the distribution of the outcomes) may provide a better understanding than the analysis in this section.

Unfunded Actuarial Liability and Funded Ratio

The unfunded actuarial liability (UAL) and the funded ratio for the past 10 years for both the SRS and TRS are shown below. The UAL is the Actuarial Liability less the Actuarial Value of Assets. The funded ratio is the Actuarial Value of Assets divided by the Actuarial Liability. The retirement system is said to be fully funded when the UAL is zero, or said another way, when the funded ratio is 100%. Actuarial valuations have been performed every year over this period (except in 2020) and the valuation results are determined as of January 1.

SRS Unfunded Actuarial Liability and Funded Ratio

	2012	2013	2014	2015	2016	2017	2018	2019	2021	2022
UAL (in billions)	$7.3	$9.1	$9.1	$11.0	$13.5	$13.5	$14.2	$15.5	$15.3	$12.8
Funded Ratio	73.8%	69.1%	70.3%	67.5%	63.5%	64.7%	64.9%	63.7%	66.5%	72.9%

TRS Unfunded Actuarial Liability and Funded Ratio

	2012	2013	2014	2015	2016	2017	2018	2019	2021	2022
UAL (in billions)	$14.3	$17.3	$17.8	$20.2	$22.0	$23.6	$24.6	$26.0	$27.7	$24.7
Funded Ratio	60.7%	55.7%	56.3%	54.3%	52.8%	52.1%	52.4%	51.7%	53.0%	59.0%

The UAL for both systems has generally increased over this period but decreased in 2022. The 2012 valuation was the fourth actuarial valuation after the significant market value loss in 2008. The 2008 investment loss was not fully recognized until the 2013 valuation. Reductions in the investment return assumption and changes to the mortality assumption in the past 10 years have increased the plan's actuarial liability and therefore the UAL. The plan has reduced its investment return assumption several times from 8.0% in the 2012 valuation to 7.0% in this valuation. The mortality assumption has also been updated several times during this period. For comparison, using the January 1, 2012 plan assumptions and provisions, the UAL as of January 1, 2022 would be approximately $24.6 billion.

The funded ratio generally decreased through 2016, remained fairly consistent through 2019, then increased in 2021 and 2022. The assumption changes described above have also significantly impacted the funded ratio. For comparison, using the 2012 plan assumptions, the 2022 funded ratio would be approximately 75%.

The UAL on an AVA basis is $40.0 billion and the funded ratio is 64.3%. On a market value basis, the UAL is $32.0 billion and the funded ratio is 71.5%.

Investment Return Assumption

The investment return assumption of 7.0% is in our 2022 recommended range of 6.85% to 7.0% and is consistent with our 2021 recommendation. Currently 53 systems use an assumption of 7.0% or lower. We expect the number of systems using an assumption of 7.00% or lower to increase slightly as more of the 2022 actuarial valuations are completed.

Funding Schedule and Amortization Basis

Amortization of UAL basis:	9.63% total appropriation increase to FY35 with a final amortization payment in FY36

It is important to note that our emphasis since 2013 has been for systems to establish funding schedules that complete the amortization of the UAL no later than FY35. This allows systems some flexibility in the event of another market downturn. In 2011, the Commonwealth adopted a schedule that extended the amortization of the UAL to FY40 due to the 2008 investment loss. In 2014, the schedule reduced the amortization period to FY36. The 2017 and 2020 schedules maintained the FY36 date by increasing the level of future appropriations. The next Commonwealth funding schedule is due to be updated early next year based on the results of this actuarial valuation.

A related priority to fully funding the System by FY35 is limiting the amount and period of "negative amortization". Negative amortization occurs while the UAL increases in the funding schedule. The reason it occurs is that the amortization payment for a given year is not large enough to pay the interest on the UAL. Negative amortization often occurs in amortization schedules with annual increasing payments. Negative amortization is acceptable if it is only for a limited period of time. We believe the goal for all systems should be to eliminate negative amortization as soon as possible. The negative amortization for the Commonwealth schedule extends to FY25.

Many Massachusetts systems have adopted schedules that increase the total appropriation by a set percentage for a period of time (or the entire length of the schedule). The Commonwealth schedule reflects this methodology. Since the level of annual increase exceeds 6.0%, there is some risk in whether such a level of annual increase is sustainable. However, the Commonwealth has consistently met (and increased as necessary) the higher level of appropriations since the 2011 schedule was adopted.

2. EXECUTIVE SUMMARY *(continued)*

D | RISK *(continued)*

Maturity and Volatility Measures

There are a number of plan maturity and volatility ratios that can provide significant insight into the level of a plan's risk. To illustrate, we are providing two such measures. In both cases, we show the 10-year history of the ratio. In addition, we comment on how the results compare with local systems. We believe that these measures are more useful when compared to historical averages and the results of other plans. See our comments in PART C with respect to assumption changes and plan amendments over this period, which significantly affect these results.

Retiree Actuarial Liability / Total Actuarial Liability

This ratio measures the percentage of actuarial liability due to the plan's retirees. Higher ratios and/or an increase in this ratio indicate a system that is more mature or becoming more mature. As this ratio increases, it generally indicates the retired population is increasing faster than the active member population and there is a greater likelihood of negative cash flow (benefit payments exceeding employer and employee contributions). Retirees in pay status are more expensive than younger members. As a plan matures, it becomes more sensitive to investment volatility and the plan will have more difficulty recovering from losses even with increases in employer contributions.

SRS Retiree Actuarial Liability / Total Actuarial Liability

Valuation Date									
2012	2013	2014	2015	2016	2017	2018	2019	2021	2022
0.49	0.49	0.50	0.50	0.53	0.54	0.54	0.55	0.56	0.57

TRS Retiree Actuarial Liability / Total Actuarial Liability

Valuation Date									
2012	2013	2014	2015	2016	2017	2018	2019	2021	2022
0.58	0.59	0.59	0.59	0.58	0.58	0.58	0.57	0.55	0.55

The ratios for SRS show a steady increase. The ratios for TRS are fairly consistent. Both plans are fairly mature. Public sector plans often have aging populations generating an increase in this ratio. We have found this to be generally true for the systems for which PERAC is the actuary In 2012, this ratio ranged from .33 to .61. In recent valuations this range has increased to .47 to .67. These plans have consistently been within these ranges. Most systems have seen an increase in this ratio over the past 10-15 years (like SRS) as the number of retirees, and specifically the retiree liability has increased as a percentage of the total. A number of systems have had fairly consistent ratios (like TRS) and a few have had decreasing ratios. Such systems have already reached and or maintained a more mature level.

2. EXECUTIVE SUMMARY *(continued)*

D | RISK *(continued)*

Actuarial Liability / Pay

This measure reflects how a change in actuarial liability (and therefore UAL) may impact the adequacy of contributions. As this ratio increases, plan contributions (using a traditional amortization schedule) increase as a percentage of pay. Furthermore, like the Retiree Liability ratio noted above, higher ratios exacerbate the impact of investment losses on plan contributions.

SRS Actuarial Liability / Pay

Valuation Date									
2012	2013	2014	2015	2016	2017	2018	2019	2021	2022
5.6	5.7	5.7	6.0	6.4	6.5	6.6	6.7	7.0	7.1

TRS Actuarial Liability / Pay

Valuation Date									
2012	2013	2014	2015	2016	2017	2018	2019	2021	2022
6.5	6.8	6.8	7.1	7.3	7.5	7.6	7.6	7.7	7.8

Both systems show gradually increasing rates. For comparison with other PERAC systems, in 2012, this ratio ranged from 4.6 to 7.3. For recent valuations, this range has increased. The ratios currently range from 5.1 to 8.8. Again, both systems have been consistently within these ranges. These ratios indicate an increased level of risk for the plans.

Impact of Investment Returns on Unfunded Liability and Funded Ratio (Market Value Basis)

We have prepared simple 5-year projections illustrating the potential impact of actual investment returns on funding levels for both SRS and TRS. For these estimates, we used the market value of assets and did not attempt to develop an actuarial value of assets. In projecting the actuarial liability, we assumed the January 1, 2022 actuarial assumptions are exactly realized over the next 5 years and that there are no changes in assumptions over this period.

