

# Commonwealth

ACTUARIAL VALUATION REPORT

JANUARY 1, 2013

PUBLIC EMPLOYEE RETIREMENT ADMINISTRATION COMMISSION  
COMMONWEALTH OF MASSACHUSETTS



# COMMONWEALTH ACTUARIAL VALUATION REPORT

January 1, 2013

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# I. INTRODUCTION & CERTIFICATION

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

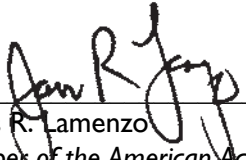
- State Employees' Retirement System (SRS)
- Massachusetts Teachers' Retirement System (TRS)
- Boston Teachers
- Cost of Living Allowance Reimbursements to Local Systems

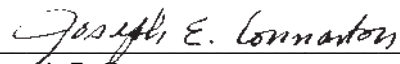
The valuation was performed as of January 1, 2013 pursuant to Chapter 32 of the General Laws of the Commonwealth of Massachusetts, and is based on the plan provisions in effect at that time. The actuarial assumptions used to calculate the accrued liability and the normal cost reflect our recent experience analysis of SRS and TRS. Our detailed experience analysis reports will be completed later this year.

This valuation is based on member data as of December 31, 2012, which was supplied by the State, Massachusetts Teachers', and Boston Retirement Boards. We performed a number of tests on the data to ensure reasonableness and made specific assumptions for a number of Massachusetts Teacher data items. Asset information as of December 31, 2012 was provided by the Pension Reserves Investment Management Board. We reviewed both the membership data and financial information for reasonableness but we did not audit this information.

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

Respectfully submitted,  
Public Employee Retirement Administration Commission

  
\_\_\_\_\_  
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\_\_\_\_\_  
Joseph E. Connarton  
*Executive Director*

Dated: September 25, 2013

## 2. EXECUTIVE SUMMARY

### PART A | PRINCIPAL VALUATION RESULTS

Section 22C of G.L. c. 32 mandates the establishment of a funding schedule for the pension obligation of the Commonwealth of Massachusetts. The schedule, as mandated by law, calls for payment of the Normal Cost plus an amortization payment on the Unfunded Actuarial Liability (UAL). The provisions of Chapter 32, Section 22C require amortization payments such that the UAL is reduced to \$0 by June 30, 2040.

The Commonwealth's current funding schedule is based on the January 1, 2010 Commonwealth Actuarial Valuation and was filed by the Secretary of Administration and Finance in 2011. The FY13 appropriation is \$1.552 billion. This amount will increase 5% in FY14 and 6% in FY15, FY16, and FY17 as specified in Section 46 of Chapter 68 of the Acts of 2011. Therefore, the appropriations for FY14 through FY17 are respectively, \$1.630 billion, \$1.728 billion, \$1.831 billion and \$1.941 billion. Beginning in FY18, the remaining UAL will be amortized on a 4.0% annual increasing basis to 2040. In no event can appropriations be less than the current schedule through FY17. However, these appropriations could increase depending on the results of future actuarial valuations.

The UAL increased approximately \$3.1 billion from the January 1, 2012 valuation (before reflecting the increase due to the change in assumptions and the decrease due to the change in plan provisions reflecting Chapter 176). This increase primarily reflects the final recognition of the 2008 investment loss. We noted in our 2012 report that an increase of this magnitude was to be expected. The development of the Annual Required Contribution (ARC) for FY13 under GASB 27 is shown on page 12 and reflects the UAL as of January 1, 2013. The calculated ARC is approximately \$400 million greater than the amount shown in the current funding schedule.

The current funding schedule is due to be updated in 2014. The results of this valuation will be the basis for developing the revised schedule. The revised schedule will reflect the final recognition of the 2008 investment loss and a net increase in UAL due to assumption and plan provision changes that are outlined both in this report as well as our 2012 report.

The results of the January 1, 2013 actuarial valuation are as follows (in thousands):

Total Normal Cost	\$1,372,224
Expected Employee Contributions	<u>1,058,399</u>
Net Normal Cost	<u>\$313,825</u>

Total Actuarial Liability	\$71,865,832
Assets	<u>43,517,498</u>
Unfunded Actuarial Liability	<u>\$28,348,334</u>

## 2. EXECUTIVE SUMMARY *(continued)*

### PART B | COMPARISON WITH PRIOR VALUATION AND EXPERIENCE ANALYSIS

A comparison of the results of the current valuation and the January 1, 2012 valuation is shown below. (\$000's omitted)

	1/1/13	1/1/12	Increase (Decrease)	Increase (Decrease)
Total Normal Cost	\$1,372,224	\$1,358,334	\$13,890	1.0%
Expected Employee Contributions	<u>1,058,399</u>	<u>1,023,059</u>	<u>35,340</u>	3.5%
Net Normal Cost	<u>\$313,825</u>	<u>\$335,275</u>	<u>(\$21,450)</u>	(6.4%)
Actuarial Liability				
Actives	\$30,833,410	\$29,668,420	\$1,164,990	3.9%
Retirees and Inactives	<u>41,032,422</u>	<u>37,878,167</u>	<u>3,154,255</u>	8.3%
Total	\$71,865,832	\$67,546,587	\$4,319,245	6.4%
Assets (Actuarial Value)	<u>43,517,498</u>	<u>43,941,682</u>	<u>(424,184)</u>	(1.0%)
Unfunded Actuarial Liability	<u>\$28,348,334</u>	<u>\$23,604,905</u>	<u>\$4,743,429</u>	20.1%
Funded Ratio	60.6%	65.1%	(4.5%)	

The development of the actuarial gain/(loss) is shown on page 10. During 2012, there was an overall actuarial loss of \$2.7 billion. There was a non-investment gain on actuarial liability of approximately \$61 million and a loss on assets (on an actuarial value basis) of approximately \$2.8 billion. The return on assets was approximately 13.9% on a market value basis compared to 3.0% on an actuarial value basis.

Since 1998, PERAC has valued system assets using a smoothing technique which spreads gains and losses over short periods (5 years) and employs a "corridor" so that the actuarial value is within 10% of the market value of assets. Due to the severity of the 2008 investment loss and later the 2011 investment loss, the actuarial value of assets has been 110% of the market value in each valuation from January 1, 2009 through January 1, 2012. The 2008 investment loss is completely recognized as of January 1, 2013. The calculated actuarial value of assets as of January 1, 2013 is 99.4% of the market value. The corridor does not apply in this valuation.

## 2. EXECUTIVE SUMMARY *(continued)*

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

The unfunded actuarial liability (UAL) decreased from \$22.1 billion on January 1, 2009 to \$20.0 billion on January 1, 2010, and to \$18.6 billion on January 1, 2011. Those decreases were primarily the result of the plan being subject to the 110% corridor limit in each year. The UAL increased to \$23.6 billion as of January 1, 2012 and to \$28.3 billion as of January 1, 2013. These increases primarily reflected the final recognition of the 2008 loss. In addition, the increase as of January 1, 2012 reflected the increase in the COLA base to \$13,000 (\$286 million) and an update in the mortality assumption (\$726 million). The increase as of January 1, 2013 also reflects the net increase due to revised actuarial assumptions of \$1.6 billion.

The plan has used an investment return assumption of 8.25% for the past 15 years. In last year's report, we recommended lowering this assumption to 8.0% as of January 1, 2013. This decrease in the investment return assumption by itself increased plan liabilities by approximately \$1.66 billion. However, we recommended making the investment return assumption change at the same time we revised our assumptions based on the experience studies that have been in progress the past several years. We suggested this approach since we felt the salary increase assumption would be lowered as part of this experience analysis, and such a change would mitigate some of the increase in actuarial liability caused by decreasing the investment return assumption.

