State Retirement System

Experience Study Analysis

2006-2011

FEBRUARY, 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 State Retirement System. This report presents the results of our experience analysis for members of the State Retirement System (SRS) over the six-year period from January 1, 2006 through December 31, 2011 and is based on annual data provided to us by the SRS each year from January 1, 2006 through January 1, 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 our 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 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. 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 annual 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 State 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 but slightly conservative. There were actuarial gains (experience better than anticipated) in 5 of the 6 years ranging from $33 million to $346 million. There was an actuarial loss in 2006 of $163 million. Over the entire 6-year period, the assumptions generated a net cumulative gain of $694 million, or an average gain of $116 million per year. This amount is quite small considering the total actuarial accrued liability of approximately $27.8 billion as of January 1, 2012 (average gain of less than ½ of 1% of actuarial liability each year).

As part of this experience study, we performed member reconciliations 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.

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% 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 decrease the total plan cost. This is consistent with the cumulative actuarial gains over the 6-year period. The revised assumptions are reflected in our January 1, 2013 actuarial valuation.

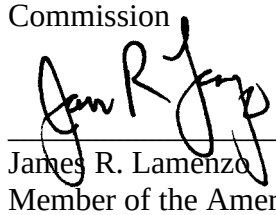
Our study focused on the demographic assumptions that have the greatest impact on plan costs (salary increases, retirement, disability, withdrawal, and mortality). There are a number of other demographic assumptions (including the percentage of disabilities that are job related and the percentage of 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 active 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 SRS reflect only one component of the Total Commonwealth Obligation. The other components are the Massachusetts Teachers' Retirement System, Boston teachers, and reimbursements to local systems to reflect COLAs granted from 1982 through 1996. The experience study of the Massachusetts Teachers' Retirement System is in progress and will be released later this year.

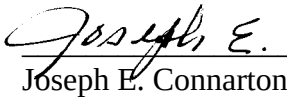
Introduction (continued)

We gratefully acknowledge the efforts of the State Retirement Board staff in completing this project.

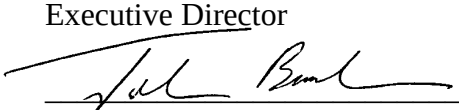
Respectfully submitted,
Public Employee Retirement Administration
Commission



James R. Lamenzo
Member of the American Academy of Actuaries
Associate of the Society of Actuaries
Enrolled Actuary Number 11-4709



Joseph E. Connarton
Executive Director



John F. Boorack
Senior Actuarial Associate

Dated: February 27, 2014

Executive Summary

In October, 2000, PERAC published the first experience study of the SRS. 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 SRS.

In July, 2007, PERAC published the second experience study of the SRS and covered the six-year period from 2000-2005. Based on the results of that study, we made minor changes to most of the assumptions.

This study covers the six-year period from 2006-2011. Based on the results of this study, we are making minor changes to most assumptions and more significant changes 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 – most significant changes for Group 1 females; minor changes to other groups; small decrease in total plan cost
- Rates of disability for all active members at selected ages; negligible change in plan cost
- Rates of withdrawal for all active members; slight decrease in total plan cost
- Rates of salary increases for active members; decrease in total plan cost
- Rates of mortality for active and retired members; increase in total plan cost

Nature and effect of changes:

- Revised changes are based on both actual past and anticipated future experience
- Overall, revised changes produce a total plan cost less than that under the prior assumptions, as shown below (dollars are in thousands):

January 1, 2013 Valuation	Prior Assumptions	Revised Assumptions
Employer Normal Cost	$228,100	$185,172
Unfunded Actuarial Liability	$9,488,196	$9,068,053
Funded Ratio	68.2%	69.1%

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.

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.
- Data used in this study was provided by the State Retirement Board and reflects the data used in the State actuarial valuations in each of these years.
- Reconciliation of members completed for each year.
- For each period in the 6-year experience study period (1/06 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.
- 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 (and/or years of service) 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 job group:
  – Group 1 – general employees
  – Group 2 – certain employees with hazardous positions
  – Group 3 – state police
  – Group 4 – generally public safety and correction officers

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 were eligible to retire at the beginning of a period and is not in the active file at the end of the period.
- Analyzed results for Groups 1 and 2 by gender.
- Analyzed results separately for members below age 50 and over age 70.