We first projected the market value of assets assuming the actual return for each of the next 5 years is 7.0% (the assumption used in the valuation). For comparison, we have also shown the results if the return were 3.0% each year. The 3.0% assumption is not intended to be a worst case basis, but only to reflect the impact of a lower short-term return than the current plan assumption. As discussed earlier in the Executive Summary, projected returns are lower over the next 10 years than over the next 30 years.

2. EXECUTIVE SUMMARY *(continued)*

D | RISK *(continued)*

State Retirement System Projections

	Valuation Date					
	2022	2023	2024	2025	2026	2027
UAL (in billions)						
7.00%	$9.0	$8.9	$8.7	$8.5	$8.2	$7.8
3.00%	$9.0	$10.4	$11.8	$13.4	$14.9	$16.6
Funded Ratio						
7.00%	81.0%	81.8%	82.8%	83.7%	84.8%	85.9%
3.00%	81.0%	78.7%	76.5%	74.4%	72.2%	70.1%

Massachusetts Teachers' Retirement System Projections

	Valuation Date					
	2022	2023	2024	2025	2026	2027
UAL (in billions)						
7.00%	$20.8	$20.8	$20.7	$20.5	$20.2	$19.8
3.00%	$20.8	$22.3	$23.9	$25.6	$27.2	$29.0
Funded Ratio						
7.00%	65.5%	66.7%	67.9%	69.3%	70.7%	72.3%
3.00%	65.5%	64.2%	62.9%	61.6%	60.4%	59.3%

For this comparison, we assumed that for the 3.0% projections, the appropriation for the next 5 years would remain as in the current funding schedule (and the same as that if the actual returns were 7.0% per year). If actual returns were in fact 3.0% per year, the funding schedule would almost certainly need to be increased before FY27.

This analysis shows that if the fund exactly meets expectations for the next few years, the UAL will begin to decrease immediately on a market value basis. In past years, the plan was subject to negative amortization discussed earlier in this section. Note that under the 7.0% analysis, the funded ratio gradually increases over the next few years. The funded ratio will begin to increase more rapidly over the last 10 years of the schedule, assuming that all assumptions are exactly realized.

2. EXECUTIVE SUMMARY *(continued)*

D | RISK *(continued)*

Cash Flow

Cash flow reflects receipts (primarily employee and employer contributions) less disbursements (primarily benefit payments and expenses). We use the information provided in the Annual Statement but subtract any investment income credit or excess investment income entries from the total receipts. Then we measure the ratio of receipts to disbursements. A ratio greater than 1.0 means receipts are greater than disbursements (positive cash flow). A ratio less than 1.0 means receipts are less than disbursements (negative cash flow).

Most Massachusetts public systems have negative cash flow. This is not a significant issue for long-term funding but presents potential issues for short-term funding. All else being equal, over the short term, a negative cash flow produces a yearly funded ratio lower than it would have been if there were positive cash flow. This is because a portion of the investment earnings are being used to pay the net benefits and expenses. Therefore, less of the investment earnings are included in the end of the year value of the plan assets resulting in a lower MVA and a lower funded ratio. This may dampen funded ratio expectations somewhat when reviewing 5-year projections. The SRS had a ratio of .67 using the 2020 Annual Statement and .68 using the 2021 Annual Statement. Since the ratio is significantly less than 1.0, there may be appreciable impact on our 5-year funded ratio projections The TRS had a ratio of .79 using the 2020 Annual Statement and .84 using the 2021 Annual Statement. Since the ratio is significantly less than 1.0, there may be appreciable impact on our 5-year funded ratio projections.

3. SUMMARY OF VALUATION RESULTS

(Dollars in thousands)

A. Number of Members	State	Mass. Teachers	Boston Teachers	Local COLA	Total
Active	85,999	98,926	6,659		191,584
Vested Terminated	4,909	0	410		5,319
Non-Vested Terminated	26,149	N/A	2,907		29,056
Retired/ Beneficiaries	68,280	69,727	4,816		142,823
Total	185,337	168,653	14,792		368,782
B. Total Payroll	$6,651,010	$7,704,176	$667,038		$15,022,224
C. Normal Cost					
Total Normal Cost	$1,016,368	$1,122,461	$104,974		$2,243,803
Expected Employee Contributions	616,405	791,561	68,609		1,476,575
Net Employer Normal Cost	$399,963	$330,900	$36,365		$767,228
Administrative Expenses	$41,400	$37,700	$10,600		$89,700
Optional Retirement Plan Payment	14,700	0	0		14,700
3(8)(c) Amounts Transferred to Other Systems	16,800	5,700	0		22,500
Total Expenses and Transfers	$72,900	$43,400	$10,600		$126,900
Net Normal Cost Plus Expenses & Transfers	$472,863	$374,300	$46,965		$894,128
D. Actuarial Liability					
Total Active	$18,988,965	$26,398,161	$1,689,898		$47,077,024
Vested Terminated (a)	1,071,737	950,000	80,741		2,102,478
Non-Vested Terminated	449,234	0	70,610		519,844
Retirees and Survivors	26,765,220	32,960,134	2,680,201	90,000	62,495,555
Total Actuarial Liability	$47,275,156	$60,308,295	$4,521,450	$90,000	$112,194,901
E. Actuarial Value of Assets	34,467,610	35,569,967	2,130,436	0	72,168,013
F. Unfunded Actuarial Liability	$12,807,546	$24,738,328	$2,391,014	$90,000	$40,026,888
G. Funded Ratio: E/D	72.9%	59.0%	47.1%	0.0%	64.3%

(a) Massachusetts Teachers' amounts are estimated and includes non-vested terminated members.

4. DEVELOPMENT OF THE ACTUARIAL GAIN OR LOSS *(in millions)*

		State	Mass. Teachers	Boston Teachers	Local COLA	Total
A.	**Gain/(loss) on Actuarial Liability**					
1.	Actuarial Liability 1/1/21	45,704	58,830	4,342	105	108,981
2.	Total Normal Cost 1/1/21	1,003	1,123	100	0	2,226
3.	Interest on (1) and (2) at 7.0%	3,269	4,197	311	7	7,784
4.	Benefits paid during 2021 [a]	2,625	3,275	275	14	6,189
5.	Interest on (4) at 7.0% assuming mid-year payment	92	115	10	0	217
6.	Change to $15,000 COLA base for Boston teachers	0	0	22	0	22
7.	Expected Actuarial Liability 1/1/22: (1)+(2)+(3)-(4)-(5)+(6)	47,260	60,760	4,490	98	112,608
8.	Actuarial Liability 1/1/22	47,275	60,308	4,521	90	112,194
9.	Gain/(Loss): (7)-(8)	(15)	452	(31)	8	414
B.	**Gain/(loss) on assets**					
1.	Actuarial Value of Assets (AVA) 1/1/21	30,370	31,171	1,866	0	63,407
2.	Interest on (1) at 7.0%	2,126	2,182	131	0	4,438
3.	Net receipts [b]	776	987	179	0	1,942
4.	Net disbursements [b]	1,684	1,724	204	0	3,612
5.	Net Cash Flow: (3)-(4)	(908)	(737)	(25)	0	(1,670)
6.	Interest on (5) at 7.0% assuming mid-year payment	(32)	(26)	(1)	0	(58)
7.	Expected AVA 1/1/22: (1)+(2)+(5)+(6)	31,556	32,590	1,971	0	66,117
8.	AVA 1/1/22	34,468	35,570	2,130	0	72,168
9.	Gain/(loss): (8)-(7)	2,912	2,980	159	0	6,051
C.	Total Gain/(Loss): (A9)+(B9)	2,896	3,432	129	8	6,465

Figures may not add due to rounding

[a] Estimated
[b] Amounts actually received or disbursed by the fund

5. AUDIT INFORMATION

The Commonwealth valuation reports prior to 2015 included information required under Governmental Accounting Standards Board (GASB) Statement No. 27 (GASB 27). The Commonwealth began implementing GASB 27 in Fiscal Year 1996. GASB 27 has been replaced by GASB 68. In addition, GASB 67 replaced the requirements under GASB 25.