The experience studies encompass the years 2006-2011. Aside from the salary increase assumption, the experience study reviewed rates of retirement, disability, turnover, and mortality. Our review of the SRS mortality assumption was completed prior to our January 1, 2012 valuation and the revised assumption was included in that valuation (see our 2012 report for additional detail). For the remaining assumptions reviewed in the experience studies, the salary increase assumption and the mortality assumption for TRS had the most significant impact on valuation results. In the 2012 valuation, we estimated TRS mortality rates by making modest life expectancy increases to the SRS mortality assumption. Our final TRS experience analysis results determined that mortality was even more favorable than anticipated, and the increase in actuarial liability due to the mortality revision was greater than the decrease in liability due to the salary assumption change. This result is quite different than SRS and is noted in line 7 of the gain/(loss) analysis on page 10. The revised assumptions effective with this valuation (salary, retirement, disability, termination) decreased the active actuarial liability by approximately \$23 million. We are in the process of completing detailed experience analysis reports for both SRS and TRS. These reports will be issued later this year.

As noted above, the net increase in actuarial liability due to the revised assumptions (both investment return and experience analysis) is approximately \$1.64 billion (\$1.66 billion – \$23 million). In addition, the overall change in assumptions increased the net normal cost by approximately \$3.5 million. The SRS normal cost decreased \$17 million but the TRS and Boston teachers normal cost increased \$20.5 million.



## 2. EXECUTIVE SUMMARY *(continued)*

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

Chapter 176 of the Acts of 2011, An Act Providing for Pension Reform and Benefit Modernization made a number of changes to the Chapter 32 pension law. There are several changes that will have the most impact on decreasing plan liabilities over the longer term. These include an increase in the normal retirement age by two years (for example, from age 65 to age 67 for Group I members), an increase in the age (early retirement) reduction factor for ages below the maximum age (from a 4.0% to a 6.0% annual reduction), and an increase in the period for determining a member's average annual compensation (from 3 years to 5 years). Since these changes are effective only for members hired after April 1, 2012, this is the first actuarial valuation to reflect these changes.

As of January 1, 2013, there were approximately 10,200 members hired after April 1, 2012. Since these members have less than one year of service and are generally young, there is relatively little impact on plan costs (on a percentage basis) in this valuation. The normal cost decreased approximately \$15 million and the actuarial liability decreased approximately \$1.5 million for these members compared to the figures under the prior provisions.

#### Teachers

We have detailed a number of the assumptions we made for missing or questionable data for active members of the Massachusetts Teachers' Retirement System (TRS) in Part C of Section 7. We performed a number of additional data checks as part of this valuation. We believe these assumptions provide reasonable valuation results on an overall basis for the Commonwealth. We will continue to work on data issues with the TRS as their new system implementation moves forward.

#### Boston Teachers

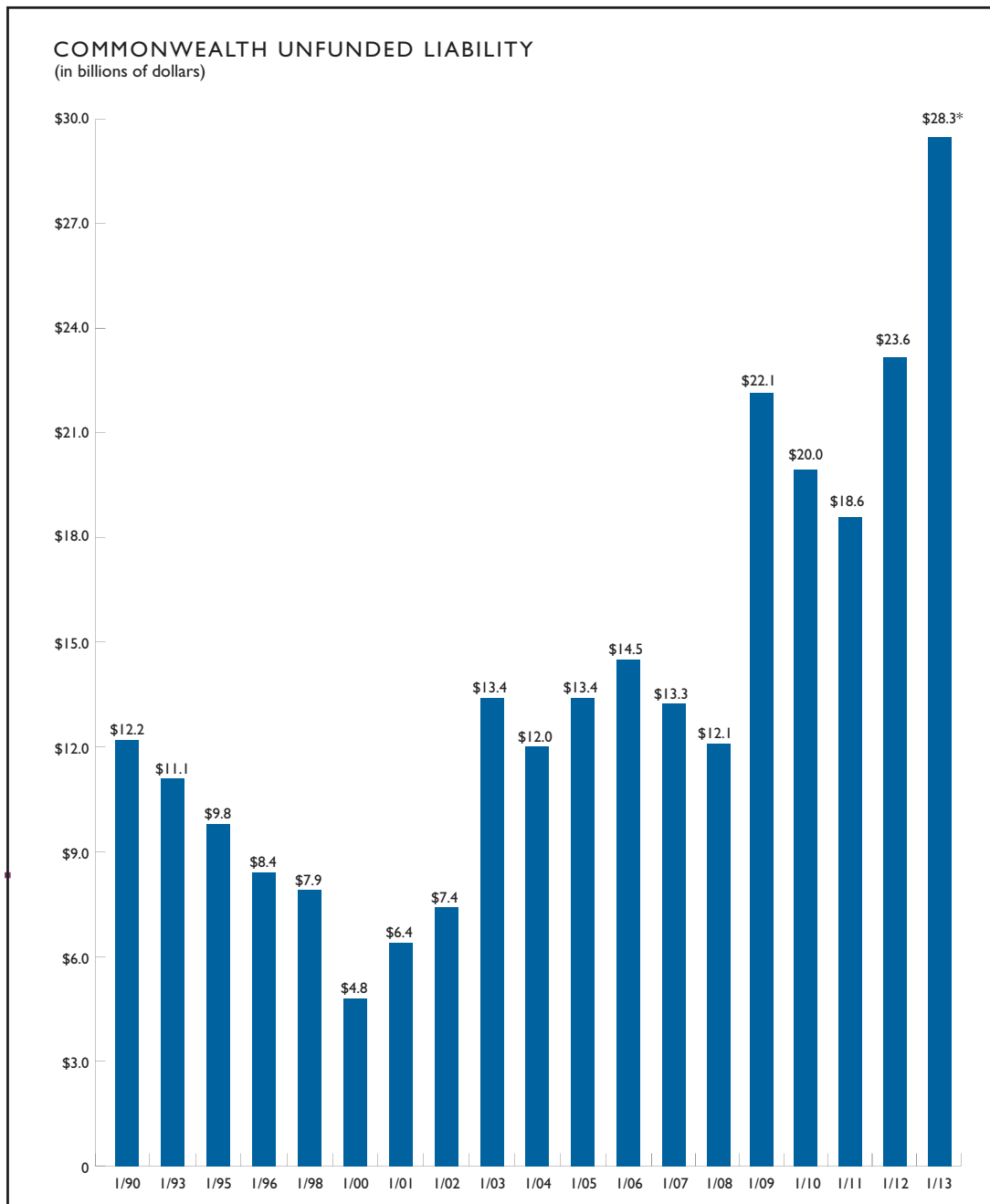
As part of this valuation, we noticed that the January 1, 2012 actuarial liability in our report was overstated by approximately \$73 million and the normal cost was understated by \$1 million. The published report incorrectly reflected the January 1, 2011 active data file. The error did not materially affect the Commonwealth results.

## 2. EXECUTIVE SUMMARY

### PART C | FUNDING PROGRESS UNFUNDED LIABILITY

The chart below shows the Commonwealth's unfunded actuarial accrued liability (UAL) since 1990. The UAL represents the actuarial accrued liability less the actuarial value of plan assets. When there is no UAL, a system is said to be "fully funded." In this exhibit, for years prior to 2000, the figures were estimated to reflect implementation of updated actuarial software.

\*This figure would be \$26.7 billion without the assumption changes outlined on the previous pages.

