

# Vermont State Employees' Retirement System

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





**David L. Driscoll**  
*Principal, Consulting Actuary*

Buck Consultants, LLC  
101 Federal Street, Suite 900  
Boston, MA 02110

David.Driscoll@xerox.com  
tel 617-275-8028  
fax 201-633-5168

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Board of Trustees  
Vermont State Employees' Retirement System  
Montpelier, Vermont 05609


Dear Board Members:


Section 471, subsection (j), of Title 16, Chapter 3, of the 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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## Vermont State Employees' Retirement System

### 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 the funding pace is adequate to meet the System's obligations.

The primary purpose of funding is to equitably allocate costs between generations of taxpayers and 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 these 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 (COLA) 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 made by the American Academy of Actuaries may be summarized as follows:

- (i) The actuarial assumptions selected should reflect the actuary's best judgment of future events. They should take into account actual experience to the extent possible, but they should also reflect long-term future trends and not 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 to 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 to 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) recent past experience;
- (b) 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 are based on the actuarial valuation data for Groups A, D and F combined and separately for Group C. The basis for analysis of the System's experience is a comparison of the actual number of separations from service under each contingency with those anticipated by 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 eligible for normal retirement would be exposed to disability, death and normal retirement.

The 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 the 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 employees. Presently, the assumed probabilities of withdrawal in active service are the same for male and female members.

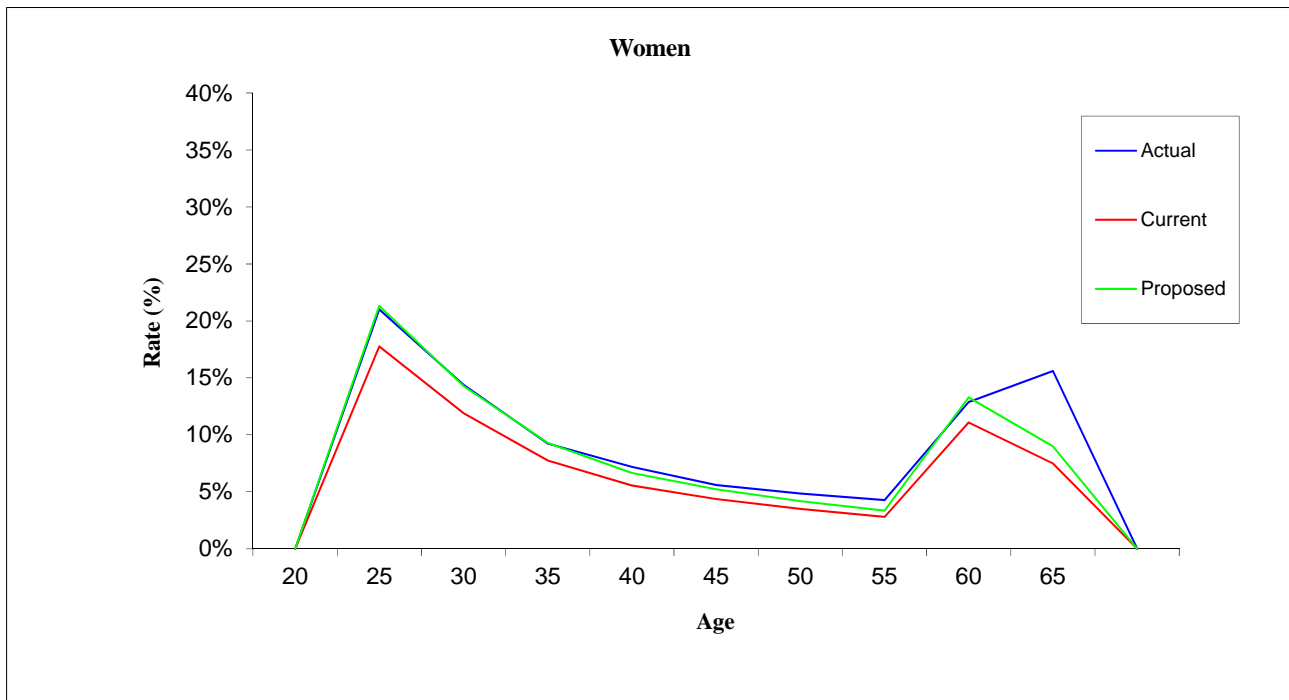
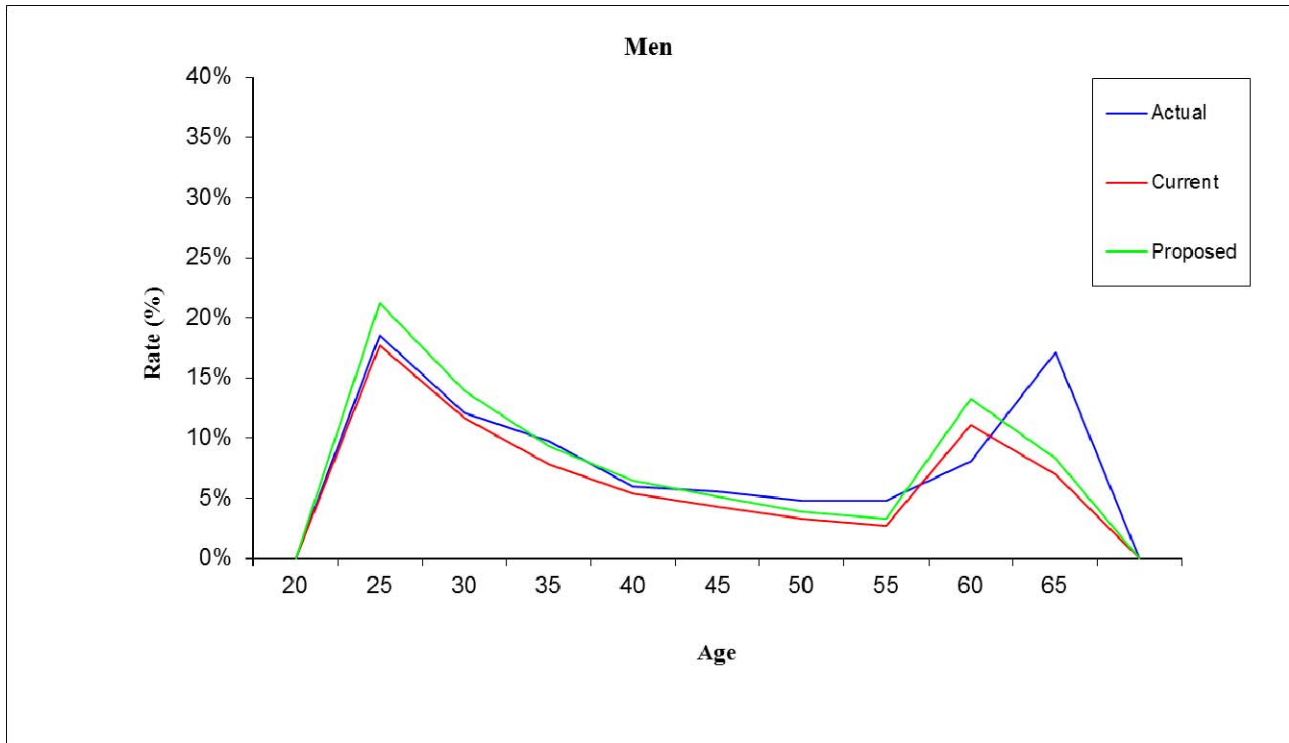
Reviewing the withdrawal and vesting experience for Groups A, D and F, it can be seen that, overall, there are more members leaving before service retirement than expected for both males and females.

On the basis of this experience, and after discussions with state officials of the outlook for terminations among the systems' active membership in the foreseeable future, we recommend that the assumed rates of withdrawal for Groups A, D and F be increased by 20%.

The experience of the last four years indicates that there have been more terminations among Group C than were expected under the present assumption. The limited exposure of this group might lead one to be reluctant to make a change in this assumption on the basis of the present evidence. Nonetheless, this is the fourth experience study to show that actual terminations among the members of this group exceed those assumed, and with the continued growth of this group over the past twenty years it is prudent to make further upward adjustments in the assumed rates of turnover applied to this group. We recommend that the assumed rates of withdrawal for Groups C be increased by 20%, as we have recommended for Groups A, D and F.

