Massachusetts Teachers' Retirement System

ACTUARIAL VALUATION REPORT

JANUARY 1, 2012

PUBLIC EMPLOYEE RETIREMENT ADMINISTRATION COMMISSION
COMMONWEALTH OF MASSACHUSETTS

PERAC ACTUARIAL VALUATION REPORT

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1. INTRODUCTION & CERTIFICATION

This report presents the results of the actuarial valuation of the Massachusetts Teachers' Retirement System (TRS).

The valuation was performed as of January 1, 2012 pursuant to Chapter 32 of the General Laws of the Commonwealth of Massachusetts and based on the plan provisions at that time. The actuarial assumptions used to calculate the accrued liability and the normal cost reflect the updated Experience Study Analysis report we issued in 2008.

This valuation was based on member data as of December 31, 2011, which was supplied by the Retirement Board. We performed a number of tests on the data and made specific assumptions and determinations for a number of data items. We provide more detail on these issues in Section 6. Asset information as of December 31, 2011 was provided by the Pension Reserves Investment Management Board. Both the membership data and financial information were reviewed for reasonableness but not audited by us.

Although we have some concerns as outlined in Section 6, overall we believe this report represents an accurate appraisal of the actuarial status of the TRS performed in accordance with generally accepted actuarial principles and practices relating to pension plans. 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
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Dated: October 19, 2012

2. EXECUTIVE SUMMARY

PART A | PRINCIPAL VALUATION RESULTS

Section 22C of G.L. c. 32 mandates the establishment of a funding schedule for the Commonwealth of Massachusetts pension obligation. The TRS reflects one component of the Commonwealth schedule. The other components are the State Retirement System, liabilities for Boston teachers, and State reimbursements to local systems to reflect COLAs granted from 1982 through 1996. 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. Under the current schedule the FY13 appropriation is $1.552 billion. This amount will increase 5% in FY14 and 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. However, these appropriations could increase depending on the results of future actuarial valuations.

As noted on page 4 of this report, the UAL increased approximately $1.9 billion from the January 1, 2011 valuation (before reflecting the increase due to the change in the COLA base and mortality assumption). This increase reflects additional recognition of the 2008 investment loss as well as the treatment of investment gains and losses in the past 5 years and regular UAL increases in the plan's funding schedule due to the increasing nature of the schedule. We expect a similar level of increase from the UAL set forth in this valuation to the UAL when we perform the January 1, 2013 actuarial valuation and the final portion of the 2008 investment loss is recognized. The potential impact on the funding schedule of these increases will need to be addressed as we move forward. Note that the amount of required Commonwealth funding will also be reduced over time by continued increases in the average level of employee contributions and by the impact of pension reform over the long term.

The results of the January 1, 2012 actuarial valuation are as follows (000s omitted):

Total Normal Cost	$677,964
Expected Employee Contributions	555,655
Net Normal Cost	$122,309

Total Actuarial Liability	$36,483,027
Assets	22,141,475
Unfunded Actuarial Liability	$14,341,552

2. EXECUTIVE SUMMARY *(continued)*

PART B | COMPARISON WITH PRIOR VALUATION

A comparison of the current valuation and the January 1, 2011 valuation is shown below. ($000's omitted)

	1/1/12	1/1/11	Increase (Decrease)	Increase (Decrease)
Total Normal Cost	$677,964	$650,796	$27,168	4.2%
Expected Employee Contributions	555,655	543,832	11,823	2.2%
Net Normal Cost	$122,309	$106,964	$15,345	14.3%
Actuarial Liability				
Actives	$14,962,324	$14,731,090	$231,234	1.6%
Retirees and Inactives	21,520,703	20,159,901	1,360,802	6.8%
Total	$36,483,027	$34,890,991	$1,592,036	4.6%
Assets	22,141,475	23,117,952	(976,477)	(4.2%)
Unfunded Actuarial Liability	$14,341,552	$11,773,039	$2,568,513	21.8%
Funded Ratio	60.7%	66.3%	(5.6%)	(8.4%)

2. EXECUTIVE SUMMARY *(continued)*

PART B | COMPARISON WITH PRIOR VALUATION

Actives	1/1/12	1/1/11	% Difference
Number	86,860	87,136	(0.3%)
Total Payroll	$5,655,353,161	$5,558,311,345	1.7%
Average Salary	$65,109	$63,789	2.1%
Average Age	44.2	44.3	(0.2%)
Average Service	12.8	12.9	(0.8%)

Retirees and Survivors	1/1/12	1/1/11	% Difference
Number	57,406	55,690	3.1%
Total Benefits	$2,261,958,477	$2,133,290,214	6.0%
Average Benefits	$39,403	$38,307	2.9%
Average Age	70.4	70.2	0.3%

The development of the actuarial gain/(loss) is shown on page 8. During 2011, there was an overall actuarial loss of approximately $1.6 billion. There was a non-investment gain on actuarial liability of approximately $325 million and a loss on assets (on an actuarial value basis) of approximately $1.9 billion.