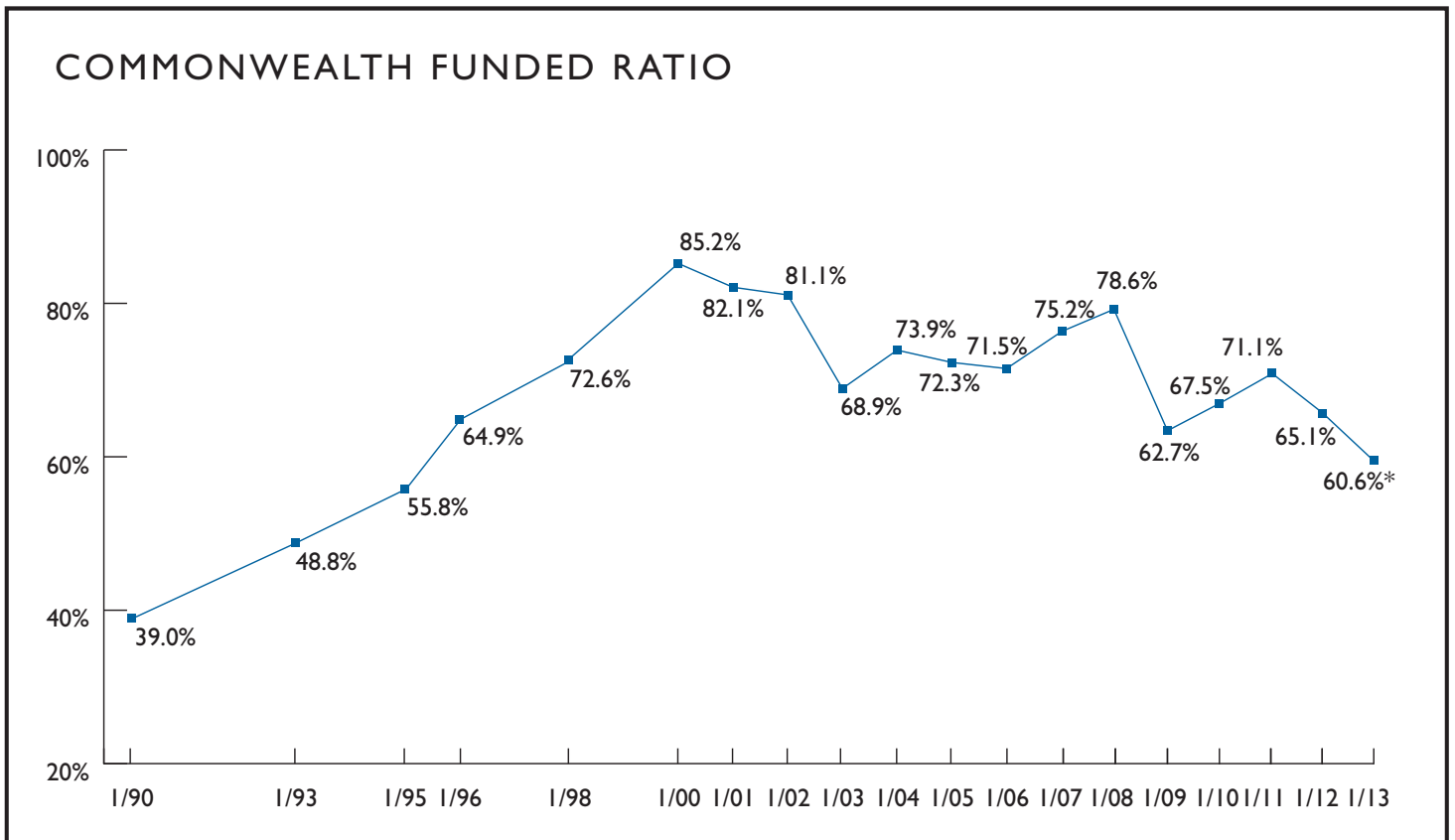


## 2. EXECUTIVE SUMMARY

### PART C | FUNDING PROGRESS FUNDED RATIO

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

\*This figure would be 62.0% without the assumption changes outlined on the previous pages.

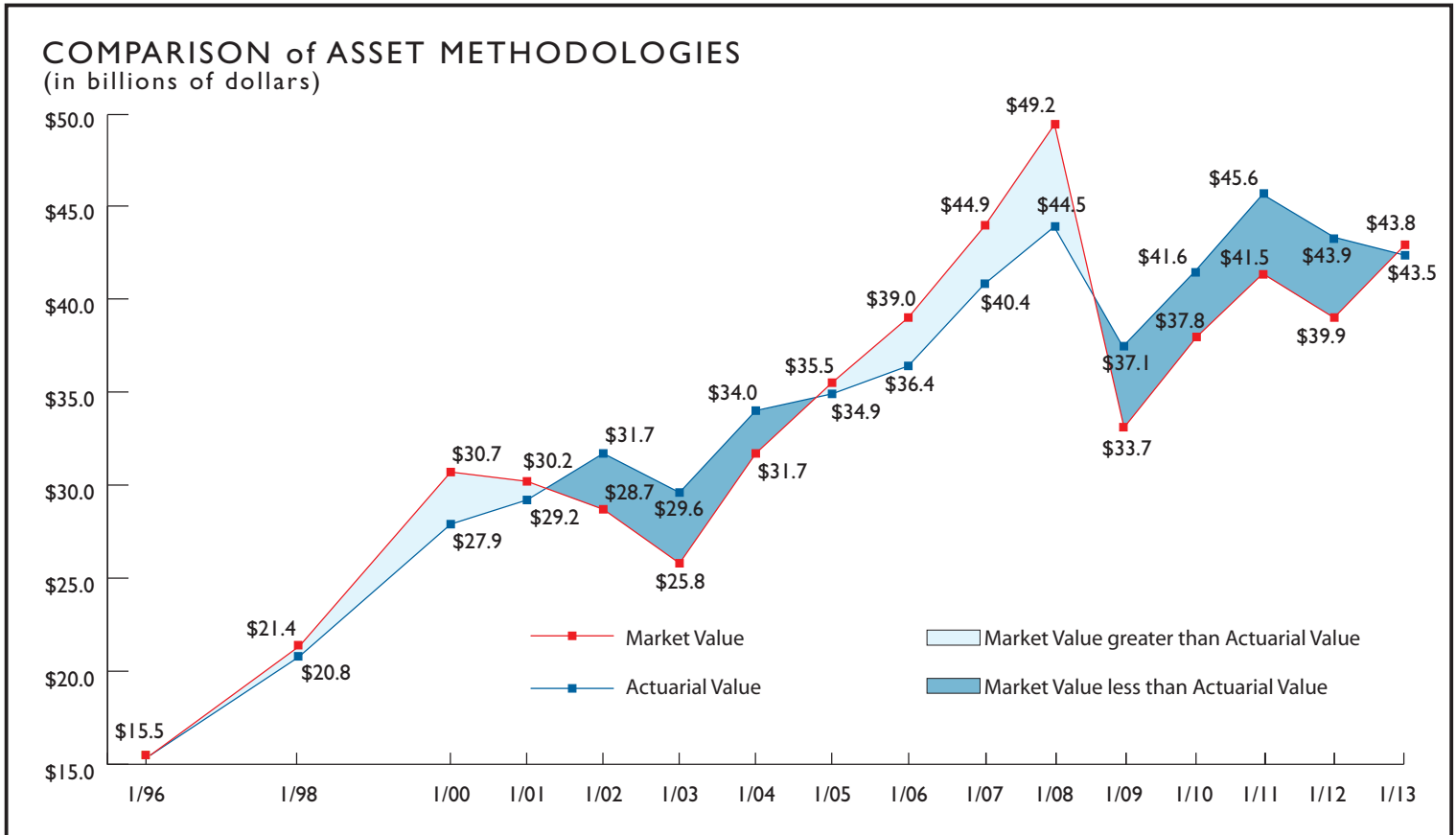


## 2. EXECUTIVE SUMMARY

### PART C | FUNDING PROGRESS

#### COMPARISON OF MARKET AND ACTUARIAL VALUE OF ASSETS

In valuations prior to 1998, plan assets were determined at market value. As part of the 1998 valuation, this methodology was adjusted to reduce the potential volatility in the market value approach from year to year. The actuarial method smoothes gains and losses over a five-year period. Investment gains and losses are not fully realized until five years have elapsed. Therefore, in some years the actuarial value will be less than the market value, and in other years, it will exceed the market value.