GASB 67 reflects plan financial statement reporting and was first effective for the plan year ending June 30, 2014. GASB 68 reflects employer financial statement reporting and was first effective for the fiscal year ending June 30, 2015.

We have not provided any GASB 67 or GASB 68 exhibits for SRS or TRS in this valuation report. These exhibits are provided separately.

6. ASSETS

A | STATE AND MASSACHUSETTS TEACHERS'

(Dollars in thousands)

	State	Mass. Teachers
Pension Reserves Investment Trust		
Market Value	$38,297,344	$39,522,186
Actuarial Value	$34,467,610	$35,569,967
Actuarial Value as a Percentage of Market Value	90.0%	90.0%

The actuarial value of assets (AVA) is determined so that 20% of the investment gain and loss in a given year is recognized annually for the next five years. Therefore, these investment gains and losses are fully recognized after five years. In addition to this treatment of gains and losses, we use a "corridor" approach so that the actuarial value of assets can never be too far from the market value of assets (MVA). Under our approach for the Commonwealth, the actuarial value cannot be less than 90% nor greater than 110% of the market value. As of January 1, 2022, the calculated value of the AVA is 87.2% of the MVA. The AVA has been adjusted to be within the specified corridor.

B | BOSTON TEACHERS

Based on the enactment of Chapter 112 of the Acts of 2010, the assets of the Boston Teachers are maintained by PRIM. The transfer of these assets occurred during 2010. We set the actuarial value of assets to 90.0% of the market value based on the results for SRS and TRS.

Market Value	$2,367,151
Actuarial Value	$2,130,436

6. ASSETS *(continued)*

C | DEVELOPMENT OF ACTUARIAL VALUE OF ASSETS

(Dollars in thousands)

A. Development of total investment income (incl. appreciation) (excluding Boston teachers)

	State	Mass. Teachers	Total
1. Beginning of Year Market value of assets	32,611,969	33,473,661	66,085,630
2a. Net Receipts *	776,550	986,928	1,763,478
b. Net disbursements *	1,684,414	1,723,663	3,408,077
c. Cash flow: (a) – (b)	(907,864)	(736,735)	(1,644,599)
3. End of Year Market value of assets	38,297,344	39,522,186	77,819,530
4. Investment income including appreciation: (3) – (1) – (2(c))	6,593,239	6,785,260	13,378,499
B. Expected market value development			
1. Beginning of Year Market value of assets	32,611,969	33,473,661	66,085,630
2. Cash flow (A2(c))	(907,864)	(736,735)	(1,644,599)
3. Expected Return on (1) B1 x 0.07	2,282,838	2,343,156	4,625,994
4. Expected return on cash flow B2 x 0.07 / 2	(31,775)	(25,786)	(57,561)
5. Expected market value End of Year (1)+(2)+(3)+(4)	33,955,168	35,054,297	69,009,464
C. Gain/(loss) for year: A3-B5	4,342,176	4,467,889	8,810,066
D. Development of Actuarial Value of Assets			
1. End of year market value	38,297,344	39,522,186	77,819,530
2a. Asset gain/(loss) in current year	4,342,176	4,467,889	8,810,066
b. Asset gain/(loss) in 1st prior year	1,564,805	1,604,527	3,169,332
c. Asset gain/(loss) in 2nd prior year	2,485,222	2,551,693	5,036,915
d. Asset gain/(loss) in 3rd prior year	(2,477,946)	(2,547,823)	(5,025,769)
3. Unrecognized gain/(loss) .8 x [2a] + .6 x [2b] + .4 x [2c] +.2 x [2d]	4,911,124	5,048,141	9,959,264
4. End of year actuarial value of assets: [1] - [3]	33,386,220	34,474,045	67,860,266
5. Actuarial value / Market value	87.2%	87.2%	87.2%
6. Adjusted actuarial value: (4) but not less than 90% nor greater than 110% of market value	34,467,610	35,569,967	70,037,577

*Reflects actual cash flow of PRIT Fund

7. SYSTEM MEMBERSHIP

A | STATE ACTIVE MEMBERS

A critical element of an actuarial valuation is accurate and up-to-date membership information. As part of this valuation, PERAC analyzed the member data provided by the State Retirement System.

	Actives	Vested Terminations
Number of Members	85,999	4,909
Average Age	47.0	53.2
Average Service	12.2	15.1
Average Salary	$77,338	$70,231
Average Annuity Savings Fund Balance	$73,013	$77,112

Age by Service Distribution of Active Members

Years of Service

Present Age	0 – 4	5 – 9	10 – 14	15 – 19	20 – 24	25 – 29	30+	Total
0 - 24	1,870	4						1,874
25 - 29	5,638	833	2					6,473
30 - 34	5,203	3,697	585	6				9,491
35 - 39	3,719	3,374	2,350	761	8			10,212
40 - 44	2,681	2,562	1,924	2,006	562	5		9,740
45 - 49	2,266	1,856	1,577	1,723	1,966	442	17	9,847
50 - 54	2,181	1,974	1,583	1,837	2,161	1,686	766	12,188
55 - 59	1,768	1,656	1,432	1,567	1,792	1,453	2,165	11,833
60 - 64	1,071	1,299	1,136	1,271	1,349	1,105	1,786	9,017
65+	504	726	711	798	842	587	1,156	5,324
Total	26,901	17,981	11,300	9,969	8,680	5,278	5,890	85,999

7. SYSTEM MEMBERSHIP *(continued)*

A | STATE ACTIVE MEMBERS *(continued)*

Salary by Age Distribution of Active Members

Present Age	Number of Members	Total Salary	Average Salary
0 - 24	1,874	$85,218,745	$45,474
25 - 29	6,473	$367,947,254	$56,843
30 - 34	9,491	$624,841,170	$65,835
35 - 39	10,212	$745,992,471	$73,051
40 - 44	9,740	$762,876,580	$78,324
45 - 49	9,847	$799,590,299	$81,201
50 - 54	12,188	$1,021,827,522	$83,839
55 - 59	11,833	$1,003,841,185	$84,834
60 - 64	9,017	$767,789,261	$85,149
65+	5,324	$471,085,805	$88,483
Total	85,999	$6,651,010,292	$77,338

7. SYSTEM MEMBERSHIP *(continued)*

B | STATE RETIREES AND SURVIVORS

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Number of Members	57,721	560	3,420	6,579	68,280
Average Age	72.5	64.6	65.5	74.8	72.3
Average Annual Benefit	$41,357	$22,117	$45,541	$22,603	$39,602

Benefit by Retirement Type

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Annuity	$499,729,839	$2,221,152	$13,926,411	$25,306,019	$541,183,421
Pension	$1,887,443,811	$10,164,556	$141,825,297	$123,398,583	$2,162,832,247
Total	$2,387,173,650	$12,385,708	$155,751,708	$148,704,602	$2,704,015,668

7. SYSTEM MEMBERSHIP *(continued)*

B | STATE RETIREES & SURVIVORS *(continued)*

Benefit by Age Distribution

Present Age	Number of Members	Total Benefits	Average Benefits
Less than 40	204	$6,185,207	$30,320
40 – 44	155	$5,925,394	$38,228
45 – 49	443	$17,039,183	$38,463
50 – 54	1,488	$67,930,445	$45,652
55 – 59	3,873	$164,738,066	$42,535
60 – 64	8,568	$367,734,078	$42,919
65 – 69	13,527	$582,382,692	$43,053
70 – 74	15,017	$624,429,205	$41,581
75 – 79	11,162	$427,650,226	$38,313
80 – 84	6,563	$230,567,169	$35,131
85 – 89	4,208	$130,667,471	$31,052
90+	3,072	$78,766,532	$25,640
Totals	68,280	$2,704,015,668	$39,602

7. SYSTEM MEMBERSHIP *(continued)*

C | MASSACHUSETTS TEACHERS' ACTIVE MEMBERS

A critical element of an actuarial valuation is accurate and up-to-date membership information. As part of this valuation, PERAC analyzed the member data provided by the TRS. We made several assumptions about missing, questionable, or unavailable data.

