Massachusetts Teachers' Retirement System
Actuarial Valuation

January 1, 2023

PUBLIC EMPLOYEE RETIREMENT
ADMINISTRATION COMMISSION
COMMONWEALTH OF MASSACHUSETTS

Massachusetts Teachers' Retirement System

ACTUARIAL VALUATION REPORT

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1. INTRODUCTION & CERTIFICATION

This report presents the results of the actuarial valuation of the Massachusetts Teachers' Retirement System (TRS). The valuation was performed as of January 1, 2023, pursuant to Chapter 32 of the General Laws of the Commonwealth of Massachusetts and based on the plan provisions at that time. The actuarial assumptions used to calculate the accrued liability and the normal cost primarily reflect our most recent Experience Study Analysis report which was issued in 2014 and our most recent analysis of retiree mortality during 2020. The actuarial assumptions used in this valuation are the same as those used in the January 1, 2022 actuarial valuation except there was a slight revision to the generational mortality assumption.

This valuation was based on member data as of December 31, 2022, which was supplied by the Retirement Board. We performed a number of tests on the data and made specific assumptions and determinations for a number of data items. We provide more detail on these issues in Section 6. Asset information as of December 31, 2022, was provided by the Pension Reserves Investment Management 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 Massachusetts Teachers' Retirement Board, its staff and its auditors. The report was performed to determine the funded status of the System 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 TRS 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 State Retirement System (SRS) reflects one component of the Commonwealth schedule. The other components are the Massachusetts Teachers' Retirement System, liabilities for Boston teachers, and State reimbursements to local systems to reflect COLAs granted from 1982 through 1996 (determined on an actuarial basis). Beginning in FY18, Chapter 5 of the Acts of 2017 required that several additional items be included in the development of the Commonwealth funding schedule but shown separately. These items include the administrative expenses of the Public Employee Retirement Administration Commission (PERAC), the employer contribution 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. Beginning in FY24, Chapter 126 of the Acts of 2022 required the inclusion of the administrative expenses for the Department of Higher Education's deferred compensation plan (403(b) plan) for the SRS. 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, 2023 and was based on the results of the January 1, 2022 Commonwealth Actuarial Valuation. The FY24 appropriation under the schedule is $4.105 billion. The total appropriation under the schedule increases 9.63% each year until FY28. Beginning in FY29, the remaining UAL is amortized on a 4.0% annual increasing basis to FY36. The next schedule will be adopted in early 2026 based on the results of the 2025 Commonwealth actuarial valuation.

The TRS's portion of the FY24 Commonwealth appropriation is $2.3525 billion.

The principal results of the January 1, 2023 actuarial valuation are as follows (dollars in thousands):

Total Normal Cost	$1,223,637
Expected Employee Contributions	862,148
Net Normal Cost	$361,489
Total Expenses and Transfers	$46,450
Net Normal Cost Plus Expenses	$407,939

Total Actuarial Liability	$62,286,199
Assets	$36,536,834
Unfunded Actuarial Liability	$25,749,365
Funded Ratio	58.7%

2. EXECUTIVE SUMMARY *(continued)*

B | COMPARISON WITH PRIOR VALUATION AND EXPERIENCE ANALYSIS

A comparison of the current valuation and the January 1, 2023 valuation is shown below.
(Dollars in thousands)

	1/1/23	1/1/22	Increase (Decrease)	Increase (Decrease)
Total Normal Cost	$1,223,637	$1,122,461	101,176	9.0%
Expected Employee Contributions	862,148	791,561	70,587	8.9%
Net Normal Cost	$361,489	$330,900	$30,589	9.2%
Expenses	$40,450	$37,700	$2,750	7.3%
3(8)(c) Amounts Transferred to Other Systems	6,000	5,700	300	5.3%
Total Expenses and Transfers	$46,450	$43,400	$3,050	7.0%
Net Normal Cost Plus Expenses and Transfers	$407,939	$374,300	$33,639	9.0%
Actuarial Liability				
Actives	$27,484,650	$26,398,161	$1,086,489	4.1%
Retirees and Inactives	34,801,549	33,910,134	891,415	2.6%
Total	$62,286,199	$60,308,295	$1,977,904	3.3%
Assets (Actuarial Value)	$36,536,834	$35,569,967	$966,867	2.7%
Unfunded Actuarial Liability	$25,749,365	$24,738,328	$1,011,037	4.1%
Funded Ratio	58.7%	59.0%	(0.3%)	

