Massachusetts Teachers' Retirement System

Actuarial Valuation Report

January 1, 2021

PUBLIC EMPLOYEE RETIREMENT ADMINISTRATION COMMISSION
COMMONWEALTH OF MASSACHUSETTS

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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, 2021, 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 2015 and 2016. The actuarial assumptions used in this valuation are the same as those used in the January 1, 2019 actuarial valuation except the investment return assumption was reduced from 7.25% to 7.0% and there was a slight revision to the mortality assumption.

This valuation was based on member data as of December 31, 2020, 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, 2020 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.

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,

Public Employee Retirement Administration Commission

John F. Boorack, Actuary
Member of the American Academy of Actuaries
Associate of the Conference of Consulting Actuaries
Enrolled Actuary Number 20-8562

James R. Lamenzo, Actuarial Consultant
Member of the American Academy of Actuaries
Associate of the Society of Actuaries
Enrolled Actuary Number 20-4709

John W. Parsons
Executive Director, Esq.

November 4, 2021

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 Massachusetts Teachers' Retirement System (TRS) reflects one component of the Commonwealth schedule. The other components are the State Retirement System (SRS), 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 payment to the Optional Retirement Plan (ORP) for SRS under Section 40 of Chapter 15A, and a modification to the 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 FY22 appropriation under the schedule is $3.415 billion. The total appropriation under the schedule increases 9.63% each year until FY35 with a final amortization payment in FY36. The next schedule will be based on the results of the 2022 Commonwealth actuarial valuation.

The Massachusetts Teachers' Retirement System's portion of the FY22 Commonwealth appropriation is $1.886 billion.

The principal results of the January 1, 2021 actuarial valuation are as follows (dollars in thousands):

Total Normal Cost	$1,123,403
Expected Employee Contributions	786,143
Net Normal Cost	$337,260
Total Expenses and Transfers	$40,000
Net Normal Cost Plus Expenses	$377,260

Total Actuarial Liability	$58,829,999
Assets	$31,170,723
Unfunded Actuarial Liability	$27,659,276
Funded Ratio	53.0%

2. EXECUTIVE SUMMARY *(continued)*

B | COMPARISON WITH PRIOR VALUATION AND EXPERIENCE ANALYSIS

A comparison of the current valuation and the January 1, 2019 valuation is shown below.
(Dollars in thousands)

	1/1/21	1/1/19	Increase (Decrease)	Increase (Decrease)
Total Normal Cost	$1,123,403	$983,673	$139,730	14.2%
Expected Employee Contributions	786,143	719,517	66,626	9.3%
Net Normal Cost	$337,260	$264,156	$73,104	27.7%
Administrative Expenses	$32,800	$27,000	$5,800	21.5%
3(8)(c) Amounts Transferred to Other Systems	7,200	4,500	2,700	60.0%
Total Expenses and Transfers	$40,000	$31,500	$8,500	27.0%
Net Normal Cost Plus Expenses and Transfers	$377,260	$295,656	$81,604	27.6%
Actuarial Liability				
Actives	$25,630,238	$22,387,633	$3,242,605	14.5%
Retirees and Inactives	33,199,761	31,476,508	1,723,253	5.5%
Total	$58,829,999	$53,864,141	$4,965,858	9.2%
Assets (Actuarial Value)	$31,170,723	$27,854,444	$3,316,279	11.9%
Unfunded Actuarial Liability	$27,659,276	$26,009,697	$1,649,579	6.3%
Funded Ratio	53.0%	51.7%	1.3%	

Total Expenses and Transfers
In our 2017 valuation, we began showing the expense and transfer items separately from the normal cost. Administrative expenses (including PERAC's administrative expenses) reflect the expenses from the most recent Annual Statement excluding investment related expenses. In addition, $7.2 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	1/1/21	1/1/19	% Difference
Number	96,527	94,103	2.6%
Total Payroll	$7,670,306,306	$7,074,960,153	8.4%
Average Salary	$79,463	$75,183	5.7%
Average Age	43.6	43.6	0.0%
Average Service	13.4	13.2	1.5%

