State Teachers' Retirement System of Vermont

Report on an Experience Study: July 1, 2010 – June 30, 2014

March 2016

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Board of Trustees
State Teachers' Retirement System of Vermont
Montpelier, Vermont 05602

Dear Board Members:

Section 1942, subsection (m), of Title 16, Chapter 55, Vermont Statutes Annotated, provides in part that at least once in each five-year period, the actuary is to make a study of the System's recent experience to assist in setting assumptions. In accordance with this provision, the results of our experience study covering the four-year period from July 1,2010, through June 30, 2014, are described in this report, along with our recommendations for certain modifications in the present assumptions. We have also included a brief section discussing the financial impact of the recommended changes.

The Table of Contents, which immediately follows, outlines the information contained in this report.

This study was prepared under the supervision of David L. Driscoll, with analysis of the rate-of-return and inflation assumptions performed under the supervision of Kai Petersen. We are Fellows of the Society of Actuaries and Members of the American Academy of Actuaries. We meet the Qualification Standards of the Academy to render the actuarial opinions contained herein, and we are available to answer questions concerning them. Additionally, Mr. Petersen is a Chartered Financial Analyst (CFA) Charter holder and has performed the analyses in accordance with the professional standards of the CFA Institute.

Respectfully submitted,

David L. Driscoll, FSA, EA, MAAA
Principal, Consulting Actuary

Kai Petersen, FSA, EA, MAAA, CFA
Principal, National Asset Liability Management Group Leader

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Appendix

The State Teachers' Retirement System of Vermont

Report on the Results of an Investigation of the Actuarial Experience of the System, 2010-2014

I. INTRODUCTION

In order to accumulate funds to pay retirement benefits on a reasonable and relatively stable basis, the actuary prepares annual valuations of the System's assets and liabilities to measure the funded status and to ensure that funding is progressing at a rate that is adequate to meet the System's obligations.

The primary purposes of funding are to equitably allocate costs between generations of taxpayers and to provide security to members, who view the funds set aside as assurance that their benefits will be paid.

While the ultimate cost of the System is not determinable until all benefits are paid and expenses provided for, each actuarial valuation attempts to estimate costs based on assumptions selected to predict, as accurately as possible, future experience in order to produce stable contribution rates.

Overly conservative or aggressive assumptions will result in actuarial gains or losses each year. When translated into contributions, this will result in decreasing or increasing contribution rates and an inequitable allocation of costs.

The major actuarial assumptions are:

    (a) Active service demographic assumptions,

    (b) Compensation increase assumptions,

    (c) Post-retirement mortality rates,

    (d) Interest rate, and

    (e) Cost-of-living adjustment rates.

Before presenting our analysis of the System's experience and discussion of the proposed assumptions, it is important to outline considerations that should govern the selection of actuarial assumptions. The recommendations of the American Academy of Actuaries are as follows:

    (i) The actuarial assumptions selected should reflect the actuary's best judgement of future events. They should take into account actual experience to the extent possible, but they should also reflect long-term future trends rather than give undue weight to recent past experience.

    (ii) The actuary should consider the impact of inflation in selecting the actuarial assumptions to be used.

    (iii) The actuary should give consideration to the reasonableness of each actuarial assumption independently as well as the combined impact of all the assumptions.

    (iv) The actuary should give careful attention to changes in plan design that may significantly alter expected future experience. For example, a liberalization of early retirement benefits may make advisable a revision in the retirement assumption.

    (v) The actuary, in choosing assumptions, should take into account general or specific information available from other sources, including the plan sponsor, plan administrator, investment managers, accountants, economists, etc.

The purpose of this Report is to provide the information necessary to decide on the appropriate assumptions to be used in future valuations. It should be noted that these decisions cannot be made "in a vacuum" but must reflect the present and expected situation within the State and the System.

The balance of this Report deals in detail with the various assumptions.   In each area we have made recommendations as to what we believe are appropriate assumptions.   These recommendations reflect our "best estimate" of the likely future experience based on:

    (a) the recent past experience,

    (b) the general economic views prevailing at this time, and

    (c) anticipated trends.

II. Active Service Demographic Assumptions

The active service demographic assumptions include rates of:

(a) Termination,

(b) Disability,

(c) Death before retirement, and

(d) Retirement.

Our review of active service demographic assumptions is based on the actuarial valuation data for Group C members of the System, since Group A is closed to new members and relatively few active Group A members remain. The basis for analysis of the System's experience is a comparison of the actual number of separations from service under each category with those expected based on the assumptions currently in use.

The "expected" values are calculated by applying the various rates or probabilities to the individuals exposed to each respective event. For example, active members not yet eligible for early retirement would be exposed to the probabilities of withdrawal, death and disability. A member eligible for early retirement would be exposed to disability, death and early retirement. A member who is who is eligible for normal retirement would be exposed to disability, death and normal retirement.

Numerical summaries of the System's experience from July 1, 2010, through June 30, 2014, are presented in Appendix I. The tables show the ratios of the actual experience of the System as compared to that anticipated by the present actuarial assumptions. The results are shown separately by assumption and, where appropriate, by gender.

The ratios of actual to expected experience indicate the extent of deviation from the assumptions. A ratio of 1.0 would mean the experience has been exactly as anticipated.

As an aid to the Trustees in analyzing these results, we have also prepared a series of graphs, which present the statistical data summarized in Appendix I in visual form. Our comments will refer to these graphs, which immediately follow each of the following subsections.

Termination

The graphs that follow present the withdrawal and vesting experience separately for male and female teachers.

The experience of the last four years among Group C indicates that terminations among both male and female members were approximately at expected levels overall. To better reflect anticipated future experience, we propose a series of adjustments to the termination probabilities now in use. In particular, we propose raising the assumed probabilities of termination among male teachers at ages 25 through 39 and among female teachers at ages below 25 and over 39.