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 were 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 service and age/service combined in addition to age.
- 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

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

Findings

Retirement

- For Groups 1 and 2, the Early Retirement Incentives (ERIs) adopted in 2002 and 2003 no longer seem to have any impact on retirements. The ERIs skewed the results of our prior experience study analysis as many members who would have normally retired in 2004 or later took advantage of the ERI.

- For Group 1, there is a significant proportion of the workers 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.

- For Group 1 males, total expected retirements were about the same as actual retirements for ages 50 to 69. However, actual retirements exceeded the expected amount at most ages from age 50 to 61. After age 61, the actual figure was generally less than the expected figure.

- For Group 1 females, actual retirements were significantly less than expected for most ages from age 56 to age 69 and more comparable at other ages.

- For Group 2, overall expected retirements were close to the actual figures. Actual retirements were generally lower than expected for ages 51 to 57. From age 58 to 69, actual exceeded expected in some years while expected retirements were greater in other years.

- For Group 3, the actual experience was generally consistent with the prior assumptions at most ages. From ages 55 to 60, actual retirements were generally greater than expected.

- For Group 4, total retirements were about as expected. Actual retirements were generally greater than expected from ages 45 to 50. The actual figures were less than expected for most ages between 52 and 62.

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 somewhat less than expected for Group 1.

- Actual number of disability retirements about as expected for Groups 2, 3, and 4.

- Although the overall assumptions (in total) were reasonable for each job group, individual age rates required adjustment.

Findings (continued)

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 Group 1, actual terminations were greater than expected. Most of the difference was in 2006 and 2007. By years of service, members with up to 7 years of service had actual terminations greater than expected. For members with over 7 years of service, actual terminations were less than expected.

- For Group 2, we found the results were similar to Group 1. We will continue to use the same assumptions for both job groups.

- For Group 3, actual terminations were about as expected.

- For Group 4, actual terminations were somewhat greater than expected.

Salary Increases

- Like withdrawal rates, accurately measuring salary increases continues to be a challenge due to part-time employees, leaves of absence, and union contract settlements. Therefore, our assumptions tend to be more conservative than retirement and disability rates.

- For Groups 1, 2, and 4, salary increases for continuing members were less than assumed over the 6-year period and in almost every individual year. Results as of January 1, 2012 (and January 1, 2013 although not part of this study) were somewhat higher than the prior 3 years and reflects union contract settlements.

- For Group 3, salary increases for continuing members increased more than expected over the 6-year period. However this result reflects a significant increase in 2006 which we suspect is a data issue. The results varied significantly by year.

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

Findings (continued)

Post-Retirement Mortality

- Overall, mortality (deaths) was about as expected.
- Male mortality was slightly greater than expected.
- Female mortality was about as expected.
- Disabled mortality was greater than expected for both males and females. The number of exposed lives for females was significantly less than that for males.
- For males, mortality does not appear to vary significantly by job group. For females, this appears to be the case for Groups 1 and 2. There is not enough data for Groups 3 and 4 to make a determination.
- Although, overall, deaths were about as expected, we revised the mortality assumption as part of our January 1, 2012 actuarial valuation to reflect mortality improvement beyond 2012. This assumption will continue to be monitored each year as we perform the actuarial valuation and we expect to adjust this assumption frequently, perhaps annually, moving forward.

Determination of Revised Assumptions

Retirement

- For Group 1 males, revised rates are generally higher than prior assumption from ages 50 to 61 and generally lower from ages 62 to 69. Overall, total expected retirements comparable to prior assumption.

- For Group 1 females, revised rates are lower at most ages. Revised rates decrease the number of expected retirements by approximately 100 per year.

- For Group 2, revised rates are generally lower than prior assumption from ages 53 to 59 and the same at other ages. Revised rates decrease the number of expected retirements by approximately 15 per year.

- For Group 3, revised rates are generally the same as prior assumption with minor changes at most ages between 51 and 60.