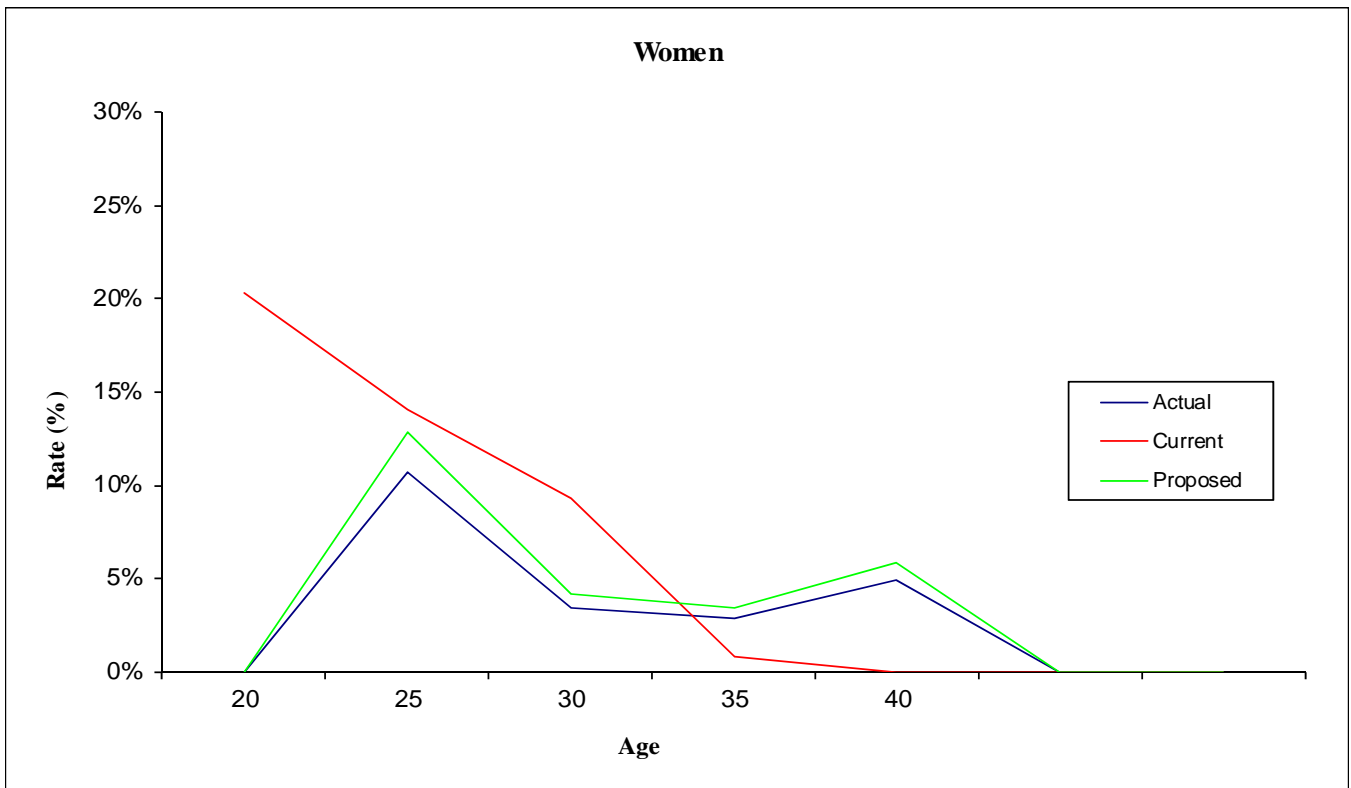
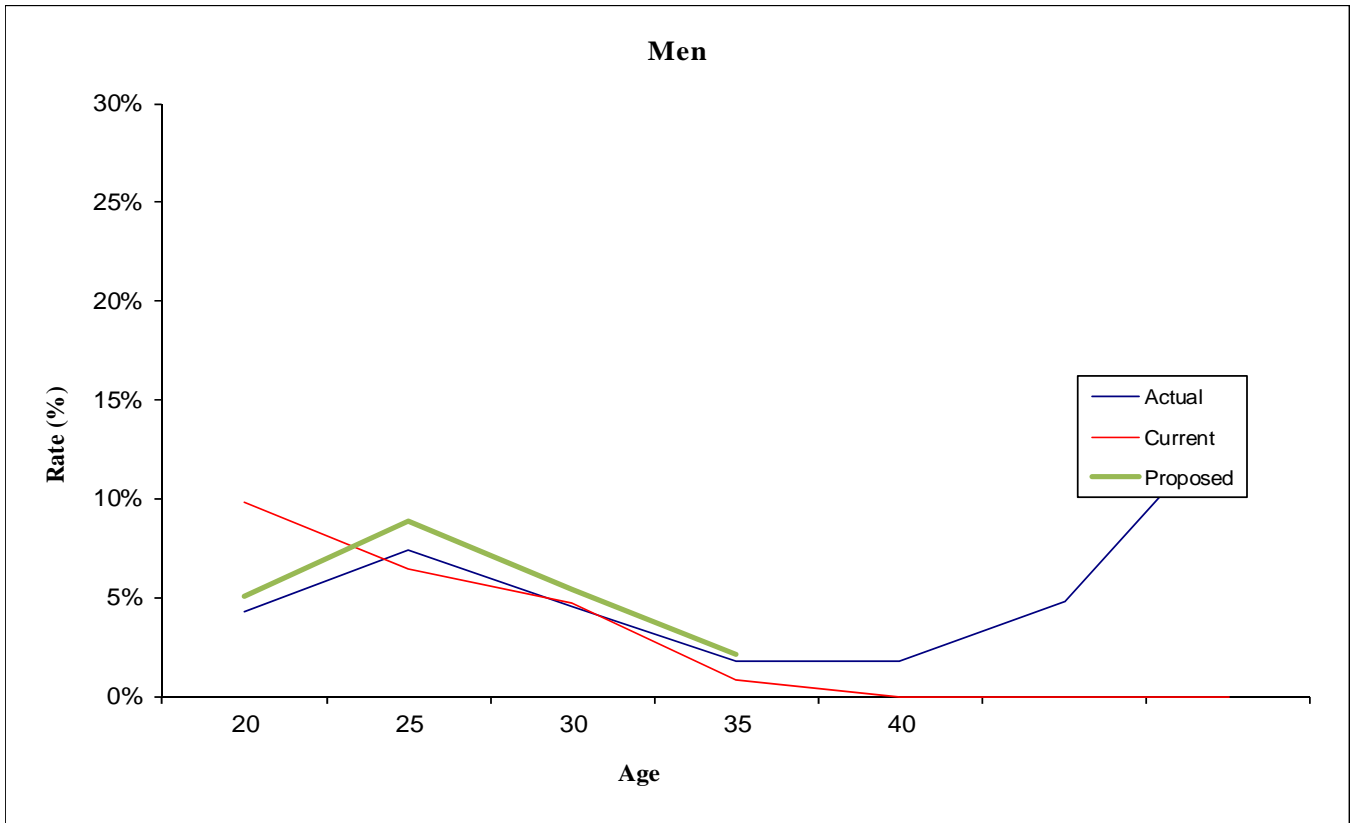
The following graphs show the current ultimate rate, the actual ultimate rate and (where applicable) the proposed new ultimate rate separately for males and females. The proposed rates are set forth in detail in Appendix II.

Vermont State Employees' Retirement System  
 Groups A, D, and F Active Service Experience – Terminations  
 July 1, 2010 through June 30, 2014





Vermont State Employees' Retirement System  
 Group C Active Service Experience – Terminations  
 July 1, 2010 through June 30, 2014