Active Service Experience - Terminations
July 1, 2010 through June 30, 2014

Men Teachers

Women Teachers
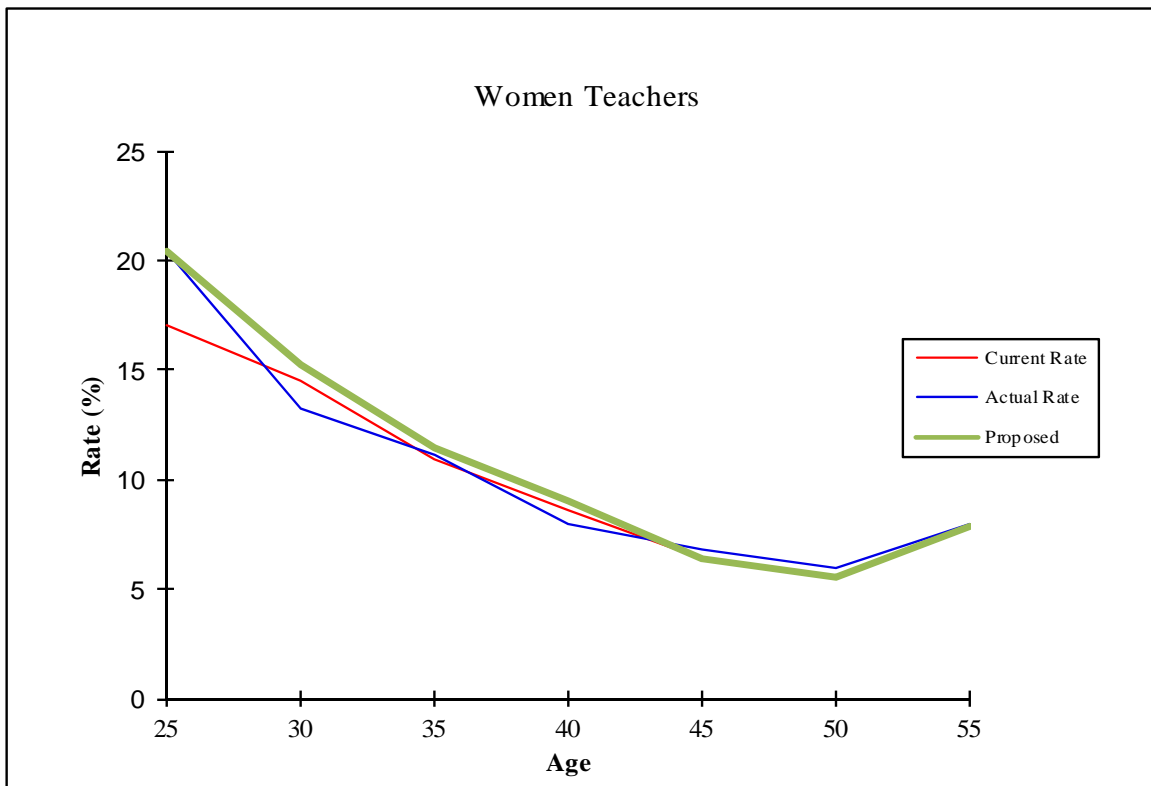
Disability

The graphs that follow show the incidence of disability among employees. The financial impact on the funding of the System of this experience is relatively minor. Upon examination, the current assumed table of disability probabilities produced expected disabilities that exceeded the actual number for participants except at ages 50 – 54. We therefore recommend reducing the assumed disability rates by 50% at those ages. The statistics are summarized in Table 2 of Appendix I. The proposed rates are set forth in detail in Appendix II.

Death

Like disabilities, deaths among active members are a relatively small proportion of the overall incidence of departure from the active population. Overall active service mortality was higher among males and lower among females than what had been expected. We recommend the application of assumed mortality based on the RP-2000 Tables with using Scale BB to the year 2029. This is consistent with the recommendation we are making for assumed mortality among retired lives.   This assumption reflects both current and expected future improvements in in-service longevity, as required under applicable Actuarial Standards of Practice.

Active Service Experience - Disability Retirements
July 1, 2010 through June 30, 2014
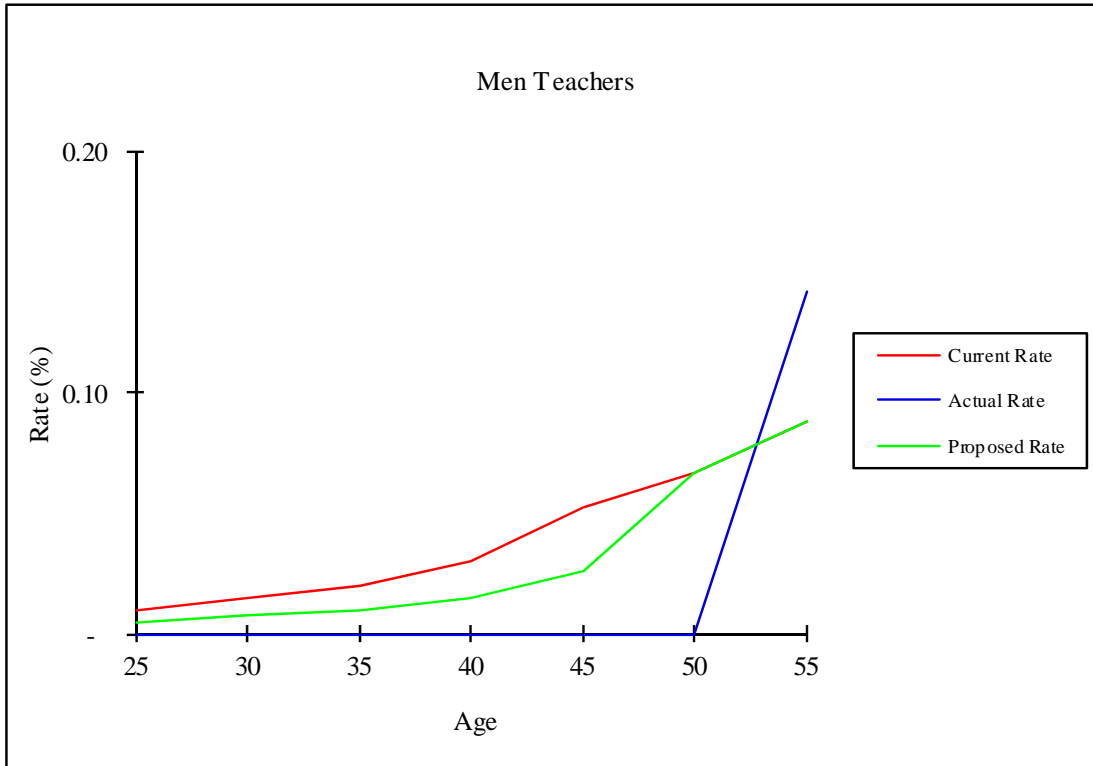
Active Service Experience - Deaths
July 1, 2010 through June 30, 2014
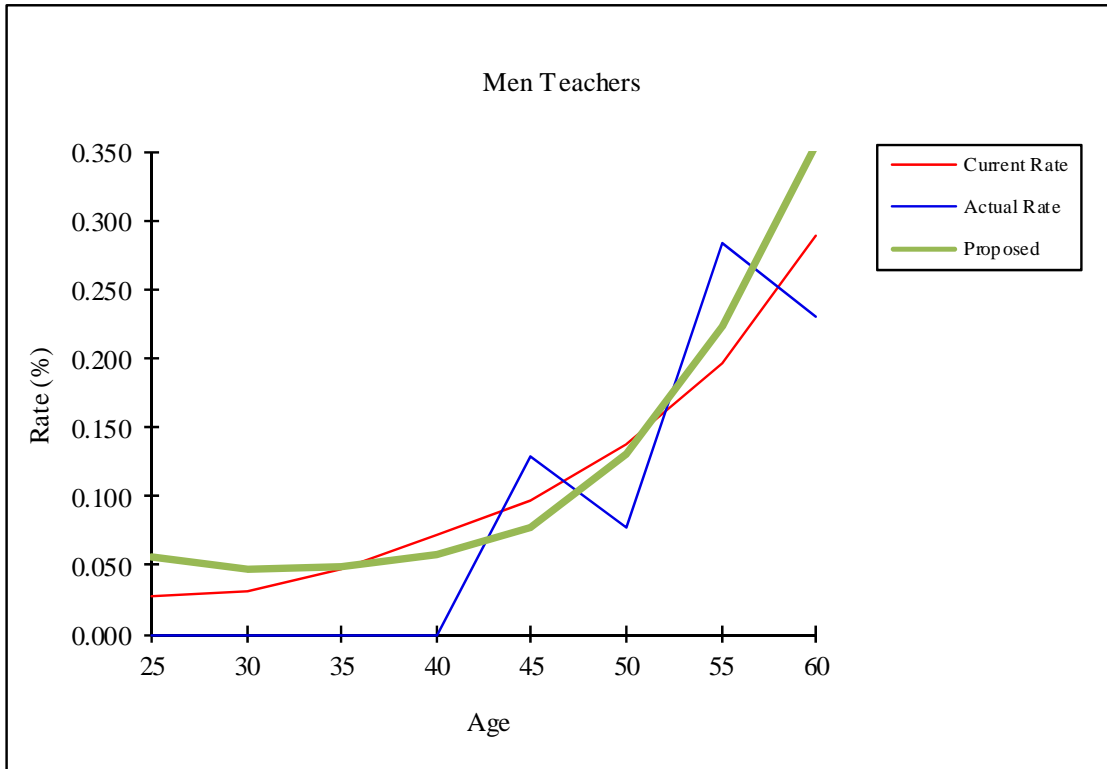
Reduced Early Retirement

The experience with regard to reduced early retirement is shown on the following graphs. The overall actual numbers of early retirements among both males and female employees were greater than the expected numbers of early retirements. The extent of the difference between actual and expected numbers of such retirements varied significantly by age, so we are proposing to lower the assumed probability of reduced early retirement to 70% of its current value at age 55 and to increase the probabilities by 50% at ages 59 through 61 for Group C; and to increase the probabilities by 50% at ages 59 and 61 for Group A. The proposed rates are set forth in detail in Appendix II.