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, the actuarial value of assets has been 110% of the market value since the January 1, 2009 valuation. The calculated actuarial values were 133.8%, 119.8% and 110.7% of the market value on January 1, 2009, 2010, and 2011 respectively. Had the market value return on assets been closer to the 8.25% assumption, the actuarial value of assets would have been less than the 110% of the market value. The 2011 market return was .17%. The calculated actuarial value as of January 1, 2012 is 112.1% of the market value and the 110% of the market value corridor once again applies.

The unfunded actuarial liability decreased from $13.6 billion on January 1, 2009 to $12.5 billion on January 1, 2010, and to $11.8 billion on January 1, 2011. Those decreases were the result of the plan being subject to the 110% corridor and the better than assumed returns in 2009 and 2010. We noted in last year's report that we expected the UAL to increase as of January 1, 2012 and 2013 as the remaining 2008 loss is recognized. The UAL as of January 1, 2012 is $13.7 billion before reflecting the changes in the COLA base and the mortality assumption discussed on the next page.

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

2. EXECUTIVE SUMMARY *(continued)*

PART B | COMPARISON WITH PRIOR VALUATION

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 1 members), an increase in the age (early retirement) reduction factor for ages below the maximum age (from a 4.0% to a 6.0% annual reduction), and an increase in the period for determining a member's average annual compensation (from 3 years to 5 years). These changes only affect members hired on or after April 2, 2012 and will first begin to be recognized in the January 1, 2013 actuarial valuation.

Chapter 176 also increased the COLA base from $12,000 to $13,000. This provision is first effective for COLAs granted on July 1, 2012. The actuarial liability increased $148 million (.4%) to reflect this change. We recognized this change as part of this actuarial valuation.

A recent change to the Actuarial Standards of Practice requires actuaries to consider future mortality improvement in determining the mortality assumption. We are in the process of completing an experience analysis of Teachers' Retirement System data for years 2005 through 2011. Our analysis of mortality is not yet complete. Based on our preliminary analysis, we increased the liabilities determined using the prior assumptions by 1.25%. This change increased the actuarial liability by approximately $445 million. Had we adopted a "fully generational" mortality table (mortality improvement projected indefinitely), the increase would have been about 2.0%.

The plan has used an investment return assumption of 8.25% for the past 15 years. This assumption was determined by the legislature in Chapter 43 of the Acts of 1997 (FY98 General Appropriations Act). We have previously recommended decreasing this assumption from 8.25% to 8.0%. This change would increase the actuarial liability by approximately $900 million. Our experience analysis will adjust the other assumptions we use in future valuations, most notably the salary increase assumption. Based on the current environment, we expect to reduce the overall salary increase assumption when we complete our experience analysis. A reduction of the salary increase assumption could decrease the actuarial liability by $200 to $500 million. Therefore, a change in the salary increase assumption will mitigate some of the increase in actuarial liability caused by decreasing the investment return assumption. We believe any change in the investment return assumption should be made at the same time as changes to the salary increase and other actuarial assumptions. We recommend these changes be implemented in the January 1, 2013 actuarial valuation.