Total Expenses and Transfers
In our 2017 valuation, we began showing the expense and transfer items separately from the normal cost. Expenses (including PERAC's administrative expenses) reflect the expenses from the most recent Annual Statement and include a portion of investment related expenses. In addition, $6.0 million is included for amounts transferred to other systems under Section 3(8)(c) for members with 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)*

Actives	1/1/23	1/1/22	% Difference
Number	101,286	98,926	2.4%
Total Payroll	$8,371,449,529	$7,704,175,982	8.7%
Average Salary	$82,652	$77,878	6.1%
Average Age	43.5	43.6	(0.2%)
Average Service	13.0	13.2	(1.5%)

Retirees and Survivors	1/1/23	1/1/22	% Difference
Number	70,769	69,727	1.5%
Total Benefits	$3,424,512,110	$3,307,271,295	3.5%
Average Benefits	$48,390	$47,432	2.0%
Average Age	74.3	74.0	0.4%

Gain/(Loss) and Change in Unfunded Actuarial Liability (UAL)
The development of the actuarial gain/(loss) is shown on page 16. During 2022, there was an overall actuarial loss of $955 million. There was a non-investment related gain on the actuarial liability of approximately $63 million and a loss of approximately $1.018 billion on the actuarial value of assets. The return on assets for 2022 was approximately 4.1% on an AVA basis, compared to -10.8% on a market value basis.

The UAL increased from $24.7 billion as of January 1, 2022 to $25.7 billion as of January 1, 2023.

Actuarial Assumptions
Investment Return

The January 1, 2023 valuation reflects a 7.0% investment return assumption (the same as the January 1, 2022 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 the assumption, the Commission decided to maintain this assumption.

Early this year, NEPC, the Pension Reserves Investment Trust's (PRIT) 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 7.7% in this study (7.2% if we assume expenses of 50 basis points and the expected return reflects a gross return). This figure is 80 basis points greater than the figure from the 2022 study. Note that the 7.7% average expected return does not mean that the expected return each year will be 7.7%. In fact, over the shorter term (10 years) the average expected return is 7.0% (130 basis points greater than last year). Greater expected returns in later years determined NEPC's long-term projection. The NEPC projected returns are the first measure we use to determine a reasonable range for 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)						
	2017	2018	2019	2020	2021	2022	2023
5-7 year expected return	6.8%	6.6%	6.8%	6.2%	5.8%	5.7%	7.0%
30 year expected return	7.8%	7.7%	7.9%	7.3%	6.8%	6.9%	7.7%

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

Actual Returns as of December 31, 2022	
2022	-10.8%
5 years (2018-2022)	6.8%
10 years (2013-2022)	8.3%
20 years (2003-2022)	8.5%
38 years (1985-2022)	9.3%

Besides the NEPC analysis, we review the capital market assumptions (CMAs) of other investment consultants for comparison. We estimate the short-term and/or long-term expected returns using these capital market assumptions and PRIT's asset allocation. The results of these CMAs are generally consistent with NEPC. We also review the Horizon Actuarial Services Survey of Capital Market Assumptions. This study compares the assumptions of 40 different investment consultants including NEPC. The Horizon study used in our analysis was published in August 2022. Since it reflects 2022 capital market assumptions, there is a lag between the Horizon results and the NEPC study. The Horizon short-term (10 years) expected return increased by 25 basis points from 5.38% to 5.63% in this survey. The Horizon long-term (20 years) expected return increased by only 4 basis points from 6.25% to 6.29%. At first glance, the results of the Horizon survey indicate a potential bottoming of the long-term expected returns. It may be a one-year anomaly but is something we will monitor over the next few years.