- For Group 4, revised rates are slightly higher or the same as prior assumption for ages 45 to 53 and slightly lower or the same as prior assumption at other ages. Overall, total expected retirements decrease by approximately 7 per year.

- Overall, the effect of the revised assumptions is a small decrease in total plan cost.

Disability

- For Group 1, revised rates are the same or slightly lower than prior assumption at all ages.

- For Group 2, revised rates are slightly lower below age 36 and above age 48. Rates are slightly higher at other ages.

- For Group 3, revised rates are the same below age 35, are slightly lower from age 35 to age 54 and slightly higher above age 55.

- For Group 4, revised rates are the same below age 30 and above age 59, slightly lower from ages 30 to 39 and 55 to 59, and slightly higher from ages 40 to 54.

- The revised assumptions have a negligible change on total plan cost.

Determination of Revised Assumptions (continued)

Withdrawal

- For Groups 1 and 2, we continue to use an assumption based on both age and service with ultimate rates after 10 years of service. The revised rates reflect minor changes to the current assumption table.

- For Group 3, we continue to use a service based assumption. The revised rates decrease slightly at all years of service.

- For Group 4, we continue to use a service based assumption. The revised rates generally increase slightly from the prior assumption up to 10 years of service, and thereafter decrease slightly.

- The revised assumptions slightly decrease total plan cost.

Salary Increases

- Determining a revised salary increase assumption reflects the greatest challenge in this experience analysis. Salary increases were less than assumed over the period but not unexpected based on the financial environment during the period. The challenge is to select an assumption that meets our best estimate both over the shorter and longer term. We considered moving to a level increase for all members (for example 4.0% per year) and then reevaluating in a few years. However, we did not feel this was the best assumption for the longer term. We decided on an approach that melds the flat approach for several years to reflect the current environment with the prior approach (graded based on service and job group). The revised assumption for all members is 3.5% for 2013, 3.75% for 2014, and 4.0% for 2015. Thereafter, the prior graded approach with lower initial and ultimate rates is utilized.

- For Groups 1 and 2, we maintained the select and ultimate approach with greater increases in earlier years of service and grading down over time. Rates for 0-3 years of service decreased by 1% from the prior assumption. Rates for 4-9 years of service decreased by .75%. Rates for 10 years of service or more decreased by .5%. The ultimate rate at 20 years is 4.0%.

- For Groups 3 and 4, we maintained the select and ultimate approach with greater increases in earlier years of service and grading down over time. Rates for 0-3 years of service decreased by 1% . Rates for 4-9 years of service decreased by .75%. Rates for 10 years of service or more decreased by .5%. The ultimate rate at 20 years is 4.5%.

- The revised assumptions decrease total plan cost.

Determination of Revised Assumptions (continued)

Mortality

- The revised assumptions (both pre-retirement and post-retirement) maintain using a standard set of tables, the RP-2000 Mortality Tables and are gender distinct. To reflect future mortality improvement, we projected the tables beyond the 10 years of the previous assumption. Mortality is projected to 2015 for retirees and 2020 for active members.

- The revised mortality assumption for disabled retirees continues to reflect shorter life expectancy than for non-disabled retirees.

- The revised assumptions increase total plan cost.

- We expect to adjust this assumption frequently, perhaps annually, moving forward.

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 for Group specific assumptions are shown in the Appendix.

Assumptions Common to All Groups

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

2. Pre-Retirement Mortality: Prior rates of mortality are in accordance with the RP-2000 Employees table (gender distinct) projected 10 years with Scale AA. To reflect future mortality improvement, the revised pre-retirement mortality rates will continue to use the RP-2000 Employees table (gender distinct), but be projected 20 years with Scale AA.

3. Post-Retirement Mortality: Prior rates of mortality are in accordance with the RP-2000 Healthy Annuitant table (gender distinct) projected 10 years with Scale AA. To reflect future mortality improvement, the revised post-retirement mortality rates will continue to use the RP-2000 Healthy Annuitant table (gender distinct), but be projected 15 years with Scale AA. For disabled members, prior rates are in accordance with the RP-2000 Healthy Annuitant table (gender distinct) set forward 3 years for males. The revised rates reflect the RP-2000 Healthy Annuitant table (gender distinct) projected 5 years with Scale AA set forward 3 years for males.

