



ANDOVER CONTRIBUTORY RETIREMENT SYSTEM

**ACTUARIAL VALUATION
as of
January 1, 2021**

KMS Actuarial, LLC
52 Hunt Road
Kingston, NH 03848

December, 2021



December 9, 2021

Andover Contributory Retirement Board
Town Offices
36 Bartlet Street
Andover, MA 01810

Dear Board Members:

We are pleased to present the enclosed report providing the results of our actuarial valuation of the Andover Contributory Retirement System as of January 1, 2021. Our valuation was performed in accordance with the provisions contained in Chapter 32 of the Massachusetts General Laws, "M.G.L.", as of January 1, 2021. Disclosures under GASB Statement No. 67, Financial Reporting for Pension Plans (GASB 67) and GASB Statement No. 68, Accounting and Financial Reporting for Pensions (GASB 68) are provided in a separate report.

The principal results of our valuation are summarized in Section 2. The Summary of Plan Provisions and Actuarial Assumptions and Methods are shown in Sections 5 and 6, respectively. Section 7 summarizes the demographic profile of active members, retired plan members and beneficiaries and disabled plan members. Asset information and actuarial liabilities are presented in Section 2. The development of the required appropriations pursuant to Chapter 32 of the M.G.L. is shown in Section 3, including a 30-year forecast of the required appropriations and projected cash flows. Section 4 includes a summary of valuation information for PERAC as well as information relating to the primary risks to the System and an assessment of those risks.

This valuation is based upon member data provided by the Andover Contributory Retirement Board and asset information reported to the Public Employee Retirement Administration Commission (PERAC) by the Retirement Board. Although we did not audit the data used in the valuation, we believe that the information is complete and reliable.

Liabilities presented in this report are based on a long-term investment return rate assumption of 5.75%, net of investment expense, compounded annually.

This report was completed in accordance with generally accepted actuarial standards and procedures, and conforms to the Code of Professional Conduct of the American Academy of Actuaries. The actuarial assumptions used in the determination of costs are reasonably related to the experience of the System and to reasonable expectations, and represent our best estimate of anticipated long-term experience under the System.

K M S A C T U A R I E S

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Future actuarial valuation results may differ significantly from the current results presented in this report. Examples of potential sources of volatility include plan experience differing from that anticipated by the economic or demographic assumptions, the effect of new entrants, changes in economic or demographic assumptions, the effect of law changes and the delayed effect of smoothing techniques.

Our valuation follows generally accepted actuarial methods and we perform such tests as we consider necessary to assure the accuracy of the results. The amounts presented in this report have been appropriately determined according to the actuarial assumptions and methods stated herein.

This report is intended for the sole use of the Andover Contributory Retirement Board and is intended to provide information to comply with the stated purpose of the report. It may not be appropriate for other purposes.

The undersigned credentialed actuaries are Members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries necessary to render the actuarial opinion contained herein. They are available to answer any questions with regard to this report.

Respectfully submitted,



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SECTION 1 - EXECUTIVE SUMMARY

Background

We have completed the Actuarial Valuation of the Andover Contributory Retirement System as of January 1, 2021. This valuation is based upon census data provided by the Retirement Board and asset information reported to the Public Employee Retirement Administration Commission (PERAC) by the Andover Contributory Retirement Board. Information for the prior valuation completed as of January 1, 2020 was obtained from the valuation report prepared by Segal.

Massachusetts General Laws

The valuation was prepared in accordance with Chapter 32 of the Massachusetts General Laws ("M.G.L."). The results are based on the active, inactive and retired members and beneficiaries as of December 31, 2020, the assets as of December 31, 2020 and assumptions regarding investment returns, salary increases, mortality, turnover, disability and retirement.

The valuation does not take into consideration:

- ◆ Changes in the law after the valuation date,
- ◆ Transfers between retirement systems pursuant to Section 3(8)(c) of Chapter 32,
- ◆ State-mandated benefits and
- ◆ Cost-of-living increases granted to members in pay status between 1982 and 1997.

GASB Statement Numbers 67 and 68

In June 2012, the GASB approved two related Statements that significantly changed the way pension plans and governments account and report pension liabilities. Effective for plans with fiscal years beginning after June 15, 2013, GASB Statement No. 67, Financial Reporting for Pension Plans, replaced the requirements of Statement No. 25 and effective for employers with fiscal years beginning after June 15, 2014, GASB Statement No. 68, Accounting and Financial Reporting for Pensions, replaced the requirements of Statement No. 27.

The pension standards reflect changes from those previously in place regarding how governments calculate total pension liability and pension expense. Further, the standards contain requirements for disclosing information in the notes to financial statements and presenting required supplementary information following the notes.

The required disclosures and notes under GASB Statement Number 67 and 68 for the fiscal year ending December 31, 2020 are provided in a separate report.

Assets

This valuation is based upon asset information reported to the Public Employee Retirement Administration Commission (PERAC) by the Andover Contributory Retirement Board. The market value of assets increased from \$162,235,822 as of December 31, 2019 to \$183,587,589 as of December 31, 2020. During the plan years ended 2019 and 2020, the market value rates of return were 18.72% and 12.42%, respectively.

The actuarial value of assets increased from \$154,482,022 as of January 1, 2020 to \$170,829,408 as of January 1, 2021. During the plan years ended 2019 and 2020, the rates of return on the actuarial value of assets were 7.22% and 9.28%, respectively.

SECTION 1 - EXECUTIVE SUMMARY

Changes Since the Last Valuation

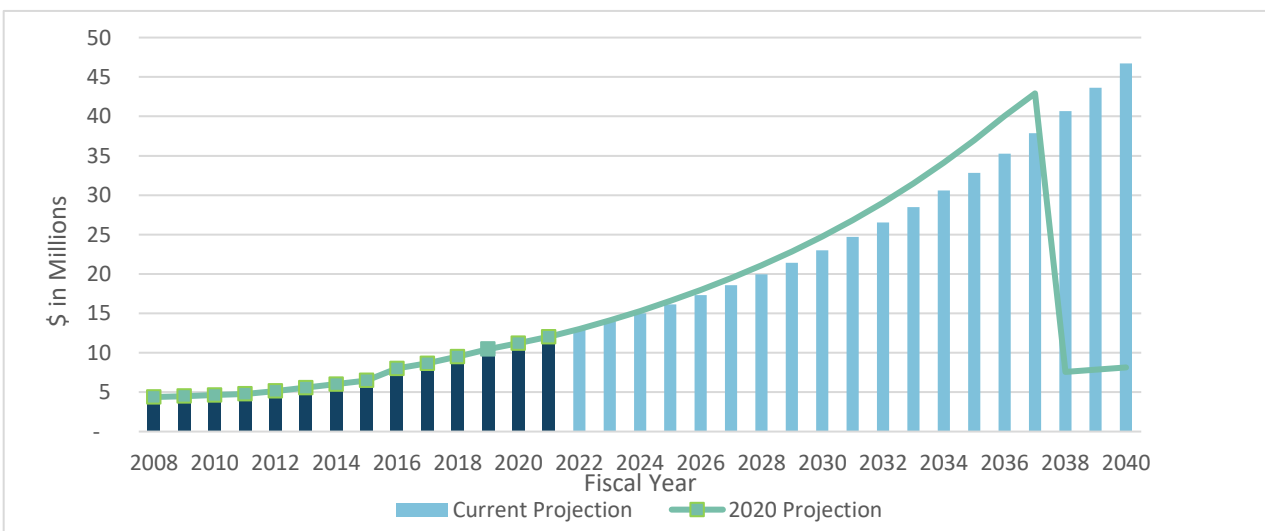
Since the last valuation, the total unfunded actuarial accrued liability of the System was expected to decrease from \$172,219,749 as of January 1, 2020 to \$171,402,883 as of January 1, 2021, for a total decrease of \$816,866. The actual unfunded actuarial accrued liability, before any assumption or plan changes, was \$171,802,107, resulting in an actuarial loss of \$399,224. The actuarial loss was primarily due to an asset gain of approximately \$4,709,000 and a demographic experience loss of approximately \$5,108,000. The details of the gain and loss analysis are provided in Section 2, Actuarial Experience.

Appropriations

The funding appropriation for each year is computed as the sum of the normal cost, net 3(8)(c) transfers and an amortization payment to pay off the Unfunded Actuarial Liability, adjusted for annual payments of the appropriation made August 1. The appropriation calculated as of the January 1, 2021 valuation is \$16,987,291, and is made up of a normal cost payment of \$5,203,567, net 3(8)(c) transfers of \$0, and an amortization payment of \$11,783,724. The amortization method is an increasing amortization of the unfunded actuarial accrued liability at 4% over 19 years and is expected to fully pay the unfunded actuarial accrued liability by the year 2040. The development of the appropriation as of January 1, 2021 is presented in Section 3, Annual Appropriations.

For fiscal year 2022, we show the actual appropriation developed under the previous funding schedule and reported on the PERAC "Required Fiscal Year 2022 Appropriation" letter dated November 4, 2020 of \$13,029,857. For fiscal year 2023, we developed an annual appropriation of \$13,990,159, which is made up of a normal cost of \$5,564,230, net 3(8)(c) transfers of \$160,000 and payment toward the unfunded actuarial accrued liability of \$8,265,929. The unfunded actuarial accrued liability is expected to be fully paid by 2040. The Board adopted a schedule that limits the annual increase in appropriation to 7.37% for each year. The current funding schedule is shown in Section 3, Exhibit 3.1.

The chart below shows the historical (navy bars) and projected (blue bars) annual appropriations compared to the projected amounts shown in the prior valuation and funding schedule (green line).



SECTION 1 - EXECUTIVE SUMMARY

Plan Provisions

All Plan provisions used in this valuation are the same as those used in the prior valuation and are summarized in Section 5, Summary of Plan Provisions.

Actuarial Assumptions and Methods

Some Actuarial Assumptions and Methods used in this valuation have changed since the last valuation, including revising the assumption for terminated vested benefits and refunds to assume that 50% of terminated employees with 10 or more years of service will elect a refund, reducing the investment return rate from 6.25% to 5.75%, and updating the mortality and mortality improvement rates. Changing these assumptions resulted in a net increase in the unfunded actuarial accrued liability of \$21,673,079 and an increase in the employer normal cost of \$1,041,556. The Actuarial Assumptions and Methods utilized in this valuation are detailed in Section 6, Actuarial Assumptions and Methods.

Census Data

As of January 1, 2021, there are 739 active members who may be eligible for benefits in the future, 479 retirees and beneficiaries, 163 inactives and 44 disabled retirees. Summaries of the active, retired and disabled employees are included in Section 7, Plan Member Information.

COVID-19 Pandemic

The assumptions in this report do not reflect the potential impacts of the COVID-19 pandemic on the System. Especially in the short range, the pandemic is likely to materially affect the economic and demographic experience, in a way not anticipated by the assumptions on which the projections are based.

SECTION 1 - EXECUTIVE SUMMARY

A summary of principal valuation results from the current valuation and the prior valuation follows.