2. EXECUTIVE SUMMARY *(continued)*

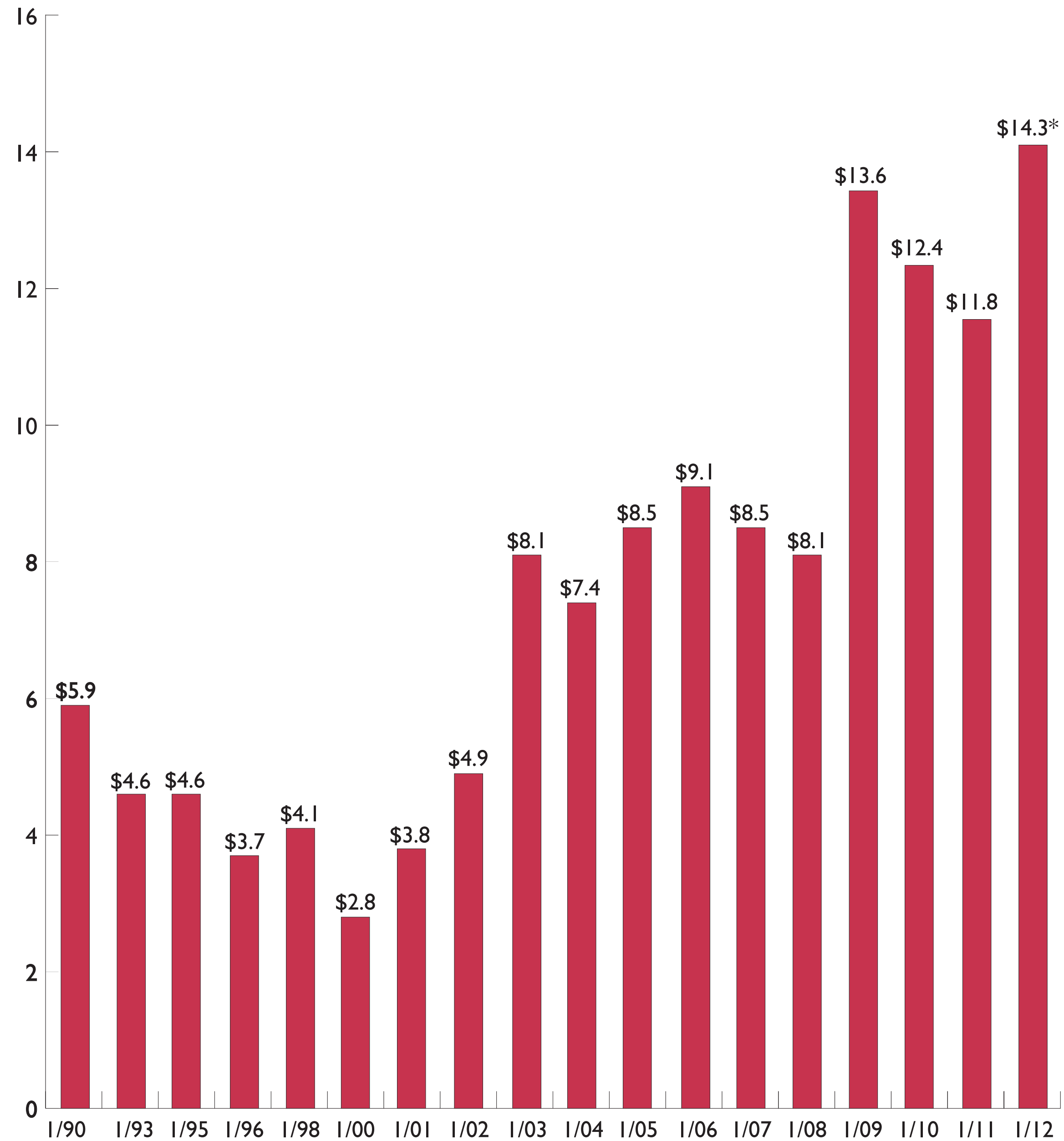
PART C | FUNDING PROGRESS

UNFUNDED LIABILITY

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

*This figure would be $13.7 billion without the changes in the COLA base and mortality assumption (see page 4).

MASSACHUSETTS
TEACHERS' UNFUNDED LIABILITY
(in billions of dollars)



