

State Employees' Retirement System of Illinois

2018 Actuarial Experience Study

July 1, 2015 — June 30, 2018



June 17, 2019

Board of Trustees
State Employees' Retirement System
2101 South Veterans Parkway
Springfield, Illinois 62794-9255

Subject: 2018 Actuarial Experience Study

Dear Members of the Board:

We are pleased to present our report on the results of the 2018 Actuarial Experience Study for the State Employees' Retirement System of Illinois ("SERS" or "System"). The purpose of the study is to evaluate the continued appropriateness of the actuarial assumptions used in the annual actuarial valuation by comparing actual experience to expected experience. Our study was based on census information for the period from July 1, 2015, to June 30, 2018, as provided by SERS staff. This report includes our recommended assumptions and methods effective for the June 30, 2019, actuarial valuation. It also provides the actuarial impact produced by these recommendations as though they had been effective for the June 30, 2018, actuarial valuation.

Pursuant to Public Act 99-0232, effective August 3, 2015, the five state systems shall conduct an actuarial experience study at least once every three years.

Our study includes a review of the experience associated with the following actuarial assumptions:

- Price inflation;
- Investment return;
- General wage inflation and payroll growth;
- Salary increases;
- Mortality;
- Retirement;
- Withdrawal (Turnover);
- Deferred Vested member benefit adjustment; and
- Unused sick leave and optional service purchase adjustment.

Actuarial assumptions are set by the Board of Trustees. With the Board's approval of the recommendations in this report, we believe the actuarial condition of the System will be more accurately portrayed. The Board's decisions should be based on the appropriateness of each recommendation individually, not on their collective effect on the funding period or the unfunded liability.

This report should not be relied on for any purpose other than the purpose stated. This report may be provided to parties other than SERS only in its entirety and only with the permission of SERS. GRS is not responsible for unauthorized use of this report.

The results of the experience study and recommended assumptions set forth in this report are based on the data and actuarial techniques and methods previously described, and upon the provisions of the System as of the most recent actuarial valuation date, June 30, 2018. To the best of our knowledge, the information contained in this report is accurate and fairly presents the experience of members participating in the System for the period July 1, 2015, to June 30, 2018. All calculations have been made in conformity with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board.

Alex Rivera, Heidi G. Barry, and Jeffrey T. Tebeau are Members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

The signing actuaries are independent of the plan sponsor.

We believe that the proposed actuarial assumptions that are the result of this experience study represent a reasonable estimate of expected future experience of the State Employees' Retirement System of Illinois.

Respectfully submitted,

Gabriel, Roeder, Smith & Company



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SECTION A

EXECUTIVE SUMMARY

Executive Summary

The results of the three-year experience review of the State Employees' Retirement System of Illinois are presented in this report. Public Act 99-0232 requires an experience review once every three years.

The last comparable experience review was prepared for the period from July 1, 2012, to June 30, 2015. In this report, actual experience is compared to expected experience for the three-year period from July 1, 2015, to June 30, 2018, in order to evaluate and update the actuarial assumptions used for the most recent actuarial valuation as of June 30, 2018. The cost impact of the updated assumptions was measured as of June 30, 2018. The updated actuarial assumptions are effective beginning with the actuarial valuation as of June 30, 2019.

Based on our review of the actuarial experience, we recommend the following updates to the principal actuarial valuation assumptions:

- Decrease the assumed investment return assumption from 7.00 percent to 6.75 percent.
- Reduce the price inflation assumption from 2.50 percent to 2.25 percent.
- Reduce the general payroll growth assumption from 3.00 percent to 2.75 percent.
- Maintain the salary increase assumption.
- Update the mortality tables to the Pub 2010 General Healthy Retiree and Employee Mortality Tables for members covered under the Regular Benefit formula, and the Pub 2010 Public Safety Healthy Retiree and Employee Mortality Tables for members covered under the Alternative Benefit formula, with adjustments for the Plan's credibility factors and future mortality improvements using Scale MP-2018.
- Adjust the normal and early retirement rates to better reflect observed experience. In general, overall increases are recommended for normal retirement rates and decreases in early retirement rates.
- Increase the current turnover rates for both Tier 1 and Tier 2 members.

Executive Summary

Based on the preceding recommended assumptions, the actuarial liability as of June 30, 2018, and the fiscal year 2020 statutory contributions are expected to change as follows:

| Actuarial Valuation as of June 30, 2018 (\$ in millions) | Actuarial Liability as of June 30, 2018 | Fiscal Year 2020 Statutory Contribution |
|---|--|--|
| Baseline | \$ 47,926 | \$ 2,291 |
| Impact due to: | | |
| • Buyout Program | \$ (292) -0.6% | \$ (20) -0.9% |
| • Mortality Table Changes | (1,682) -3.5% | (41) -1.8% |
| • Other Demographic Assumption Changes | 183 0.4% | (69) -3.0% |
| • Economic Assumption Changes | <u>1,273 2.7%</u> | <u>99 4.3%</u> |
| Total Impact | \$ (518) -1.0% | \$ (31) -1.4% |
| After Recommended Changes | \$ 47,408 | \$ 2,260 |

The funded ratio as of June 30, 2018, and the fiscal year 2020 Statutory Contribution as a percent of pay are expected to change as follows:

| Actuarial Valuation as of June 30, 2018 | Funded Ratio based on Market Value of Assets | Fiscal Year 2020 Statutory Contribution as a Percent of Pay |
|---|---|---|
| Baseline | 36.4% | 52.2% |
| Impact due to: | | |
| • Buyout program | 0.2% | -0.5% |
| • Mortality Table Changes | 1.4% | -0.9% |
| • Other Demographic Assumption Changes | -0.2% | -1.5% |
| • Economic Assumption Changes | <u>-1.0%</u> | <u>2.4%</u> |
| Total Impact | 0.4% | -0.5% |
| After Recommended Changes | 36.8% | 51.7% |

As shown in the above tables, the decrease in costs due to the mortality assumption change is partially offset by the increase in cost due to other demographic and economic assumption changes.

Executive Summary

The remainder of the report is an integral part of the Experience Study and includes:

- An introduction to key factors that were included in the study;
- An analysis of the experience and assumption recommendations;
- Cost impact of the proposed assumption changes; and
- Tables showing the recommended actuarial assumptions.

SECTION B

INTRODUCTION

Introduction

Background

For any pension plan, actuarial assumptions are selected that are intended to provide reasonable estimates of future expected events, such as investment returns, interest crediting, and patterns of retirement, turnover, and mortality. These assumptions, along with an actuarial cost method, an asset valuation method, the employee census data, and the System's provisions are used to determine the actuarial liabilities and overall actuarially determined funding requirements for the System. The true cost to the System over time will be the actual benefit payments and expenses required by the System's provisions for the participant group under the System. To the extent the actual experience deviates from the actuarial assumptions, experience gains and losses will occur. These gains (losses) then serve to reduce (increase) future actuarially determined contributions and increase (reduce) the funded ratio.

A periodic review and update of the actuarial assumptions is one of many important components of understanding and managing the financial aspects of the State Employees' Retirement System of Illinois. Use of outdated or inappropriate assumptions can result in understated costs which will lead to higher future contribution requirements or perhaps an inability to pay benefits when due; or, on the other hand, produce overstated costs which place an unnecessarily large burden on the current generation of members, employers, and taxpayers.

A single set of actuarial assumptions is typically not expected to be suitable forever. As the actual experience unfolds or the future expectations change, the assumptions should be reviewed and adjusted accordingly.