Valuation Date	January 1, 2021	January 1, 2020	% Change
Census Data			
Active Members	739	755	(2.1%)
Valuation Salary	\$45,838,583	\$44,207,781	3.7%
Average Salary	\$62,028	\$58,553	5.9%
Retired Members and Beneficiaries	479	456	5.0%
Total Annual Retirement Allowance	\$14,639,261	\$13,781,656	6.2%
Average Annual Retirement Allowance	\$30,562	\$30,223	1.1%
Disabled Members	44	41	7.3%
Total Annual Retirement Allowance	\$1,932,535	\$1,662,960	16.2%
Average Annual Retirement Allowance	\$43,921	\$40,560	8.3%
Inactive Members	163	137	19.0%
Annuity Savings Fund	\$6,580,650	\$2,082,692	216.0%
Funded Status			
Actuarial Accrued Liability (AAL)	\$364,304,594	\$326,701,771	11.5%
Market Value of Assets (MVA)	\$183,587,589	\$162,235,822	13.2%
Unfunded Accrued Liability on MVA	\$180,717,005	\$164,465,949	9.9%
Funded Status on MVA	50.4%	49.7%	1.4%
Actuarial Value of Assets (AVA)	\$170,829,408	\$154,482,022	10.6%
Unfunded Accrued Liability on AVA	\$193,475,186	\$172,219,749	12.3%
Funded Status on AVA	46.9%	47.3%	(0.8%)
Appropriations			
Fiscal Year 2021	N/A	\$12,025,710	N/A
Fiscal Year 2022	\$13,029,857	\$13,029,857	0.0%
Fiscal Year 2023	\$13,990,159	\$14,117,850	(0.9%)
Fiscal Year 2024	\$15,021,232	\$15,296,690	(1.8%)

SECTION 2 - PRINCIPAL VALUATION RESULTS

Market Value of Assets

Asset information is reported annually to the Public Employee Retirement Administration Commission by the Andover Contributory Retirement Board. The Market Value of Assets for the three most recent calendar years are as follows:

Calendar Year	2020	2019	2018
Trust Fund Composition at Year-End			
Cash	\$346,743	\$335,171	\$164,364
Short-Term Investments	0	0	0
Fixed Income Securities	0	0	0
Equities	0	0	0
Pooled Short Term Funds	0	0	0
Pooled Domestic Equity Funds	53,612,785	46,418,343	36,608,622
Pooled International Equity Funds	9,010,131	7,739,741	6,289,890
Pooled Global Equity Funds	0	0	0
Pooled Domestic Fixed Income Funds	15,041,645	13,944,314	12,569,793
Pooled International Fixed Income Funds	0	0	0
Pooled Global Fixed Income Funds	0	0	0
Pooled Alternative Investments	0	0	0
Pooled Real Estate Funds	13,256,151	13,174,674	11,911,848
Pooled Domestic Balanced Funds	0	0	0
Pooled International Balanced Funds	0	0	0
Hedge Funds	0	0	0
PRIT Cash	350,079	451,631	522,110
PRIT Fund	91,871,462	80,191,773	69,463,178
Interest Due & Accrued	0	0	0
Prepaid Expenses	260	0	0
Accounts Receivable	112,581	4,153	85,329
Land	0	0	0
Buildings	0	0	0
Accumulated Depreciation - Buildings	0	0	0
Accounts Payable	(14,248)	(23,978)	(20,494)
Total Market Value of Assets	\$183,587,589	\$162,235,822	\$137,594,640

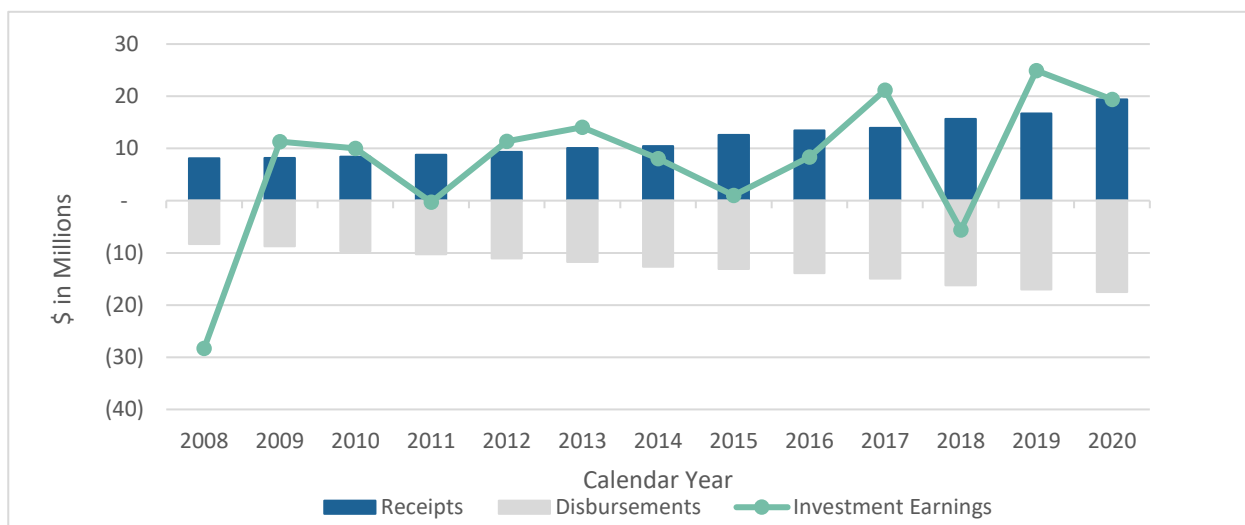
SECTION 2 - PRINCIPAL VALUATION RESULTS

Market Value of Assets

Calendar Year	2020	2019	2018
Funds			
Annuity Savings Fund	\$45,680,722	\$44,798,809	\$43,049,163
Annuity Reserve Fund	14,283,064	13,542,817	13,766,943
Special Military Service Fund	31,870	31,838	31,806
Pension Fund	2,080,657	0	48,240
Expense Fund	0	0	0
Pension Reserve Fund	121,511,276	103,862,358	80,698,488
Total Market Value of Assets	\$183,587,589	\$162,235,822	\$137,594,640
Asset Activity			
Market Value as of Beginning of Year	\$162,235,822	\$137,594,640	\$143,771,761
Contributions and Receipts	19,419,020	16,721,204	15,641,941
Benefit Payments and Expenses	(17,495,532)	(17,019,004)	(16,196,722)
Investment Return	19,428,279	24,938,982	(5,622,340)
Total Market Value of Assets	\$183,587,589	\$162,235,822	\$137,594,640

Rate of Return 12.42% 18.72% -3.49%

Below are the receipts and disbursements during the last 13 years. The green line reflects investment earnings, which vacillate as investment markets fluctuate. Blue bars indicate contributions, from employees and employers, and grey bars show benefit payments and administrative expenses.



SECTION 2 - PRINCIPAL VALUATION RESULTS

Actuarial Value of Assets

The Actuarial Value of Assets is the market value of assets as of the valuation date adjusted to phase in investment gains and losses over a 5-year period, further constrained to be within 15% of the market value of assets. Investment gains and losses are the excess or deficiency of the expected returns over the actual returns.

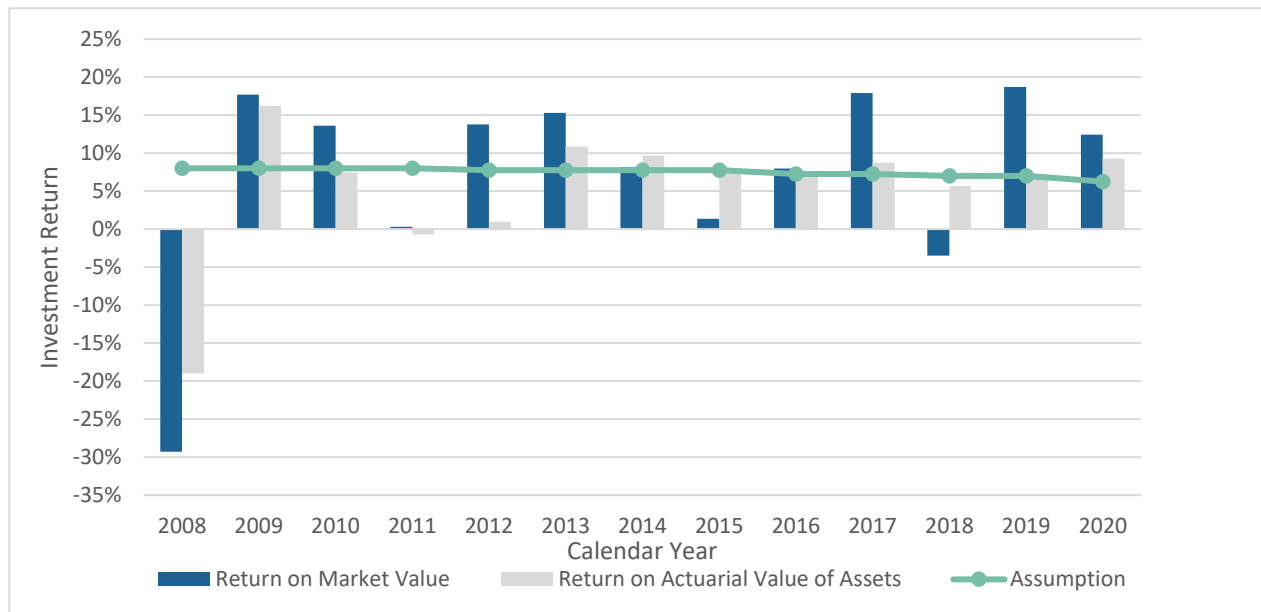
Valuation Date	January 1, 2021	January 1, 2020	January 1, 2019	
1. Expected Market Value of Assets				
a. Market Value of Assets as of prior January 1	\$162,235,822	\$137,594,640	\$143,771,761	
b. Prior Year Contributions and Receipts	19,419,020	16,721,204	15,641,941	
c. Prior Year Benefit Payments and Expenses	(17,495,532)	(17,019,004)	(16,196,722)	
d. Expected Investment Return Rate	6.25%	7.00%	7.00%	
e. Expected Investment Return	10,199,848	9,621,203	10,044,606	
f. Expected Market Value of Assets	\$174,359,158	\$146,918,043	\$153,261,586	
2. Prior Year Gain/(Loss)				
a. Market Value of Assets as of January 1	\$183,587,589	\$162,235,822	\$137,594,640	
b. Expected Market Value of Assets	174,359,158	146,918,043	153,261,586	
c. Prior Year Gain/(Loss)	\$9,228,431	\$15,317,779	(\$15,666,946)	
3. Phase-In of Asset Gains and Losses				
Calendar Year	Gain / (Loss)	Unrecognized Gain / (Loss)	Unrecognized Gain / (Loss)	Unrecognized Gain / (Loss)
a. 2020	\$9,228,431	\$7,382,745	\$0	\$0
b. 2019	15,317,779	9,190,667	12,254,223	0
c. 2018	(15,666,946)	(6,266,778)	(9,400,167)	(12,533,557)
d. 2017	12,257,736	2,451,547	4,903,094	7,354,641
e. 2016	(16,750)	0	(3,350)	(6,700)
f. 2015	(7,906,589)	0	0	(1,581,318)
g. Total Deferred Gains/(Losses)		\$12,758,181	\$7,753,800	(\$6,766,934)

SECTION 2 - PRINCIPAL VALUATION RESULTS

Actuarial Value of Assets

Valuation Date	January 1, 2021	January 1, 2020	January 1, 2019
4. Actuarial Value of Assets			
a. Market Value of Assets	\$183,587,589	\$162,235,822	\$137,594,640
b. Deferred Gains/(Losses)	12,758,181	7,753,800	(6,766,934)
c. Market Value of Assets Less Deferred Gains/(Losses)	\$170,829,408	\$154,482,022	\$144,361,574
d. 85% of Market Value of Assets	156,049,451	137,900,449	116,955,444
e. 115% of Market Value of Assets	211,125,727	186,571,195	158,233,836
f. Actuarial Value of Assets, c., but not less than d. and not greater than e.	\$170,829,408	\$154,482,022	\$144,361,574
g. Ratio of Actuarial Value of Assets to Market Value of Assets	93.1%	95.2%	104.9%
5. Rate of Return on Actuarial Value of Assets for Prior Calendar Year	9.28%	7.22%	5.64%

Below are the investment returns during the last 13 years. The green line reflects the investment return actuarial assumption. Blue bars indicate investment return rates on market value of assets, and grey bars show investment return rates on actuarial value of assets.