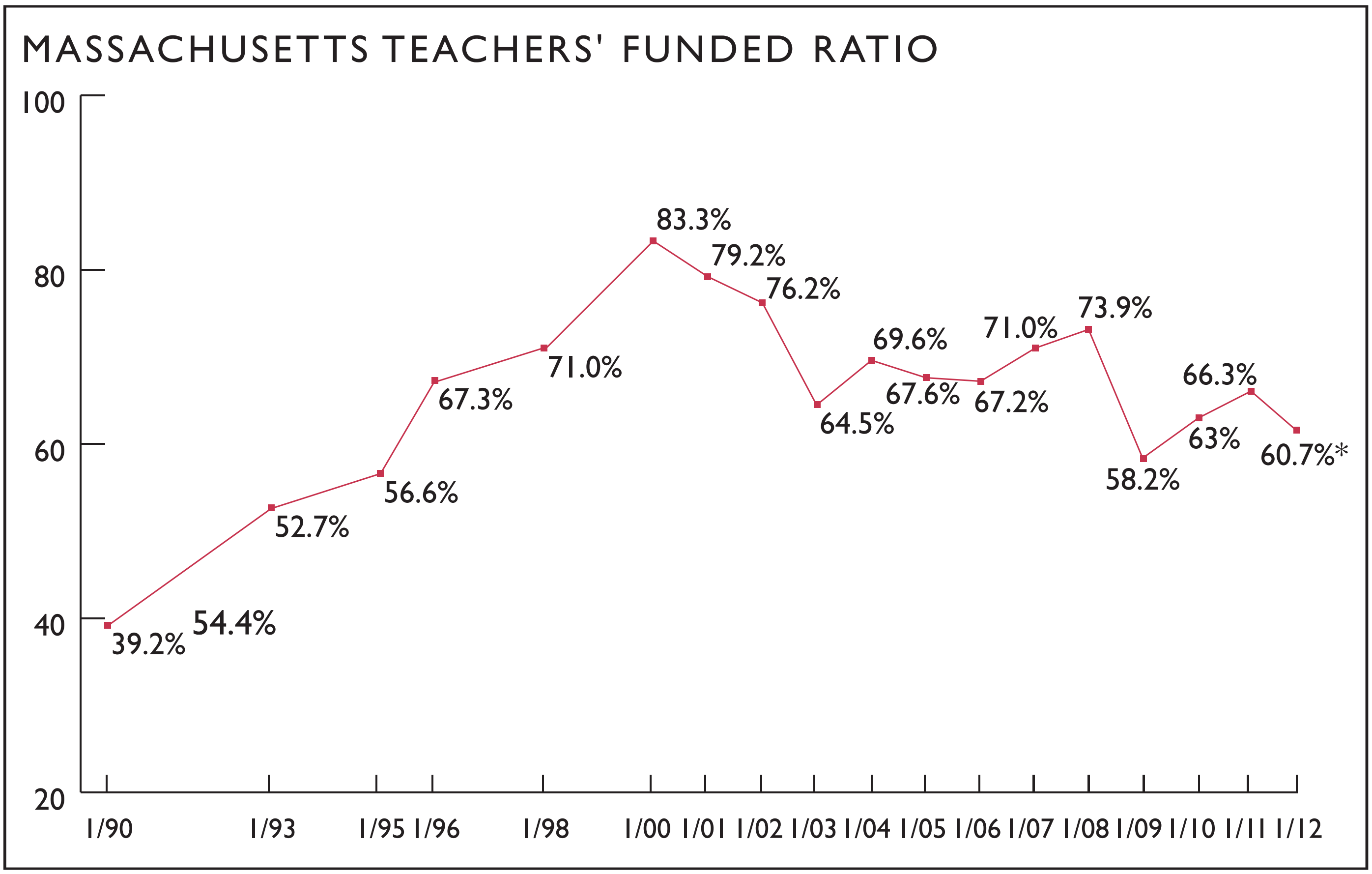
2. EXECUTIVE SUMMARY *(continued)*

PART C | FUNDING PROGRESS *(continued)*

FUNDED RATIO

The chart below shows the 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, estimates were developed to reflect implementation of new actuarial software.

*This figure would be $61.7% without the changes in the COLA base and mortality assumption (see page 4).



3. SUMMARY OF VALUATION RESULTS

(dollars in thousands)

A. Number of Members	
Active	86,860
Vested Terminated	N/A
Retired/ Beneficiaries	57,406
Total	144,266
B. Total Payroll	$5,655,353
C. Normal Cost	
Superannuation	$564,276
Death	29,131
Disability	8,784
Termination	75,773
Total Normal Cost	$677,964
Expected Employee Contributions	555,655
Net Employer Normal Cost	$122,309
D. Actuarial Liability	
Active	
Superannuation	$14,257,484
Death	224,324
Disability	82,235
Termination	398,281
Total Active	$14,962,324
Vested Terminated (a)	500,000
Non-Vested Terminated	0
Retirees and Survivors	21,020,703
Total Actuarial Liability	$36,483,027
E. Actuarial Value of Assets	22,141,475
F. Unfunded Actuarial Liability	$14,341,552
G. Funded Ratio: E/D	60.7%