Retirees and Survivors	1/1/21	1/1/19	% Difference
Number	68,780	67,110	2.5%
Total Benefits	$3,212,144,434	$3,029,696,436	6.0%
Average Benefits	$46,702	$45,145	3.4%
Average Age	73.7	73.0	1.0%

Gain/(Loss) and Change in Unfunded Actuarial Liability (UAL)

The development of the actuarial gain/(loss) is shown on pages 16 and 17. During 2019 and 2020, there were overall actuarial gains of $1,271 million. There was a non-investment related gain on the actuarial liability of approximately $126 million and a gain of approximately $1,146 million on the actuarial value of assets. The returns on assets for 2019 and 2020 were approximately 7.9% and 10.5% respectively on an actuarial basis compared to 16.6% and 12.8% respectively on a market value basis.

The UAL increased from $26.0 billion as of January 1, 2019 to $27.7 billion as of January 1, 2021. The UAL would have only increased to $26.2 billion and the funded ratio would have been 54.3% had there been no changes in the actuarial assumptions (see next section).

Actuarial Assumptions

Investment Return

The January 1, 2021 valuation reflects a 7.0% investment return assumption (reduced from the 7.25% assumption in the January 1, 2019 valuation). The investment return assumption previously decreased consistently from 8.25% as of January 1, 2012. Please note that PERAC had recommended, and the Commission had adopted, a reduction in the investment return assumption to 7.15% for the January 1, 2020 actuarial valuation. However, due to the COVID-19 pandemic, we ultimately did not complete the 2020 valuation. As part of this valuation, we considered whether to maintain the 7.15% assumption or reduce it further. Although a case could be made to maintain this assumption, we believe a stronger case can be made to slightly reduce it.

2. EXECUTIVE SUMMARY *(continued)*

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

Early this year, NEPC, PRIT's investment consultant, provided figures for 30-year expected return projections using a building block approach, the target allocation, and expected long term returns by asset class. The expected annual return is 6.8% (6.3% assuming expenses of 50 basis points and the expected return reflects a gross return) in this study. This figure is 50 basis points lower than the figure from the 2020 study (which was 60 basis points lower than the 2019 study). Note that the 6.8% average expected return does not mean that the expected return each year will be 6.8%. In fact, over the shorter term (10 years) the average expected return is 5.8% (40 basis points lower 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.

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

	Expected Annual Return (gross)						
	2015	2016	2017	2018	2019	2020	2021
5-7 year expected return	6.8%	6.8%	6.8%	6.6%	6.8%	6.2%	5.8%
30 year expected return	7.9%	7.8%	7.8%	7.7%	7.9%	7.3%	6.8%

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

Actual Returns as of December 31, 2020	
2020	12.5%
5 years (2016-2020)	10.4%
10 years (2011-2020)	9.0%
20 years (2001-2020)	7.3%
36 years (1985-2020)	9.6%

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 July 2020. Since it reflects 2020 capital market projections, there is a lag between the Horizon results and the NEPC 2021 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 February 2021, the average investment return assumption is 7.18% which is a slight decrease from the 7.22% figure published in February 2020. Although this study does not take in to account different asset allocations between the plans, it demonstrates the continuing reduction in this assumption.

The change in the investment return assumption increased the normal cost by approximately $67 million and the actuarial liability by approximately $1,570 million.

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 (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. The change in this assumption increased the normal cost by approximately $6 million and decreased the actuarial liability by approximately $127 million.

Total Impact

The overall impact of these two assumption changes increased the normal cost by approximately $73 million and the actuarial accrued liability by approximately $1,443 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, 2021, there were approximately 38,900 members hired after April 1, 2012. The employer normal cost is approximately $74 million lower than it would have been if the prior provisions were in place for these members. The actuarial liability is approximately $550 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. TRS implemented a new software system with the data submission for the January 1, 2014 valuation. As part of the 2014 and 2015 valuations, we identified several issues that TRS subsequently reviewed prior to the January 1, 2016 data submission. Since then, the data submissions for valuations have improved.

