Experience Study Analysis

Massachusetts Teachers' Retirement System: 2000-2005

Public Employee Retirement Administration Commission

Commonwealth of Massachusetts
Public Employee Retirement Administration Commission

- The Honorable Domenic J. F. Russo
  Chairman

- The Honorable A. Joseph DeNucci
  Auditor of the Commonwealth
  Vice Chairman

- The Honorable Deval Patrick
  Governor of the Commonwealth

- The Honorable Paul V. Doane
  Executive Director
  Arkansas Teacher Retirement System

- Kenneth J. Donnelly
  Lieutenant (Retired)
  Lexington Fire Department

- James M. Machado
  Sergeant
  Fall River Police Department

- Donald R. Marquis
  Former Town Manager
  Arlington

- Joseph E. Connarton
  Executive Director

Five Middlesex Avenue, Suite 304, Somerville, MA 02145
ph 617 666 4446 | *fax* 617 628 4002 | *tty* 617 591 8917 | *web* www.mass.gov/perac

Published by PERAC Communications, 2008.
Printed on recycled paper.

TABLE OF CONTENTS

PAGE

Introduction

The Public Employee Retirement Administration Commission (PERAC) has completed our second Experience Study of the Massachusetts Teachers' Retirement System. This report presents the results of our experience analysis for members of the Massachusetts Teachers' Retirement System over the six-year period from January 1, 2000 through December 31, 2005. In addition, for some of our analysis, we used data as of December 31, 2006.

The nature of an experience study is to track annual salary increases and how members leave a system (retirement, death, disability, or withdrawal) and adjust our actuarial assumptions based on both this past experience as well as anticipated future experience. This task requires more detailed data than is necessary for an annual actuarial valuation. We received additional information from the Massachusetts Teachers' Retirement Board to complete this study.

Until the January 1, 2006 actuarial valuation, PERAC estimated salary for a significant number of members due to questionable reported pay. Our estimates were based on the Annuity Savings Fund contributions and the contribution rate. In addition, since actual credited service is not provided to us, each year we estimate service based on a member's original date of hire as recorded by the Massachusetts Teachers' System. For these reasons, the salary analysis and any experience results based on service are not as reliable as the other components of this study.

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 2000 through 2006. PERAC performed valuations for each year in this period. Our review of the gains and losses over this period shows that, overall, the actuarial assumptions are reasonable. Although there were actuarial losses in each of the past six years, the losses were relatively small, typically representing less than 1% of the actuarial liability. The losses exceeded $250 million only once in the six years ($876 million in 2002), and we expect a significant portion of this loss relates to the implementation of Chapter 114 of the Acts of 2000 (Retirement Plus). Despite the relatively small losses each year, there were consistent actuarial losses and we hope our revised assumptions provide a better estimate of plan liabilities going forward.

Introduction (continued)

As part of this experience study, we performed a detailed member reconciliation of actual retirements, terminations, and disabilities over the 6-year period. We analyzed these results using not only our valuation data from each year, but also listings generated by the PERAC Disability Unit and the Massachusetts Teachers' Retirement Board's response to a number of our data questions.

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 liability. The actuarial accrued liability less plan assets equals the unfunded liability. The unfunded liability is amortized through FY2023 under the current schedule. In addition to the amortization of the unfunded liability, 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 accrued 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 accrued liability (and thereby the amortization of the unfunded liability).

Overall, our proposed assumptions slightly increase the total plan cost.

It is important to note that the results for the Massachusetts Teachers' reflect only one component of the total Commonwealth obligation. The revised assumptions will first be reflected in our January 1, 2008 actuarial valuation.

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
Member of the American Academy of Actuaries
Associate of the Society of Actuaries
Enrolled Actuary Number 05-4709

Joseph E. Connarton
Executive Director

John F. Boorack
Actuarial Associate

Dated: February 29, 2008

Executive Summary

In November, 2000, PERAC published the first experience study of the Massachusetts Teachers' Retirement System. 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 the Massachusetts Teachers' Retirement System.

This study continues the analysis of the experience of the Massachusetts Teachers' Retirement System and covers the six-year period from 2000-2005. Based on the results of this study, we are recommending minor changes be made to most of the assumptions used to value the liabilities of the Massachusetts Teachers' Retirement System. These changes are detailed below.