   These rates will continue to be reviewed and adjusted as necessary. We expect the mortality assumption to be updated frequently, perhaps annually.

Summary of Revised Assumptions (continued)

Group 1 – Specific Assumptions:

1. Rates of Retirement: The following tables compare the prior and revised retirement rates at various ages for both males and females. The revised rates for males are greater than the prior assumption from ages 50 to 54 and 58 to 61, and lower than the prior assumption at age 55 and most ages between 62 and 69. The revised rates for females are either less than or the same as the prior assumption at all ages. The revised rates at all ages are shown in the Appendix.

	Males		Females	
Age	Prior	Revised	Prior	Revised
50	.015	.030	.030	.030
55	.040	.035	.050	.050
60	.080	.090	.080	.075
65	.250	.200	.250	.200
70	1.000	1.000	1.000	1.000

2. Rates of Disability: The following table compares the prior and revised disability rates. The revised rates are the same or lower than the prior rates at all ages. It is also assumed that the percentage of job-related disabilities remains unchanged at 75%.

Age	Prior	Revised
20	.00010	.00010
30	.00010	.00010
40	.00075	.00068
50	.00140	.00133
60	.00200	.00120

3. Rates of Withdrawal: 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 lower than the prior rates after 10 years of service.

Age	Prior (0 years)	Prior (5 years)	Prior (after 10 years)	Revised (0 years)	Revised (5 years)	Revised (after 10 years)
20	.270	.120	.060	.270	.120	.045
30	.230	.100	.055	.230	.100	.045
40	.160	.080	.040	.160	.080	.030
50	.140	.060	.030	.180	.060	.030

Summary of Revised Assumptions (continued)

Group 1 – Specific Assumptions (continued):

4. Rate of Salary Increase: Rates for all members were set at 3.5% for 2013, 3.75% for 2014, and 4.0% for 2015. Thereafter, the rate is based on service. The prior assumption was based strictly on service. The following table compares the prior and revised service based salary increase rates. The revised rates are lower than the prior rates at each year of service.

Service	Prior	Revised
0	8.00%	7.00%
5	6.00%	5.25%
10	5.25%	4.75%
15	5.00%	4.50%
20+	4.50%	4.00%

Summary of Revised Assumptions (continued)

Group 2 - Specific Assumptions:

1. Rates of Retirement: The following table compares the prior and revised retirement rates at various ages. The revised rates are lower than the prior assumption at ages 53 to 57 and age 59 and the same at all other ages. The revised rates at all ages are shown in the Appendix.

Age	Prior	Revised
50	.020	.020
55	.100	.075
60	.150	.150
62	.150	.150
65	.200	.200
70	1.000	1.000

2. Rates of Disability: The following table compares the prior and revised disability rates. The revised rates are generally lower than the prior rates below age 36 and over age 47 and generally greater at other ages. It is also assumed that the percentage of job-related disabilities remains unchanged at 75%.

Age	Prior	Revised
20	.00060	.00050
30	.00080	.00072
40	.00166	.00210
50	.00425	.00420
60	.00550	.00500

Summary of Revised Assumptions (continued)

Group 2 - Specific Assumptions (continued):

3. Rates of Withdrawal: Prior and revised rates are age and service based rates for the first 10 years of service and age based after 10 years. The revised rates are generally lower than the prior rates after 10 years of service. The revised rates are the same as the Group 1 rates.

Age	Prior (0 years)	Prior (5 years)	Prior (after 10 years)	Revised (0 years)	Revised (5 years)	Revised (after 10 years)
20	.270	.120	.060	.270	.120	.045
30	.230	.100	.055	.230	.100	.045
40	.160	.080	.040	.160	.080	.030
50	.140	.060	.030	.180	.060	.030

4. Rate of Salary Increase: Revised rates for all members were set at 3.5% for 2013, 3.75% for 2014, and 4.0% for 2015. Thereafter, the rate is based on service. The prior assumption was based strictly on service. The following table compares the prior and revised service based salary increase rates. The revised rates are lower than the prior rates at each year of service.