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, 2021. 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 is the UAL. As of January 1, 2021, the actuarial liability is $58.8 billion and the actuarial value of assets is $31.2 billion. The difference of $27.6 billion is the UAL. The actuarial liability has grown 6.1 times over this period ($58.8B / $9.7B). But assets have grown 8.2 times over this same period ($31.2B / $3.8B).

For this reason, we believe the funded ratio represents a better measure of funding progress. If you draw a straight line from the 1990 funded ratio of 39.2% to the January 1, 2021 amount of 53.0%, the line is moving upward to the right. This demonstrates the funding progress to date. Although the funded ratio reached 83.3% on January 1, 2000, this was the result of average annual returns from 1985-1999 that exceeded 12.5% and attaining such a high level of funding so quickly was not expected. Over the past 21 years (2000-2020), the average annual return on assets on a market value basis is approximately 7.0%. Over a 10-year and 5-year period, the returns have been 9.0% and 10.4% respectively. The 36-year return (since inception) is 9.6%. All returns are shown gross of investment fees.

Impact of assumption and plan changes since 2009

As noted earlier, the actuarial liability as of January 1, 2021 increased $1,570 million to reflect a revised investment return assumption and decreased $127 million to reflect a revised mortality assumption. There have been a number of other plan and assumption changes since 2009 that have increased the actuarial liability. These changes include five other 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, and in this valuation. Other changes include adjustments made based on the experience study results and the adoption of a $13,000 COLA base. Including the reduction in the investment return assumption as of January 1, 2021, the unfunded actuarial liability is approximately $9.2 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, 2021 would be $18.5 billion and the funded ratio would be 62.8%.

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	$9.05
Plan Amendments	0.15
Total	$9.20

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)	1,602
Other experience study changes (2013)	311
Total	9,051