General Analysis

The principal results of the six-year experience study can be summarized as follows:

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; increase in total plan cost
- Rates of withdrawal for all active members; slight decrease in total plan cost
- Rates of salary increases for active members; slight decrease in total plan cost

No changes were made to the following assumptions:

- Rates of disability for all active members
- Rates of mortality for retired members
- Rates of mortality for disabled members

Nature and effect of changes:

- Proposed changes are based on both actual past and anticipated future experience
- Overall, proposed changes produce a total plan cost slightly greater than that under the current assumptions

Executive Summary (continued)

Specific Analysis

Retirement

- Propose keeping gender distinct rates
- Propose different rates for teachers in Retirement Plus and teachers not in Retirement Plus
- Propose different rates for teachers in Retirement Plus retiring with less than 20 years of service, with 20-30 years of service and 30 or more years of service
- Propose different rates for teachers not in Retirement Plus retiring with less than 20 years of service and 20 or more years of service
- Proposed assumptions increase total plan cost

Disability

- Propose leaving these rates unchanged
- Proposed assumptions would have no impact on total plan cost

Withdrawal

- For males and females, propose increasing the rates for all years of service and most ages within each year of service
- Proposed assumptions would slightly decrease total plan cost

Salary Increases

- Propose contracting the table with an ultimate rate of 4.75% at 14 years. Also propose decreasing or leaving the rates unchanged at all years of service with the most significant decreases at 0-2 years of service
- Proposed assumptions slightly decrease total plan cost

Post-Retirement Mortality

- Propose leaving these rates unchanged
- Proposed assumptions would have no impact on total plan cost

Methodology

General methodology for all assumptions

- Study comprises the years January 1, 2000 through January 1, 2006. In addition, data through January 1, 2007 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 Massachusetts Teachers' actuarial valuations in each of these years.

- Reconciliation of members completed for each year

- For each period in the 6-year experience study period (1/00 to 1/01, 1/01 to 1/02, 1/02 to 1/03, 1/03 to 1/04, 1/04 to 1/05, and 1/05 to 1/06), we determined the member experience relating to:
  – Retirement
  – Disability
  – Withdrawal (Turnover)
  – Salary increases
  – Post-retirement mortality

- 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.

- Expected experience determined for each assumption. For example, for retirement, we determined the expected number of members retiring at each age 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

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

- Compared the results of the experience from this study, with the results of the experience from the study from 1995-2000

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 by the percentage of disabilities that are job-related (accidental) compared to non-job-related (ordinary)
- 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
- Considered dividing the groups into teachers in Retirement Plus and teachers not in Retirement Plus. Ultimately did not perform this analysis since newly hired teachers are required to join Retirement Plus and thus the population of teachers with less than 10 years of service who are not in Retirement Plus is diminishing each year.

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 3-year and 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
- Analyzed results by job group
- Adjusted results for each Group to reflect retiree deaths with continuing payments to beneficiaries
- Compared actual experience for each Group to the RP-2000 mortality table
- Performed testing for disabled retired members separately by gender
- Analyzed results in 5-year age brackets in selecting assumptions

Findings

Retirement

- Actual Retirements were generally greater than expected, (except female teachers in Retirement Plus with more than 30 years of service)
- Males and females not in Retirement Plus with less than 20 years of service had similar rates of retirement
- For females not in Retirement Plus, there is a significant proportion of the teachers over age 70 that continue working instead of retiring. However, since this cohort is such a small percentage of the 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.
- Actual number of disability retirements about as expected up to age 50.
- Actual number of disability retirements less than expected after age 50, but possibly an aberration (disability rates should increase as members age). We will closely monitor this over next 5 years.
- Actual ratio of accidental disability to ordinary disability retirements about as expected over the 5-year period, but over the past 3 years, the ratio is less than expected. We will closely monitor this over the next 5 years.

Withdrawal

- Measuring withdrawal (termination) rates continues to be a challenge. Therefore, our rates for this assumption tend to be more conservative than retirement and disability
- For males, actual terminations are greater than expected for most years of service
- For females, actual terminations are greater than expected for most years of service

Findings (continued)

Salary Increases

- Like withdrawal rates, accurately measuring salary increases continues to be a challenge. Therefore, our assumptions tend to be more conservative than retirement and disability rates.

- The ultimate rate for salary increases remained the same but the period was shortened

- Reliability of results questionable due to numerous salary changes made in annual valuation data

Post-Retirement Mortality

- Overall, mortality somewhat less than expected but data issues may influence this understatement

- Male mortality slightly less than expected in all years

- Female mortality greater than expected in most years

- Recent retiree data is more credible than past data for retirees; 2006 experience (although beyond the scope of the study) appears the most reliable and also provides the best match of the actual and expected for both males and females

- Total disabled mortality somewhat greater than expected; gender allocation and small sample make it difficult to assess

- Mortality not significantly different by Group

- This assumption will continue to be monitored each year as we perform the actuarial valuation. We did not change this assumption because of issues reconciling the actual number of deaths due to data issues for most of the 6-year period of our study.

