# The State Police

# Retirement System of New Jersey

# Report on an Investigation of Experience

Prepared as of June 30, 2014

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Spetember 22, 2015

Board of Trustees
The State Police Retirement System
 of New Jersey
Trenton, New Jersey 08625-0295

Members of the Board:

This year an actuarial investigation of the mortality and service experience of the members and beneficiaries of the retirement system was made in accordance with the provisions of Section 32 of Chapter 89, P.L. 1965.  This Section specifies that such an investigation shall be made once in every three-year period.  The results of this investigation, which examined the experience of the System from July 1, 2011 to June 30, 2014 are described in the attached report.

Buck performed the experience review based on data supplied by the State of New Jersey Division of Pensions and Benefits. Buck Consultants did not audit the data, although it was reviewed for reasonableness and consistency with prior data. The results of this review are dependent on the accuracy of the data.

The assumptions recommended in this report are proposed for use in valuing the pension benefits for members in the State Police Retirement System. Use of these assumptions for any other purpose may not be appropriate. No one may make any representations or guarantees based on any statements or conclusions contained in this report without the written consent of Buck Consultants.

To the best of our knowledge, this experience investigation report is complete and accurate. Future actuarial measurements may differ significantly from current measurements due to plan experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in plan provisions or applicable law. An analysis of the potential range of future results is beyond the scope of this valuation.

This report was prepared under my supervision. I am a Fellow of the Society of Actuaries and a Member of the American Academy of Actuaries. I meet the Academy's qualification Standards to issue this Statement of Actuarial Opinion. This report has been prepared in accordance with all applicable Actuarial Standards of Practice and I am available to answer questions about it.

Respectfully submitted,

Aaron Shapiro, FSA, EA, MAAA
Principal, Consulting Actuary

# Table of Contents

# Report on an Investigation of The Experience of The State Police Retirement System of New Jersey

# Prepared as of June 30, 2014

## I. Introduction

Section 32 of Chapter 89, P.L. 1965 of the New Jersey Statutes provides that once in every three-year period the actuary shall examine in detail the mortality, service and compensation experience of the members and beneficiaries of the Retirement System. This investigation is designed to ensure that the tables used for determining expected liabilities of the Retirement System are consistent with recent experience. If tables are not updated periodically, the resulting contributions may either be too large or too small to fund the actual accruing liabilities.

This report was prepared in accordance with applicable Actuarial Standards of Practice (ASOP). The Standards of Practice provide guidance to actuaries in selecting various actuarial assumptions for measuring obligations under defined benefit plans.

This report summarizes the Retirement System experience for the period from July 1, 2011 through June 30, 2014. Experience for active male and female members were examined in total. Mortality experience among beneficiaries was examined based on gender. Please note that, in instances where the data being examined appeared inconsistent with prior results or incomplete, we made no current recommendation. These items will be reviewed closely when the next scheduled experience study is prepared as of June 30, 2017 and proposed changes, if warranted, will be recommended at that time.

## II.  Examination of Experience

Although this study covers the period from July 1, 2011 to June 30, 2014, it will also make reference to the results from prior studies, where appropriate.

The experience among active members, retired members and beneficiaries has been compared with the experience expected according to the active service tables and retirement tables adopted by the Board of Trustees as a result of the July 1, 2008 - June 30, 2011 experience study.

In the case of withdrawals, since the Board has adopted different rates of withdrawal for the first four years of service and for five to nineteen years of service, the data for employees with less than five years of service were tabulated separately from the data for employees with five to nineteen years of service.  Similarly, incidence of service retirement were examined separately for employees with twenty, twenty-one, twenty-two to twenty-four, twenty-five and more than twenty-five years of service.  For purposes of the analysis of experience with respect to death and disability retirement, employees were treated as one group for each assumption.

The expected number of separations from service on account of withdrawal, death, disability and service retirement was calculated by multiplying the rates of separation used as a basis for the active service tables by the number of those exposed to risk. Similarly, the expected number of deaths among service retirees, beneficiaries of deceased members and disability retirees was calculated by multiplying the rate of mortality used as a basis for the inactive tables by the number exposed to risk. The actual number was then compared with the expected number. The tables shown in Section III present the results of these comparisons. If the ratio of actual to expected is 1.000, the tables have exactly predicted what actually occurred. If the ratio of actual to expected is greater than 1.000, then the tables have underestimated actual experience. If the ratio is less than 1.000, then the tables have overstated actual experience.

Finally, the expected salaries of those members who remain in service from year to year were obtained and these expected salaries were compared with the actual salaries. Again, a ratio of actual to expected of 1.000 would indicate that actual salary increases were identical to anticipated increases while a ratio greater than 1.000 indicates that salaries have increased faster than anticipated and a ratio less than 1.000 indicates that salaries have increased more slowly than anticipated.

# III. Comments and General Recommendation of the Actuary

The following presents the tabular results of the experience data studied, a discussion of the results and our recommendation.

The tables present a summary of the number of exposures, actual and expected experience and the ratios of actual to expected experience. In addition, we have prepared graphs that illustrate the actual current and proposed (if applicable) rates for each assumption.  Please note that the experience for certain assumptions, such as accidental death that has a large exposed population and a rather small incidence, does not graph well because of the relative number of members.

## A. Active Plan Experience

The first portion of this section contains a summary of active plan experience, which examines the following rates:

- a. Withdrawal Rates
- b. Ordinary Disability Rates
- c. Accidental Disability Rates
- d. Service Retirement Rates
- e. Salary Increase Rates

a. Withdrawal Rates

1. Less than five years of service

The following table presents a summary of the number of exposures, actual and expected terminations and the ratios of actual to expected terminations of withdrawals with less than five years of service.

| Central Age Group | Exposures | Actual Withdrawals | Expected Withdrawals | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| 20 | 0 | 0 | 0.00 | 0.00 | 0.000 | 0.000 |
| 25 | 199 | 0 | 1.00 | 0.75 | 0.000 | 0.000 |
| 30 | 445 | 1 | 2.22 | 1.67 | 0.451 | 0.599 |
| 35 | 136 | 1 | 1.12 | 1.12 | 0.893 | 0.893 |
| 40 | 9 | 0 | 0.00 | 0.00 | 0.000 | 0.000 |
| 45 | 0 | 0 | 0.00 | 0.00 | 0.000 | 0.000 |
| 50 | 0 | 0 | 0.00 | 0.00 | 0.000 | 0.000 |
| 53 | 0 | 0 | 0.00 | 0.00 | 0.000 | 0.000 |
| 54 | 0 | 0 | 0.00 | 0.00 | 0.000 | 0.000 |
| Total | 789 | 2 | 4.34 | 3.54 | 0.461 | 0.565 |

Recommendation: Decrease rates prior to central age group 35.

The experience for members with less than 5 years of service shows there were less actual withdrawals than expected. Therefore, we recommend decreasing the rates at the ages at which this actual incidence has been greater than expected.

## 2. Five to nineteen years of service
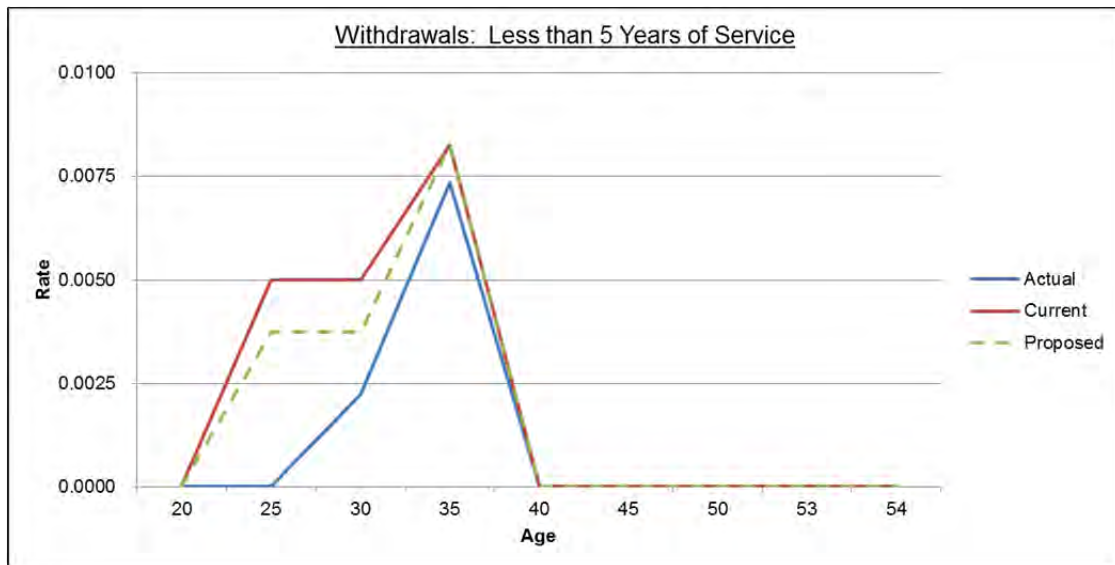
The following table presents a summary of the number of exposures, actual and expected terminations and the ratios of actual to expected terminations of withdrawals with five to nineteen years of service.

| Central Age Group | Exposures | Actual Withdrawals | Expected Withdrawals | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| 20 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 25 | 17 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 30 | 982 | 0 | 3.94 | 1.96 | 0.0000 | 0.0000 |
| 35 | 1,663 | 3 | 1.67 | 2.33 | 1.7964 | 1.2880 |
| 40 | 1,493 | 0 | 2.24 | 1.12 | 0.0000 | 0.0000 |
| 45 | 893 | 0 | 1.79 | 0.89 | 0.0000 | 0.0000 |
| 50 | 171 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 53 | 3 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 54 | 2 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| Total | 5,224 | 3 | 9.64 | 6.30 | 0.3112 | 0.4760 |

 Recommendation: Increase the rate for central age group 35 and decrease the rates for all other ages.

The experience for members with 5 to 19 years of service show that actual terminations were about 31% of that expected. We recommend decreasing the rates at the ages at which this actual incidence has been much lower than expected and increasing the rates for central age 35 group.


Withdrawals: 5 to 19 Years of Service

## b. Ordinary Disability Rates
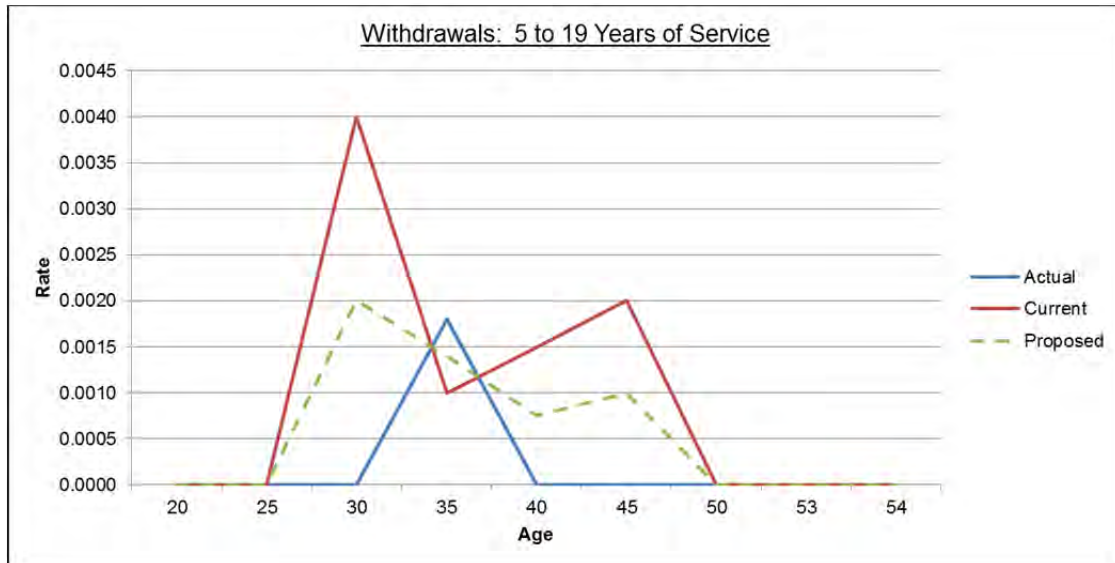
The following table presents a summary of the number of exposures, actual and expected terminations and the ratios of actual to expected terminations due to ordinary disability.

| Central Age Group | Exposures | Actual Disability | Expected Disability | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| 20 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 25 | 216 | 0 | 0.14 | 0.09 | 0.0000 | 0.0000 |
| 30 | 1,427 | 1 | 1.23 | 0.84 | 0.8130 | 1.1905 |
| 35 | 1,799 | 2 | 3.81 | 2.70 | 0.5249 | 0.7407 |
| 40 | 1,513 | 2 | 3.71 | 2.60 | 0.5391 | 0.7692 |
| 45 | 1,643 | 2 | 5.34 | 3.66 | 0.3745 | 0.5464 |
| 50 | 1,246 | 1 | 6.40 | 4.70 | 0.1563 | 0.2128 |
| 53 | 79 | 0 | 0.53 | 0.37 | 0.0000 | 0.0000 |
| 54 | 73 | 2 | 0.53 | 0.37 | 3.7736 | 5.4054 |
| Total | 7,996 | 10 | 21.69 | 15.33 | 0.4610 | 0.6523 |

Recommendation: Decrease the rates for all ages.