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

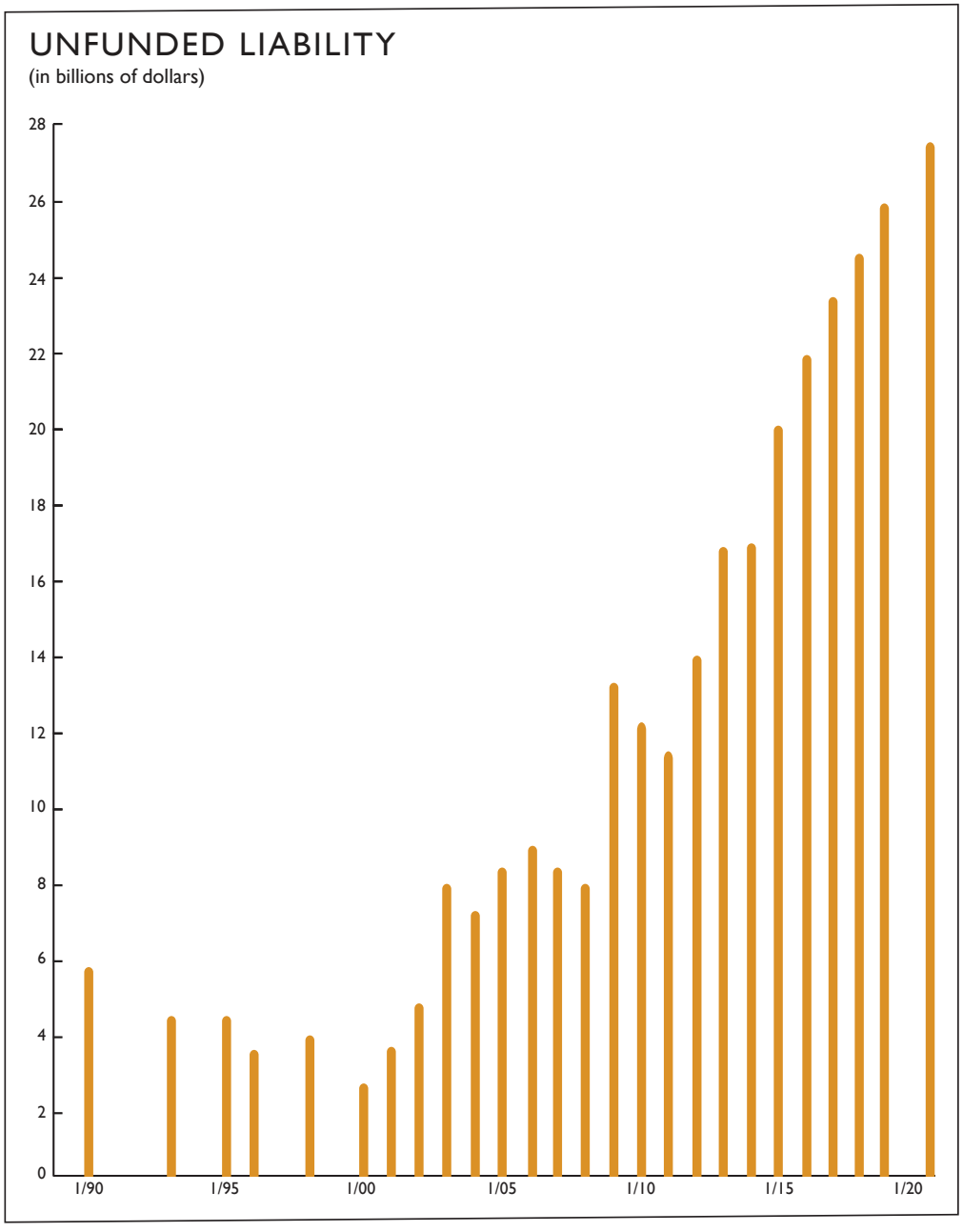
2. EXECUTIVE SUMMARY *(continued)*

C | FUNDING PROGRESS *(continued)*

The chart below compares the Unfunded Actuarial Accrued Liability (UAL) since 1990. The UAL represents the actuarial accrued liability less the actuarial value of plan assets. When there is no UAL, a system is said to be "fully funded". In this exhibit, estimates were developed for years prior to 2000 to reflect our implementation of updated actuarial software at that time.

The UAL is $27.7 billion. On a market value basis the UAL is $25.4 billion.

The UAL increased $1.7 billion since January 1, 2019. The revised assumptions increased the actuarial liability by $1,443 million. If the 2021 valuation reflected the 2019 valuation assumptions and plan provisions, the UAL would be $26.2 billion.