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

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

A. Gain/(loss) on Actuarial Liability	
1. Actuarial Liability 1/1/11	34,891
2. Total Normal Cost 1/1/11	651
3. Interest on (1) and (2) at 8.25%	2,932
4. Benefits paid during 2011 [a]	2,170
5. Interest on (4) assuming mid-year payment	90
6. Expected Actuarial Liability 1/1/12: (1)+(2)+(3)-(4)-(5)	36,215
7. Increase due to $13,000 COLA base	148
8. Increase due to mortality assumption change	445
9. Expected Actuarial Liability 1/1/12: (6)+(7)+(8)	36,808
10. Actuarial Liability 1/1/12	36,483
11. Gain/(loss): (9)-(10)	325
B. Gain/(loss) on assets	
12. Actuarial Value of Assets (AVA) 1/1/11	23,118
13. Interest on (12) at 8.25%	1,907
14. Net Receipts [b]	627
15. Net Disbursements [b]	1,571
16. Net Cash Flow: (14)-(15)	(944)
17. Interest on (16) assuming mid year payment	(42)
18. Expected AVA 1/1/12: (12)+(13)+(16)+(17)	24,039
19. AVA 1/1/2012	22,141
20. Gain/(loss): (19)-(18)	(1,898)
C. Total Gain/(loss): (11)+(20)	(1,573)

[a] Estimated

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

Figures may not add due to rounding.

5. ASSETS

PART A | ASSET ALLOCATION (dollars in thousands)

Investment in the Pension Reserves	
Investment Trust	
Market value	$20,128,614
Actuarial value	$22,141,475
Actuarial value as a percentage of market value	110%

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 the actuarial value of assets corridor approach, the actuarial value of assets cannot be less than 90% nor greater than 110% of market value.

Due to the severity of the 2008 investment loss, the actuarial value of assets has been 110% of the market value since the January 1, 2009 valuation. See page 4 for a more detailed explanation.

5. ASSETS *(continued)*

PART B | DEVELOPMENT OF ACTUARIAL VALUE OF ASSETS (in thousands)

A. Development of 12/31/11 expected actuarial value of assets (AVA)

1. Market Value (MV) 12/31/10	21,016,320
2. Actuarial Value 12/31/10 (as calculated)	23,264,343
3. Net Receipts 2011	626,829
4. Net Disbursements 2011	1,570,710
5. Net Cash Flow: (3)-(4)	(943,881)
6. Expected Investment Return on (2): 0.0825x(2)	1,919,308
7. Expected Investment Return on (5): ½x 0.0825 x (5)	(38,935)
8. Expected AVA 12/31/11: (2)+(5)+(6)+(7)	24,200,835

B. Previous differences not yet amortized

1. Unrecognized amount of 12/31/10 difference	
a. .2 x 2007 Gain/(loss)	215,583
b. .4 x 2008 Gain/(loss)	(3,672,764)
c. .6 x 2009 Gain/(loss)	659,778
d. .8 x 2010 Gain/(loss)	549,379
e. Total	(2,248,024)

C. Gain/(loss) from 2011

1. Market Value 12/31/11	20,128,614
2. Expected Market Value 12/31/11: A(8)+B(1e)	21,952,812
3. Gain/ (loss) from 2011 investment: (1)-(2)	(1,824,198)

D. Development of AVA 12/31/11

1. 2011 Gain/(loss)	(1,824,198)
2. 2010 Gain/(loss)	686,724
3. 2009 Gain/(loss)	1,099,630
4. 2008 Gain/(loss)	(9,181,910)
5. 2007 Gain/(loss)	1,077,916
6. 20% of 2011 Gain/(loss)	(364,840)
7. 20% of 2010 Gain/(loss)	137,345
8. 20% of 2009 Gain/(loss)	219,926
9. 20% of 2008 Gain/(loss)	(1,836,382)
10. 20% of 2007 Gain/(loss)	215,583
11. Total	(1,628,368)
12. Actuarial Value 12/31/11: A8+D11	22,572,468
13. Percentage of Market Value	112.1%
14. Actuarial Value: (12) but not more than 110% of C(1)	22,141,475

6. SYSTEM MEMBERSHIP

PART A | ACTIVE MEMBERS

A critical element of an actuarial valuation is accurate and up-to-date membership information. As part of this valuation, PERAC analyzed the member data provided by the 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% 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 2011 was annualized. We assumed a rate of pay of $50,000 for members hired after October 1.

This year there were a number of districts that submitted only partial year information. TRS provided a list showing those departments and the number of months actually provided in the data so we could annualize this information appropriately. In addition, the data for approximately 8,000 members with a reported status date in 2011 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% 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.