Full Early Retirement

The overall actual numbers of early retirements among both males and female employees were greater than the expected numbers of full early retirements. We are proposing to increase the assumed probability of full early retirement by 10%. The proposed rates are set forth in detail in Appendix II.

Service Retirement

Overall, the incidence of service retirements was slightly below expected levels for male employees and slightly above expected levels for female employees. An examination of retirements over the past four years indicates that current assumed probabilities of retirement are low relative to experience at particular ages. We therefore recommend that expected rates of retirement be increased by 50% at age 61 and by 10% at ages 63 and up. The proposed rates are set forth in detail in Appendix II.

Active Service Experience - Reduced Early
July 1, 2010 through June 30, 2014

Men Teachers

Women Teachers
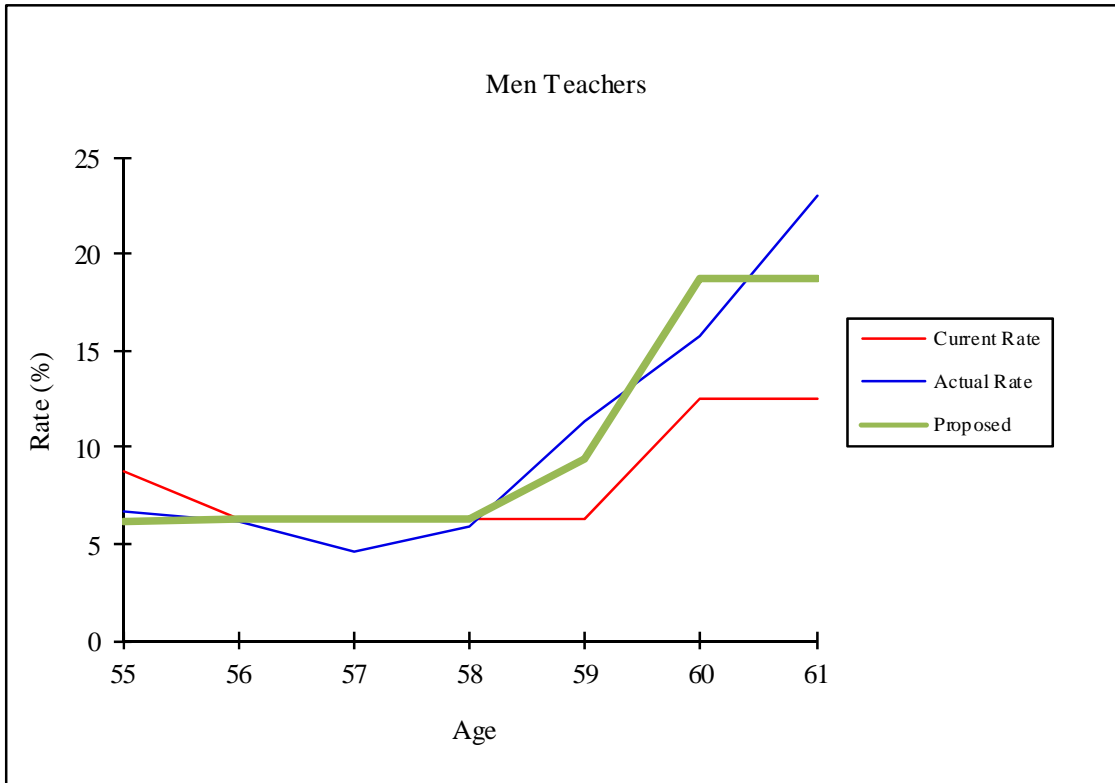
Active Service Experience - Service Retirements
July 1, 2010 through June 30, 2014
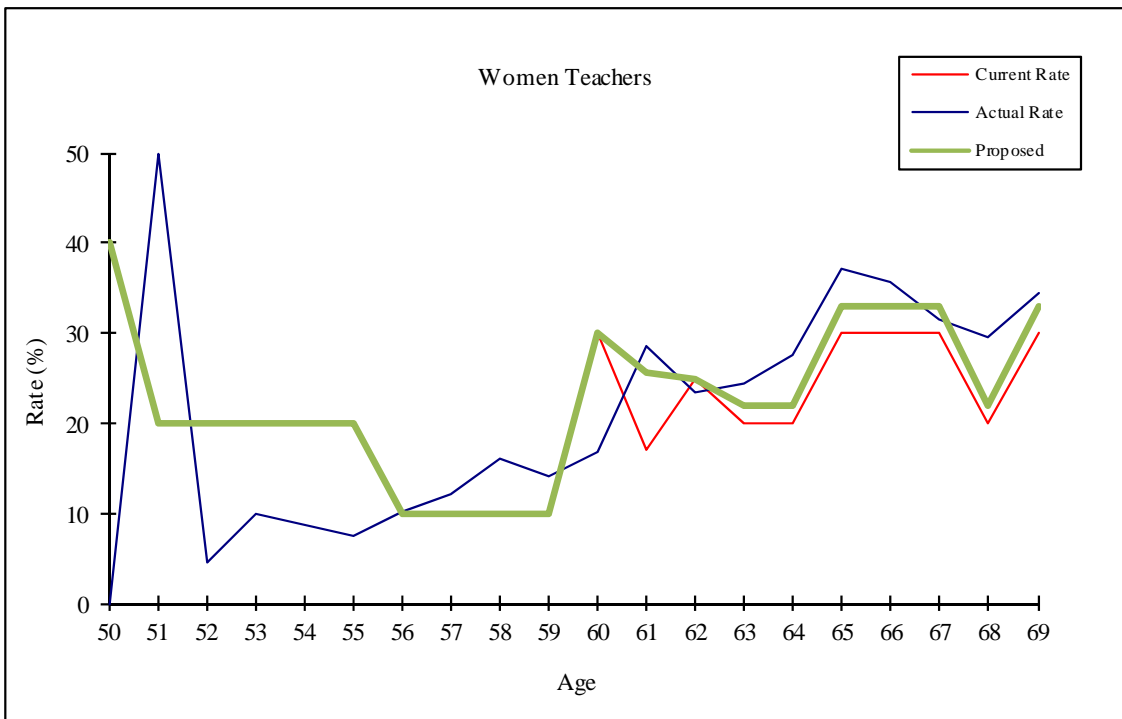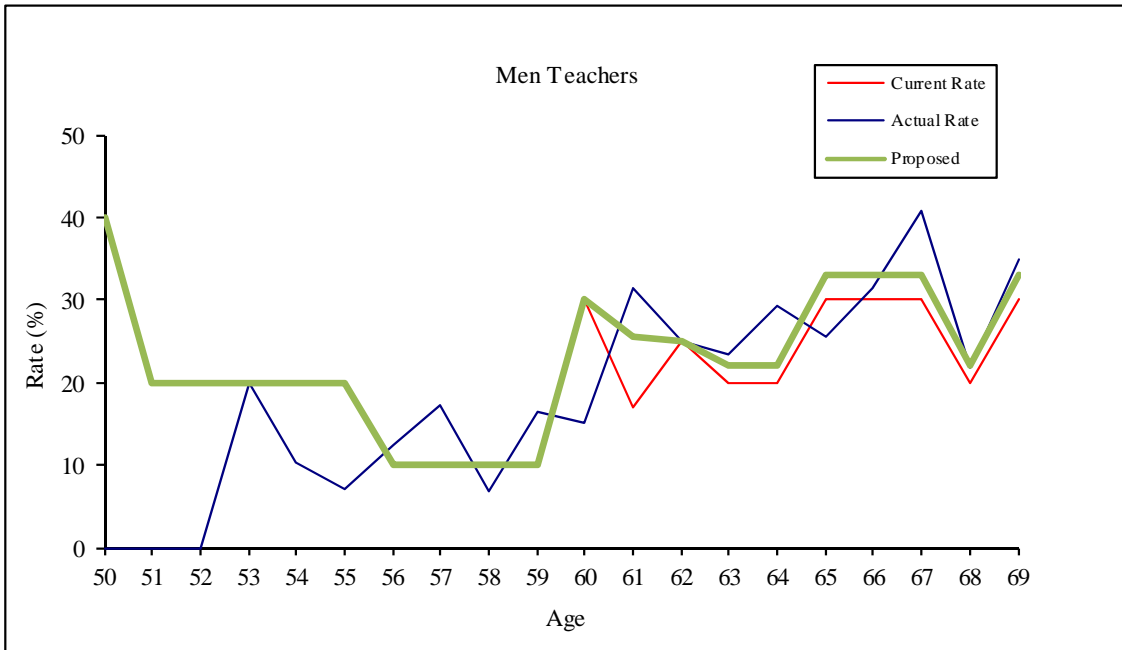
III. Post-Retirement Mortality Rates