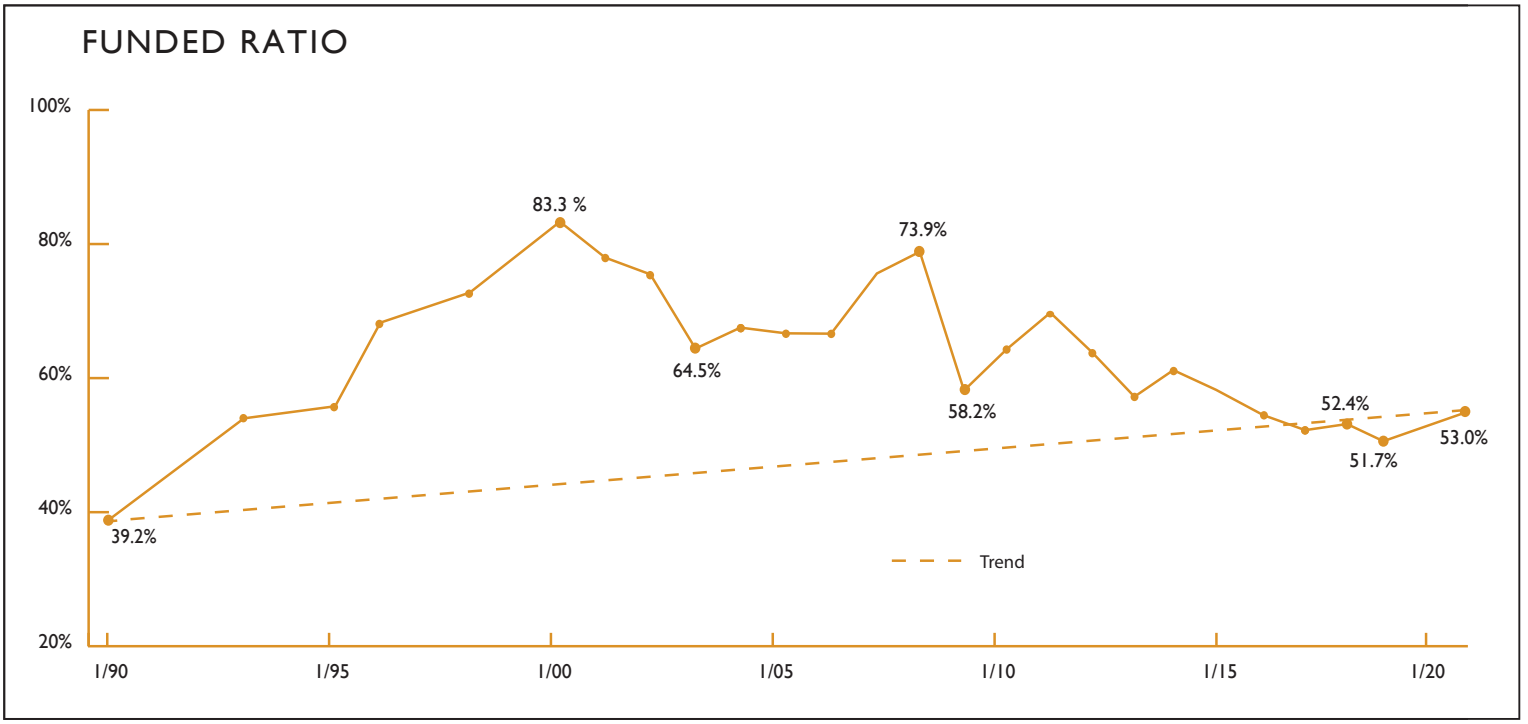
2. EXECUTIVE SUMMARY *(continued)*

C | FUNDING PROGRESS *(continued)*

The chart below shows the Teachers' funded ratio progress since 1990. The funded ratio represents the actuarial value of plan assets divided by the actuarial accrued liability. When the funded ratio reaches 100%, a system is said to be "fully funded". In this exhibit, estimates were developed for years prior to 2000 to reflect our implementation of updated actuarial software at that time.

The funded ratio is 53.0%. On a market value basis the funded ratio is 56.9%.

The funded ratio increased from 51.7% as of January 1, 2019 to 53.0% as of January 1, 2021. The revised assumptions decreased the funded ratio as of January 1, 2021. If the 2021 valuation reflected the 2019 valuation assumptions and plan provisions, the funded ratio would be 54.3%.



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

We previously discussed in detail the impact of assumption and plan provision changes on the Unfunded Actuarial Liability and the Funded Ratio (see pages 7-10).

Investment Return Assumption

The investment return assumption of 7.0% is consistent with our 2021 recommendation. Currently 32 Massachusetts systems use an assumption of 7.0% or lower. We expect the number of systems using 7.0% or lower to increase as more of the 2021 actuarial valuations are completed.

2. EXECUTIVE SUMMARY *(continued)*

D | RISK *(continued)*

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 for over the past 5 years has been 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 appropriations.

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 by FY21. The negative amortization for the Commonwealth schedule extends to FY25.

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%, 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.

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.

2. EXECUTIVE SUMMARY *(continued)*

D | RISK *(continued)*

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									
2011	2012	2013	2014	2015	2016	2017	2018	2019	2021
0.56	0.58	0.59	0.59	0.59	0.58	0.58	0.58	0.57	0.55

The ratios for this system are fairly consistent (slightly increasing then slightly decreasing) indicating 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 2011, this ratio ranged from .33 to .67. In recent valuations this range has increased to .45 to .65. 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, like the TRS, have had fairly consistent ratios and a few have had decreasing ratios. Such systems have already reached and or maintained a more mature level.