The experience of ordinary disability indicates that actual disabilities were about 46% of that expected. We recommend decreasing the rates at all ages.
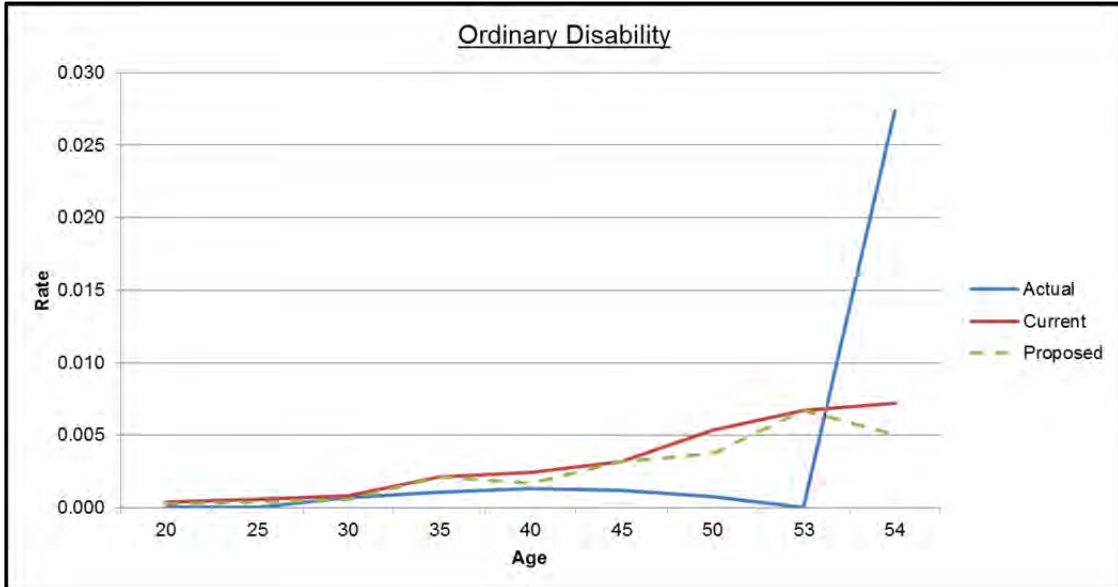
### c. Accidental Disability Rates

The following table presents a summary of the number of exposures, actual and expected terminations and the ratios of actual to expected terminations due to accidental disability.

| Central Age Group | Exposures | Actual Disability | Expected Disability | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| 20 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 25 | 216 | 0 | 0.05 | 0.05 | 0.0000 | 0.0000 |
| 30 | 1,427 | 1 | 0.75 | 0.75 | 1.3333 | 1.3333 |
| 35 | 1,799 | 2 | 3.48 | 3.48 | 0.5747 | 0.5747 |
| 40 | 1,513 | 2 | 3.13 | 3.13 | 0.6390 | 0.6390 |
| 45 | 1,643 | 4 | 3.51 | 3.51 | 1.1396 | 1.1396 |
| 50 | 1,246 | 4 | 2.81 | 2.81 | 1.4235 | 1.4235 |
| 53 | 79 | 0 | 0.21 | 0.21 | 0.0000 | 0.0000 |
| 54 | 73 | 0 | 0.21 | 0.21 | 0.0000 | 0.0000 |
| Total | 7,996 | 13 | 14.15 | 14.15 | 0.9187 | 0.9187 |

Recommendation: No change.

The data for accidental disabilities indicates that actual accidental disability retirements were within an acceptable range of that expected and their incidence is quite small in relation to the total number of members who were exposed. We recommend no change to these rates at this time.

d.  Service Retirement Rates

    1.  20 years of service

The following table presents a summary of the number of exposures, actual and expected retirements and the ratios of actual to expected retirements among members with 20 years of service.

| Central Age Group | Exposures | Actual Retirements | Expected Retirements | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| 40 | 4 | 0 | 0.08 | 0.08 | 0.0000 | 0.0000 |
| 45 | 49 | 1 | 0.98 | 0.98 | 1.0204 | 1.0204 |
| 50 | 42 | 1 | 0.84 | 0.84 | 1.1905 | 1.1905 |
| 53 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 54 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| Total | 95 | 2 | 1.90 | 1.90 | 1.0526 | 1.0526 |

Recommendation: No Change

With regard to retirements with 20 years of service, there were 2 actual retirements compared to approximately 2 expected retirements. We recommend that no changes be made to the rates at this time.

## 2. 21 years of service
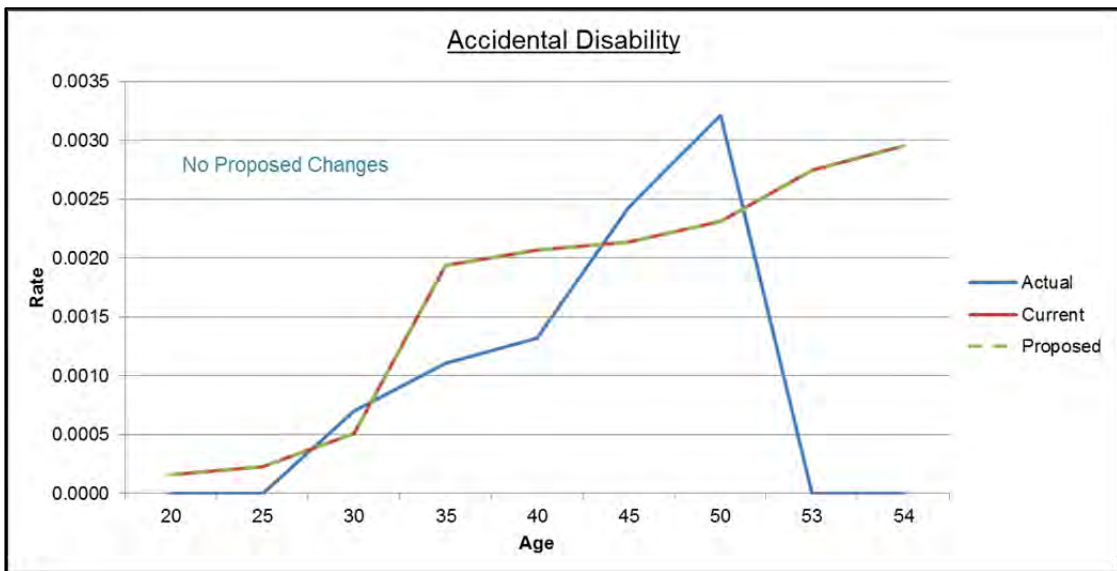
The following table presents a summary of the number of exposures, actual and expected retirements and the ratios of actual to expected retirements among members with 21 years of service.

| Central Age Group | Exposures | Actual Retirements | Expected Retirements | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| **40** | 3 | 0 | 0.02 | 0.02 | 0.0000 | 0.0000 |
| **45** | 19 | 0 | 0.10 | 0.10 | 0.0000 | 0.0000 |
| **50** | 1 | 0 | 0.01 | 0.01 | 0.0000 | 0.0000 |
| **53** | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| **54** | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| **Total** | 23 | 0 | 0.13 | 0.13 | 0.0000 | 0.0000 |

Recommendation: No Change

The results of the study show that there were no actual retirement among members with 21 years of service compared to about 0 expected retirements. We recommend that no changes be made to the rates at this time.
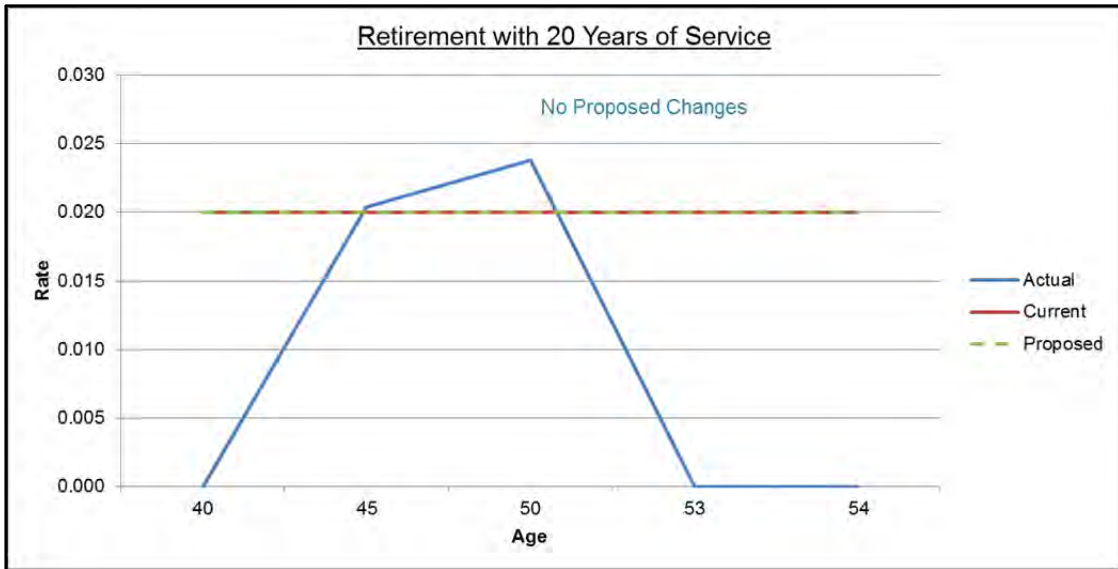


Retirement with 21 Years of Service

### 3. 22- 24 years of service

The following table presents a summary of the number of exposures, actual and expected retirements and the ratios of actual to expected retirements among members with 22 - 24 years of service.

| Central Age Group | Exposures | Actual Retirements | Expected Retirements | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| 40 | 4 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 45 | 413 | 2 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 50 | 306 | 1 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 53 | 14 | 2 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 54 | 12 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| Total | 749 | 5 | 0.00 | 0.00 | 0.0000 | 0.0000 |

Recommendation: No Change

There were 5 retirements for members with 22 to 24 years of service compared to no assumed retirements. Since this represents less than 1% of the exposed population, we recommend the continued use of the current rates.
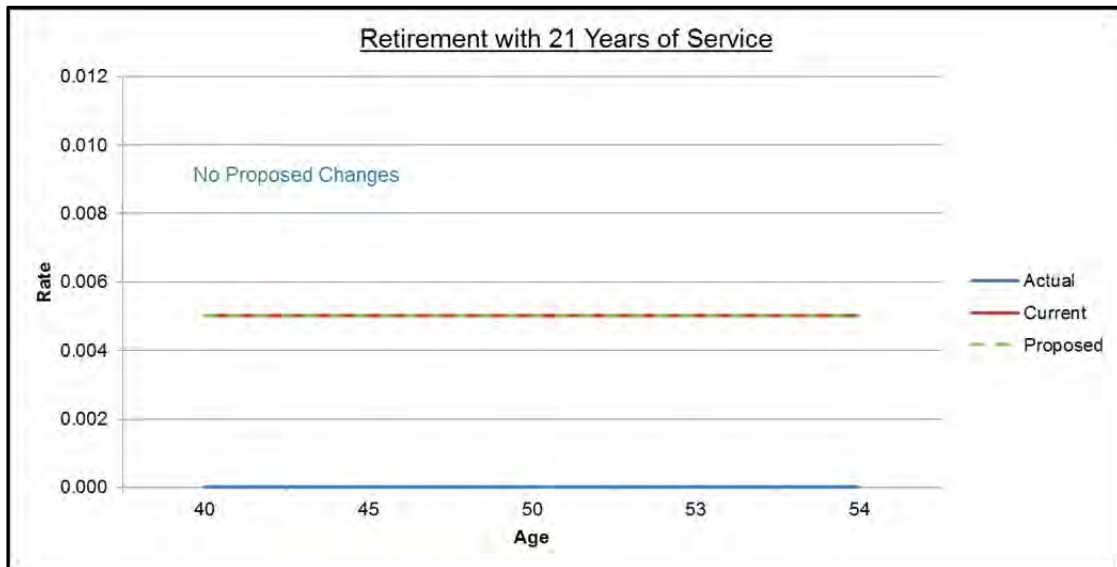
### 4. 25 years of service

The following table presents a summary of the number of exposures, actual and expected retirements and the ratios of actual to expected retirements among members with 25 years of service.

| Central Age Group | Exposures | Actual Retirements | Expected Retirements | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| 45 | 215 | 119 | 97.83 | 107.50 | 1.2164 | 1.1070 |
| 50 | 379 | 210 | 172.45 | 189.50 | 1.2177 | 1.1082 |
| 53 | 19 | 8 | 8.65 | 9.50 | 0.9249 | 0.8421 |
| 54 | 14 | 11 | 6.37 | 7.00 | 1.7268 | 1.5714 |
| Total | 627 | 348 | 285.30 | 313.50 | 1.2198 | 1.1100 |

Recommendation: Increase Rates

The results of the study show that actual retirements among members with 25 years of service were about 122% of those expected. This continues a trend observed in the prior study. Due to the continued higher than expected retirement incidence, we recommend a further increase in these retirement rates.