Service	Prior	Revised
0	8.00%	7.00%
5	6.00%	5.25%
10	5.25%	4.75%
15	5.00%	4.50%
20+	4.50%	4.00%

Summary of Revised Assumptions (continued)

Group 3 – Specific Assumptions:

1. Rates of Retirement: The following table compares the prior and revised retirement rates at various ages. The revised rates are lower than the prior assumption at ages 51 and 52, and higher than the prior assumption at most ages between 53 and 60. The revised rates at all ages are shown in the Appendix.

Age	Prior	Revised
45	.020	.020
50	.050	.050
55	.080	.100
60	.110	.140
62	.150	.150
65	.250	.250
70	1.000	1.000

2. Rates of Disability: The following table compares the prior and revised disability rates. The revised rates are the same as the prior rates until age 32 and from ages 56-59. The revised rates are the same as the prior rates below age 35, slightly less from ages 35 to 54, and slightly greater above age 54. It is also assumed that the percentage of job-related disabilities remains unchanged at 95%.

Age	Prior	Revised
20	.0010	.0010
30	.0016	.0016
40	.0080	.0036
50	.0140	.0094
60	.0300	.0430

Summary of Revised Assumptions (continued)

Group 3 - Specific Assumptions (continued):

3. Rates of Withdrawal: Prior rates are strictly service based. The revised rates will remain service based. The revised rates are lower than the prior rates for all years of service.

Service	Prior	Revised
0-5	.008	.007
6-9	.008	.007
10-14	.006	.005
15+	.006	.005

4. Rate of Salary Increase: Revised rates for all members were set at 3.5% for 2013, 3.75% for 2014, and 4.0% for 2015. Thereafter, the rate is based on service. The prior assumption was based strictly on service. The following table compares the prior and revised service based salary increase rates. The revised rates are lower than the prior rates at each year of service.

Service	Prior	Revised
0	8.00%	7.00%
5	7.00%	6.25%
10	5.25%	4.75%
15	5.25%	4.75%
20+	5.00%	4.50%

Summary of Revised Assumptions (continued)

Group 4 – Specific Assumptions:

1. Rates of Retirement: The following table compares the prior and revised retirement rates at various ages. The revised rates are the same or greater than the prior assumption from ages 45 to 51, and lower than the prior assumption at several other ages. The revised rates at all ages are shown in the Appendix.

Age	Prior	Revised
45	.040	.060
50	.050	.060
55	.250	.250
60	.200	.200
62	.250	.200
65	.650	.500
70	1.000	1.000

2. Rates of Disability: The following table compares the prior and revised disability rates. The revised rates are the same as the prior rates below age 30 and above age 59, lower from ages 30-39 and 55-59, and greater from ages 40 to 54. It is also assumed that the percentage of job-related disabilities remains unchanged at 95%.

Age	Prior	Revised
20	.0020	.0020
30	.0040	.0021
40	.0070	.0071
50	.0100	.0110
60	.0080	.0080

Summary of Revised Assumptions (continued)

Group 4 - Specific Assumptions (continued):

3. Rates of Withdrawal: Prior rates are strictly service based. The revised rates will remain service based. The revised rates are generally greater than the prior rates up to 10 years of service and lower thereafter.

Service	Prior	Revised
0	.080	.090
5	.045	.070
10	.030	.035
15	.025	.020
20+	.040	.015

4. Rate of Salary Increase: Revised rates for all members were set at 3.5% for 2013, 3.75% for 2014, and 4.0% for 2015. Thereafter, the rate is based on service. The prior assumption was based strictly on service. The following table compares the prior and revised service based salary increase rates. The revised rates are lower than the prior rates at each year of service.