It is important to recognize that the impact from various outcomes and the ability to adjust from experience deviating from the assumption are not symmetric. Due to compounding economic forces, legal limitations, and moral obligations, outcomes from underestimating future liabilities are much more difficult to manage than outcomes of overestimates. That asymmetric risk should be considered when the assumption set, investment policy and funding policy are created. As such, the assumption set used in the actuarial valuation process needs to represent the best estimate of the future experience of the System and be at least as likely, if not more than likely, to overestimate the future liabilities versus underestimate them.

Using this strategic mindset, each assumption was analyzed compared to the actual experience of the System and general experience of other large public employee retirement funds. Changes in certain assumptions and methods are suggested based upon this comparison to remove any bias that may exist and to perhaps add in a slight margin for future adverse experience where appropriate. Next, the assumption set as a whole was analyzed for consistency and to ensure that the projection of liabilities was reasonable and consistent with historical trends.

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Actuarial Standards of Practice (“ASOPs”)

The Actuarial Standards Board (“ASB”) provides guidance on measuring the costs of financing a retirement program through the following Actuarial Standards of Practices (“ASOPs”):

- (1) ASOP No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*;
- (2) ASOP No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*;
- (3) ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*; and
- (4) ASOP No. 44, *Selection and Use of Asset Valuation Methods for Pension Valuations*.

The recommended assumptions provided in this report are consistent with the preceding actuarial standards of practice.

The ASB recently adopted Actuarial Standard of Practice (ASOP) No. 51, Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions. ASOP No. 51 will be effective for any actuarial work product with a measurement date on or after November 1, 2018.

Summary of Process

In determining liabilities and contribution rates for retirement plans, actuaries must make assumptions about the future. The actuarial assumptions are usually divided into two categories:

- Economic assumptions, which include:
 - Assumed rate of price inflation (as measured by the change in the Consumer Price Index for all Urban consumers)
 - Underlies all other economic assumptions
 - Basis for cost-of-living increases for members hired on or after January 1, 2011
 - Assumed long-term rate of return on investments
 - Rate at which projected benefits are reduced to present value
 - Rate for reversionary annuity factors
 - General wage increases
 - Reflects inflationary forces on increases in pay for all members
 - Rate of payroll growth
 - Reflects expectation of growth in total payroll and affects level percent of pay statutory contribution
- Demographic assumptions, which include:
 - Mortality rates
 - Retirement rates
 - Withdrawal (Turnover) rates

For some of these assumptions, such as the mortality rates, past experience provides important evidence about the future. For others, such as the investment return assumption, the link between past and future results is much weaker. In either case, actuaries should review the System’s assumptions periodically and

Introduction

determine whether these assumptions are consistent with both actual past experience and anticipated future experience.

The last such actuarial experience study was performed following the June 30, 2015, actuarial valuation and the recommendations were first effective with the June 30, 2016, actuarial valuation. For this experience study, we have reviewed the System's experience for the three-year period from July 1, 2015, through June 30, 2018.

In conducting experience studies, actuaries generally use data over a period of several years. This is necessary in order to gather enough data so that the results are statistically significant. In addition, if the study period is too short, the impact of the current economic conditions may lead to misleading results. It is known, for example, that the health of the general economy can impact salary increase rates and withdrawal rates. Using results gathered during a short-term boom or bust period will not be representative of the long-term trends in these assumptions. Also, the adoption of legislation, such as plan improvements or changes in salary schedules, will sometimes cause a short-term distortion in the experience. For example, if an early retirement window was opened during the study period, we would usually see a short-term spike in the number of retirements followed by a decline of retirements for the following two to four years. Using a longer period prevents giving too much weight to such short-term effects. On the other hand, using a much longer period could dampen real changes that may be occurring, such as mortality improvement or a change in the ages at which members retire.

In an experience study, we first determine the number of deaths, retirements, etc. that occurred during the period. Then we determine the number expected to occur, based on the current actuarial assumptions. The number of "expected" decrements is determined by multiplying the probability of the occurrence at the given age, by the "exposures" at that same age. For example, consider a rate of retirement of 5.00 percent at age 55. The number of exposures can only be those members who are age 55 and eligible for retirement at that time. Thus they are considered "exposed" to that assumption. Finally, we calculate the A/E ratio, where "A" is the actual number (of retirements, for example) and "E" is the expected number. If the current assumptions were "perfect," the A/E ratio would be 100 percent. When it varies much from this figure, it is a sign that new assumptions may be needed. However, in some cases we prefer to set our assumptions to produce an A/E ratio a little above or below 100 percent, in order to introduce some conservatism. Of course we not only look at the assumptions as a whole, but we also review how well they fit the actual results by gender, by age, and by service.

If the data leads the actuary to conclude that new tables are needed, the actuary may "graduate" or smooth the results, since the raw results can be quite uneven from age to age or from service to service.

Please bear in mind while the recommended assumption set represents our best estimate, there are other reasonable assumptions sets that could be supported. Some other reasonable assumption sets would show higher or lower liabilities or costs.

Introduction

Summary of Recommendations

Our recommended changes to the current actuarial assumptions are summarized as follows:

Economic Assumptions

- **Price inflation:** We recommend decreasing the rate of price inflation from 2.50 percent to 2.25 percent.
- **Investment return:** We recommend decreasing the nominal investment return assumption from 7.00 percent to 6.75 percent. Based on blended capital market assumptions from independent sources and the System's current asset allocation, over the next 20 years the likelihood assets will earn at least 7.00 percent per year is 45.66 percent and the likelihood assets will earn at least 6.75 percent per year is 49.34 percent. Based on a shorter 10-year horizon, the likelihood assets will earn at least 7.00 percent is 40.66 percent and the likelihood assets will earn at least 6.75 percent is 43.29 percent.
- **Payroll growth assumption:** We recommend lowering the general payroll growth assumption from 3.00 percent to 2.75 percent, which reflects an underlying general price inflation assumption of 2.25 percent.
- **Salary increase:** We recommend reducing the salary increase assumption to reflect the change in the payroll growth assumption.

Mortality Assumptions

- We recommend updating post-retirement mortality tables to the recently published public sector tables: the Pub-2010 General Healthy Retiree Mortality tables for Regular Formula members and the Pub-2010 Public Safety Healthy Retiree Mortality tables for Alternative Formula members.
- We recommend updating pre-retirement mortality tables for active employees to the recently published public sector tables: the Pub-2010 General Employee Mortality tables for Regular Formula members and the Pub-2010 Public Safety Employee Mortality tables for Alternative Formula members.
- We also recommend assuming mortality rates will improve in the future using a fully generational approach, with the most recently published projection scale, MP-2018.
- We recommend applying scaling factors to the base mortality tables; i.e., Pub-2010 General Tables and Public Safety tables, to partially reflect observed mortality experience to the extent it is credible.

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Other Demographic Assumptions

- **Normal retirement rates:** Overall, the actual rates of retirement were higher than expected. We recommend increasing the overall rates to better reflect observed experience, especially for Regular Formula members.
- **Early retirement rates:** Overall, experience was generally lower than expected. We recommend decreasing the overall rates to better reflect observed experience.
- **Turnover rates:** Overall, the observed experience showed that more members terminated employment than expected. We recommend increasing the rates of termination.
- **Load for inactive members eligible for deferred vested pension benefits:** Based on recent experience, we recommend changing the current assumption of 15 percent to 11 percent for Regular Formula members and 9 percent for Alternative Formula members. This load represents additional cost due to participation in a reciprocal system.
- **Marriage assumption:** We recommend maintaining the current assumption of 85 percent of active male participants and 65 percent of active female participants. Actual marital status at benefit commencement is used for retired members.
- **Unused sick leave and optional service purchases:** We recommend maintaining the current assumption of increasing each current and future active member's service by 4.5 months to reflect additional service credit received at retirement due to converting unused sick leave and vacation days and purchasing applicable optional service.
- **Disability load:** We recommend maintaining the current disability load of 1.65 percent of pay on the normal cost because members who receive disability typically spend less than one year on disability and are considered active members for valuation purposes.