SECTION 2 - PRINCIPAL VALUATION RESULTS

Actuarial Liabilities

The **Actuarial Present Value of Future Benefits** is the present value of the cost to finance all benefits payable in the future, discounted to reflect the probability of payment and the time value of money. Below is the Actuarial Present Value of Future Benefits from the current valuation and the prior valuation:

Valuation Date	January 1, 2021	January 1, 2020
Actives	\$261,117,051	Not available
Retired Members and Beneficiaries	166,190,269	
Disabled Members	24,540,045	
Inactive Members	4,642,367	
Total Present Value of Future Benefits	\$456,489,732	

The **Actuarial Accrued Liability** is the portion of the Actuarial Present Value of Future Benefits which is allocated to all periods prior to a valuation year and therefore is not provided for by future Normal Costs. Below is the Actuarial Accrued Liability from the current valuation and the prior valuation:

Valuation Date	January 1, 2021	January 1, 2020
Actives	\$168,931,913	\$152,163,301
Retired Members and Beneficiaries	166,190,269	168,707,376
Disabled Members ¹	24,540,045	-
Inactive Members	4,642,367	5,831,094
Total Actuarial Accrued Liability	\$364,304,594	\$326,701,771

¹ Included in Retired Members and Beneficiaries for 2020 valuation.

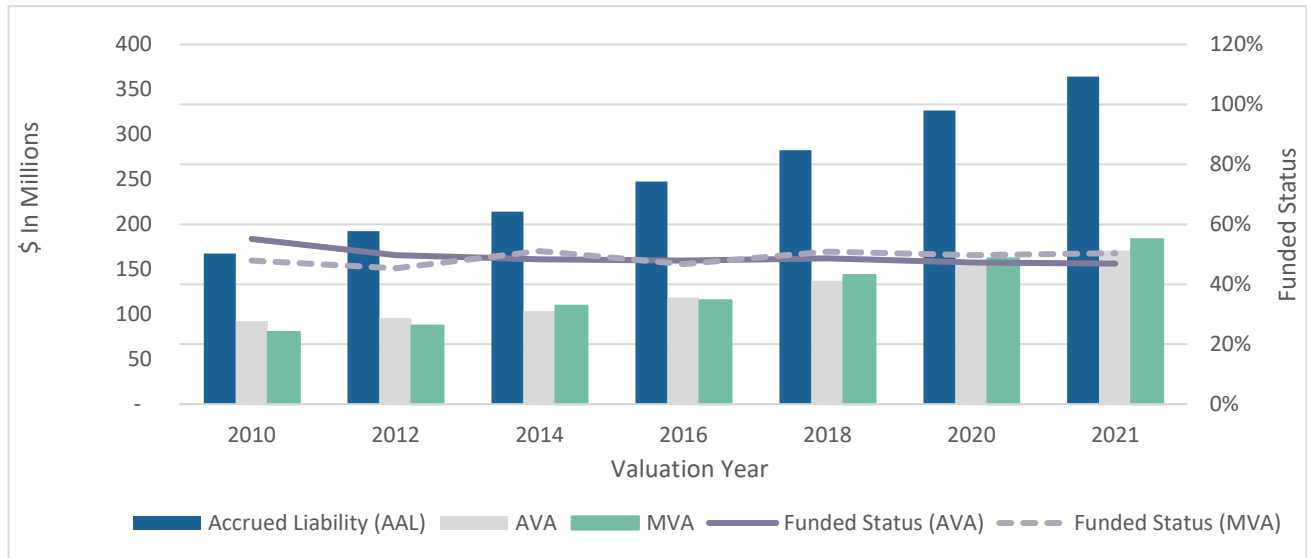
The **Unfunded Actuarial Accrued Liability** is the difference between the Actuarial Accrued Liability and the Actuarial Value of Assets as of the valuation date. The **Funded Status** is the Actuarial Value of Assets divided by the Actuarial Accrued Liability and is a point-in-time measurement of the amount of assets set aside to cover actuarial accrued liabilities. Below is the Unfunded Actuarial Accrued Liability and Funded Status from the current valuation and the prior valuation:

Valuation Date	January 1, 2021	January 1, 2020
Unfunded Actuarial Accrued Liability		
a. Actuarial Accrued Liability	\$364,304,594	\$326,701,771
b. Actuarial Value of Assets	170,829,408	154,482,022
c. Unfunded Actuarial Accrued Liability (a. - b.)	\$193,475,186	\$172,219,749
d. Funded Status (b. divided by a.)	46.9%	47.3%

SECTION 2 - PRINCIPAL VALUATION RESULTS

Actuarial Liabilities

Below are the accrued liabilities, asset values (actuarial and market) and funded status for each of the last 7 valuations. The purple solid line reflects the funded status on an actuarial value of assets (AVA) basis and the purple dotted line reflects the funded status on a market value (MVA) basis. Blue bars indicate actuarial accrued liabilities, grey bars indicate actuarial value of assets and green bars indicate market value of assets.



The **Normal Cost** is the portion of the Actuarial Present Value of Future Benefits which is allocated to a valuation year. Only active employees who have not reached Normal Retirement Age incur a Normal Cost. Below is the Normal Cost from the current valuation and the prior valuation:

Valuation Date	January 1, 2021	January 1, 2020
Total Normal Cost	\$9,365,800	\$7,948,484
As of Percentage of Salary	20.4%	18.0%
Employee Normal Cost	\$4,472,233	\$4,346,824
As of Percentage of Salary	9.8%	9.8%
Administrative Expenses	\$310,000	\$310,000
As a Percentage of Salary	0.7%	0.7%
Net Employer Normal Cost	\$5,203,567	\$3,911,660
As a Percentage of Salary	11.4%	8.8%

SECTION 2 - PRINCIPAL VALUATION RESULTS

Actuarial Experience

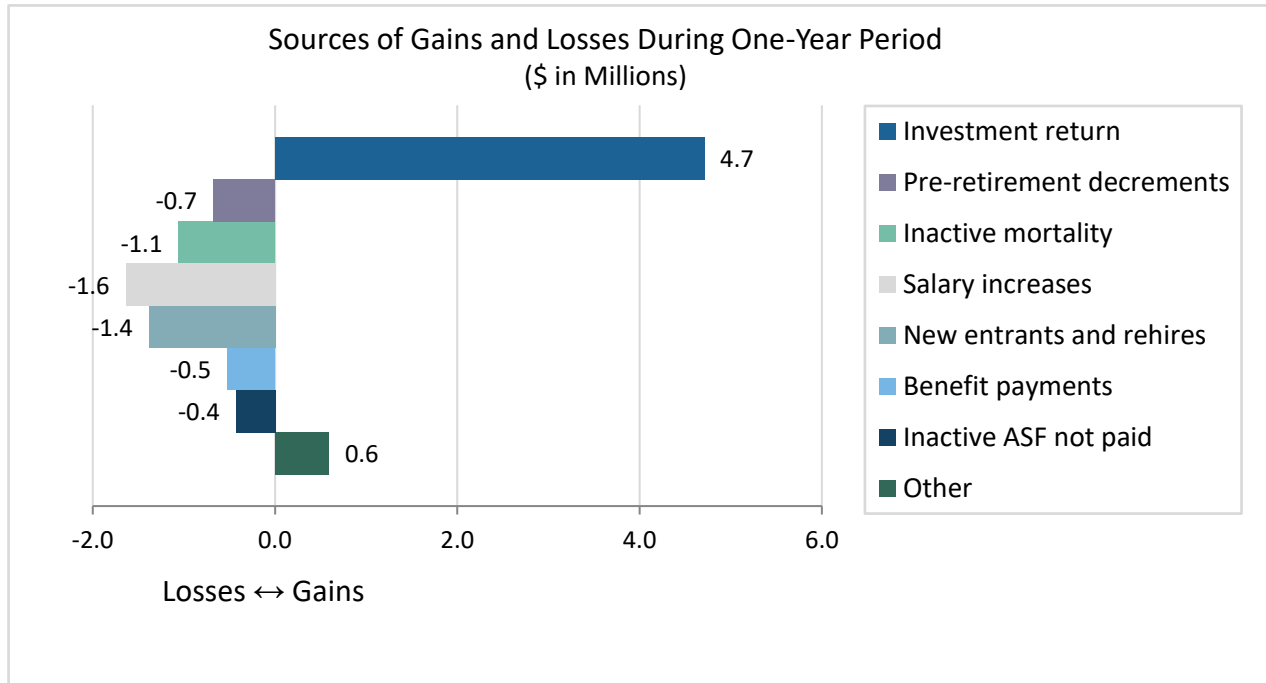
In performing the actuarial valuation, various assumptions are made regarding mortality, retirement, disability and withdrawal rates as well as salary increases and investment returns. A comparison of the results of the current valuation and the prior valuation is made to determine how closely actual experience relates to expected. During the one year since the last valuation, the total unfunded actuarial accrued liability of the System was expected to decrease by \$816,866. Below is the development of the Actuarial Loss for the current 1-year period:

Calendar Year Ending	December 31, 2020
Expected Unfunded Actuarial Accrued Liability	
1. Unfunded Actuarial Accrued Liability, Beginning of Year	\$172,219,749
2. Normal Cost, Beginning of Year	7,948,484
3. Total Contributions	19,419,020
4. Interest (full year on 1. and 2., one-half year on 3.)	10,653,670
5. Expected Unfunded Actuarial Accrued Liability	\$171,402,883
6. Unfunded Actuarial Accrued Liability (before changes)	171,802,107
7. (Gain)/Loss (6. - 5.)	\$399,224
Asset Gain/(Loss)	
1. Actuarial Value of Assets, Beginning of Year	\$154,482,022
2. Contributions and Receipts	19,419,020
3. Benefit Payments and Expenses	(17,495,532)
4. Assumed Rate of Return (prior valuation)	6.25%
5. Expected Return	9,715,235
6. Actuarial Value of Assets, End of Year	\$170,829,408
7. Actual Return	14,423,898
8. Actual Rate of Return	9.28%
9. Asset Gain/(Loss) (7. - 5.)	4,708,663

SECTION 2 - PRINCIPAL VALUATION RESULTS

Actuarial Experience

Below are the various sources of gains and losses over the 1-year period. The asset gain during the period was \$4,708,663, and the total demographic loss during the period was \$5,107,886, which totals to an overall loss of \$399,224.



*"Other" includes a \$1.41 million gain that is attributable to the change in actuarial firms.

Unfunded Actuarial Accrued Liability

1. Changes due to:	
a. Asset Gain	(4,708,663)
b. Demographic Experience Loss	5,107,886
c. Total Loss Prior to Changes	399,224
d. Plan Change	-
e. Assumption Change - Change in Mortality and Mortality Improvement Rates, Investment Return Rate and assumption regarding terminated vested benefits and refunds	21,673,079
f. Total Increase (including changes)	22,072,303
2. Unfunded Actuarial Accrued Liability, End of Year	\$193,475,186

SECTION 3 - CHAPTER 32 OF M.G.L. APPROPRIATIONS

Annual Appropriations

The Annual Appropriation is determined in accordance with the requirements set forth in Sections 22D and 22F of Chapter 32 of the Massachusetts General Laws ("M.G.L."). The appropriation is comprised of the annual employer normal cost and amortization payments to pay the unfunded actuarial accrued liability. Below are the details of the annual appropriations for the current and prior valuations, adjusted for annual payments made August 1. The appropriations shown are based on the results of the valuation and do not account for any adjustments made to appropriations in the selected funding schedule.