Service	Prior	Revised
0	10.00%	9.00%
5	7.00%	6.25%
10	5.25%	4.75%
15	5.25%	4.75%
20+	5.00%	4.50%

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. The valuation results reflect the use of an 8.0% investment return assumption beginning in 2013. The prior investment return assumption was 8.25%. The Prior Assumptions column below is estimated and reflects the actuarial assumptions used in the January 1, 2011 actuarial valuation except an 8.0% investment return assumption was used. We used the January 1, 2011 assumptions because the mortality assumption developed as part of this experience study was determined and included in the January 1, 2012 valuation.

1. Number of Members:			
Active Members		87,175	
Terminated Vested Members		4,067	
Retirees and Survivors		55,383	
Total		146,625	
2. Total Annual Regular Compensation		$5,183,195,000	
3. Average Annual Regular Compensation		$59,457	
Actuarial Valuation Results (in thousands)	Prior Assumptions	Revised Assumptions	Increase/(Decrease)
4. Normal Cost			
a. Total Normal Cost	$674,100	$627,549	($46,551)
b. Employee Contributions	$446,000	$442,377	($3,623)
c. Employer Normal Cost	$228,100	$185,172	($42,928)
5. Actuarial Accrued Liability			
a. Active Members	$14,614,000	$14,073,236	($540,764)
b. Vested Terminated Members	$622,100	$627,084	$4,984
c. Non-vested Terminated Members	$185,485	$185,485	$0
d. Retirees and Survivors	$14,384,000	$14,499,637	$115,637
e. Total Actuarial Liability	$29,805,585	$29,385,442	($420,143)
6. Actuarial Value of Assets	$20,317,389	$20,317,389	$0
7. Unfunded Actuarial Liability: (5e)-(6)	$9,488,196	$9,068,053	($420,143)
8. Funded Ratio: (6) / (5e)	68.2%	69.1%	0.9%

The results of the State valuation represent only one of the components of the total Commonwealth obligation. The Commonwealth valuation results would also include the results of the Massachusetts Teachers' 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 prior 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 ACTUARIAL LIABILITY The excess of the Actuarial Accrued Liability over the Assets.

Appendix

Superannuation Retirement Assumptions - Revised Rates

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

Appendix (continued)

Disability Retirement Assumptions - Revised Rates

Age	Group 1	Group 2	Group 3	Group 4
< 20	0.00010	0.00050	0.0010	0.0020
20	0.00010	0.00052	0.0010	0.0020
21	0.00010	0.00054	0.0010	0.0020
22	0.00010	0.00056	0.0010	0.0020
23	0.00010	0.00058	0.0010	0.0020
24	0.00010	0.00060	0.0010	0.0020
25	0.00010	0.00062	0.0011	0.0020
26	0.00010	0.00064	0.0012	0.0020
27	0.00010	0.00066	0.0013	0.0020
28	0.00010	0.00068	0.0014	0.0020
29	0.00010	0.00070	0.0015	0.0020
30	0.00010	0.00072	0.0016	0.0021
31	0.00010	0.00074	0.0017	0.0023
32	0.00010	0.00076	0.0018	0.0025
33	0.00018	0.00078	0.0019	0.0030
34	0.00026	0.00080	0.0020	0.0035
35	0.00034	0.00100	0.0023	0.0040
36	0.00042	0.00130	0.0026	0.0045
37	0.00050	0.00160	0.0030	0.0050
38	0.00056	0.00180	0.0032	0.0057
39	0.00062	0.00200	0.0034	0.0064
40	0.00068	0.00210	0.0036	0.0071
41	0.00074	0.00220	0.0038	0.0078
42	0.00080	0.00240	0.0040	0.0085
43	0.00090	0.00260	0.0046	0.0090
44	0.00095	0.00280	0.0052	0.0095
45	0.00100	0.00300	0.0058	0.0100
46	0.00110	0.00310	0.0064	0.0105
47	0.00125	0.00320	0.0070	0.0110
48	0.00130	0.00350	0.0078	0.0110
49	0.00130	0.00390	0.0086	0.0110
50	0.00133	0.00420	0.0094	0.0110
51	0.00136	0.00440	0.0102	0.0110
52	0.00140	0.00460	0.0110	0.0110
53	0.00145	0.00480	0.0140	0.0110
54	0.00150	0.00500	0.0170	0.0110
55	0.00140	0.00500	0.0190	0.0080
56	0.00130	0.00500	0.0220	0.0080
57	0.00120	0.00500	0.0250	0.0080
58	0.00120	0.00500	0.0310	0.0080
59	0.00120	0.00500	0.0370	0.0080
60	0.00120	0.00500	0.0430	0.0080
61	0.00120	0.00490	0.0490	0.0080
62	0.00120	0.00480	0.0550	0.0080
63	0.00120	0.00470	0.0550	0.0080
64	0.00120	0.00460	0.0550	0.0080
65	0.00120	0.00450	0.0550	0.0080