SECTION C

ANALYSIS OF EXPERIENCE AND RECOMMENDATIONS

Economic Assumptions

Economic assumptions reflect the effects of economic forces on the projections of retirement benefits payable from the System and in the discounting of those benefits to present value.

These assumptions are based, at their core, on the assumed level of price inflation. Each economic assumption is then developed from expected spreads over price inflation.

The key economic assumptions are:

- Assumed Rate of Inflation – The rate of price inflation (as measured by the Consumer Price Index for all Urban consumers) which underlies the remainder of the economic assumptions.
- Assumed Rate of Investment Return – The rate at which projected future benefits under the pension plan are reduced to present value.
- Rate of General Annual Pay Increases – This reflects inflationary forces on increases in pay for individual members.

Actuarial Standard of Practice No. 27

Actuarial Standard of Practice No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, provides guidance to actuaries on giving advice on selecting economic assumptions for measuring obligations for defined benefit plans. ASOP No. 27 was revised and adopted by the Actuarial Standards Board (ASB) in September 2013 (applicable to actuarial valuation dates on or after September 30, 2014). The standard requires that the selected economic assumptions be consistent with each other. That is, the selection of the investment return assumption should be consistent with the selection of the wage inflation and price inflation assumptions.

Although no one knows what the future holds, it is necessary for an actuary to estimate possible future economic outcomes. Recognizing that there is not one right answer, the current standard calls for an actuary to develop a reasonable economic assumption. A reasonable assumption is one that is:

1. Appropriate for the purpose of the measurement;
2. Reflects the actuary's professional judgment;
3. Takes into account historical and current economic data that is relevant as of the measurement date;
4. Is an estimate of future experience; an observation of market data; or a combination thereof; and
5. Has no significant bias except when provisions for adverse deviation or plan provisions that are difficult to measure are included.

However, the standard explicitly advises an actuary not to give undue weight to recent experience.

Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular actuarial valuation, each economic assumption should be consistent with every other economic assumption over the measurement period. Generally, the economic assumptions are much more subjective in nature than the demographic assumptions.

Economic Assumptions

Inflation Assumption

By “inflation,” we mean price inflation, as measured by annual increases in the Consumer Price Index (CPI). This inflation assumption underlies most of the other economic assumptions. It has an impact on investment return, salary increases, and overall payroll growth. The current annual inflation assumption is 2.50 percent.

Over the three-year period from June 2015 through June 2018, the CPI-U has increased at an average annual rate of 1.83 percent. **However, the assumed inflation rate is only weakly tied to past results.**

The following table shows the average inflation over various periods, ending June 2018.

| Fiscal Year | Annual Increase in CPI-U |
|-----------------|--------------------------|
| 2013-14 | 2.07% |
| 2014-15 | 0.12% |
| 2015-16 | 1.00% |
| 2016-17 | 1.63% |
| 2017-18 | 2.87% |
| 3-Year Average | 1.83% |
| 5-Year Average | 1.54% |
| 10-Year Average | 1.42% |
| 20-Year Average | 2.20% |
| 25-Year Average | 2.25% |
| 30-Year Average | 2.56% |
| 40-Year Average | 3.44% |
| 50-Year Average | 4.04% |

Future Inflation Expectations

Since price inflation is relatively volatile and is subject to a number of influences not based on recent history, economic assumptions are less reliably based on recent past experience than are the demographic assumptions. Therefore, it is important not to give undue weight to recent experience. We must also consider future expectations as well.

One source of information about future inflation is the market for US Treasury bonds. Simplistically, the difference in yield between non-indexed and indexed treasury bonds should be a reasonable estimate of what the bond market expects on a forward looking basis for inflation. As of January 1, 2019, the difference for 20-year bonds implies that inflation over the next 20 years would average 1.82 percent. The difference in yield for 30-year bonds implies 1.85 percent inflation over the next 30 years.

Economic Assumptions

The following tables present a summary of inflation rate forecasts from the Federal Reserve.

| Federal Reserve Bank of Cleveland | July 2015 | July 2016 | July 2017 | July 2018 | January 2019 |
|--|------------------|------------------|------------------|------------------|---------------------|
| 30-Year Expectation | 2.20% | 2.04% | 2.18% | 2.32% | 2.24% |
| 20-Year Expectation | 2.07% | 1.87% | 2.04% | 2.23% | 2.12% |
| 10-Year Expectation | 1.88% | 1.63% | 1.85% | 2.10% | 1.96% |
| 5-Year Expectation | 1.77% | 1.51% | 1.74% | 2.03% | 1.87% |

| Federal Reserve Bank of St. Louis | July 2015 | July 2016 | July 2017 | July 2018 | January 2019 |
|--|------------------|------------------|------------------|------------------|---------------------|
| 30-Year Breakeven Inflation | 1.96% | 1.62% | 1.87% | 2.13% | 1.85% |
| 20-Year Breakeven Inflation | 1.90% | 1.40% | 1.81% | 2.10% | 1.82% |
| 10-Year Breakeven Inflation | 1.89% | 1.43% | 1.73% | 2.11% | 1.71% |

However, this analysis is known to be imperfect as it ignores the inflation risk premium that buyers of US Treasury bonds often demand as well as possible differences in liquidity between US Treasury bonds and Treasury Inflation Protected Securities (TIPS).

Another point of reference is the Social Security Administration's (SSA) 2018 Trustees Report, in which the Office of the Chief Actuary is projecting a long-term average ultimate annual inflation rate of 2.60 percent under the intermediate cost assumption. The ultimate inflation assumption is 2.00 percent and 3.20 percent respectively in the low cost and high cost projection scenarios. The Social Security Trustees report uses the ultimate rates for their 75-year projections, much longer than the longest horizon we can discern from Treasuries and TIPS.

We also surveyed the inflation assumption used by various investment consulting firms. In our sample of these firms, the inflation assumption ranged from 1.95 percent to 2.75 percent, with an average of 2.20 percent in the short-term (10 years or less) and 2.42 percent in the long-term (20 to 30 years).

The following table provides inflation forecasts from various sources.