## Disability

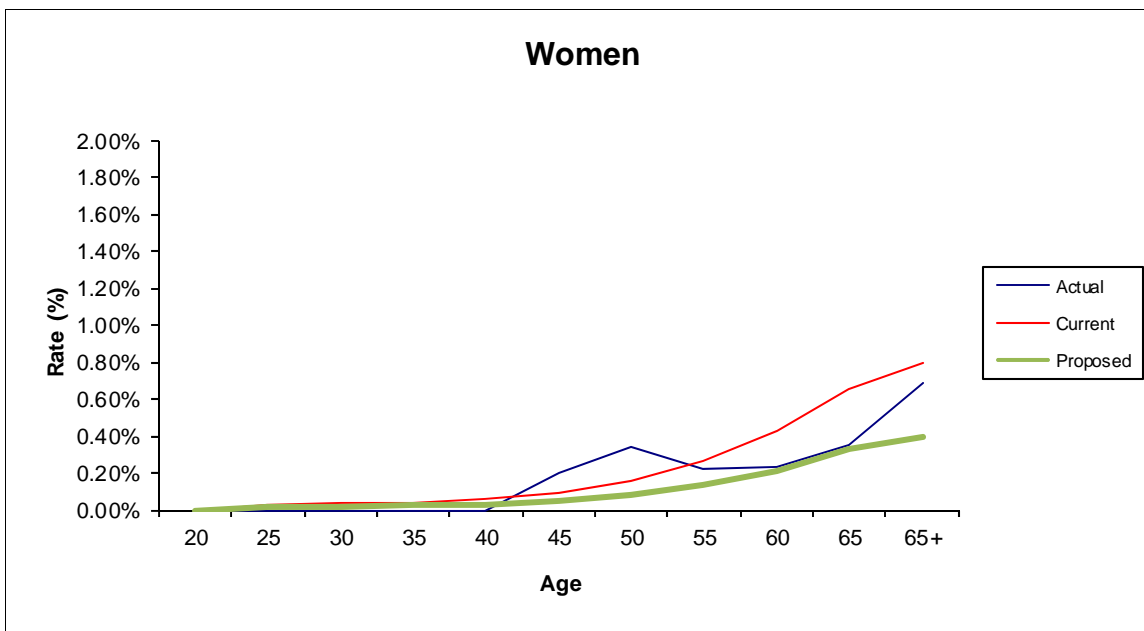
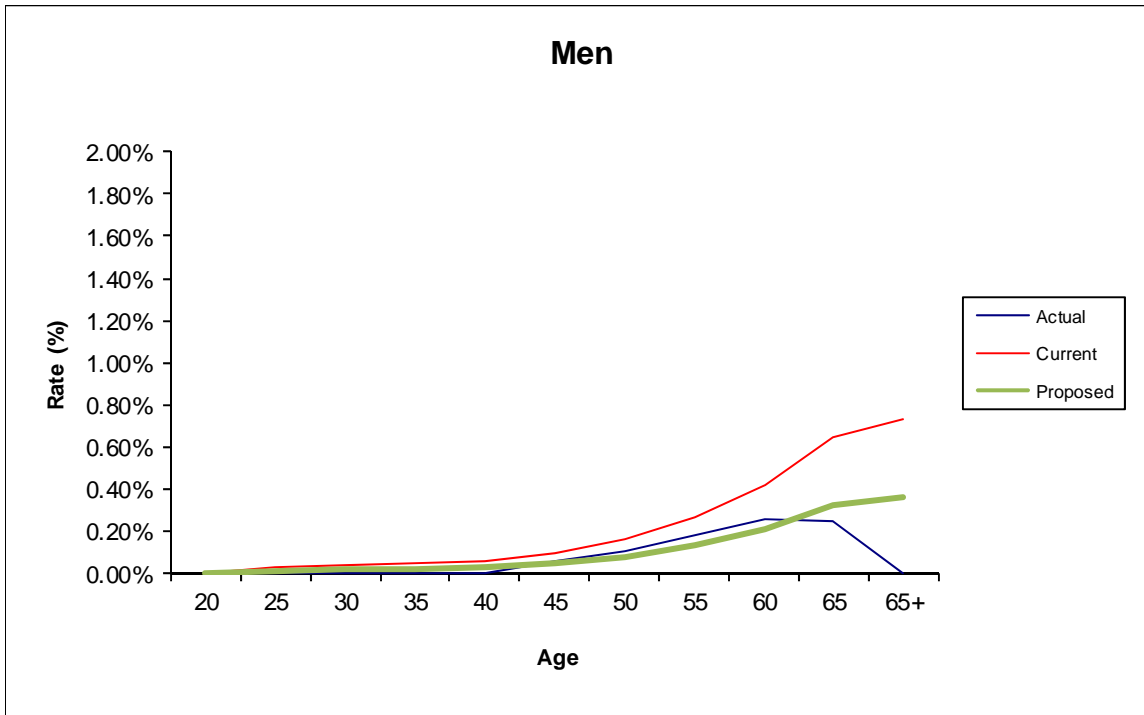
The graphs that follow show the incidence of disability among employees and the incidence of active service mortality. The financial impact on the funding of the System of this experience is relatively minor. It should be noted that the low incidence of actual disabilities makes this experience susceptible to rather large fluctuations from year to year.

The experience of the last four years indicates that there have been fewer disabilities among male and female members than expected under the current assumption. We therefore recommend reducing the disability rates by 50% of their present levels.

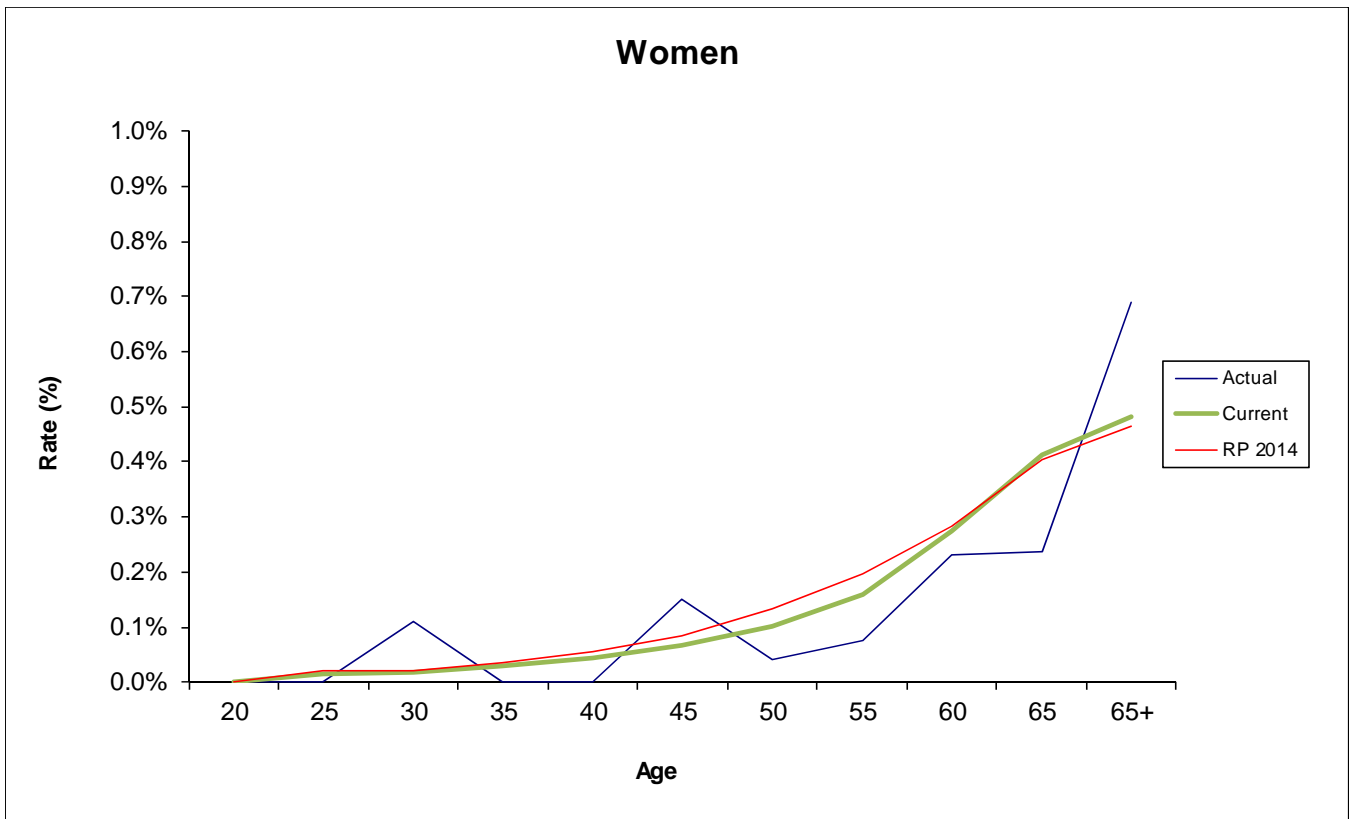
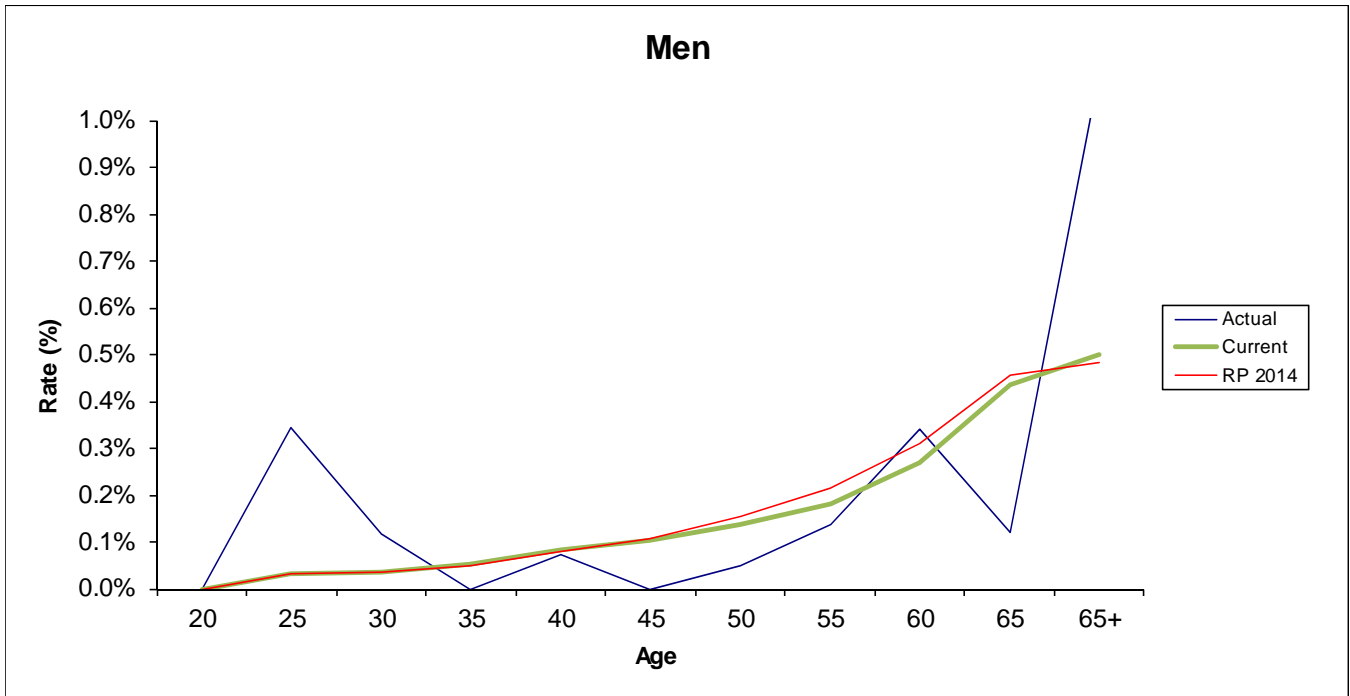
## Death