Summary of Assumptions

The selection of the actuarial assumptions reflects a work in progress. The assumptions shown here will first be used in the January 1, 2008 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 for the assumptions are shown in the Appendix.

1. Rate of Investment Return: Currently the rate is 8.25% annually. This assumption is determined by the legislature and was not reviewed as part of this study.

2. Rates of Retirement: The following tables compare current and proposed retirement rates. The proposed 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	Current	Proposed	Current	Proposed
50	0.00	0.00	0.01	0.02
55	0.02	0.06	0.03	0.05
60	0.12	0.15	0.20	0.20
62	0.18	0.20	0.35	0.35
65	0.40	0.30	0.50	0.40
68	0.40	0.30	0.30	0.30
70	1.00	1.00	1.00	1.00

Males in Retirement Plus:

	Less than 20 years		20 – 30 years		30 + years	
Age	Current	Proposed	Current	Proposed	Current	Proposed
50	0.00	0.00	0.01	0.01	0.01	0.02
55	0.02	0.03	0.03	0.03	0.06	0.06
60	0.12	0.15	0.20	0.20	0.35	0.50
62	0.18	0.20	0.35	0.30	0.40	0.40
65	0.40	0.40	0.50	0.40	0.50	0.50
68	0.40	0.40	0.30	0.30	0.30	0.50
70	1.00	1.00	1.00	1.00	1.00	1.00

Summary of Assumptions (continued)

Females Not in Retirement Plus:

	Less than 20 years		20+ years	
Age	Current	Proposed	Current	Proposed
50	0.00	0.00	0.01	0.02
55	0.02	0.06	0.04	0.05
60	0.12	0.15	0.16	0.20
62	0.18	0.20	0.25	0.30
65	0.40	0.30	0.40	0.40
68	0.40	0.30	0.35	0.40
70	1.00	1.00	1.00	1.00

Females in Retirement Plus:

	Less than 20 years		20 – 30 years		30 + years	
Age	Current	Proposed	Current	Proposed	Current	Proposed
50	0.00	0.00	0.01	0.015	0.01	0.02
55	0.02	0.02	0.04	0.03	0.06	0.06
60	0.12	0.20	0.16	0.16	0.35	0.35
62	0.18	0.25	0.25	0.30	0.40	0.40
65	0.40	0.30	0.40	0.30	0.40	0.35
68	0.40	0.30	0.35	0.30	0.35	0.30
70	1.00	1.00	1.00	1.00	1.00	1.00

3. Rates of Disability: The current assumptions for disability were found to closely match the experience, so the rates of disability did not change. Also, the assumption that 35% of disabilities are job-related remains unchanged.

4. Rates of Withdrawal: Current rates are age and service based for the first 10 years of service and age based after 10 years. The proposed rates will remain age and service based for the first 10 years and age based after 10 years. The proposed rates are generally higher than the current rates.

Male Rates

Age	Current (0 years)	Proposed (0 years)	Current (5 years)	Proposed (5 years)	Current (after 10 years)	Proposed (after 10 years)
30	.108	.114	.043	.045	.010	.010
40	.093	.097	.049	.054	.015	.017
50	.059	.100	.042	.048	.019	.022
60	.050	.075	.035	.055	.025	.050

Summary of Assumptions (continued)

Female Rates

Age	Current (0 years)	Proposed (0 years)	Current (5 years)	Proposed (5 years)	Current (after 10 years)	Proposed (after 10 years)
30	.116	.120	.090	.090	.040	.050
40	.114	.110	.070	.065	.031	.029
50	.068	.082	.045	.042	.019	.021
60	.050	.080	.025	.055	.015	.050

5. Rate of Salary Increase: The following table compares current and proposed salary increase rates. The proposed rates are lower than the current rates for 0-3 years of service and for 11-24 or more years of service.

Service	Current	Proposed
0	9.50%	8.00%
5	6.75%	6.75%
10	5.50%	5.50%
15	5.00%	4.75%
20	5.00%	4.75%
25+	4.75%	4.75%

6. Pre-Retirement Mortality: Current rates of mortality are in accordance with the RP-2000 Employees table projected 10 years with Scale AA. Based on our analysis, the pre-retirement mortality rates will not change. We will continue to monitor this assumption closely.