### 3. SUMMARY OF VALUATION RESULTS

(Dollars in thousands)

A. Number of Members	State	Mass. Teachers	Boston Teachers	Local COLA	Total
Active	87,175	87,765	5,492		180,432
Vested Terminated	4,067	0	238		4,305
Retired/ Beneficiaries	<u>55,383</u>	<u>59,019</u>	<u>4,235</u>		<u>118,637</u>
Total	146,625	146,784	9,965		303,374
<b>B. Total Payroll</b>	<b>\$5,183,195</b>	<b>\$5,783,294</b>	<b>\$441,918</b>		<b>\$11,408,407</b>
<b>C. Normal Cost</b>					
Superannuation	\$454,813	\$582,598	\$44,211		\$1,081,622
Death	42,443	26,869	1,903		71,215
Disability	69,448	8,896	629		78,973
Termination	<u>60,845</u>	<u>73,779</u>	<u>5,790</u>		<u>140,414</u>
Total Normal Cost	\$627,549	\$692,142	\$52,533		\$1,372,224
Expected Employee Contributions	<u>442,377</u>	<u>572,482</u>	<u>43,540</u>		<u>1,058,399</u>
Net Employer Normal Cost	\$185,172	\$119,660	\$8,993		\$313,825
<b>D. Actuarial Liability</b>					
Active					
Superannuation	\$13,102,818	\$14,913,060	1,103,306		29,119,184
Death	298,846	219,153	16,511		534,510
Disability	364,977	80,241	6,029		451,247
Termination	<u>306,595</u>	<u>393,468</u>	<u>28,406</u>		<u>728,469</u>
Total Active	\$14,073,236	\$15,605,922	\$1,154,252		\$30,833,410
Vested Terminated (a)	627,084	600,000	35,188		1,262,272
Non-Vested Terminated	185,485	0	33,139		218,624
Retirees and Survivors	<u>14,499,637</u>	<u>22,929,296</u>	<u>1,878,493</u>	<u>244,100</u>	<u>39,551,526</u>
Total Actuarial Liability	\$29,385,442	\$39,135,218	\$3,101,072	\$244,100	\$71,865,832
<b>E. Actuarial Value of Assets</b>	<b>20,317,389</b>	<b>21,787,470</b>	<b>1,412,639</b>	<b>0</b>	<b>43,517,498</b>
<b>F. Unfunded Actuarial Liability</b>	<b>\$9,068,053</b>	<b>\$17,347,748</b>	<b>\$1,688,433</b>	<b>244,100</b>	<b>28,348,334</b>
<b>G. Funded Ratio: E/D</b>	<b>69.1%</b>	<b>55.7%</b>	<b>45.6%</b>	<b>0.0%</b>	<b>60.6%</b>

(a) Massachusetts Teachers' amount is estimated and includes non-vested terminated members.

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

	State	Mass. Teachers	Boston Teachers	Local COLA	Total
A. Gain/(loss) on Actuarial Liability					
1. Actuarial Liability 1/1/12	27,785	36,483	3,016	263	67,547
2. Total Normal Cost 1/1/12	629	679	52	0	1,359
3. Interest on (1) and (2) at 8.25%	2,344	3,066	253	22	5,685
4. Benefits paid during 2012 [a]	1,550	2,350	195	37	4,132
5. Interest on (4) assuming mid year payment	64	97	8	2	170
6. Expected Actuarial Liability before adjustments: (1)+(2)+(3)-(4)-(5)	29,144	37,780	3,118	246	70,288
7. Increase due to change in assumption	162	1,380	98	0	1,640
8. Decrease due to change in plan provisions (Chapter 176)	(1)	(1)	0	0	(2)
9. Expected Actuarial Liability 1/1/13: (6)+(7)+(8)	29,305	39,159	3,216	246	71,926
10. Actuarial Liability 1/1/13	29,385	39,135	3,101	244	71,865
11. Gain/(loss): (9)-(10)	(80)	24	115	2	61
B. Gain/(loss) on assets					
12. Actuarial Value of Assets (AVA) 1/1/12	20,508	22,572	1,293	0	44,373
13. Interest on (12) at 8.25%	1,692	1,862	107	0	3,661
14. Net Receipts [b]	507	653	185	0	1,345
15. Net Disbursements [b]	1,305	1,604	106	0	3,015
16. Net Cash Flow: (14)-(15)	(798)	(951)	79	0	(1,670)
17. Interest on (16) [c]	(33)	(39)	3	0	(69)
18. Expected AVA 1/1/13: (12)+(13)+(16)+(17)	21,369	23,444	1,482	0	46,295
19. AVA 1/1/13	20,317	21,787	1,413	0	43,517
20. Gain/(loss): (19)-(18)	(1,052)	(1,657)	(69)	0	(2,778)
C. Total Gain/(loss): (11)+(20)	(1,132)	(1,633)	46	2	(2,717)

[a] Estimated

[b] Amounts actually received or disbursed by the fund. Boston teachers' receipts reflect full year amounts of \$90 million in January and \$95 million in December.

[c] Assumes time weighting based on monthly cash flow. Boston Teachers assumed mid year.

Figures may not add due to rounding.

## 5. AUDIT INFORMATION

### PART A | OVERVIEW

We have included the actuarial information required by GASB Statement No. 27 in this report. The Commonwealth of Massachusetts began implementing Statement No. 27 in Fiscal Year 1996.

Under GASB Statement No. 27, an Annual Required Contribution (ARC) must be calculated each year. The same methods and assumptions that are used to determine funding requirements are used in this calculation. At this time, the methods and assumptions used by the Commonwealth to determine the funding schedule are well within the parameters established by Statement No. 27.

When GASB 27 was implemented in FY96, a Net Pension Obligation (NPO) at transition was calculated. This was essentially the cumulative difference between the employer's required contributions and the contributions actually made by the employer for all years, beginning with Fiscal Year 1988. In each year since FY96, the NPO has been updated.

After the January 1, 2006 actuarial valuation was released, the Comptroller's office requested we recalculate the GASB 27 development from inception through FY06 assuming a zero pension obligation as of June 30, 1997. Those results were first shown in the January 1, 2007 valuation report.

As part of this valuation, we brought the NPO forward from FY12 to FY13. For FY13, the amortization cost was determined using a 4.0% annual increasing amortization to FY40. The current schedule used by the Commonwealth has a FY12 appropriation of \$1.478 billion and increases by 5% in FY13 and FY14 and by 6% in FY15, FY16, and FY17. Beginning in FY18, the remaining UAL will be amortized on a 4.0% annual increasing basis to 2040. In no event can appropriations be less than the current schedule through FY17.

Note that, in any year, the amount of the ARC will not equal the Commonwealth's appropriation amounts for the following reasons:

1. The ARC is based upon the most recent valuation, whereas the funding schedule is generally submitted to the legislature 15 months after the valuation upon which it is based. The funding schedule is then set for the upcoming three fiscal years.
2. Amortization bases of actuarial gains and losses and plan amendments may be amortized on a different basis than the rest of the funding schedule. However, the amortization cost that GASB 27 reflects is an amortization of the entire unfunded liability which is roughly equivalent to the current schedule.
3. Although there is no difference in the totals, until FY11 contributions had been allocated in a slightly different manner between the State and local COLA portions. For purposes of Statement No. 27, a larger contribution was made to the State, with a lesser amount to the COLA. This was done so the NPO for the local COLA remained at zero. No assets are attributed to the local COLA. We stopped making this adjustment in FY11.

