Massachusetts Teachers' Retirement System

Experience Study Analysis

2006-2011

JULY, 2014

PUBLIC EMPLOYEE RETIREMENT ADMINISTRATION COMMISSION

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Introduction

The Public Employee Retirement Administration Commission (PERAC) has completed our third Experience Study of the Massachusetts Teachers' Retirement System (TRS). This report presents the results of our experience analysis for members of the TRS over the six-year period from January 1, 2006 through December 31, 2011 and is based on annual data provided to us by TRS each year. In addition, for some of our analysis, we used data as of December 31, 2012.

The nature of an experience study is to track annual salary increases and how members leave a system (retirement, death, disability, or withdrawal) and, if warranted, to adjust the actuarial assumptions based on both this past experience as well as anticipated future experience. This task requires a more thorough review of the data provided to us for each annual actuarial valuation.

Please note that PERAC recommended reducing the investment return assumption from 8.25% to 8.0% effective with the January 1, 2013 actuarial valuation. The investment return assumption is not part of this experience analysis. However, in determining the effect of the revised assumptions, we used the 8.0% investment return assumption.

Each year as part of the valuation, we test how well the assumptions are working by performing a gain/loss analysis. If plan liabilities increase more than expected, there is an actuarial loss. Conversely, if plan liabilities increase less than expected, there is an actuarial gain. If each year the results consistently produced an actuarial loss (or an actuarial gain), then this would indicate that the assumptions are not properly reflecting actual experience. In this way, the gain/loss analysis serves as a proxy to the performance of a detailed experience study.

We reviewed the gains and losses on plan liabilities (excluding asset gains and losses) from 2006 through 2011. PERAC performed TRS valuations for each year in this period. Our review of the gains and losses over this period shows that, overall, the actuarial assumptions were generally reasonable. There were actuarial losses (experience worse than anticipated) in each year from 2006 to 2008, ranging from $150 million to $250 million. There were actuarial gains (experience better than anticipated) in each year from 2009 to 2011, ranging from $160 million to $325 million. Over the entire 6-year period, the assumptions generated a net cumulative gain of $43 million, or an average gain of $7.2 million per year. This amount is quite small considering the total actuarial accrued liability of approximately $36.5 billion as of January 1, 2012 (average gain of less than 1/10 of 1% of actuarial liability each year). Despite the relatively small overall gain over the period, we determined that some individual assumptions need to change more significantly.

Introduction (continued)

The annual funding schedule appropriation (the total plan cost) reflects two sources of plan costs and liabilities. The first is the amortization of the unfunded actuarial liability (UAL). The actuarial accrued liability less plan assets equals the UAL. The UAL was amortized through FY40 under the prior Commonwealth funding schedule. In January, 2014, the schedule was revised with total appropriation payments that increase 10.0% in FY15, FY16, and FY17, and 7.0% each year thereafter. Based on the January 1, 2013 actuarial valuation results, the amortization of the UAL is completed in FY36. In addition to the amortization of the UAL, the annual appropriation also reflects the normal cost (or current cost), which represents the value of benefits accruing during the coming year. The measure of the impact on the total plan cost of any change in assumptions is the impact of that change on these two components.

Although the normal cost and actuarial liability directly determine the appropriation under the funding schedule, these items are components that make up a portion of the present value of future benefits (PVFB). The PVFB may be the most accurate measure of the "true" total cost of a plan since it represents the present value of total projected benefits for all active, inactive and retired members. Any change in the actuarial assumptions will change the PVFB and, accordingly, the normal cost and actuarial liability.

Overall, our revised assumptions increase the total plan cost, primarily due to the change in the mortality assumption which reflects expected future mortality improvement. The revised assumptions were first reflected in our January 1, 2013 actuarial valuation.

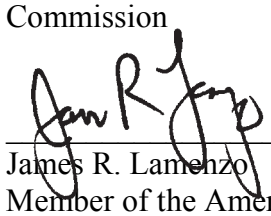
Our study focused on the demographic assumptions that have the greatest impact on plan costs (salary increases, retirement, disability, withdrawal, and mortality). There are a number of other demographic assumptions (including the percentage of disabilities that are job related and the percentage of active members that are married) which appear reasonable but were not reviewed in detail as part of this study. In addition, we used the same assumptions for the group of members hired after April 1, 2012 (and subject to a different benefit structure under Chapter 176 of the Acts of 2011) as for members hired prior to April 1, 2012. Since these members are a number of years from retirement and we have no basis to determine a different assumption set, we believe this is a reasonable approach at this time.

It is important to note that the results for the TRS reflect only one component of the Total Commonwealth Obligation. The other components are the State Retirement System, Boston teachers, and reimbursements to local systems to reflect COLAs granted from 1982 through 1996. The most recent experience study of the State Retirement System was released in February, 2014.

Introduction (continued)

We gratefully acknowledge the efforts of the Massachusetts Teachers' Retirement Board staff in completing this project.

Respectfully submitted,
Public Employee Retirement Administration
Commission



James R. Lamenzo
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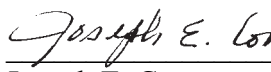

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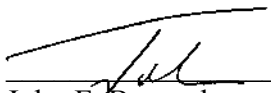
Executive Director



John F. Boorack
Senior Actuarial Associate

Dated: July 21, 2014

Executive Summary

In November, 2000, PERAC published the first experience study of the TRS. That study looked at the experience over the five-year period from 1995-1999. Based on the results of that study, there were a number of changes made to the assumptions used to value the liabilities of TRS.