Valuation Date	January 1, 2021	January 1, 2020
1. Unfunded Actuarial Accrued Liability		
Fully Funded Year	2040	2037
Balance as of Valuation Date	\$193,475,186	\$172,219,749
Amortization Amount	\$11,783,724	\$11,956,771
Increasing Rate	4.00%	4.00%
Remaining Payment Period from Valuation Date	19	17
2. Total Amortization Payments	\$11,783,724	\$11,956,771
3. Normal Cost	\$5,203,567	\$3,911,660
4. Net 3(8)(c) Transfers	\$0	\$0
5. Total Appropriation as of January 1	\$16,987,291	\$15,868,431
6. Adjusted for Annual Payments as of August 1	\$17,550,427	\$16,439,649

SECTION 3 - CHAPTER 32 OF M.G.L. APPROPRIATIONS

Exhibit 3.1 - 30-Year Forecast of Annual Appropriations

Fiscal Year Ending	Employer Normal Cost	Amortization Payment of UAL	Net 3(8)(c) Transfers	Total Employer Cost	Increase over Prior Year	Unfunded Actuarial Accrued Liability
2022	\$5,376,067	\$7,653,790	\$0	\$13,029,857		\$193,475,186
2023	5,564,230	8,265,929	160,000	13,990,159	7.37%	196,765,832
2024	5,758,978	9,262,254	-	15,021,232	7.37%	199,619,126
2025	5,960,542	10,167,755	-	16,128,297	7.37%	201,616,676
2026	6,169,161	11,147,791	-	17,316,952	7.37%	202,802,243
2027	6,385,081	12,208,130	-	18,593,211	7.37%	203,052,847
2028	6,608,560	13,354,971	-	19,963,531	7.37%	202,232,531
2029	6,839,860	14,594,983	-	21,434,843	7.37%	200,191,176
2030	7,079,254	15,935,337	-	23,014,591	7.37%	196,763,207
2031	7,327,027	17,383,739	-	24,710,766	7.37%	191,766,186
2032	7,583,473	18,948,477	-	26,531,950	7.37%	184,999,297
2033	7,848,895	20,638,458	-	28,487,353	7.37%	176,241,697
2034	8,123,607	22,463,266	-	30,586,873	7.37%	165,250,723
2035	8,407,933	24,433,191	-	32,841,124	7.37%	151,759,953
2036	8,702,210	26,559,305	-	35,261,515	7.37%	135,477,111
2037	9,006,788	28,853,500	-	37,860,288	7.37%	116,081,782
2038	9,322,026	31,328,566	-	40,650,592	7.37%	93,222,957
2039	9,648,297	33,998,244	-	43,646,541	7.37%	66,516,350
2040	9,985,988	36,719,731	-	46,705,719	7.01%	35,541,515
2041	10,335,497	-	-	10,335,497	-77.87%	-
2042	10,697,239	-	-	10,697,239	3.50%	-
2043	11,071,643	-	-	11,071,643	3.50%	-
2044	11,459,151	-	-	11,459,151	3.50%	-
2045	11,860,221	-	-	11,860,221	3.50%	-
2046	12,275,328	-	-	12,275,328	3.50%	-
2047	12,704,965	-	-	12,704,965	3.50%	-
2048	13,149,639	-	-	13,149,639	3.50%	-
2049	13,609,876	-	-	13,609,876	3.50%	-
2050	14,086,222	-	-	14,086,222	3.50%	-
2051	14,579,239	-	-	14,579,239	3.50%	-

SECTION 3 - CHAPTER 32 OF M.G.L. APPROPRIATIONS

Exhibit 3.2 - 30-Year Forecast of Cash Flow

Calendar Year	Market Value of Assets, BOY	Benefit Payments	Employee Contributions	Employer Contributions	Investment Return	Market Value of Assets, EOY
2021	\$183,587,589	\$19,405,613	\$4,472,233	\$12,611,772	\$10,980,705	\$192,246,686
2022	192,246,686	18,955,093	4,628,761	13,386,393	11,545,097	202,851,844
2023	202,851,844	19,982,443	4,790,768	14,694,116	12,209,867	214,564,152
2024	214,564,152	21,059,802	4,958,445	15,610,793	12,914,701	226,988,289
2025	226,988,289	22,109,683	5,131,991	16,761,308	13,675,038	240,446,943
2026	240,446,943	23,136,382	5,311,611	17,996,616	14,500,751	255,119,539
2027	255,119,539	24,143,622	5,497,517	19,322,967	15,402,422	271,198,823
2028	271,198,823	25,088,536	5,689,930	20,747,069	16,392,764	288,940,050
2029	288,940,050	26,134,961	5,889,078	22,276,128	17,482,172	308,452,467
2030	308,452,467	26,994,671	6,095,196	23,917,879	18,685,672	330,156,543
2031	330,156,543	27,835,933	6,308,528	25,680,626	20,023,095	354,332,859
2032	354,332,859	29,088,550	6,529,326	27,573,288	21,498,744	380,845,667
2033	380,845,667	30,397,535	6,757,852	29,605,440	23,115,586	409,927,010
2034	409,927,010	31,765,424	6,994,377	31,787,360	24,887,497	441,830,820
2035	441,830,820	33,194,868	7,239,180	34,130,089	26,829,653	476,834,874
2036	476,834,874	34,688,637	7,492,551	36,645,476	28,958,644	515,242,908
2037	515,242,908	36,249,626	7,754,790	39,346,248	31,292,600	557,386,920
2038	557,386,920	37,880,859	8,026,208	42,246,067	33,851,329	603,629,665
2039	603,629,665	39,585,498	8,307,125	45,207,085	36,647,690	654,206,067
2040	654,206,067	41,366,845	8,597,874	10,003,865	37,497,152	668,938,113
2041	668,938,113	43,228,353	8,898,800	10,354,000	38,328,162	683,290,722
2042	683,290,722	45,173,629	9,210,258	10,716,390	39,136,257	697,179,998
2043	697,179,998	47,206,442	9,532,617	11,091,464	39,916,549	710,514,186
2044	710,514,186	49,330,732	9,866,259	11,479,665	40,663,698	723,193,076
2045	723,193,076	51,550,615	10,211,578	11,881,453	41,371,871	735,107,363
2046	735,107,363	53,870,393	10,568,983	12,297,304	42,034,711	746,137,968
2047	746,137,968	56,294,561	10,938,897	12,727,710	42,645,294	756,155,308
2048	756,155,308	58,827,816	11,321,758	13,173,180	43,196,089	765,018,519
2049	765,018,519	61,475,068	11,718,020	13,634,241	43,678,912	772,574,624
2050	772,574,624	64,241,446	12,128,151	14,111,439	44,084,876	778,657,644

SECTION 3 - CHAPTER 32 OF M.G.L. APPROPRIATIONS

Forecast Notes

Exhibit 3.1:

- ◆ The Employer Normal Cost is expected to increase 3.5% per year.
- ◆ The Unfunded Actuarial Accrued Liability ("UAL") is computed as of January 1 of each year assuming no future gains or losses.
- ◆ The Amortization Payment of UAL is an increasing payment at 4% paid over 19 years through 2040.
- ◆ Net 3(8)(c) transfers are a level dollar amount based on the net transfers expected to be paid by the Andover Contributory Retirement Board during the current year offset by the amount received during the same period.
- ◆ Total Employer Cost is the sum of the Employer Normal Cost, net 3(8)(c) transfers and the Amortization of the UAL, all computed as of January 1 of each year and adjusted for annual payments made on August 1.
- ◆ For fiscal year 2022, we show the actual appropriation developed under the previous funding schedule of \$13,029,857. For fiscal years 2023 and later, the Board has selected a funding schedule that fully amortizes the unfunded actuarial accrued liability by 2040, with annual employer costs limited to increases of 7.37% over the prior year.

Exhibit 3.2:

- ◆ Expected benefit payments include payments expected to be made to retired members, beneficiaries, disabled members and active members expected to retire. In addition, expected benefit payments include distribution of the annuity savings fund attributed to inactive members.
- ◆ Benefit payments exclude cost-of-living increases granted to members in pay status between 1982 and 1997. In addition, benefit payments are as expected for the first ten years of the forecast, then increase by the greater of 4.5% per year thereafter or the expected future payments for the current population projected by our computer model.
- ◆ Calendar year cash flow entries are developed as of each January 1.

SECTION 4 - DISCLOSURES

4.1 - GASB 67 and GASB 68 Disclosures

In June 2012, the GASB approved two related Statements that significantly changed the way pension plans and governments account and report pension liabilities. Effective for plans with fiscal years beginning after June 15, 2013, GASB Statement No. 67, *Financial Reporting for Pension Plans*, replaced the requirements of Statement No. 25 and effective for employers with fiscal years beginning after June 15, 2014, GASB Statement No. 68, *Accounting and Financial Reporting for Pensions*, replaced the requirements of Statement No. 27.

The pension standards reflect changes from those previously in place regarding how governments calculate total pension liability and pension expense. Further, the standards contain requirements for disclosing information in the notes to financial statements and presenting required supplementary information following the notes.

GASB 67 requires defined benefit pension plans, such as the Andover Contributory Retirement System, to present a statement of fiduciary net position (pension plan assets) and a statement of changes in fiduciary net position. Further, the statement requires that notes to financial statements include descriptive information such as the types of benefits provided, the classes of plan members covered and the composition of the pension plan's retirement board. Finally, GASB 67 requires pension plans to present in required supplementary information the sources of the changes in the net pension liability and information about the actuarially determined contributions compared with the actual contributions made to the plan and related ratios.

GASB 67 and GASB 68 require projected benefit payments be discounted to their actuarial present value using the single rate that reflects:

- (1) a long-term expected rate of return on pension plan investments *to the extent that the pension plan's assets are sufficient to pay benefits and pension plan assets are expected to be invested using a strategy to achieve that return* and
- (2) a tax-exempt, high-quality municipal bond rate *to the extent that the conditions for use of the long-term expected rate of return are not met.*

GASB 68 establishes standards for measuring and recognizing liabilities, deferred outflows of resources, deferred inflows of resources and pension expense by state and local governments.

The effective date for GASB 67 is for plan years beginning after June 15, 2013, which is the fiscal year ending December 31, 2014 for the Andover Contributory Retirement System. The effective date for GASB 68 is for employers' fiscal years beginning after June 15, 2014. The GASB report, submitted under separate cover and prepared as of December 31, 2020 (the measurement date), presents information to assist the Andover Contributory Retirement Board in providing the required information under GASB 68 to participating employers.

SECTION 4 - DISCLOSURES

4.2 - PERAC Disclosure Information

The most recent actuarial valuation of the System was prepared by KMS Actuaries, LLC as of January 1, 2021.

Normal Cost - Employees	\$4,472,233	9.8% of payroll
Normal Cost - Employers	\$5,203,567	11.4% of payroll
Actuarial Liability - Active Members	\$168,931,913	46% of total AAL
Actuarial Liability - Retired and Inactive Members	195,372,681	54% of total AAL
Total Actuarial Liability (AAL)	<u>\$364,304,594</u>	
System Assets	\$170,829,408	
Unfunded Actuarial Accrued Liability	\$193,475,186	
Funded Status	46.9%	

Principal actuarial assumptions used in the valuation:

Investment Return	5.75%
Rate of Salary Increase	Based on service, 6% graded down to 4.25% for Group 1 Based on service, 7% graded down to 4.75% for Group 4

SECTION 4 - DISCLOSURES

4.3 - Risk Measures

The Andover Contributory Retirement System is subject to certain risks that could affect the plan's future financial condition. Here we identify the primary risks to the System, provide some background information about those risks, and provide an assessment of those risks in accordance with Actuarial Standards of Practice (ASOP) 51.

Risk is the potential of actual future measurements deviating from expected future measurements resulting from actual future experience deviating from actuarially assumed experience. Examples of potential risks that may be reasonably anticipated to significantly affect the future financial condition of the plan 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 Other Demographic Risks** - the potential that mortality or other demographic experience will be different than expected.
- ◆ **Contribution Risk** - the potential of actual future contributions deviating from expected future contributions. For example, that actual contributions are not made in accordance with the plan's funding policy, that other anticipated payments to the plan are not made, or that material changes occur in the anticipated number of covered employees, covered payroll, or other relevant contribution base.