To review the statistics with regard to post-retirement mortality for retired members, we examined mortality experience by age and also on a liability-weighted basis.

Examining mortality experience on the basis of liabilities released by deaths as well as on the basis of the numbers of decedents is a recommended approach for measuring mortality experience and is consistent with published studies that show that higher economic class (i.e., higher income level) tends to correlate with longer life expectancy. Mortality measured on the basis of deaths alone is useful for establishing the degree of statistical credibility of a pension plan's own experience in establishing mortality assumptions.

Results summarized in Table 7 of Appendix I show that mortality over the past four years has conformed reasonably well to the current assumption on the basis of actual deaths among retired members observed in the experience period. However, recent evidence published by the Society of Actuaries and other sources indicates that the provisions for future improvements in longevity that are incorporated in assumed mortality should be strengthened. Pending the development by the Society of special tables for public retirement systems, we recommend that assumed mortality be set at probabilities in the RP-2000 Pre/Post-Commencement Mortality Table projected to 2029 by Scale BB for male and female members.

Overall deaths among disabled lives have exceeded somewhat the numbers projected by the current assumption. We recommend that the mortality assumption applied to disabled retirees be changed to the RP-2000 Disabled life tables for Males and Females with projection using Scale AA to 2020.

IV. Members in Inactive Status

Since 2008, liabilities for members in inactive status have been maintained at 350% of their accumulated contributions with interest. An examination of the liability ultimately created by participants who move from inactive status to some other status leads us to recommend that the percentage of contributions with interest used to estimate the liability for these participants be maintained at 350%.

V. Economic Assumptions

Economic assumptions include rates of compensation increase, investment income and post-retirement adjustment in benefits on account of inflation. These assumptions have been analyzed by their components; i.e., the inflation level reflected in each assumption and the merit-promotion component of the compensation increase rates or the real rate of investment income component of the total return rate.

Inflation / Cost-of-Living

The System provides annual cost-of-living adjustments (COLAs). For the Group A, the annual adjustment is equal to the increase in the CPI-U, but not more than 5%. For Group C, the adjustment equals one-half the increase in the CPI-U, again limited to 5%.

With regard to the inflation assumption, the U.S. Consumer Price Index indicates that annual rates of inflation have been as follows since 2010:

Fiscal Year End	Increase[1]
2010	1.1%
2011	3.6%
2012	1.7%
2013	1.8%
2014	2.1%

Over the past five years, the U.S. Consumer Price Index (CPI-U) thus indicates that the inflation rate has averaged slightly above 2.0% annually.

The long-term expected level of inflation forecast by GEMS, the economic scenario generator used by Buck (which is described in greater detail subsequently) is approximately 3% per year. We therefore recommend that assumed inflation be maintained at an annual rate of 3%.

Currently, we assume a 3% annual adjustment in pensions for Group A and a 1.5% annual adjustment in pensions for Group C members. We recommend that this assumption be retained.

Merit-Promotion Salary Increases

The graph on next page has shown that the overall active service salary increases are slightly lower than the expectations. Based on the actual experience and anticipated future salary increases, we recommend lowering in the salary increase assumptions. The statistics are summarized in Table 6 of Appendix I. The proposed rates are set forth in detail in Appendix II.

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[1] Based on CPI-U unadjusted 12 month ended June 30 for All items

Active Service Experience - Salary Experience
July 1, 2010 through June 30, 2014
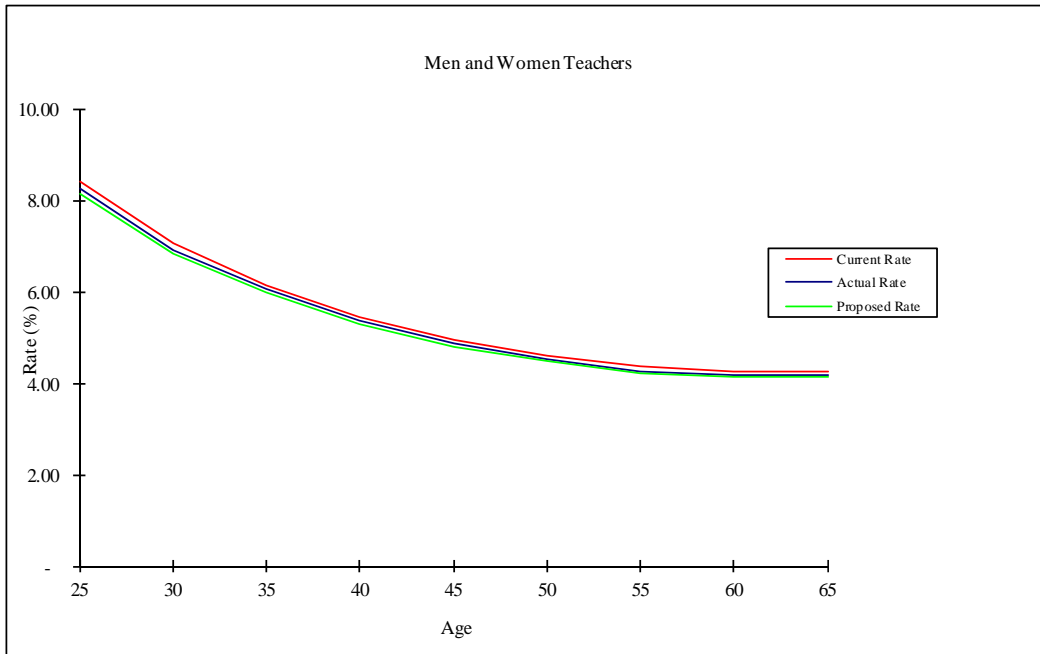
Interest Rate

The estimated total rates of return earned on the System's assets are shown below.