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 for both males and females was lower than what is expected. On the basis of a discussion with state officials, for Groups A, D, and F we recommend the application of assumed mortality based on the RP-2000 Healthy Employees Tables blended 70% General Collar, 30% Blue-Collar with ten years of projected improvement from the valuation date using Scale BB. For Group C we recommend the application of assumed mortality based on the Blue Collar Adjusted RP-2000 Tables with ten years of projected improvement from the valuation date using Scale BB. 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.

Vermont State Employees' Retirement System  
 Groups A, D, and F Active Service Experience – Disability Retirements  
 July 1, 2010 through June 30, 2014



Vermont State Employees' Retirement System  
 Groups A, D, and F Active Service Experience – Deaths  
 July 1, 2010 through June 30, 2014



## Service Retirement

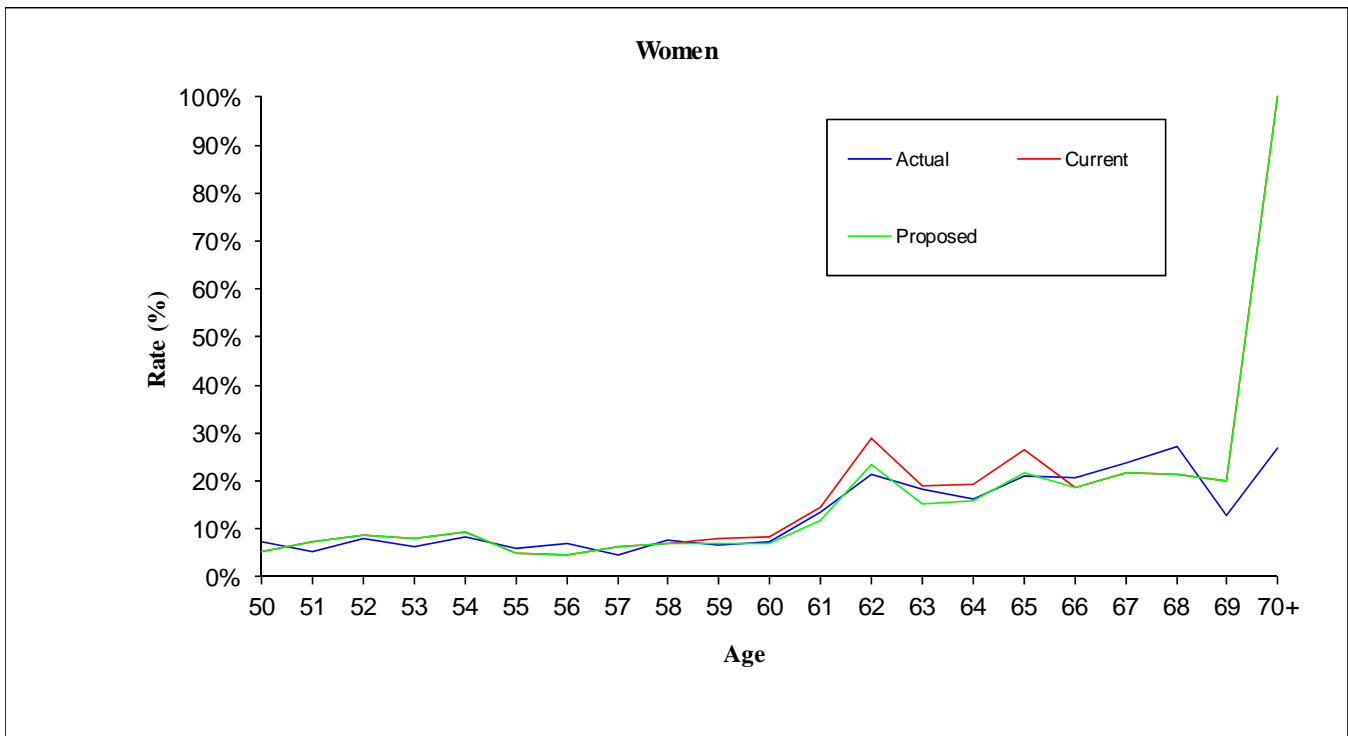
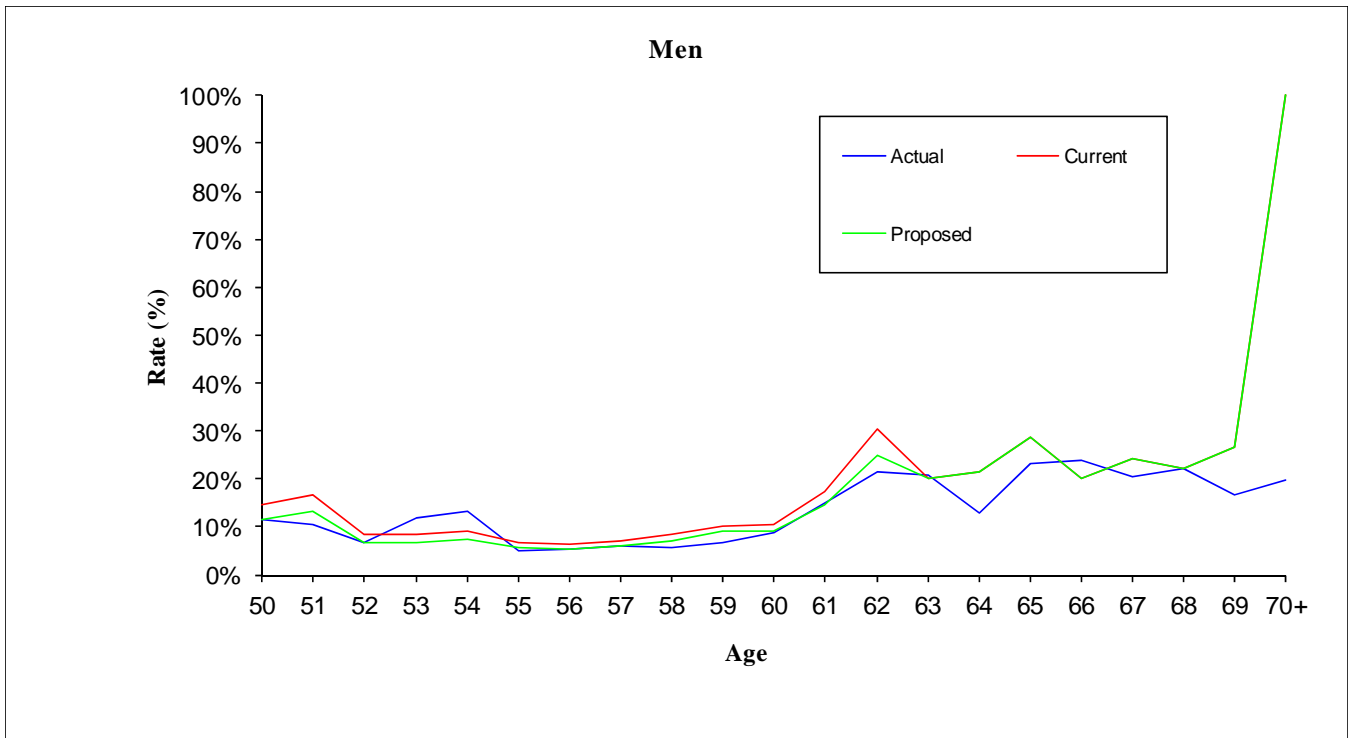
Overall, the incidence of service retirements was below expected levels in the four years covered by the study.

