BUCK

The Massachusetts Bay Transportation Authority Retirement Fund

Actuarial Valuation Report

Prepared as of December 31, 2022

May 2023

Table of Contents

Section I - Overview

May 15, 2023

Retirement Board
Massachusetts Bay Transportation Authority Retirement Fund
One Washington Mall, Fourth Floor
Boston, MA 02108

Dear Board Members:

The Pension Agreement covering the Massachusetts Bay Transportation Authority Retirement Fund provides that the actuary make annual actuarial valuations of the Fund and certify rates of contribution to the Retirement Board. Buck has been engaged by the Board of the Retirement Fund to make such annual actuarial valuations of the Fund.

This report presents the results of an actuarial valuation of the Fund, prepared as of December 31, 2022, together with our recommendations regarding the rates of contribution payable beginning July 1, 2023.

Buck prepared this report for use by the Retirement Fund and its auditors in reviewing the operation of the Fund, including the determination of contributions to be made to the Fund. Use of this report by other parties or for any other purpose may not be appropriate and may result in mistaken conclusions due to failure to understand applicable assumptions, methodologies, or the inapplicability of the report for that purpose. Because of the risk of misinterpretation of actuarial results, Buck recommends requesting its advance review of any statement, document, or filing to be based on information contained in this report. Buck will accept no liability for any such statement, document, or filing made without its prior review.

This valuation reflects the funding policy adopted by the Board effective December 31, 2009. The actuarial cost method used is the entry age normal cost method. The amortization of the unfunded liability is made in installments increasing at the rate of four percent per year over a closed 30-year period beginning December 31, 2009.

This valuation is based on the assumptions adopted by the Retirement Board in April 2023, and effective with the December 31, 2022, valuation, on the basis of an experience study covering the period January 1, 2018, through December 31, 2022. Significant assumptions revised due to the experience study include mortality rates, salary increases, termination rates, and retirement rates. We continue to monitor these assumptions through gain/(loss) analysis performed every year.

In April 2020, the Retirement Board adopted an assumed annual rate of return on assets of 7.25%, coincident with a revision of the Fund's investment policy. In the case of the Fund's selection of expected return on assets ("EROA"), the signing actuary used economic information provided by Buck's Investment Consulting and Financial Risk Management practices. Buck's Capital Market Assumptions provide relevant expected returns, standard deviations, and correlations. Projected returns are then developed for the portfolio using the GEMS® Economic Scenario Generator from Conning & Company. This sophisticated model (disclosed here under ASOP 56) uses a multifactor approach to create internally consistent, realistic economic scenarios (paths) for all asset classes that reflect the current economic environment as a starting point. Equity returns include stochastic volatility with jumps ("SVJ") to reflect extreme infrequent events; however, such scenarios do not typically impact the 5th through 95th percentiles. Corporate bond yields are generated by adding credit spreads to the corresponding zero-coupon treasury yield. The credit spread is driven by several factors, including equity returns, and also contains a shock process to allow the model to generate scenarios like the 2008 Financial Crisis. GEMS® does not, however, model specific risks such as war, pandemics, political risks, severe economic dislocations occurring with greater frequency or severity than predicted by the model, or the risk that relationships among macroeconomic variables may be different than in the past.

From these scenarios, a probabilistic model of expected returns is created reflecting the duration (horizon) of investment and the approximate allocation of assets in the portfolio to various asset classes. Under current calibrations, GEMS® will tend to show higher expected returns for longer durations, and will show a greater divergence between arithmetic and geometric average returns the higher the standard deviation of portfolio return.

Based on the actuary's analysis, including consistency with other assumptions used in the valuation, along with discussions with Buck's investment consultants, and the percentiles generated by the GEMS® model, the actuary believes the EROA does not significantly conflict with what, in the actuary's professional judgment, is reasonable for the purpose of the measurement.

Effective with the December 31, 2021, valuation, participants who have been receiving Workers' Compensation benefits for five or more years are assumed to receive a refund of their contributions to the Fund with interest in lieu of a pension benefit. In addition, participants who are active but did not contribute to the plan in the prior year are assumed to remain non-contributing and to receive only a refund of their contributions to the Fund with interest.

We performed the valuation using participant data and Fund asset data supplied by the Retirement Fund. Although we did not audit the data, we reviewed the data for reasonableness and consistency with prior years' information. The accuracy of the results of the valuation is dependent on the accuracy of the data.

Actuarial Standard of Practice No. 56 ("ASOP 56") provides guidance to actuaries when performing actuarial services with respect to designing, developing, selecting, modifying, using, reviewing, or evaluating models. Buck uses third-party software in the performance of annual actuarial valuations and projections. The model is intended to calculate the liabilities associated with the provisions of the plan using data and assumptions as of the measurement date under the funding methods specified in this report. The output from the third-party vendor software is used as input to an internally developed model that applies applicable funding methods and policies to the liabilities derived and other inputs, such as plan assets and contributions, to generate many of the exhibits found in this report. Buck has an extensive review process whereby the results of the liability calculations are checked using detailed sample output, changes from year to year are summarized by source, and significant deviations from expectations are investigated. Other funding outputs and the internal model are similarly reviewed in detail and at a high level for accuracy, reasonability, and consistency with prior results. Buck also reviews the third-party model when significant changes are made to the software. The review is performed by experts within the company who are familiar with applicable funding methods as well as the manner in which the model generates its output. If significant changes are made to the internal model, extra checking and review are completed. Significant changes to the internal model that are applicable to multiple clients are generally developed, checked, and reviewed by multiple experts within the company who are familiar with the details of the required changes.

Future actuarial measurements may differ significantly from current measurements due to Fund experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in Fund provisions or applicable law. An analysis of the potential range of such future differences is beyond the scope of this valuation. However, in accordance with the requirements of Actuarial Standard of Practice No. 51 (“ASOP 51”), a risk assessment for the Fund is presented in Section X of this report.

Where presented, the “funded ratio” and “unfunded accrued liability” are typically measured using the actuarial value of assets. It should be noted that recomputation of these measurements using the market value of assets would result in different funded ratios and unfunded accrued liabilities. Moreover, the funded ratio presented is appropriate for evaluating the need for, and level of, future contributions but does not provide a basis for assessing what the funded status of the Fund would be if the Fund were to settle (i.e., purchase annuities to cover) a portion or all of its liabilities.

I am a Fellow of the Society of Actuaries and a Member of the American Academy of Actuaries. I meet the Qualification Standards of the Academy to render the actuarial opinions contained in this report. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and I am available to answer questions about it.

Buck Global, LLC (Buck)

David L. Driscoll

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

Section II - Summary of Principal Results

1. The principal results of the current and preceding years' valuations are summarized below:

Valuation Date	December 31, 2021	December 31, 2022
Number of active members	5,486	5,555
Annual compensation of all members	$ 458,857,189	$ 496,467,531
Annual compensation of active members below normal retirement age	$ 454,984,547	$ 492,169,885
Average age (years)	48.46	48.42
Average service (years)	11.12	10.86
Average compensation	$ 83,641	$ 89,373
Number of active members not accumulating creditable service	215	307
Number of retired members, beneficiaries and disabled members	6,738[1]	6,783[2]
Annual retirement allowances	$ 225,623,892[3]	$ 232,067,261[4]
Assets for funding purposes	$ 1,760,643,571	$ 1,799,924,778
Unfunded accrued liability	$ 1,341,060,444	$ 1,367,546,343
Contribution rates required:		
Normal	12.1200%	12.6400%
Accrued liability	21.7500%	21.4100%
Expenses	1.0000%	1.0000%
Total required rate	34.8700%	35.0500%
Member excess rate	0.0000%	0.0000%
Actual contribution rate during following fiscal year	34.8700%	35.0500%

2. Valuation results as of December 31, 2022, are given in Section VI, and contribution levels are set forth in Section VII.
3. Schedule B of this report outlines the actuarial assumptions and methods used in the valuation. The actuarial assumptions were selected on the basis of an experience study covering the five-year period ending December 31, 2022. The Retirement Board voted to adopt these assumptions in April 2023.
4. Schedule C of this report presents a summary of the main provisions of the Fund, as interpreted in preparing the actuarial valuation.