In addition to the NEPC and other capital market analyses, NASRA periodically publishes a survey of investment return assumptions used by over 100 large public plans. The most recent study available at the time of our analysis was published in November 2022. In that study, the average investment return assumption was 6.93%, a decrease from the 7.04% figure published in January 2022. In an updated study as of March 2023, the average investment return assumption was still 6.93%. Although the NASRA study does not consider different asset allocations between the plans, it demonstrates the continuing reduction in this assumption.

As part of our analysis, we considered whether to recommend maintaining the 7.0% assumption adopted in 2021 (and maintained in 2022) or reducing the assumption further. We recommended maintaining this assumption as part of this valuation.

Despite the increase in NEPC's long-term expectations, we do not recommend increasing the assumption this year. This year's results could be an anomaly. We would want to see results like this year's results over the next few years before we consider increasing this assumption.

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

We could make a reasonable argument to reduce the assumption this year. NEPC is just one of many investment consultants. Past analyses have indicated that NEPC's expectations are in the middle of the pack when compared to the expectations of other investment consultants. Thus, using CMAs from the more conservative end of the spectrum would result in a reduction in the investment return assumption.

Over the past ten years, we have taken a measured approach regarding our recommendation of this assumption. We review this assumption annually, and generally we have not recommended a decrease in this assumption of more than 25 basis points between any two successive years. Until a few years ago, our assumption was between the NEPC short-term and long-term expectations. However, with the significant decreases in the NEPC expectations in 2020 and 2021, many of our recommendations for 2020 and 2021 ended up being greater than NEPC's long-term expectation (6.8% and 6.9% respectively). Because of our measured approach regarding this assumption, the assumption might exceed the NEPC long-term expectation for a limited period, but we expect it would return to being between the two expectations over time. With the increase in the NEPC expectations in 2023, most of our recommendations will be closer to the short-term expectation.

We generally prefer that this assumption be between the NEPC short and long-term expectations, but not exceed the NEPC long-term expectation for two reasons. First, although the assumption is a long-term assumption, we want to reflect the fact that over the short term, returns are expected to be lower. Second, we noted earlier that the 30-year expected return would be 7.2% if we assume expenses to be 50 basis points. Although actual PRIM returns are reported gross of expenses, our understanding is that NEPC considers the expectations to be net of expenses because their methodology models indexed funds with negligible fees and that active management has historically at least offset fees. However, the Actuarial Standards of Practice, which provide guidance in developing assumptions, note that anticipating superior performance may be unduly optimistic. We are inclined to be conservative in developing the investment return assumption, to reflect both short-term returns and investment expenses.

We recommended maintaining the 7.0% assumption for this valuation and the Commission agreed.

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

Mortality

In our 2011 actuarial valuation, we began reflecting future mortality improvement (increasing 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 in early 2015 of retiree mortality during 2012, 2013, and 2014, we adopted a fully generational assumption in the 2015 valuation. Based on our 2017 analysis of retiree mortality during 2015 and 2016, we further adjusted the mortality assumption by adopting the RP-2014 white collar table as of January 1, 2017. 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) and updated the mortality improvement scale to the more current MP-2020. We maintained the base mortality table but we updated the mortality improvement scale in this valuation to MP-2021. This change increased the actuarial accrued liability by approximately $111 million.

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 factor 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, 2023, there were approximately 48,700 members hired after April 1, 2012. The employer normal cost is approximately $100 million lower than it would have been if the prior provisions were in place for these members. The actuarial liability is approximately $825 million lower than it would have been if the prior provisions were in place.

Data Assumptions

We have detailed a number of the assumptions we made for missing or questionable data for active members of the TRS in Section 6.