7. Post-Retirement Mortality: Current rates of mortality are in accordance with the RP-2000 Healthy Annuitant table projected 10 years with Scale AA. For disabled members, current rates are in accordance with the RP-2000 table set forward 3 years for males. Based on our analysis, the post-retirement mortality rates will not change. We will continue to monitor this assumption closely.

Effect of Proposed Assumptions

For illustration, the effect of the proposed changes to the salary scale and demographic assumptions based on the January 1, 2007 valuation results is shown below. In light of the common goal of addressing the pension funding of the Commonwealth in a disciplined and appropriate manner, it is recommended that no change in the existing funding schedule take place at this time that would reduce the current level of appropriation.

1. Number of Members:	
Active Members	88,962
Term. Vested Members	N/A
Retirees and Survivors	47,635
Total	136,597
2. Total Annual Regular Compensation	$4,969,091,773
3. Average Annual Regular Compensation	$55,856

Development of Total Cost (in thousands)	Current Assumptions	Proposed Assumptions	Increase/Decrease
4. Normal Cost			
a. Total Normal Cost	$591,002	$578,702	($12,300)
b. Employee Contributions	$480,366	$476,595	($3,771)
c. Net Normal Cost	$110,636	$102,107	($8,529)
5. Actuarial Accrued Liability			
a. Active Members	$14,293,696	$14,460,731	$167,035
b. Inactive Members	$400,000	$400,000	$0
c. Retirees and Survivors	$14,627,018	$14,627,018	$0
d. Total Actuarial Liability	$29,320,714	$29,487,749	$167,035
6. Actuarial Value of Assets	$20,820,392	$20,820,392	$0
7. Unfunded Actuarial Liability: (5d)-(6)	$8,500,322	$8,667,357	$167,035
8. Funded Ratio: (6) / (5d)	71.0%	70.6%	(0.4%)
9. Amortization of unfunded liability (16 year, 4.5% increasing)	$683,017	$696,439	$13,422
10. Total Cost: (4c) + (9)	$793,654	$798,546	$4,892
11. Total Cost FY08: (10) x 1.0825	$859,130	$864,426	$5,296

Our results are shown for comparison only and assume a 16 year, 4.5% annual increasing schedule to amortize the unfunded liability. The results of the Massachusetts Teachers' valuation represent only one of the components of the total Commonwealth obligation. The determination of the funding schedule for the Commonwealth would also include the results of the State valuation, 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 recently 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 ACCRUED LIABILITY The excess of the Actuarial Accrued Liability over the Assets.

Appendix

Retirement Assumptions - Proposed Rates

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

Appendix (continued)

Retirement Assumptions - Proposed Rates

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

Appendix (continued)

Disability Assumptions - Proposed 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	0.00010
42	0.00020
43	0.00020
44	0.00030
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	0.00080
56	0.00080
57	0.00080
58	0.00090
59	0.00090
60	0.00100
61	0.00100
62	0.00110
63	0.00110
64	0.00120
65+	0.00120

Appendix (continued)