Economic Assumptions

| Forward-looking Annual Inflation Forecasts (From Professional Experts in the Field of Forecasting Inflation) | |
|---|--|
| Federal Reserve Board's Federal Open Market Committee Current Long-run Price Inflation Objective (Since Jan 2012; Personal Consumer Expenditures) | 2.00% |
| Congressional Budget Office: <i>The Budget and Economic Outlook</i> Overall Consumer Price Index (August 2018; Ultimate) Personal Consumer Expenditures (August 2018; Ultimate) | 2.40% 2.00% |
| 2018 Social Security Trustees Report CPI-W 15-Year Intermediate Assumption CPI-W 30-Year Intermediate Assumption GDP Deflator 15-Year Intermediate Assumption GDP Deflator 30-Year Intermediate Assumption | 2.60% 2.60% 2.20% 2.20% |
| Quarterly Survey of Professional Forecasters 3Q2018 Federal Reserve Bank of Philadelphia 10-Year Forecast | 2.21% |
| Federal Reserve Bank of Cleveland 30-Year Expectation on February 1, 2019 20-Year Expectation on February 1, 2019 10-Year Expectation on February 1, 2019 | 2.25% 2.13% 1.97% |
| Bond Investors (Excess Yield of Non-indexed Treasuries Over Indexed Treasuries) 30-Year Expectation on January 1, 2019 Median 30-year Expectation over 12/31/13 - 12/31/18 20-Year Expectation on January 1, 2019 Median 20-year Expectation over 12/31/13 - 12/31/18 10-Year Expectation on December 31, 2018 Median 10-year Expectation over 12/31/13 - 12/31/18 | 1.85% 1.97% 1.82% 1.91% 1.71% 1.86% |
| Investment Consultants and Forecasters 2018 GRS Survey major national investment forecasters and consultants Median expectation among 11 firms (averaging 9.9 years) Median expectation among 3 firms (averaging 26.7 years) 2018 HAS* Survey of 13 investment advisors: Median (10 years) 2018 HAS* Survey of 13 investment advisors: Median (20 years) | 2.20% 2.42% 2.41% 2.47% |

*Horizon Actuarial Service 2018 Survey of Capital Market Assumptions

Economic Assumptions

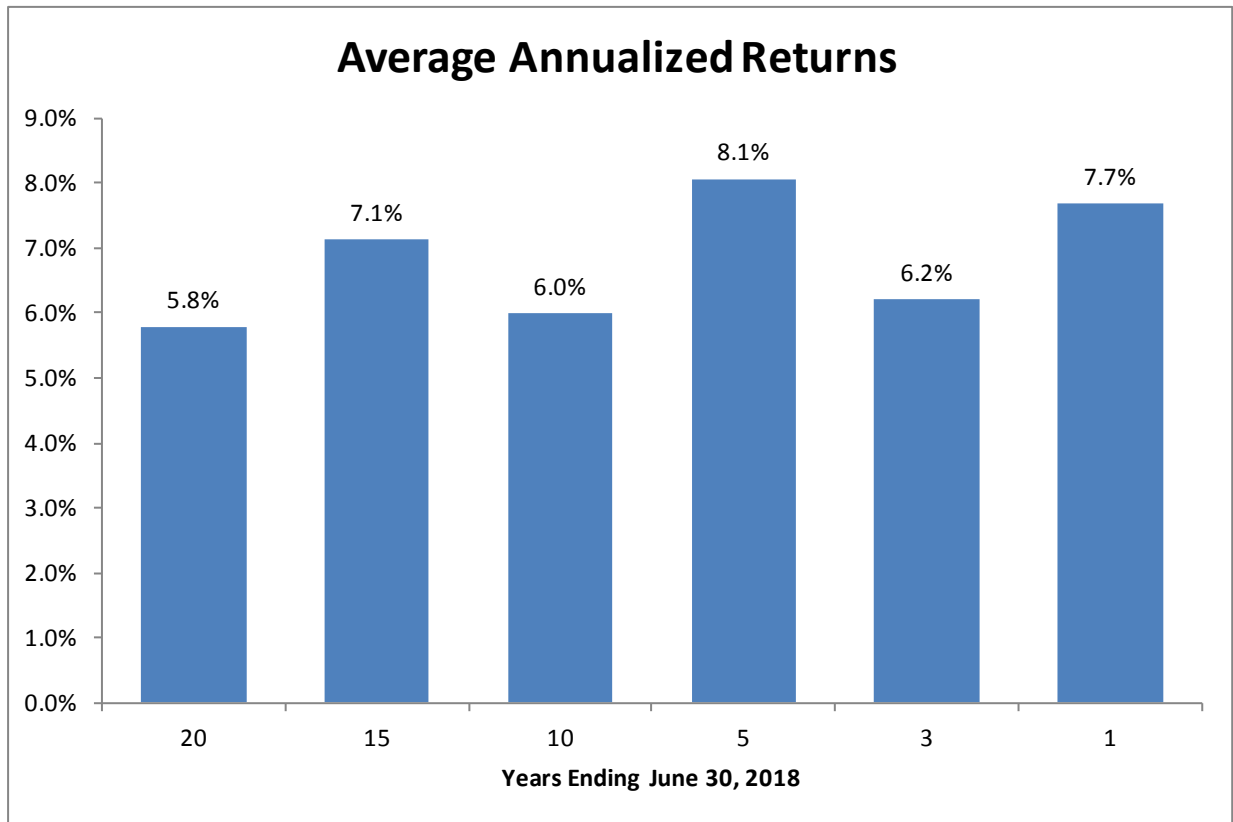
Recommendation

Based on this information, our opinion is that it would be reasonable to lower the current price inflation assumption of 2.50 percent. However, we caution against lowering the price inflation assumption too low (i.e., below 2.00 percent). We are recommending the inflation assumption be reduced from 2.50 percent to 2.25 percent. This reduction recognizes lower inflation expectations in both the near and longer term. The change will bring it closer to recent inflation levels and closer to levels expected in the financial markets. As you will see, this change also affects all other economic assumptions.

Investment Return Assumption

The investment return assumption is one of the principal assumptions used in any actuarial valuation of a retirement plan. It is used to discount future expected benefit payments to the actuarial valuation date in order to determine the liabilities of the plans. Even a small change to this assumption can produce significant changes to the liabilities and contribution rates. Currently, it is assumed that future investment returns will average 7.00 percent per year, net of investment expenses.

The chart below shows the historical average annualized returns of the System's market returns through fiscal year end 2018.



Economic Assumptions

Real Return

The allocation of assets within the universe of investment options will have a significant impact on the overall performance. Therefore, it is meaningful to identify the range of expected returns based on the fund's targeted allocation of investments and an overall set of capital market assumptions.

Based on information provided by SERS and ISBI, following is a table with the System's current target asset allocation and capital market assumptions based on a 20-year horizon:

| Asset Category | Current Target | Annualized Compounded Return | Annualized Average Return | Annualized Standard Deviation |
|--|----------------|------------------------------|---------------------------|-------------------------------|
| U.S. Equity | 23.00% | 7.50% | 9.10% | 18.00% |
| Developed Foreign Equity | 13.00% | 7.30% | 9.30% | 20.00% |
| Emerging Market Equity | 8.00% | 9.80% | 13.20% | 26.00% |
| Private Equity | 7.00% | 9.60% | 13.20% | 27.00% |
| Intermediate Investment Grade Bonds | 14.00% | 3.50% | 3.60% | 4.00% |
| Long-term Government Bonds | 4.00% | 3.80% | 4.60% | 12.50% |
| TIPS | 4.00% | 3.50% | 3.80% | 7.50% |
| High Yield | 2.50% | 6.00% | 6.80% | 12.50% |
| Bank Loans | 2.50% | 5.50% | 6.00% | 10.00% |
| Opportunistic Debt - Direct Lending | 2.00% | 7.30% | 8.60% | 16.00% |
| Opportunistic Debt - Mezzanine Debt | 2.00% | 6.80% | 8.80% | 20.00% |
| Opportunistic Debt - Distressed Debt | 2.00% | 6.90% | 9.80% | 24.00% |
| Opportunistic Debt - Real Estate Debt | 2.00% | 6.90% | 9.50% | 23.00% |
| Emerging Market Debt | 2.00% | 5.90% | 7.00% | 14.50% |
| Core Real Estate | 5.50% | 5.70% | 6.50% | 12.50% |
| Non-core Real Estate - Value Add Real Estate | 2.50% | 7.20% | 9.00% | 19.00% |
| Non-core Real Estate - Opportunistic Real Estate | 2.00% | 8.90% | 12.00% | 25.00% |
| Infrastructure | 2.00% | 8.80% | 11.40% | 23.00% |
| Total | 100.00% | | | |

Based on page 54 of the ISBI Asset Allocation Review and Risk Analysis report issued by Meketa Investment Group on September 21, 2018.