## 5. AUDIT INFORMATION *(continued)*

### PART B | GASB STATEMENT NO. 27 (\$000's omitted)

	State	Mass. Teachers	Boston Teachers	Local COLA	Total
1. Annual Required Contribution (ARC) for FY13					
a. Normal Cost	185,172	119,660	8,993	0	313,825
b. Amortization Cost	514,790	984,826	95,852	13,857	1,609,325
c. ARC: (a) + (b)	699,962	1,104,486	104,845	13,857	1,923,150
2. Amount under (over) funded from prior year (NPO)	299,185	936,306	184,386	(7,290)	1,412,586
3. Interest on NPO	23,935	74,904	14,751	(583)	113,007
4. Amortization of NPO	16,985	53,154	10,468	(414)	80,192
5. Pension Cost: (1c) + (3) – (4)	706,912	1,126,236	109,128	13,688	1,955,965
6. Actual Contribution *	545,453	891,580	94,846	20,121	1,552,000
7. (5) – (6)	161,459	234,656	14,282	(6,433)	403,965
8. Net Pension Obligation/(Asset): (2)+ (7)	460,644	1,170,962	198,668	(13,723)	1,816,551

\* estimated allocation

Totals may not add exactly due to rounding.



## 6. ASSETS

### PART A | STATE AND MASS. TEACHERS'

(Dollars shown in thousands)

	State	Mass. Teachers
Pension Reserves Investment Trust		
Market Value	\$20,405,004	\$21,934,211
Actuarial Value	\$20,317,389	\$21,787,470
Actuarial Value as a Percentage of Market Value	99.6%	99.3%

The Market Value of Assets shown above for the State consists of the assets as of December 31, 2012 for the State Employees' Retirement System (\$20.224 billion) and the assets remaining in the Massachusetts Turnpike Authority Employees' Retirement System fund (\$181.1 million).

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

### PART B | BOSTON TEACHERS

Based on the enactment of Chapter 112 of the Acts of 2010, the assets of the Boston Teachers are maintained by PRIM. The transfer of these assets occurred during 2010. We set the actuarial value of assets to 99.4% of the market value based on the results for State and Massachusetts Teachers.

Market Value	\$1,421,166
Actuarial Value	\$1,412,639

### PART C | IMPACT OF 2008 LOSS AND ASSET CORRIDOR

Due to the severity of the 2008 investment loss, the actuarial value of assets had been 110% of the market value in each valuation from January 1, 2009 through January 1, 2012. The 2008 investment loss is completely recognized as of January 1, 2013. The corridor does not apply in this valuation.

## 6. ASSETS (continued)

### PART D | DEVELOPMENT OF ACTUARIAL VALUE OF ASSETS

(\$000s omitted)

	State	Mass. Teachers	Total
<b>A. Development of 12/31/12 expected actuarial value of assets (AVA)</b>			
1. Market Value (MV) 12/31/11	18,643,313	20,128,614	38,771,927
2. Actuarial Value 12/31/11 (as calculated)	20,919,202	22,572,468	43,491,670
3. Net Receipts 2012	506,882	652,973	1,159,855
4. Net Disbursements 2012	1,304,565	1,603,693	2,908,258
5. Net Cash Flow: (3)-(4)	(797,683)	(950,720)	(1,748,403)
6. Expected Investment Return on (2): 0.0825 x (2)	1,725,834	1,862,229	3,588,063
7. Expected Investment Return on (5): ½x 0.0825 x (5)	(32,904)	(39,217)	(72,122)
8. Expected AVA 12/31/12: (2)+(5)+(6)+(7)	21,814,449	23,444,759	45,259,208
<b>B. Previous differences not yet amortized</b>			
1. Unrecognized amount of 12/31/11 difference			
a. .2 x 2008 Gain/(loss)	(1,639,689)	(1,836,382)	(3,476,071)
b. .4 x 2009 Gain/(loss)	388,571	439,852	828,423
c. .6 x 2010 Gain/(loss)	374,972	412,034	787,006
d. .8 x 2011 Gain/(loss)	(1,399,742)	(1,459,358)	(2,859,101)
e. Total	(2,275,889)	(2,443,854)	(4,719,743)
<b>C. Gain/(loss) from 2012</b>			
1. Market Value 12/31/12	20,405,004	21,934,211	42,339,215
2. Expected Market Value 12/31/12: A(8)+B(1e)	19,538,560	21,000,905	40,539,465
3. Gain/ (loss) from 2012 investment: (1)-(2)	866,444	933,306	1,799,750
<b>D. Development of AVA 12/31/12</b>			
1. 2012 Gain/(loss)	866,444	933,306	1,799,750
2. 2011 Gain/(loss)	(1,749,678)	(1,824,198)	(3,573,876)
3. 2010 Gain/(loss)	624,953	686,724	1,311,677
4. 2009 Gain/(loss)	971,427	1,099,630	2,071,057
5. 2008 Gain/(loss)	(8,198,447)	(9,181,910)	(17,380,357)
6. 20% of 2012 Gain/(loss)	173,289	186,661	359,950
7. 20% of 2011 Gain/(loss)	(349,936)	(364,840)	(714,775)
8. 20% of 2010 Gain/(loss)	124,991	137,345	262,335
9. 20% of 2009 Gain/(loss)	194,285	219,926	414,211
10. 20% of 2008 Gain/(loss)	(1,639,689)	(1,836,382)	(3,476,071)
11. Total	(1,497,060)	(1,657,290)	(3,154,350)
12. Actuarial Value 12/31/12: A(8)+D(11)	20,317,389	21,787,470	42,104,859
9 13. Percentage of Market Value	99.6%	99.3%	99.4%
14. Actuarial Value: (12) but not less than 90% of C(1)	20,317,389	21,787,470	42,104,859

## 7. SYSTEM MEMBERSHIP

### PART A | STATE ACTIVE MEMBERS

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

	Actives	Vested Terminations
Number of Members	87,175	4,067
Average Age	47.6	53.2
Average Service	13.5	15.8
Average Salary	\$59,457	\$52,883
Average Annuity Savings Fund Balance	\$58,282	\$57,823

### Age by Service Distribution of Active Members

Present Age	Years of Service							Total
	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30+	
0 - 24	1,874	20						1,894
25 - 29	5,194	1,258	10					6,462
30 - 34	3,865	3,242	692	10				7,809
35 - 39	2,658	2,351	2,284	559	13			7,865
40 - 44	2,484	2,400	2,537	2,342	933	56	1	10,753
45 - 49	2,280	2,164	2,059	2,000	2,272	1,301	77	12,153
50 - 54	1,996	1,975	1,976	1,783	2,040	2,606	1,207	13,583
55 - 59	1,469	1,744	1,822	1,637	1,601	2,189	2,668	13,130
60 - 64	820	1,149	1,255	1,129	1,142	1,476	2,140	9,111
65+	310	485	629	626	536	695	1,134	4,415
Total	22,950	16,788	13,264	10,086	8,537	8,323	7,227	87,175

## 7. SYSTEM MEMBERSHIP *(continued)*

### PART A | STATE ACTIVE MEMBERS *(continued)*

#### Salary by Age Distribution of Active Members

Present Age	Number of Members	Total Salary	Average Salary
0 - 24	1,894	\$61,470,848	\$32,456
25 - 29	6,462	\$273,386,738	\$42,307
30 - 34	7,809	\$392,385,548	\$50,248
35 - 39	7,865	\$437,234,943	\$55,592
40 - 44	10,753	\$645,561,786	\$60,036
45 - 49	12,153	\$742,096,607	\$61,063
50 - 54	13,583	\$854,255,763	\$62,892
55 - 59	13,130	\$856,861,876	\$65,260
60 - 64	9,111	\$615,475,676	\$67,553
65+	4,415	\$304,465,223	\$68,962
Total	87,175	\$5,183,195,009	\$59,457