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[1] Includes 6,572 retirees and beneficiaries, 25 individuals receiving worker's compensation for over 5 years, and 141 individuals receiving payments under QDROs.

[2] Includes 6,614 retirees and beneficiaries, 24 individuals receiving worker's compensation for over 5 years, and 145 individuals receiving payments under QDROs.

[3] Excludes 25 individuals receiving worker's compensation for over 5 years.

[4] Excludes 24 individuals receiving worker's compensation for over 5 years.

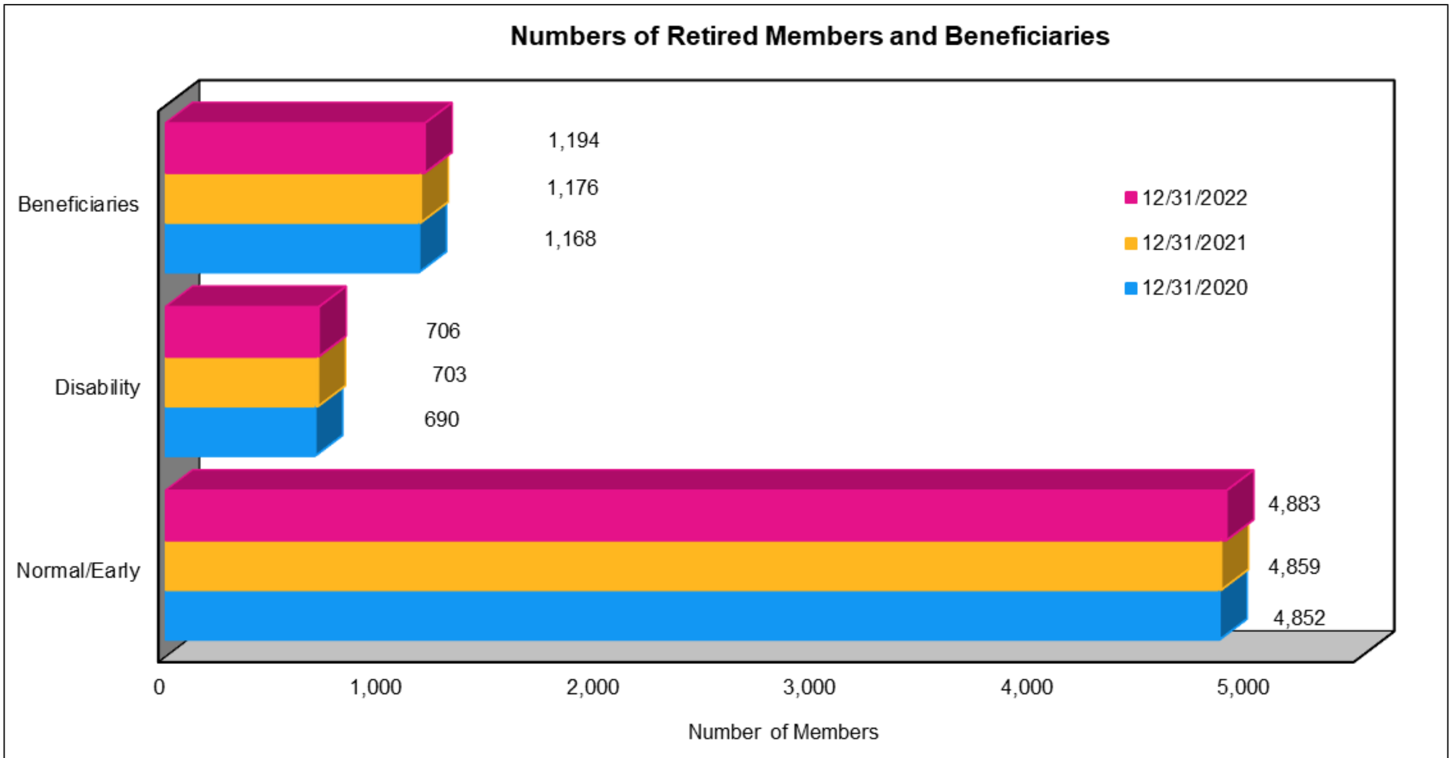
Section III - Membership Data

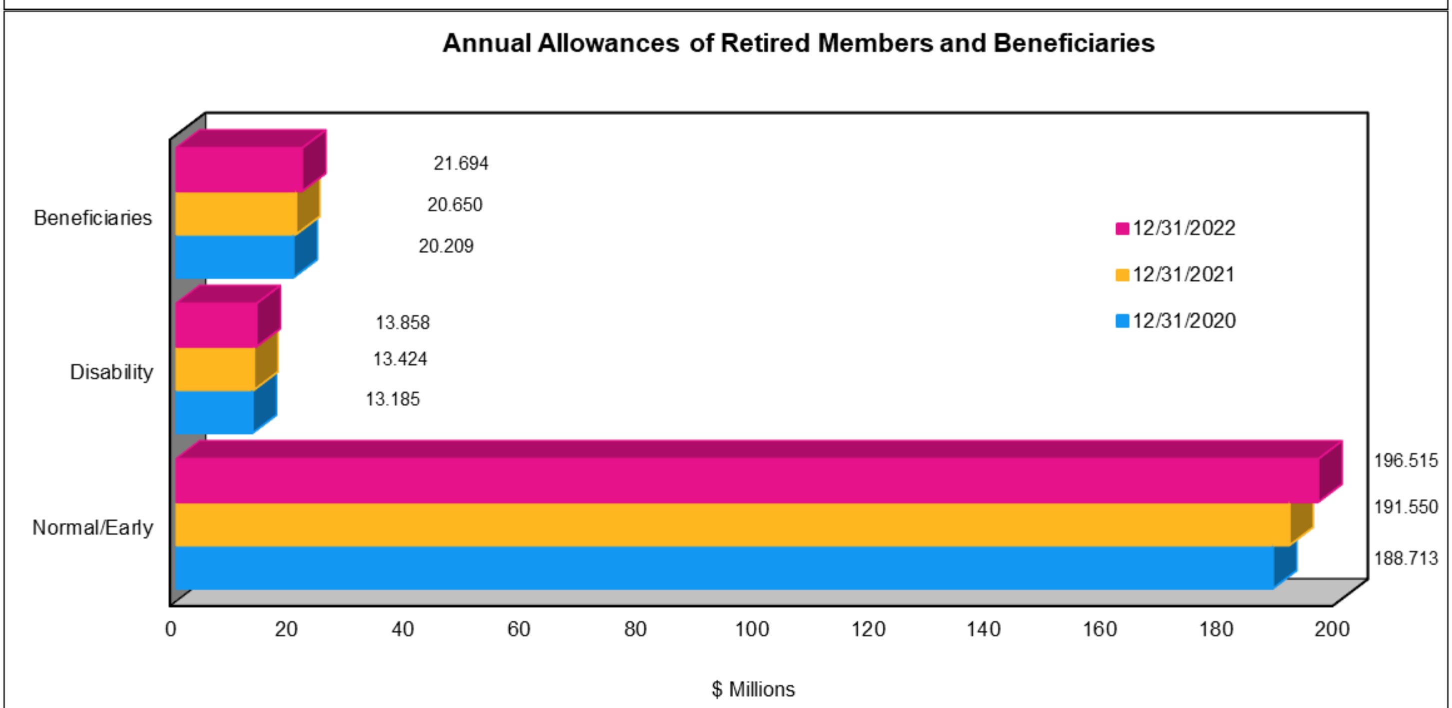
1. Employee data were furnished by the Authority and Retirement Fund.
2. Table 1 of Schedule D shows the number and annual compensation of active members, while Table 2 of Schedule D shows the number and annual retirement allowances of retired members, disabled members and beneficiaries.
3. The following table summarizes the number and annual retirement allowances of retired members, disabled members and beneficiaries as of December 31, 2022:

Category	Number	Annual Retirement Allowances
Benefits to Members Retired on Normal, Early Normal and Reduced Early Retirement Allowances	4,883	$ 196,514,835
Benefits to Members Retired on Disability Retirement Allowances	706[1]	13,857,982[2]
Benefits to Beneficiaries of Deceased Members[3]	1,194	21,694,444
Total	6,783	$ 232,067,261

[1] Includes 24 individuals receiving worker's compensation for over 5 years.
[2] Excludes 24 individuals receiving worker's compensation for over 5 years.
[3] Includes 145 individuals receiving payments under QDROs.

Section III - Membership Data (continued)[1]





[1] Disability counts include individuals receiving worker's compensation for over 5 years, and disability allowances exclude individuals receiving worker's compensation for over 5 years.

Section IV - Assets

1. Asset information was obtained from the Retirement Fund office.
2. The market value of the Fund's net assets available for benefits as of December 31, 2022, amounted to $1,622,548,978.
3. The asset valuation method is a five-year phase-in smoothing method under which the value of assets for actuarial purposes equals market value adjusted for a five-year phase-in of the differences between actual and assumed investment return. The value of assets for actuarial purposes may not differ from the market value of assets by more than 20%. The smoothing method used to calculate the value of assets for actuarial purposes was restarted as of December 31, 2013, coincident with the change to the present method.
4. The calculation of the actuarial value of assets as of December 31, 2022, is presented below:

Market value as of December 31, 2022		1,622,548,978	(A)

Adjustment to recognize asset gains (losses) over 5 years:

Year Ending	Asset gain (loss)	X	Adjustment factor	=	Adjustment	
12/31/2022	(395,720,797)		0.80		(316,576,637)	
12/31/2021	106,359,393		0.60		63,815,636	
12/31/2020	114,287,041		0.40		45,714,817	
12/31/2019	148,351,928		0.20		29,670,386	
Total					(177,375,800)	(B)

Actuarial value of assets, as of December 31, 2022	1,799,924,778	
<u>Asset gain during fiscal year ending December 31, 2022</u>		
Actual return on market value and cash flow		
Income from investments and securities lending	27,428,499	
Net appreciation	(279,781,753)	
Total	(252,353,254)	(C)
Expected 7.25% return on market value and cash flow	143,367,543	(D)
Asset gain (loss) (C) – (D)	(395,720,797)	

The assets for valuation purposes are 110.90% of market value.

5. As of December 31, 2007, members' excess contributions (as discussed in Section V) had been fully depleted to cover the cost of the one-time cost-of-living increases negotiated in collective bargaining related to the benefits provided under the Fund. The actuarial asset value derived above thus requires no additional adjustment for members' excess contributions.

Section V – Member Excess Contributions

1. Effective July 1, 1998, in lieu of a reduction in the 4% contribution rate, members continued to make contributions equal to 4% of covered payroll.
2. To the extent that 4.00% exceeds the actuarially determined member required contribution rate, the excess is characterized as member excess contributions. These amounts are to be accumulated within the Retirement Fund and used to provide additional benefits.
3. The member excess rates developed in prior years are as follows:

Period	Excess Rate	Period	Excess Rate
July 1, 2008 – June 30, 2009	0.00000%	July 1, 2015 – June 30, 2016	0.00000%
July 1, 2009 – June 30, 2010	0.00000%	July 1, 2016 – June 30, 2017	0.00000%
July 1, 2010 – June 30, 2011	0.00000%	July 1, 2017 – June 30, 2018	0.00000%
July 1, 2011 – June 30, 2012	0.00000%	July 1, 2018 – June 30, 2019	0.00000%
July 1, 2012 – June 30, 2013	0.00000%	July 1, 2019 – June 30, 2020	0.00000%
July 1, 2013 – June 30, 2014	0.00000%	July 1, 2020 – June 30, 2021	0.00000%
July 1, 2014 – June 30, 2015	0.00000%	July 1, 2021 – June 30, 2022	0.00000%

4. As of December 31, 2007, members' excess contributions accumulated in prior years had been fully depleted.
5. The member excess rate for the period July 1, 2022 - June 30, 2023 is derived as follows:

a.	Effective prior member excess rate (December 31, 2021)	-4.7089%
b.	Decrease in total required contribution rate from prior valuation (see Section VII)	-0.18%
c.	Current member excess rate (July 1, 2022) ((a.) + 25% of (b.))	-4.7539%

6. The accumulated value of the excess contributions as of December 31, 2022 is $0.

Section VI – Comments on Valuation

1. Schedule A of this report presents the results of the valuation as of December 31, 2022.
2. The total entry age normal accrued liability on account of benefits expected to be paid to present retired members, former members, beneficiaries, active and inactive members is $3,167,471,121**.** Of this amount, $2,143,395,353 is on account of retired members and beneficiaries, $1,014,935,574 is on account of present active members and $9,140,194 is on account of active members not accumulating creditable service.
3. The value of Fund assets to be used in developing required contributions to the Fund is $1,799,924,778, including required contributions made by active members. When $1,799,924,778 is subtracted from $3,167,471,121, there remains $1,367,546,343, which represents the unfunded actuarial accrued liability of the Fund.
4. Amortization of the unfunded liability over the remaining 17 years in the amortization period as of December 31, 2022, in annual installments rising at the rate of 4% per year produces an amortization installment of $105,361,014 as of December 31, 2022. This amounts to 21.41% of the value of annual compensation of active members below normal retirement age on that date.
5. The total entry age normal cost at December 31, 2022, is $62,188,799, or 12.64% of the annual compensation of active members below normal retirement age on that date.
6. In addition to the amounts needed to cover amortization of the unfunded liability and normal cost, an allowance of 1.00% of annual compensation of active members below normal retirement age is included in the total required contribution to cover expected administrative expenses. Under the current funding policy of fully covering the actuarially determined contribution, and assuming there are no future experience gains or losses, future expected Fund contributions are expected to remain relatively level as a percent of payroll for 17 years and remain relatively level as a percent of payroll thereafter at the normal cost rate, and the funded status is expected to increase to 100% after 17 years.
7. During 2022, the unfunded actuarial accrued liability increased $26.4 million, from $1,341.1 million to $1,367.5 million. The expected unfunded actuarial accrued liability at December 31, 2022, was $1,315.6 million. The $51.9 million difference consists of a $30.7 million loss in 2022 of returns on the actuarial value of assets and $21.2 million in increased accrued liability due to unfavorable demographic experience, assumption changes due to the experience study, and contribution rate changes. Additional detail is provided in Section IX.

Section VII – Contributions to the Fund

1. Effective December 31, 2009, the contributions by members and the Authority are to provide normal contributions, amortization of the unfunded accrued liability and administrative expenses. It is assumed that investment earnings will be sufficient to cover fiduciary and investment expenses and, in addition, provide the yield assumed for actuarial purposes.