We applied the System's target asset allocation, and performed an analysis using capital market assumptions from a sample of eleven nationally known investment consulting firms. Three of the investment consulting firms provided capital market expectations for longer time horizons (20 to 30 years). Eleven firms provided capital market expectations for shorter time horizons (10 years or less).

These investment consulting firms periodically issue reports that describe their capital market assumptions; that is, their estimates of expected returns, volatility and correlations among the different asset classes. The assumptions for most of the investment consultants are for 2018. While some of these assumptions may be based upon historical analysis, many of these firms also incorporate forward-looking adjustments to better reflect near-term and long-term expectations. The estimates for core investments (i.e., fixed income, equities and real estate) are generally based on anticipated returns produced by passive index funds.

The current nominal investment return assumption of 7.00 percent is based on an inflation assumption of 2.50 percent and a real return of 4.50 percent.

Given the System's current target asset allocation and the capital market assumptions from the investment consultants, the development of the average nominal return, net of investment expenses, is provided in the following tables.

Economic Assumptions

Short-term Investment Horizon (10 years or less) Assumptions – One Year Arithmetic Returns

| Investment Consultant | Investment Consultant Expected Nominal Return Net of Expenses | Investment Consultant Inflation Assumption | Expected Real Return (2)–(3) | Actuary Inflation Assumption | Expected Nominal One-year Arithmetic Return Net of Expenses (4)+(5) | Annualized Standard Deviation of Expected Return |
|-----------------------|---|--|------------------------------|------------------------------|---|--|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 1 | 6.30% | 2.26% | 4.04% | 2.25% | 6.29% | 10.45% |
| 2 | 6.07% | 2.00% | 4.07% | 2.25% | 6.32% | 9.96% |
| 3 | 6.62% | 2.50% | 4.12% | 2.25% | 6.37% | 12.41% |
| 4 | 6.77% | 2.50% | 4.27% | 2.25% | 6.52% | 12.22% |
| 5 | 6.40% | 2.00% | 4.40% | 2.25% | 6.65% | 11.56% |
| 6 | 6.64% | 2.21% | 4.43% | 2.25% | 6.68% | 12.81% |
| 7 | 6.83% | 2.31% | 4.53% | 2.25% | 6.78% | 11.26% |
| 8 | 6.80% | 2.26% | 4.54% | 2.25% | 6.79% | 13.28% |
| 9 | 6.67% | 1.95% | 4.72% | 2.25% | 6.97% | 11.76% |
| 10 | 7.02% | 2.25% | 4.77% | 2.25% | 7.02% | 13.63% |
| 11 | 7.69% | 2.00% | 5.69% | 2.25% | 7.94% | 9.91% |
| Average | 6.71% | 2.20% | 4.51% | 2.25% | 6.76% | 11.75% |

Long-term Investment Horizon (20 to 30 years) Assumptions – One Year Arithmetic Returns

| Investment Consultant | Investment Consultant Expected Nominal Return Net of Expenses | Investment Consultant Inflation Assumption | Expected Real Return (2)–(3) | Actuary Inflation Assumption | Expected Nominal One-year Arithmetic Return Net of Expenses (4)+(5) | Annualized Standard Deviation of Expected Return |
|-----------------------|---|--|------------------------------|------------------------------|---|--|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 1 | 7.16% | 2.31% | 4.85% | 2.25% | 7.10% | 11.55% |
| 2 | 8.08% | 2.75% | 5.33% | 2.25% | 7.58% | 12.22% |
| 3 | 7.46% | 2.20% | 5.26% | 2.25% | 7.51% | 12.81% |
| Average | 7.57% | 2.42% | 5.15% | 2.25% | 7.40% | 12.19% |

Based on each investment consulting firm’s assumptions, we estimated the expected real return of the System’s portfolio (col. (4)). Next, based on the actuary’s recommended inflation, we estimated the expected one-year arithmetic return net of expenses (col. (6)). The average one-year arithmetic return is 6.76 percent using short-term investment horizon assumptions, and 7.40 percent using long-term

Economic Assumptions

investment horizon assumptions. Based on the capital market assumptions for Meketa, the average one-year arithmetic return is 7.84 percent.

However, in addition to examining the expected one-year arithmetic return, it is important to review anticipated volatility of the investment portfolio and understand the range of long-term net returns that could be expected to be produced by the investment portfolio.

The following tables provide the 40th, 50th, and 60th percentiles of the geometric average (10-year for short-term investment horizon and 20-year for long-term investment horizon) of the expected nominal return, net of expenses based on the recommended inflation assumption of 2.25 percent. The tables also show the probability of exceeding the baseline 7.00 percent assumption and alternative lower assumptions.

Economic Assumptions

Short-term Investment Horizon (10 years or less) – Annualized 10-year Geometric Returns

| Investment Consultant | Distribution of 10-Year Average Geometric Net Nominal Return | | | Probability of Exceeding 7.00% | Probability of Exceeding 6.75% | Probability of Exceeding 6.50% |
|-----------------------|--|------------------|------------------|--------------------------------|--------------------------------|--------------------------------|
| | 40 th | 50 th | 60 th | | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (6) |
| 1 | 4.95% | 5.78% | 6.61% | 35.55% | 38.39% | 41.31% |
| 2 | 5.07% | 5.86% | 6.65% | 35.83% | 38.82% | 41.89% |
| 3 | 4.67% | 5.65% | 6.64% | 36.48% | 38.90% | 41.36% |
| 4 | 4.86% | 5.83% | 6.80% | 38.04% | 40.52% | 43.05% |
| 5 | 5.11% | 6.02% | 6.95% | 39.43% | 42.09% | 44.79% |
| 6 | 4.91% | 5.92% | 6.94% | 39.39% | 41.79% | 44.22% |
| 7 | 5.29% | 6.19% | 7.08% | 40.92% | 43.68% | 46.47% |
| 8 | 4.92% | 5.97% | 7.03% | 40.24% | 42.57% | 44.92% |
| 9 | 5.40% | 6.33% | 7.27% | 42.81% | 45.48% | 48.17% |
| 10 | 5.09% | 6.16% | 7.24% | 42.22% | 44.51% | 46.83% |
| 11 | 6.71% | 7.49% | 8.28% | 56.30% | 59.45% | 62.56% |
| Average | 5.18% | 6.11% | 7.05% | 40.66% | 43.29% | 45.96% |

Long-term Investment Horizon (20 to 30 years) – Annualized 20-year Geometric Returns

| Investment Consultant | Distribution of 20-Year Average Geometric Net Nominal Return | | | Probability of Exceeding 7.00% | Probability of Exceeding 6.75% | Probability of Exceeding 6.50% |
|-----------------------|--|------------------|------------------|--------------------------------|--------------------------------|--------------------------------|
| | 40 th | 50 th | 60 th | | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (6) |
| 1 | 5.84% | 6.49% | 7.14% | 42.06% | 45.90% | 49.78% |
| 2 | 6.21% | 6.89% | 7.58% | 48.40% | 52.09% | 55.76% |
| 3 | 6.04% | 6.75% | 7.47% | 46.51% | 50.02% | 53.54% |
| Average | 6.03% | 6.71% | 7.40% | 45.66% | 49.34% | 53.03% |

Meketa (20 years)

| Investment Consultant | Distribution of 20-Year Average Geometric Net Nominal Return | | | Probability of Exceeding 7.00% | Probability of Exceeding 6.75% | Probability of Exceeding 6.50% |
|-----------------------|--|------------------|------------------|--------------------------------|--------------------------------|--------------------------------|
| | 40 th | 50 th | 60 th | | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (6) |
| Meketa | 6.33% | 7.06% | 7.79% | 50.81% | 54.26% | 57.68% |

As these tables indicate, the average expected rate of return at the 50th percentile based on (1) the System's current target asset allocation, (2) the recommended inflation assumption of 2.25 percent and (3) the capital market assumptions from the investment consultants is 6.11 percent under the shorter-term investment horizon and 6.71 percent under the longer-term investment horizon. Based on the capital market assumptions from Meketa, the average expected rate of return at the 50th percentile is 7.06 percent.