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									
2011	2012	2013	2014	2015	2016	2017	2018	2019	2021
6.3	6.5	6.8	6.8	7.1	7.3	7.5	7.6	7.6	7.7

The chart shows gradually increasing rates. For comparison with other PERAC systems, in 2009, this ratio ranged from 4.3 to 7.3. For recent valuations, this range has increased. The ratios currently range from 5.3 to 8.9. Again, the TRS has been consistently within these ranges. These ratios indicate an increased level of risk for the plan.

2. EXECUTIVE SUMMARY *(continued)*

D | RISK *(continued)*

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, 2021 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					
	2021	2022	2023	2024	2025	2026
UAL (in millions)						
7.0%	$25.4	$25.4	$25.2	$24.8	$24.2	$23.3
3.0%	$25.4	$26.7	$28.0	$29.2	$30.3	$31.3
Funded Ratio						
7.0%	56.9%	58.3%	60.0%	61.9%	64.2%	66.7%
3.0%	56.9%	56.1%	55.6%	55.2%	55.1%	55.2%

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 FY26.

This analysis shows that if the fund exactly meets expectations for the next few years and there are no changes to plan assumptions or provisions, the UAL begins decreasing in 2023. 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). Likewise, 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.

3. SUMMARY OF VALUATION RESULTS

(Dollars in thousands)

A. Number of Members	
Active	96,527
Vested Terminated	0
Retired/ Beneficiaries	68,780
Total	165,307
B. Total Payroll	$7,670,306
C. Normal Cost	
Total Normal Cost	$1,123,403
Expected Employee Contributions	786,143
Net Employer Normal Cost	$337,260
Administrative Expenses	$32,800
3(8)(c) Amounts Transferred to Other	7,200
Total Expenses and Transfers	$40,000
Net Normal Cost Plus Expenses & Transfers	$377,260
D. Actuarial Liability	
Total Active	$25,630,238
Vested Terminated (a)	850,000
Non-Vested Terminated	0
Retirees and Survivors	32,349,761
Total Actuarial Liability	$58,829,999
E. Actuarial Value of Assets	31,170,723
F. Unfunded Actuarial Liability	$27,659,276
G. Funded Ratio: E/D	53.0%

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

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

A.	Gain/(Loss) on Actuarial Liability	
1.	Actuarial Liability 1/1/19	53,864
2.	Total Normal Cost 1/1/19	984
3.	Interest on (1) and (2) at 7.25%	3,976
4.	Benefits paid during 2019 [a]	3,075
5.	Interest on (4) assuming mid-year payment	111
6.	Expected Actuarial Liability 1/1/20 before adjustments: (1)+(2)+(3)-(4)-(5)	55,638
7.	Increase due to changes in assumptions	859
8.	Expected Actuarial Liability 1/1/20: (6)+(7)	56,497
9.	Estimated Total Normal Cost 1/1/20 (7.15%)	1,049
10.	Interest on (8) and (9) at 7.15%	4,115
11.	Benefits paid during 2020 [a]	3,175
12.	Interest on (11) at 7.15% assuming mid-year payment	114
13.	Expected Actuarial Liability 1/1/21 before adjustments: (8)+(9)+(10)-(11)-(12)	58,372
14.	Increase due to change in assumptions	584
15.	Expected Actuarial Liability 1/1/21: (13)+(14)	58,956
16.	Actuarial Liability 1/1/21	58,830
17.	Gain/(Loss): (15)-(16)	126