6. SYSTEM MEMBERSHIP *(continued)*

PART A | ACTIVE MEMBERS *(continued)*

	Actives
Number of Members	86,860
Average Age	44.2
Average Service	12.8
Average Salary	$65,109
Average Annuity Savings Fund Balance	$59,704

Age by Service Distribution of Active Members

	Years of Service							
Present Age	0 – 4	5 -9	10 - 14	15 – 19	20 – 24	25 - 29	30+	Total
0 - 24	905	1						906
25 - 29	5,981	1,984	3					7,968
30 - 34	7,488	6,602	1,696	1				15,787
35 - 39	1,412	3,052	5,262	766	2			10,494
40 - 44	1,325	2,174	4,053	3,590	368			11,510
45 - 49	1,197	1,908	2,433	1,857	1,719	532	2	9,648
50 - 54	823	1,883	2,565	1,496	1,316	1,989	557	10,629
55 - 59	434	1,266	2,268	1,603	1,211	1,336	3,791	11,909
60 - 64	256	545	1,125	931	863	598	2,395	6,713
65+	28	100	237	162	157	108	504	1,296
Total	19,849	19,515	19,642	10,406	5,636	4,563	7,249	86,860

6. SYSTEM MEMBERSHIP *(continued)*

PART A | ACTIVE MEMBERS *(continued)*

Salary by Age Distribution of Active Members

Present Age	Number of Members	Total Salary	Average Salary
0 - 24	906	$38,989,360	$43,035
25 - 29	7,968	$406,835,424	$51,059
30 - 34	15,787	$875,939,696	$55,485
35 - 39	10,494	$687,731,692	$65,536
40 - 44	11,510	$783,546,078	$68,075
45 - 49	9,648	$655,185,037	$67,909
50 - 54	10,629	$744,789,685	$70,071
55 - 59	11,909	$869,985,045	$73,053
60 - 64	6,713	$495,293,001	$73,781
65+	1,296	$97,058,145	$74,891
Total	86,860	$5,655,353,161	$65,109

6. SYSTEM MEMBERSHIP *(continued)*

PART B | RETIREES AND SURVIVORS

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Number of Members	53,055	411	320	3,620	57,406
Average Age	70.4	67.5	69.6	71.9	70.4
Average Annual Benefit	$40,975	$19,738	$36,107	$18,881	$39,403

Benefit by Retirement Type

	Superannuation	Ordinary Disability	Accidental Disability	Survivors	Total
Annuity	$351,396,288	$874,613	$589,584	$8,613,122	$361,473,608
Pension	$1,822,547,295	$7,237,857	$10,964,612	$59,735,106	$1,900,484,869
Total	$2,173,943,583	$8,112,470	$11,554,196	$68,348,228	$2,261,958,477

6. SYSTEM MEMBERSHIP *(continued)*

PART B | RETIREES & SURVIVORS *(continued)*

Benefit by Age Distribution

Present Age	Number of Members	Total Benefits	Average Benefits
Less than 40	147	$3,539,677	$24,079
40 – 44	28	$368,370	$13,156
45 – 49	74	$1,500,951	$20,283
50 – 54	161	$3,436,219	$21,343
55 – 59	3,138	$141,657,800	$45,143
60 – 64	14,944	$716,047,643	$47,915
65 – 69	14,363	$633,296,086	$44,092
70 – 74	8,695	$328,753,171	$37,809
75 – 79	6,369	$206,465,805	$32,417
80 – 84	4,977	$134,641,079	$27,053
85 – 89	2,791	$61,308,836	$21,967
90+	1,719	$30,942,840	$18,000
Totals	57,406	$2,261,958,477	$39,403

7. 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 member of the retirement system, would fully fund by retirement, death, disability or termination, the projected benefits which the member is expected to receive. The *Actuarial Liability* for each member is determined as the present value as of the valuation date of all projected benefits which the member is expected to receive, minus the present value of future annual Normal Cost payments expected to be made to the fund. Since only active members have a Normal Cost, the Actuarial Liability for inactives, retirees and survivors is simply equal to the present value of all projected benefits. The sum of Normal Cost and Actuarial Liability for each member is equal to the Normal Cost and Actuarial Liability for the Plan. The *Unfunded Actuarial Liability* is the Actuarial Liability less current assets.

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

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

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.

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 approach from year to year. The actuarial value of assets as of January 1, 2012 is 110% of the market value.

8. ACTUARIAL ASSUMPTIONS

INVESTMENT RETURN	8.25% per year
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

Pre-retirement mortality reflects a 1.25% increase on the RP-2000 Employees table projected 10 years with Scale AA.