Appendix (continued)

Turnover Assumptions - Revised Rates (Groups 1 and 2)

Age	Service										
	0	1	2	3	4	5	6	7	8	9	10+
< 21	0.27	0.25	0.220	0.150	0.150	0.120	0.090	0.080	0.080	0.060	0.045
21	0.26	0.24	0.210	0.150	0.150	0.120	0.090	0.080	0.080	0.060	0.045
22	0.26	0.24	0.200	0.150	0.140	0.120	0.090	0.080	0.080	0.060	0.045
23	0.25	0.23	0.200	0.150	0.135	0.120	0.090	0.080	0.080	0.060	0.045
24	0.25	0.23	0.190	0.150	0.135	0.120	0.090	0.080	0.080	0.060	0.045
25	0.25	0.22	0.190	0.140	0.130	0.110	0.090	0.080	0.080	0.060	0.045
26	0.25	0.22	0.180	0.140	0.130	0.110	0.090	0.080	0.080	0.060	0.045
27	0.24	0.21	0.180	0.140	0.125	0.105	0.090	0.080	0.065	0.060	0.045
28	0.24	0.20	0.170	0.140	0.125	0.100	0.090	0.080	0.065	0.060	0.045
29	0.23	0.19	0.160	0.140	0.120	0.100	0.090	0.080	0.060	0.060	0.045
30	0.23	0.18	0.150	0.130	0.120	0.100	0.090	0.080	0.055	0.055	0.045
31	0.20	0.17	0.150	0.130	0.120	0.095	0.090	0.080	0.050	0.050	0.045
32	0.20	0.16	0.140	0.130	0.120	0.095	0.090	0.080	0.050	0.050	0.045
33	0.19	0.16	0.140	0.130	0.110	0.090	0.085	0.080	0.050	0.050	0.045
34	0.19	0.15	0.130	0.130	0.110	0.090	0.085	0.080	0.050	0.050	0.035
35	0.18	0.14	0.130	0.120	0.110	0.090	0.080	0.065	0.050	0.050	0.033
36	0.18	0.14	0.120	0.110	0.110	0.090	0.075	0.065	0.050	0.035	0.031
37	0.17	0.13	0.120	0.100	0.100	0.085	0.070	0.065	0.045	0.035	0.030
38	0.17	0.13	0.120	0.100	0.100	0.085	0.070	0.060	0.045	0.035	0.030
39	0.16	0.12	0.110	0.095	0.090	0.080	0.070	0.060	0.045	0.035	0.030
40	0.16	0.12	0.110	0.095	0.090	0.080	0.070	0.060	0.045	0.035	0.030
41	0.16	0.12	0.100	0.090	0.080	0.080	0.065	0.055	0.045	0.035	0.030
42	0.16	0.12	0.100	0.090	0.080	0.075	0.060	0.055	0.045	0.035	0.030
43	0.15	0.11	0.100	0.090	0.075	0.070	0.060	0.055	0.045	0.035	0.030
44	0.15	0.11	0.090	0.085	0.075	0.070	0.055	0.050	0.045	0.035	0.030
45	0.15	0.10	0.085	0.080	0.070	0.070	0.055	0.050	0.040	0.035	0.030
46	0.15	0.10	0.085	0.080	0.070	0.065	0.050	0.050	0.040	0.035	0.030
47	0.14	0.10	0.085	0.075	0.070	0.065	0.050	0.050	0.040	0.035	0.030
48	0.14	0.10	0.080	0.075	0.065	0.060	0.050	0.050	0.035	0.035	0.030
49	0.18	0.10	0.080	0.070	0.065	0.060	0.050	0.050	0.035	0.035	0.030
50	0.18	0.09	0.080	0.070	0.065	0.060	0.050	0.050	0.035	0.030	0.030
51	0.18	0.09	0.080	0.065	0.065	0.055	0.040	0.040	0.030	0.030	0.030
52	0.18	0.09	0.080	0.065	0.065	0.055	0.040	0.040	0.030	0.030	0.030
53	0.18	0.09	0.075	0.065	0.060	0.050	0.040	0.040	0.030	0.030	0.030
54	0.18	0.09	0.075	0.060	0.060	0.050	0.040	0.040	0.030	0.030	0.030
55	0.18	0.10	0.080	0.060	0.060	0.050	0.040	0.040	0.030	0.025	0.000
56	0.18	0.10	0.080	0.060	0.060	0.050	0.040	0.040	0.030	0.025	0.000
57	0.18	0.10	0.080	0.060	0.060	0.050	0.040	0.035	0.030	0.030	0.000
58	0.18	0.10	0.080	0.060	0.065	0.045	0.040	0.035	0.030	0.035	0.000
59	0.18	0.10	0.080	0.060	0.070	0.045	0.050	0.035	0.030	0.035	0.000
60	0.18	0.10	0.080	0.075	0.075	0.050	0.050	0.035	0.035	0.035	0.000
61	0.18	0.10	0.080	0.075	0.075	0.055	0.055	0.035	0.035	0.035	0.000
62	0.18	0.10	0.080	0.075	0.075	0.060	0.055	0.035	0.035	0.040	0.000
63	0.18	0.10	0.100	0.100	0.075	0.065	0.060	0.050	0.050	0.050	0.000
64	0.25	0.12	0.120	0.120	0.110	0.100	0.070	0.060	0.050	0.050	0.000
65	0.25	0.15	0.150	0.150	0.150	0.120	0.100	0.100	0.080	0.070	0.000