2. The valuation indicates that 12.64% of compensation is required to cover normal cost and 21.41% of compensation is required to cover amortization of the unfunded accrued liability. Adding 1.00% of compensation for anticipated administrative expenses, excluding fiduciary and other investment expenses, results in a total contribution rate of 35.05% of compensation to be paid by the Authority and the members of the Retirement Fund from July 1, 2023, through June 30, 2024.

3. This rate is 0.18% more than the 34.87% rate developed in the December 31, 2021, valuation. Under the adjustment formula contained in the July 1, 2002, Pension Agreement, 75% of the change will be allocated to the Authority as a change in the contribution rate and 25% will be allocated to the member's required contribution rate. This results in the following rates payable during the year beginning July 1, 2023:

Authority	25.9511%
Members' required	9.0989%[1]
Subtotal (Section II)	35.0500%
Members' excess (Section V)	0.0000%
Total	35.0500%

[1] The actual rate in effect as of July 1, 2023, will be 125 basis points higher, as specified in the new pension agreement.

Section VIII – Statement No. 25 of the Governmental Accounting Standards Board

1. Statement No. 25 of the Governmental Accounting Standards Board has been superseded by Statement No. 67. Required reporting for the Retirement Fund under Statement No. 67 will be covered in a separate report. The information below is shown nonetheless for informational purposes.
2. The following schedule shows funding progress information that would have been required by Statement No. 25 as of December 31, 2022:

Schedule of Funding Progress (,000's)[1]

Year Ending December 31	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) (b)	Unfunded AAL (UAAL) (b-a)	Funded Ratio (a/b)	Covered Payroll (c)	UAAL as a Percentage Covered Payroll ((b-a)/c)
2022	1,799,925	3,167,471	1,367,546	56.83%	492,170	277.86%
2021	1,760,644	3,101,704	1,341,060	56.76%	454,985	294.75%
2020	1,636,054	3,055,123	1,419,069	53.55%	456,930	310.57%
2019	1,561,193	3,021,110	1,459,918	51.68%	433,577	336.72%
2018	1,559,453	2,916,800	1,357,348	53.46%	423,075	320.83%
2017	1,599,505	2,829,386	1,229,881	56.53%	425,658	288.94%
2016	1,607,560	2,694,556	1,086,996	59.66%	444,455	244.57%

[1] Some numbers in the table do not add up due to rounding.

Section IX – Experience

Records are maintained in which the actual experience of active and retired members is compared to that expected on the basis of the tables adopted by the Retirement Board. In this way, deviations in the experience from that anticipated will be noted and any adjustments believed necessary will be brought to the attention of the Retirement Board in future experience studies.

During the last year, the total unfunded actuarial accrued liability (UAL) was expected to decrease from $1,341,060,444 to $1,315,603,383. The actual UAL at the end of the year was $1,367,546,343. The chart below reconciles the expected to actual UAL. The primary sources of changes were a $66,725,664 increase in the accrued liability resulting from unfavorable demographic experience in 2022 and returns on assets measured at actuarial value that were $30,694,315 below expected levels in 2022.

The sources of the (Gains)/Losses are shown below:

Actual UAL as of December 31, 2021		$ 1,341,060,444
Expected UAL (Prior to Changes) as of December 31, 2022		$ 1,315,603,383
Salary Increases	$ 43,739,664	
New Participants	1,276,703	
Active – Retirements	16,995,018	
Active – Terminations	2,241,210	
Active – Mortality	726,625	
Active – Disabilities	(1,211,122)	
Retiree Mortality	(6,065,341)	
Other (Data Corrections, etc.)	9,022,907	
Liability (Gain)/Loss – Demographic Experience		$ 66,725,664
Change in Accrued Liability Due to Contribution Rate Changes		$ 22,281
Change in Accrued Liability Due to Assumption Changes		$ (45,499,300)
Total of Liability (Gain)/Loss and effects of changes in assumptions and Contribution rates		$ 21,248,645
Investment (Gain)/Loss		$ 30,694,315
Total Change in UAL		$ 51,942,960
Actual UAL as of December 31, 2022		$ 1,367,546,343

Section X – ASOP 51

Actuarial Standard of Practice No. 51 (“ASOP 51”) Disclosures

Funding future retirement benefits before they become due requires assumptions regarding future economic and demographic experience. These assumptions are applied to calculate actuarial liabilities and the corresponding funded status of the Fund. However, to the extent future experience deviates from the assumptions used, variations will occur in these calculated values. These variations create risk to the Fund. Understanding the risks to the funding of the Fund is important.

Actuarial Standard of Practice No. 51 (“ASOP 51”) requires certain disclosures of potential risks to the Fund and the provision of useful information for intended users of actuarial reports who determine Fund contributions or evaluate the adequacy of specified contribution levels to support benefit provisions. While its status as a governmental pension plan (as defined in the Internal Revenue Code) exempts it from the funding provisions of ERISA, the Massachusetts Bay Transportation Authority Retirement Fund uses the information presented to assist in making decisions regarding contribution levels.

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

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

In the actuary’s professional judgment, the following risks may reasonably be anticipated to significantly affect the Fund’s future financial condition.

- Investment risk – the risk that assets will not earn the expected rate of return
- Interest rate risk – the risk that the general level of interest rates will increase or decrease significantly from current levels
- Asset liability mismatch - Potential that changes in asset values are not matched by changes in the value of liabilities
- Longevity and other demographic risk – the risk that mortality or other demographic experience will be different from expected

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

Note that ASOP 51 does not require the actuary to evaluate the ability or willingness of the sponsor of a pension plan to make contributions to the plan. In addition, this valuation report in not intended to provide investment advice or guidance on managing or reducing risk. Buck welcomes the opportunity to assist with such matters as part of a separate project or projects utilizing the appropriate staff and resources for those objectives.

Section X – ASOP 51 (continued)

Assessment of Risks

- Investment return: Lower assets mean higher unfunded liability and larger contribution amounts. For example, if returns on assets at market value were an additional 1% lower than actual, this would reduce the actuarial value of assets by approximately $3.8 million, which would increase the 2022 Authority contribution rate by 0.045% and the member contribution rate by 0.015%.

- Interest rate risk: Actuarial liabilities contained in this report are based on the assumption that interest rates will remain at current levels throughout the forecast period. These interest rates are used to discount future expected benefit payments to determine the Fund liability. As interest rates increase, the discounted value of future benefit payments will decrease; similarly, as interest rates decrease, the discounted value of future benefit payments will increase. The duration of the Fund's liability is approximately nine years, which means that every 100-basis point change in interest rates will result in roughly a 9% change in Fund liability.

- Asset liability mismatch: Unless assets are explicitly structured to mimic the characteristics of Fund liabilities, there is a risk that economic scenarios that affect interest rates will have a larger impact on liability than on assets. This is because Fund liability is the discounted value of benefit payments that extend way out into future years, i.e., have a long duration. Fund investments, on the other hand, typically have a shorter duration with respect to interest rate changes, often holding fixed income securities with lower durations than Fund liabilities, and typically maintaining some monies in equity investments that are not as directly sensitive to interest rate changes.

- Longevity and other demographic risk: The Fund is subject to longevity risk, the risk that participants will live longer (or shorter) than expected. The most recent experience study showed that actual mortality experience had tracked closely to the current mortality assumption as determined by the experience study completed in 2023.

In addition, the Fund is subject to risks associated with assumptions with respect to active and deferred vested participants (for example, salary increases, termination prior to retirement, retirement, and optional form election). The current assumptions for these decrements are based on the experience study completed in 2023. Changes in future liabilities will result to the extent actual experience differs from these assumptions. In particular, higher than expected salary increases (including base pay plus short-term incentives) would increase actuarial liabilities. Further, due to the subsidized early retirement reductions for certain groups, retirements earlier than expected could increase liabilities.