Economic Assumptions

Additionally, the average results of the investment firms with shorter-term expectations indicate there is about a 40.66 percent chance that the System will produce an average return that exceeds 7.00 percent in the next 10 years, a 43.29 percent chance that the average return exceeds 6.75 percent, and a 45.96 percent chance that the average return exceeds 6.50 percent.

The average results of the investment firms with longer-term expectations indicate there is about a 45.66 percent chance that the System will produce an average return that exceeds 7.00 percent in the next 20 years, a 49.34 percent chance that the average return exceeds 6.75 percent, and a 53.03 percent chance that the average return exceeds 6.50 percent.

Recommendation

Based on our analysis of the expected investment return and the current target asset allocation, we recommend reducing the investment return assumption to 6.75 percent for the actuarial valuation as of June 30, 2019, reflecting an inflation assumption of 2.25 percent.

We recommend that the assumed investment return be monitored for continued appropriateness between experience reviews. Also, any significant changes in the target asset allocation of the System may warrant an additional review of the rate of return assumption.

We believe that this assumption can be supported by the Actuarial Standard of Practice No. 27. Under the Standard, all economic assumptions must be selected to be consistent with the purpose of the measurement. The purpose of the measurement is to determine the contribution rate which will lead to the accumulation of assets to pay benefits when due.

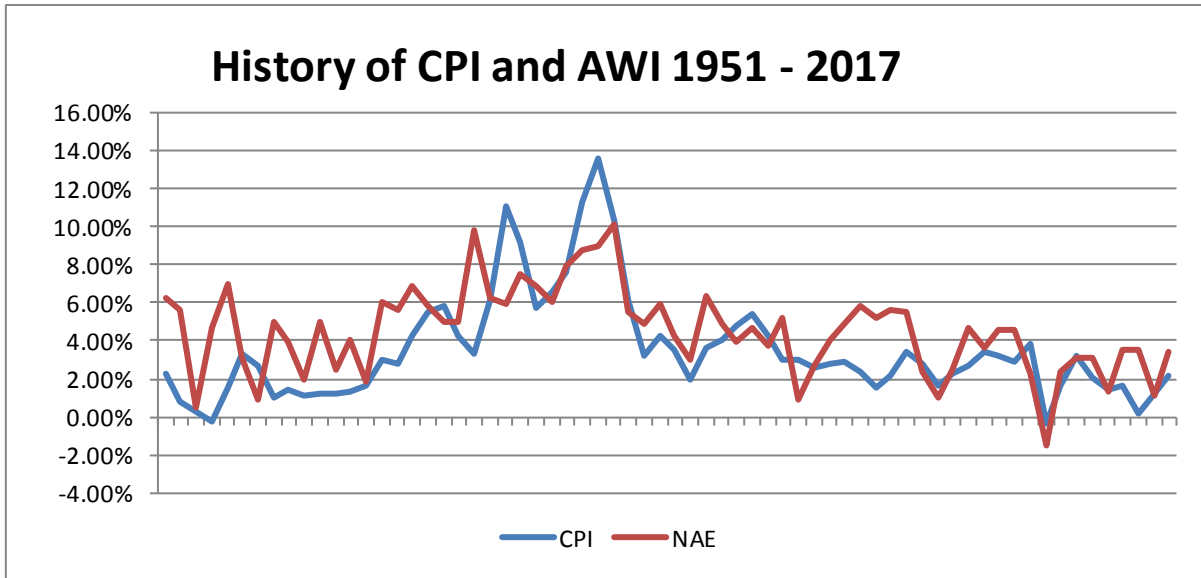
General Wage Inflation and Payroll Growth

A General Wage Inflation (“GWI”) assumption represents the real wage growth over time in the general economy. It is the assumption on how much the pay scales themselves will change year to year, not necessarily how much the pay increases received by individuals are, or even necessarily how the payroll in total may change, which can be affected by population changes, etc. Wage inflation consists of two components, (1) a portion due to pure price inflation (i.e., increases due to changes in the CPI), and (2) increases in average salary levels in excess of pure price inflation (i.e., increases due to changes in productivity levels, supply and demand in the labor market and other macroeconomic factors).

The Average Wage Index (“AWI”), formerly named the National Average Earnings (“NAE”), series published in connection with the operation of the Social Security program is a useful proxy for measuring general changes in wage levels in the economy. Increases in AWI typically exceed increases in the Consumer Price Index (“CPI”), although there are periods where the patterns are reversed. The economic argument for wages exceeding prices in the long run is that CPI is based on the prices of a fixed basket of goods whereas wages reflect innovations, real productivity growth, labor supply and demand, and other factors in addition to pure price inflation.

Economic Assumptions

The following graph compares CPI and AWI over the past 66 years.



Economic Assumptions

The following table shows the average inflation and increase in the AWI through 2017.

| Years | Annual Increases in | | |
|-----------------|---------------------|-------------|------------|
| | Prices (CPI-U) | Wages (AWI) | Difference |
| 1958-1967 | 1.60% | 3.65% | 2.06% |
| 1968-1977 | 6.15% | 6.49% | 0.34% |
| 1978-1987 | 6.48% | 6.54% | 0.06% |
| 1988-1997 | 2.98% | 4.06% | 1.07% |
| 1998-2007 | 2.59% | 3.95% | 1.36% |
| 2008-2017 | 1.69% | 2.22% | 0.53% |
| 3-Year Average | 1.83% | 2.68% | 0.85% |
| 5-Year Average | 1.54% | 2.57% | 1.04% |
| 10-Year Average | 1.42% | 2.22% | 0.80% |
| 20-Year Average | 2.20% | 3.08% | 0.88% |
| 25-Year Average | 2.25% | 3.19% | 0.94% |
| 30-Year Average | 2.56% | 3.41% | 0.84% |
| 40-Year Average | 3.44% | 4.18% | 0.74% |
| 50-Year Average | 4.04% | 4.64% | 0.59% |
| 60-Year Average | 3.68% | 4.47% | 0.80% |
| 65-Year Average | 3.48% | 4.45% | 0.97% |

Since 1951, for the national economy as a whole, wage inflation has been about 1.00 percent higher than price inflation each year. For the last 10 years, for the national economy as a whole, wage inflation has been 2.22 percent, outpacing price inflation by about 0.80 percent. However, that spread will likely be viewed as overstated due to the historically low inflation during the past decade.