We have provided several risk measures in this section that we believe are most significant for the plan. However, we believe that a more rigorous assessment of risk would be beneficial to the Board to understand the risks identified above, such as:

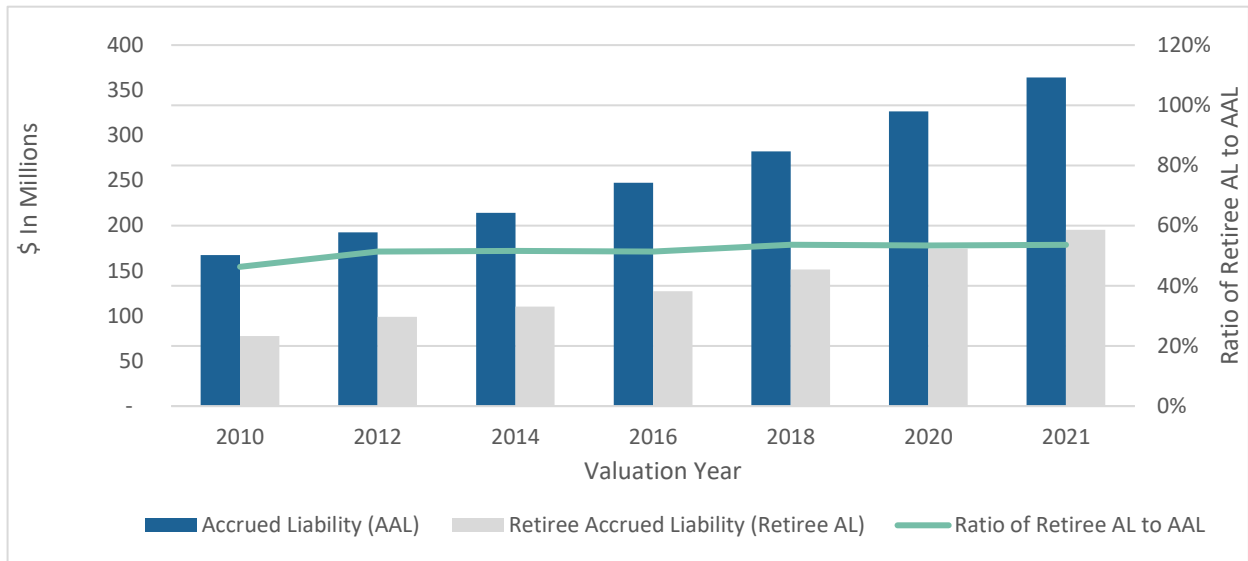
- ◆ **Scenario Test** - a process for assessing the impact of one possible event, or several simultaneous or sequentially occurring possible events, on a plan's financial condition.
- ◆ **Sensitivity Test** - a process for assessing the impact of a change in an actuarial assumption on an actuarial measurement.
- ◆ **Stochastic Modeling** - a process for generating numerous potential outcomes by allowing for random variations in one or more inputs over time for the purpose of assessing the distribution of those outcomes.
- ◆ **Stress Test** - a process for assessing the impact of adverse changes in one or relatively few factors affecting a plan's financial condition.

SECTION 4 - DISCLOSURES

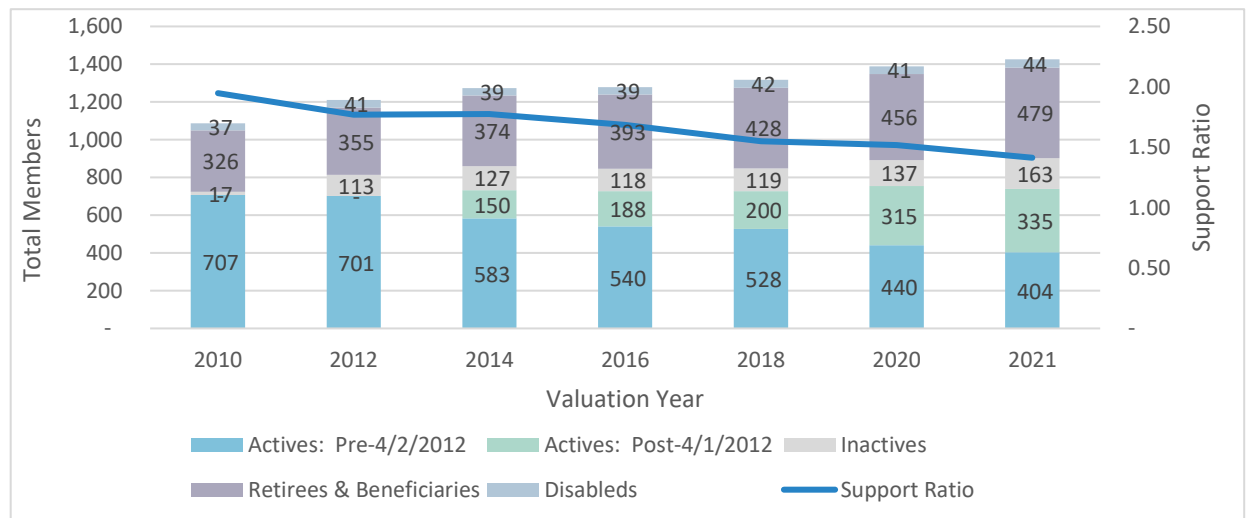
4.3 - Risk Measures

Maturity Measures

As retirement systems mature they become much more sensitive to risks. This is because a higher proportion of the actuarial liability is attributable to participants who are no longer active. Plan maturity measures are helpful in understanding the risks associated with a plan. One such maturity measure is the ratio of the system's retiree liability to its total liability. A retirement system in its infancy will have a very low ratio of retiree liability to total liability. As the system matures, the ratio starts increasing. A mature plan will often have a ratio above 60%. For the Andover Contributory Retirement System and other retirement systems in the United States these ratios have been steadily increasing in recent years.



Another maturity measure is the ratio of actives to retirees, or support ratio. A retirement system in its infancy will have a very high ratio of active to retired members. As the system matures, and members retire, the support ratio starts declining. A mature system will often have a support ratio near or below one.



SECTION 4 - DISCLOSURES

4.3 - Risk Measures

Volatility Indices

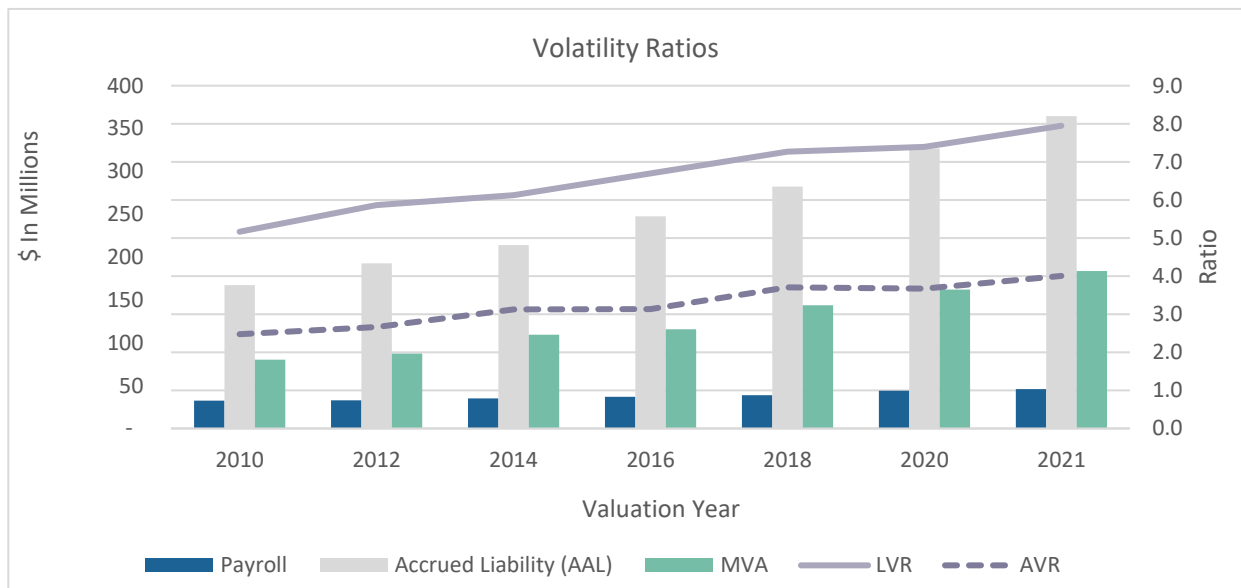
Volatility indices are measures of the relative sensitivity of employer contributions to changes in assets or liabilities. Below we present two such indices - the Asset Volatility Ratio (AVR) and the Liability Volatility Ratio (LVR):

Asset Volatility Ratio (AVR)

The Asset Volatility Ratio (AVR) is the ratio of the Market Value of Assets (MVA) to Payroll. Systems with a higher AVR experience more volatile employer contributions (as a percentage of payroll) due to investment return. This ratio indicates a measure of the system's current contribution volatility. The AVR increases over time but generally tends to stabilize as the system matures.

Liability Volatility Ratio (LVR)

The Liability Volatility Ratio (LVR) is the ratio of the Actuarial Accrued Liability (AAL) to Payroll. Systems with a higher LVR experience more volatile employer contributions (as a percentage of payroll) due to the investment return assumption and changes in liability. This ratio indicates a longer-term potential for contribution volatility. The AVR, described above, will tend to move close to the LVR as the system matures.

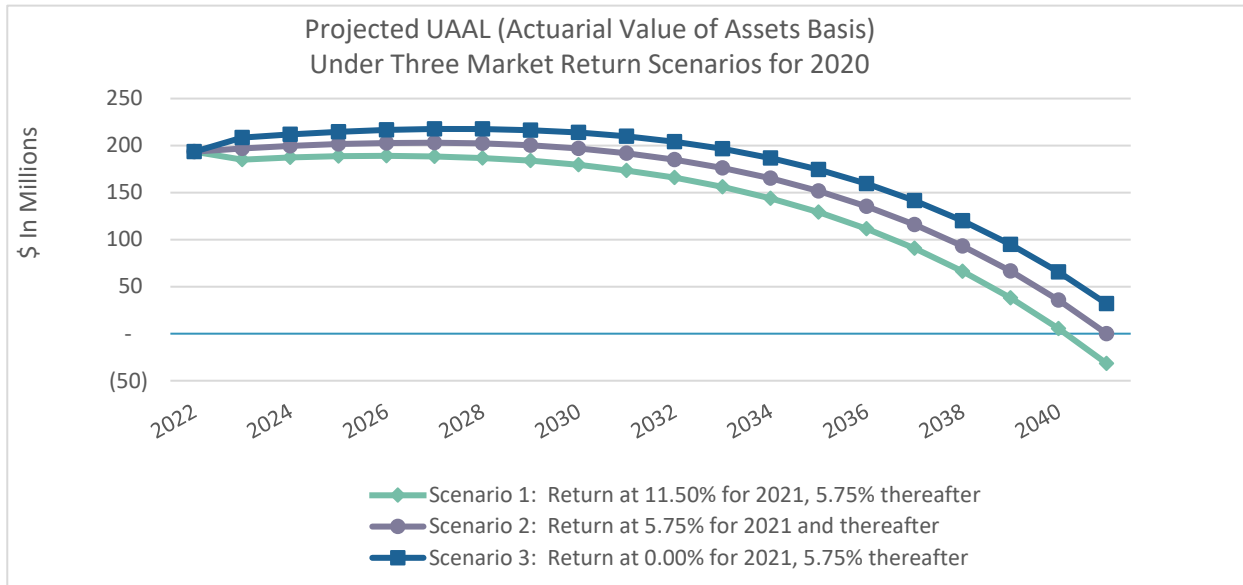


SECTION 4 - DISCLOSURES

4.3 - Risk Measures

Market Return Scenarios

Below we illustrate the projected effect on funding levels of a single year of investment return above or below the assumed investment return. Scenario 1 assumes a one-year return of 2 times the assumed return and the expected return thereafter, Scenario 2 assumes assets earn the expected return every year and Scenario 3 assumes a one-year return of 0% and the expected return thereafter.