In February, 2008, PERAC published the second study of the TRS which covered the six-year period from 2000-2005. Based on the results of that study, we made minor changes to most of the principal assumptions used to value the liabilities of the TRS.

This study covers the six-year period from 2006-2011. Based on the results of this study, we are making minor changes to the retirement, disability and withdrawal assumptions, but more significant change to the salary increase and mortality assumptions.

These changes are detailed below.

Experience indicates that changes should be made to the following assumptions:

- Rates of retirement for teachers both in Retirement Plus and not in Retirement Plus; negligible impact on total plan cost.
- Rates of withdrawal for all active members; negligible impact on total plan cost.
- Rates of salary increases for active members; decrease in total plan cost.
- Rates of disability at some ages for all active members; slight decrease in total plan cost.
- Rates of mortality for retired and disability retired members; increase in plan cost.

Nature and effect of changes:

- Revised assumptions are based on both actual past and anticipated future experience.

- Overall, the revised assumptions produce a total plan cost greater than that under the prior assumptions. Although there was a decrease in the normal cost, primarily due to the revised salary increase assumption, there was an increase in the actuarial liability (and therefore a corresponding increase in the unfunded actuarial liability) as shown in the figures below (dollars in thousands).

The revised assumptions were first reflected in our January 1, 2013 actuarial valuation.

January 1, 2013 Valuation	Prior Assumptions	Revised Assumptions
Employer Normal Cost	$138,060	$119,660
Actuarial Accrued Liability	$38,200,218	$39,135,218
Actuarial Value of Assets	21,787,470	21,787,470
Unfunded Actuarial Liability	$16,412,748	$17,347,748
Funded Ratio	57.0%	55.7%

The figures above reflect the 8.0% investment return assumption adopted as part of the January 1, 2013 actuarial valuation. The investment return assumption is not part of this experience analysis.

The actuarial accrued liability (and therefore, the unfunded actuarial liability) increased $935 million reflecting the revised assumptions. The change in the mortality assumption increased the actuarial liability by approximately $1.56 billion. The change in the salary assumption decreased the actuarial liability by approximately $510 million. The changes in the retirement, disability and turnover assumptions decreased the actuarial liability by approximately $115 million.

Methodology

The Actuarial Standards Board has issued Actuarial Standard of Practice (ASOP) No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations,* which provides guidance to actuaries in selecting demographic assumptions for measuring obligations under defined benefit plans. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP 35.

General methodology for all assumptions

- Study comprises the years January 1, 2006 through January 1, 2012. In addition, data through January 1, 2013 was utilized for some comparisons and checks for reasonableness.

- Data used in this study was provided by the Massachusetts Teachers' Retirement Board and reflects the data used in the TRS actuarial valuations in each of these years.

- For each period in the 6-year experience study period (1/06 to 1/07, 1/07 to 1/08, 1/08 to 1/09, 1/09 to 1/10, 1/10 to 1/11, and 1/11 to 1/12), we determined the member experience relating to:
  – Retirement
  – Disability
  – Withdrawal (Turnover)
  – Salary increases
  – Post-retirement mortality, including disabled retirees

- Actual experience determined at each age (and/or years of service) for each assumption. For example, for retirement, we determined the actual number of members retiring at each age as well as additional breakdowns by service.

- Expected experience determined for each assumption. For example, for retirement, we determined the expected number of members retiring at each age (with breakdowns by the criteria in the preceding bullet) based on the plan assumptions.

- An actual/expected (A/E) ratio was computed at each age for each assumption.

- Reviewed experience results and used various smoothing techniques to select final assumptions. Often used 5-year averages to smooth results.

- Analysis reflects a review by age, service and in some cases gender.

Methodology (continued)

In addition to the general methodology that was used for each assumption outlined on the previous page, the following specific analysis was conducted:

Retirement

- Assumed a member retired if the member was eligible to retire at the beginning of a period and is not in the active file at the end of the period.
- Analyzed results by gender for teachers in Retirement Plus and teachers not in Retirement Plus.
- Analyzed results separately for members with less than 20 years of service, with 20-30 years of service, and with more than 30 years of service.

Disability

- Results modified to reflect that some members retire from an inactive status as opposed to an active status.
- Compared results to historical disability counts from PERAC Disability Unit.
- Analyzed results in 5-year age brackets in selecting assumptions.

Withdrawal

- Assumed a member withdrew if the member was not eligible to retire at the beginning of the period and is not in the active file at the end of the period.
- Analyzed results by age, service, and age/service combined.
- Analyzed results in 5-year age brackets in selecting assumptions.

Methodology (continued)

Salary Increases

- Determined ratios of salaries at the end of the year to salaries at the beginning of the year for continuing members.
- Analyzed results by age, service, and age/service combined.
- Analyzed results in 5-year age brackets in selecting assumptions.