Until the January 1, 2006 actuarial valuation, we had estimated the total creditable service for each member for the actuarial valuation. The estimate was based on either the employment date (date of hire as a teacher) or the adjusted employment date and was set equal to the greater of the two calculated service amounts. We used this methodology, which we believed was conservative, because we had no way to assess additional costs for members who buy back service near retirement. In 2006, we compared the service estimated for valuation purposes with actual service for over 6,800 members who retired in 2004 and 2005. We found that, in total, our methodology slightly understated service. To estimate this additional cost, we increased the plan liabilities as of January 1, 2006. We have continued using this methodology in each subsequent valuation.

For members with a date of birth and/or date of hire that seemed questionable, we assumed (based on credited service or date of birth) the member was hired at age 30 (or at a younger age, if the member was under 30).

Based on our experience with prior years' data, buyback issues, and questions to TRS regarding specific members, we made several adjustments. Members whose pay was less than $5,000 were assumed to be inactive. For members with pay between $5,000 and $20,000, we used an estimated pay of $50,000. For members with submitted pay over $150,000, we compared this year's figure to the pay used in the prior valuation. We adjusted this year's figure based on the amount contributed if we believed it was overstated.

Determining valuation pay for members with reported pay less than $20,000 is difficult. Although we make the assumptions outlined above, we know there will always be a significant number of members that fall into this category for a variety of reasons including leaves of absence and part time employment. We believe our overall assumption is reasonable but know some members that we have deemed inactive are active members. To reflect this uncertainty, we made an additional increase to the calculated plan liabilities consistent with last year.

We increased the normal cost by 2.0% and the active actuarial liability by 1.0% to reflect the service buyback and various data issues.

Pay for all members hired in 2021 was annualized.

Because we could not determine the number of vested terminations, we estimated a combined inactive (terminated vested plus terminated with an ASF balance) liability. This is the same methodology we have used in prior valuations.

7. SYSTEM MEMBERSHIP *(continued)*

C | MASSACHUSETTS TEACHERS' ACTIVE MEMBERS *(continued)*

A critical element of an actuarial valuation is accurate and up-to-date membership information. As part of this valuation, PERAC analyzed the member data provided by the Massachusetts Teachers' Retirement System.

	Actives
Number of Members	98,926
Average Age	43.6
Average Service	13.2
Average Salary	$77,878
Average Annuity Savings Fund Balance	$85,825

Age by Service Distribution of Active Members

	Years of Service							
Present Age	0 – 4	5 – 9	10 – 14	15 – 19	20 – 24	25 – 29	30+	Total
0 - 24	2,519							2,519
25 - 29	8,371	1,895	1					10,267
30 - 34	4,826	6,961	1,434	5				13,226
35 - 39	2,641	3,596	5,833	1,931	3			14,004
40 - 44	2,104	1,911	2,785	6,062	1,823	12		14,697
45 - 49	1,392	1,326	1,469	2,704	5,409	942	16	13,258
50 - 54	1,114	1,186	1,422	1,962	3,750	3,857	526	13,817
55 - 59	618	708	1,147	1,605	2,034	1,673	1,854	9,639
60 - 64	243	323	528	1,122	1,452	936	996	5,600
65+	82	126	177	362	462	247	443	1,899
Total	23,910	18,032	14,796	15,753	14,933	7,667	3,835	98,926

7. SYSTEM MEMBERSHIP *(continued)*

C | MASSACHUSETTS TEACHERS' ACTIVE MEMBERS *(continued)*

Salary by Age Distribution of Active Members

Present Age	Number of Members	Total Salary	Average Salary
0 - 24	2,519	$77,901,141	$30,925
25 - 29	10,267	$519,490,619	$50,598
30 - 34	13,226	$856,642,952	$64,770
35 - 39	14,004	$1,073,043,658	$76,624
40 - 44	14,697	$1,230,369,028	$83,716
45 - 49	13,258	$1,164,546,267	$87,837
50 - 54	13,817	$1,235,269,136	$89,402
55 - 59	9,639	$864,752,187	$89,714
60 - 64	5,600	$509,169,377	$90,923
65+	1,899	$172,991,617	$91,096
Total	98,926	$7,704,175,982	$77,878

7. SYSTEM MEMBERSHIP *(continued)*

D | MASSACHUSETTS TEACHERS' RETIREES AND SURVIVORS

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Number of Members	65,202	358	278	3,889	69,727
Average Age	73.8	68.1	72.8	77.2	74.0
Average Annual Benefit	$48,971	$24,472	$46,414	$23,812	$47,432

Benefit by Retirement Type

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Annuity	$656,416,729	$1,767,436	$1,223,631	$16,959,316	$676,367,112
Pension	$2,536,584,201	$6,993,360	$11,679,436	$75,647,186	$2,630,904,183
Total	$3,193,000,930	$8,760,796	$12,903,067	$92,606,502	$3,307,271,295

7. SYSTEM MEMBERSHIP *(continued)*

D | MASSACHUSETTS TEACHERS' RETIREES & SURVIVORS *(continued)*

Benefit by Age Distribution

Present Age	Number of Members	Total Benefits	Average Benefits
Less than 40	19	$247,593	$13,031
40 – 44	44	$658,325	$14,962
45 – 49	91	$1,477,493	$16,236
50 – 54	229	$5,207,535	$22,740
55 – 59	1,497	$64,785,406	$43,277
60 – 64	5,793	$286,902,550	$49,526
65 – 69	13,612	$701,200,491	$51,513
70 – 74	20,537	$1,052,303,817	$51,239
75 – 79	14,156	$674,545,595	$47,651
80 – 84	7,134	$299,851,764	$42,031
85 – 89	3,988	$144,746,859	$36,296
90+	2,627	$75,343,867	$28,681
Totals	69,727	$3,307,271,295	$47,432

7. SYSTEM MEMBERSHIP *(continued)*

E | BOSTON TEACHERS' ACTIVE MEMBERS

A critical element of an actuarial valuation is accurate and up-to-date membership information. As part of this valuation, PERAC analyzed the member data provided by the Boston Retirement System.

	Actives	Vested Terminations
Number of Members	6,659	410
Average Age	42.8	48.9
Average Service	10.2	14.8
Average Salary	$100,171	$76,671
Average Annuity Savings Fund Balance	$98,621	$117,797

Age by Service Distribution of Active Members

	Years of Service							
Present Age	0 – 4	5 – 9	10 – 14	15 – 19	20 – 24	25 – 29	30+	Total
0 - 24	92							92
25 - 29	626	92						718
30 - 34	583	476	44					1,103
35 - 39	324	350	336	56				1,066
40 - 44	241	169	270	302	44			1,026
45 - 49	154	122	145	187	208	16	3	835
50 - 54	161	82	100	124	162	128	29	786
55 - 59	101	59	61	71	86	72	85	535
60 - 64	72	33	51	55	53	41	44	349
65+	27	22	23	12	28	19	18	149
Total	2,381	1,405	1,030	807	581	276	179	6,659

7. SYSTEM MEMBERSHIP *(continued)*

E | BOSTON TEACHERS' ACTIVE MEMBERS *(continued)*

Salary by Age Distribution of Active Members

Present Age	Number of Members	Total Salary	Average Salary
0 - 24	92	$5,750,841	$62,509
25 - 29	718	$54,241,253	$75,545
30 - 34	1,103	$98,824,295	$89,596
35 - 39	1,066	$107,641,509	$100,977
40 - 44	1,026	$109,533,510	$106,758
45 - 49	835	$91,734,303	$109,861
50 - 54	786	$86,510,909	$110,065
55 - 59	535	$60,029,349	$112,204
60 - 64	349	$36,891,917	$105,707
65+	149	$15,879,726	$106,575
Total	6,659	$667,037,612	$100,171

7. SYSTEM MEMBERSHIP *(continued)*

F | BOSTON TEACHERS' RETIREES AND SURVIVORS

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Number of Members	4,375	42	71	328	4,816
Average Age	74.2	67.2	72.6	75.5	74.2
Average Annual Benefit	$58,372	$26,042	$54,658	$26,810	$55,885