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, 2023. We believe these measures alone are not appropriate for assessing the sufficiency of assets to cover the estimated cost of settling the Teachers' 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. As of January 1, 1990, the actuarial liability was $9.7 billion and assets were $3.8 billion. The difference of $5.9 billion was the UAL. As of January 1, 2023, the actuarial liability is $62.3 billion and the actuarial value of assets is $36.5 billion. The difference of $25.7 billion is the UAL. The actuarial liability has grown 6.4 times over this period ($62.3B / $9.7B). But assets have grown 9.6 times over this same period ($36.5B / $3.8B). For this reason, we believe the funded ratio represents a better measure of funding progress.

Impact of assumption and plan changes since 2009

There have been a number of other plan and assumption changes since 2009 that have increased the actuarial liability. These changes include six 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, 2021 and 2023. Other changes include adjustments made based on the experience study results and the adoption of a $13,000 COLA base. Including the changes as of January 1, 2023, the unfunded actuarial liability is approximately $9.3 billion greater than it would have been using the 2009 valuation assumptions and plan provisions.

2. EXECUTIVE SUMMARY *(continued)*

C | FUNDING PROGRESS *(continued)*

The chart below provides further detail on these changes.

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

	Mass. Teachers
Assumption Changes	$9.16
Plan Amendments	0.15
Total	$9.31

Assumption changes (with valuation date reflected)	(In millions)
Reduction in investment return assumption from 8.25% to 8.0% (2013)	$889
Reduction in investment return assumption from 8.0% to 7.75% (2015)	1,045
Reduction in investment return assumption from 7.75% to 7.50% (2016)	1,190
Reduction in investment return assumption from 7.50% to 7.35% (2018)	845
Reduction in investment return assumption from 7.35% to 7.25% (2019)	577
Reduction in investment return assumption from 7.25% to 7.0% (2021)	1,570
Adoption of fully generational mortality assumption (2015)	1,022
Other mortality adjustments (2012, 2013, 2014, 2017, 2021,2023)	1,713
Other experience study changes (2013)	311
Total	9,162

Plan amendment (with valuation date reflected)	
$13,000 COLA base (2012)	$148

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 the plan. 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 plan's unfunded actuarial liability (UAL) and the funded ratio for the past 10 years 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.

	2013	2014	2015	2016	2017	2018	2019	2021	2022	2023
UAL (in billions)	$17.3	$17.8	$20.2	$22.0	$23.6	$24.6	$26.0	$27.7	$24.7	$25.7
Funded Ratio	55.7%	56.3%	54.3%	52.8%	52.1%	52.4%	51.7%	53.0%	59.0%	58.7%

The UAL has generally increased over this period. The 2013 valuation was the fifth actuarial valuation after the significant market value loss in 2008. The 2008 investment loss was fully recognized in 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 2013 valuation to the current assumption. The mortality assumption has also been updated several times during this period. For comparison, using the January 1, 2013 plan assumptions and provisions, the UAL as of January 1, 2023 would be approximately $17.0 billion.

2. EXECUTIVE SUMMARY *(continued)*

D | RISK *(continued)*

The funded ratio generally decreased through 2017, remained fairly consistent through 2019, then increased through 2022. The assumption changes described above have also significantly impacted the funded ratio. For comparison, using the 2013 plan assumptions, the 2023 funded ratio would be approximately 68%.

The UAL on an AVA basis is $25.7 billion and the funded ratio is 58.7%. On a market value basis, the UAL is $27.6 billion and the funded ratio is 55.7%.

Investment Return Assumption

The investment return assumption of 7.0% is consistent with our 2023 recommended assumption. Currently 72 Chapter 32 systems use an assumption of 7.0% or lower.

Funding Schedule and Amortization Basis

Amortization of UAL basis:	9.63% total appropriation increase to FY28, then 4.0% increasing amortization of the remaining UAL to 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 2023 schedule maintained the 9.63% increases until FY28 but reverts to a traditional increasing amortization schedule in FY29 and maintains the FY36 payoff date.

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 as long as 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 current schedule has no negative amortization.

A large number of 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% for the next few years, 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.