Section X – ASOP 51 (continued)

Historical Results

The following table shows selected historical values of key valuation measures. These items illustrate how actual volatility has impacted the Fund in recent years and gives additional context to the risks described above. Further information can be found in the actuarial valuation reports for each year.

	12/31/2018	12/31/2019	12/31/2020	12/31/2021	12/31/2022
Actuarial Value of Assets (AVA)	$1.56B	$1.56B	$1.64B	$1.76B	$1.80B
Asset Return on MV in Prior Year	(3.37)%	17.67%	14.22%	13.23%	(9.26)%
Investment gain/(loss) on AVA	$(59M)	$(28M)	$33M	$66M	$(31M)
Actuarial Accrued Liability	$2.91B	$3.02B	$3.06B	$3.10B	$3.17B
The ratio of retired life* actuarial accrued liability to total actuarial accrued liability	72%	71%	69%	69%	68%
The ratio of benefit payments to actuarial value of assets	14%	14%	14%	13%	13%
The ratio of actuarial value of assets to participant payroll	367%	357%	355%	384%	363%
Normal cost	$48M	$52M	$55M	$55M	$62M
Discount rate	7.50%	7.25%	7.25%	7.25%	7.25%
Non-Investment gain/(loss)	$(10M)	$4M	$8M	$1M	$(67M)
Funding Policy contribution	$144M	$156M	$161M	$159M	$172M

* Retired members, former members and beneficiaries

Commentary on Fund Maturity Measures

The ratio of retired life actuarial accrued liability to total actuarial accrued liability

A mature pension plan will often have a ratio above 60 - 65 percent. A higher percentage will generally indicate an increased need for asset / liability matching due to inability to accept volatility in future returns.

The ratio of benefit payments to actuarial value of assets

Higher benefit payments as a percentage of assets means the fund may need to invest in more liquid assets to cover the benefit payments. More liquid assets may not garner the same returns as less liquid assets and therefore increase the investment risk. However, there may already be enough liquid assets to cover the benefit payments, less investment return is needed to cover the shortfall, or only a small portion of assets will need to be converted to cash. Therefore, the investment risk is likely not amplified at this time. This maturity measure should be monitored for continual upward trend with greater magnitude.

The ratio of actuarial value of assets to participant payroll

Plans that have higher asset-to-payroll ratios experience *more* volatile employer contributions (as a percentage of payroll) due to investment return. For example, if lower than expected asset return increases the unfunded liability of two pension plans by the same percentage, the plan with the higher assets-to-payroll ratio may experience higher contribution volatility than a plan with the lower asset-to-payroll ratio.

Section XI – Alternative Scenarios

What if Active Headcount Remained at its 12/31/2016 Level?

		12/31/2022 Valuation (A)	More Active Employees (B)
1.	Normal Cost Rate	12.64%	12.64%
2.	Expenses	1.00%	1.00%
3.	Amortization	$105,361,014	$105,361,014
4.	Active Employees 12/31/2022	NA	5,555
5.	Active Employees 12/31/2016	NA	5,786
6.	New Entrant Salary	NA	$65,000
7.	Payroll (7.A+6.x(5.-4.))	$492,169,885	$507,184,885
8.	Accrued Liability Amortization Rate (3./7.)	21.41%	20.77%
9.	Total Contribution (1.+ 2.+ 8.)	35.05%	34.41%
10.	Member Contribution	9.0989%	8.9387%

- In column B, we have assumed the employees who have terminated from 12/31/2016 to 12/31/2022 were replaced by new hires
- The normal cost rate would change with addition of new employees. For the purpose of this illustration, we have assumed the change in normal cost rate is not significant
- Member contribution is calculated as (34.41%-34.87%)*25%+9.0539%=8.9387%

Section XI – Alternative Scenarios (continued)

Contribution as a % of Pay Under Alternative Funding Policies

The current funding policy contribution rates were determined by amortizing the unfunded liability over an 17-year period ending in 2040 in installments escalating at the rate of 4% per year. The table below presents calculations of what the contribution rates developed in this valuation would be if the Fund were to change its current funding policy with respect to the amortization of the unfunded liability.

Amort.	**Escalator % per year**									
(years)	0%		1%		2%		3%		4%	
	Authority	Member	Authority	Member	Authority	Member	Authority	Member	Authority	Member
10	38.87%	13.41%	37.76%	13.03%	36.67%	12.67%	35.61%	12.32%	34.58%	11.98%
11	37.07%	12.80%	35.91%	12.42%	34.79%	12.05%	33.71%	11.69%	32.67%	11.34%
12	35.57%	12.30%	34.39%	11.91%	33.24%	11.53%	32.14%	11.16%	31.07%	10.81%
13	34.31%	11.89%	33.11%	11.48%	31.94%	11.09%	30.81%	10.72%	29.73%	10.36%
14	33.25%	11.53%	32.01%	11.12%	30.83%	10.72%	29.68%	10.34%	28.58%	9.97%
15	32.34%	11.23%	31.08%	10.81%	29.87%	10.40%	28.70%	10.02%	27.59%	9.64%
16	31.55%	10.96%	30.26%	10.54%	29.03%	10.13%	27.85%	9.73%	26.72%	9.35%
17	30.86%	10.74%	29.56%	10.30%	28.30%	9.88%	27.10%	9.48%	25.95%	9.10%

- The “Years” on the left side denote the years over which the unfunded liability is amortized
- Dollar amounts shown are expressed in $millions
- Percentages of payroll shown represent total contributions developed as a % of pay
- The red circle represents current funding policy

Section XI – Alternative Scenarios (continued)

2022 Amortization under Alternative Funding Policies

The table below presents calculations of what the contribution for amortization of the unfunded liability developed in this valuation would be if the Fund were to change its current funding policy with respect to the amortization of the unfunded liability

Amort. (years)	Escalator % per year				
	0%	1%	2%	3%	4%
10	$190.19	$182.83	$175.68	$168.75	$162.03
11	$178.30	$170.74	$163.41	$156.32	$149.46
12	$168.48	$160.73	$153.23	$145.99	$139.00
13	$160.25	$152.32	$144.66	$137.28	$130.17
14	$153.27	$145.16	$137.35	$129.84	$122.61
15	$147.28	$139.02	$131.06	$123.41	$116.08
16	$142.11	$133.68	$125.58	$117.82	$110.38
17	$137.61	$129.02	$120.79	$112.90	$105.36

- The “Years” on the left side denote the years over which the unfunded liability is amortized
- Dollar amounts shown are expressed in $ millions
- Percentages of payroll shown represent total contributions developed as a % of pay
- The red circle represents current funding policy

Schedule A – Results of the Valuation as of December 31, 2022

1.	Present Value of Future Benefits	
(a)	Present value of prospective benefits to retired members, former members and beneficiaries	$ 2,143,395,353
(b)	Present value of prospective retirement allowances on account of present active members	1,540,158,552
(c)	Present value of prospective retirement allowances or return of members' contributions for members not accumulating creditable service	9,140,194
(d)	Total actuarial liabilities	$ 3,692,694,099
2.	Assets of the Fund for purposes of development of contributions	$ 1,799,924,778
3.	Present value of future contributions to the fund (1(d)-2)	$ 1,892,769,321
4.	Present value of future normal contributions to the Fund[1]	$ 525,222,978
5.	Unfunded accrued liability (3) - (4)	$ 1,367,546,343

[1] Includes future contributions of members at the rate developed in Section VII.

Schedule B – Outline of Actuarial Assumptions and Methods

In 2023, an Experience study was conducted based on the experience from January 1, 2018 to December 31, 2022. Based on the experience study, Buck proposed assumptions for mortality tables, salary increases, termination rates, and retirement rates. All proposed assumptions were approved by the Retirement Board in April 2023.