Benefit by Retirement Type

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Annuity	$52,789,924	$256,777	$417,636	$1,675,922	$55,140,259
Pension	$202,586,163	$837,001	$3,463,110	$7,117,793	$214,004,067
Total	$255,376,087	$1,093,778	$3,880,746	$8,793,715	$269,144,326

7. SYSTEM MEMBERSHIP *(continued)*

F | BOSTON TEACHERS' RETIREES & SURVIVORS *(continued)*

Benefit by Age Distribution

Present Age	Number of Members	Total Benefits	Average Benefits
Less than 40	9	$232,477	$25,831
40 - 44	7	$197,881	$28,269
45 - 49	2	$51,912	$25,956
50 - 54	12	$356,453	$29,704
55 - 59	107	$4,828,009	$45,122
60 - 64	386	$23,733,131	$61,485
65 - 69	872	$53,800,216	$61,697
70 - 74	1,405	$84,924,417	$60,444
75 - 79	1,038	$57,817,386	$55,701
80 - 84	520	$25,425,169	$48,895
85 - 89	258	$10,666,148	$41,342
90+	200	$7,111,127	$35,556
Totals	4,816	$269,144,326	$55,885

8. VALUATION COST METHODS

A | ACTUARIAL COST METHOD

The Actuarial Cost Method which was used to determine pension liabilities in this valuation is known as the *Entry Age Normal Cost Method***.** Under this method, the *Normal Cost* for each active member on the valuation date is determined as the level percent of salary, which, if paid annually from the date the employee first became a retirement system member, would fully fund by retirement, death, disability or termination, the projected benefits which the member is expected to receive. The *Actuarial Liability* for each member is determined as the present value as of the valuation date of all projected benefits which the member is expected to receive, minus the present value of future annual Normal Cost payments expected to be made to the fund. Since only active members have a Normal Cost, the Actuarial Liability for inactive members, retirees, and survivors is simply equal to the present value of all projected benefits. The *Unfunded Actuarial Liability* is the Actuarial Liability less current assets.

The Normal Cost for a member will remain a level percent of salary for each year of membership, except for changes in provisions of the plan or the actuarial assumptions employed in projection of benefits and present value determinations. The Normal Cost for the entire system will also be changed by the addition of new members or the retirement, death, disability, or termination of members. The Actuarial Liability for a member will increase each year to reflect the additional accrual of Normal Cost. It will also change if the plan provisions or actuarial assumptions change.

Differences each year between the actual experience of the plan and the experience projected by the actuarial assumptions are reflected by adjustments to the Unfunded Actuarial Liability. An experience difference which increases the Unfunded Actuarial Liability is an *Actuarial Loss* and one which decreases the Unfunded Actuarial Liability is called an *Actuarial Gain.*

B | ASSET VALUATION METHOD

The actuarial value of assets is determined in accordance with the deferred recognition method under which 20% of the gains or losses occurring in the prior year are recognized, 40% of those occurring 2 years ago are recognized, etc., so that 100% of gains or losses occurring 5 years ago are recognized. The actuarial value of assets will be adjusted, if necessary, in order to remain between 90% and 110% of the market value. The actuarial value of assets as of January 1, 2022 is 90.0% of the market value.

C | ACTUARIAL MODELS

The software we used in our actuarial valuations measures the present value of the plan's actuarial liabilities from which we develop funding schedules that determine annual appropriations for each system. The software was created and is maintained by a national vendor of actuarial software and we have used this software for over 20 years. We periodically review the results of the software by analyzing detailed individual test lives and have compared our results to those of other actuaries using the same data set. The valuation output is prepared before a final review by our actuary.

In addition, we used a simple projection model prepared in a spreadsheet, to perform a rough analysis of the impact of investment returns on the unfunded actuarial liability and funded ratio for the next five years. The work is tailored to each valuation and reviewed by the actuary.

9. ACTUARIAL ASSUMPTIONS

Investment Return

7.0% per year net of investment expenses (*same as the prior assumption*)

The investment return assumption is a long-term assumption and is based on capital market expectations by asset class, historical returns, and professional judgment. We considered analysis prepared by PRIM's investment advisor using a building block approach which included expected returns by asset class, risk analysis, and the determination of a 30-year expected target rate of return.

Inflation

2.5% per year

Interest Rate Credited to the Annuity Savings Fund

3.5% per year

Assumed Rate of Cost of Living Increases (COLA)

3.0% per year (on the first $13,000 of an allowance; $15,000 for Boston Teachers)

Mortality

State: Pre-retirement mortality reflects RP-2014 Blue Collar Employees table projected generationally with Scale MP-2020 set forward 1 year for females. *(Same as the prior assumption)*

Teachers: Pre-retirement mortality reflects SOA Pub-2010 Teachers (headcount) Employees table projected generationally with MP-2020 (gender distinct). *(Same as the prior assumption)*

State: Post-retirement mortality reflects RP-2014 Blue Collar Healthy Annuitant table projected generationally with Scale MP-2020 set forward 1 year for females. *(Same as the prior assumption)*

Teachers: Post-retirement mortality reflects SOA Pub-2010 Teachers (headcount) Healthy Retirees table projected generationally with MP-2020 (gender distinct). *(Same as the prior assumption)*

State: For disabled retirees, mortality reflects the post-retirement mortality described in the previous paragraph, set forward 1 year. *(Same as the prior assumption)*

Teachers: For disabled members, the mortality reflects SOA Pub-2010 Teachers (headcount) Healthy Retirees table projected generationally with MP-2020 (gender distinct). *(Same as the prior assumption)*

It is assumed that 75% of pre-retirement deaths are job-related for Group 1 and 2 members and 90% are job-related for Group 4 members. For members retired under an Accidental Disability, 40% of deaths are assumed to be from the same cause as the disability.

The mortality assumptions reflect our recent experience analysis published in 2014 (based on the years 2006-2011), updated to reflect actual experience from 2012 through 2020 for post-retirement mortality, and professional judgment. This assumption reflects observed current mortality as well as expected mortality improvement.

9. ACTUARIAL ASSUMPTIONS *(continued)*

Salary Increase

Based on an analysis of past experience. Annual rates are based on service as shown below.

Service	Groups 1& 2	Group 3	Group 4
0	7.00%	7.00%	9.00%
1	6.50%	7.00%	8.00%
2	6.00%	7.00%	7.50%
3	5.50%	7.00%	7.00%
4	5.50%	6.75%	6.75%
5	5.25%	6.25%	6.25%
6	5.00%	5.25%	5.75%
7	4.75%	4.75%	5.25%
8-12	4.75%	4.75%	4.75%
13-15	4.50%	4.75%	4.75%
16-19	4.25%	4.75%	4.75%
20+	4.00%	4.50%	4.50%

Service	Teachers
0	7.50%
1	7.10%
2	7.00%
3	6.90%
4	6.80%
5	6.70%
6	6.60%
7	6.50%
8	6.30%
9	6.10%
10	5.90%
11	5.70%
12	5.20%
13	4.70%
14	4.35%
15-16	4.20%
17-19	4.10%
20+	4.00%

The salary increase assumption reflects both prior experience (2014 studies) and professional judgment.