Retiree Actuarial Liability / Total Actuarial Liability

Valuation Date									
2013	2014	2015	2016	2017	2018	2019	2021	2022	2023
0.59	0.59	0.59	0.58	0.58	0.58	0.57	0.55	0.55	0.54

The ratios for TRS are fairly consistent indicating that the plan is 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 2013, this ratio ranged from .35 to .61. In recent valuations, this range has increased to .47 to .67. This plan has consistently been within these ranges. Most systems have seen an increase in this ratio over the past 10-15 years 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.

Actuarial Liability / Pay

Valuation Date									
2013	2014	2015	2016	2017	2018	2019	2021	2022	2023
6.8	6.8	7.1	7.3	7.5	7.6	7.6	7.7	7.8	7.4

The chart shows gradually increasing rates with a decrease in 2023. For comparison with other PERAC systems, in 2013, this ratio ranged from 4.6 to 7.6. For recent valuations, this range has increased. The ratios currently range from 5.1 to 8.8. Again, the TRS has 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 a simple 5-year projection illustrating the potential impact of actual investment returns on funding levels. For this estimate, 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, 2023 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.

	Valuation Date					
	2023	2024	2025	2026	2027	2028
UAL (in millions)						
7.0%	$27.6	$27.7	$27.8	$27.7	$27.6	$27.3
3.0%	$27.6	$29.1	$30.7	$32.3	$33.9	$35.5
Funded Ratio						
7.0%	55.7%	56.9%	58.3%	59.7%	61.3%	63.1%
3.0%	55.7%	54.8%	54.0%	53.2%	52.5%	51.9%

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 FY28.

This analysis shows that if the fund exactly meets expectations for the next few years on a market value basis, the UAL will remain fairly level for a few years and begin to decrease in 2026. 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.

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 TRS had ratios of 0.79, 0.84 and 0.79 using the 2020, 2021 and 2022 Annual Statements respectively. Since the ratio is significantly less than 1.0, there may be an appreciable impact on our 5-year funded ratio projections.

3. SUMMARY OF VALUATION RESULTS

(Dollars in thousands)

A. Number of Members	
Active	101,286
Inactive	N/A
Retired/ Beneficiaries	70,769
Total	172,055
B. Total Payroll	$8,371,450
C. Normal Cost	
Total Normal Cost	$1,223,637
Expected Employee Contributions	$862,148
Net Employer Normal Cost	$361,489
Expenses	$40,450
3(8)(c) Amounts Transferred to Other	$6,000
Total Expenses and Transfers	$46,450
Net Normal Cost Plus Expenses & Transfers	$407,939
D. Actuarial Liability	
Total Active	$27,484,650
Total Inactive (a)	$980,000
Retirees and Survivors	$33,821,549
Total Actuarial Liability	$62,286,199
E. Actuarial Value of Assets	36,536,834
F. Unfunded Actuarial Liability	$25,749,365
G. Funded Ratio: E/D	58.7%

(a) estimated and includes both vested terminated and non-vested terminated members.

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

		(in millions)
A.	**Gain/(Loss) on Actuarial Liability**	
1.	Actuarial Liability 1/1/22	60,308
2.	Total Normal Cost 1/1/22	1,122
3.	Interest on (1) and (2) at 7.0%	4,300
4.	Benefits paid during 2022 [a]	3,375
5.	Interest on (4) at 7.0% assuming mid-year payment	118
6.	Expected Actuarial Liability 1/1/23 (before adjustment): (1)+(2)+(3)-(4)-(5)	62,238
7.	Increase due to change in mortality assumption	111
8.	Expected Actuarial Liability 1/1/23: (6) + (7)	62,349
9.	Actuarial Liability 1/1/23	62,286
10.	Total Gain/(Loss): (8)-(9)	63
B.	**Gain/(Loss) on assets**	
1.	Actuarial Value of Assets (AVA) 1/1/22	35,570
2.	Interest on (1) at 7.0%	2,490
3.	Net Receipts [b]	1,158
4.	Net Disbursements [b]	1,646
5.	Net Cash Flow: (3)-(4)	(488)
6.	Interest on (5) at 7.0% assuming mid-year payment	(17)
7.	Expected AVA 1/1/23: (1)+(2)+(5)+(6)	37,555
8.	AVA 1/1/23	36,537
9.	Gain/(Loss) during 2022: (8)-(7)	(1,018)
C.	**Total Gain/(Loss): (A10)+(B9)**	(955)