Retirement with 25 Years of Service

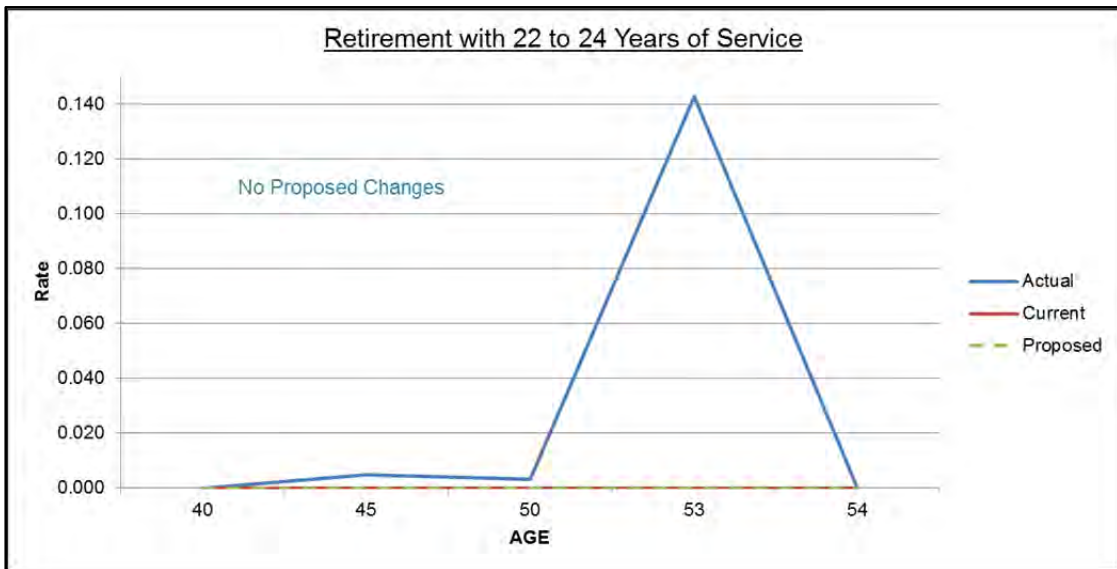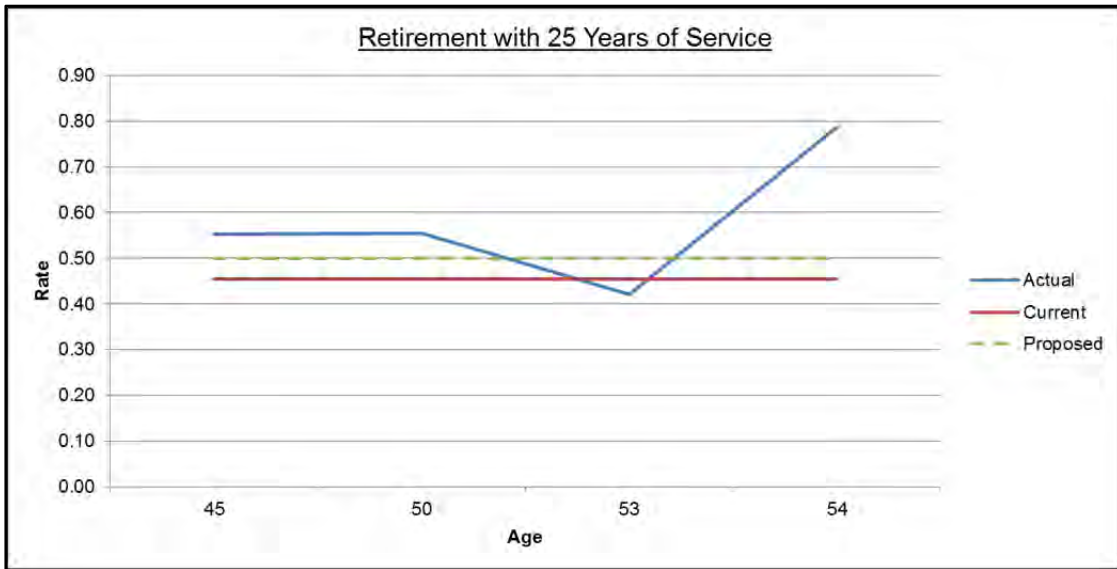### 5. More than 25 years of service

The following table presents a summary of the number of exposures, actual and expected retirements and the ratios of actual to expected retirements among members with more than 25 years of service.

| Central Age Group | Exposures | Actual Retirements | Expected Retirements | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| **45** | 54 | 16 | 13.50 | 15.12 | 1.1852 | 1.0582 |
| **50** | 346 | 127 | 103.80 | 114.18 | 1.2235 | 1.1123 |
| **53** | 43 | 15 | 12.90 | 14.19 | 1.1628 | 1.0571 |
| **54** | 42 | 28 | 23.10 | 25.62 | 1.2121 | 1.0929 |
| **Total** | 485 | 186 | 153.30 | 169.11 | 1.2133 | 1.0999 |

Recommendation: Increase Rates

For retirements among members with more than 25 years of service, actual retirements were about 121% of those expected. This continues a trend observed in the prior study. Due to the continued higher than expected retirement incidence, we recommend an increase in these retirement rates.

e.  Salary Increase Rates

The following table presents a summary of the total salary from the prior year, actual and expected salary for the following year and the ratios of actual to expected salary among continuing actives.

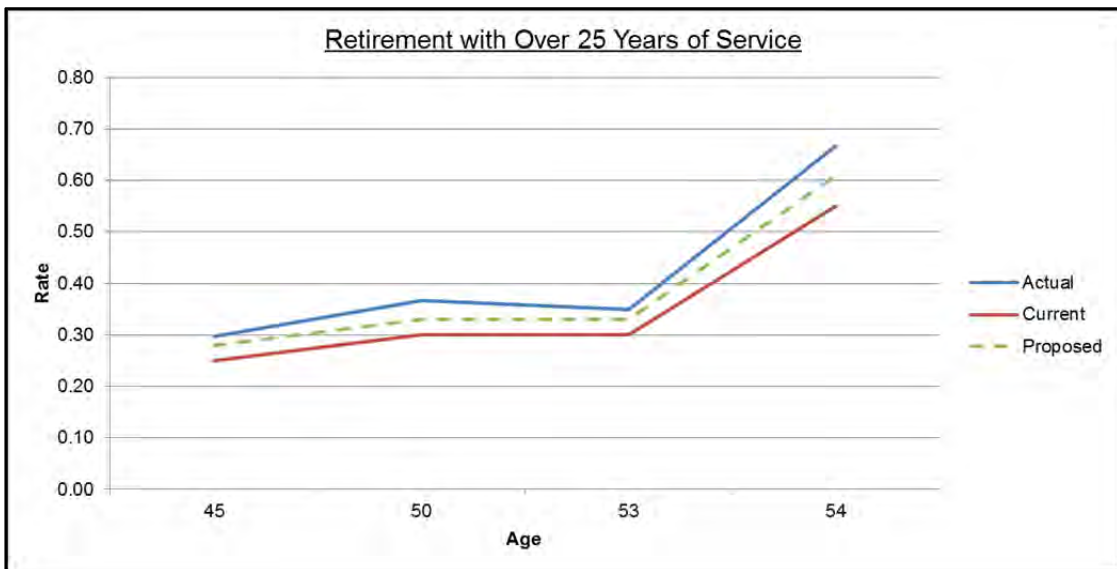| CENTRAL AGE OF GROUP | SALARY INCREASE | | | |
|---|---|---|---|---|
| | Actual Salary from Previous Year | Actual | Expected | Ratio of Actual to Expected |
| 25 | $ 15,797,379 | $ 16,896,236 | $ 16,342,387 | 1.034 |
| 30 | 116,236,634 | 124,614,142 | 120,246,797 | 1.036 |
| 35 | 166,739,803 | 176,736,943 | 172,492,325 | 1.025 |
| 40 | 156,495,312 | 164,080,568 | 161,894,403 | 1.014 |
| 45 | 165,368,893 | 173,874,827 | 171,074,120 | 1.016 |
| 50 | 103,278,452 | 108,178,772 | 106,841,559 | 1.013 |
| Greater than 52 | 9,911,399 | 10,392,235 | 10,253,343 | 1.014 |
| Total | $733,827,872 | $774,773,723 | $759,144,934 | 1.021 |

Recommendation: No Change

Future salary is assumed to increase by 3.45% per annum through fiscal year ending 2021 and 4.45% per annum for fiscal years ending 2022 and thereafter. The three-year study shows actual salary increases were about 2.1% higher than expected.

However, Troopers with the New Jersey State Police received, at least, $23.4 million in retroactive payments under a contract awarded by an arbiter in September, 2011. Thus, the results of the three-year study indicate a short term observation specific to the examination period rather than the beginning of a new salary increase trend.

The following tables present a summary of the total salary from the prior year, actual and expected salary for the three valuation years that were considered for this study:

| CENTRAL AGE OF GROUP | 2011 to 2012 SALARY INCREASE | | | |
|---|---|---|---|---|
| | Actual Salary from Previous Year | Actual | Expected | Ratio of Actual to Expected |
| 25 | 6,118,862 | 6,835,235 | 6,329,962 | 1.080 |
| 30 | 41,738,975 | 46,934,436 | 43,178,970 | 1.087 |
| 35 | 49,249,996 | 54,940,814 | 50,949,121 | 1.078 |
| 40 | 49,611,282 | 54,549,426 | 51,322,872 | 1.063 |
| 45 | 61,644,849 | 67,570,689 | 63,771,596 | 1.060 |
| 50 | 35,165,748 | 38,408,383 | 36,378,966 | 1.056 |
| Greater than 52 | 3,707,117 | 4,008,203 | 3,835,013 | 1.045 |
| Total | 247,236,829 | 273,247,186 | 255,766,500 | 1.068 |

| CENTRAL AGE OF GROUP | 2012 to 2013 SALARY INCREASE | | | |
|---|---|---|---|---|
| | Actual Salary from Previous Year | Actual | Expected | Ratio of Actual to Expected |
| 25 | 6,544,573 | 6,818,175 | 6,770,360 | 1.007 |
| 30 | 40,572,535 | 42,481,682 | 41,972,287 | 1.012 |
| 35 | 57,512,556 | 60,104,462 | 59,496,739 | 1.010 |
| 40 | 53,113,071 | 54,620,925 | 54,945,473 | 0.994 |
| 45 | 53,079,307 | 54,386,305 | 54,910,543 | 0.990 |
| 50 | 35,152,498 | 35,955,911 | 36,365,260 | 0.989 |
| Greater than 52 | 3,579,535 | 3,682,032 | 3,703,029 | 0.994 |
| **Total** | 249,554,075 | 258,049,492 | 258,163,691 | 1.000 |

| CENTRAL AGE OF GROUP | 2013 to 2014 SALARY INCREASE | | | |
|---|---|---|---|---|
| | Actual Salary from Previous Year | Actual | Expected | Ratio of Actual to Expected |
| 25 | 3,133,944 | 3,242,826 | 3,242,065 | 1.000 |
| 30 | 33,925,124 | 35,198,024 | 35,095,540 | 1.003 |
| 35 | 59,977,251 | 61,691,667 | 62,046,465 | 0.994 |
| 40 | 53,770,959 | 54,910,217 | 55,626,058 | 0.987 |
| 45 | 50,644,737 | 51,917,833 | 52,391,981 | 0.991 |
| 50 | 32,960,206 | 33,814,478 | 34,097,333 | 0.992 |
| Greater than 52 | 2,624,747 | 2,702,000 | 2,715,301 | 0.995 |
| **Total** | 237,036,968 | 243,477,045 | 245,214,743 | 0.993 |

The above tables show that the annual salary increase assumption is within an acceptable range of actual experience during the last two periods covered in this study. The current assumption reflects a 3.45% per annum increase through fiscal year ending 2021 and 4.45% per annum increase for fiscal years ending 2022 and thereafter. We believe that the current salary assumption is a reasonable assumption given the experience of the System and discussions with the Division of Pension and Benefits regarding anticipated salary growth. Therefore, we recommend no changes to the salary scale at this time.

## B. Mortality Experience Among Active and Inactive Plan Members

### Mortality Improvement

As noted in prior experience studies, we have seen continued and steady improvement in mortality rates over time.  This trend is expected to continue into the future.  In fact, Actuarial Standard of Practice No. 35 states that the actuary should "include an assumption as to expected mortality improvement after the measurement date."  Accordingly, in our prior experience study, we recommended the use of projection scale AA in the projection of the mortality tables to provide a generational approach toward future mortality improvements.