9. ACTUARIAL ASSUMPTIONS *(continued)*

Retirement

State

	Group 1		Group 2	Group 3	Group 4
Age	Male	Female			
45	0.000	0.000	0.000	0.020	0.060
46	0.000	0.000	0.000	0.020	0.060
47	0.000	0.000	0.000	0.050	0.060
48	0.000	0.000	0.000	0.050	0.060
49	0.000	0.000	0.000	0.050	0.060
50	0.030	0.030	0.020	0.050	0.060
51	0.030	0.030	0.020	0.060	0.060
52	0.030	0.030	0.020	0.070	0.060
53	0.030	0.030	0.030	0.080	0.075
54	0.030	0.035	0.040	0.090	0.150
55	0.035	0.050	0.075	0.100	0.250
56	0.035	0.050	0.075	0.100	0.150
57	0.040	0.055	0.080	0.110	0.150
58	0.050	0.060	0.100	0.110	0.150
59	0.060	0.065	0.120	0.120	0.150
60	0.090	0.075	0.150	0.140	0.200
61	0.110	0.100	0.150	0.150	0.200
62	0.150	0.150	0.150	0.150	0.200
63	0.150	0.150	0.150	0.150	0.200
64	0.160	0.150	0.200	0.250	0.300
65	0.200	0.200	0.200	0.250	0.500
66	0.200	0.200	0.200	0.250	0.250
67	0.200	0.200	0.200	0.250	0.250
68	0.200	0.200	0.200	0.250	0.250
69	0.200	0.200	0.200	0.250	0.250
70	1.000	1.000	1.000	1.000	1.000

9. ACTUARIAL ASSUMPTIONS *(continued)*

Teachers

Males

	Not in Retirement Plus	
	Less than 20	20+
47	0.000	0.000
48	0.000	0.000
49	0.000	0.000
50	0.000	0.020
51	0.000	0.020
52	0.000	0.020
53	0.000	0.020
54	0.000	0.030
55	0.035	0.030
56	0.035	0.035
57	0.050	0.040
58	0.055	0.050
59	0.060	0.060
60	0.075	0.150
61	0.120	0.250
62	0.140	0.300
63	0.140	0.300
64	0.140	0.300
65	0.300	0.300
66	0.300	0.250
67	0.300	0.250
68	0.300	0.250
69	0.300	0.250
70+	1.000	1.000

	Retirement Plus		
	Less than 20	20-30	30+
47	0.00	0.000	0.00
48	0.00	0.000	0.00
49	0.00	0.000	0.00
50	0.00	0.010	0.02
51	0.00	0.010	0.02
52	0.00	0.010	0.02
53	0.00	0.015	0.02
54	0.00	0.025	0.02
55	0.05	0.030	0.06
56	0.05	0.060	0.20
57	0.05	0.100	0.40
58	0.05	0.150	0.50
59	0.10	0.200	0.50
60	0.10	0.250	0.40
61	0.20	0.300	0.40
62	0.20	0.350	0.35
63	0.25	0.400	0.35
64	0.25	0.400	0.35
65	0.25	0.400	0.35
66	0.30	0.300	0.40
67	0.30	0.300	0.40
68	0.30	0.300	0.40
69	0.30	0.300	0.40
70+	1.00	1.000	1.00

9. ACTUARIAL ASSUMPTIONS *(continued)*

Teachers

Females

	Not in Retirement Plus	
	Less than 20	20+
47	0.000	0.000
48	0.000	0.000
49	0.000	0.000
50	0.000	0.010
51	0.000	0.010
52	0.000	0.015
53	0.000	0.020
54	0.000	0.020
55	0.035	0.040
56	0.035	0.040
57	0.035	0.040
58	0.050	0.060
59	0.065	0.080
60	0.085	0.150
61	0.100	0.200
62	0.120	0.200
63	0.120	0.250
64	0.200	0.300
65	0.300	0.400
66	0.300	0.300
67	0.300	0.300
68	0.300	0.300
69	0.300	0.300
70+	1.000	1.000

	Retirement Plus		
	Less than 20	20-30	30+
47	0.00	0.00	0.000
48	0.00	0.00	0.000
49	0.00	0.00	0.000
50	0.00	0.01	0.015
51	0.00	0.01	0.015
52	0.00	0.01	0.015
53	0.00	0.01	0.015
54	0.00	0.01	0.020
55	0.03	0.03	0.050
56	0.03	0.05	0.150
57	0.04	0.08	0.350
58	0.08	0.10	0.350
59	0.08	0.15	0.350
60	0.10	0.20	0.350
61	0.12	0.25	0.350
62	0.12	0.30	0.350
63	0.15	0.30	0.350
64	0.20	0.30	0.350
65	0.25	0.40	0.350
66	0.25	0.30	0.350
67	0.30	0.30	0.300
68	0.30	0.30	0.300
69	0.30	0.30	0.300
70+	1.00	1.00	1.000

Retirement rates are based on our most recent experience analysis (2014) which reviewed age, service, gender, and job group. The assumption reflects this analysis and professional judgment.

9. ACTUARIAL ASSUMPTIONS *(continued)*

Disability

Based on an analysis of past experience. Sample annual rates are shown below.

Age	Group 1	Group 2	Group 3	Group 4	Teachers
20	0.00010	0.00052	0.0010	0.0020	0.00004
30	0.00010	0.00072	0.0016	0.0021	0.00006
40	0.00068	0.00210	0.0036	0.0071	0.00010
50	0.00133	0.00420	0.0094	0.0110	0.00050
60	0.00120	0.00500	0.0430	0.0080	0.00070

It is also assumed that 75% of disabilities will be job-related for Group 1 and 2 members (other than Teachers), and 95% will be job-related for Group 3 and 4 members, and 35% will be job-related for Teachers.

Disability rates are based on our most recent experience analysis (2014) which reviewed age, gender and job group. The assumption reflects this analysis and professional judgment.

Withdrawal

Rates are based on an analysis of past experience and professional judgment. For Groups 1 and 2, rates are both age and service based for service up to 10 years. After 10 years of service, rates are age based. In addition to being age and service based, Teacher rates are also gender based. For Groups 3 and 4, rates are service based. Sample annual rates are shown below.

Groups 1 & 2

Age	Service		
	0	5	10+
20	0.270	0.000	0.000
30	0.230	0.100	0.045
40	0.160	0.080	0.030
50	0.180	0.060	0.030

Groups 3 & 4

Service	Group 3	Group 4
0	0.007	0.090
5	0.007	0.060
10	0.005	0.035
15	0.005	0.020
20+	0.005	0.015

9. ACTUARIAL ASSUMPTIONS *(continued)*

Teachers

Age	Service					
	0		5		10+	
	Male	Female	Male	Female	Male	Female
20	0.130	0.100	0.055	0.070	0.015	0.050
30	0.150	0.150	0.054	0.088	0.015	0.045
40	0.133	0.105	0.052	0.050	0.017	0.022
50	0.162	0.098	0.070	0.050	0.023	0.020

Members Hired on or After April 2, 2012

Chapter 176 of the Acts of 2011 changed the retirement eligibility for the different job groups. For example, Group 1 eligibility changed from 55 years old with 10 years of service to 60 years old with 10 years of service (Chapter 176 removed the provision that allowed retirement at any age with 20 years of service). Our software system is programmed such that at any given age, a member is assumed to either retire or terminate, but not both. Therefore, we adjusted the retirement and termination rates for members impacted by Chapter 176. For example, for Group 1 members, we removed retirement rates for ages 50-59. Termination rates remain in effect for those years. We will monitor these assumptions going forward.

Family Composition

It is assumed that 80% of plan participants are married and that the male spouse in 3 years older than the female spouse.

Loading and Administrative Expenses

State

We increased the normal cost by 2% and the actuarial accrued liability of active members by $325 million to account for certain Chapter 32 benefits that cannot be readily valued with our software system. Such benefits include, but are not limited to, benefits provided under Sections10, 28M, 28N, 65D, and 100. In addition, we increased the normal cost by 1.5% and the actuarial accrued liability of active members by $140 million to estimate the impact of potential changes in job group status for certain members of DMH and Social Services.

Teachers

We increased the total normal cost by 2% and the actuarial accrued liability of active members by 1% to account for buybacks at retirement and various data issues including the status of members with reported pay of less than $20,000.

Boston Teachers

We increased the total normal cost by 2% and the actuarial accrued liability of active members by 1%.

10. SUMMARY OF PLAN PROVISIONS

ADMINISTRATION

There are 104 contributory retirement systems for public employees in Massachusetts. Each system is governed by a retirement board and all boards, although operating independently, are governed by Chapter 32 of the Massachusetts General Laws. This law in general provides uniform benefits, uniform contribution requirements and a uniform accounting and funds structure for all systems.

PARTICIPATION

Participation is mandatory for all full-time employees. Eligibility with respect to part-time, provisional, temporary, seasonal or intermittent employment is governed by regulations promulgated by the retirement board, and approved by PERAC. Membership is optional for certain elected officials.

There are 4 classes of membership in the Commonwealth. Members of the Massachusetts Teachers' Retirement System and Boston teachers are classified in Group 1.

Group 1:

General employees, including clerical, administrative, technical and all other employees not otherwise classified, as well as all teachers.