Sensitivity Analysis

The following presents the Actuarial Accrued Liability and Funded Status calculated using the investment return rate of 5.75%, as well as what the Actuarial Accrued Liability and Funded Status would be if it were calculated using an investment return rate 1-percentage point lower (4.75%) or 1-percentage point higher (6.75%) than the assumed investment return rate:

	1% Decrease (4.75%)	Current Investment Return Rate (5.75%)	1% Increase (6.75%)
Actuarial Accrued Liability	\$410,373,231	\$364,304,594	\$325,705,581
% Change	13%		-11%
Actuarial Value of Assets	\$170,829,408	\$170,829,408	\$170,829,408
Unfunded Actuarial Accrued Liability	239,543,823	193,475,186	154,876,173
% Change	24%	N/A	-20%
Funded Status	41.63%	46.89%	52.45%

SECTION 4 - DISCLOSURES

4.3 - Risk Measures

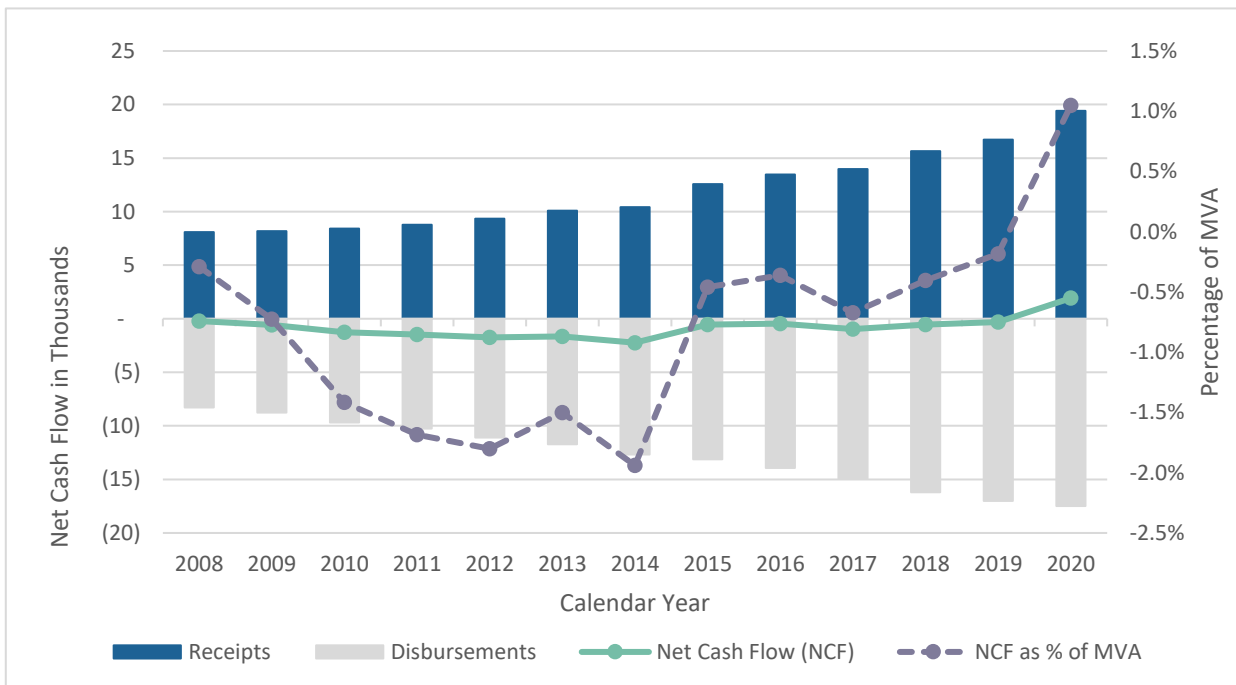
Duration

Duration is another measure that is used to describe how the present value of a cash flow series changes when small changes are made to the underlying interest rates. The duration of the Andover Contributory Retirement System is 12, and this represents an approximate percentage change in the Actuarial Accrued Liability for each 1% change to the investment return rate.

Net Cash Flow (NCF)

Net cash flow (NCF) during a year is the difference between contributions, both employer and employee, paid into the System and benefit payments and expenses paid from the System. If the level of benefit payments plus expenses is greater than contributions, then the System has negative NCF. Mature plans generally have a negative NCF as the number of retirees grows. When a System has negative NCF, then additional cash from existing assets are needed to pay the pension benefits.

Historical NCF since 2008 is shown in the next graph. Blue bars indicate contributions, from employees and employers, and grey bars show benefit payments and administrative expenses. The NCF is represented by the green line. The dashed purple line (which corresponds to the right-hand axis) provides the NCF as a percentage of the Market Value of Assets. As of December 31, 2020, the NCF was positive \$1.9 million, which represents 1.0% of the Market Value of Assets. The NCF falls within the range of -1.9% to 1.0% of total assets over the 13-year period.



SECTION 5 - SUMMARY OF PLAN PROVISIONS

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

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

Membership Groups There are four membership groups in the Retirement System:

Group 1	General employees, including clerical, administrative, technical and all other employees not otherwise classified.
Group 2	Certain specified hazardous duty positions.
Group 3	State police officers and inspectors.
Group 4	Local police officers, firefighters and other specified hazardous positions.

For members in more than one group, participation will be proportional.

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

Prior to 1975	5% of Salary
1975 - 1983	7% of Salary
1984 - June 30, 1996	8% of Salary
July 1, 1996 - present	9% of Salary
1979 - present	An additional 2% of Salary in excess of \$30,000.
Group 1 members hired on or after April 2, 2012	6% of Salary with 30 or more 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 ten financial institutions.

SECTION 5 - SUMMARY OF PLAN PROVISIONS

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

Salary Gross regular compensation. This does not include bonuses, overtime, severance pay, unused sick leave credit or other similar compensation.

Average Salary

Membership before April 2, 2012 ♦ 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.

Membership on or after April 2, 2012 ♦ 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.

Creditable Service The period during which a member contributes to the retirement system plus certain periods of military service and “purchased” service.

Benefit Rate The benefit rate varies with the member's retirement age, Group, membership date and years of creditable service at retirement. Each year a member retires prior to the age at which the 2.5% maximum benefit rate applies, a reduction is applied to each year of age under the maximum age. The maximum age and reduction for each Group and membership date is as follows:

	Group 1	Group 2	Group 4
2.5% for Membership before April 2, 2012:			
Maximum age:	65	60	55
Reduction:	0.1%	0.1%	0.1%
2.5% for Membership on or after April 2, 2012 (less than 30 years of service):			
Maximum age:	67	62	57
Reduction:	0.15%	0.15%	0.15%
2.5% for Membership on or after April 2, 2012 (30+ years of service):			
Maximum age:	67	62	57
Reduction:	0.125%	0.125%	0.125%

SECTION 5 - SUMMARY OF PLAN PROVISIONS

Superannuation Retirement	Eligibility if membership before April 2, 2012	<ul style="list-style-type: none"> ◆ completion of 20 years of Creditable Service, or ◆ attainment of age 55 if hired prior to 1978, or ◆ attainment of age 55 with 10 years of Creditable Service, if hired after 1978.
	Eligibility if membership on or after April 2, 2012	<ul style="list-style-type: none"> ◆ attainment of age 60 with 10 years of Creditable Service if classified in Group 1 ◆ attainment of age 55 with 10 years of Creditable Service if classified in Group 2 ◆ attainment of age 55 if classified in Group 4
	Benefit Amount	Product of the member's Benefit Rate, Average Salary and Creditable Service.
	Maximum Benefit	80% of the member's Average Salary.
	Veteran's Benefit	Additional benefit of \$15 per year of Creditable Service, up to a maximum of \$300.
Deferred Vested	Eligibility	<ul style="list-style-type: none"> ◆ completion of ten or more years of Creditable Service. ◆ elected officials hired prior to 1978, completion of six years of Creditable Service.
	Benefit Amount	Accrued benefit payable commencing at age 55, or the completion of 20 years of Creditable Service, or may be deferred until later at the participant's option.
Withdrawal of Contributions		<p>Contributions may be withdrawn upon termination of employment.</p> <ul style="list-style-type: none"> ◆ Members hired on or after January 1, 1984 who terminate with less than ten years of Creditable Service receive contributions plus interest on the Annuity Savings Account at an annual rate of 3%. ◆ All other withdrawals receive contributions plus 100% of the regular interest that has accrued to the Annuity Savings Account.

SECTION 5 - SUMMARY OF PLAN PROVISIONS

Ordinary Disability Retirement	Eligibility	Non-job related disability after completion of ten years of Creditable Service.
	Benefit Amount for Group 1 membership before April 2, 2012 or Group 2 or Group 4	Superannuation benefit determined if the member is age 55, up to a maximum of 80% of Average Salary over three years. If the member is a veteran, 50% of final rate of salary (final year) plus an annuity based on the accumulated member contributions plus credited interest, up to a maximum of 80% of Average Salary over five years.
	Benefit Amount for Group 1 membership on or after April 2, 2012	Superannuation benefit determined if the member is age 60, up to a maximum of 80% of Average Salary over three years. If the member is a veteran, 50% of final rate of salary (final year) plus an annuity based on the accumulated member contributions plus credited interest, up to a maximum of 80% of Average Salary over five years.
Accidental Disability Retirement	Eligibility	Disabled as a result of an accident in the performance of duties. There is no minimum age or service requirement.
	Benefit Amount	72% of Salary plus an annuity based on accumulated member contributions plus credited interest.
	Maximum Benefit	100% of Salary if hired before January 1, 1988, otherwise 75% of Salary.
	Veteran's Benefit	Additional allowance of \$15 per year of Creditable Service, up to a maximum of \$300.
	Supplemental Dependent Allowance	Additional allowance of \$980.88 per year for each child until age 18 (or age 22 if a full-time student).
Non-Occupational Death	Eligibility	For members with at least two years of creditable service who die while in active service, but not due to occupational injury.
	Benefit Amount	Benefit as if Option C had been elected. Minimum benefit of \$250 per month for surviving spouse, \$120 per month for first child and \$90 per month for each additional child.

SECTION 5 - SUMMARY OF PLAN PROVISIONS

Accidental Death	Eligibility	For members who die as a result of an occupational injury.
	Benefit Amount	72% of Salary plus an annuity based on accumulated member contributions plus credited interest.
	Maximum Benefit	100% of Salary if hired before January 1, 1988, otherwise 75% of Salary.
	Veteran's Benefit	Additional allowance of \$15 per year of creditable service, up to a maximum of \$300.
	Supplemental Dependent Allowance	Additional allowance of \$980.88 per year for each child until age 18 (or age 22 if a full-time student).
Cost-of-Living Adjustment (COLA)	In accordance with the adoption of Chapter 17 of the Acts of 1997, the granting of a Cost-of-Living Adjustment will be determined by an annual vote by the Retirement Board. The amount of increase will be based upon the Consumer Price Index, limited to a maximum of 3.0%, beginning on July 1. All retirees, disabled retirees and beneficiaries who have been receiving benefit payments for at least one year as of July 1 are eligible for the adjustment. The maximum amount of pension benefit subject to a COLA is \$12,000. All COLAs granted to members after 1981 and prior to July 1, 1998 are deemed to be an obligation of the Commonwealth of Massachusetts and are not the liability of the Retirement System.	
Optional Forms of Payment	A member may elect to receive his or her retirement allowance, payable in monthly installments, in one of three forms of payment: <ul style="list-style-type: none">◆ Option A – Total annual allowance commencing at retirement and terminating at member's death.◆ Option B – A reduced annual allowance commencing at retirement with death benefit equal to excess of member contributions plus credited interest to retirement over annuity benefit paid to member.◆ Option C – A reduced annual allowance commencing at retirement with 66⅔% of benefit continued to designated beneficiary upon death of member. For members who retired on or after January 12, 1988, if the beneficiary pre-deceases the retiree, the benefit payable increases 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 increases based on the factor used to determine the Option C benefit at retirement.	