Data

The rate of pay was used for the 2022 valuation (projected 2023 pensionable earnings). Starting with the 2021 valuation, participants who have been receiving Workers' Compensation benefits for 5 or more years are assumed to never commence their Massachusetts Bay Transportation Authority Retirement Fund pension benefit, but are assumed to receive a refund of their contributions to the Fund with interest. In addition, participants who are active but did not contribute to the plan in 2022, are assumed to remain non-contributing for the remainder of their employment.

Interest rate for funding purposes

7.25% per annum, compounded annually, in addition to fiduciary and investment management expenses.

Separations from active service

Representative values of the assumed rates of withdrawal and reduced early retirement and disability are as follows:

Current Year:

	Withdrawal[1]					
Age/Service	0	1	2	3	4	5+
25	6.59%	6.31%	6.62%	4.62%	4.16%	5.73%
30	6.59%	6.31%	6.62%	4.62%	4.16%	6.25%
35	6.59%	6.31%	6.62%	4.62%	4.16%	3.17%
40	6.59%	6.31%	6.62%	4.62%	4.16%	2.73%
45	6.59%	6.31%	6.62%	4.62%	4.16%	2.19%
50	6.59%	6.31%	6.62%	4.62%	4.16%	1.68%
55	6.59%	6.31%	6.62%	4.62%	4.16%	2.33%
60	6.59%	6.31%	6.62%	4.62%	4.16%	2.72%
>64	6.59%	6.31%	6.62%	4.62%	4.16%	3.65%

Age	Disability Male[2]	Disability – Female[2]
20	0.07%	0.11%
25	0.08%	0.12%
30	0.10%	0.15%
35	0.13%	0.20%
40	0.17%	0.26%
45	0.15%	0.38%
50	0.25%	0.44%
55	0.46%	0.80%
60	0.90%	1.58%
64	1.68%	2.94%

[1] 100% of future terminated members not eligible for a retirement allowance are assumed to receive a refund of their accumulated employee contributions.

[2] 50% of disabled employees are assumed to qualify for occupational disability benefits.

Schedule B – Outline of Actuarial Assumptions and Methods (continued)

Separations from active service (continued)

Prior year:

Age	Withdrawal[1]
20-24	4.78%
25-29	7.12%
30-34	0.40%
35-39	3.48%
40-44	3.13%
45-49	2.87%
50-54	2.51%
55-59	2.82%
60-64	4.24%

Age	Disability Male[2]	Disability – Female[2]
20	0.07%	0.11%
25	0.08%	0.12%
30	0.10%	0.15%
35	0.13%	0.20%
40	0.17%	0.26%
45	0.15%	0.38%
50	0.25%	0.44%
55	0.46%	0.80%
60	0.90%	1.58%
64	1.68%	2.94%

Salary increases

Current year:

Service	Salary Increase %
0	14.00%
1	13.00%
2	12.00%
3	11.00%
4	10.00%
5-9	4.00%
10-14	3.00%
15+	2.75%

Prior year:

Service	Salary Increase %
0-4	8.00%
5-9	4.00%
10-14	3.00%
15-19	2.75%
20-24	2.75%
25-29	2.75%
30-34	2.75%
35-39	2.75%
40+	2.75%

[1] 100% of future terminated members not eligible for a retirement allowance are assumed to receive a refund of their accumulated employee contributions.

[2] 50% of disabled employees are assumed to qualify for occupational disability benefits.

Schedule B – Outline of Actuarial Assumptions and Methods (continued)

Unreduced retirement rates

Representative rates of unreduced early normal retirement allowances are as follows:

Current Year:

	Unreduced Retirement		
Age	In the year attaining eligibility	In years after first eligibility	Reduced Retirement
42	39.0%	5.8%	N/A
43	42.0%	5.8%	N/A
44	27.1%	32.3%	N/A
45	30.0%	24.3%	N/A
46	28.7%	17.3%	N/A
47	36.5%	18.1%	N/A
48	24.9%	14.1%	N/A
49	30.2%	15.9%	N/A
50	33.3%	14.7%	N/A
51	37.0%	21.2%	N/A
52	31.7%	15.6%	N/A
53	35.0%	17.0%	N/A
54	28.3%	15.4%	N/A
55	28.6%	15.3%	3.4%
56	30.5%	14.6%	3.7%
57	33.3%	14.8%	4.6%
58	26.7%	23.2%	4.3%
59	31.2%	23.2%	3.8%
60	25.6%	22.3%	5.3%
61	35.5%	20.6%	5.2%
62	40.0%	26.0%	9.7%
63	59.3%	27.8%	11.7%
64	52.9%	18.8%	15.8%
65	30.9%	30.4%	N/A
66	30.9%	27.8%	N/A
67	30.9%	23.9%	N/A
68	30.9%	20.6%	N/A
69	30.9%	26.6%	N/A
70+	100.0%	100.0%	N/A

Schedule B – Outline of Actuarial Assumptions and Methods (continued)

Unreduced retirement rates (continued)

Prior year:

	Unreduced Retirement		
Age	In the year attaining eligibility	In years after first eligibility	Reduced Retirement
45	30.0%	20.0%	N/A
46	30.0%	15.0%	N/A
47	25.0%	15.0%	N/A
48	25.0%	10.0%	N/A
49	25.0%	10.0%	N/A
50	25.0%	15.0%	N/A
51	25.0%	15.0%	N/A
52	25.0%	15.0%	N/A
53	25.0%	20.0%	N/A
54	25.0%	20.0%	N/A
55	30.0%	15.0%	3.9%
56	30.0%	15.0%	3.7%
57	30.0%	18.0%	4.0%
58	30.0%	18.0%	4.3%
59	20.0%	25.0%	4.7%
60	20.0%	25.0%	5.8%
61	35.0%	25.0%	6.3%
62	45.0%	30.0%	8.3%
63	45.0%	25.0%	9.2%
64	45.0%	25.0%	11.4%
65	30.0%	40.0%	N/A
66	30.0%	25.0%	N/A
67	30.0%	28.0%	N/A
68	30.0%	28.0%	N/A
69	30.0%	28.0%	N/A
70+	100.0%	100.0%	N/A

Schedule B – Outline of Actuarial Assumptions and Methods (continued)

Inflation:

2.75% per year.

Deaths before and after retirement

Current year:

The PRI-2012 Amount Weighted Blue Collar Mortality Tables with fully generational projection using Scale MP-2021 are used for all active participants. 101.1% of the PRI-2012 Amount Weighted Blue Collar Post Commencement Tables with fully generational projection using Scale MP-2021 are used for all retirees and beneficiaries preceding their related member's death. 98.3% of the PRI-2012 Amount Weighted Blue Collar Contingent Survivor Tables with fully generational projection using Scale MP-2021 are used for all beneficiaries following the death of their related member. The PRI-2012 Amount Weighted Total Dataset Disability Tables with fully generational projection using Scale MP-2021 are used for the period after disability retirement. Among pre-retirement deaths, 7.50% are assumed to qualify for accidental death benefits.

Prior year:

The RP-2014 Blue Collar Mortality Tables with fully generational projection using Scale MP-2018 are used for all active participants and deferred vested participants. 94.5% of the RP-2014 Blue Collar Mortality Tables with fully generational projection using Scale MP-2018 are used for all retirees. 107.5% of the RP-2014 Blue Collar Mortality Tables with fully generational projection using Scale MP-2018 are used for all beneficiary participants. The RP-2014 Disabled Mortality Table with fully generational projection using Scale MP-2018 are used for the period after disability retirement. Among pre-retirement deaths, 7.50% are assumed to qualify for accidental death benefits.