Members of Groups A and D are assumed to retire when first eligible to do so. We recommend retention of that assumption for these groups, given their small sizes and unique demographics.

For Group F members, an examination of retirements over the past four years indicates that current assumed probabilities of retirement are high relative to experience, particularly for male members ages 62 and below and female members between ages 59 through 65. We therefore recommend that expected rates of retirement be decreased by 20% for these participants.

Examination of the relation of actual to expected retirements at various ages in this study leads us to recommend that no change be made to the present retirement assumption for Group C members.

Vermont State Employees' Retirement System  
 Groups A, D, and F 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 Tables 7, 8 and 9 of Appendix I show that mortality over the past four years has conformed well to the existing assumption on the basis of actual deaths observed in the experience period, except among disabled retirees. However, the current assumption has performed less well in terms of projecting liabilities released by deaths. 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. On the basis of discussions with state officials, 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 Tables for Healthy Lives blended 70% General Collar, 30% Blue Collar with ten years of projected improvement from the valuation date using Scale BB for Groups A,D, and F. For Group C we recommend the application of assumed mortality based on the Blue Collar RP-2000 Tables for Healthy Lives with ten years of projected improvement from the valuation date using Scale BB.

Deaths among disabled lives have greatly exceeded 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 projected to 2025 by Scale BB with a five-year age set-forward.

### IV. Members in Inactive Status

In the past, liabilities for members in inactive status have been maintained at 250% of their accumulated contributions with interest. We recommend that the percentage of contributions with interest used to estimate the liability for these participants remain at 250%.

## 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 F, the annual adjustment is equal to one-half of the percentage increase in the CPI-U. For Groups A, C and D, the adjustment equals one-half of the percentage increase in the CPI-U, 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 <sup>1</sup>
2010	1.1%
2011	3.6%
2012	1.7%
2013	1.8%
2014	2.1%

Over the five-year period covered by this study, 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 that the annual adjustments to benefits of eligible retired members of Groups A, C and D are 3.0%, and the assumed annual adjustment for eligible retired members of Group F is 1.50% (beginning at age 62 for deferred retirements). For a Group F employee retiring after July 1, 2009, the cost-of-living-adjustment is assumed to increase from 1.5% to 3% per annum effective January 1, 2014. We recommend retention of these assumptions.

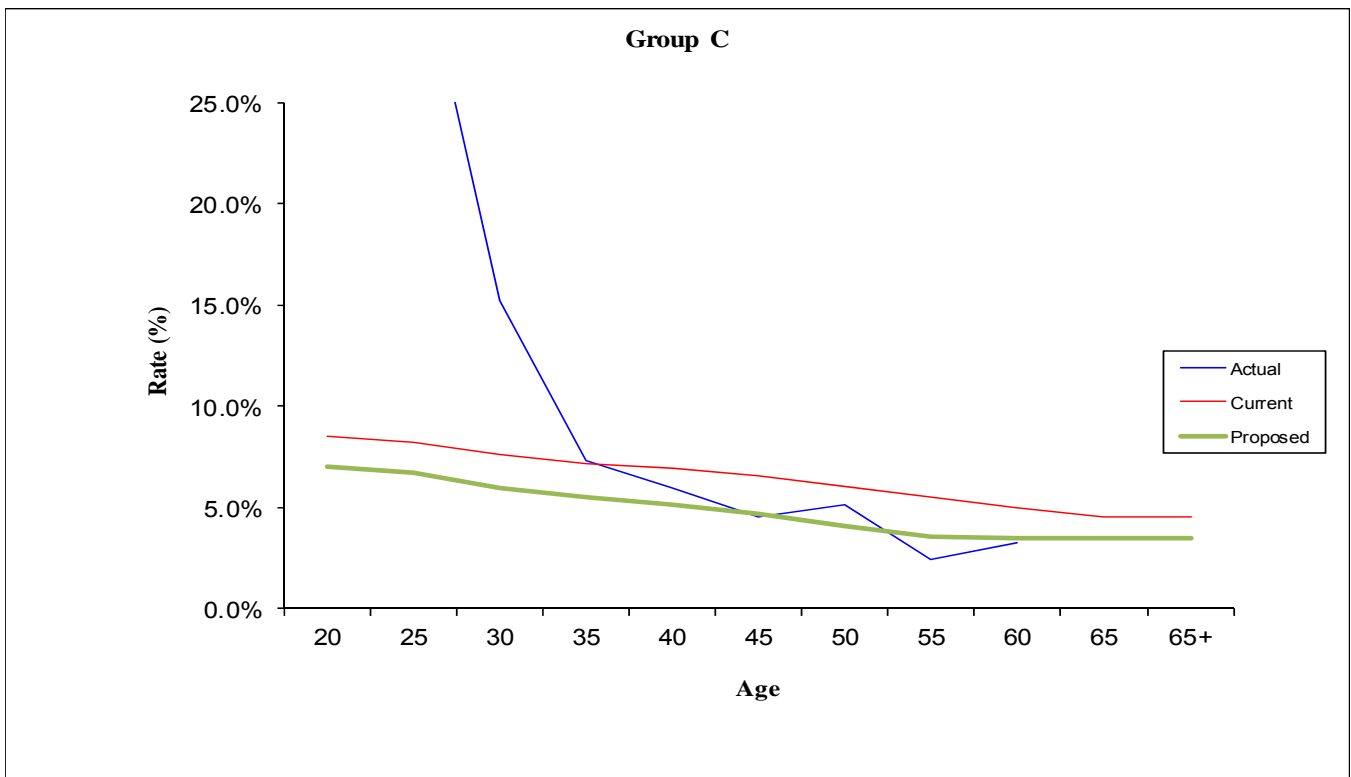
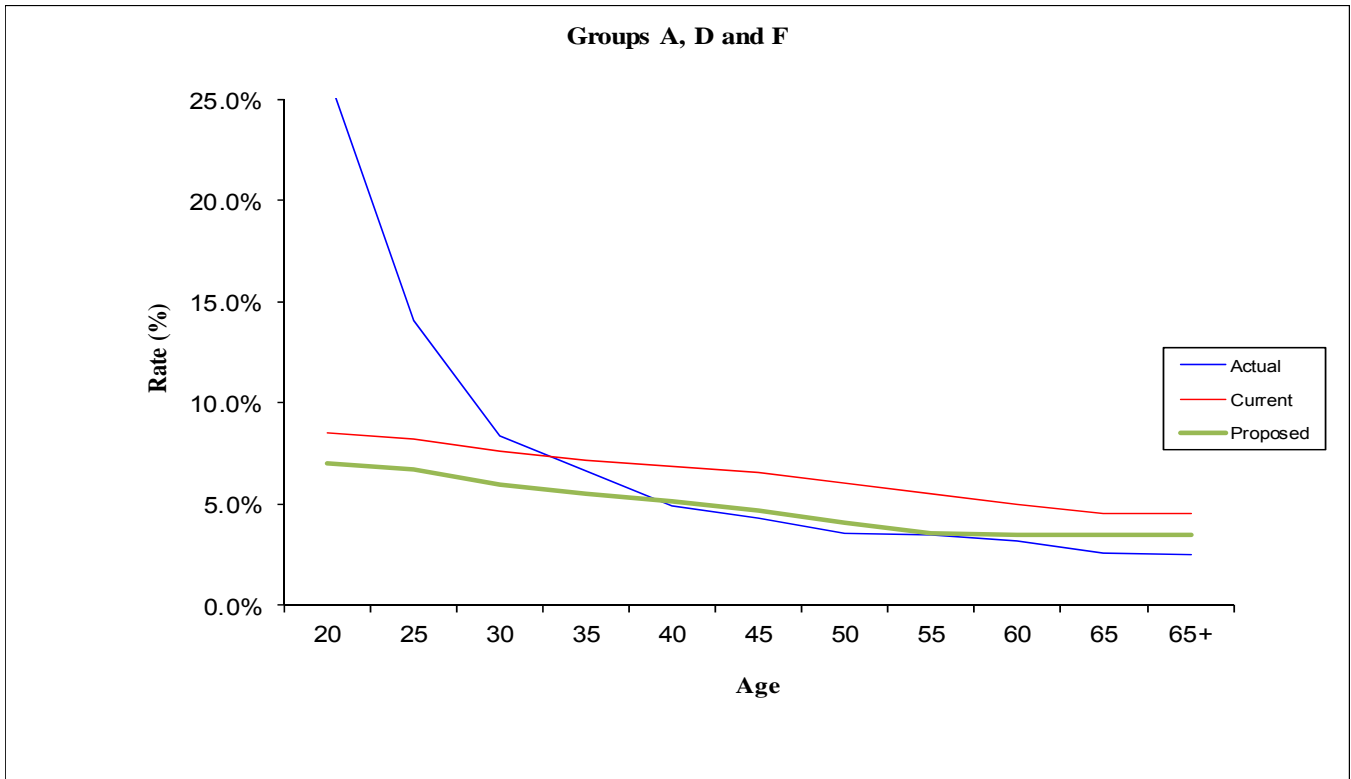
### Merit-Promotion Salary Increases