Post-Retirement Mortality

- Assumes a member died if they were coded as receiving an allowance at the beginning of the year and were coded as not receiving an allowance or are missing from the file at the end of the year.
- Analyzed results by gender.
- Adjusted results to reflect retiree deaths with continuing payments to beneficiaries.
- Compared actual experience to the RP-2000 mortality table with various projections.
- Performed testing for disabled retired members separately by gender.
- Analyzed results in 5-year age brackets in selecting assumptions.

Findings

Retirement

- In total, actual retirements were less than expected retirements for both males and females not eligible for Retirement Plus and for both males and females with less than 20 years of service who are eligible for Retirement Plus. Actual retirements were less than expected retirements for most individual ages.

- In total, actual retirements were somewhat greater than expected for both males and females with 20-30 years of service and eligible for Retirement Plus.

- In total, actual retirements were about as assumed for both males and females with over 30 years of service and eligible for Retirement Plus.

- For both males and females, the majority of exposed lives eligible for retirement were in the over 20 years of service category. Therefore, we spent more time developing these assumptions than those for less than 20 years of service.

- For females not in Retirement Plus, there are almost 500 exposure years for teachers age 70 and over who have continued working (a teacher currently age 73 would contribute 4 such exposure years- one each for age 70, 71, 72, and 73). However, since this cohort is such a small percentage of the total population, we will continue to use an assumption of 100% retirement at age 70.

Disability

- There is often a lag between the date of injury of a member and the date of retirement. Our software cannot recognize this lag so we monitor this issue and make adjustments as necessary.

- In total, actual number of disability retirements slightly less than expected.

Withdrawal

- Measuring withdrawal (termination) rates continues to be a challenge. Therefore, we determine our rates for this assumption to be more conservative than retirement and disability rates.

- For males, actual terminations were greater than expected for most years of service.

- For females, actual terminations were less than expected for most years of service.

Findings (continued)

Salary Increases

- Like withdrawal rates, accurately measuring salary increases continues to be a challenge. Negotiated contracts vary in amount and timing from town to town which makes it difficult to determine overall rates for all teachers. In addition, the reliability of a portion of the salary experience analysis is questionable due to adjustments we have made to the data for a significant number of members in performing our annual valuations. Therefore, we determine our salary assumption to be more conservative than retirement and disability rates.

- Salary increases for continuing members were less than assumed over the 6-year period and in each individual year except 2008. However, this was expected due to the economic climate since 2008.

- Results based on service continue to show a more consistent pattern than age based results. We believe the service based assumption is more indicative of expected experience.

Post-Retirement Mortality

- Overall, mortality was significantly less than assumed over the 6-year period for both males and females. This was also true in each individual year. Due to this significant difference, we reviewed our work from our prior experience study which covered 2000-2005. We noticed that for females, in total, mortality was greater than assumed from 2000-2005 but this trend began to diminish in the later years and in 2004 and 2005 mortality was less than assumed. However, the 2004 and 2005 results did not significantly impact the total for the 6-year period ending in 2005 and, overall for that period, mortality was greater than assumed. For the 2000-2005 period for males, mortality was less than expected in all years. However, there were some inconsistencies in the 2000-2005 results with respect to both gender and data. We believed that data issues contributed to these results and we maintained the assumptions adopted in 2000 which already included a projection for mortality improvement to 2010. In retrospect, a more conservative assumption would have been appropriate in our prior study due to the uncertainty with regard to actual experience and the discrepancy between male and female results.

- We noted in our prior study that data issues had seemed to improve by 2006. We found this trend continued to hold for data in all years of this study.

- Disabled mortality for males was about as expected. Disabled mortality for females was somewhat greater than expected. Gender allocation and the relatively small number of exposures make these results difficult to assess.

Determination of Revised Assumptions

Retirement

- Revised assumptions maintain gender distinct rates.

- Revised rates are lower than the prior assumptions at most ages for both males and females not eligible for Retirement Plus and all teachers with less than 20 years and eligible for Retirement Plus.

- Revised rates for both males and females with 20-30 years of service and eligible for Retirement Plus are the same or somewhat greater at most ages than the prior assumptions.

- Revised rates are the same or comparable to the prior rates for both males and females with more than 30 years of service and eligible for Retirement Plus.

- Revised assumptions have a negligible impact on total plan cost.

Disability

- Revised rates are the same as the prior assumption at most ages. Rates at age 55 and older are slightly lower than the prior assumptions at all ages.

- Revised assumptions slightly decrease total plan cost.

Withdrawal

- Revised rates for males are generally the same or higher at most age/service combinations. Revised rates for females are generally the same or lower at most age/service combinations.

- Revised rates were determined using 5-year age groupings and grading the rates by each year of service from 0-9. All members with at least 10 years of service were grouped together.

- Revised assumptions have a negligible impact on total plan cost.

Salary Increases

- Revised salary increase assumption continues to be based on years of service. The initial rate of increase is somewhat lower than the prior assumption and the rates gradually grade down until reaching the ultimate rate of 4.0% at 20 years of service.

- Revised assumptions decrease total plan cost.

Determination of Revised Assumptions (continued)

Post-Retirement Mortality

- We reviewed a number of options in determining revised mortality rates. We considered different projection period for mortality improvement, different projection scales, white collar vs. blue collar mortality, and the impact on the size of the annual benefit. The assumption used in the January 1, 2013 actuarial valuation reflects the RP-2000 Healthy Annuitant table adjusted for large annuity amounts and projected 15 years with Scale AA (gender distinct).