Normal retirement

Age 65.

Percent married

90% of male members and 50% of female members under age 55 or who have less than 23 years of service are assumed to be married. 100% of employees age 55 and older or who have 23 or more years of service are assumed to be married. In each case, the female is assumed to be three years younger than the male.

Schedule B – Outline of Actuarial Assumptions and Methods (continued)

Pension options

50% of male members elect a 75% joint and survivor benefit and 10% of female members elect a 50% joint and survivor benefit. All others elect a life annuity.

Fiduciary and investment management expenses

Paid from investment earnings of the Fund.

Loading or contingency reserves

None.

Valuation method

Prior to December 31, 2009, projected benefit method with entry age normal cost and open-end accrued liability. On and after December 31, 2009, individual entry age normal method.

Asset valuation method

A five-year phase-in smoothing method is used, under which the value of assets for actuarial purposes equals market value less a five-year phase-in of the differences between actual and assumed investment return. The value of assets for actuarial purposes may not differ from the market value of assets by more than 20%.

Effective December 31, 2013, the actuarial asset method was changed from a five-year moving average of market values to a five-year phase-in smoothing method, with the smoothing restarted as of December 31, 2013.

Prior to December 31, 2013, a five-year moving average of market values method was used to compute the actuarial value of assets.

Administrative expenses

Administrative expenses are estimated to be 1.0% of covered payroll per year.

Summary of Changes from December 31, 2021 Valuation

- Assumption changes to the salary scale, mortality rates, termination rates, and retirement rates were made according to the experience study completed in 2023. This decreased the actuarial accrued liability by $45.50 million.

Schedule C – Summary of Main Provisions of the Fund as Interpreted for Valuation Purposes

The Massachusetts Bay Transportation Authority Retirement Fund became effective as of January 1, 1948. The following summary describes the current main membership, benefit, and contribution provisions of the Fund as interpreted for the valuation.

1 - Definitions

“Compensation” means the full regular remuneration paid to an employee, excluding any overtime pay. “Service” creditable under the Fund means all service rendered by a member prior to his normal retirement date since he last became a member for which contributions are made by the member and by the Authority. “Union” means Boston Carmen’s Union, Local Division 589 of the Amalgamated Transit Union, AFL-CIO.

2 - Membership

Each employee, including employees on a part-time basis, who is or who may become a member of the Union or any union recognized by the Authority for collective bargaining purposes is included in the membership of the Fund. Any employee who is not a member of the Union but who is in a group which was authorized to participate in the Fund is included in the membership.

3 - Benefits

Normal Retirement Allowance

Condition for Allowance

Any member may retire at age 65. A member may remain in service after the stated retirement date.

Amount of Allowance

The normal retirement allowance equals 2.46% of 3-year average annual compensation multiplied by the years of service, such allowance not to exceed 75% of such average annual compensation.

Early Normal Retirement Allowance

Condition for Allowance

Any member hired prior December 6, 2012 and has completed at least 23 years of service may retire on an early normal retirement allowance.

Any member hired on or after December 6, 2012, has attained age 55 and completed at least 25 years of service may retire on an early normal retirement allowance.

Amount of Allowance

The early normal retirement allowance is computed in the same manner as a normal retirement allowance on the basis of the compensation and service to the time of retirement.

Early Reduced Retirement Allowance

Condition for Allowance

A member who has attained age 55 and has completed at least 20 years of service may be retired on an early reduced retirement allowance.

Amount of Allowance

The early reduced retirement allowance is an immediate allowance, commencing at the date of retirement, and is computed in the same manner as a normal retirement allowance on the basis of compensation and service to the time of early retirement, but reduced by ½ of 1% for each month of retirement prior to normal retirement date.

Schedule C – Summary of Main Provisions of the Fund as Interpreted for Valuation Purposes (continued)

Disability Retirement Allowance

Condition for Allowance

Any member who has completed 4 years of service in case of disablement due to an occupational accident or sickness, or who has completed 6 years of service in case of disablement due to any other cause, and who has become totally and permanently incapacitated, mentally or physically, for the further performance of duty may be retired.

Amount of Allowance

Upon disability retirement, a member receives an allowance commencing immediately, which is computed as a normal retirement allowance on the basis of the compensation and service to the time of disability retirement and is not less than 15% of the member's 3-year average annual compensation.

Vested Retirement Allowance

Condition for Allowance

Any member who has completed 10 years of service and who is not eligible for a retirement allowance is eligible for a vested retirement allowance, in lieu of a refund of his contributions with interest, in the event his employment terminates for reasons other than voluntary quit or discharge for cause.

Amount of Allowance

The vested retirement allowance is a deferred allowance commencing on the member's normal retirement date and equal to a percentage, not exceeding 100 percent, of the amount computed as a normal retirement allowance on the basis of the compensation and service to the time of termination; the applicable percentage is 5 percent multiplied by the number of years of creditable service, not in excess of 20, at the time of termination.

Survivor Benefit

Condition for Benefit

Upon the death of a member who has completed 10 years of service and who is survived by a spouse and/or dependent children designated to receive the deceased member's contributions with interest, a benefit may be elected by such survivor in lieu of the payment of the contributions with interest.

Amount of Benefit

If the deceased member had completed at least 10 but fewer than 23 years of service, the survivor's benefit, payable for life, is equal to the amount which would have become payable if the member had retired as of the date of his death and elected a 50% joint and survivor option in effect as of the date of death with the survivor as the designated person under the option. There is no reduction for early commencement.

If the deceased member had completed at least 23 years of service, the survivor's benefit, payable for life, is equal to the amount which would have become payable if the member had retired as of the date of his death and elected a 100% joint and survivor option in effect as of the date of death with the survivor as the designated person under the option. There is no reduction for early commencement.

Accidental Death Benefit

Condition for Benefit

Upon the death of a member in service whose death results solely from an injury or injuries sustained in the performance of duty, and who is survived by a spouse designated to receive the deceased member's contribution with interest, an allowance shall be payable to said spouse.

Schedule C – Summary of Main Provisions of the Fund as Interpreted for Valuation Purposes (continued)

Amount of Benefit

The accidental death benefit, payable for life, is equal to the amount which would have become payable to the member if the member had retired as of the date of his death on a disability retirement allowance. If there should be insufficient creditable service, the surviving spouse receives the minimum allowance available under the disability retirement provision.

Return of Contributions

On Account of Termination of Service

In the event of a member's termination of employment for any reason other than death or retirement, he is paid the amount of his contributions, with interest.

On Account of Death Prior to Retirement

Upon the death of a member or retired member before his retirement allowance has become effective, the amount of his contributions, with interest, is paid to his beneficiary or estate, unless a survivor benefit is payable.

On Account of Death after Retirement

Upon the death of a retired member, or the survivor of a retired member and his designated beneficiary under an optional benefit, any excess of his contributions at retirement, with interest, over the sum of all retirement allowance payments made is paid to the member's beneficiary or to the survivor's estate.

Our valuation does not include return of contributions on account of death after retirement for current retirees due to negligible impact on the Fund's liabilities.

Optional Benefits in Lieu of Regular Benefits

At retirement, or on his normal retirement date if prior thereto, any member may elect to convert his allowance into an optional benefit of equivalent actuarial value permitted by the Rules and Regulations.

Reinstatement of Creditable Service

If a member's service is interrupted by reason of resignation or dismissal, he has the opportunity upon the completion of 3 years of service after he has been rehired to repay to the Fund all amounts he has withdrawn together with an amount equal to their reasonable earnings. Upon such repayment, the member is to be credited with service for the periods before and after the interruption as though they had been a single period of service.