Appendix **(continued)**

Turnover Assumptions - Revised Rates

Service	Group 3	Group 4
0	0.007	0.090
1	0.007	0.090
2	0.007	0.080
3	0.007	0.075
4	0.007	0.070
5	0.007	0.060
6	0.005	0.040
7	0.005	0.040
8	0.005	0.035
9	0.005	0.035
10	0.005	0.035
11	0.005	0.025
12	0.005	0.022
13	0.005	0.022
14	0.005	0.020
15	0.005	0.020
16	0.005	0.020
17	0.005	0.020
18	0.005	0.015
19	0.005	0.015
20+	0.005	0.015

Appendix (continued)

Salary Increase Assumption - Revised Rates

Years of Service	Group 1	Group 2	Group 3	Group 4
0	7.00%	7.00%	7.00%	9.00%
1	6.50%	6.50%	7.00%	8.00%
2	6.00%	6.00%	7.00%	7.50%
3	5.50%	5.50%	7.00%	7.00%
4	5.50%	5.50%	6.75%	6.75%
5	5.25%	5.25%	6.25%	6.25%
6	5.00%	5.00%	5.25%	5.75%
7	4.75%	4.75%	4.75%	5.25%
8	4.75%	4.75%	4.75%	4.75%
9	4.75%	4.75%	4.75%	4.75%
10	4.75%	4.75%	4.75%	4.75%
11	4.75%	4.75%	4.75%	4.75%
12	4.75%	4.75%	4.75%	4.75%
13	4.50%	4.50%	4.75%	4.75%
14	4.50%	4.50%	4.75%	4.75%
15	4.50%	4.50%	4.75%	4.75%
16	4.25%	4.25%	4.75%	4.75%
17	4.25%	4.25%	4.75%	4.75%
18	4.25%	4.25%	4.75%	4.75%
19	4.25%	4.25%	4.75%	4.75%
20+	4.00%	4.00%	4.50%	4.50%

The above table applies beginning in 2016. The increases for 2013, 2014 and 2015 are assumed to be 3.50%, 3.75% and 4.0% respectively for all members.

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