- For disability retiree mortality, we used the assumption outlined in the previous bullet for the January 1, 2013 actuarial valuation due to the uncertainty regarding the smaller number of exposures, the relatively small cost impact, and our work with respect to disability retirees was not yet complete when we issued the January 1, 2013 actuarial valuation. The revised assumption reflects an assumption more consistent with the disability retiree assumption used for other systems. The assumption reflects the same mortality table for retirees as described in the previous bullet, but projected for 5 years instead of 15, and set forward 3 years for males.

- Revised assumptions increase total plan cost.

- This assumption will continue to be monitored in each valuation. We expect to adjust this assumption frequently, perhaps annually, moving forward. The general RP-2000 mortality tables and projection scales are in the process of being updated and should be finalized this year. The updated tables will be reviewed and compared to the actual experience of the TRS in developing an updated assumption in 2015 and beyond.

Summary of Revised Assumptions

The selection of the actuarial assumptions reflects a work in progress. The assumptions shown here were first used in the January 1, 2013 actuarial valuation. However, we will continue to test and refine the assumptions in future years.

In this section, we show sample rates for each assumption. A rate essentially represents the likelihood of an event occurring at a given time. For example, the mortality rates represent the likelihood of death. The complete tables of assumptions are shown in the Appendix.

1. Rate of Investment Return: For valuations prior to January 1, 2013, the rate was 8.25% annually. We recommended this assumption be reduced to 8.0% as of January 1, 2013 in conjunction with the experience study. This assumption was not reviewed as part of this study.

2. Rates of Retirement: The following tables compare the prior and revised retirement rates. The rates are based on gender, service, and whether the teacher is subject to Retirement Plus.

Males Not in Retirement Plus:

	Less than 20 years		20+ years	
Age	Prior	Revised	Prior	Revised
50	0.00	0.000	0.02	0.02
55	0.06	0.035	0.05	0.03
60	0.15	0.075	0.20	0.15
62	0.20	0.140	0.35	0.30
65	0.30	0.300	0.40	0.30
68	0.30	0.300	0.30	0.25
70	1.00	1.000	1.00	1.00

Males in Retirement Plus:

	Less than 20 years		20 – 30 years		30 + years	
Age	Prior	Revised	Prior	Revised	Prior	Revised
50	0.00	0.00	0.01	0.01	0.02	0.02
55	0.03	0.05	0.03	0.03	0.06	0.06
60	0.15	0.10	0.20	0.25	0.50	0.40
62	0.20	0.20	0.30	0.35	0.40	0.35
65	0.40	0.25	0.40	0.40	0.50	0.35
68	0.40	0.30	0.30	0.30	0.50	0.40
70	1.00	1.00	1.00	1.00	1.00	1.00

Summary of Revised Assumptions (continued)

Females Not in Retirement Plus:

	Less than 20 years		20+ years	
Age	Prior	Revised	Prior	Revised
50	0.00	0.000	0.02	0.01
55	0.06	0.035	0.05	0.04
60	0.15	0.085	0.20	0.15
62	0.20	0.120	0.30	0.20
65	0.30	0.300	0.40	0.40
68	0.30	0.300	0.40	0.30
70	1.00	1.002	1.00	1.00

Females in Retirement Plus:

	Less than 20 years		20 – 30 years		30 + years	
Age	Prior	Revised	Prior	Revised	Prior	Revised
50	0.00	0.00	0.015	0.01	0.02	0.015
55	0.02	0.03	0.03	0.03	0.06	0.05
60	0.20	0.10	0.16	0.20	0.35	0.35
62	0.25	0.12	0.30	0.30	0.40	0.35
65	0.30	0.25	0.30	0.40	0.35	0.35
68	0.30	0.30	0.30	0.30	0.30	0.30
70	1.00	1.00	1.00	1.00	1.00	1.00

3. Rates of Disability: The prior assumptions for disability were found to closely match the experience. The rates of disability were slightly modified at a few ages and for all ages after age 54. We did not adjust the assumption that 35% of disabilities are job-related.

(Rates per ten thousand)

Age	Prior	Revised
20	0.4	0.4
30	0.6	0.6
40	1.0	1.0
50	5.0	5.0
60	10.0	7.0
65+	12.0	15.0

Summary of Revised Assumptions (continued)

4. Rates of Withdrawal: The prior and revised rates are age and service based for the first 10 years of service and age based after 10 years. The revised rates are generally the same or higher for males and generally the same or lower for females compared to the prior rates.

Male Rates

Age	Prior (0 years)	Revised (0 years)	Prior (5 years)	Revised (5 years)	Prior (after 10 years)	Revised (after 10 years)
30	.114	.150	.045	.054	.010	.015
40	.097	.133	.054	.052	.017	.017
50	.100	.162	.048	.070	.022	.023
60	.075	.200	.055	.090	.050	.050

Female Rates

Age	Prior (0 years)	Revised (0 years)	Prior (5 years)	Revised (5 years)	Prior (after 10 years)	Revised (after 10 years)
30	.120	.150	.090	.088	.050	.045
40	.110	.105	.065	.050	.029	.022
50	.082	.098	.042	.050	.021	.020
60	.080	.200	.055	.060	.050	.050

5. Rate of Salary Increase: The following table compares prior and revised salary increase rates. The revised rates are generally lower than the current rates. The ultimate rate after 20 year of service has been reduced by .75%.