Salary increases observed among VSERS members during the experience period have been slightly above assumed levels, although when compared to the ultimate assumed rates in use for each age they have been slightly below expected levels at all but the youngest ages. Based on the actual experience and anticipated future salary increases (as described to us in discussions with state officials), we recommend lowering the salary increase assumptions. The proposed rates are set forth in detail in Appendix II.

<sup>1</sup> Based on CPI-U unadjusted 12 month ended June 30 for All items



Vermont State Employees' Retirement System  
 Active Service Experience – Salary Increases  
 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	6.71%	17.9%
2011	9.34%	21.2%
2012	6.27%	2.4%
2013	6.71%	1.2%
2014	8.28%	14.5%
2010-2014	7.46%	11.14%

The rate of return on the market value of assets has averaged approximately 11.14% 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 most recent 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%. On the basis of this forecast, 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 decreased from \$46,237,853 to \$44,273,739. 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 this 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**

Age	Men			Women		
	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected
Under 25	54	51.57	1.047	51	42.26	1.207
25-29	102	98.09	1.040	130	107.40	1.210
30-34	113	90.34	1.251	121	101.56	1.191
35-39	83	75.20	1.104	108	83.43	1.294
40-44	100	76.65	1.305	112	87.00	1.287
45-49	94	64.30	1.462	112	80.85	1.385
50-54	96	54.89	1.749	100	65.41	1.529
Over 55	42	39.28	1.069	66	48.46	1.362
Total	684	550.32	1.243	800	616.37	1.298
Grand Total Including Group C	743	579.17	1.283	807	625.53	1.290

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

**Table 2: Comparison of Actual and Expected Separations from Active Service - Disability Retirements**

Age	Men			Women		
	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected
Under 25	0	0.08	0.000	0	0.06	0.000
25-29	0	0.28	0.000	0	0.30	0.000
30-34	0	0.51	0.000	0	0.57	0.000
35-39	0	0.85	0.000	0	0.91	0.000
40-44	1	1.70	0.588	4	1.88	2.128
45-49	2	3.14	0.637	8	3.73	2.145
50-54	4	5.78	0.692	6	6.97	0.861
Over 55	10	24.35	0.411	15	25.60	0.586
Total	17	36.69	0.463	33	40.02	0.825
Grand Total Including Group C	20	43.49	0.460	34	40.65	0.836

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

Table 3: Comparison of Actual and Expected Separations from Active Service - Deaths

Central Age of Group	Men			Women		
	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected
Under 25	1	0.09	11.111	0	0.04	0.000
25-29	1	0.30	3.333	1	0.17	5.882
30-34	0	0.62	0.000	0	0.40	0.000
35-39	1	1.15	0.870	0	0.68	0.000
40-44	0	1.88	0.000	3	1.35	2.222
45-49	1	2.73	0.366	1	2.38	0.420
50-54	3	3.94	0.761	2	4.22	0.474
55-59	8	6.35	1.260	6	7.12	0.843
Over 60	8	9.87	0.811	7	9.02	0.776
Total	23	26.93	0.854	20	25.38	0.788
Grand Total Including Group C	23	28.28	0.813	20	25.46	0.786

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

**Table 4: Comparison of Actual and Expected Separations from Active Service - Service Retirements**

Age	Men			Women		
	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected
Under 53	10	11.10	0.901	16	12.78	1.252
53	5	3.60	1.389	4	5.22	0.766
54	7	4.80	1.458	6	6.70	0.896
55	20	27.50	0.727	27	23.65	1.142
56	23	27.26	0.844	31	20.19	1.535
57	26	29.85	0.871	22	29.09	0.756
58	23	34.76	0.662	35	31.72	1.103
59	26	39.83	0.653	29	34.77	0.834
60	33	39.57	0.834	29	33.16	0.875
61	55	63.72	0.863	50	53.12	0.941
62	70	99.76	0.702	70	93.88	0.746
63	55	52.80	1.042	46	47.05	0.978
64	25	41.20	0.607	32	37.60	0.851
65	38	46.75	0.813	30	38.00	0.789
66	27	22.90	1.179	20	17.80	1.124
67	15	17.73	0.846	14	12.80	1.094
68	12	11.93	1.006	12	9.35	1.283
69	6	9.60	0.625	4	6.20	0.645
Over 69	21	106.00	0.198	17	63.00	0.270
Total	497	690.66	0.720	494	576.08	0.858
Grand Total Including Group C	530	758.66	0.699	494	576.08	0.858

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

**Table 5: Comparison of Actual and Expected Annual Salaries of Members - Groups A, D, and F**

Age	Men			Women		
	Annual Salaries			Annual Salaries		
	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected
Under 25	9,694,102	8,605,228	1.127	6,847,131	6,080,026	1.126
25 - 29	32,631,330	30,476,417	1.071	32,035,582	29,742,221	1.077
30 - 34	50,239,625	47,492,278	1.058	53,881,128	50,825,246	1.060
35 - 39	67,887,028	65,024,629	1.044	67,034,855	64,269,150	1.043
40 - 44	91,739,964	88,428,035	1.037	94,924,967	91,213,999	1.041
45 - 49	106,037,251	102,812,046	1.031	113,267,317	109,353,284	1.036
50 - 54	117,329,982	114,050,590	1.029	131,425,205	127,053,627	1.034
55 - 59	130,521,078	126,598,644	1.031	129,919,366	126,609,265	1.026
60 - 64	85,789,565	84,179,469	1.019	78,811,395	77,011,298	1.023
Over 65	25,370,231	25,014,736	1.014	18,426,492	18,158,176	1.015
Total	717,240,156	692,682,072	1.035	726,573,438	700,316,292	1.037

**Table 6: Comparison of Actual and Expected Annual Salaries of Members - Groups C**

Age	Men			Women		
	Annual Salaries			Annual Salaries		
	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected
Under 25	-	-	0.000	-	-	0.000
25 - 29	2,442,232	1,855,867	1.316	585,578	426,191	1.374
30 - 34	9,263,439	8,130,191	1.139	1,475,348	1,303,386	1.132
35 - 39	13,663,302	12,800,659	1.067	1,802,958	1,688,353	1.068
40 - 44	20,430,937	19,371,067	1.055	2,378,329	2,244,656	1.060
45 - 49	30,026,339	28,819,183	1.042	2,918,491	2,776,444	1.051
50 - 54	24,442,399	23,428,076	1.043	1,917,395	1,905,877	1.006
55 - 59	5,262,111	5,174,808	1.017	-	-	0.000
60 - 64	111,231	110,958	1.002	-	-	0.000
Over 65	-	-	0.000	-	-	0.000
Total	105,641,990	99,690,809	1.060	11,078,099	10,344,907	1.071