Since the last experience study, the Society of Actuaries (SOA) conducted a mortality study and determined that the overall rates of mortality improvement in the US have differed from those predicted by Scale AA.  Based on their study, the SOA published an updated mortality improvement projection scale, MP-2014. However, there are many who believe that the SOA's MP-2014 scale is unduly conservative with unrealistic mortality improvement rates.  Emerging experience since the data was collected by the SOA seems to support the contention. Therefore, Buck has published an alternative mortality improvement scale, the Buck Modified MP-2014. The Buck table was constructed to provide a reasonable projection scale for use by employers who believe that future mortality improvement will be lower than that predicted by the SOA's MP-2014. The parameters used in the construction of this table were based on the mortality improvement forecasts from the Social Security Administration just as they were used by the SOA in developing MP-2014 . The substantive difference between the Buck scale and that published by the SOA's MP-2014 scale is that the Buck scale applies a 15 year period prior to reaching an ultimate improvement rate of 0.75% versus the SOA's scale which applies a 20 year period prior to reaching an ultimate improvement rate of 1.0%. This scale is based on the SOA's Retirement Plans Experience Committee 2014 model, which is the same methodology used for the development of the MP-2014 projection scale. The 0.75% ultimate level is reduced after age 85 to 0.60% at age 95, then to 0.0% by age 115. We recommend the use of the Buck Modified MP-2014 scale in the projection of the mortality tables.

The mortality experience for all retirees, beneficiaries and active participants eligible for ordinary death benefits is not sufficient to be considered fully credible. Therefore, we have recommended the use of the RP-2000 Combined Healthy Mortality Tables with ages set back 3 years for Males and unadjusted for Females projected on a generational basis from the base year of 2000 to 2013 using Projection Scale BB as the base tables. Projection Scale BB is an alternative projection scale developed by the SOA that is based on more recent data and newly developed techniques.  Scale BB is very similar in its projection of future mortality improvements to the Buck Modified MP-2014.  The base tables, projected to 2013 with Scale BB, will be further projected beyond the valuation date using the Buck Modified MP-2014.

a. Ordinary and Accidental Death Rates Among Active Members

The following tables present a summary of the number of exposures, actual and expected terminations and the ratios of actual to expected terminations due to ordinary and accidental death. Since different benefits are paid upon ordinary and accidental death, the mortality experience with respect to these two causes of death were investigated separately.

1. Ordinary Death Rates

Male

| Central Age Group | Exposures | Actual Deaths | Expected Deaths | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| 20 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 25 | 204 | 0 | 0.08 | 0.07 | 0.0000 | 0.0000 |
| 30 | 1,361 | 0 | 0.53 | 0.51 | 0.0000 | 0.0000 |
| 35 | 1,713 | 0 | 0.96 | 0.93 | 0.0000 | 0.0000 |
| 40 | 1,427 | 1 | 1.29 | 1.25 | 0.7752 | 0.8000 |
| 45 | 1,597 | 1 | 1.99 | 1.91 | 0.5025 | 0.5236 |
| 50 | 1,214 | 0 | 2.04 | 1.96 | 0.0000 | 0.0000 |
| 53 | 78 | 0 | 0.17 | 0.16 | 0.0000 | 0.0000 |
| 54 | 72 | 0 | 0.18 | 0.17 | 0.0000 | 0.0000 |
| Total | 7,666 | 2 | 7.24 | 6.97 | 0.2762 | 0.2869 |
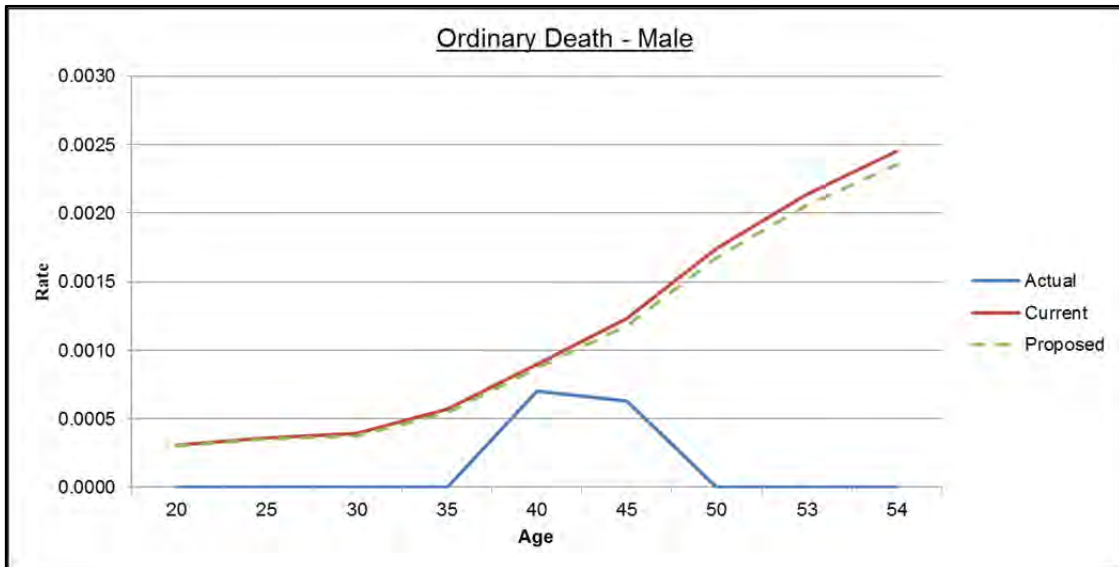

Ordinary Death - Male

Female

| Central Age Group | Exposures | Actual Deaths | Expected Deaths | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| 20 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 25 | 12 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 30 | 66 | 0 | 0.02 | 0.02 | 0.0000 | 0.0000 |
| 35 | 86 | 0 | 0.04 | 0.04 | 0.0000 | 0.0000 |
| 40 | 86 | 0 | 0.06 | 0.06 | 0.0000 | 0.0000 |
| 45 | 46 | 0 | 0.05 | 0.05 | 0.0000 | 0.0000 |
| 50 | 32 | 0 | 0.05 | 0.05 | 0.0000 | 0.0000 |
| 53 | 1 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 54 | 1 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| Total | 330 | 0 | 0.22 | 0.22 | 0.0000 | 0.0000 |



Ordinary Death - Female

Recommendation: The experience for ordinary deaths indicates that there were 2 actual male deaths during the measurement period compared to 7.24 expected male deaths and no actual female deaths compared to 0.22 expected female deaths. Currently, the System is using the RP-2000 Combined Healthy Male (set back 3 years) and RP-2000 Combined Healthy Female Mortality Tables projected on a generational basis from the base year of 2012 using Projection Scale AA. We recommend using the RP-2000 Combined Healthy Mortality Tables with ages set back 3 years for Males and unadjusted for Females projected on a generational basis from the base year of 2000 to 2013 using Projection Scale BB as the base tables. The base tables will be projected beyond the valuation date using the Buck Modified MP-2014.

2. Accidental Death Rates

Males and Females combined

| Central Age Group | Exposures | Actual Deaths | Expected Deaths | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| **20** | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| **25** | 216 | 0 | 0.08 | 0.08 | 0.0000 | 0.0000 |
| **30** | 1,427 | 0 | 0.69 | 0.69 | 0.0000 | 0.0000 |
| **35** | 1,799 | 0 | 0.90 | 0.90 | 0.0000 | 0.0000 |
| **40** | 1,513 | 1 | 0.75 | 0.75 | 1.3333 | 1.3333 |
| **45** | 1,643 | 0 | 1.14 | 1.14 | 0.0000 | 0.0000 |
| **50** | 1,246 | 0 | 1.10 | 1.10 | 0.0000 | 0.0000 |
| **53** | 79 | 0 | 0.04 | 0.04 | 0.0000 | 0.0000 |
| **54** | 73 | 0 | 0.02 | 0.02 | 0.0000 | 0.0000 |
| **Total** | 7,996 | 1 | 4.72 | 4.72 | 0.2119 | 0.2119 |
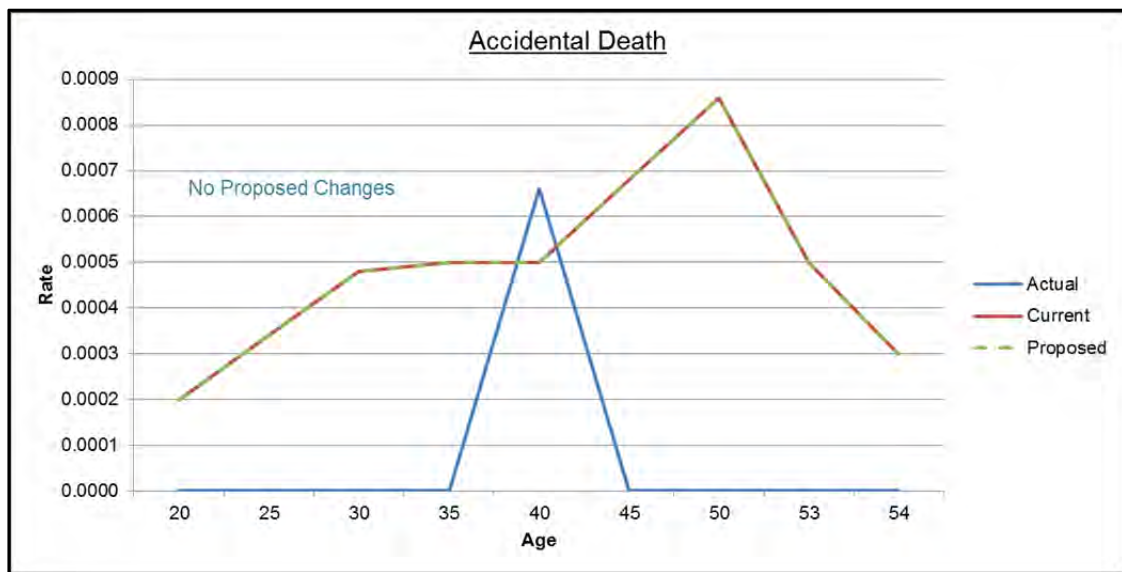


Recommendation: For accidental death, there was 1 actual death compared to the approximately 5 expected during the study period. However, since this represents less than 0.1% of the group exposed, no changes are recommended at this time.

b. Inactive Plan Experience

The second portion of this section contains a summary of inactive plan experience which examines the following rates:

1. Service Retirement Mortality Rates

2. Beneficiary Mortality Rates

3. Disability Mortality Rates

## 1. Service Retirement Mortality Rates

The experience indicates that the number of actual deaths were about 82% of those expected for male retirees. For female retirees, there were no actual deaths during the three-year period, which is within an acceptable range.

### Male

| Central Age Group | Exposures | Actual Deaths | Expected Deaths | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| Less than 48 | 116 | 0 | 0.16 | 0.15 | 0.0000 | 0.0000 |
| 50 | 833 | 0 | 1.46 | 1.42 | 0.0000 | 0.0000 |
| 55 | 1,133 | 3 | 3.05 | 2.94 | 0.9836 | 1.0204 |
| 60 | 939 | 4 | 4.44 | 4.07 | 0.9009 | 0.9828 |
| 65 | 1,151 | 5 | 10.39 | 8.95 | 0.4812 | 0.5587 |
| 70 | 1,134 | 12 | 18.15 | 15.14 | 0.6612 | 0.7926 |
| 75 | 532 | 9 | 14.12 | 11.78 | 0.6374 | 0.7640 |
| 80 | 358 | 14 | 17.33 | 14.46 | 0.8078 | 0.9682 |
| 85 | 310 | 27 | 24.27 | 20.29 | 1.1125 | 1.3307 |
| 90 | 72 | 10 | 9.07 | 7.88 | 1.1025 | 1.2690 |
| Greater than 92 | 12 | 2 | 2.53 | 2.35 | 0.7905 | 0.8511 |
| Total | 6,590 | 86 | 104.97 | 89.43 | 0.8193 | 0.9616 |



Service Retirement - Male

Recommendation: Currently, the System is using the RP-2000 Combined Healthy Male Mortality Table (set back 3 years) projected on a generational basis from the base year of 2012 using Projection Scale AA. We recommend using the RP-2000 Combined Healthy Male Mortality Table with ages set back 3 years projected on a generational basis from the base year of 2000 to 2013 using Projection Scale BB as the base table. The base table will be projected beyond the valuation date using the Buck Modified MP-2014.