Year Ending June 30	Rate of Return Based on Actuarial Asset Value	Rate of Return Based on Market Asset Value
2010	6.75%	18.0%
2011	9.32%	20.5%
2012	6.25%	2.2%
2013	6.72%	8.5%
2014	8.29%	14.2%
2010-2014	7.47%	12.48%

The rate of return on the market value of assets has averaged approximately 12.48% annually during the past five years.

In an effort to forecast the expected long-term rate of return on System assets, we use a capital market model (described in more detail in the Appendix) in which individual asset class returns are estimated under a wide variety of simulated economic environments based on their underlying relationships to key economic variables, and then rolled up into a forecast of the performance of a portfolio invested in accordance with the most recent target allocation established by the Vermont Pension Investment Committee (VPIC) at its August 24, 2010, meeting. The model is calibrated to current economic and market conditions, and trends to a state of equilibrium. Over a 30- year period, the 50th percentile rate of return forecast by our model for such a portfolio is approximately 7.97%. In keeping with the rounding practices used in the past, we recommend the System adopt an assumed rate of return on assets of 7.95%.

VI. Cost Analysis and Conclusion

To assist the Board in selecting and approving the final package of valuation assumptions to be used prospectively from June 30, 2015, we have prepared a valuation of the System as of June 30, 2014, to reflect the potential impact of the revised assumptions.

Based on the assumptions recommended in this report, the total State contribution calculated as of June 30, 2014 for the fiscal year ending on June 30, 2016, would have increased from $76,102,909 to $76,841,190. These results are summarized in Appendix V.

This report discusses actuarial assumptions only. Methods such as the five-year average asset valuation procedure and the amortization period used for the unfunded accrued liability also affect the costs of System. These methods are not reviewed because they are not within the scope of an experience analysis. We should note, however, that this experience study has not revealed any reasons to change any of the methods currently employed.

Appendix I: Tables Showing Actual and Expected Experience

TABLE 1

**COMPARISON OF ACTUAL AND EXPECTED SEPARATIONS
FROM ACTIVE SERVICE**

TERMINATIONS

Central Age of Group	Men Teachers			Women Teachers		
	Actual	**Expected**	**Ratio of Actual To Expected**	**Actual**	**Expected**	**Ratio of Actual To Expected**
Under 25	12	12.96	0.926	55	45.73	1.203
25-29	81	77.22	1.049	264	288.81	0.914
30-34	108	103.10	1.048	370	363.25	1.019
35-39	109	105.32	1.035	277	300.56	0.922
40-44	92	105.87	0.869	257	238.64	1.077
45-49	84	80.16	1.048	221	207.55	1.065
50-54	81	81.02	1.000	350	346.91	1.009
55 and over	41	42.12	0.973	97	93.88	1.033
Total	608	608	1.000	1,891	1,885	1.003

TABLE 2

**COMPARISON OF ACTUAL AND EXPECTED SEPARATIONS
FROM ACTIVE SERVICE**

DISABILITY RETIREMENTS

Central Age of Group	Men Teachers			Women Teachers		
	Actual	**Expected**	**Ratio of Actual To Expected**	**Actual**	**Expected**	**Ratio of Actual To Expected**
Under 25	0	0	0.000	0	0.02	0.000
25-29	0	0.04	0.000	0	0.15	0.000
30-34	0	0.08	0.000	0	0.25	0.000
35-39	0	0.18	0.000	0	0.28	0.000
40-44	0	0.3	0.000	0	0.51	0.000
45-49	0	0.37	0.000	0	1.03	0.000
50-54	2	1.04	1.923	5	3.66	1.366
55 and over	3	4.14	0.725	11	8.32	1.322
Total	5	6.15	0.813	16	14.22	1.125

TABLE 3

COMPARISON OF ACTUAL AND EXPECTED SEPARATIONS FROM ACTIVE SERVICE

DEATHS

Central Age of Group	Men Teachers			Women Teachers		
	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected
Under 25	0	0.02	0.000	0	0.04	0.000
25-29	0	0.17	0.000	0	0.37	0.000
30-34	0	0.43	0.000	0	0.94	0.000
35-39	0	0.94	0.000	1	1.56	0.641
40-44	2	1.5	1.333	3	2.59	1.158
45-49	1	1.77	0.565	1	4.01	0.249
50-54	4	2.78	1.439	1	7.27	0.138
55-59	4	5.03	0.795	5	12.05	0.415
60-64	1	5.37	0.186	5	11.54	0.433
65 and over	3	1.79	1.676	1	2.65	0.377
Total	15	19.80	0.758	17	43.02	0.395

TABLE 4

**COMPARISON OF ACTUAL AND EXPECTED SEPARATIONS
FROM ACTIVE SERVICE**

REDUCED EARLY RETIREMENTS

Central Age of Group	Men Teachers			Women Teachers		
	Actual	**Expected**	**Ratio of Actual To Expected**	**Actual**	**Expected**	**Ratio of Actual To Expected**
55	17	16.59	1.025	46	49.1	0.937
56	15	15.63	0.960	57	49.73	1.146
57	11	15.07	0.730	52	50.44	1.031
58	14	15.09	0.928	68	51.79	1.313
59	25	20.66	1.210	76	79.18	0.960
60	32	26.21	1.221	84	105.12	0.799
61	38	31.08	1.223	176	130.22	1.352
Total	152	140.33	1.083	559	515.58	1.084

TABLE 5

**COMPARISON OF ACTUAL AND EXPECTED SEPARATIONS
FROM ACTIVE SERVICE**

SERVICE RETIREMENTS

Central Age of Group	Men Teachers			Women Teachers		
	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected
50	0	0.00	0.000	0	0.40	0.000
51	0	0.00	0.000	1	0.40	2.500
52	0	0.60	0.000	1	2.40	0.417
53	3	2.00	1.500	5	7.20	0.694
54	3	5.20	0.577	7	13.80	0.507
55	3	8.60	0.349	8	21.20	0.377
56	7	5.60	1.250	15	14.90	1.007
57	15	8.70	1.724	21	17.30	1.214
58	7	10.20	0.686	30	18.80	1.596
59	20	12.10	1.653	27	19.30	1.399
60	19	37.80	0.503	32	57.30	0.558
61	39	21.93	1.778	54	33.66	1.604
62	59	59.25	0.996	162	173.25	0.935
63	47	42.98	1.094	125	110.50	1.131
64	46	33.38	1.378	104	81.48	1.276
65	31	39.09	0.793	100	87.24	1.146
66	26	26.67	0.975	55	50.01	1.100
67	22	17.25	1.275	27	27.93	0.967
68	7	6.88	1.017	16	11.70	1.368
69	7	6.45	1.085	10	9.39	1.065
70 and over	13	48.00	0.271	16	56.00	0.286
Total	374	392.68	0.952	816	814.16	1.002

TABLE 6

**COMPARISON OF ACTUAL AND EXPECTED
ANNUAL SALARIES OF MEMBERS**

Central Age of Group	Men Teachers Annual Salaries (Salaries shown in 1,000s)			Women Teachers Annual Salaries (Salaries shown in 1,000s)		
	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected
Under 25	2,153	2,295	0.938	7,543	7,988	0.944
25-29	18,575	19,571	0.949	69,156	72,743	0.951
30-34	38,831	40,604	0.956	134,687	140,048	0.962
35-39	64,016	66,742	0.959	161,892	168,397	0.961
40-44	86,357	89,464	0.965	190,027	196,735	0.966
45-49	77,462	79,811	0.971	201,155	207,718	0.968
50-54	85,420	87,479	0.976	246,210	252,752	0.974
55-59	104,925	107,168	0.979	287,653	294,421	0.977
60-64	65,798	67,232	0.979	173,970	177,828	0.978
65 and over	16,863	17,279	0.976	26,083	26,767	0.974
Total	560,400	577,645	0.970	1,498,376	1,545,397	0.970