[a] Estimated

[b] Amounts actually received or disbursed by the fund

5. ASSETS

A | SUMMARY OF ASSETS

(Dollars in thousands)

Pension Reserve Investment Trust (Teachers' Retirement System)	
Market Value	$34,712,145
Actuarial Value	$36,536,834
Actuarial Value as a Percentage of Market Value	105.3%

The actuarial value of assets (AVA) is determined so that 20% of the investment gain or loss in a given year is recognized annually for the ensuing 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 AVA can never be too far from the market value of assets. Under our approach for the Commonwealth, the AVA cannot be less than 90% nor greater than 110% of the market value. As of January 1, 2023, the calculated AVA is 105.3% of the MVA.

5. ASSETS *(continued)*

B | DEVELOPMENT OF ACTUARIAL VALUE OF ASSETS

(Dollars in thousands)

A. Development of total investment income including appreciation

(Dollars in thousands)

	2022
1. Beginning of Year Market value of assets	39,522,186
2a. Net Receipts *	1,158,079
b. Net disbursements *	1,645,643
c. Cash flow: (a) – (b)	(487,564)
3. End of Year Market value of assets	34,712,145
4. Investment income including appreciation: (3) – (1) – (2(c))	(4,322,477)

B. Expected market value development

1. Beginning of Year Market value of assets	39,522,186
2. Cash flow (A2(c))	(487,564)
3. Expected Return on (1) B1 x 0.07	2,766,553
4. Expected return on cash flow B2 x 0.07 / 2	(17,065)
5. Expected market value End of Year (1)+(2)+(3)+(4)	41,784,110
C. Gain/(loss) for year: A3-B5	(7,071,965)

D. Development of Actuarial Value of Assets

1. End of year market value	34,712,145
2a. Asset gain/(loss) in current year	(7,071,965)
b. Asset gain/(loss) in 1st prior year	4,467,889
c. Asset gain/(loss) in 2nd prior year	1,604,527
d. Asset gain/(loss) in 3rd prior year	2,551,693
3. Unrecognized gain/(loss) .8 x [2a] + .6 x [2b] + .4 x [2c] +.2 x [2d]	(1,824,689)
4. End of year actuarial value of assets: [1] - [3]	36,536,834
5. Actuarial value / Market value	105.3%
6. Adjusted actuarial value: (4) but not less than 90% nor greater than 110% of market value	36,536,834

*Reflects actual cash flow of PRIT fund

6. SYSTEM MEMBERSHIP

A | 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 2022 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.

6. SYSTEM MEMBERSHIP *(continued)*

A | ACTIVE MEMBERS *(continued)*

	Actives
Number of Members	101,286
Average Age	43.5
Average Service	13.0
Average Salary	$82,652
Average Annuity Savings Fund Balance	$87,543

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	2,602							2,602
25 - 29	8,911	1,690	1					10,602
30 - 34	5,263	6,790	1,323	18				13,394
35 - 39	3,030	3,863	5,590	1,796	7			14,286
40 - 44	2,473	1,917	2,801	6,183	1,731	7		15,112
45 - 49	1,737	1,319	1,409	2,829	5,389	1,009	17	13,709
50 - 54	1,377	1,141	1,271	1,856	3,621	4,292	665	14,223
55 - 59	818	686	1,068	1,603	2,005	2,009	1,879	10,068
60 - 64	341	320	498	1,036	1,341	978	891	5,405
65+	141	125	157	340	436	268	418	1,885
Total	26,693	17,851	14,118	15,661	14,530	8,563	3,870	101,286