Female

| Central Age Group | Exposures | Actual Deaths | Expected Deaths | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| Less than 48 | 8 | 0 | 0.01 | 0.01 | 0.0000 | 0.0000 |
| 50 | 38 | 0 | 0.07 | 0.06 | 0.0000 | 0.0000 |
| 55 | 48 | 0 | 0.13 | 0.12 | 0.0000 | 0.0000 |
| 60 | 10 | 0 | 0.04 | 0.04 | 0.0000 | 0.0000 |
| 65 | 5 | 0 | 0.05 | 0.04 | 0.0000 | 0.0000 |
| 70 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 75 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 80 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 85 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 90 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| Greater than 92 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| Total | 109.0 | 0 | 0.30 | 0.27 | 0.0000 | 0.0000 |
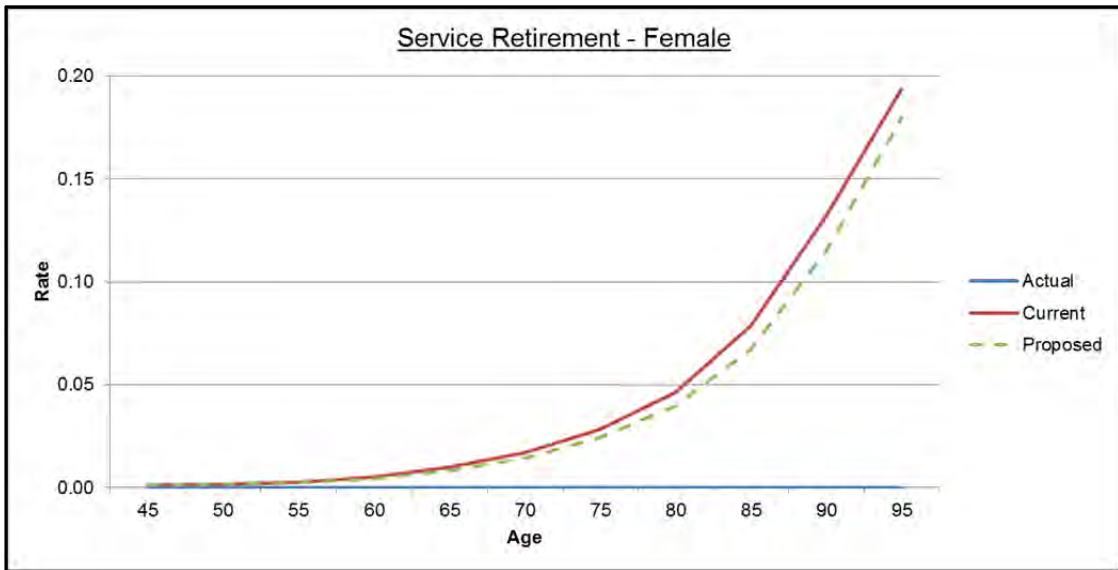


Service Retirement - Female

Recommendation: Currently, the System is using the RP-2000 Combined Healthy Female Mortality Table projected on a generational basis from the base year of 2012 using Projection Scale AA. We recommend using the RP-2000 Combined Healthy Female Mortality Table projected on a generational basis from the base year of 2000 to 2013 using Projection Scale BB as the base table. The base table will be projected beyond the valuation date using the Buck Modified MP-2014.

2. Beneficiary Mortality Rates

The results indicate that there were no actual deaths among the relatively small population of male beneficiaries. Actual deaths among female beneficiaries were within a reasonable range of that expected.

Male

| Central Age Group | Exposures | Actual Deaths | Expected Deaths | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| Less than 48 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 50 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 55 | 3 | 0 | 0.01 | 0.02 | 0.0000 | 0.0000 |
| 60 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 65 | 3 | 0 | 0.03 | 0.03 | 0.0000 | 0.0000 |
| 70 | 3 | 0 | 0.05 | 0.05 | 0.0000 | 0.0000 |
| 75 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 80 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 85 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 90 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| Greater than 92 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| Total | 9 | 0 | 0.09 | 0.10 | 0.0000 | 0.0000 |


Beneficiaries - Male

Recommendation: Currently, the System is using the RP-2000 Combined Healthy Male Mortality Table (set back 3 years) projected on a generational basis from the base year of 2012 using Projection Scale AA. We recommend using the RP-2000 Combined Healthy Male Mortality Table with ages set back 3 years projected on a generational basis from the base year of 2000 to 2013 using Projection Scale BB as the base table. The base table will be projected beyond the valuation date using the Buck Modified MP-2014.

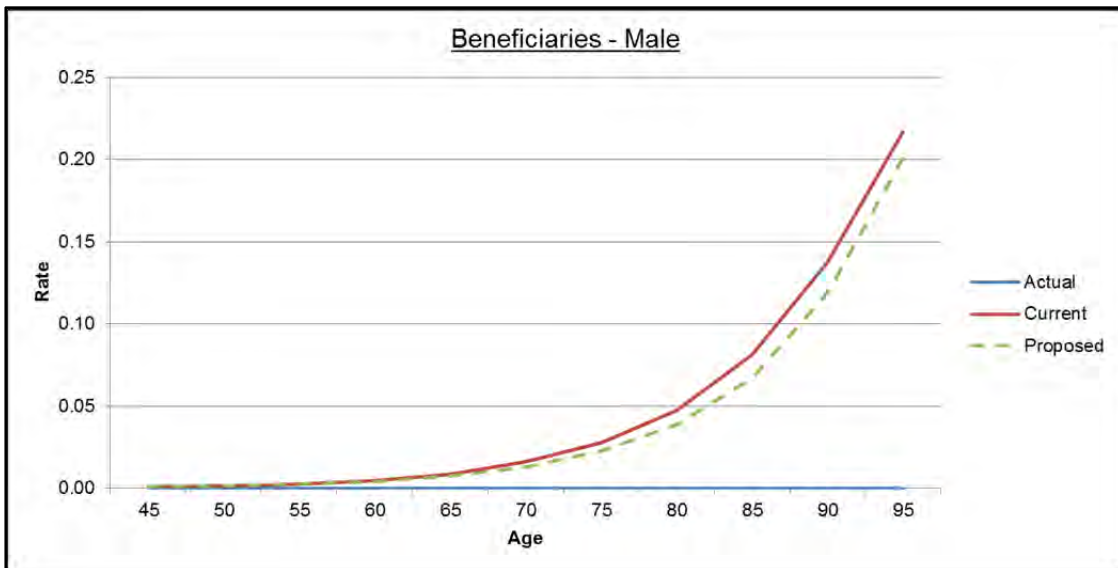| Central Age Group | Exposures | Actual Deaths | Expected Deaths | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| Less than 48 | 33 | 5 | 0.02 | 0.02 | 250.0000 | 250.0000 |
| 50 | 26 | 0 | 0.04 | 0.04 | 0.0000 | 0.0000 |
| 55 | 42 | 0 | 0.12 | 0.11 | 0.0000 | 0.0000 |
| 60 | 55 | 0 | 0.30 | 0.27 | 0.0000 | 0.0000 |
| 65 | 124 | 0 | 1.23 | 1.06 | 0.0000 | 0.0000 |
| 70 | 177 | 0 | 2.98 | 2.58 | 0.0000 | 0.0000 |
| 75 | 131 | 1 | 3.66 | 3.17 | 0.2732 | 0.3155 |
| 80 | 226 | 10 | 10.80 | 9.35 | 0.9259 | 1.0695 |
| 85 | 210 | 17 | 15.83 | 13.69 | 1.0739 | 1.2418 |
| 90 | 93 | 7 | 11.99 | 10.52 | 0.5838 | 0.6654 |
| Greater than 92 | 45 | 7 | 8.47 | 7.84 | 0.8264 | 0.8929 |
| Total | 1,162 | 47 | 55.44 | 48.65 | 0.8478 | 0.9661 |
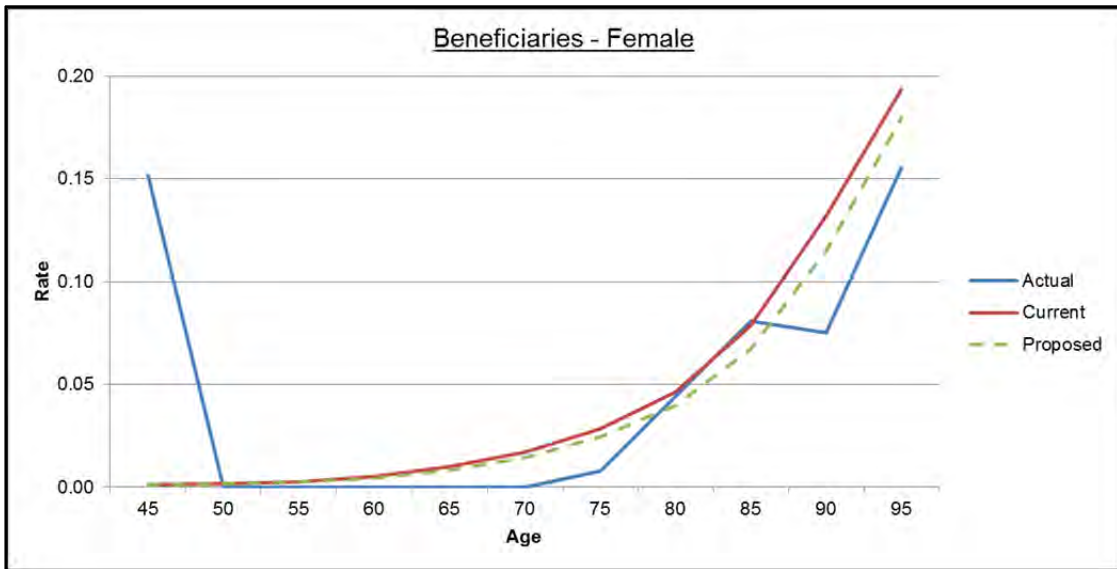


Beneficiaries - Female

Recommendation: Currently, the System is using the RP-2000 Combined Healthy Female Mortality Table projected on a generational basis from the base year of 2012 using Projection Scale AA. We recommend using the RP-2000 Combined Healthy Female Mortality Table projected on a generational basis from the base year of 2000 to 2013 using Projection Scale BB as the base table. The base table will be projected beyond the valuation date using the Buck Modified MP-2014.

### 3. Disability Mortality Rates

The data indicates that actual deaths are in line with expectations.

#### Male

| Central Age Group | Exposures | Actual Deaths | Expected Deaths | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| Less than 48 | 208 | 0 | 0.41 | 0.41 | 0.0000 | 0.0000 |
| 50 | 174 | 1 | 0.63 | 0.63 | 1.5873 | 1.5873 |
| 55 | 89 | 1 | 0.60 | 0.60 | 1.6667 | 1.6667 |
| 60 | 55 | 0 | 0.69 | 0.69 | 0.0000 | 0.0000 |
| 65 | 40 | 1 | 0.92 | 0.92 | 1.0870 | 1.0870 |
| 70 | 67 | 1 | 2.59 | 2.59 | 0.3861 | 0.3861 |
| 75 | 32 | 2 | 1.83 | 1.83 | 1.0929 | 1.0929 |
| 80 | 3 | 0 | 0.37 | 0.37 | 0.0000 | 0.0000 |
| 85 | 5 | 1 | 1.03 | 1.03 | 0.9709 | 0.9709 |
| 90 | 2 | 0 | 0.47 | 0.47 | 0.0000 | 0.0000 |
| Greater than 92 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| Total | 675 | 7 | 9.54 | 9.54 | 0.7338 | 0.7338 |
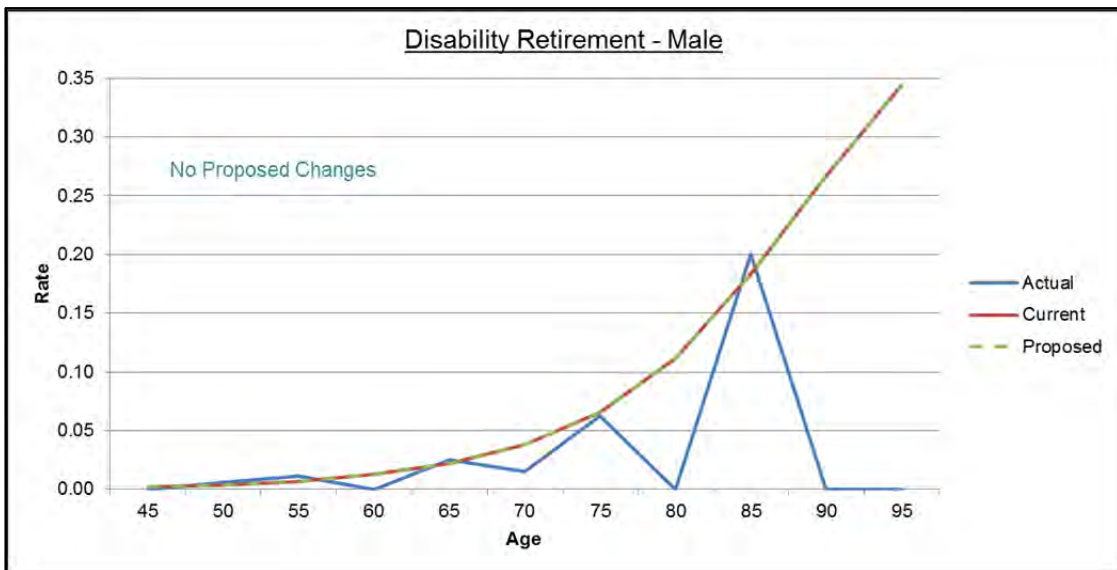