As with the investment return assumption, past experience does not necessarily dictate future expectations. Current expectations are mixed on whether price and wage inflation will remain low in the short term, particularly due to the after effects of recent federal government spending. For a long-term view, the 2018 Annual Report from the Trustees of the Social Security Administration (SSA) assumes an intermediate average ultimate CPI of 2.60 percent over the next 75 years and an ultimate intermediate growth assumption for average wages in covered employment of 3.80 percent. The SSA report provides alternate “High-cost” assumptions of 2.00 percent CPI/2.60 percent wages and “Low-cost” assumptions of 3.20 percent CPI/5.00 percent wages.

Economic Assumptions

Recommendation

While the ongoing pressure on the ability of states to sustain across the board increases in wages is consistent with historical norms, we do not believe there is justification to increase the assumption for productivity increases; in other words, to increase the assumed gap between price increases and wage growth. In fact, we recommend maintaining the assumption for productivity increases of 0.50 percent. Combining this recommendation with our recommendation for price inflation of 2.25 percent implies a wage inflation assumption of 2.75 percent. These assumptions are summarized below:

| | SERS Wage Inflation and Payroll Growth Assumption | |
|-------------------------------|---|------------------------|
| | Current Assumption | Recommended Assumption |
| Price Inflation | 2.50% | 2.25% |
| Productivity Increases | 0.50% | 0.50% |
| Total Wage Inflation | 3.00% | 2.75% |

Economic Assumptions

Salary Increase

Most actuaries recommend salary increase assumptions that include elements which depend on the member's age or service. Generally, younger or shorter-service employees receive higher merit and promotion salary increases. As the employee's age or service increases, these salary increases tend to decrease.

During the experience period, plan members earned an average salary increase of 1.53 percent per year which was significantly lower than the assumed average salary increase of 4.53 percent per year. The low salary increase experience was mainly due to the budget impasse and delay in the renewal of bargaining agreements.

Since salary experience is not consistent with future expectation, we recommend making no changes to the current age based salary increase assumption. However, we do recommend adjusting the salary increase assumption to reflect the change in the wage inflation assumption

This assumption was developed using both Tier One and Tier Two data and is applicable to both Tier One and Tier Two members.

Table I and Graph I compare the salary experience, current assumptions, and recommended assumptions by years of service for each of the following:

- Table I – Salary Experience by Age
- Graph I – Salary Experience by Age

Economic Assumptions

Table I

| Age at Beginning of Year | Number | Actual | | Expected Current Year | Actual Real Increase ¹ | Actual Total Increase | Expected Real Increase ² | Expected Total Increase | Proposed Real Increase ³ | Proposed Total Increase |
|--------------------------|----------------|-----------------------|-----------------------|-----------------------|-----------------------------------|-----------------------|-------------------------------------|-------------------------|-------------------------------------|-------------------------|
| | | Prior Year | Current Year | | | | | | | |
| Under 20 | 115 | 2,197,225 | 2,501,397 | 2,367,521 | 12.01% | 13.84% | 5.25% | 7.75% | 5.25% | 7.50% |
| 20-24 | 2,737 | 121,739,954 | 131,881,406 | 131,175,038 | 6.50% | 8.33% | 5.25% | 7.75% | 5.25% | 7.50% |
| 25-29 | 11,225 | 601,456,585 | 625,998,240 | 643,046,046 | 2.25% | 4.08% | 4.41% | 6.91% | 4.41% | 6.66% |
| 30-34 | 15,076 | 905,482,538 | 934,217,553 | 957,641,678 | 1.34% | 3.17% | 3.26% | 5.76% | 3.26% | 5.51% |
| 35-39 | 17,577 | 1,187,748,711 | 1,210,300,687 | 1,247,172,201 | 0.07% | 1.90% | 2.50% | 5.00% | 2.50% | 4.75% |
| 40-44 | 21,715 | 1,608,022,222 | 1,631,015,677 | 1,683,391,181 | -0.40% | 1.43% | 2.19% | 4.69% | 2.19% | 4.44% |
| 45-49 | 28,069 | 2,193,439,749 | 2,217,226,219 | 2,290,059,748 | -0.75% | 1.08% | 1.91% | 4.41% | 1.91% | 4.16% |
| 50-54 | 27,530 | 2,128,710,372 | 2,152,321,527 | 2,215,676,033 | -0.72% | 1.11% | 1.59% | 4.09% | 1.59% | 3.84% |
| 55-59 | 22,893 | 1,749,269,943 | 1,766,377,208 | 1,817,547,236 | -0.85% | 0.98% | 1.40% | 3.90% | 1.40% | 3.65% |
| 60-64 | 13,916 | 1,052,789,825 | 1,061,306,614 | 1,091,806,486 | -1.02% | 0.81% | 1.21% | 3.71% | 1.21% | 3.46% |
| 65-69 | 4,861 | 369,296,405 | 370,630,863 | 381,788,609 | -1.47% | 0.36% | 0.88% | 3.38% | 0.88% | 3.13% |
| 70-74 | 1,339 | 100,833,615 | 101,400,174 | 104,110,712 | -1.27% | 0.56% | 0.75% | 3.25% | 0.75% | 3.00% |
| 75-79 | 350 | 24,660,851 | 24,641,673 | 25,462,340 | -1.91% | -0.08% | 0.75% | 3.25% | 0.75% | 3.00% |
| 80+ | 115 | 7,485,125 | 7,399,228 | 7,728,390 | -2.98% | -1.15% | 0.75% | 3.25% | 0.75% | 3.00% |
| Total | 167,518 | 12,053,133,120 | 12,237,218,466 | 12,598,973,219 | -0.30% | 1.53% | 2.03% | 4.53% | 2.03% | 4.28% |

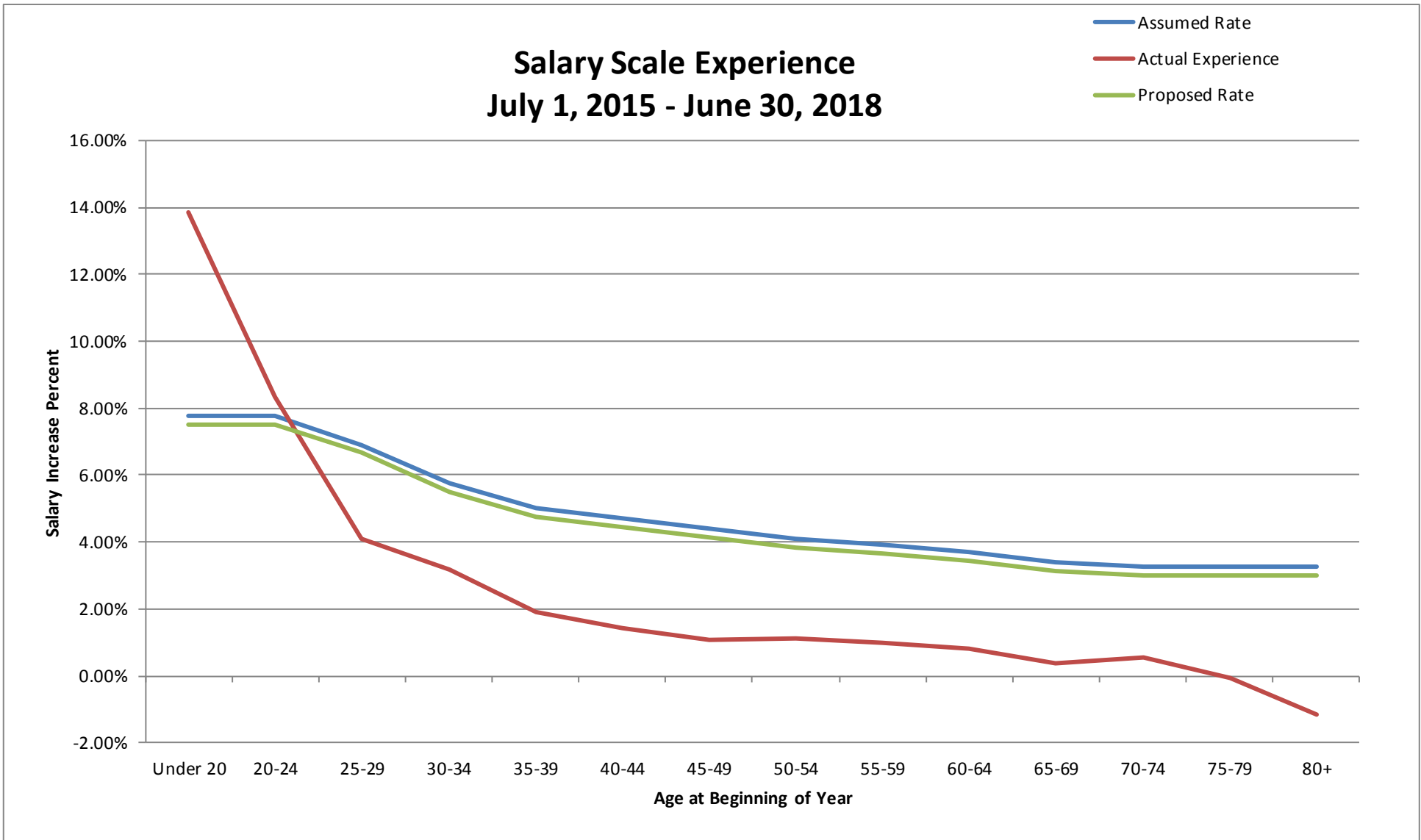
¹Total increase less average inflation of 1.83 percent.