Service	Prior	Revised
0	8.00%	7.50%
5	6.75%	6.70%
10	5.50%	5.90%
15	4.75%	4.20%
20+	4.75%	4.00%

Summary of Revised Assumptions (continued)

6. Pre-Retirement Mortality: Prior rates of mortality were in accordance with the RP-2000 Employees table projected 10 years with Scale AA. The revised rates reflect the RP-2000 Employees table adjusted for white collar employment and projected 20 years with scale AA (gender distinct).

(Rates per ten thousand)

	Prior		Revised	
Age	Males	Females	Males	Females
20	2.85	1.63	1.88	1.38
30	4.22	2.39	3.21	2.16
40	9.96	6.07	7.35	4.75
50	17.83	14.12	13.68	11.30
60	41.51	37.39	30.74	33.78
65	65.77	55.36	50.84	52.66

7. Post-Retirement Mortality: Prior rates of mortality were in accordance with the RP-2000 Healthy Annuitant table projected 10 years with Scale AA. The revised rates reflect the RP-2000 Healthy Annuitant table adjusted for large annuity amounts and projected 15 years with Scale AA (gender distinct). For disabled members, prior rates are in accordance with the RP-2000 Healthy Annuitant table set forward 3 years for males. The revised rates reflect the RP-2000 Healthy Annuitant table adjusted for large annuity amounts and projected 5 years with Scale AA (gender distinct) and set forward 3 years for males.

(For both tables below, rates per ten thousand)

Non-Disabled Members

	Prior		Revised	
Age	Males	Females	Males	Females
50	44.59	19.75	24.43	17.40
60	69.75	58.97	51.48	48.31
70	190.91	159.23	132.77	130.44
80	582.13	427.67	437.35	384.00
90	1,762.02	1,277.84	1,433.47	1,082.57

Disabled Members

	Prior		Revised	
Age	Males	Females	Males	Females
50	57.22	23.44	35.17	20.65
60	109.51	62.00	83.69	50.79
70	303.87	167.42	205.68	137.15
80	897.18	458.79	706.73	411.94
90	2,336.62	1,316.82	1,910.47	1,115.58

Effect of Revised Assumptions

For illustration, the effect of the revised changes to the salary scale and demographic assumptions based on the January 1, 2013 valuation results is shown below.

1. Number of Members:			
Active Members		87,765	
Term. Vested Members		N/A	
Retirees and Survivors		59,019	
Total		136,597	
2. Total Annual Regular Compensation		$5,783,294,111	
3. Average Annual Regular Compensation		$65,895	
Actuarial Valuation Results (in thousands)	Prior Assumptions	Revised Assumptions	Increase/Decrease
4. Normal Cost			
a. Total Normal Cost	$708,542	$692,142	($16,400)
b. Employee Contributions	570,482	572,482	2,000
c. Net Normal Cost	$138,060	$119,660	($18,400)
5. Actuarial Accrued Liability			
a. Active Members	$15,720,922	$15,605,922	($115,000)
b. Inactive Members	$575,000	$600,000	25,000
c. Retirees and Survivors	21,904,296	22,929,296	1,025,000
d. Total Actuarial Liability	$38,200,218	$39,135,218	$935,000
6. Actuarial Value of Assets	$21,787,470	$21,787,470	$0
7. Unfunded Actuarial Liability: (5d)-(6)	$16,412,748	$17,347,748	$935,000
8. Funded Ratio: (6) / (5d)	57.0%	55.7 %	(1.3%)

The revised mortality assumption was updated in two pieces. In the January 1, 2012 actuarial valuation, we increased plan liabilities by 1.25% to estimate the impact of a revised assumption. The revised assumption was not determined until the January 1, 2013 valuation. The Prior Assumptions column above reflects the results based on the mortality assumption used in the January 1, 2011 actuarial valuation. The figures in the Prior Assumptions column are estimated and rounded.

The actuarial accrued liability (and therefore, the unfunded actuarial liability) increased $935 million reflecting the revised assumptions. The change in the mortality assumption increased the actuarial liability by approximately $1.56 billion. The change in the salary assumption decreased the actuarial liability by approximately $510 million. The changes in the retirement, disability and turnover assumptions decreased the actuarial liability by approximately $115 million.

The results of the Massachusetts Teachers' valuation represent only one of the components of the total Commonwealth obligation. The Commonwealth valuation results would also include the results of the State Retirement System, Boston teachers, and the local COLA liability.

Terms and Definitions

ACTUAL/EXPECTED (or A/E) RATIO: The ratio of the actual number of occurrences of a particular decrement compared to the expected number of occurrences of that decrement, based upon the current set of assumptions and the applicable exposures.

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 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).

DECREMENTS: The means by which a member changes status. For active members, the decrements are retirement, disability retirement, withdrawal and death. For retired members, the only decrement is death.

EXPOSURE: The number of lives exposed to a given risk of decrement for a particular age (and/or service and gender). It represents the number of members who could have potentially retired, become disabled, withdrawn or died at that particular age.

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.

RP-2000: Mortality tables published by the Society of Actuaries based on a study of uninsured pension plan mortality. The tables reflect data submitted from 100 large pension plans for the years 1990-1994, and the resulting table is projected to the year 2000.