Turnover Assumptions - Proposed Rates

Males

Age	Service									
	0-1	2	3	4	5	6	7	8	9	10+
< 21	0.120	0.105	0.079	0.065	0.045	0.040	0.035	0.025	0.015	0.010
21	0.120	0.105	0.079	0.065	0.045	0.040	0.035	0.025	0.015	0.010
22	0.120	0.105	0.079	0.065	0.045	0.040	0.035	0.025	0.015	0.010
23	0.120	0.105	0.079	0.065	0.045	0.040	0.035	0.025	0.015	0.010
24	0.120	0.105	0.079	0.065	0.045	0.040	0.035	0.025	0.015	0.010
25	0.120	0.105	0.079	0.065	0.045	0.040	0.035	0.025	0.015	0.010
26	0.120	0.105	0.079	0.065	0.045	0.040	0.035	0.025	0.015	0.010
27	0.120	0.105	0.079	0.065	0.045	0.040	0.035	0.025	0.015	0.010
28	0.118	0.104	0.079	0.065	0.045	0.040	0.035	0.025	0.015	0.010
29	0.116	0.103	0.078	0.064	0.045	0.040	0.035	0.025	0.015	0.010
30	0.114	0.102	0.077	0.063	0.045	0.039	0.032	0.025	0.015	0.010
31	0.112	0.101	0.077	0.062	0.046	0.038	0.032	0.025	0.015	0.010
32	0.110	0.100	0.076	0.062	0.047	0.037	0.032	0.028	0.018	0.011
33	0.110	0.098	0.076	0.061	0.048	0.036	0.032	0.030	0.018	0.012
34	0.110	0.095	0.075	0.061	0.049	0.035	0.033	0.031	0.018	0.013
35	0.110	0.093	0.075	0.060	0.050	0.035	0.033	0.032	0.019	0.015
36	0.100	0.090	0.074	0.060	0.051	0.035	0.033	0.033	0.019	0.015
37	0.100	0.088	0.073	0.060	0.052	0.035	0.034	0.033	0.019	0.016
38	0.099	0.087	0.072	0.060	0.053	0.036	0.034	0.033	0.020	0.016
39	0.098	0.085	0.071	0.059	0.054	0.036	0.034	0.033	0.020	0.017
40	0.097	0.083	0.070	0.058	0.054	0.037	0.035	0.034	0.020	0.017
41	0.096	0.081	0.070	0.057	0.053	0.037	0.035	0.034	0.020	0.018
42	0.095	0.080	0.071	0.057	0.052	0.038	0.035	0.034	0.021	0.018
43	0.094	0.079	0.072	0.056	0.051	0.038	0.036	0.034	0.021	0.019
44	0.093	0.078	0.073	0.056	0.050	0.039	0.036	0.035	0.022	0.019
45	0.095	0.077	0.074	0.055	0.050	0.039	0.036	0.035	0.022	0.020
46	0.098	0.076	0.075	0.055	0.050	0.040	0.037	0.035	0.022	0.020
47	0.100	0.075	0.075	0.054	0.049	0.040	0.037	0.035	0.023	0.021
48	0.100	0.075	0.075	0.054	0.049	0.040	0.037	0.035	0.023	0.021
49	0.100	0.075	0.075	0.053	0.048	0.040	0.038	0.035	0.023	0.022
50	0.100	0.075	0.074	0.053	0.048	0.040	0.038	0.035	0.024	0.022
51	0.100	0.075	0.073	0.052	0.047	0.040	0.038	0.035	0.024	0.023
52	0.100	0.075	0.072	0.052	0.047	0.040	0.039	0.036	0.024	0.023
53	0.100	0.075	0.071	0.051	0.046	0.040	0.039	0.036	0.024	0.024
54	0.100	0.075	0.070	0.051	0.046	0.040	0.039	0.037	0.025	0.024
55	0.075	0.070	0.060	0.050	0.045	0.040	0.039	0.038	0.025	0.025
56	0.075	0.070	0.060	0.050	0.045	0.040	0.040	0.035	0.025	0.025
57	0.075	0.070	0.060	0.050	0.045	0.040	0.040	0.030	0.025	0.025
58	0.075	0.070	0.060	0.050	0.045	0.040	0.040	0.030	0.025	0.025
59	0.075	0.070	0.060	0.050	0.045	0.040	0.040	0.030	0.025	0.025
60	0.075	0.070	0.060	0.060	0.055	0.050	0.050	0.050	0.050	0.050
61	0.075	0.070	0.060	0.060	0.055	0.050	0.050	0.050	0.050	0.050
62	0.075	0.070	0.060	0.060	0.055	0.050	0.050	0.050	0.050	0.050
63	0.075	0.070	0.060	0.060	0.055	0.050	0.050	0.050	0.050	0.050
64	0.075	0.070	0.060	0.060	0.055	0.050	0.050	0.050	0.050	0.050
65	0.075	0.070	0.060	0.060	0.055	0.050	0.050	0.050	0.050	0.050

Appendix (continued)