Disability Retirement - Male

Recommendation: No change from the current mortality basis: RP- 2000 Combined Healthy Male Mortality Table with ages set forward 5 years.

| Central Age Group | Exposures | Actual Deaths | Expected Deaths | | Ratio of Actual to Expected | |
|---|---|---|---|---|---|---|
| | | | Current | Proposed | Current | Proposed |
| Less than 48 | 16 | 0 | 0.02 | 0.02 | 0.0000 | 0.0000 |
| 50 | 32 | 0 | 0.09 | 0.09 | 0.0000 | 0.0000 |
| 55 | 18 | 0 | 0.08 | 0.08 | 0.0000 | 0.0000 |
| 60 | 2 | 0 | 0.02 | 0.02 | 0.0000 | 0.0000 |
| 65 | 4 | 0 | 0.06 | 0.06 | 0.0000 | 0.0000 |
| 70 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 75 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 80 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 85 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| 90 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| Greater than 92 | 0 | 0 | 0.00 | 0.00 | 0.0000 | 0.0000 |
| Total | 72 | 0 | 0.27 | 0.27 | 0.0000 | 0.0000 |
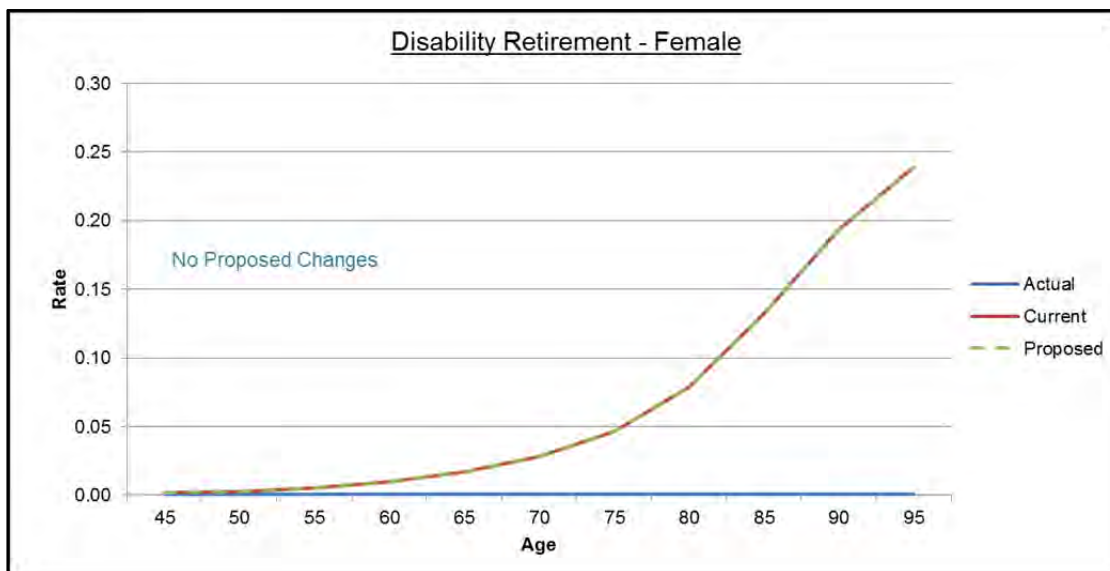


Disability Retirement - Female

Recommendation: No change from the current mortality basis: RP- 2000 Combined Healthy Female Mortality Table with ages set forward 5 years.

# IV. Summary of Proposed Assumptions

As noted earlier in the report, the experience investigation for the period from July 1, 2011 to June 30, 2014 indicates the need for certain changes in the tables used for determining the liabilities of the System.  The proposed changes are summarized as follows:

| Rates | Proposed Changes |
|---|---|
| **Non-Vested Withdrawal** | |
| Less Than Five Years of Service | Decrease |
| Five to Nineteen Years of Service | Adjust[1] |
| | |
| **Death** | |
| Ordinary | Change[2] |
| Accidental | No Change |
| | |
| **Disability** | |
| Ordinary | Decrease |
| Accidental | No Change |
| | |
| **Service Retirement** | |
| 20 Years of Service | No Change |
| 21 Years of Service | No Change |
| 22 to 24 Years of Service | No Change |
| 25 Years of Service | Increase |
| Greater Than 25 Years of Service | Increase |
| | |
| **Salary Increase** | No Change |
| | |
| **Inactive Mortality** | |
| Service Retirements | Change[2] |
| Beneficiaries of Deceased Active and Retired Members | Change[2] |
| Disability Retirements | No Change |

1. Increase the rate for central age group 35 and decrease the rates for all other ages.
2. In addition, the base table will be projected beyond the valuation date using the Buck Modified MP-2014.

# V. Cost Impact of the Proposed Assumptions

The overall effect of the proposed changes in assumptions would be to increase the normal contribution and the accrued liability payment. The following chart presents a summary of the liabilities and contributions under the current and proposed assumptions:

|  | Current | Proposed |
|---|---|---|
| **Actuarial Accrued Liability** | $ 2,963,182,120 | $ 3,013,625,246 |
| **Additional Accrued Liability** | | |
| **Unfunded Accrued** Liability/(Surplus) | $ 981,805,625 | $ 1,032,248,751 |
| **Funded Ratios** | | |
| Actuarial Value of Assets | 66.9% | 65.7% |
| Market Value of Assets | 66.4% | 65.3% |
| **Recommended Contribution:** | | |
| Normal Cost | $ 32,210,942 | $ 32,699,831 |
| Accrued Liability | 86,389,763 | 90,828,289 |
| **Total Contribution** | $ 118,600,705 | $ 123,528,120 |
| **Additional Annual Contribution** | | $ 4,927,415 |

The calculations were based on the same data and actuarial methods as were used in the July 1, 2014 valuation, including a 7.90% interest rate. In addition, the comparison of contribution amounts presented are based on the full recommended contribution amounts.

# Appendix A. Comparison of Actual, Current and Proposed Rates of Separation and Mortality

The following tables give a comparison of the actual, current and proposed rates of separation from active service and rates of mortality for active and retired members at quinquennial ages.

**TABLE 1**

**COMPARISON OF ACTUAL AND EXPECTED RATES OF SEPARATION
FROM ACTIVE SERVICE**

**WITHDRAWALS**

### LESS THAN FIVE YEARS OF SERVICE

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates |
|---|---|---|---|
| 20 | 0.00000 | 0.00000 | 0.00000 |
| 25 | 0.00000 | 0.00500 | 0.00375 |
| 30 | 0.00225 | 0.00500 | 0.00375 |
| 35 | 0.00735 | 0.00825 | 0.00825 |
| 40 | 0.00000 | 0.00000 | 0.00000 |
| 45 | 0.00000 | 0.00000 | 0.00000 |
| 50 | 0.00000 | 0.00000 | 0.00000 |
| 53 | 0.00000 | 0.00000 | 0.00000 |
| 54 | 0.00000 | 0.00000 | 0.00000 |

### FIVE TO NINETEEN YEARS OF SERVICE

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates |
|---|---|---|---|
| 20 | 0.00000 | 0.00000 | 0.00000 |
| 25 | 0.00000 | 0.00000 | 0.00000 |
| 30 | 0.00000 | 0.00400 | 0.00200 |
| 35 | 0.00180 | 0.00100 | 0.00140 |
| 40 | 0.00000 | 0.00150 | 0.00075 |
| 45 | 0.00000 | 0.00200 | 0.00100 |
| 50 | 0.00000 | 0.00000 | 0.00000 |
| 53 | 0.00000 | 0.00000 | 0.00000 |
| 54 | 0.00000 | 0.00000 | 0.00000 |

**TABLE 2**

**COMPARISON OF ACTUAL AND EXPECTED RATES OF SEPARATION
FROM ACTIVE SERVICE**

**DISABILITY RETIREMENTS**

ORDINARY CAUSES

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates |
|---|---|---|---|
| 20 | 0.00000 | 0.00042 | 0.00029 |
| 25 | 0.00000 | 0.00057 | 0.00040 |
| 30 | 0.00070 | 0.00084 | 0.00059 |
| 35 | 0.00111 | 0.00214 | 0.00150 |
| 40 | 0.00132 | 0.00245 | 0.00172 |
| 45 | 0.00122 | 0.00318 | 0.00223 |
| 50 | 0.00080 | 0.00538 | 0.00377 |
| 53 | 0.00000 | 0.00672 | 0.00470 |
| 54 | 0.02740 | 0.00722 | 0.00505 |

ACCIDENTAL CAUSES

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates: No Change |
|---|---|---|---|
| 20 | 0.00000 | 0.00016 | 0.00016 |
| 25 | 0.00000 | 0.00023 | 0.00023 |
| 30 | 0.00070 | 0.00051 | 0.00051 |
| 35 | 0.00111 | 0.00194 | 0.00194 |
| 40 | 0.00132 | 0.00207 | 0.00207 |
| 45 | 0.00243 | 0.00214 | 0.00214 |
| 50 | 0.00321 | 0.00231 | 0.00231 |
| 53 | 0.00000 | 0.00275 | 0.00275 |
| 54 | 0.00000 | 0.00295 | 0.00295 |

TABLE 3

**COMPARISON OF ACTUAL AND EXPECTED RATES OF SEPARATION
FROM ACTIVE SERVICE**

**SERVICE RETIREMENTS**

TWENTY YEARS OF SERVICE

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates: No Change |
|---|---|---|---|
| 40 | 0.00000 | 0.02000 | 0.02000 |
| 45 | 0.02041 | 0.02000 | 0.02000 |
| 50 | 0.02381 | 0.02000 | 0.02000 |
| 53 | 0.00000 | 0.02000 | 0.02000 |
| 54 | 0.00000 | 0.02000 | 0.02000 |

TWENTY-ONE YEARS OF SERVICE

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates: No Change |
|---|---|---|---|
| 40 | 0.00000 | 0.00500 | 0.00500 |
| 45 | 0.00000 | 0.00500 | 0.00500 |
| 50 | 0.00000 | 0.00500 | 0.00500 |
| 53 | 0.00000 | 0.00500 | 0.00500 |
| 54 | 0.00000 | 0.00500 | 0.00500 |

TWENTY-TWO TO TWENTY-FOUR YEARS OF SERVICE

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates: No Change |
|---|---|---|---|
| 40 | 0.00000 | 0.00000 | 0.00000 |
| 45 | 0.00484 | 0.00000 | 0.00000 |
| 50 | 0.00327 | 0.00000 | 0.00000 |
| 53 | 0.14286 | 0.00000 | 0.00000 |
| 54 | 0.00000 | 0.00000 | 0.00000 |

# TABLE 3

## COMPARISON OF ACTUAL AND EXPECTED RATES OF SEPARATION
## FROM ACTIVE SERVICE

## SERVICE RETIREMENTS
### (Continued)

### TWENTY-FIVE YEARS OF SERVICE

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates |
|---|---|---|---|
| 45 | 0.55349 | 0.45500 | 0.50000 |
| 50 | 0.55409 | 0.45500 | 0.50000 |
| 53 | 0.42105 | 0.45500 | 0.50000 |
| 54 | 0.78571 | 0.45500 | 0.50000 |

### OVER TWENTY-FIVE YEARS OF SERVICE

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates |
|---|---|---|---|
| 45 | 0.29630 | 0.25000 | 0.28000 |
| 50 | 0.36710 | 0.30000 | 0.33000 |
| 53 | 0.34880 | 0.30000 | 0.33000 |
| 54 | 0.66670 | 0.55000 | 0.61000 |

**TABLE 4**

**COMPARISON OF ACTUAL AND EXPECTED**

**SALARY INCREASES**

| Central Age of Group | Actual Rates | Current Rates | | Proposed Rates: No Change | |
|---|---|---|---|---|---|
| | | Through Fiscal Year Ending 2021 | Fiscal Year Ending 2022 and Thereafter | Through Fiscal Year Ending 2021 | Fiscal Year Ending 2022 and Thereafter |
| 25 | 6.956% | 3.450% | 4.450% | 3.450% | 4.450% |
| 30 | 7.207% | 3.450% | 4.450% | 3.450% | 4.450% |
| 35 | 5.996% | 3.450% | 4.450% | 3.450% | 4.450% |
| 40 | 4.847% | 3.450% | 4.450% | 3.450% | 4.450% |
| 45 | 5.144% | 3.450% | 4.450% | 3.450% | 4.450% |
| 50 | 4.745% | 3.450% | 4.450% | 3.450% | 4.450% |
| Over 52 | 4.851% | 3.450% | 4.450% | 3.450% | 4.450% |

# TABLE 5

## COMPARISON OF ACTUAL AND EXPECTED RATES OF SEPARATION
## FROM ACTIVE SERVICE

### DEATHS

### ORDINARY CAUSE

MALE

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates* |
|---|---|---|---|
| 20 | 0.00000 | 0.00031 | 0.00030 |
| 25 | 0.00000 | 0.00036 | 0.00035 |
| 30 | 0.00000 | 0.00039 | 0.00037 |
| 35 | 0.00000 | 0.00057 | 0.00055 |
| 40 | 0.00070 | 0.00090 | 0.00087 |
| 45 | 0.00063 | 0.00123 | 0.00118 |
| 50 | 0.00000 | 0.00174 | 0.00168 |
| 53 | 0.00000 | 0.00214 | 0.00206 |
| 54 | 0.00000 | 0.00245 | 0.00236 |

* The base table will be projected beyond the valuation date using the Buck Modified MP-2014.