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

**Table 7: Summary of Mortality Experience of Pensioners - Service Retirees**

Age	Men			Women			Total		
	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected
Under 55	8	1.38	5.797	4	0.32	12.500	12	1.70	7.059
55-59	16	4.21	3.800	4	2.81	1.423	20	7.02	2.849
60-64	10	16.59	0.603	15	12.34	1.216	25	28.93	0.864
65-69	26	32.26	0.806	14	22.96	0.610	40	55.22	0.724
70-74	31	37.04	0.837	24	24.2	0.992	55	61.24	0.898
75-79	35	45.07	0.777	26	28.71	0.906	61	73.78	0.827
80-84	37	40.1	0.923	20	25.46	0.786	57	65.56	0.869
85-89	25	18.86	1.326	15	15.16	0.989	40	34.02	1.176
90-94	19	14.05	1.352	21	20.83	1.008	40	34.88	1.147
Over 95	10	7.82	1.279	22	14.88	1.478	32	22.70	1.410
Total	217	217.38	0.998	165	167.67	0.984	382	385.05	0.992

**Table 8: Summary of Mortality Experience of Pensioners - Disability Retirees**

Age	Men			Women			Total		
	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected
Under 50	4	0.12	33.333	2	0.11	18.182	6	0.23	26.087
50-54	1	0.22	4.545	0	0.21	0.000	1	0.43	2.326
55-59	0	0.93	0.000	1	0.69	1.449	1	1.62	0.617
60-64	5	2.4	2.083	1	1.59	0.629	6	3.99	1.504
65-69	2	2.69	0.743	1	1.97	0.508	3	4.66	0.644
70-74	4	2.82	1.418	3	1.6	1.875	7	4.42	1.584
75-79	3	2.44	1.230	1	1.31	0.763	4	3.75	1.067
80-84	5	2.97	1.684	1	0.47	2.128	6	3.44	1.744
85-89	2	1.53	1.307	3	1.59	1.887	5	3.12	1.603
90-94	5	2.12	2.358	3	1.91	1.571	8	4.03	1.985
Over 95	0	0.27	0.000	2	0.88	2.273	2	1.15	1.739
Total	31	18.51	1.675	18	12.33	1.460	49	30.84	1.589

**Table 9: Summary of Mortality Experience of Pensioners - Dependents of Deceased Members**

Age	Men			Women			Total		
	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected	Actual	Expected	Ratio of Actual To Expected
Under 50	0	0.00	0.000	0	0.00	0.000	0	0.00	0.000
50-54	0	0.02	0.000	0	0.07	0.000	0	0.09	0.000
55-59	1	0.21	4.762	1	0.47	2.128	2	0.68	2.941
60-64	0	0.13	0.000	0	0.95	0.000	0	1.08	0.000
65-69	0	0.46	0.000	1	2.63	0.380	1	3.09	0.324
70-74	3	0.88	3.409	2	4.18	0.478	5	5.06	0.988
75-79	0	1.05	0.000	7	5.72	1.224	7	6.77	1.034
80-84	5	3.06	1.634	15	9.06	1.656	20	12.12	1.650
85-89	1	0.62	1.613	11	10.92	1.007	12	11.54	1.040
90-94	1	1.92	0.521	15	12.82	1.170	16	14.74	1.085
Over 95	1	1.04	0.962	12	9.92	1.210	13	10.96	1.186
Total	12	9.39	1.278	64	56.74	1.128	76	66.13	1.149

## Appendix II: Recommended Active Service Tables

### Groups A, D, and F<sup>1</sup> Active Service Table - Male/Female Employees

Recommended Assumed Rates of:			Recommended Assumed Rates of:		
Age	Termination	Retirement	Age	Termination	Retirement
19	0.000	N/A	45	0.027	N/A
20	0.065	N/A	46	0.026	N/A
21	0.061	N/A	47	0.025	N/A
22	0.057	N/A	48	0.024	N/A
23	0.054	N/A	49	0.023	N/A
24	0.052	N/A	50	0.022	0.160
25	0.049	N/A	51	0.022	0.160
26	0.047	N/A	52	0.021	0.080
27	0.045	N/A	53	0.020	0.080
28	0.043	N/A	54	0.019	0.080
29	0.041	N/A	55	0.018	0.040
30	0.039	N/A	56	N/A	0.034
31	0.037	N/A	57	N/A	0.045
32	0.036	N/A	58	N/A	0.050
33	0.035	N/A	59	N/A	0.056
34	0.034	N/A	60	N/A	0.056
35	0.033	N/A	61	N/A	0.112
36	0.032	N/A	62	N/A	0.224
37	0.032	N/A	63	N/A	0.175
38	0.031	N/A	64	N/A	0.175
39	0.031	N/A	65	N/A	0.250
40	0.030	N/A	66	N/A	0.150
41	0.030	N/A	67	N/A	0.175
42	0.029	N/A	68	N/A	0.175
43	0.029	N/A	69	N/A	0.200
44	0.028	N/A	70	N/A	1.000

<sup>1</sup> All group A and D members are assumed to retire when first eligible.

## Appendix II: Recommended Active Service Tables (continued)

### Group C Active Service Table - Termination Rates

Age	Current		Proposed	
	Men	Women	Men	Women
19	0.036	0.0720	0.043	0.0864
20	0.036	0.0720	0.043	0.0864
21	0.036	0.0720	0.043	0.0864
22	0.036	0.0720	0.043	0.0864
23	0.036	0.0720	0.043	0.0864
24	0.036	0.0720	0.043	0.0864
25	0.036	0.0720	0.043	0.0864
26	0.036	0.0720	0.043	0.0864
27	0.036	0.0720	0.043	0.0864
28	0.036	0.0720	0.043	0.0864
29	0.036	0.0720	0.043	0.0864
30	0.036	0.0720	0.043	0.0864
31	0.036	0.0720	0.043	0.0864
32	0.036	0.0720	0.043	0.0864
33	0.036	0.0720	0.043	0.0864
34	0.036	0.0720	0.043	0.0864
35	0.036	0.0720	0.043	0.0864

## Appendix II: Recommended Active Service Tables (continued)

### All Groups Active Service Table

#### Comparison of Current and Recommended Future Salary Increase

Age	Current	Recommended
25	7.79%	6.21%
26	7.68%	6.08%
27	7.58%	5.96%
28	7.49%	5.86%
29	7.41%	5.76%
30	7.33%	5.66%
31	7.25%	5.57%
32	7.19%	5.49%
33	7.12%	5.41%
34	7.06%	5.32%
35	7.01%	5.26%
36	6.95%	5.19%
37	6.91%	5.12%
38	6.86%	5.06%
39	6.81%	4.99%
40	6.75%	4.92%
41	6.68%	4.83%
42	6.60%	4.73%
43	6.50%	4.62%
44	6.39%	4.49%
45	6.27%	4.36%
46	6.15%	4.22%
47	6.03%	4.08%
48	5.92%	3.95%
49	5.81%	3.82%
50	5.70%	3.70%
51	5.60%	3.60%
52	5.50%	3.50%
53	5.40%	3.50%
54	5.30%	3.50%
55	5.20%	3.50%
56	5.10%	3.50%
57	4.99%	3.50%
58	4.88%	3.50%
59	4.78%	3.50%
60	4.67%	3.50%

## Appendix II: Recommended Active Service Tables (continued)

### Groups A, D, and F Active Service Table

#### Comparison of Current and Recommended Separations - Disability

Age	Current	Recommended	Age	Current	Recommended
25	0.03%	0.02%	45	0.13%	0.06%
26	0.03%	0.02%	46	0.14%	0.07%
27	0.03%	0.02%	47	0.16%	0.08%
28	0.04%	0.02%	48	0.17%	0.09%
29	0.04%	0.02%	49	0.19%	0.10%
30	0.04%	0.02%	50	0.21%	0.11%
31	0.04%	0.02%	51	0.24%	0.12%
32	0.04%	0.02%	52	0.26%	0.13%
33	0.05%	0.02%	53	0.29%	0.14%
34	0.05%	0.02%	54	0.32%	0.16%
35	0.05%	0.03%	55	0.35%	0.18%
36	0.06%	0.03%	56	0.39%	0.19%
37	0.06%	0.03%	57	0.43%	0.21%
38	0.06%	0.03%	58	0.47%	0.24%
39	0.07%	0.04%	59	0.52%	0.26%
40	0.08%	0.04%	60	0.57%	0.28%
41	0.08%	0.04%	61	0.62%	0.31%
42	0.09%	0.05%	62	0.68%	0.34%
43	0.10%	0.05%	63	0.75%	0.37%
44	0.11%	0.06%	64	0.81%	0.41%