Turnover Assumptions - Proposed Rates

Females

Age	Service									
	0-1	2	3	4	5	6	7	8	9	10+
< 21	0.100	0.095	0.090	0.090	0.090	0.080	0.075	0.075	0.070	0.050
21	0.100	0.095	0.090	0.090	0.090	0.080	0.075	0.075	0.070	0.050
22	0.100	0.095	0.090	0.090	0.090	0.080	0.075	0.075	0.070	0.050
23	0.100	0.094	0.090	0.090	0.090	0.080	0.075	0.075	0.070	0.050
24	0.100	0.093	0.090	0.090	0.090	0.080	0.075	0.075	0.070	0.050
25	0.100	0.092	0.090	0.090	0.090	0.080	0.075	0.075	0.070	0.050
26	0.100	0.091	0.090	0.090	0.090	0.080	0.075	0.075	0.070	0.050
27	0.100	0.090	0.090	0.090	0.090	0.080	0.075	0.075	0.070	0.050
28	0.110	0.096	0.094	0.094	0.090	0.079	0.075	0.075	0.070	0.050
29	0.110	0.102	0.098	0.098	0.090	0.078	0.075	0.075	0.070	0.050
30	0.120	0.108	0.102	0.102	0.090	0.077	0.075	0.075	0.070	0.050
31	0.120	0.114	0.106	0.106	0.090	0.076	0.075	0.075	0.070	0.050
32	0.130	0.120	0.110	0.110	0.090	0.075	0.075	0.075	0.070	0.050
33	0.127	0.116	0.107	0.106	0.088	0.074	0.073	0.073	0.066	0.047
34	0.124	0.112	0.104	0.102	0.086	0.073	0.071	0.070	0.062	0.044
35	0.121	0.108	0.101	0.098	0.084	0.072	0.069	0.068	0.058	0.041
36	0.118	0.104	0.098	0.094	0.082	0.071	0.067	0.065	0.054	0.038
37	0.116	0.100	0.095	0.090	0.080	0.070	0.065	0.063	0.050	0.035
38	0.114	0.096	0.089	0.085	0.075	0.062	0.058	0.057	0.047	0.033
39	0.112	0.092	0.083	0.080	0.070	0.054	0.051	0.051	0.044	0.031
40	0.110	0.088	0.077	0.075	0.065	0.046	0.045	0.045	0.041	0.029
41	0.098	0.084	0.071	0.070	0.060	0.040	0.040	0.040	0.038	0.027
42	0.096	0.081	0.066	0.064	0.055	0.035	0.035	0.035	0.035	0.025
43	0.093	0.080	0.064	0.062	0.052	0.033	0.032	0.032	0.032	0.025
44	0.091	0.078	0.063	0.060	0.049	0.029	0.029	0.029	0.029	0.024
45	0.089	0.076	0.062	0.058	0.047	0.028	0.027	0.026	0.026	0.024
46	0.087	0.074	0.061	0.056	0.045	0.028	0.026	0.023	0.023	0.023
47	0.085	0.073	0.060	0.054	0.043	0.027	0.025	0.020	0.020	0.023
48	0.084	0.073	0.059	0.052	0.043	0.027	0.025	0.020	0.020	0.022
49	0.083	0.073	0.058	0.051	0.042	0.026	0.025	0.020	0.020	0.022
50	0.082	0.072	0.057	0.050	0.042	0.026	0.025	0.020	0.020	0.021
51	0.081	0.072	0.056	0.049	0.041	0.025	0.025	0.020	0.020	0.021
52	0.080	0.072	0.055	0.048	0.040	0.025	0.025	0.020	0.020	0.020
53	0.080	0.072	0.051	0.045	0.037	0.024	0.024	0.020	0.020	0.020
54	0.080	0.072	0.047	0.042	0.035	0.023	0.023	0.020	0.020	0.020
55	0.080	0.071	0.043	0.039	0.032	0.022	0.022	0.020	0.020	0.020
56	0.080	0.071	0.039	0.036	0.030	0.021	0.021	0.020	0.020	0.020
57	0.080	0.070	0.035	0.033	0.027	0.020	0.020	0.020	0.020	0.020
58	0.080	0.070	0.035	0.033	0.027	0.020	0.020	0.020	0.020	0.020
59	0.080	0.070	0.035	0.033	0.027	0.020	0.020	0.020	0.020	0.020
60	0.080	0.070	0.065	0.060	0.055	0.050	0.050	0.050	0.050	0.050
61	0.080	0.070	0.065	0.060	0.055	0.050	0.050	0.050	0.050	0.050
62	0.080	0.070	0.065	0.060	0.055	0.050	0.050	0.050	0.050	0.050
63	0.080	0.070	0.065	0.060	0.055	0.050	0.050	0.050	0.050	0.050
64	0.080	0.070	0.065	0.060	0.055	0.050	0.050	0.050	0.050	0.050
65	0.080	0.070	0.065	0.060	0.055	0.050	0.050	0.050	0.050	0.050

Appendix (continued)

Salary Increase Assumption - Proposed Rates

Years of Service	Teachers
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%

PERAC
Five Middlesex Ave.
Suite 304
Somerville, MA 02145
ph 617 666 4446
fax 617 628 4002
tty 617 591 8917
web www.mass.gov/perac