Appendix I: Tables Showing Actual and Expected Experience
(continued)

TABLE 7

SUMMARY OF MORTALITY EXPERIENCE
OF PENSIONERS

Group	Men Teachers			Women Teachers			Total		
	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected
Service Retirees	201	212.83	0.944	357	333.87	1.069	558	546.70	1.021
Disability Retirees	12	12.05	0.996	16	14.07	1.137	28	26.12	1.072
Beneficiaries of Deceased Members	18	11.88	1.515	36	31.24	1.152	54	43.12	1.252
Total	231	236.76	0.976	409	379.18	1.079	640	615.94	1.039

Appendix II: Recommended Active Service Tables

TABLE 1

COMPARISON OF CURRENT AND RECOMMENDED SEPARATIONS FROM ACTIVE SERVICE

DISABILITY

Age	Men Teachers Current	Men Teachers Recommended	Women Teachers Current	Women Teachers Recommended
25	0.0100%	0.0050%	0.0150%	0.0075%
26	0.0150%	0.0075%	0.0150%	0.0075%
27	0.0150%	0.0075%	0.0150%	0.0075%
28	0.0150%	0.0075%	0.0150%	0.0075%
29	0.0150%	0.0075%	0.0150%	0.0075%
30	0.0150%	0.0075%	0.0150%	0.0075%
31	0.0150%	0.0075%	0.0150%	0.0075%
32	0.0150%	0.0075%	0.0150%	0.0075%
33	0.0150%	0.0075%	0.0150%	0.0075%
34	0.0200%	0.0100%	0.0150%	0.0075%
35	0.0200%	0.0100%	0.0150%	0.0075%
36	0.0250%	0.0125%	0.0150%	0.0075%
37	0.0250%	0.0125%	0.0150%	0.0075%
38	0.0300%	0.0150%	0.0150%	0.0075%
39	0.0350%	0.0175%	0.0200%	0.0100%
40	0.0300%	0.0150%	0.0200%	0.0100%
41	0.0340%	0.0170%	0.0200%	0.0100%
42	0.0380%	0.0190%	0.0250%	0.0125%
43	0.0410%	0.0205%	0.0300%	0.0150%
44	0.0490%	0.0245%	0.0400%	0.0200%
45	0.0520%	0.0260%	0.0450%	0.0225%
46	0.0550%	0.0275%	0.0500%	0.0250%
47	0.0580%	0.0290%	0.0550%	0.0275%
48	0.0610%	0.0305%	0.0600%	0.0300%
49	0.0640%	0.0320%	0.0650%	0.0325%
50	0.0670%	0.0670%	0.0700%	0.0700%
51	0.0700%	0.0700%	0.0750%	0.0750%
52	0.0730%	0.0730%	0.0800%	0.0800%
53	0.0760%	0.0760%	0.0850%	0.0850%
54	0.0790%	0.0790%	0.0900%	0.0900%
55	0.0880%	0.0440%	0.0950%	0.0475%
56	0.1060%	0.0530%	0.1000%	0.0500%
57	0.1420%	0.0710%	0.1050%	0.0525%
58	0.1880%	0.0940%	0.1220%	0.0610%
59	0.2340%	0.1170%	0.1420%	0.0710%
60	0.2940%	0.1470%	0.1680%	0.0840%
61	0.3660%	0.1830%	0.2020%	0.1010%
62	0.4600%	0.2300%	0.2420%	0.1210%
63	0.5760%	0.2880%	0.2880%	0.1440%
64	0.7200%	0.3600%	0.3400%	0.1700%
65	0.0000%	0.0000%	0.3980%	0.1990%
66	0.0000%	0.0000%	0.4620%	0.2310%
67	0.0000%	0.0000%	0.5320%	0.2660%
68	0.0000%	0.0000%	0.6080%	0.3040%
69	0.0000%	0.0000%	0.6900%	0.3450%

TABLE 2

COMPARISON OF CURRENT AND RECOMMENDED
FUTURE SALARY INCREASE

Age	Current	Recommended
25	8.40%	8.15%
26	7.95%	7.71%
27	7.50%	7.28%
28	7.35%	7.13%
29	7.20%	6.98%
30	7.05%	6.84%
31	6.90%	6.69%
32	6.75%	6.55%
33	6.55%	6.35%
34	6.35%	6.16%
35	6.15%	5.97%
36	5.95%	5.77%
37	5.75%	5.58%
38	5.65%	5.48%
39	5.55%	5.38%
40	5.45%	5.29%
41	5.35%	5.19%
42	5.25%	5.09%
43	5.15%	5.00%
44	5.05%	4.90%
45	4.95%	4.80%
46	4.85%	4.70%
47	4.75%	4.61%
48	4.70%	4.56%
49	4.65%	4.51%
50	4.60%	4.46%
51	4.55%	4.41%
52	4.50%	4.37%
53	4.45%	4.32%
54	4.40%	4.27%
55	4.35%	4.22%
56	4.30%	4.17%
57	4.25%	4.12%
58	4.25%	4.12%
59	4.25%	4.12%
60	4.25%	4.12%

TABLE 3

**COMPARISON OF CURRENT AND RECOMMENDED SEPARATIONS
FROM ACTIVE SERVICE**

TERMINATION

Age	Men Teachers		Women Teachers	
	Current	Recommended	Current	Recommended
19	20.00%	20.00%	20.00%	24.00%
20	20.00%	20.00%	20.00%	24.00%
21	20.00%	20.00%	20.00%	24.00%
22	20.00%	20.00%	20.00%	24.00%
23	20.00%	20.00%	20.00%	24.00%
24	20.00%	20.00%	20.00%	24.00%
25	20.00%	21.00%	20.00%	20.00%
26	18.06%	18.96%	18.62%	18.62%
27	16.30%	17.12%	17.34%	17.34%
28	14.72%	15.46%	16.15%	16.15%
29	13.29%	13.96%	15.04%	15.04%
30	12.00%	12.60%	14.00%	14.00%
31	11.07%	11.62%	13.41%	13.41%
32	10.20%	10.71%	12.85%	12.85%
33	9.41%	9.88%	12.31%	12.31%
34	8.68%	9.11%	11.79%	11.79%
35	8.00%	8.40%	11.30%	11.30%
36	7.67%	8.06%	10.70%	10.70%
37	7.36%	7.73%	10.13%	10.13%
38	7.06%	7.42%	9.59%	9.59%
39	6.78%	7.11%	9.08%	9.08%
40	6.50%	6.50%	8.60%	9.03%
41	6.35%	6.35%	8.00%	8.40%
42	6.21%	6.21%	7.45%	7.82%
43	6.07%	6.07%	6.93%	7.28%
44	5.93%	5.93%	6.45%	6.77%
45	5.80%	5.80%	6.00%	6.30%
46	5.72%	5.72%	5.79%	6.07%
47	5.64%	5.64%	5.58%	5.86%
48	5.56%	5.56%	5.38%	5.65%
49	5.48%	5.48%	5.19%	5.45%
50	5.40%	5.40%	5.00%	5.25%
51	5.40%	5.40%	4.96%	5.21%
52	5.40%	5.40%	4.92%	5.17%
53	5.40%	5.40%	4.88%	5.12%
54	5.40%	5.40%	4.84%	5.08%
55 and over	0.00%	0.00%	0.00%	0.00%

Appendix II: Recommended Active Service Tables (continued)