Post-retirement mortality reflects a 1.25% increase on the RP-2000 Healthy Annuitant table projected 10 years with scale AA (gender distinct).

For disabled members, the mortality rate reflects a 1.25% increase in accordance with the RP-2000 Table (gender distinct) set forward 3 years for males.

It is assumed that 55% of pre-retirement deaths are job-related for Group 1 and Group 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.

SALARY INCREASE

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

Service	
0	8.00%
1	7.75%
2	7.50%
3	7.25%
4	7.00%
5	6.75%
6	6.50%
7	6.25%
8	6.00%
9	5.75%
10	5.50%
11	5.25%
12	5.00%
13	5.00%
14+	4.75%

8. ACTUARIAL ASSUMPTIONS *(continued)*

RETIREMENT

Males

	Not in Retirement Plus	
	Less than 20	20+
47	0.00	0.00
48	0.00	0.00
49	0.00	0.00
50	0.00	0.02
51	0.00	0.02
52	0.00	0.02
53	0.00	0.02
54	0.00	0.02
55	0.06	0.05
56	0.06	0.05
57	0.07	0.05
58	0.07	0.06
59	0.10	0.07
60	0.15	0.20
61	0.20	0.35
62	0.20	0.35
63	0.20	0.35
64	0.25	0.35
65	0.30	0.40
66	0.30	0.30
67	0.30	0.30
68	0.30	0.30
69	0.30	0.30
70+	1.00	1.00

	Retirement Plus		
	Less than 20	20-30	30+
47	0.00	0.00	0.00
48	0.00	0.00	0.00
49	0.00	0.00	0.00
50	0.00	0.01	0.02
51	0.00	0.01	0.02
52	0.00	0.01	0.02
53	0.00	0.01	0.02
54	0.00	0.01	0.02
55	0.03	0.03	0.06
56	0.08	0.05	0.20
57	0.15	0.08	0.35
58	0.15	0.10	0.50
59	0.20	0.20	0.50
60	0.15	0.20	0.50
61	0.30	0.25	0.50
62	0.20	0.30	0.40
63	0.30	0.30	0.40
64	0.40	0.30	0.40
65	0.40	0.40	0.50
66	0.40	0.30	0.50
67	0.40	0.30	0.50
68	0.40	0.30	0.50
69	0.40	0.30	0.50
70+	1.00	1.00	1.00

8. ACTUARIAL ASSUMPTIONS *(continued)*

RETIREMENT

Females

	Not in Retirement Plus	
	Less than 20	20+
47	0.00	0.00
48	0.00	0.00
49	0.00	0.00
50	0.00	0.02
51	0.00	0.02
52	0.00	0.02
53	0.00	0.02
54	0.00	0.02
55	0.06	0.05
56	0.06	0.05
57	0.07	0.05
58	0.07	0.07
59	0.10	0.10
60	0.15	0.20
61	0.20	0.30
62	0.20	0.30
63	0.20	0.30
64	0.25	0.30
65	0.30	0.40
66	0.30	0.40
67	0.30	0.40
68	0.30	0.40
69	0.30	0.40
70+	1.00	1.00

	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	0.015	0.02
51	0.00	0.015	0.02
52	0.00	0.015	0.02
53	0.00	0.015	0.02
54	0.00	0.015	0.02
55	0.02	0.03	0.06
56	0.02	0.03	0.15
57	0.08	0.07	0.30
58	0.10	0.07	0.35
59	0.15	0.11	0.35
60	0.20	0.16	0.35
61	0.20	0.20	0.35
62	0.25	0.30	0.40
63	0.24	0.30	0.30
64	0.20	0.30	0.35
65	0.30	0.30	0.35
66	0.30	0.30	0.35
67	0.30	0.30	0.30
68	0.30	0.30	0.30
69	0.30	0.30	0.30
70+	1.00	1.00	1.00

8. ACTUARIAL ASSUMPTIONS *(continued)*

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

Age	
20	0.00004
30	0.00006
40	0.00010
50	0.00050
60	0.00100

It is also assumed that 35% of disabilities will be job-related for Teachers.

WITHDRAWAL

Based on an analysis of past experience. In addition to being age and service based, Teacher rates are also gender based. Sample annual rates are shown below.