6. SYSTEM MEMBERSHIP *(continued)*

A | ACTIVE MEMBERS *(continued)*

Salary by Age Distribution of Active Members

Present Age	Number of Members	Total Salary	Average Salary
0 - 24	2,602	$136,808,498	$52,578
25 - 29	10,602	$626,238,477	$59,068
30 - 34	13,394	$931,802,455	$69,569
35 - 39	14,286	$1,148,070,339	$80,363
40 - 44	15,112	$1,332,814,679	$88,196
45 - 49	13,709	$1,254,215,156	$91,488
50 - 54	14,223	$1,321,781,511	$92,933
55 - 59	10,068	$938,568,006	$93,223
60 - 64	5,405	$506,637,519	$93,735
65+	1,885	$174,512,889	$92,580
Total	101,286	$8,371,449,529	$82,652

6. SYSTEM MEMBERSHIP *(continued)*

B | RETIREES AND SURVIVORS

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Number of Members	66,119	355	278	4,017	70,769
Average Age	74.1	67.9	73.2	77.4	74.3
Average Annual Benefit	$49,945	$25,053	$47,276	$24,939	$48,390

Benefit by Retirement Type

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Annuity	$685,925,426	$1,840,398	$1,257,007	$18,489,759	$707,512,590
Pension	$2,616,369,476	$7,053,317	$11,885,816	$81,690,911	$2,716,999,520
Total	$3,302,294,902	$8,893,715	$13,142,823	$100,180,670	$3,424,512,110

6. SYSTEM MEMBERSHIP *(continued)*

B | RETIREES & SURVIVORS *(continued)*

Benefit by Age Distribution

Present Age	Number of Members	Total Benefits	Average Benefits
Less than 40	25	$295,993	$11,840
40 – 44	49	$803,733	$16,403
45 – 49	74	$1,141,152	$15,421
50 – 54	255	$6,098,501	$23,916
55 – 59	1,635	$71,585,144	$43,783
60 – 64	5,793	$294,127,762	$50,773
65 – 69	12,361	$642,106,599	$51,946
70 – 74	19,728	$1,028,373,345	$52,128
75 – 79	15,932	$785,421,284	$49,298
80 – 84	8,060	$355,298,931	$44,082
85 – 89	4,144	$157,391,045	$37,980
90+	2,713	$81,868,621	$30,176
Totals	70,769	$3,424,512,110	$48,390

7. 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 member of the retirement system, 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 inactives, retirees and survivors is simply equal to the present value of all projected benefits. The sum of Normal Cost and Actuarial Liability for each member is equal to the Normal Cost and Actuarial Liability for the Plan. 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 change due to the addition of new members or the retirement, death 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 are changed.

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 called 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 gain or loss occurring in the prior year is recognized, 40% of the gain or loss occurring two years ago is recognized, etc., so that 100% of the gain or loss occurring 5 or more years ago is recognized. This approach reduces the potential volatility in the market value approach from year to year. Under our corridor approach, the actuarial value of assets cannot be less than 90% nor greater than 110% of 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.

8. 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)

Mortality

Pre-retirement mortality reflects SOA Pub-2010 Teachers (headcount) Employees table projected generationally with MP-2021 (gender distinct). *(Prior assumption used mortality improvement Scale MP-2020.)*

Post-retirement mortality reflects SOA Pub-2010 Teachers (headcount) Healthy Retirees table projected generationally with MP-2021 (gender distinct). *(Prior assumption used mortality improvement Scale MP-2020.)*

For disabled members, the mortality reflects SOA Pub-2010 Teachers (headcount) Healthy Retirees table projected generationally with MP-2021 (gender distinct). *(Prior assumption used mortality improvement Scale MP-2020.)*

It is assumed that 75% of pre-retirement deaths are job-related. 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 to 2020 for post-retirement mortality and professional judgment. This assumption reflects observed current mortality as well as expected mortality improvement.