TABLE 4

COMPARISON OF CURRENT AND RECOMMENDED
EARLY AND FULL RETIREMENT RATES

Age	Reduced Early Retirement				Full Early Retirement	
	Group A		Group C		Grandfathered (Group C)	
	Current	Recommended	Current	Recommended	Current	Recommended
55	8.75%	6.13%	8.75%	6.13%	20.00%	6.13%
56	6.25%	6.25%	6.25%	6.25%	10.00%	6.25%
57	6.25%	6.25%	6.25%	6.25%	10.00%	6.25%
58	6.25%	6.25%	6.25%	6.25%	10.00%	6.25%
59	6.25%	9.38%	6.25%	9.38%	10.00%	9.38%
60	12.50%	12.50%	12.50%	18.75%	30.00%	18.75%
61	12.50%	18.75%	12.50%	18.75%	17.00%	18.75%

TABLE 5

COMPARISON OF CURRENT AND RECOMMENDED
SERVICE RETIREMENTS

Age	Proposed			Current	
	Group A	Group C		Grandfathered	Non-Grandfathered
		Grandfathered	Non-Grandfathered		
55	6.13%	6.13%	6.13%	8.75%	8.75%
56	6.25%	6.25%	6.25%	6.25%	6.25%
57	6.25%	6.25%	6.25%	6.25%	6.25%
58	6.25%	6.25%	6.25%	6.25%	6.25%
59	9.38%	9.38%	25.00%	6.25%	6.25%
60	12.50%	18.75%	18.75%	12.50%	12.50%
61	18.75%	18.75%	18.75%	12.50%	25.00%
62	25.00%	20.00%	20.00%	25.00%	20.00%
63	22.00%	22.00%	22.00%	20.00%	20.00%
64	22.00%	22.00%	22.00%	20.00%	20.00%
65	33.00%	33.00%	33.00%	30.00%	30.00%
66	33.00%	33.00%	33.00%	30.00%	30.00%
67	33.00%	33.00%	33.00%	30.00%	30.00%
68	22.00%	22.00%	22.00%	20.00%	20.00%
69	33.00%	33.00%	33.00%	30.00%	30.00%
70	100.00%	100.00%	100.00%	100.00%	100.00%

Appendix III: Recommended Post-Retirement Mortality Tables

APPENDIX III

POST RETIREMENT MORTALITY TABLES
SERVICE PENSIONERS

Base Table

AGE	MALES	FEMALES	AGE	MALES	FEMALES
50	0.00535	0.00234	86	0.12280	0.08638
51	0.00553	0.00246	87	0.13604	0.09634
52	0.00564	0.00265	88	0.15059	0.10730
53	0.00572	0.00290	89	0.16642	0.11915
54	0.00580	0.00319	90	0.18341	0.13168
55	0.00591	0.00353	91	0.19977	0.14460
56	0.00612	0.00393	92	0.21661	0.15762
57	0.00644	0.00439	93	0.23366	0.17043
58	0.00690	0.00492	94	0.25069	0.18280
59	0.00749	0.00553	95	0.26749	0.19451
60	0.00820	0.00620	96	0.28391	0.20538
61	0.00900	0.00692	97	0.29985	0.21524
62	0.00992	0.00769	98	0.31530	0.22395
63	0.01095	0.00851	99	0.33021	0.23139
64	0.01212	0.00940	100	0.34456	0.23747
65	0.01342	0.01036	101	0.35863	0.24483
66	0.01487	0.01141	102	0.37169	0.25450
67	0.01646	0.01254	103	0.38304	0.26604
68	0.01820	0.01377	104	0.39200	0.27906
69	0.02011	0.01515	105	0.39789	0.29312
70	0.02221	0.01674	106	0.40000	0.30781
71	0.02457	0.01858	107	0.40000	0.32273
72	0.02728	0.02067	108	0.40000	0.33744
73	0.03039	0.02297	109	0.40000	0.35154
74	0.03390	0.02546	110	0.40000	0.36462
75	0.03783	0.02811	111	0.40000	0.37625
76	0.04217	0.03097	112	0.40000	0.38602
77	0.04691	0.03411	113	0.40000	0.39351
78	0.05212	0.03760	114	0.40000	0.39831
79	0.05793	0.04151	115	0.40000	0.40000
80	0.06437	0.04588	116	0.40000	0.40000
81	0.07204	0.05078	117	0.40000	0.40000
82	0.08049	0.05629	118	0.40000	0.40000
83	0.08972	0.06251	119	0.40000	0.40000
84	0.09978	0.06952	120	1.00000	1.00000
85	0.11076	0.07745			

Adjustment Scale BB

AGE	MALES	FEMALES	AGE	MALES	FEMALES
50	0.00300	0.00300	86	0.01500	0.01200
51	0.00300	0.00300	87	0.01400	0.01200
52	0.00300	0.00300	88	0.01300	0.01200
53	0.00300	0.00300	89	0.01200	0.01200
54	0.00300	0.00400	90	0.01100	0.01100
55	0.00300	0.00500	91	0.01000	0.01000
56	0.00300	0.00600	92	0.00900	0.00900
57	0.00400	0.00700	93	0.00800	0.00800
58	0.00500	0.00800	94	0.00700	0.00700
59	0.00600	0.00900	95	0.00600	0.00600
60	0.00700	0.01000	96	0.00500	0.00500
61	0.00800	0.01100	97	0.00400	0.00400
62	0.00900	0.01200	98	0.00400	0.00400
63	0.01000	0.01200	99	0.00300	0.00300
64	0.01100	0.01200	100	0.00300	0.00300
65	0.01200	0.01200	101	0.00200	0.00200
66	0.01300	0.01200	102	0.00200	0.00200
67	0.01400	0.01200	103	0.00100	0.00100
68	0.01500	0.01200	104	0.00100	0.00100
69	0.01500	0.01200	105	0.00000	0.00000
70	0.01500	0.01200	106	0.00000	0.00000
71	0.01500	0.01200	107	0.00000	0.00000
72	0.01500	0.01200	108	0.00000	0.00000
73	0.01500	0.01200	109	0.00000	0.00000
74	0.01500	0.01200	110	0.00000	0.00000
75	0.01500	0.01200	111	0.00000	0.00000
76	0.01500	0.01200	112	0.00000	0.00000
77	0.01500	0.01200	113	0.00000	0.00000
78	0.01500	0.01200	114	0.00000	0.00000
79	0.01500	0.01200	115	0.00000	0.00000
80	0.01500	0.01200	116	0.00000	0.00000
81	0.01500	0.01200	117	0.00000	0.00000
82	0.01500	0.01200	118	0.00000	0.00000
83	0.01500	0.01200	119	0.00000	0.00000
84	0.01500	0.01200	120	0.00000	0.00000
85	0.01500	0.01200			