## 7. SYSTEM MEMBERSHIP *(continued)*

### PART B | STATE RETIREES AND SURVIVORS

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Number of Members	45,084	635	3,163	6,501	55,383
Average Age	72.0	65.3	63.1	75.4	71.8
Average Annual Benefit	\$30,068	\$18,322	\$36,117	\$15,462	\$28,564

### Benefit by Retirement Type

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Annuity	\$240,937,278	\$1,758,973	\$8,068,550	\$14,675,438	\$265,440,239
Pension	\$1,114,642,256	\$9,875,595	\$106,169,612	\$85,842,599	\$1,316,530,062
Total	\$1,355,579,534	\$11,634,568	\$114,238,162	\$100,518,037	\$1,581,970,301

## 7. SYSTEM MEMBERSHIP *(continued)*

### PART B | STATE RETIREES & SURVIVORS *(continued)*

#### Benefit by Age Distribution

Present Age	Number of Members	Total Benefits	Average Benefits
Less than 40	120	\$3,055,414	\$25,462
40 – 44	368	\$11,623,729	\$31,586
45 – 49	972	\$31,962,943	\$32,884
50 – 54	1,673	\$50,632,187	\$30,264
55 – 59	3,801	\$110,174,820	\$28,986
60 – 64	7,921	\$261,570,297	\$33,022
65 – 69	10,911	\$362,343,375	\$33,209
70 – 74	8,828	\$271,829,530	\$30,792
75 – 79	7,067	\$191,579,724	\$27,109
80 – 84	6,250	\$148,861,671	\$23,818
85 – 89	4,708	\$95,339,219	\$20,250
90+	2,764	\$42,997,393	\$15,556
Totals	55,383	\$1,581,970,301	\$28,564

## 7. SYSTEM MEMBERSHIP *(continued)*

### PART C | MASSACHUSETTS TEACHERS' ACTIVE MEMBERS

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

Until the January 1, 2006 actuarial valuation, we had estimated the total creditable service for each member for the actuarial valuation. The estimate was based on either the employment date (date of hire as a teacher) or the adjusted employment date and was set equal to the greater of the two calculated service amounts. We used this methodology, which we believed was conservative, because we had no way to assess additional costs for members who buy back service near retirement. Several years ago, with the help of the TRS, we compared the service estimated for valuation purposes with actual service for over 6,800 members who retired in 2004 and 2005. We found that, in total, our methodology slightly understated service. To better reflect this cost, we adjusted our normal cost and liability figures as of January 1, 2006 and have continued using this methodology in each valuation. We increased plan liabilities by 1.0% based on our analysis.

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

Based on our experience with prior years' data, buyback issues, and questions to TRS regarding specific members, we made several adjustments. Members whose pay was less than \$5,000 were assumed to be inactive. For members with pay between \$5,000 and \$10,000, we used an estimated pay of \$50,000. For members with submitted pay over \$150,000, we compared this year's figure to the pay used in last year's valuation. We adjusted this year's figure based on the amount contributed if we believed it was overstated.

Pay for all members hired in 2012 was annualized. We assumed a rate of pay of \$50,000 for members hired after October 1.

The data for approximately 12,000 members with a reported status date in 2012 is not consistent. In some cases reported pay is overstated and in others it is understated. As in previous years, after reviewing with the TRS, we could draw no definitive conclusions. To provide a conservative estimate of the salary for members in both circumstances, we increased plan liabilities by an additional 1.0% in this valuation.

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

## 7. SYSTEM MEMBERSHIP *(continued)*

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

	Actives
Number of Members	87,765
Average Age	44.1
Average Service	12.9
Average Salary	\$65,895
Average Annuity Savings Fund Balance	\$62,393

#### Age by Service Distribution of Active Members

Present Age	Years of Service							Total
	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30+	
0 - 24	1,132							1,132
25 - 29	5,353	1,958	5					7,316
30 - 34	8,058	6,777	1,754	3				16,592
35 - 39	1,366	3,148	5,174	1,114				10,802
40 - 44	1,178	2,059	3,716	4,376	559	1		11,889
45 - 49	1,095	1,910	2,289	2,383	1,661	658	2	9,998
50 - 54	734	1,768	2,340	1,775	1,110	2,241	385	10,353
55 - 59	415	1,170	2,161	1,779	1,139	1,528	3,023	11,215
60 - 64	168	604	1,127	1,077	857	833	2,315	6,981
65+	20	106	270	200	152	161	578	1,487
Total	19,519	19,500	18,836	12,707	5,478	5,422	6,303	87,765



## 7. SYSTEM MEMBERSHIP *(continued)*

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

#### Salary by Age Distribution of Active Members

Present Age	Number of Members	Total Salary	Average Salary
0 - 24	1,132	\$46,072,939	\$40,700
25 - 29	7,316	\$359,628,134	\$49,156
30 - 34	16,592	\$919,906,234	\$55,443
35 - 39	10,802	\$713,682,115	\$66,069
40 - 44	11,889	\$829,429,581	\$69,764
45 - 49	9,998	\$696,935,873	\$69,708
50 - 54	10,353	\$740,442,008	\$71,520
55 - 59	11,215	\$833,643,586	\$74,333
60 - 64	6,981	\$527,826,186	\$75,609
65+	1,487	\$115,727,456	\$77,826
Total	87,765	\$5,783,294,111	\$65,895

## 7. SYSTEM MEMBERSHIP *(continued)*

### PART D | MASSACHUSETTS TEACHERS' RETIREES AND SURVIVORS

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Number of Members	54,658	413	322	3,626	59,019
Average Age	70.7	67.6	70.1	72.3	70.8
Average Annual Benefit	\$41,913	\$20,367	\$37,105	\$17,847	\$40,258

#### Benefit by Retirement Type

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Annuity	\$380,379,867	\$994,631	\$642,861	\$9,222,271	\$391,239,630
Pension	\$1,910,511,757	\$7,416,811	\$11,304,869	\$55,490,381	\$1,984,723,818
Total	\$2,290,891,624	\$8,411,442	\$11,947,730	\$64,712,652	\$2,375,963,448

## 7. SYSTEM MEMBERSHIP *(continued)*

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

#### Benefit by Age Distribution

Present Age	Number of Members	Total Benefits	Average Benefits
Less than 40	143	\$2,635,450	\$18,430
40 – 44	34	\$456,038	\$13,413
45 – 49	74	\$1,334,737	\$18,037
50 – 54	160	\$3,470,131	\$21,688
55 – 59	2,505	\$112,719,211	\$44,998
60 – 64	13,730	\$665,775,319	\$48,491
65 – 69	16,071	\$728,016,206	\$45,300
70 – 74	9,776	\$388,312,150	\$39,721
75 – 79	6,587	\$223,480,055	\$33,927
80 – 84	5,142	\$146,866,011	\$28,562
85 – 89	2,995	\$69,278,007	\$23,131
90+	1,802	\$33,620,133	\$18,657
Totals	59,019	\$2,375,963,448	\$40,258

## 7. SYSTEM MEMBERSHIP *(continued)*

### PART E | BOSTON TEACHERS' ACTIVE MEMBERS

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

	Actives	Vested Terminations
Number of Members	5,492	238
Average Age	43.3	50.0
Average Service	12.8	21.1
Average Salary	\$80,466	\$49,431
Average Annuity Savings Fund Balance	\$75,763	\$75,418