UNFUNDED ACTUARIAL LIABILITY: The Actuarial Accrued Liability less Assets.

Appendix

Retirement Assumptions - Revised Rates

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

Appendix (continued)

Retirement Assumptions - Revised Rates

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

Appendix (continued)

Disability Assumptions - Revised Rates

Age	Teachers
< 20	0.00004
20	0.00004
21	0.00004
22	0.00004
23	0.00004
24	0.00004
25	0.00005
26	0.00005
27	0.00005
28	0.00005
29	0.00005
30	0.00006
31	0.00006
32	0.00006
33	0.00006
34	0.00006
35	0.00006
36	0.00006
37	0.00006
38	0.00006
39	0.00006
40	0.00010
41	0.00015
42	0.00020
43	0.00020
44	0.00025
45	0.00030
46	0.00030
47	0.00040
48	0.00040
49	0.00050
50	0.00050
51	0.00060
52	0.00060
53	0.00070
54	0.00070
55	0.00070
56	0.00070
57	0.00070
58	0.00070
59	0.00070
60	0.00070
61	0.00070
62	0.00070
63	0.00070
64	0.00070
65+	0.00150

Appendix (continued)

Turnover Assumptions - Revised Rates

Males

Age	Service									
	0-1	2	3	4	5	6	7	8	9	10+
< 21	0.130	0.115	0.083	0.066	0.055	0.040	0.040	0.033	0.015	0.015
21	0.130	0.115	0.083	0.066	0.055	0.040	0.040	0.033	0.015	0.015
22	0.130	0.115	0.083	0.066	0.055	0.040	0.040	0.033	0.015	0.015
23	0.130	0.115	0.083	0.066	0.055	0.040	0.040	0.033	0.015	0.015
24	0.130	0.115	0.083	0.066	0.055	0.040	0.040	0.033	0.015	0.015
25	0.130	0.115	0.083	0.066	0.055	0.040	0.040	0.033	0.015	0.015
26	0.130	0.115	0.083	0.066	0.055	0.040	0.040	0.033	0.015	0.015
27	0.130	0.115	0.083	0.066	0.055	0.040	0.040	0.033	0.015	0.015
28	0.130	0.115	0.083	0.066	0.055	0.040	0.040	0.033	0.015	0.015
29	0.130	0.115	0.083	0.066	0.055	0.040	0.040	0.033	0.015	0.015
30	0.150	0.110	0.089	0.070	0.054	0.045	0.040	0.033	0.015	0.015
31	0.150	0.110	0.089	0.070	0.054	0.045	0.040	0.033	0.015	0.015
32	0.150	0.110	0.089	0.070	0.054	0.045	0.040	0.033	0.020	0.015
33	0.150	0.110	0.089	0.070	0.054	0.045	0.040	0.033	0.020	0.015
34	0.150	0.110	0.089	0.070	0.053	0.045	0.040	0.033	0.020	0.015
35	0.133	0.095	0.071	0.065	0.053	0.050	0.036	0.033	0.025	0.015
36	0.133	0.095	0.071	0.065	0.053	0.050	0.036	0.033	0.030	0.015
37	0.133	0.095	0.071	0.065	0.053	0.050	0.036	0.033	0.030	0.016
38	0.133	0.095	0.071	0.065	0.052	0.050	0.036	0.033	0.030	0.016
39	0.133	0.095	0.071	0.065	0.052	0.050	0.036	0.033	0.030	0.017
40	0.133	0.130	0.071	0.075	0.052	0.055	0.030	0.034	0.025	0.017
41	0.133	0.130	0.071	0.075	0.052	0.055	0.030	0.035	0.024	0.018
42	0.133	0.130	0.071	0.075	0.051	0.055	0.030	0.035	0.023	0.019
43	0.133	0.130	0.071	0.075	0.051	0.055	0.030	0.036	0.022	0.020
44	0.133	0.130	0.071	0.075	0.051	0.055	0.030	0.036	0.021	0.021
45	0.140	0.136	0.083	0.060	0.070	0.060	0.035	0.020	0.022	0.022
46	0.140	0.136	0.083	0.060	0.070	0.060	0.040	0.020	0.022	0.022
47	0.140	0.136	0.083	0.060	0.070	0.060	0.040	0.020	0.023	0.022
48	0.140	0.136	0.083	0.060	0.070	0.060	0.040	0.020	0.024	0.023
49	0.140	0.136	0.083	0.060	0.070	0.060	0.045	0.020	0.025	0.023
50	0.162	0.112	0.088	0.090	0.070	0.065	0.050	0.022	0.025	0.023
51	0.162	0.112	0.088	0.090	0.070	0.065	0.055	0.022	0.024	0.023
52	0.162	0.112	0.088	0.090	0.070	0.065	0.060	0.022	0.023	0.023
53	0.162	0.112	0.088	0.090	0.070	0.065	0.060	0.022	0.022	0.024
54	0.162	0.112	0.088	0.090	0.070	0.065	0.060	0.022	0.021	0.024
55	0.246	0.112	0.100	0.100	0.065	0.080	0.040	0.040	0.040	0.025
56	0.246	0.112	0.100	0.100	0.065	0.080	0.040	0.040	0.040	0.025
57	0.246	0.112	0.100	0.100	0.065	0.080	0.040	0.040	0.040	0.025
58	0.246	0.112	0.100	0.100	0.065	0.080	0.040	0.040	0.040	0.025
59	0.246	0.112	0.100	0.100	0.065	0.080	0.040	0.040	0.040	0.025
60	0.200	0.120	0.100	0.100	0.090	0.080	0.050	0.050	0.050	0.050
61	0.200	0.120	0.100	0.100	0.090	0.080	0.050	0.050	0.050	0.050
62	0.200	0.120	0.100	0.100	0.090	0.080	0.050	0.050	0.050	0.050
63	0.200	0.120	0.100	0.100	0.090	0.080	0.050	0.050	0.050	0.050
64	0.200	0.120	0.100	0.100	0.090	0.080	0.050	0.050	0.050	0.050
65	0.200	0.120	0.100	0.100	0.100	0.080	0.050	0.050	0.050	0.050