SECTION 6 - ACTUARIAL ASSUMPTIONS AND METHODS

Valuation Date January 1, 2021

Investment Return 5.75% per year. Previously, 6.25% per year.
 The investment return assumption is a long-term assumption based on capital market expectations by asset class, historical returns and professional judgment. We considered analysis prepared by Andover's investment consultant Dahab Associates and other reliable sources using a building block approach and using the target asset allocation, expected returns by asset class and risk analysis to determine a long-term expected average annual rate of return.

Annuity Savings Fund Interest Rate 2.00% per year

Amortization Method *Unfunded Actuarial Accrued Liability (UAL):*
 Increasing dollar amount at 4% to reduce the Unfunded Actuarial Accrued Liability to zero on or before June 30, 2040.

Salary Scale The assumed annual rates for salary increases including longevity are illustrated by the following rates:

Years of Service	Groups 1 and 2	Group 4
0	6.00%	7.00%
1	5.50%	6.50%
2	5.50%	6.00%
3	5.25%	5.75%
4	5.25%	5.25%
5	4.75%	5.25%
6	4.75%	4.75%
7	4.50%	4.75%
8	4.50%	4.75%
9+	4.25%	4.75%

The salary scale assumption is a long-term estimate derived from historical data, current and recent market expectations and professional judgment.

Cost-of-Living Allowance Cost-of-Living Allowances (COLA) are assumed to be 3% of the pension amount, capped at \$360 per year.

SECTION 6 - ACTUARIAL ASSUMPTIONS AND METHODS

Mortality Rates

RP-2014 Blue Collar Mortality Table with full generational mortality improvement using Scale MP-2018. For disabled members, RP-2014 Blue Collar Mortality Table set forward one year with full generational mortality improvement using Scale MP-2018.

General Employees: 55% of deaths are job-related.

Police and Fire: 90% of deaths are job-related.

PERAC completed a local system retiree mortality study in 2019 and selected the RP-2014 Blue Collar Mortality Table with full generational mortality improvement using Scale MP-2018. The underlying tables with generational mortality improvement selected reasonably reflect the mortality experience of the System as of the valuation date based on historical and current demographic data as well as professional judgement.

Turnover Rates

Illustrative turnover rates are shown below:

Creditable Service	Groups 1 and 2	Group 4
0	0.1500	0.0150
10	0.0540	0.0150
20	0.0200	0.0000
30	0.0000	0.0000

Disability Rates

Illustrative disability rates are shown below:

Attained Age	Groups 1 and 2	Group 4
20	0.0001	0.0010
30	0.0003	0.0030
40	0.0010	0.0030
50	0.0019	0.0125
60	0.0028	0.0085

General Employees: 55% of disabilities are accidental and 45% are ordinary.

Police and Fire: 90% of disabilities are accidental and 10% are ordinary.

SECTION 6 - ACTUARIAL ASSUMPTIONS AND METHODS

Retirement Rates

Illustrative retirement rates are shown below:

Attained Age	Groups 1 and 2		Group 4
	Male	Female	Male & Female
50	0.0100	0.0150	0.0200
51	0.0100	0.0150	0.0200
52	0.0100	0.0200	0.0200
53	0.0100	0.0250	0.0500
54	0.0200	0.0250	0.0750
55	0.0200	0.0550	0.1500
56	0.0250	0.0650	0.1000
57	0.0250	0.0650	0.1000
58	0.0500	0.0650	0.1000
59	0.0650	0.0650	0.1500
60	0.1200	0.0500	0.2000
61	0.2000	0.1300	0.2000
62	0.3000	0.1500	0.2500
63	0.2500	0.1250	0.2500
64	0.2200	0.1800	0.3000
65	0.4000	0.1500	1.0000
66	0.2500	0.2000	1.0000
67	0.2500	0.2000	1.0000
68	0.3000	0.2500	1.0000
69	0.3000	0.2000	1.0000
70	1.0000	1.0000	1.0000

The turnover, disability and retirement rates are based on PERAC's most recent experience analysis of local retirement systems which reviewed age, gender and job group. The assumptions reflect this analysis as well as professional judgment.

Actuarial Cost Method

Individual Entry Age Normal.

Actuarial Asset Method

The Actuarial Value of Assets is the market value of assets as of the valuation date reduced by the sum of:

- a) 80% of gains and losses of the prior year,
- b) 60% of gains and losses of the second prior year,
- c) 40% of gains and losses of the third prior year,
- d) 20% of gains and losses of the fourth prior year.

Investment gains and losses are determined by the excess or deficiency of the expected return over the actual return on the market value. The actuarial valuation of assets is further constrained to be not less than 85% or more than 115% of market value.

Census Data

Census data as of the valuation date were submitted by the Retirement Board.

SECTION 6 - ACTUARIAL ASSUMPTIONS AND METHODS

Asset Data	Asset information is reported annually to the Public Employee Retirement Administration Commission by the Andover Contributory Retirement Board.
Dependents	80% of all members will be survived by a spouse. Age assumption for spouses is that males are assumed to be three years older than females.
Net Section 3(8)(c) Transfers	Reimbursements paid to and received from other retirement systems for that portion of a retiree's pension that is based on service earned in another retirement system. Net 3(8)(c) transfers are assumed to be \$160,000 for FY2023 and \$0 per year thereafter.
Administrative Expenses	<p>The anticipated administrative expenses for the fiscal year. For Fiscal Year 2022, the administrative expenses were assumed to be \$310,000 and are anticipated to increase 3.5% per year.</p> <p>The administrative expense assumption is based on information relating to the System's administrative expenses provided by the Retirement System.</p>

SECTION 7 - PLAN MEMBER INFORMATION

Exhibit 7.1 - Summary of Census Data as of January 1, 2021

Census data as of December 31, 2020 was provided to us by the Retirement Board. We performed edits on the data to ensure that it is reasonable and complete and made certain assumptions regarding any missing or invalid data so that results are not materially affected. Presented on the following pages are summaries of the demographic profile of active members (Exhibit 7.2) and retired plan members and beneficiaries and disabled plan members (Exhibit 7.3). Below, we present a comparison of the census data from the current and prior valuations:

Valuation Date	January 1, 2021	January 1, 2020	% Change
Census Data			
Active Members	739	755	(2.1%)
Average Age	48.9	48.8	0.3%
Average Service	12.3	12.2	0.6%
Valuation Salary	\$45,838,583	\$44,207,781	3.7%
Average Salary	\$62,028	\$58,553	5.9%
Retired Members and Beneficiaries			
	479	456	5.0%
Average Age	73.1	73.1	0.0%
Total Annual Retirement Allowance	\$14,639,261	\$13,781,656	6.2%
Average Annual Retirement Allowance	\$30,562	\$30,223	1.1%
State Reimbursed COLAs ¹	\$48,171	\$21,663	122.4%
Total System-Funded Retirement Allowance	\$14,591,090	\$13,759,993	6.0%
Disabled Members			
	44	41	7.3%
Average Age	67.3	67.7	(0.6%)
Total Annual Retirement Allowance	\$1,932,535	\$1,662,960	16.2%
Average Annual Retirement Allowance	\$43,921	\$40,560	8.3%
State Reimbursed COLAs ¹	\$7,522	\$270	2685.9%
Total System-Funded Retirement Allowance	\$1,925,013	\$1,662,690	15.8%
Inactive Members			
	163	137	19.0%
Annuity Savings Fund	\$6,580,650	\$2,082,692	216.0%

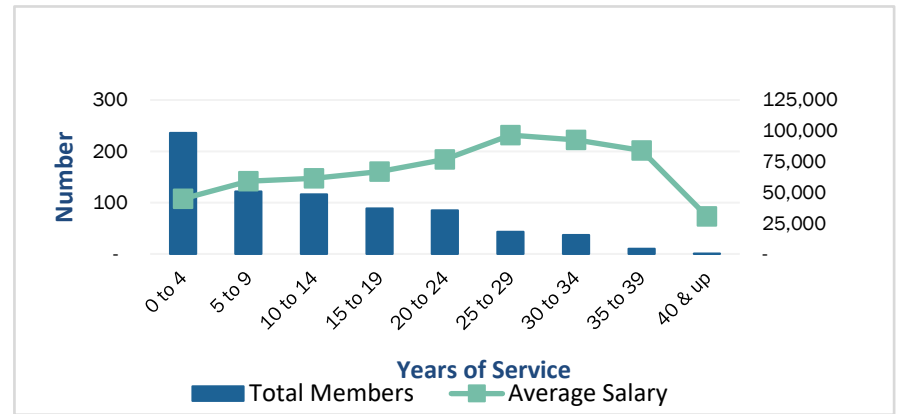
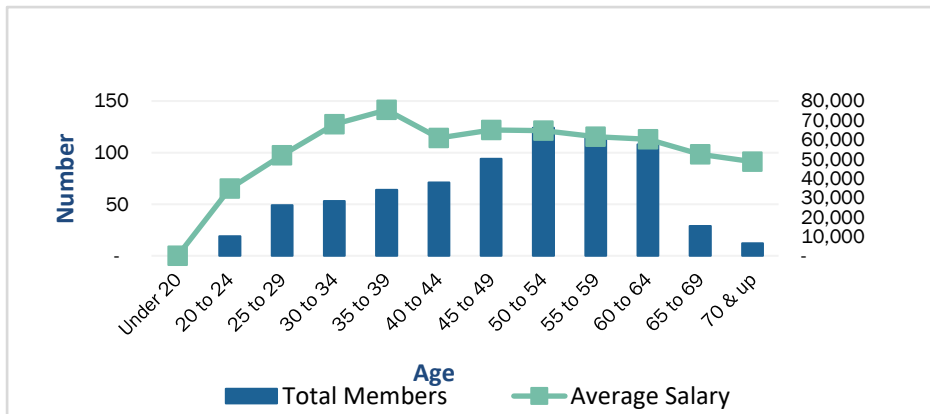
¹KMS worked with the Andover Contributory Retirement System to update missing information regarding state reimbursed COLAs in the 2021 valuation.