4 - Contributions

Contributions required to provide benefits and meet administrative expenses are made jointly by the Authority and members. The member contribution rate was increased from 5.1489% to 5.4989% effective August 11, 2012, to 5.5589% effective July 1, 2013, to 5.7989% effective July 1, 2014, to 5.7914% effective July 1, 2015, to 6.4614% effective July 1, 2016, to 7.1189% effective July 1, 2017, to 8.0089% effective July 1, 2018, to 8.8239% effective July 1, 2019, to 9.3339% effective July 1, 2020, to 9.1239% effective July 1, 2021, to 9.0539% effective July 1, 2022, and to 9.0989% effective July 1, 2023. Member contributions are "picked up" by the Authority pursuant to Section 414(h)(2) of the Internal Revenue Code.

Summary of Changes from December 31, 2021 Valuation

None.

Schedule D – Tables of Employee Data

Table 1 – The Number and Annual Compensation of Active Members Distributed by Fifth Age and Service as of December 31, 2022[1]

Attained Age	Completed Years of Service																			
	0 to 4		5 to 9		10 to 14		15 to 19		20 to 24		25 to 29		30 to 34		35 to 39		40 & up		Total	
	No.	Salary	No.	Salary	No.	Salary	No.	Salary	No.	Salary	No.	Salary	No.	Salary	No.	Salary	No.	Salary	No.	Salary
Under 25	39	$ 2,290,696	0	$ 0	0	$ 0	0	$ 0	0	$ 0	0	$ 0	0	$ 0	0	$ 0	0	$ 0	39	$ 2,290,696
25 to 29	141	10,228,633	8	762,133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	149	10,990,766
30 to 34	280	21,124,060	120	11,185,279	46	4,239,564	0	0	0	0	0	0	0	0	0	0	0	0	446	36,548,903
35 to 39	285	22,006,516	212	19,399,420	150	14,157,104	72	7,089,044	2	184,018	0	0	0	0	0	0	0	0	721	62,836,101
40 to 44	260	18,727,022	207	19,081,558	133	12,862,720	152	14,923,043	47	4,807,254	1	84,011	0	0	0	0	0	0	800	70,485,609
45 to 49	258	18,653,519	186	16,586,315	140	13,385,915	136	13,019,026	95	9,029,426	16	1,518,982	1	95,139	0	0	0	0	832	72,288,322
50 to 54	180	13,987,775	190	17,808,178	157	15,209,921	164	15,881,902	126	11,838,291	17	1,615,286	10	931,112	0	0	0	0	844	77,272,466
55 to 59	133	10,516,143	155	14,871,563	174	16,990,804	199	19,535,044	153	14,249,718	42	3,972,804	22	1,938,456	11	1,092,520	0	0	889	83,167,052
60 to 64	50	4,354,114	103	9,797,228	141	14,275,810	147	14,348,680	129	12,509,831	18	1,613,186	14	1,315,080	13	1,201,242	0	0	615	59,415,171
65 to 69	12	1,485,182	44	4,396,575	33	3,156,849	44	4,099,447	22	1,921,566	9	864,677	9	880,360	6	584,750	0	0	179	17,389,407
70 & up	4	242,607	8	845,187	9	904,322	5	425,110	9	801,986	4	369,491	0	0	0	0	2	194,334	41	3,783,037
Total	1,642	$123,616,268	1,233	$114,733,436	983	$ 95,183,009	919	$ 89,321,297	583	$ 55,342,090	107	$ 10,038,437	56	$ 5,160,147	30	$ 2,878,512	2	$ 194,334	5,555	$496,467,531

[1] Minor differences between the sums of values shown and the totals shown may arise due to rounding.

Schedule D – Tables of Employee Data (continued)

Table 2 – The Number and Annual Retirement Allowances Distributed by Age as of December 31, 2022[1]

	Service Retirements		Disabled Members		Beneficiaries	
Age	Number	Amount	Number	Amount	Number	Amount
<50	38	$ 2,137,819	29	$ 569,850	27	$ 379,221
50	18	902,185	5	111,748	5	53,158
51	29	1,533,366	9	222,517	9	196,932
52	31	1,708,917	6	111,570	7	104,162
53	34	1,740,831	6	76,583	5	115,233
54	56	3,001,071	11	265,712	4	63,191
55	61	3,093,684	16	279,967	8	126,462
56	66	3,351,585	13	263,274	12	197,507
57	92	4,774,412	12	249,075	11	187,296
58	102	5,204,544	20	490,311	10	106,150
59	120	6,275,993	17	370,647	16	251,272
60	105	5,224,224	25	626,085	19	303,860
61	100	5,053,125	24	533,157	16	267,199
62	124	6,038,007	32	733,977	13	245,831
63	138	6,832,777	39	759,507	17	250,413
64	167	7,838,977	35	816,720	23	308,692
65	154	7,080,995	27	639,373	19	528,433
66	188	8,148,028	19	414,700	31	543,660
67	193	8,324,132	32	684,391	37	606,756
68	186	7,817,172	39	751,271	24	531,148
69	193	8,030,855	24	452,281	25	409,651
70	212	8,766,482	22	381,896	29	648,352
71	187	7,239,982	12	272,202	31	525,808
72	187	7,000,798	28	510,700	24	602,192
73	195	7,470,738	25	458,685	28	645,623
74	209	7,666,732	18	351,591	42	882,514
75	201	6,972,289	20	456,719	38	869,953
76	178	6,264,967	14	247,083	49	942,508
77	160	5,459,656	14	312,407	44	942,209
78	176	5,971,771	16	273,351	46	1,019,624
79	154	5,029,210	22	288,317	53	1,006,102
80	141	4,655,633	13	248,082	52	899,868
81	113	3,539,254	10	182,670	45	787,222
82	100	2,950,275	8	144,001	44	794,358
83	81	2,608,560	4	53,602	33	622,592
84	74	2,263,062	7	120,222	36	609,092
85	70	1,990,379	3	51,104	33	639,810
>85	250	6,552,346	6	82,633	229	3,480,390
Total	4,883	$196,514,835	682	$ 13,857,982	1,194	$ 21,694,444
No Option	3,074	125,043,921	560	11,679,119	1,194	21,694,444
Survivor Option	34	1,576,576	1	18,676	0	0
Pop-Up Option	1,775	69,894,337	121	2,160,187	0	0
Total	4,883	$196,514,835	682	$ 13,857,982	1,194	$ 21,694,444

[1] Minor differences between the sums of values shown and the totals shown may arise due to rounding. Disabled members' counts and allowances exclude 24 individuals receiving worker's compensation for over 5 years.

Schedule D – Tables of Employee Data (continued)

Table 3 – Reconciliation of Participant Data

	Actives	Retirees	Beneficiaries	Disabled[1]	Actives, not accruing service	Total
Participants as of December 31, 2021	5,486	4,859	1,176	703	215	12,439
Changes due to:						
Termination						
Due Contributions	(101)				101	0
Received Contributions	(64)				(37)	(101)
Retirements	(204)	205			(1)	0
Disability	(26)			27	(1)	0
Deaths						
With Survivor	(1)	(77)		(5)		(83)
Without Survivor	(1)	(105)	(74)	(21)		(201)
New Entrants	457		93		48	598
Rehires	30				(17)	13
Benefits Expired			(1)			(1)
Stopped contributing	(21)				21	0
Escheatment					(21)	(21)
Data Corrections		1		2	(1)	2
Total Changes	69	24	18	3	92	206
Participants as of December 31, 2022	5,555	4,883	1,194	706	307	12,645

[1] Includes 25 individuals on December 31, 2021 and 24 individuals on December 31, 2022 receiving worker's compensation for over 5 years.