[a] Estimated

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

B.	Gain/(Loss) on assets	
1.	Actuarial Value of Assets (AVA) 1/1/19	27,854
2.	Interest on (1) at 7.25%	2,019
3.	Net Receipts [b]	860
4.	Net Disbursements [b]	1,800
5.	Net Cash Flow: (3)-(4)	(940)
6.	Interest on (5) at 7.25% assuming mid-year payment [c]	(34)
7.	Expected AVA 1/1/20: (1)+(2)+(5)+(6)	28,899
8.	AVA 1/1/20	29,077
9.	Gain/(Loss) during 2019: (8)-(7)	178
10.	Actuarial Vale of Assets (AVA) 1/1/20	29,077
11.	Interest on (10) at 7.15%	2,079
12.	Net receipts [b]	837
13.	Net disbursements [b]	1,757
14.	Net Cash Flow: (12)-(13)	(920)
15.	Interest on (14) at 7.15% assuming mid-year payment [c]	(33)
16.	Expected AVA 1/1/21: (10)+(11)+(14)+(15)	30,203
17.	AVA 1/1/21	31,171
18.	Gain/(Loss) during 2020: (17)-(16)	968
19.	Total Gain/(Loss) on assets: (9)+(18)	1,146
C.	Total Gain/(Loss): (A17)+(B19)	1,271

Figures may not add due to rounding.

[b] Amounts actually received or disbursed by the fund.

[c] Assumes time weighting based on monthly cash flow.

5. ASSETS

A | SUMMARY OF ASSETS

(Dollars in thousands)

Pension Reserve Investment Trust (Teachers' Retirement System)	
Market Value	$33,473,661
Actuarial Value	$31,170,723
Actuarial Value as a Percentage of Market Value	93.1%

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 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. Under our approach for the Commonwealth, the actuarial value cannot be less than 90% nor greater than 110% of the market value.

5. ASSETS *(continued)*

B | DEVELOPMENT OF ACTUARIAL VALUE OF ASSETS

(Dollars in thousands)

A. Development of total investment income including appreciation (in thousands)

	2019	2020
1. Beginning of year market value of assets	27,090,335	30,631,485
2a. Net receipts *	859,990	837,066
b. Net disbursements *	1,800,489	1,756,692
c. Cash flow: (a) – (b)	(940,499)	(919,626)
3. End of year market value of assets	30,631,485	33,473,661
4. Investment income including appreciation: (3) – (1) – (2(c))	4,481,649	3,761,802

B. Expected market value development

1. Beginning of year market value of assets	27,090,335	30,631,485
2. Cash flow (A2(c))	(940,499)	(919,626)
3. Expected return on (1) B1 x 0.0725 for 2019 and B1 x 0.0715 for 2020	1,964,049	2,190,151
4. Expected return on cash flow A2(c) x 0.0725 / 2 for 2019 and A2(c) x 0.0715 / 2 for 2020	(34,093)	(32,877)
5. Expected market value end of year (1)+(2)+(3)+(4)	28,079,792	31,869,134
C. Gain/(Loss) for year: A3-B5	2,551,693	1,604,527

D. Development of Actuarial Value of Assets

1. End of year market value	30,631,485	33,473,661
2a. Asset gain/(loss) in prior year	2,551,693	1,604,527
b. Asset gain/(loss) in 2nd prior year	(2,547,823)	2,551,693
c. Asset gain/(loss) in 3rd prior year	2,537,146	(2,547,823)
d. Asset gain/(loss) in 4th prior year	136,381	2,537,146
3. Unrecognized gain/(loss) .8 x [2a] + .6 x [2b] + .4 x [2c] +.2 x [2d]	1,554,795	2,302,938
4. End of year actuarial value of assets: [1] - [3]	29,076,690	31,170,723
5. Actuarial value / Market value	94.9%	93.1%
6. Adjusted actuarial value: (4) but not less than 90% nor greater than 110% of market value	29,076,690	31,170,723

*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 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 last year's 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 2020 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	96,527
Average Age	43.6
Average Service	13.4
Average Salary	$79,463
Average Annuity Savings Fund Balance	$83,727