Appendix (continued)

Turnover Assumptions - Revised Rates

Females

Age	Service									
	0-1	2	3	4	5	6	7	8	9	10+
< 21	0.100	0.105	0.075	0.073	0.070	0.050	0.060	0.070	0.070	0.050
21	0.100	0.105	0.075	0.073	0.070	0.050	0.060	0.070	0.070	0.050
22	0.100	0.105	0.075	0.073	0.070	0.050	0.060	0.070	0.070	0.050
23	0.100	0.105	0.075	0.073	0.070	0.050	0.060	0.070	0.070	0.050
24	0.100	0.105	0.075	0.073	0.070	0.050	0.060	0.070	0.070	0.050
25	0.100	0.105	0.075	0.073	0.070	0.050	0.060	0.070	0.070	0.050
26	0.100	0.105	0.080	0.073	0.070	0.050	0.060	0.070	0.070	0.050
27	0.100	0.105	0.085	0.073	0.070	0.050	0.060	0.070	0.070	0.050
28	0.100	0.105	0.090	0.073	0.070	0.050	0.060	0.070	0.070	0.050
29	0.100	0.105	0.095	0.073	0.070	0.050	0.060	0.070	0.070	0.050
30	0.150	0.115	0.100	0.100	0.088	0.073	0.060	0.070	0.060	0.045
31	0.150	0.115	0.100	0.100	0.088	0.073	0.060	0.070	0.055	0.042
32	0.150	0.115	0.100	0.100	0.088	0.073	0.060	0.060	0.050	0.039
33	0.150	0.115	0.095	0.100	0.088	0.073	0.060	0.060	0.050	0.036
34	0.150	0.115	0.090	0.100	0.088	0.073	0.060	0.060	0.050	0.033
35	0.110	0.125	0.080	0.066	0.070	0.070	0.060	0.055	0.050	0.030
36	0.110	0.125	0.080	0.066	0.070	0.065	0.060	0.050	0.050	0.028
37	0.110	0.125	0.080	0.066	0.065	0.060	0.060	0.045	0.050	0.027
38	0.110	0.125	0.080	0.066	0.060	0.055	0.055	0.040	0.050	0.026
39	0.110	0.125	0.080	0.066	0.055	0.050	0.050	0.035	0.050	0.024
40	0.105	0.085	0.066	0.052	0.050	0.050	0.045	0.035	0.030	0.022
41	0.105	0.085	0.066	0.052	0.040	0.050	0.040	0.034	0.030	0.022
42	0.105	0.085	0.066	0.052	0.040	0.045	0.035	0.033	0.030	0.022
43	0.105	0.085	0.066	0.052	0.040	0.045	0.030	0.032	0.030	0.021
44	0.105	0.085	0.066	0.052	0.040	0.045	0.030	0.030	0.030	0.021
45	0.098	0.085	0.071	0.052	0.040	0.025	0.030	0.028	0.030	0.021
46	0.098	0.085	0.071	0.052	0.040	0.025	0.030	0.026	0.030	0.021
47	0.098	0.085	0.071	0.052	0.040	0.025	0.030	0.025	0.030	0.021
48	0.098	0.085	0.071	0.052	0.040	0.025	0.030	0.025	0.030	0.021
49	0.098	0.085	0.071	0.052	0.040	0.025	0.030	0.024	0.030	0.020
50	0.098	0.120	0.079	0.066	0.050	0.030	0.040	0.024	0.030	0.020
51	0.098	0.120	0.079	0.066	0.050	0.030	0.040	0.024	0.030	0.020
52	0.138	0.120	0.079	0.066	0.050	0.030	0.040	0.023	0.030	0.020
53	0.138	0.120	0.079	0.066	0.050	0.030	0.040	0.023	0.030	0.020
54	0.138	0.120	0.079	0.066	0.050	0.030	0.040	0.022	0.030	0.020
55	0.138	0.125	0.096	0.066	0.060	0.036	0.040	0.020	0.020	0.020
56	0.138	0.125	0.096	0.066	0.060	0.036	0.040	0.020	0.020	0.020
57	0.200	0.125	0.096	0.066	0.060	0.036	0.040	0.020	0.020	0.020
58	0.200	0.125	0.096	0.066	0.060	0.036	0.040	0.020	0.020	0.020
59	0.200	0.125	0.096	0.066	0.060	0.036	0.040	0.020	0.020	0.020
60	0.200	0.200	0.100	0.100	0.060	0.060	0.060	0.050	0.050	0.050
61	0.200	0.200	0.100	0.100	0.060	0.060	0.060	0.050	0.050	0.050
62	0.200	0.200	0.100	0.100	0.060	0.060	0.060	0.050	0.050	0.050
63	0.200	0.200	0.100	0.100	0.060	0.060	0.060	0.050	0.050	0.050
64	0.200	0.200	0.100	0.100	0.060	0.060	0.060	0.050	0.050	0.050
65	0.200	0.200	0.100	0.100	0.060	0.060	0.060	0.050	0.050	0.050