SECTION 7 - PLAN MEMBER INFORMATION

Exhibit 7.2 - Active Members by Age and Years of Service as of January 1, 2021

Attained Age	Years of Service										Total	Total Salary	Average Salary
	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				
Under 20	-	-	-	-	-	-	-	-	-	-	-	-	-
20 to 24	19	-	-	-	-	-	-	-	-	-	19	659,046	34,687
25 to 29	44	5	-	-	-	-	-	-	-	-	49	2,544,772	51,934
30 to 34	33	20	-	-	-	-	-	-	-	-	53	3,600,611	67,936
35 to 39	15	23	20	5	1	-	-	-	-	-	64	4,824,968	75,390
40 to 44	35	5	13	12	5	1	-	-	-	-	71	4,323,391	60,893
45 to 49	27	21	10	9	21	6	-	-	-	-	94	6,107,020	64,968
50 to 54	39	14	18	15	13	16	9	-	-	-	124	8,025,201	64,719
55 to 59	12	18	24	18	14	8	16	6	-	-	116	7,147,174	61,614
60 to 64	9	14	21	21	25	6	9	3	-	-	108	6,499,522	60,181
65 to 69	2	2	8	7	4	3	2	1	-	-	29	1,522,609	52,504
70 & up	1	-	2	2	2	3	1	-	1	-	12	584,269	48,689
Total	236	122	116	89	85	43	37	10	1	739	45,838,583	62,028	
Average Salary	44,888	59,118	61,341	66,787	76,781	96,488	92,648	83,917	30,518				

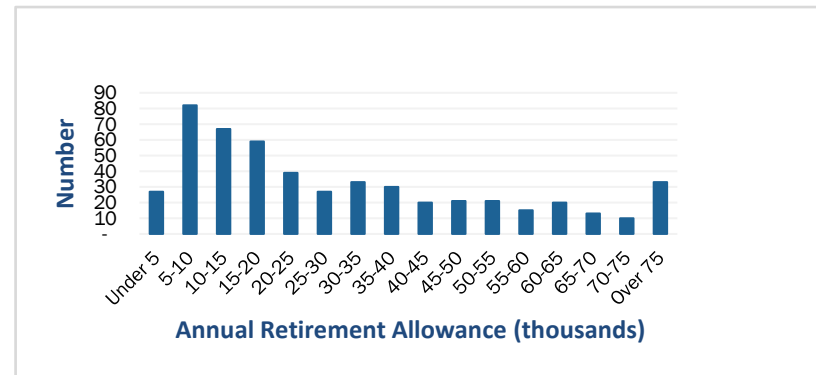
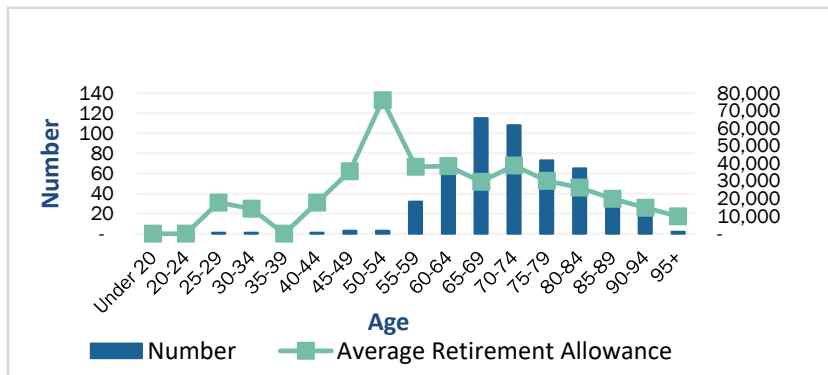
Average Age: **48.94** Average Service: **12.27**



SECTION 7 - PLAN MEMBER INFORMATION

Exhibit 7.3 - Annual Retirement Allowances as of January 1, 2021

Attained Age	Service Retirements		Disability Retirements		Beneficiaries	
	Number	Annual Retirement Allowance	Number	Annual Retirement Allowance	Number	Annual Retirement Allowance
Under 20	0	0	0	0	0	0
20-24	0	0	0	0	0	0
25-29	0	0	0	0	1	17,721
30-34	0	0	0	0	1	14,317
35-39	0	0	0	0	0	0
40-44	0	0	0	0	1	17,661
45-49	0	0	2	97,976	1	8,511
50-54	1	115,145	2	113,002	0	0
55-59	21	729,543	10	483,468	1	7,681
60-64	52	1,915,615	6	350,083	5	161,617
65-69	97	3,031,210	6	207,375	12	148,807
70-74	97	3,824,881	6	244,022	5	132,549
75-79	61	1,885,161	7	249,358	5	63,619
80-84	54	1,482,983	3	119,069	8	107,895
85-89	28	576,596	1	23,171	9	155,804
90-94	15	190,052	1	45,011	2	32,285
95+	2	19,608	0	0	0	0
Total	428	13,770,794	44	1,932,535	51	868,467
Average Age	73.1		67.3		72.9	
Average Retirement Allowance		32,175		43,921		17,029



SECTION 8 - 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 commencement, amount and duration of pension benefits, such as: changes in compensation, mortality, withdrawal, disablement and retirement; 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 current year (Normal Cost) and the past (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 the valuation date and the most recent immediately preceding valuation date.

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 by the local retirement board 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 Member Contributions, including interest, is transferred at the time a member retires, and from which annuity payments are made.

Annuity Savings Fund – The fund in which Member 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 total value of the investments held by the Plan trust that are for the payment of promised benefits. Employer appropriations and Member Contributions, as well as investment earnings, are added to the Plan trust. Benefit payments and other disbursements are withdrawn from the Plan trust. For valuation purposes, assets are usually measured at market value.

Cost of Benefits – The estimated payment from the pension system for benefits for the fiscal year.

Expense Fund – The fund into which the appropriation for administrative expenses is paid and from which all such expenses are paid.

SECTION 8 - GLOSSARY OF TERMS

Funded Ratio – The Actuarial Value of Assets expressed as a percentage of the Actuarial Accrued Liability.

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 22D and Section 22F 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 expected to accrue in the current fiscal year. The Employee Normal Cost is the amount of the expected Member Contributions for the current 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.

Present Value of Future Benefits – The actuarial present value of the cost to finance benefits payable in the future, discounted to reflect the expected effects of the time value of money and the probabilities of payment.

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.

Total Pension Liability – The portion of the Actuarial Present Value attributable to past service in accordance with the Entry Age cost method as stipulated by GASB Statement Number 67 (GASB 67).

Unfunded Actuarial Accrued Liability – The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets.

SECTION 9 - RESULTS BY DEPARTMENT

Department	Water	Sewer	Housing Authority	School - Cafeteria Workers	School	All Other	Total
Summary of Member Data as of January 1, 2021							
Active Members	19	4	9	36	328	343	739
Average Age	46.8	49.8	50.1	53.1	49.8	47.7	48.9
Average Service	13.9	14.2	17.0	7.6	9.4	15.2	12.3
Salary	1,442,617	292,109	612,284	971,928	12,988,690	29,530,956	45,838,583
Average Salary	75,927	73,027	68,032	26,998	39,600	86,096	62,028
Retired Members and Survivors	13	3	5	21	170	267	479
Annual Pensions	672,041	86,857	118,850	189,680	2,535,335	11,036,498	14,639,261
Average Age	66.6	67.2	77.8	74.8	73.1	73.2	73.1
Disabled Members	2	0	0	1	7	34	44
Annual Pensions	92,423	0	0	4,379	219,182	1,616,551	1,932,535
Average Age	67.3	0.0	0.0	55.3	70.9	66.9	67.3
Inactive Members	1	0	2	18	115	27	163
Annuity Savings Fund	75,525	0	10,113	162,309	791,595	1,256,029	2,295,571
Normal Cost as of January 1, 2021							
1.1 Total Normal Cost	233,906	50,263	102,537	216,422	2,496,920	6,265,752	9,365,800
1.2 Administrative Expenses	7,742	1,664	3,394	7,163	82,646	207,391	310,000
1.3 Total Normal Cost = 1.1 + 1.2	241,648	51,927	105,931	223,585	2,579,566	6,473,143	9,675,800
1.4 Employee Normal Cost	143,889	28,939	59,567	90,822	1,208,728	2,940,288	4,472,233
1.5 Employer Normal Cost = 1.3 - 1.4	97,759	22,988	46,364	132,763	1,370,838	3,532,855	5,203,567
1.6 Adjusted for payment timing	101,000	23,750	47,901	137,164	1,416,282	3,649,970	5,376,067
Actuarial Accrued Liability (AAL) as of January 1, 2021							
2.1 Active Employees	4,864,868	1,034,099	2,833,442	2,318,707	37,430,113	120,450,684	168,931,913
2.2 Retired Members and Survivors	8,706,921	1,024,461	1,225,183	2,276,353	29,929,517	123,027,834	166,190,269
2.3 Disabled Members	1,034,015	0	0	97,949	2,732,456	20,675,625	24,540,045
2.4 Inactive Members	192,426	0	10,113	334,106	1,172,157	2,933,565	4,642,367
2.5 Total AAL = 2.1 + 2.2 + 2.3 + 2.4	14,798,230	2,058,560	4,068,738	5,027,115	71,264,243	267,087,708	364,304,594

SECTION 9 - RESULTS BY DEPARTMENT

Department	Water	Sewer	Housing Authority	School - Cafeteria Workers	School	All Other	Total
Actuarial Value of Plan Assets as of January 1, 2021							
3.1 Market Value of Assets							183,587,589
3.2 Additional Contributions	68,612	9,857		30,387	361,132	1,421,081	1,891,069
3.3 Interest on 3.2	4,261	612		1,887	22,426	88,249	117,435
3.4 Market Value Less Additional Contributions	7,390,834	1,028,128	1,662,732	2,510,745	35,592,245	133,394,401	181,579,085
3.5 Market Value = 3.2 + 3.3 + 3.4 *	7,463,707	1,038,597	1,662,732	2,543,019	35,975,803	134,903,731	183,587,589
3.6 Actuarial Value of Assets	6,945,026	966,421	1,547,183	2,366,295	33,475,711	125,528,772	170,829,408
Unfunded Actuarial Accrued Liability (UAAL) as of January 1, 2021							
4.1 UAL = 2.5 - 3.1	7,853,204	1,092,139	2,521,555	2,660,820	37,788,532	141,558,936	193,475,186
Projected Payroll	1,442,617	292,109	612,284	971,928	12,988,690	29,530,956	45,838,583

SECTION 9 - RESULTS BY DEPARTMENT

Department	Water	Sewer	Housing Authority	School - Cafeteria Workers	School	All Other	Total
FY2022 Appropriation							
5.1 Employer Normal Cost	101,000	23,750	47,901	137,164	1,416,282	3,649,970	5,376,067
5.2 Amortization Payment of UAL*	354,049	15,659	84,566	98,983	1,299,794	5,800,739	7,653,790
5.3 Total = 5.1 + 5.2	455,049	39,409	132,467	236,147	2,716,076	9,450,709	13,029,857
FY2023 Appropriation							
6.1 Employer Normal Cost	104,535	24,581	49,578	141,965	1,465,852	3,777,719	5,564,230
6.2 Amortization Payment of UAL**	340,043	48,812	110,503	116,165	1,654,554	6,155,853	8,425,929
6.3 Total = 6.1 + 6.2	444,578	73,393	160,081	258,130	3,120,406	9,933,572	13,990,159
Increase over prior year	-2.301%	86.234%	20.846%	9.309%	14.887%	5.109%	7.370%
FY2024 Appropriation							
7.1 Employer Normal Cost	108,194	25,441	51,313	146,934	1,517,157	3,909,939	5,758,978
7.2 Amortization Payment of UAL	373,794	53,657	121,471	127,695	1,818,779	6,766,859	9,262,254
7.3 Total = 7.1 + 7.2	481,988	79,098	172,784	274,629	3,335,936	10,676,798	15,021,232
Increase over prior year	8.415%	7.773%	7.935%	6.392%	6.907%	7.482%	7.370%

Notes:

1. FY2023 and FY2024 Appropriation is based on Funding Schedule F-3 adopted by the Retirement Board August 26, 2021.
2. 2022 Employer Normal Cost (5.1) is the Employer Normal Cost as of January 1, 2021, adjusted for payment timing (1.6). 2023 Employer Normal Cost (6.1) is based on 2022 Employer Normal Cost (5.1) increased by 3.5%.
- *3. Market Value is developed as follows:
 - (a) Additional appropriations made during FY2021, plus interest for one-half year, are subtracted from Market Value at December 31, 2020.
 - (b) Result from (a) is allocated to all departments except Housing Authority in the proportion that the AAL (2.5) bears to the total AAL (2.5).
 - (c) Market Value for Housing Authority is developed from actual cash flows during 2020.
 - (d) Actuarial Value of assets is allocated to all departments in the proportion that the assets (3.5) bears to the total Market Value of Assets (3.5).
- **4. Amortization Payment of UAL (5.2) equals fiscal year 2022 budgeted appropriation (5.3) developed in the January 1, 2020 actuarial valuation less Employer Normal Cost (5.1).
- ***5. Amortization Payment of UAL (6.2) is the total Amortization Payment of UAL (6.2) allocated to each department in the proportion that the UAL (4.1) less 2022 Amortization Payment of UAL (5.2) bears to the total UAL (4.1) less total 2022 Amortization Payment of UAL (5.2).