### Age by Service Distribution of Active Members

Present Age	Years of Service							Total
	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30+	
0 - 24	120							120
25 - 29	517	117	2					636
30 - 34	315	479	108	10				912
35 - 39	154	295	292	77	12			830
40 - 44	90	127	181	205	65	11		679
45 - 49	60	64	104	115	134	61	6	544
50 - 54	47	82	92	90	109	147	42	609
55 - 59	20	50	74	90	98	154	159	645
60 - 64	22	24	39	63	56	88	103	395
65+	3	4	15	15	15	23	47	122
Total	1,348	1,242	907	665	489	484	357	5,492

## 7. SYSTEM MEMBERSHIP *(continued)*

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

#### Salary by Age Distribution of Active Members

Present Age	Number of Members	Total Salary	Average Salary
0 - 24	120	\$6,220,175	\$51,835
25 - 29	636	\$38,809,170	\$61,021
30 - 34	912	\$67,291,515	\$73,785
35 - 39	830	\$66,955,347	\$80,669
40 - 44	679	\$57,373,369	\$84,497
45 - 49	544	\$47,059,752	\$86,507
50 - 54	609	\$52,550,364	\$86,290
55 - 59	645	\$58,413,073	\$90,563
60 - 64	395	\$36,143,717	\$91,503
65+	122	\$11,101,590	\$90,997
Total	5,492	\$441,918,074	\$80,466

## 7. SYSTEM MEMBERSHIP *(continued)*

### PART F | BOSTON TEACHERS' RETIREES AND SURVIVORS

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Number of Members	3,822	39	68	306	4,235
Average Age	71.0	66.6	71.0	73.9	71.2
Average Annual Benefit	\$48,872	\$22,265	\$42,184	\$22,310	\$46,601

#### Benefit by Retirement Type

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Annuity	\$34,260,455	\$152,674	\$276,151	\$1,345,470	\$36,034,750
Pension	\$152,529,388	\$715,663	\$2,592,370	\$5,481,291	\$161,318,712
Total	\$186,789,843	\$868,337	\$2,868,521	\$6,826,761	\$197,353,462

## 7. SYSTEM MEMBERSHIP *(continued)*

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

#### Benefit by Age Distribution

Present Age	Number of Members	Total Benefits	Average Benefits
Less than 40	4	\$59,536	\$14,884
40 - 44	2	\$24,552	\$12,276
45 - 49	7	\$129,844	\$18,549
50 - 54	15	\$423,429	\$28,229
55 - 59	184	\$8,462,215	\$45,990
60 - 64	903	\$52,229,571	\$57,840
65 - 69	1,191	\$62,681,798	\$52,630
70 - 74	715	\$32,307,496	\$45,185
75 - 79	430	\$17,057,232	\$39,668
80 - 84	369	\$12,777,987	\$34,629
85 - 89	268	\$7,823,813	\$29,193
90+	147	\$3,375,989	\$22,966
Totals	4,235	\$197,353,462	\$46,601

## 8. VALUATION COST METHODS

### PART A | ACTUARIAL COST METHOD

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

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

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

### PART B | ASSET VALUATION METHOD

The actuarial value of assets is determined in accordance with the deferred recognition method under which 20% of the gains or losses occurring in the prior year are recognized, 40% of those occurring 2 years ago, etc., so that 100% of gains and losses occurring 5 years ago are recognized. The actuarial value of assets will be adjusted, if necessary, in order to remain between 90% and 110% of market value. The actuarial value of assets as of January 1, 2013 is 99.4% of the market value.

In valuations prior to 1998, plan assets were determined at market value. As part of the 1998 valuation, this methodology was adjusted to reduce the potential volatility in the market value approach from year to year.



## 9. ACTUARIAL ASSUMPTIONS

INVESTMENT RETURN	8.00% per year (previous assumption was 8.25%)
INTEREST RATE CREDITED TO THE ANNUITY SAVINGS FUND	3.5% per year
COST OF LIVING INCREASES (COLA)	3% per year (on the first \$13,000 of an allowance)
MORTALITY	<p><u>State:</u> Pre-retirement mortality reflects RP-2000 Employees table projected 20 years with Scale AA (gender distinct).</p> <p><u>Teachers:</u> Pre-retirement mortality reflects RP-2000 Employees table adjusted for “white-collar” employment projected 20 years with Scale AA (gender distinct). <i>[Previous assumption reflected a 1.25% increase of the RP-2000 Employees table projected 10 years with Scale AA.]</i></p> <p><u>State:</u> Post-retirement mortality reflects RP-2000 Healthy Annuitant table projected 15 years with Scale AA (gender distinct).</p> <p><u>Teachers:</u> Post-retirement mortality reflects RP-2000 Healthy Annuitant table adjusted for large annuity amounts and projected 15 years with Scale AA (gender distinct). Sample rates shown below. <i>[Previous assumption reflected a 1.25% increase of the RP-2000 Healthy Annuitant table projected 10 years with Scale AA (gender distinct).]</i></p> <p><u>State:</u> For disabled members, the mortality rate is assumed to be in accordance with the RP-2000 Table projected 5 years with Scale AA (gender distinct) set forward 3 years for males.</p> <p><u>Teachers:</u> For disabled members, post-retirement mortality reflects RP-2000 Healthy Annuitant table adjusted for large annuity amounts and projected 15 years with Scale AA (gender distinct). Sample rates shown below. <i>[Previous assumption reflected a 1.25% increase of the RP-2000 Healthy Annuitant table projected 10 years with Scale AA (gender distinct).]</i></p> <p>It is assumed that 55% of pre-retirement deaths are job-related for Group 1 and 2 members and 90% are job-related for Group 4 members. For members retired under an Accidental Disability, 40% of deaths are assumed to be from the same cause as the disability</p>

## 9. ACTUARIAL ASSUMPTIONS (continued)

### MORTALITY (continued)

Sample Post-retirement mortality rates for Teachers and Boston Teachers

Deaths per 1,000

Age	<u>Males</u>	<u>Females</u>
55	3.3	2.5
60	5.1	4.8
65	8.9	7.9
70	13.3	13.0
75	22.7	21.9
80	43.7	38.4

### SALARY INCREASE

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

Increases for State employees are 3.5% for 2013, 3.75% for 2014 and 4.0% for 2015. Increases after 2015 are based on service as shown below.

For Teachers, increases are based on service as shown below.

<u>Service</u>	<u>Groups 1 &amp; 2</u>	<u>Group 3</u>	<u>Group 4</u>	<u>Service</u>	<u>Teachers</u>
0	7.00%	7.00%	9.00%	0	7.50%
1	6.50%	7.00%	8.00%	1	7.10%
2	6.00%	7.00%	7.50%	2	7.00%
3	5.50%	7.00%	7.00%	3	6.90%
4	5.50%	6.75%	6.75%	4	6.80%
5	5.25%	6.25%	6.25%	5	6.70%
6	5.00%	5.25%	5.75%	6	6.60%
7	4.75%	4.75%	5.25%	7	6.50%
8-12	4.75%	4.75%	4.75%	8	6.30%
13-15	4.50%	4.75%	4.75%	9	6.10%
16-19	4.25%	4.75%	4.75%	10	5.90%
20+	4.00%	4.50%	4.50%	11	5.70%
				12	5.20%
				13	4.70%
				14	4.35%
				15-16	4.20%
				17-19	4.10%
				20+	4.00%

## 9. ACTUARIAL ASSUMPTIONS *(continued)*

### RETIREMENT

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

## 9. ACTUARIAL ASSUMPTIONS *(continued)*

Teachers

Males

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

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

## 9. ACTUARIAL ASSUMPTIONS *(continued)*

Teachers

Females

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

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

## 9. ACTUARIAL ASSUMPTIONS *(continued)*

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

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

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

### WITHDRAWAL

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

#### Groups 1 & 2

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

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

## 9. ACTUARIAL ASSUMPTIONS *(continued)*

### Teachers

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

### MEMBERS HIRED ON OR AFTER APRIL 2, 2012

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

### FAMILY COMPOSITION

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

### LOADING AND ADMINISTRATIVE EXPENSES

#### State

We increased the total normal cost by 2% and the actuarial accrued liability of active members by approximately 1% to account for certain Chapter 32 benefits that cannot be readily valued with our software system. Such benefits include, but are not limited to, benefits provided under Sections 10, 28M, 28N, 65D, and 100. In addition, an amount of \$15 million has been included in the normal cost to reflect a portion of administrative and other expenses paid by the fund and net Section 3(8)(c) cash flow.