FEMALE

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates* |
|---|---|---|---|
| 20 | 0.00000 | 0.00019 | 0.00018 |
| 25 | 0.00000 | 0.00021 | 0.00020 |
| 30 | 0.00000 | 0.00028 | 0.00027 |
| 35 | 0.00000 | 0.00047 | 0.00046 |
| 40 | 0.00000 | 0.00072 | 0.00069 |
| 45 | 0.00000 | 0.00113 | 0.00108 |
| 50 | 0.00000 | 0.00171 | 0.00164 |
| 53 | 0.00000 | 0.00221 | 0.00212 |
| 54 | 0.00000 | 0.00242 | 0.00230 |

* The base table will be projected beyond the valuation date using the Buck Modified MP-2014.

**TABLE 6**


**COMPARISON OF ACTUAL AND EXPECTED RATES OF SEPARATION
FROM ACTIVE SERVICE**


**DEATHS**


**ACCIDENTAL CAUSE**

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates: No Change |
|---|---|---|---|
| 20 | 0.00000 | 0.00020 | 0.00020 |
| 25 | 0.00000 | 0.00034 | 0.00034 |
| 30 | 0.00000 | 0.00048 | 0.00048 |
| 35 | 0.00000 | 0.00050 | 0.00050 |
| 40 | 0.00066 | 0.00050 | 0.00050 |
| 45 | 0.00000 | 0.00068 | 0.00068 |
| 50 | 0.00000 | 0.00086 | 0.00086 |
| 53 | 0.00000 | 0.00050 | 0.00050 |
| 54 | 0.00000 | 0.00030 | 0.00030 |

**TABLE 7**

**COMPARISON OF ACTUAL AND EXPECTED RATES OF MORTALITY
AFTER RETIREMENT**

## MALE SERVICE RETIREMENT

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates* |
|:---:|:---:|:---:|:---:|
| 45 | 0.00000 | 0.00123 | 0.00118 |
| 50 | 0.00000 | 0.00174 | 0.00168 |
| 55 | 0.00265 | 0.00268 | 0.00256 |
| 60 | 0.00426 | 0.00475 | 0.00432 |
| 65 | 0.00434 | 0.00890 | 0.00758 |
| 70 | 0.01058 | 0.01618 | 0.01329 |
| 75 | 0.01692 | 0.02767 | 0.02273 |
| 80 | 0.03911 | 0.04739 | 0.03894 |
| 85 | 0.08710 | 0.08128 | 0.06700 |
| 90 | 0.13889 | 0.13732 | 0.11927 |

* The base table will be projected beyond the valuation date using the Buck Modified MP-2014.

## FEMALE SERVICE RETIREMENT

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates* |
|:---:|:---:|:---:|:---:|
| 45 | 0.00000 | 0.00113 | 0.00108 |
| 50 | 0.00000 | 0.00171 | 0.00164 |
| 55 | 0.00000 | 0.00278 | 0.00260 |
| 60 | 0.00000 | 0.00518 | 0.00453 |
| 65 | 0.00000 | 0.00982 | 0.00839 |
| 70 | 0.00000 | 0.01686 | 0.01441 |
| 75 | 0.00000 | 0.02832 | 0.02421 |
| 80 | 0.00000 | 0.04641 | 0.03967 |
| 85 | 0.00000 | 0.07844 | 0.06704 |
| 90 | 0.00000 | 0.13207 | 0.11493 |

* The base table will be projected beyond the valuation date using the Buck Modified MP-2014.

# TABLE 8

## COMPARISON OF ACTUAL AND EXPECTED RATES OF MORTALITY AFTER RETIREMENT

MALE BENEFICIARY OF DECEASED ACTIVE AND RETIRED MEMBERS

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates* |
|---|---|---|---|
| 45 | 0.00000 | 0.00123 | 0.00118 |
| 50 | 0.00000 | 0.00174 | 0.00168 |
| 55 | 0.00000 | 0.00268 | 0.00256 |
| 60 | 0.00000 | 0.00475 | 0.00432 |
| 65 | 0.00000 | 0.00890 | 0.00758 |
| 70 | 0.00000 | 0.01618 | 0.01329 |
| 75 | 0.00000 | 0.02767 | 0.02273 |
| 80 | 0.00000 | 0.04739 | 0.03894 |
| 85 | 0.00000 | 0.08128 | 0.06700 |
| 90 | 0.00000 | 0.13732 | 0.11927 |

* The base table will be projected beyond the valuation date using the Buck Modified MP-2014.

FEMALE BENEFICIARY OF DECEASED ACTIVE AND RETIRED MEMBERS

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates* |
|---|---|---|---|
| 45 | 0.15152 | 0.00113 | 0.00108 |
| 50 | 0.00000 | 0.00171 | 0.00164 |
| 55 | 0.00000 | 0.00278 | 0.00260 |
| 60 | 0.00000 | 0.00518 | 0.00453 |
| 65 | 0.00000 | 0.00982 | 0.00839 |
| 70 | 0.00000 | 0.01686 | 0.01441 |
| 75 | 0.00763 | 0.02832 | 0.02421 |
| 80 | 0.04425 | 0.04641 | 0.03967 |
| 85 | 0.08095 | 0.07844 | 0.06704 |
| 90 | 0.07527 | 0.13207 | 0.11493 |

* The base table will be projected beyond the valuation date using the Buck Modified MP-2014.

**TABLE 9**

**COMPARISON OF ACTUAL AND EXPECTED RATES OF MORTALITY
AFTER RETIREMENT**

MALE DISABILITY RETIREMENT

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates: No Change |
|---|---|---|---|
| 45 | 0.00000 | 0.00222 | 0.00222 |
| 50 | 0.00575 | 0.00373 | 0.00373 |
| 55 | 0.01124 | 0.00688 | 0.00688 |
| 60 | 0.00000 | 0.01290 | 0.01290 |
| 65 | 0.02500 | 0.02235 | 0.02235 |
| 70 | 0.01493 | 0.03824 | 0.03824 |
| 75 | 0.06250 | 0.06539 | 0.06539 |
| 80 | 0.00000 | 0.11182 | 0.11182 |
| 85 | 0.20000 | 0.18336 | 0.18336 |
| 90 | 0.00000 | 0.26712 | 0.26712 |

FEMALE DISABILITY RETIREMENT

| Central Age of Group | Actual Rates | Current Rates | Proposed Rates: No Change |
|---|---|---|---|
| 45 | 0.00000 | 0.00171 | 0.00171 |
| 50 | 0.00000 | 0.00278 | 0.00278 |
| 55 | 0.00000 | 0.00518 | 0.00518 |
| 60 | 0.00000 | 0.00982 | 0.00982 |
| 65 | 0.00000 | 0.01686 | 0.01686 |
| 70 | 0.00000 | 0.02832 | 0.02832 |
| 75 | 0.00000 | 0.04641 | 0.04641 |
| 80 | 0.00000 | 0.07884 | 0.07884 |
| 85 | 0.00000 | 0.13207 | 0.13207 |
| 90 | 0.00000 | 0.19367 | 0.19367 |

# Appendix B: Complete Set of Proposed Assumptions

# TABLE 1

## ACTIVE WITHDRAWAL TABLES

| AGE | RATE OF WITHDRAWAL | |
| | Less than 5 Years of Service | 5 to 19 Years of Service |
| --- | --- | --- |
| 19 | 0.00000 | 0.00000 |
| 20 | 0.00000 | 0.00000 |
| 21 | 0.00000 | 0.00000 |
| 22 | 0.00000 | 0.00000 |
| 23 | 0.00375 | 0.00000 |
| 24 | 0.00375 | 0.00000 |
| 25 | 0.00375 | 0.00000 |
| 26 | 0.00375 | 0.00000 |
| 27 | 0.00375 | 0.00000 |
| 28 | 0.00375 | 0.00200 |
| 29 | 0.00375 | 0.00200 |
| 30 | 0.00375 | 0.00200 |
| 31 | 0.00375 | 0.00200 |
| 32 | 0.00375 | 0.00200 |
| 33 | 0.00825 | 0.00140 |
| 34 | 0.00825 | 0.00140 |
| 35 | 0.00825 | 0.00140 |
| 36 | 0.00825 | 0.00140 |
| 37 | 0.00825 | 0.00140 |
| 38 | 0.00000 | 0.00075 |
| 39 | 0.00000 | 0.00075 |
| 40 | 0.00000 | 0.00075 |
| 41 | 0.00000 | 0.00075 |
| 42 | 0.00000 | 0.00075 |
| 43 | 0.00000 | 0.00100 |
| 44 | 0.00000 | 0.00100 |
| 45 | 0.00000 | 0.00100 |
| 46 | 0.00000 | 0.00100 |
| 47 | 0.00000 | 0.00100 |
| 48 | 0.00000 | 0.00000 |
| 49 | 0.00000 | 0.00000 |
| 50 | 0.00000 | 0.00000 |
| 51 | 0.00000 | 0.00000 |
| 52 | 0.00000 | 0.00000 |
| 53 | 0.00000 | 0.00000 |
| 54 | 0.00000 | 0.00000 |

# TABLE 2

## ACTIVE DISABILITY TABLES

| AGE | RATES OF DISABILITY | |
|---|---|---|
| | Ordinary | Accidental |
| 19 | 0.00027 | 0.00015 |
| 20 | 0.00027 | 0.00015 |
| 21 | 0.00027 | 0.00015 |
| 22 | 0.00035 | 0.00020 |
| 23 | 0.00035 | 0.00020 |
| 24 | 0.00035 | 0.00020 |
| 25 | 0.00041 | 0.00025 |
| 26 | 0.00041 | 0.00025 |
| 27 | 0.00048 | 0.00025 |
| 28 | 0.00048 | 0.00045 |
| 29 | 0.00055 | 0.00045 |
| 30 | 0.00061 | 0.00053 |
| 31 | 0.00061 | 0.00053 |
| 32 | 0.00069 | 0.00060 |
| 33 | 0.00102 | 0.00188 |
| 34 | 0.00136 | 0.00191 |
| 35 | 0.00169 | 0.00194 |
| 36 | 0.00170 | 0.00196 |
| 37 | 0.00171 | 0.00199 |
| 38 | 0.00172 | 0.00202 |
| 39 | 0.00172 | 0.00205 |
| 40 | 0.00172 | 0.00208 |
| 41 | 0.00172 | 0.00209 |
| 42 | 0.00172 | 0.00210 |
| 43 | 0.00172 | 0.00211 |
| 44 | 0.00191 | 0.00212 |
| 45 | 0.00218 | 0.00214 |
| 46 | 0.00252 | 0.00215 |
| 47 | 0.00281 | 0.00216 |
| 48 | 0.00314 | 0.00217 |
| 49 | 0.00342 | 0.00218 |
| 50 | 0.00375 | 0.00220 |
| 51 | 0.00410 | 0.00240 |
| 52 | 0.00443 | 0.00260 |
| 53 | 0.00470 | 0.00275 |
| 54 | 0.00505 | 0.00295 |

# TABLE 3

## ACTIVE SERVICE RETIREMENT TABLES

| AGE | RATES OF SERVICE RETIREMENTS | | | | |
| --- | --- | --- | --- | --- | --- |
| | 20 Years of Service | 21 Years of Service | 22 - 24 Years of Service | 25 Years of Service | Greater Than 25 Years of Service |
| 40 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.05000 |
| 41 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.05000 |
| 42 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.05000 |
| 43 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.28000 |
| 44 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.28000 |
| 45 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.28000 |
| 46 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.28000 |
| 47 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.28000 |
| 48 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.33000 |
| 49 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.33000 |
| 50 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.33000 |
| 51 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.33000 |
| 52 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.33000 |
| 53 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.33000 |
| 54 | 0.02000 | 0.00500 | 0.00000 | 0.50000 | 0.61000 |