Age	Service	0		5		10+	
		Male	Female	Male	Female	Male	Female
20		0.120	0.100	0.045	0.090	0.010	0.050
30		0.114	0.120	0.045	0.090	0.010	0.050
40		0.097	0.110	0.054	0.065	0.017	0.029
50		0.100	0.082	0.048	0.042	0.022	0.021

LOADING AND ADMINISTRATIVE EXPENSES

We increased the 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 12. In addition, an amount of $7 million has been included in the normal cost to reflect a portion of administrative and other expenses paid by the fund.

9. 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 all full-time employees. Eligibility with respect to part-time, provisional, temporary, seasonal or intermittent employment is governed by regulations promulgated by the retirement board, and approved by PERAC. Membership is optional for certain elected officials. There are 4 classes of membership in the Commonwealth. Members of the Massachusetts Teachers' Retirement System are classified in Group 1.

Group 1:

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

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:

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.

9. SUMMARY OF PLAN PROVISIONS *(continued)*

RATE OF INTEREST

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

RETIREMENT AGE

There is no mandatory retirement age for employees in Groups 1 and 2. Most Group 4 members must retire at age 65. As the result of a federal court decision, there is no mandatory retirement age for Group 3 members.

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.

• 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.

9. SUMMARY OF PLAN PROVISIONS *(continued)*

• 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 multiplies 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.

9. 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".

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.

9. SUMMARY OF PLAN PROVISIONS *(continued)*

ACCIDENTAL DISABILITY

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

Retirement Allowance: 72% of salary plus an annuity based on accumulated member contributions, with interest. This amount is not to exceed 100% of pay. For those who became members-in-service after January 1, 1988 or who have not been members-in-service continually since that date, the amount is limited to 75% of pay. There is an additional pension of $751.80 per year per child who is under 18 at the time of the member's retirement, with no age limitation if the child is mentally or physically incapacitated from earning. The additional pension may continue up to age 22 for any child who is a full-time student at an accredited educational institution. Veterans, as defined in G.L. c. 32, s. 1, receive an additional benefit of $15 per year for each year of creditable service, up to a maximum of $300.

ACCIDENTAL DEATH

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

Allowance: An immediate payment to a named beneficiary equal to the accumulated deductions at the time of death, plus a pension equal to 72% of current salary and payable to the surviving spouse, dependent children or the dependent parent, plus a supplement of $708.60 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.

9. 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 $9,000.

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 1 who became a member on or after April 2, 2012 whose death occurred prior to the member's superannuation retirement age, the age 60 benefit rate is used. If the member died after age 60, the actual age is used. The minimum annual allowance payable to the surviving spouse of a member-in-service who dies with at least two years of creditable service is $6,000, provided that the member and the spouse were married for at least one year and living together on the member's date of death.

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

COST OF LIVING

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

9. 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 pre-deceases the retiree, the benefit payable increases (or "pops up") based on the factor used to determine the Option C benefit at retirement. For members who retired prior to January 12, 1988, if the System has accepted Section 288 of Chapter 194 of the Acts of 1998 and the beneficiary pre-deceases the retiree, the benefit payable "pops up" in the same fashion. The Option C became available to accidental disability retirees on November 7, 1996.

ALLOCATION OF PENSION COSTS

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

10. GLOSSARY OF TERMS

ACTUARIAL ACCRUED LIABILITY

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

ACTUARIAL ASSUMPTIONS

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

ACTUARIAL COST METHOD (OR FUNDING METHOD)

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

ACTUARIAL GAIN OR LOSS (OR EXPERIENCE GAIN OR LOSS)

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

Note: The effect on the Accrued Liability and/or the Normal Cost resulting from changes in the Actuarial Assumptions, the Actuarial Cost Method or pension plan provisions would be described as such, not as an Actuarial Gain (Loss).

ACTUARIAL PRESENT VALUE

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

AMORTIZATION PAYMENT

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

10. GLOSSARY OF TERMS *(continued)*

ANNUAL STATEMENT

The statement submitted to PERAC each year that describes the asset holdings and Fund balances as of December 3l and the transactions during the calendar year that affected the financial condition of the retirement system.

ANNUITY RESERVE FUND

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

ANNUITY SAVINGS FUND

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

ASSETS

The value of securities held by the plan.

COST OF BENEFITS

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

FUNDING SCHEDULE

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

GASB

Governmental Accounting Standards Board

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

SPECIAL FUND FOR MILITARY SERVICE CREDIT

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

UNFUNDED ACCRUED LIABILITY

The excess of the Actuarial Accrued Liability over the Assets.

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