Group 2:

Certain specified hazardous duty positions.

Group 3:

Officers and inspectors of the Department of State Police.

Group 4:

Police Officers, firefighters, corrections officers, and other specified hazardous positions.

MEMBER CONTRIBUTIONS

Member contributions vary depending on the most recent date of membership:

Date of Membership	Contribution Rate
Prior to 1975:	5% of regular compensation
1975 - 1983:	7% of regular compensation
1984 to 6/30/96:	8% of regular compensation
7/1/96 to present:	9% of regular compensation
7/1/96 to present:	12% of regular compensation (State Police)
7/1/01 to present:	11% of regular compensation (for teachers hired after 7/1/01 and those accepting provisions of Chapter 114 of the Acts of 2000)
1979 to present:	an additional 2% of regular compensation in excess of $30,000 except for teachers subject to Chapter 114 of the Acts of 2000.

In addition, members of Group 1 who join the system on or after April 2, 2012 will have their withholding rate reduced to 6% after achieving 30 years of creditable service.

10. SUMMARY OF PLAN PROVISIONS *(continued)*

RATE OF INTEREST

Interest on regular deductions made after January 1, 1984 is at a rate established by PERAC in consultation with the Commissioner of Banks. The rate is obtained from the average
rates paid on individual savings accounts by a representative sample of at least 10 financial institutions.

RETIREMENT AGE

There is no mandatory retirement age for employees in Group 1. Most Group 2 and Group 4 members may remain in service after reaching age 65. Some Group 2 and Group 4 members who are employed in certain public safety positions are required to retire at age 65.

SUPERANNUATION RETIREMENT

A person who became a member before April 2, 2012 is eligible for a superannuation retirement allowance (service retirement) upon meeting the following conditions:

- completion of 20 years of service, or
- attainment of age 55 if hired prior to 1978, or if classified in Group 4, or
- attainment of age 55 with 10 years of service, if hired after 1978, and if classified in Group 1 or 2

A person who became a member on or after April 2, 2012 is eligible for a superannuation retirement allowance (service retirement) upon meeting the following conditions:

- attainment of age 60 with 10 years of service if classified in Group 1, or
- attainment of age 55 with 10 years of service if classified in Group 2, or
- attainment of age 55 if hired prior to 1978, or if classified in Group 4.

AMOUNT OF BENEFIT

A member's annual allowance is determined by multiplying average salary by a benefit rate related to the member's age and job classification at retirement, and the resulting product by his or her creditable service. The amount determined by the benefit formula cannot exceed 80% of the member's highest three-year (or five-year salary as discussed below) average salary. For veterans as defined in G.L. c. 32, s. 1, there is an additional benefit of $15 per year for each year of creditable service, up to a maximum of $300.

• Salary is defined as gross regular compensation. For employees who become members after January 1, 2011, regular compensation is limited to 64% of the federal limit found in 26 U.S.C. 401(a)(17). In addition, regular compensation for members who retire after April 2, 2012 will be limited to prohibit "spiking" of a member's salary to increase the retirement benefit.

10. SUMMARY OF PLAN PROVISIONS *(continued)*

• For persons who became members prior to April 2, 2012, average salary is the average annual rate of regular compensation received during the three consecutive years that produce the highest average, or, if greater, during the last three years (whether or not consecutive) preceding retirement.

• For persons who became members on or after April 2, 2012, average salary is the average annual rate of regular compensation received during the 5 consecutive years that produce the highest average, or, if greater, during the last 5 years (whether or not consecutive) preceding retirement.

• The benefit rate varies with the member's retirement age. For persons who became members prior to April 2, 2012 the highest rate of 2.5% applies to Group 1 employees who retire at or after age 65, Group 2 employees who retire at or after age 60, and Group 4 employees who retire at or after age 55. A .1% reduction is applied for each year of age under the maximum age for the member's group. For Group 2 employees who terminate from service under age 55, the benefit rate for a Group 1 employee shall be used.

• For persons who became members on or after April 2, 2012 and retire with less than 30 years of creditable service, the highest rate of 2.5% applies to Group 1 employees who retire at or after age 67, Group 2 employees who retire at or after age 62, and to Group 4 employees who retire at or after age 57. A .15% reduction is applied for each year of age under the maximum age for the member's group.

• For persons who became members on or after April 2, 2012 and retire with more than 30 years of creditable service, the highest rate of 2.5% applies to Group 1 employees who retire at or after age 67, Group 2 employees who retire at or after age 62, and Group 4 employees who retire at or after age 55. A .125% reduction is applied for each year of age under the maximum age for the member's group.

• For a teacher who is subject to the provisions of Chapter 114 of the Acts of 2000 and who has completed at least 30 years of creditable service, the benefit rate is multiplied by the creditable service and the resulting percentage is increased by 2% per year for each year of service in excess of 24. The amount determined cannot exceed 80% of the average salary.

The allowance of state police officers is calculated using a slightly different formula. Information regarding this formula can be obtained directly from the State Retirement Board.

DEFERRED VESTED BENEFIT

A participant who has attained the requisite years of creditable service can elect to defer his or her retirement until a later date. Group 4 employees cannot defer beyond age 65. All participants must begin to receive a retirement allowance or withdraw their accumulated deductions no later than April 15 of the calendar year following the year they reach age 70½.

WITHDRAWAL OF CONTRIBUTIONS

Member contributions may be withdrawn upon termination of employment. The interest rate for employees who first become members on or after January 1, 1984 who voluntarily withdraw their contributions with less than 10 years of service will be 3%. Interest payable on all other withdrawals will be set at regular interest.

10. SUMMARY OF PLAN PROVISIONS *(continued)*

DISABILITY RETIREMENT

The Massachusetts Retirement Plan provides two types of disability retirement benefits:

ORDINARY DISABILITY

Eligibility: Non-veterans who become totally and permanently disabled by reason of a non-job related condition with at least ten years of creditable service.

Veterans with ten years of creditable service who become totally and permanently disabled by reason of a non-job related condition prior to reaching "maximum age". "Maximum age" applies only to employees classified in Group 4 who are subject to mandatory retirement.

Retirement Allowance: For persons who became members prior to April 2, 2012, the benefit is equal to the accrued superannuation retirement benefit as if the member was age 55. If the member is a veteran, the benefit is 50% of the member's final rate of salary during the preceding 12 months, plus an annuity based upon accumulated member contributions plus credited interest. If the member is over age 55, he or she will receive not less than the superannuation allowance to which he or she is entitled.

For persons in Group 1 who became members on or after April 2, 2012, the benefit is equal to the accrued superannuation retirement benefit as if the member was age 60. If the member is a veteran, the benefit is 50% of the member's final rate of salary during the preceding 12 months, plus an annuity based upon accumulated member contributions plus credited interest. If the member is over age 60, he or she will receive not less than the superannuation allowance to which he or she would have been entitled had they retired for superannuation.

For persons in Group 2 and Group 4 who became members on or after April 2, 2012, the benefit is equal to the accrued superannuation retirement benefit as if the member was age 55. If the member is a veteran, the benefit is 50% of the member's final rate of salary during the preceding 12 months, plus an annuity based upon accumulated member contributions plus credited interest. If the member is over age 55, he or she will receive not less than the superannuation allowance to which he or she is entitled.

ACCIDENTAL DISABILITY

Eligibility: Applies to members who become permanently incapacitated from the essential duties of the position as a result of a personal injury sustained or hazard undergone while in the performance of duties. There are no minimum age or service requirements.

Retirement Allowance: 72% of salary plus an annuity based on accumulated member contributions, with interest. This amount is not to exceed 100% of pay. However, for those who became members in service after January 1, 1988 or who have not been members in service continually since that date, the amount is limited to 75% of pay. There is an additional pension of $1,010.28 per year, per child who is under 18 at the time of the member's retirement, with no age limitation if the child is mentally or physically incapacitated from earning. The additional pension may continue up to age 22 for any child who is a full time student at an accredited educational institution. Veterans, as defined in G.L. c. 32, s. 1, receive an additional benefit of $15 per year for each year of creditable service, up to a maximum of $300.