# TABLE 4

## ACTIVE SALARY INCREASE TABLES

| AGE | Through Fiscal Year Ending 2021 | Fiscal Year Ending 2022 and Thereafter |
|---|---|---|
| 19 | 0.03450 | 0.04450 |
| 20 | 0.03450 | 0.04450 |
| 21 | 0.03450 | 0.04450 |
| 22 | 0.03450 | 0.04450 |
| 23 | 0.03450 | 0.04450 |
| 24 | 0.03450 | 0.04450 |
| 25 | 0.03450 | 0.04450 |
| 26 | 0.03450 | 0.04450 |
| 27 | 0.03450 | 0.04450 |
| 28 | 0.03450 | 0.04450 |
| 29 | 0.03450 | 0.04450 |
| 30 | 0.03450 | 0.04450 |
| 31 | 0.03450 | 0.04450 |
| 32 | 0.03450 | 0.04450 |
| 33 | 0.03450 | 0.04450 |
| 34 | 0.03450 | 0.04450 |
| 35 | 0.03450 | 0.04450 |
| 36 | 0.03450 | 0.04450 |
| 37 | 0.03450 | 0.04450 |
| 38 | 0.03450 | 0.04450 |
| 39 | 0.03450 | 0.04450 |
| 40 | 0.03450 | 0.04450 |
| 41 | 0.03450 | 0.04450 |
| 42 | 0.03450 | 0.04450 |
| 43 | 0.03450 | 0.04450 |
| 44 | 0.03450 | 0.04450 |
| 45 | 0.03450 | 0.04450 |
| 46 | 0.03450 | 0.04450 |
| 47 | 0.03450 | 0.04450 |
| 48 | 0.03450 | 0.04450 |
| 49 | 0.03450 | 0.04450 |
| 50 | 0.03450 | 0.04450 |
| 51 | 0.03450 | 0.04450 |
| 52 | 0.03450 | 0.04450 |
| 53 | 0.03450 | 0.04450 |
| 54 | 0.03450 | 0.04450 |

# TABLE 5

## ACTIVE DEATH TABLES

| AGE | RATES OF DEATH | | |
|:---:|:---:|:---:|:---:|
| | Ordinary* | | Accidental |
| | Male | Female | |
| 19 | 0.000273 | 0.000183 | 0.00020 |
| 20 | 0.000289 | 0.000184 | 0.00020 |
| 21 | 0.000304 | 0.000185 | 0.00020 |
| 22 | 0.000318 | 0.000187 | 0.00020 |
| 23 | 0.000332 | 0.000189 | 0.00020 |
| 24 | 0.000343 | 0.000193 | 0.00030 |
| 25 | 0.000352 | 0.000199 | 0.00040 |
| 26 | 0.000359 | 0.000206 | 0.00040 |
| 27 | 0.000362 | 0.000214 | 0.00040 |
| 28 | 0.000362 | 0.000226 | 0.00040 |
| 29 | 0.000364 | 0.000239 | 0.00050 |
| 30 | 0.000367 | 0.000254 | 0.00050 |
| 31 | 0.000378 | 0.000295 | 0.00050 |
| 32 | 0.000396 | 0.000337 | 0.00050 |
| 33 | 0.000427 | 0.000379 | 0.00050 |
| 34 | 0.000480 | 0.000418 | 0.00050 |
| 35 | 0.000540 | 0.000457 | 0.00050 |
| 36 | 0.000607 | 0.000494 | 0.00050 |
| 37 | 0.000675 | 0.000533 | 0.00050 |
| 38 | 0.000743 | 0.000575 | 0.00050 |
| 39 | 0.000809 | 0.000623 | 0.00050 |
| 40 | 0.000869 | 0.000679 | 0.00050 |
| 41 | 0.000927 | 0.000744 | 0.00050 |
| 42 | 0.000982 | 0.000819 | 0.00050 |
| 43 | 0.001038 | 0.000901 | 0.00060 |
| 44 | 0.001098 | 0.000990 | 0.00060 |
| 45 | 0.001168 | 0.001081 | 0.00060 |
| 46 | 0.001249 | 0.001176 | 0.00070 |
| 47 | 0.001343 | 0.001275 | 0.00090 |
| 48 | 0.001450 | 0.001379 | 0.00090 |
| 49 | 0.001554 | 0.001491 | 0.00090 |
| 50 | 0.001668 | 0.001612 | 0.00090 |
| 51 | 0.001789 | 0.001781 | 0.00090 |
| 52 | 0.001919 | 0.001941 | 0.00070 |
| 53 | 0.002056 | 0.002122 | 0.00050 |
| 54 | 0.002355 | 0.002301 | 0.00030 |

\* The base table will be projected beyond the valuation date using the Buck Modified MP-2014.

# TABLE 6

## MORTALITY TABLES FOR SERVICE RETIREMENTS AND BENEFICIARIES OF DECEASED ACTIVE AND RETIRED MEMBERS

| AGE | RATES OF MORTALITY | | AGE | RATES OF MORTALITY | |
|---|---|---|---|---|---|
| | MALE* | FEMALE* | | MALE* | FEMALE* |
| 19 | 0.000273 | 0.000183 | 65 | 0.007485 | 0.008296 |
| 20 | 0.000289 | 0.000184 | 66 | 0.008446 | 0.009363 |
| 21 | 0.000304 | 0.000185 | 67 | 0.009391 | 0.010396 |
| 22 | 0.000318 | 0.000187 | 68 | 0.010465 | 0.011492 |
| 23 | 0.000332 | 0.000189 | 69 | 0.011839 | 0.012702 |
| 24 | 0.000343 | 0.000193 | 70 | 0.013208 | 0.014310 |
| 25 | 0.000352 | 0.000199 | 71 | 0.014683 | 0.015880 |
| 26 | 0.000359 | 0.000206 | 72 | 0.016270 | 0.017663 |
| 27 | 0.000362 | 0.000214 | 73 | 0.018245 | 0.019634 |
| 28 | 0.000362 | 0.000226 | 74 | 0.020187 | 0.021760 |
| 29 | 0.000364 | 0.000239 | 75 | 0.022415 | 0.024024 |
| 30 | 0.000367 | 0.000254 | 76 | 0.024967 | 0.026468 |
| 31 | 0.000378 | 0.000295 | 77 | 0.027853 | 0.029151 |
| 32 | 0.000396 | 0.000337 | 78 | 0.031085 | 0.032134 |
| 33 | 0.000427 | 0.000379 | 79 | 0.034647 | 0.035477 |
| 34 | 0.000480 | 0.000418 | 80 | 0.038539 | 0.039215 |
| 35 | 0.000540 | 0.000457 | 81 | 0.042825 | 0.043404 |
| 36 | 0.000607 | 0.000494 | 82 | 0.047594 | 0.048117 |
| 37 | 0.000675 | 0.000533 | 83 | 0.052886 | 0.053427 |
| 38 | 0.000743 | 0.000575 | 84 | 0.059190 | 0.059420 |
| 39 | 0.000809 | 0.000623 | 85 | 0.066129 | 0.066197 |
| 40 | 0.000869 | 0.000679 | 86 | 0.073714 | 0.073830 |
| 41 | 0.000927 | 0.000744 | 87 | 0.083069 | 0.082344 |
| 42 | 0.000982 | 0.000819 | 88 | 0.093432 | 0.091717 |
| 43 | 0.001038 | 0.000901 | 89 | 0.104961 | 0.101847 |
| 44 | 0.001098 | 0.000990 | 90 | 0.117822 | 0.114046 |
| 45 | 0.001168 | 0.001081 | 91 | 0.132146 | 0.126893 |
| 46 | 0.001249 | 0.001176 | 92 | 0.147966 | 0.140140 |
| 47 | 0.001343 | 0.001275 | 93 | 0.165223 | 0.153534 |
| 48 | 0.001450 | 0.001379 | 94 | 0.182334 | 0.166845 |
| 49 | 0.001554 | 0.001491 | 95 | 0.200305 | 0.179872 |
| 50 | 0.001668 | 0.001612 | 96 | 0.218921 | 0.192423 |
| 51 | 0.001789 | 0.001781 | 97 | 0.237965 | 0.204312 |
| 52 | 0.001919 | 0.001941 | 98 | 0.253910 | 0.212577 |
| 53 | 0.002056 | 0.002122 | 99 | 0.273030 | 0.222524 |
| 54 | 0.002355 | 0.002301 | 100 | 0.288366 | 0.228371 |
| 55 | 0.002565 | 0.002546 | 101 | 0.307196 | 0.238544 |
| 56 | 0.002804 | 0.002857 | 102 | 0.321724 | 0.247960 |
| 57 | 0.003034 | 0.003174 | 103 | 0.340104 | 0.262606 |
| 58 | 0.003395 | 0.003534 | 104 | 0.353994 | 0.275449 |
| 59 | 0.003884 | 0.003949 | 105 | 0.371685 | 0.293116 |
| 60 | 0.004283 | 0.004436 | 106 | 0.383040 | 0.307811 |
| 61 | 0.004750 | 0.005035 | 107 | 0.392003 | 0.322725 |
| 62 | 0.005286 | 0.005690 | 108 | 0.397886 | 0.337441 |
| 63 | 0.005921 | 0.006537 | 109 | 0.400000 | 0.351544 |
| 64 | 0.006648 | 0.007367 | 110 | 0.400000 | 0.364617 |

* The base table will be projected beyond the valuation date using the Buck Modified MP-2014.

# TABLE 7

## MORTALITY TABLES FOR DISABILITY RETIREMENTS

| AGE | RATES OF MORTALITY | | AGE | RATES OF MORTALITY | |
|---|---|---|---|---|---|
| | MALE | FEMALE | | MALE | FEMALE |
| 19 | 0.000376 | 0.000201 | 61 | 0.014409 | 0.010954 |
| 20 | 0.000376 | 0.000207 | 62 | 0.016075 | 0.012163 |
| 21 | 0.000378 | 0.000214 | 63 | 0.017871 | 0.013445 |
| 22 | 0.000382 | 0.000223 | 64 | 0.019802 | 0.014860 |
| 23 | 0.000393 | 0.000235 | 65 | 0.022206 | 0.016742 |
| 24 | 0.000412 | 0.000248 | 66 | 0.024570 | 0.018579 |
| 25 | 0.000444 | 0.000264 | 67 | 0.027281 | 0.020665 |
| 26 | 0.000499 | 0.000307 | 68 | 0.030387 | 0.022970 |
| 27 | 0.000562 | 0.000350 | 69 | 0.033900 | 0.025458 |
| 28 | 0.000631 | 0.000394 | 70 | 0.037834 | 0.028106 |
| 29 | 0.000702 | 0.000435 | 71 | 0.042169 | 0.030966 |
| 30 | 0.000773 | 0.000475 | 72 | 0.046906 | 0.034105 |
| 31 | 0.000841 | 0.000514 | 73 | 0.052123 | 0.037595 |
| 32 | 0.000904 | 0.000554 | 74 | 0.057927 | 0.041506 |
| 33 | 0.000964 | 0.000598 | 75 | 0.064368 | 0.045879 |
| 34 | 0.001021 | 0.000648 | 76 | 0.072041 | 0.050780 |
| 35 | 0.001079 | 0.000706 | 77 | 0.080486 | 0.056294 |
| 36 | 0.001142 | 0.000774 | 78 | 0.089718 | 0.062506 |
| 37 | 0.001215 | 0.000852 | 79 | 0.099779 | 0.069517 |
| 38 | 0.001299 | 0.000937 | 80 | 0.110757 | 0.077446 |
| 39 | 0.001397 | 0.001029 | 81 | 0.122797 | 0.086376 |
| 40 | 0.001508 | 0.001124 | 82 | 0.136043 | 0.096337 |
| 41 | 0.001616 | 0.001223 | 83 | 0.150590 | 0.107303 |
| 42 | 0.001734 | 0.001326 | 84 | 0.166420 | 0.119154 |
| 43 | 0.001860 | 0.001434 | 85 | 0.183408 | 0.131682 |
| 44 | 0.001995 | 0.001550 | 86 | 0.199769 | 0.144604 |
| 45 | 0.002138 | 0.001676 | 87 | 0.216605 | 0.157618 |
| 46 | 0.002449 | 0.001852 | 88 | 0.233662 | 0.170433 |
| 47 | 0.002667 | 0.002018 | 89 | 0.250693 | 0.182799 |
| 48 | 0.002916 | 0.002207 | 90 | 0.267491 | 0.194509 |
| 49 | 0.003196 | 0.002424 | 91 | 0.283905 | 0.205379 |
| 50 | 0.003624 | 0.002717 | 92 | 0.299852 | 0.215240 |
| 51 | 0.004200 | 0.003090 | 93 | 0.315296 | 0.223947 |
| 52 | 0.004693 | 0.003478 | 94 | 0.330207 | 0.231387 |
| 53 | 0.005273 | 0.003923 | 95 | 0.344556 | 0.237467 |
| 54 | 0.005945 | 0.004441 | 96 | 0.358628 | 0.244834 |
| 55 | 0.006747 | 0.005055 | 97 | 0.371685 | 0.254498 |
| 56 | 0.007676 | 0.005814 | 98 | 0.383040 | 0.266044 |
| 57 | 0.008757 | 0.006657 | 99 | 0.392003 | 0.279055 |
| 58 | 0.010012 | 0.007648 | 100 | 0.397886 | 0.293116 |
| 59 | 0.011280 | 0.008619 | 101 | 0.400000 | 0.307811 |
| 60 | 0.012737 | 0.009706 | 102 | 0.400000 | 0.322725 |