Appendix (continued)

Salary Increase Assumption - Revised Rates

Years of Service	Teachers
0	7.5%
1	7.1%
2	7.0%
3	6.9%
4	6.8%
5	6.7%
6	6.6%
7	6.5%
8	6.3%
9	6.1%
10	5.9%
11	5.7%
12	5.2%
13	4.7%
14	4.3%
15	4.2%
16	4.2%
17	4.1%
18	4.1%
19	4.1%
20+	4.0%

Appendix (continued)

Mortality Assumption - Revised Rates

Numbers shown are deaths per 10,000

	Pre-Retirement	
Age	Male	Female
20	1.88	1.38
21	1.99	1.36
22	2.08	1.38
23	2.20	1.43
24	2.32	1.49
25	2.46	1.56
26	2.68	1.68
27	2.77	1.75
28	2.84	1.85
29	2.99	1.95
30	3.21	2.16
31	3.61	2.61
32	4.07	2.98
33	4.57	3.29
34	5.08	3.56
35	5.59	3.74
36	6.09	3.92
37	6.54	4.05
38	6.84	4.24
39	7.10	4.46
40	7.35	4.75
41	8.10	5.15
42	8.45	5.67
43	8.85	6.23
44	9.87	6.84
45	10.45	7.33
46	10.97	7.90
47	11.66	8.57
48	12.39	9.37
49	13.02	10.13
50	13.68	11.30
51	14.34	12.48
52	15.03	14.10
53	15.92	15.76
54	17.08	17.85
55	18.78	20.22
56	20.69	22.97
57	23.17	25.59
58	26.05	27.99
59	28.13	30.93
60	30.74	33.78
61	34.61	36.83
62	38.06	42.12
63	42.47	45.58
64	46.65	49.11
65	50.84	52.66
66	56.11	56.15
67	60.89	59.55
68	64.30	62.83
69	68.87	65.94
70+	72.61	68.87

	Post-Retirement			
	Healthy Annuitants		Disabled Annuitants	
Age	Male	Female	Male	Female
50	24.43	17.40	35.17	20.65
51	25.29	16.60	37.73	19.51
52	26.68	17.14	40.24	19.74
53	28.74	19.08	43.62	21.53
54	30.83	21.67	46.73	23.96
55	33.22	25.35	50.89	27.47
56	36.38	29.77	55.24	31.61
57	39.36	34.57	60.49	36.35
58	43.31	38.80	66.77	40.79
59	47.01	43.61	74.46	45.85
60	51.48	48.31	83.69	50.79
61	57.40	53.91	92.60	56.68
62	64.02	59.20	102.55	62.24
63	72.68	64.72	112.80	68.04
64	80.42	71.46	123.34	75.13
65	89.06	78.82	132.30	82.88
66	98.97	86.81	144.27	91.27
67	108.21	95.38	154.43	100.28
68	114.90	106.02	168.59	111.47
69	125.30	118.07	187.19	124.14
70	132.77	130.44	205.68	137.15
71	144.94	144.29	229.46	153.24
72	160.93	160.49	260.91	170.44
73	176.83	177.78	294.74	190.72
74	197.27	199.33	333.91	213.84
75	226.60	219.26	377.84	237.59
76	255.98	247.06	427.52	267.72
77	292.96	279.32	483.59	299.65
78	334.87	311.28	550.86	333.93
79	382.75	347.41	626.28	372.69
80	437.35	384.00	706.73	411.94
81	503.24	429.59	799.59	460.86
82	577.94	476.24	887.55	510.90
83	652.18	528.80	995.89	567.28
84	745.35	581.85	1,108.89	624.20
85	827.34	651.00	1,233.65	691.38
86	928.33	729.09	1,347.10	766.57
87	1,044.12	816.44	1,492.09	849.83
88	1,173.34	889.17	1,625.18	925.54
89	1,281.24	990.96	1,771.01	1,021.18
90	1,433.47	1,082.57	1,910.47	1,115.58
91	1,561.33	1,174.97	2,074.42	1,210.80
92	1,718.60	1,280.71	2,224.54	1,319.77
93	1,853.93	1,405.82	2,361.05	1,434.25
94	2,013.02	1,525.56	2,493.67	1,556.41
95	2,180.45	1,642.17	2,635.27	1,675.38
96	2,314.25	1,733.94	2,759.90	1,769.00
97	2,444.25	1,844.70	2,879.83	1,863.25
98	2,609.04	1,919.32	3,012.48	1,938.62
99	2,732.42	1,983.08	3,122.15	2,003.02
100	2,851.16	2,035.19	3,217.54	2,055.65

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