APPENDIX III

RECOMMENDED POST RETIREMENT MORTALITY TABLES
DISABILITY PENSIONERS

Base Table

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.00000	0.00000	70	0.06258	0.03764
20	0.00000	0.00000	71	0.06584	0.04014
21	0.02257	0.00745	72	0.06941	0.04285
22	0.02257	0.00745	73	0.07329	0.04577
23	0.02257	0.00745	74	0.07751	0.04890
24	0.02257	0.00745	75	0.08207	0.05223
25	0.02257	0.00745	76	0.08695	0.05578
26	0.02257	0.00745	77	0.09215	0.05955
27	0.02257	0.00745	78	0.09764	0.06355
28	0.02257	0.00745	79	0.10339	0.06779
29	0.02257	0.00745	80	0.10937	0.07231
30	0.02257	0.00745	81	0.11554	0.07714
31	0.02257	0.00745	82	0.12188	0.08230
32	0.02257	0.00745	83	0.12834	0.08784
33	0.02257	0.00745	84	0.13492	0.09379
34	0.02257	0.00745	85	0.14160	0.10020
35	0.02257	0.00745	86	0.14837	0.10710
36	0.02257	0.00745	87	0.15524	0.11451
37	0.02257	0.00745	88	0.16219	0.12246
38	0.02257	0.00745	89	0.16923	0.13097
39	0.02257	0.00745	90	0.18341	0.14005
40	0.02257	0.00745	91	0.19977	0.14970
41	0.02257	0.00745	92	0.21661	0.15992
42	0.02257	0.00745	93	0.23366	0.17043
43	0.02257	0.00745	94	0.25069	0.18280
44	0.02257	0.00745	95	0.26749	0.19451
45	0.02257	0.00745	96	0.28391	0.20538
46	0.02385	0.00818	97	0.29985	0.21524
47	0.02512	0.00896	98	0.31530	0.22395
48	0.02640	0.00978	99	0.33021	0.23139
49	0.02769	0.01063	100	0.34456	0.23747
50	0.02898	0.01154	101	0.35863	0.24483
51	0.03027	0.01248	102	0.37169	0.25450
52	0.03156	0.01346	103	0.38304	0.26604
53	0.03286	0.01447	104	0.39200	0.27906
54	0.03415	0.01550	105	0.39789	0.29312
55	0.03544	0.01654	106	0.40000	0.30781
56	0.03673	0.01760	107	0.40000	0.32273
57	0.03803	0.01865	108	0.40000	0.33744
58	0.03933	0.01971	109	0.40000	0.35154
59	0.04067	0.02077	110	0.40000	0.36462
60	0.04204	0.02184	111	0.40000	0.37625
61	0.04347	0.02294	112	0.40000	0.38602
62	0.04498	0.02408	113	0.40000	0.39351
63	0.04658	0.02529	114	0.40000	0.39831
64	0.04831	0.02660	115	0.40000	0.40000
65	0.05017	0.02803	116	0.40000	0.40000
66	0.05221	0.02959	117	0.40000	0.40000
67	0.05445	0.03133	118	0.40000	0.40000
68	0.05691	0.03323	119	0.40000	0.40000
69	0.05961	0.03534	120	1.00000	1.00000

Appendix III: Recommended Post-Retirement Mortality Tables (continued)

Adjustment Scale AA

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.01900	0.01500	70	0.01500	0.00500
20	0.01900	0.01600	71	0.01500	0.00600
21	0.01800	0.01700	72	0.01500	0.00600
22	0.01700	0.01700	73	0.01500	0.00700
23	0.01500	0.01600	74	0.01500	0.00700
24	0.01300	0.01500	75	0.01400	0.00800
25	0.01000	0.01400	76	0.01400	0.00800
26	0.00600	0.01200	77	0.01300	0.00700
27	0.00500	0.01200	78	0.01200	0.00700
28	0.00500	0.01200	79	0.01100	0.00700
29	0.00500	0.01200	80	0.01000	0.00700
30	0.00500	0.01000	81	0.00900	0.00700
31	0.00500	0.00800	82	0.00800	0.00700
32	0.00500	0.00800	83	0.00800	0.00700
33	0.00500	0.00900	84	0.00700	0.00700
34	0.00500	0.01000	85	0.00700	0.00600
35	0.00500	0.01100	86	0.00700	0.00500
36	0.00500	0.01200	87	0.00600	0.00400
37	0.00500	0.01300	88	0.00500	0.00400
38	0.00600	0.01400	89	0.00500	0.00300
39	0.00700	0.01500	90	0.00400	0.00300
40	0.00800	0.01500	91	0.00400	0.00300
41	0.00900	0.01500	92	0.00300	0.00300
42	0.01000	0.01500	93	0.00300	0.00200
43	0.01100	0.01500	94	0.00300	0.00200
44	0.01200	0.01500	95	0.00200	0.00200
45	0.01300	0.01600	96	0.00200	0.00200
46	0.01400	0.01700	97	0.00200	0.00100
47	0.01500	0.01800	98	0.00100	0.00100
48	0.01600	0.01800	99	0.00100	0.00100
49	0.01700	0.01800	100	0.00100	0.00100
50	0.01800	0.01700	101	0.00000	0.00000
51	0.01900	0.01600	102	0.00000	0.00000
52	0.02000	0.01400	103	0.00000	0.00000
53	0.02000	0.01200	104	0.00000	0.00000
54	0.02000	0.01000	105	0.00000	0.00000
55	0.01900	0.00800	106	0.00000	0.00000
56	0.01800	0.00600	107	0.00000	0.00000
57	0.01700	0.00500	108	0.00000	0.00000
58	0.01600	0.00500	109	0.00000	0.00000
59	0.01600	0.00500	110	0.00000	0.00000
60	0.01600	0.00500	111	0.00000	0.00000
61	0.01500	0.00500	112	0.00000	0.00000
62	0.01500	0.00500	113	0.00000	0.00000
63	0.01400	0.00500	114	0.00000	0.00000
64	0.01400	0.00500	115	0.00000	0.00000
65	0.01400	0.00500	116	0.00000	0.00000
66	0.01300	0.00500	117	0.00000	0.00000
67	0.01300	0.00500	118	0.00000	0.00000
68	0.01400	0.00500	119	0.00000	0.00000
69	0.01400	0.00500	120	0.00000	0.00000

Appendix IV: Description of Capital Market Model used in Analysis of Expected Rate of Return on System Assets

About Gems (General Economy and Market Simulator)

GEMS® is a cutting-edge Economic Scenario Generator (ESG) that enables users to simulate future states of the global economy and financial markets, including the pricing of derivatives and alternative assets. It uses financial models that are the most technologically advanced in the industry, ensuring that models perform consistently with history, provide a realistic representation of extreme events and support hedging strategies with market consistent pricing. GEMS includes comprehensive yield curve modeling and a multifactor arbitrage pricing model that develops asset-class return series based on asset-class relationships to underlying economic and capital market variables such as GDP, inflation, interest rates, credit spreads, and unemployment. The model is calibrated to current market conditions and trends the economic variables to longer-term historical norms – simulating a variety of economic environments and concomitant asset-class returns in the process.

Some of the other distinguishing features of GEMS are:

1. Many asset-class return distributions are non-normal even though many models historically have treated them as such. Asset classes exhibit non-normal return distribution characteristics such as skew and kurtosis. GEMS is more effective at capturing these characteristics. In doing so, it more effectively captures outlier fat-tail events (leptokurtosis) and positive or negative skew in a manner that more closely resembles what actually occurs.

2. Asset-class returns are linked to underlying economic conditions in the model so the user can relate a specific asset-class or portfolio return path to conditions that can be described in terms of economic variables.

3. Because GEMS is calibrated to current levels of economic activity and trends to a longer-term state of equilibrium, shorter-term asset returns forecasts in GEMS are more reflective of recent market activity and short-term characteristics and trends in economic and market variables, and longer-term returns reflect asset performance over complete market cycles.

4. There is empirical evidence that asset correlations are dynamic and move closer to unity when markets are volatile and under stress. GEMS models asset correlations dynamically.

Appendix V: Comparative Valuation Balance Sheet

Results for the Actuarial Valuation Prepared as of June 30, 2014 on Current and Recommended Assumptions

Item	Current Assumptions	Recommended Assumptions
1. Liabilities:		
Active and Inactive Members	1,620,831,146	1,606,581,623
Retired Members	1,066,218,187	1,126,441,476
total	2,687,049,333	2,733,023,099
2. Assets	1,610,285,523	1,610,285,523
3. Unfunded Accrued Liability	1,076,763,810	1,122,737,576
4. Normal Contribution, FY 2016	10,384,106	7,929,597
5. Accrued Liability Contribution, FY 2016	65,718,803	68,911,593
6. Total Contribution	76,102,909	76,841,190