8. ACTUARIAL ASSUMPTIONS *(continued)*

Salary Increase

Increases are based on service as shown below.

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 study) and professional judgment.

8. ACTUARIAL ASSUMPTIONS *(continued)*

Retirement
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

8. ACTUARIAL ASSUMPTIONS *(continued)*

Retirement
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.

8. ACTUARIAL ASSUMPTIONS *(continued)*

Disability

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

Age	
20	0.00004
30	0.00006
40	0.00010
50	0.00050
60	0.00070

It is also assumed that 35% of disabilities 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 as well as professional judgment.

Withdrawal

Based on an analysis of past experience. In addition to being age and service based, Teacher rates are also gender based. Final rates reflect this analysis as well as professional judgment. Sample annual rates are shown below.

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 members of the MTRS. MTRS 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, we removed retirement rates for ages 50-59. Termination rates remain in effect for those years. We will monitor these assumptions going forward.

Loading

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.

9. SUMMARY OF PLAN PROVISIONS

ADMINISTRATION

The Massachusetts Teachers' Retirement System is governed by a seven-member retirement board and Chapter 32 of the Massachusetts General Laws. This law establishes benefits, contribution requirements and an accounting and funds structure for the system.

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.

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

Group 1:

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

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
7/1/01 to present:	11% of regular compensation (for members 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 members 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 by 3% after achieving 30 years of creditable service.

RATE OF INTEREST

Interest on regular deductions made after January 1, 1984 is 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.

9. SUMMARY OF PLAN PROVISIONS *(continued)*

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
- attainment of age 55 with 10 years of service, if hired after 1977

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

AMOUNT OF BENEFIT

A member's annual allowance is determined by multiplying a benefit rate related to the member's age at retirement by his or her years of creditable service, and then multiplying that product by final average salary. A member who is subject to the provisions of Chapter 114 of the acts of 2000, and who completes at least 30 years of creditable service will receive an additional 2% of his average salary for each full year of service above 24 (23 for members hired on or after 4/2/12). The amount determined by the benefit formula cannot exceed 80% of the member's highest three-year (or five-year 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.

• 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 to April 2, 2012, average salary is the average annual rate of regular compensation received during the five consecutive years that produce the highest average, or, if greater, during the last five 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. A 0.1% reduction is applied for each year of age under 65.

• 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 members who retire at or after age 67. A 0.15% reduction is applied for each year of age under 67.

• For persons who became members on or after April 2, 2012 and retire with 30 or more years of creditable service, the highest rate of 2.5% applies to members who retire at or after age 67. A 0.125% reduction is applied for each year of age under 67.

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. All inactive 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.

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.

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 age 55 or older, he or she will receive not less than the superannuation allowance to which he or she is entitled.

For persons 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 age 60 or older, 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.

9. SUMMARY OF PLAN PROVISIONS *(continued)*

ACCIDENTAL DISABILITY

Eligibility: Applies to members who become permanently and totally unable to perform 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. 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 $1,060.80 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.

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 $1,060.80 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.

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.

9. SUMMARY OF PLAN PROVISIONS *(continued)*

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 person 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. If the member died after age 55, the actual age is used. For a member 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 $6,000, 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.

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.

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 pre-deceases 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 pre-deceases the retiree, the benefit payable "pops up" in the same fashion. The Option C became available to accidental disability retirees on November 7, 1996.

9. SUMMARY OF PLAN PROVISIONS *(continued)*

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.

10. 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, not as 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 the reduction of the Unfunded Accrued Liability.

ANNUAL STATEMENT

The statement submitted to PERAC each year that describes the asset holdings and Fund balances as of June 30 and 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, is transferred at the time a member retires, and from which annuity payments are made.

10. GLOSSARY OF TERMS *(continued)*

ANNUITY SAVINGS FUND

The fund in which employee contributions plus interest credited are held for active members and for former members who have not withdrawn their contributions and are not yet receiving a benefit (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 which 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 amounts 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.

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