### Group C Active Service Table

#### Comparison of Current and Recommended Separations - Disability

Age	Current	Recommended	Age	Current	Recommended
25	0.15%	0.08%	45	0.65%	0.32%
26	0.16%	0.08%	46	0.72%	0.36%
27	0.17%	0.09%	47	0.80%	0.40%
28	0.18%	0.09%	48	0.89%	0.44%
29	0.19%	0.09%	49	0.98%	0.49%
30	0.20%	0.10%	50	1.09%	0.55%
31	0.21%	0.10%	51	1.21%	0.61%
32	0.22%	0.11%	52	1.34%	0.67%
33	0.23%	0.12%	53	1.49%	0.74%
34	0.25%	0.12%	54	1.64%	0.82%
35	0.27%	0.13%	55	1.82%	0.91%
36	0.29%	0.14%	56	2.00%	1.00%
37	0.31%	0.15%	57	2.21%	1.10%
38	0.33%	0.17%	58	2.43%	1.22%
39	0.36%	0.18%	59	2.67%	1.33%
40	0.40%	0.20%	60	2.93%	1.46%
41	0.44%	0.22%	61	3.21%	1.60%
42	0.48%	0.24%	62	3.51%	1.75%
43	0.53%	0.26%	63	3.83%	1.92%
44	0.58%	0.29%	64	4.18%	2.09%

## Appendix III: Recommended Post-Retirement Mortality Tables

Pensioners and Beneficiaries Group A, D, and F: RP-2000 Custom Table  
(30% Blue Collar, 70% General)

Age	Males	Females	Age	Males	Females
50	0.00542	0.00224	86	0.12387	0.08816
51	0.00565	0.00232	87	0.13682	0.09816
52	0.00583	0.00248	88	0.15100	0.10911
53	0.00598	0.00270	89	0.16637	0.12083
54	0.00612	0.00298	90	0.18291	0.13318
55	0.00630	0.00331	91	0.19875	0.14582
56	0.00659	0.00371	92	0.21511	0.15847
57	0.00698	0.00419	93	0.23177	0.17089
58	0.00750	0.00476	94	0.24844	0.18274
59	0.00814	0.00542	95	0.26508	0.19393
60	0.00890	0.00614	96	0.28391	0.20538
61	0.00976	0.00694	97	0.29985	0.21524
62	0.01072	0.00778	98	0.31530	0.22395
63	0.01180	0.00868	99	0.33021	0.23139
64	0.01301	0.00962	100	0.34456	0.23747
65	0.01436	0.01064	101	0.35863	0.24483
66	0.01588	0.01173	102	0.37169	0.25450
67	0.01755	0.01289	103	0.38304	0.26604
68	0.01939	0.01418	104	0.39200	0.27906
69	0.02138	0.01564	105	0.39789	0.29312
70	0.02357	0.01731	106	0.40000	0.30781
71	0.02600	0.01923	107	0.40000	0.32273
72	0.02875	0.02138	108	0.40000	0.33744
73	0.03189	0.02375	109	0.40000	0.35154
74	0.03545	0.02628	110	0.40000	0.36462
75	0.03942	0.02894	111	0.40000	0.37625
76	0.04383	0.03181	112	0.40000	0.38602
77	0.04864	0.03494	113	0.40000	0.39351
78	0.05392	0.03844	114	0.40000	0.39831
79	0.05977	0.04237	115	0.40000	0.40000
80	0.06622	0.04680	116	0.40000	0.40000
81	0.07388	0.05182	117	0.40000	0.40000
82	0.08225	0.05748	118	0.40000	0.40000
83	0.09136	0.06386	119	0.40000	0.40000
84	0.10125	0.07106	120	1.00000	1.00000
85	0.11205	0.07914			

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

### Pensioners and Beneficiaries Group C: RP-2000 Custom Table (Blue Collar adjusted)

Age	Males	Females	Age	Males	Females
50	0.00241	0.00196	86	0.12636	0.09234
51	0.00274	0.00210	87	0.13863	0.10241
52	0.00300	0.00225	88	0.15195	0.11331
53	0.00330	0.00241	89	0.16625	0.12475
54	0.00364	0.00259	90	0.18176	0.13669
55	0.00420	0.00280	91	0.19637	0.14865
56	0.00497	0.00306	92	0.21162	0.16046
57	0.00563	0.00339	93	0.22735	0.17197
58	0.00640	0.00380	94	0.24317	0.18262
59	0.00726	0.00431	95	0.25947	0.19256
60	0.00827	0.00495	96	0.28391	0.20538
61	0.00943	0.00579	97	0.29985	0.21524
62	0.01077	0.00678	98	0.31530	0.22395
63	0.01231	0.00798	99	0.33021	0.23139
64	0.01381	0.00914	100	0.34456	0.23747
65	0.01554	0.01040	101	0.35863	0.24483
66	0.01755	0.01184	102	0.37169	0.25450
67	0.01954	0.01322	103	0.38304	0.26604
68	0.02168	0.01472	104	0.39200	0.27906
69	0.02394	0.01639	105	0.39789	0.29312
70	0.02676	0.01863	106	0.40000	0.30781
71	0.02934	0.02073	107	0.40000	0.32273
72	0.03219	0.02306	108	0.40000	0.33744
73	0.03540	0.02557	109	0.40000	0.35154
74	0.03905	0.02818	110	0.40000	0.36462
75	0.04313	0.03089	111	0.40000	0.37625
76	0.04769	0.03378	112	0.40000	0.38602
77	0.05268	0.03690	113	0.40000	0.39351
78	0.05812	0.04042	114	0.40000	0.39831
79	0.06407	0.04437	115	0.40000	0.40000
80	0.07055	0.04895	116	0.40000	0.40000
81	0.07816	0.05423	117	0.40000	0.40000
82	0.08636	0.06024	118	0.40000	0.40000
83	0.09519	0.06701	119	0.40000	0.40000
84	0.10467	0.07466	120	1.00000	1.00000
85	0.11508	0.08310			

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

### Pensioners and Beneficiaries Group C: RP-2000 Custom Table (Blue Collar adjusted)

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 (continued)

### Disability Pensioners Base Table

Age	Males	Females	Age	Males	Females
50	0.03544	0.01654	86	0.19977	0.14970
51	0.03673	0.01760	87	0.21661	0.15992
52	0.03803	0.01865	88	0.23366	0.17043
53	0.03933	0.01971	89	0.25069	0.18280
54	0.04067	0.02077	90	0.26749	0.19451
55	0.04204	0.02184	91	0.28391	0.20538
56	0.04347	0.02294	92	0.29985	0.21524
57	0.04498	0.02408	93	0.31530	0.22395
58	0.04658	0.02529	94	0.33021	0.23139
59	0.04831	0.02660	95	0.34456	0.23747
60	0.05017	0.02803	96	0.35863	0.24483
61	0.05221	0.02959	97	0.37169	0.25450
62	0.05445	0.03133	98	0.38304	0.26604
63	0.05691	0.03323	99	0.39200	0.27906
64	0.05961	0.03534	100	0.39789	0.29312
65	0.06258	0.03764	101	0.40000	0.30781
66	0.06584	0.04014	102	0.40000	0.32273
67	0.06941	0.04285	103	0.40000	0.33744
68	0.07329	0.04577	104	0.40000	0.35154
69	0.07751	0.04890	105	0.40000	0.36462
70	0.08207	0.05223	106	0.40000	0.37625
71	0.08695	0.05578	107	0.40000	0.38602
72	0.09215	0.05955	108	0.40000	0.39351
73	0.09764	0.06355	109	0.40000	0.39831
74	0.10339	0.06779	110	0.40000	0.40000
75	0.10937	0.07231	111	0.40000	0.40000
76	0.11554	0.07714	112	0.40000	0.40000
77	0.12188	0.08230	113	0.40000	0.40000
78	0.12834	0.08784	114	0.40000	0.40000
79	0.13492	0.09379	115	1.00000	1.00000
80	0.14160	0.10020	116	1.00000	1.00000
81	0.14837	0.10710	117	1.00000	1.00000
82	0.15524	0.11451	118	1.00000	1.00000
83	0.16219	0.12246	119	1.00000	1.00000
84	0.16923	0.13097	120	1.00000	1.00000
85	0.18341	0.14005			

## 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<sup>®</sup> 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	\$ 1,142,767,226	\$ 1,200,105,500
Retired Members	\$ 867,322,640	\$ 871,239,162
Total	\$ 2,010,089,866	\$ 2,071,344,662
2. Assets	\$ 1,566,075,540	\$ 1,566,075,540
3. Unfunded Accrued Liability	\$ 444,014,326	\$ 505,269,122
4. Normal Contribution, FY 2016	\$ 19,138,047	\$ 13,261,238
5. Accrued Liability Contribution, FY 2016	\$ 27,099,806	\$ 31,012,501
6. Total Contribution = (4) + (5)	\$ 46,237,853	\$ 44,273,739