#### Teachers

We increased the total normal cost and the actuarial accrued liability of active members by 2% to account for buybacks at retirement and issues regarding members with a status date as outlined

on page 19. In addition, an amount of \$10 million has been included in the normal cost to reflect a portion of administrative and other expenses paid by the fund and net Section 3(8)(c) cash flow.

### Boston Teachers

As with the Teachers', we increased the total normal cost and the actuarial accrued liability of active members by 2%. In addition, an amount of \$3 million has been included in the normal cost to reflect a portion of administrative and other expenses paid by the fund.



# 10. SUMMARY OF PLAN PROVISIONS

## ADMINISTRATION

There are 105 contributory retirement systems for public employees in Massachusetts. Each system is governed by a retirement board and all boards, although operating independently, are governed by Chapter 32 of the Massachusetts General Laws. This law establishes benefits, contribution requirements, and an accounting and funds structure for all systems.

## PARTICIPATION

Participation is mandatory for nearly all full-time employees. Eligibility with respect to part-time, provisional, temporary, seasonal, or intermittent employment is governed by regulations promulgated by each retirement board, and approved by PERAC. Membership is optional for certain elected officials. There are 4 classes of membership in the Commonwealth:

### **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:**

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

## MEMBER CONTRIBUTIONS

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

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

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

## 10. SUMMARY OF PLAN PROVISIONS *(continued)*

### RATE OF INTEREST

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

### RETIREMENT AGE

The mandatory retirement age for some Group 2 and Group 4 employees is age 65. Most Group 2 and Group 4 members may remain in service after reaching age 65. Group 2 and 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 employees in Group 1.

### SUPERANNUATION RETIREMENT

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

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

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

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

### AMOUNT OF BENEFIT

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

## 10. SUMMARY OF PLAN PROVISIONS *(continued)*

- Salary is defined as gross regular compensation. For employees who become members after January 1, 2011, regular compensation is limited to 64% of the federal limit found in 26 U.S.C. 401(a)(17). In addition, regular compensation for members who retire after April 2, 2012 will be limited to prohibit “spiking” of a member’s salary to increase the retirement benefit.
- For persons who became members prior to April 2, 2012, average salary is the average annual rate of regular compensation received during the three consecutive years that produce the highest average, or, if greater, during the last three years (whether or not consecutive) preceding retirement.
- For persons who became members on or after April 2, 2012, average salary is the average annual rate of regular compensation received during the 5 consecutive years that produce the highest average, or, if greater, during the last 5 years (whether or not consecutive) preceding retirement.
- The benefit rate varies with the member’s retirement age. For persons who became members prior to April 2, 2012 the highest rate of 2.5% applies to Group 1 employees who retire at or after age 65, Group 2 employees who retire at or after age 60, and Group 4 employees who retire at or after age 55. A .1% reduction is applied for each year of age under the maximum age for the member’s group. For Group 2 employees who terminate from service under age 55, the benefit rate for a Group 1 employee shall be used.
- For persons who became members on or after April 2, 2012 and retire with less than 30 years of creditable service, the highest rate of 2.5% applies to Group 1 employees who retire at or after age 67, Group 2 employees who retire at or after age 62, and to Group 4 employees who retire at or after age 57. A .15% reduction is applied for each year of age under the maximum age for the member’s group.
- For persons who became members on or after April 2, 2012 and retire with more than 30 years of creditable service, the highest rate of 2.5% applies to Group 1 employees who retire at or after age 67, Group 2 employees who retire at or after age 62, and Group 4 employees who retire at or after age 55. A .125% reduction is applied for each year of age under the maximum age for the member’s group.
- For a teacher who is subject to the provisions of Chapter 114 of the Acts of 2000 and who has completed at least 30 years of creditable service, the benefit rate is multiplied by the creditable service and the resulting percentage is increased by 2% per year for each year of service in excess of 24. The amount determined cannot exceed 80% of the average salary.

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

## 10. SUMMARY OF PLAN PROVISIONS *(continued)*

### DEFERRED VESTED BENEFIT

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

### WITHDRAWAL OF CONTRIBUTIONS

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

### ORDINARY DISABILITY

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

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

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

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

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

## 10. SUMMARY OF PLAN PROVISIONS *(continued)*

### ACCIDENTAL DISABILITY

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

**Retirement Allowance:** 72% of salary plus an annuity based on accumulated member contributions, with interest. This amount is not to exceed 100% of pay. However, for those who became members in service after January 1, 1988 or who have not been members in service continually since that date, the amount is limited to 75% of pay. There is an additional pension of \$774.36 per year, per child who is under 18 at the time of the member's retirement, with no age limitation if the child is mentally or physically incapacitated from earning. The additional pension may continue up to age 22 for any child who is a full time student at an accredited educational institution. Veterans, as defined in G.L. c. 32, s. 1, receive an additional benefit of \$15 per year for each year of creditable service, up to a maximum of \$300.

### ACCIDENTAL DEATH

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

**Allowance:** An immediate payment to a named beneficiary equal to the accumulated deductions at the time of death, plus a pension equal to 72% of current salary and payable to the surviving spouse, dependent children or the dependent parent, plus a supplement of \$774.36 per year, per child, payable to the spouse or legal guardian until all dependent children reach age 18 or 22 if a full time student, unless mentally or physically incapacitated.

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

In addition, an eligible family member of a firefighter, public prosecutor, police officer or corrections officer killed in the line of duty may receive a one time payment of \$100,000 from the State Retirement Board.

## 10. SUMMARY OF PLAN PROVISIONS *(continued)*

### DEATH AFTER ACCIDENTAL DISABILITY RETIREMENT

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

### DEATH IN ACTIVE SERVICE

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

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

### COST OF LIVING

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

## 10. SUMMARY OF PLAN PROVISIONS *(continued)*

### METHODS OF PAYMENT

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

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

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

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

### ALLOCATION OF PENSION COSTS

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

## II. GLOSSARY OF TERMS

### ACTUARIAL ACCRUED LIABILITY

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

### ACTUARIAL ASSUMPTIONS

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

### ACTUARIAL COST METHOD (OR FUNDING METHOD)

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

### ACTUARIAL GAIN OR LOSS (OR EXPERIENCE GAIN OR LOSS)

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

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

### ACTUARIAL PRESENT VALUE

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

### AMORTIZATION PAYMENT

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



## II. GLOSSARY OF TERMS *(continued)*

### ANNUAL STATEMENT

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

### ANNUITY RESERVE FUND

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

### ANNUITY SAVINGS FUND

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

### ASSETS

The value of securities held by the plan.

### COST OF BENEFITS

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

### FUNDING SCHEDULE

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

### GASB

Governmental Accounting Standards Board

## II. GLOSSARY OF TERMS *(continued)*

### NORMAL COST

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

### PENSION FUND

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

### PENSION RESERVE FUND

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

### SPECIAL FUND FOR MILITARY SERVICE CREDIT

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

### UNFUNDED ACCRUED LIABILITY

The excess of the Actuarial Accrued Liability over the Assets.



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