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	2,218							2,218
25 - 29	8,115	1,833	1					9,949
30 - 34	4,587	7,021	1,476	2				13,085
35 - 39	2,315	3,583	6,106	1,900	7		1	13,912
40 - 44	1,694	1,772	2,956	5,949	1,545	9	1	13,926
45 - 49	1,203	1,349	1,563	2,998	5,254	1,002	23	13,392
50 - 54	903	1,179	1,587	2,116	3,340	3,193	620	12,938
55 - 59	501	694	1,231	1,818	1,852	1,410	1,985	9,491
60 - 64	208	314	640	1,179	1,425	815	1,117	5,698
65+	48	123	206	387	419	248	487	1,918
Total	21,792	17,868	15,765	16,349	13,842	6,677	4,234	96,527

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	2,218	$106,881,794	$48,188
25 - 29	9,949	$560,284,317	$56,316
30 - 34	13,085	$873,891,932	$66,786
35 - 39	13,912	$1,088,865,171	$78,268
40 - 44	13,926	$1,183,713,687	$85,000
45 - 49	13,392	$1,171,810,337	$87,501
50 - 54	12,938	$1,147,290,519	$88,676
55 - 59	9,491	$850,026,166	$89,561
60 - 64	5,698	$513,485,754	$90,117
65+	1,918	$174,056,629	$90,749
Total	96,527	$7,670,306,306	$79,463

6. SYSTEM MEMBERSHIP *(continued)*

B | RETIREES AND SURVIVORS

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Number of Members	64,282	372	288	3,838	68,780
Average Age	73.5	67.6	72.2	77.1	73.7
Average Annual Benefit	$48,256	$23,815	$45,804	$22,948	$46,702

Benefit by Retirement Type

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Annuity	$627,886,708	$1,777,881	$1,234,625	$15,931,641	$646,830,855
Pension	$2,474,131,919	$7,081,463	$11,956,944	$72,143,253	$2,565,313,579
Total	$3,102,018,627	$8,859,344	$13,191,569	$88,074,894	$3,212,144,434

6. SYSTEM MEMBERSHIP *(continued)*

B | RETIREES & SURVIVORS *(continued)*

Benefit by Age Distribution

Present Age	Number of Members	Total Benefits	Average Benefits
Less than 40	22	$232,979	$10,590
40 – 44	40	$606,670	$15,167
45 – 49	92	$1,435,716	$15,606
50 – 54	225	$4,951,178	$22,005
55 – 59	1,446	$61,864,380	$42,783
60 – 64	5,851	$290,750,543	$49,692
65 – 69	15,022	$768,450,380	$51,155
70 – 74	20,631	$1,039,988,816	$50,409
75 – 79	12,562	$580,250,672	$46,191
80 – 84	6,450	$259,358,501	$40,211
85 – 89	3,950	$137,677,944	$34,855
90+	2,489	$66,576,655	$26,748
Totals	68,780	$3,212,144,434	$46,702

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. The actuarial value of assets as of January 1, 2021 is 93.1% 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.

8. ACTUARIAL ASSUMPTIONS

Investment Return

7.0% per year net of investment expenses (*prior assumption: 7.25%*)

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.

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-2020 (gender distinct). *(Prior assumption reflected RP-2014 White Collar Employees table projected generationally with Scale MP-2016 (gender distinct).)*

Post-retirement mortality reflects SOA Pub-2010 Teachers (headcount) Healthy Retirees table projected generationally with MP-2020 (gender distinct). *(Prior assumption reflected RP-2014 White Collar Healthy Annuitant table projected generationally with Scale MP-2016 (gender distinct).)*

For disabled members, the mortality reflects SOA Pub-2010 Teachers (headcount) Healthy Retirees table projected generationally with MP-2020 (gender distinct). *(Prior assumption reflected RP-2014 White Collar Healthy Annuitant table projected generationally with Scale MP-2016 (gender distinct).)*

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 and Administrative Expenses

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 $980.88 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 $980.88 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.

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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 December 31 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

Governmental Accounting Standards Board

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.

COMMONWEALTH OF MASSACHUSETTS
Public Employee Retirement Administration Commission
Five Middlesex Avenue, Suite 304 | Somerville, MA 02145
Phone: 617-666-4446 | Fax: 617-628-4002
TTY: 617-591-8917 | Web: www.mass.gov/perac