10. SUMMARY OF PLAN PROVISIONS *(continued)*

ACCIDENTAL DEATH

Eligibility: Applies to members who die as a result of a work-related injury or if the member was retired for accidental disability and the death was the natural and proximate result of the injury or hazard undergone on account of which such member was retired.

Allowance: An immediate payment to a named beneficiary equal to the accumulated deductions at the time of death, plus a pension equal to 72% of current salary and payable to the surviving spouse, dependent children or the dependent parent, plus a supplement of $1,010.28 per year, per child, payable to the spouse or legal guardian until all dependent children reach age 18 or 22 if a full time student, unless mentally or physically incapacitated.

The surviving spouse of a member of a police or fire department or any corrections officer who, under specific and limited circumstances detailed in the statute, suffers an accident and is killed or sustains injuries resulting in his death, may receive a pension equal to the maximum salary for the position held by the member upon his death.

In addition, an eligible family member of a firefighter, public prosecutor, police officer or corrections officer killed in the line of duty may receive a one-time payment of $300,000 from the State Retirement Board.

DEATH AFTER ACCIDENTAL DISABILITY RETIREMENT

Effective November 7, 1996, Accidental Disability retirees were allowed to select Option C at retirement and provide a benefit for an eligible survivor. For Accidental Disability retirees prior to November 7, 1996, who could not select Option C, if the member's death is from a cause unrelated to the condition for which the member received accidental disability benefits, a surviving spouse will receive an annual allowance of $12,000.

DEATH IN ACTIVE SERVICE *(OPTION D)*

Allowance: An immediate allowance equal to that which would have been payable had the member retired and selected Option C on the day before his or her death. For a member who became a member prior to April 2, 2012 whose death occurred prior to the member's superannuation retirement age, the age 55 benefit rate is used. For a member classified in Group 1 who became a member on or after April 2, 2012 whose death occurred prior to the member's superannuation retirement age, the age 60 benefit rate is used. If the member died after age 60, the actual age is used. The minimum annual allowance payable to the surviving spouse of a member-in-service who dies with at least two years of creditable service is $9,000, provided that the member and the spouse were married for at least one year and living together on the member's date of death.

The surviving spouse of such a member-in-service receives an additional allowance equal to the sum of $1,440 per year for the first child and $1,080 per year for each additional child until all dependent children reach age 18 or 22 if a full-time student, unless mentally or physically incapacitated.

10. SUMMARY OF PLAN PROVISIONS *(continued)*

COST OF LIVING

A cost of living adjustment (COLA) is determined based upon the increase in the Consumer Price Index (CPI) used for indexing Social Security benefits, but cannot exceed 3.0% on the first $13,000 of a retiree's benefit. For Boston teachers, the COLA cannot exceed 3.0% on the first $14,000 of a retiree's benefit.

METHODS OF PAYMENT

A member may elect to receive his or her retirement allowance in one of 3 forms of payment.

Option A: Total annual allowance, payable in monthly installments, commencing at retirement and terminating at the member's death.

Option B: A reduced annual allowance, payable in monthly installments, commencing at retirement and terminating at the death of the member, provided, however, that if the total amount of the annuity portion received by the member is less than the amount of his or her accumulated deductions, including interest, the difference or balance of his accumulated deductions will be paid in a lump sum to the retiree's beneficiary or beneficiaries of choice.

Option C: A reduced annual allowance, payable in monthly installments, commencing at retirement. At the death of the retired employee, 2/3 of the allowance is payable to the member's designated beneficiary (who may be the spouse, or former spouse who remains unmarried for a member whose retirement becomes effective on or after February 2, 1992, child, parent, sister, or brother of the employee) for the life of the beneficiary. For members who retired on or after January 12, 1988, if the beneficiary predeceases the retiree, the benefit payable increases (or "pops up") based on the factor used to determine the Option C benefit at retirement. For members who retired prior to January 12, 1988, if the System has accepted Section 288 of Chapter 194 of the Acts of 1998 and the beneficiary predeceases the retiree, the benefit payable "pops up" in the same fashion. The Option C became available to accidental disability retirees on November 7, 1996.

ALLOCATION OF PENSION COSTS

If a member's total creditable service was partly earned by employment in more than one retirement system, the cost of the "pension portion" is allocated between the different systems pro rata based on the member's service within each retirement system. If a member received regular compensation concurrently from two or more systems on or after January 1, 2010, and was not vested in both systems as of January 1, 2010, such a pro-ration will not be undertaken. This is because such a person will receive a separate retirement allowance from each system.

11. GLOSSARY OF TERMS

ACTUARIAL ACCRUED LIABILITY

That portion of the Actuarial Present Value of pension plan benefits which is not provided by future Normal Costs or employee contributions. It is the portion of the Actuarial Present Value attributable to service rendered as of the Valuation Date.

ACTUARIAL ASSUMPTIONS

Assumptions, based upon past experience or standard tables, used to predict the occurrence of future events affecting the amount and duration of pension benefits, such as: mortality, withdrawal, disablement and retirement; changes in compensation; rates of investment earnings and asset appreciation or depreciation; and any other relevant items.

ACTUARIAL COST METHOD (OR FUNDING METHOD)

A procedure for allocating the Actuarial Present Value of all past and future pension plan benefits to the Normal Cost and the Actuarial Accrued Liability.

ACTUARIAL GAIN OR LOSS (OR EXPERIENCE GAIN OR LOSS)

A measure of the difference between actual experience and that expected based upon the set of Actuarial Assumptions, during the period between two Actuarial Valuation dates.

Note: The effect on the Accrued Liability and/or the Normal Cost resulting from changes in the Actuarial Assumptions, the Actuarial Cost Method or pension plan provisions would be described as such, rather than an Actuarial Gain (Loss).

ACTUARIAL PRESENT VALUE

The dollar value on the valuation date of all benefits expected to be paid to current members based upon the Actuarial Assumptions and the terms of the Plan.

AMORTIZATION PAYMENT

That portion of the pension plan appropriation which represents payments made to pay interest on and reduce the Unfunded Accrued Liability.

ANNUAL STATEMENT

The statement submitted to PERAC each year that describes the asset holdings and Fund balances as of December 31 as well as the transactions during the calendar year that affected the financial condition of the retirement system.

ANNUITY RESERVE FUND

The fund into which total accumulated deductions, including interest, are transferred at the time a member retires, and from which annuity payments are made.

11. GLOSSARY OF TERMS *(continued)*

ANNUITY SAVINGS FUND

The fund in which employee contributions plus interest credited are held for active and inactive members.

ASSETS

The value of securities held by the plan.

COST OF BENEFITS

The estimated payment from the pension system for benefits for the fiscal year.

FUNDING SCHEDULE

The schedule, based upon the most recently approved actuarial valuation, which sets forth the amount which would be appropriated to the pension system in accordance with Section 22C of M.G.L. Chapter 32.

GASB

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NORMAL COST

Total Normal Cost is that portion of the Actuarial Present Value of pension plan benefits, which is to be paid in a single fiscal year. The Employee Normal Cost is the amount of the expected employee contributions for the fiscal year. The Employer Normal Cost is the difference between the Total Normal Cost and the Employee Normal Cost.

PENSION FUND

The fund into which appropriation amounts, as determined by PERAC are paid and from which pension benefits are paid.

PENSION RESERVE FUND

The fund that shall be credited with all amounts set aside by a system for the purpose of establishing a reserve to meet future pension liabilities. These amounts would include excess interest earnings.

SPECIAL FUND FOR MILITARY SERVICE CREDIT

The fund which is credited with an amount paid by the retirement board equal to the amount which would have been contributed by a member during a military leave of absence as if the member had remained in active service of the retirement board. In the event of retirement or a non-job related death, such amount is transferred to the Annuity Reserve Fund. In the event of termination prior to retirement or death, such amount shall be transferred to the Pension Fund.

UNFUNDED ACCRUED LIABILITY

The excess of the Actuarial Accrued Liability over the Assets.


PUBLIC EMPLOYEE RETIREMENT ADMINISTRATION COMMISSION
COMMONWEALTH OF MASSACHUSETTS

COMMONWEALTH OF MASSACHUSETTS
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