²Total increase less assumed inflation of 2.50 percent.

³Total proposed increase less proposed inflation of 2.25 percent.

Economic Assumptions

Graph I



Demographic Assumptions

The following pages present the analysis of the demographic assumptions. These assumptions include assumed rates of mortality among active and retired members, retirement patterns, turnover patterns, and disability patterns. These patterns generally take the form of tables of rates of incidence based on age and/or years of service.

Absent any significant changes in benefit provisions, these assumptions generally exhibit reasonable consistency over periods of time. As a result, each demographic assumption is normally reviewed by relating actual experience to that assumed over the recent past.

Actuarial Standard of Practice No. 35 – Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations

ASOP No. 35 applies to actuaries when they are selecting demographic and all other assumptions not covered by ASOP No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, to measure obligations under any defined benefit pension plan that is not a social insurance program as described in Section 1.2, Scope, of ASOP No. 32, Social Insurance.

The actuary should identify the types of demographic assumptions to use for a specific measurement. In doing so, the actuary should determine the following:

- (a) The purpose and nature of the measurement;
- (b) The plan provisions or benefits and factors that will affect the timing and value of any potential benefit payments;
- (c) The characteristics of the obligation to be measured (such as measurement period, pattern of plan payments over time, open or closed group, and volatility);
- (d) The contingencies that give rise to benefits or result in loss of benefits;
- (e) The significance of each assumption; and
- (f) The characteristics of the covered group.

Not every contingency requires a separate assumption. For example, for a plan that is expected to provide benefits of equal value to employees who voluntarily terminate employment or become disabled, retire, or die, the actuary may use an assumption that reflects some or all of the above contingencies in combination rather than selecting a separate assumption for each.

Analysis Approach

The analysis of demographic experience is conducted for each assumption using a measure known as the “Actual to Expected (A/E) Ratio.” The A/E Ratio is simply the ratio of the actual number of occurrences of the event to which the assumption applies (e.g., deaths or retirements) to the number expected to occur in accordance with the assumption. An A/E Ratio of 1.00 indicates that the assumption precisely predicted the number of occurrences. An A/E Ratio exceeding 1.00 indicates that the assumption underestimated actual experience. Conversely, an A/E Ratio lower than 1.00 indicates that the assumption overestimated actual experience.

Demographic Assumptions

These are statistical analyses. As a result, there are several considerations we must keep in mind as we analyze these ratios:

1. An actuarial assumption is designed to reflect average experience over long periods of time (30 - 50 years). As a result:
 - (a) A deviation between actual experience and that expected from our assumptions for one or two years does not necessarily mean that the assumption should be changed.
 - (b) A change in actuarial assumption should result if the experience indicates a consistent pattern which is different from that assumed over a period of years.
2. The larger the amount of data available, the more reliable the statistics used in the analysis. As a result:
 - (a) Events that occur with great frequency (e.g., general employment turnover) are more credibly predictable than those occurring less frequently (e.g., active member death).
 - (b) In all cases, data covering the entire study period produces more credible results than data for a single year.
 - (c) Year by year experience is helpful only in identifying trends and determining whether the three-year data is truly reflective of the entire period.

This analysis is based on the actuarial valuation data for the three-year period from July 1, 2015, to June 30, 2018.

Mortality Assumption

Mortality

Post-retirement mortality is an important component in cost calculations and should be updated from time to time to reflect current and expected future longevity improvements. Pre-retirement mortality is a relatively minor component in cost calculations. The frequency of pre-retirement deaths is so low that mortality assumptions based on actual experience can only be produced for very large retirement systems.

Actuarial Standards of Practice

Actuarial Standards of Practice (ASOP) No. 35 Disclosure Section 4.1.1 states, “The disclosure of the mortality assumption should contain sufficient detail to permit another qualified actuary to understand the provision made for future mortality improvement. If the actuary assumes zero mortality improvement after the measurement date, the actuary should state that no provision was made for future mortality improvement.” The current mortality rates used in the actuarial valuation include a provision for future mortality improvement.

The Pub-2010 Mortality Tables

The Society of Actuaries (SOA) and Retirement Plans Experience Committee (RPEC) initiated a study in January 2015 with the primary focus of a comprehensive review of recent mortality experience of public retirement plans in the United States. The previous study for the RP-2014 Mortality Tables only included data from private pension plans. The main objectives of the study were to develop mortality tables based exclusively on public sector pension plan experience, and provide new insights into the composition of gender-specific pension mortality by factors such as job category (e.g., Teachers, Public Safety, General), salary/benefit amount, health status (i.e., healthy or disabled), geographic region, and duration since event. Additional information on the background, data, and process is available in the *Pub-2010 Public Retirement Plans Mortality Tables Report* published by the SOA and RPEC.

Findings

The mortality experience was reviewed on a liability weighted basis for retired members in pay status and on a headcount basis for active members. The observed experience was compared to the current mortality tables and updated baseline mortality tables:

- Current mortality tables: RP-2014 Healthy Annuitant Mortality Tables, with a scaling factor of 105% for both males and females and projected for fully generational mortality improvements using Scale MP-2014
- Proposed Regular Benefit Formula **baseline** mortality tables: Pub-2010 General Healthy Retiree Mortality Tables set forward one year for males and set forward two years for females and projected for fully generational mortality improvements from 2010 using Scale MP-2018
- Proposed Alternative Benefit Formula **baseline** mortality tables: Pub-2010 Public Safety Healthy Retiree Mortality Tables projected for fully generational mortality improvements from 2010 using Scale MP-2018

The following tables, applicable to retired member mortality experience, compare the actual liability weighted deaths to the expected liability weighted deaths using the current tables, proposed baseline tables, and the recommended tables with credibility scaling.

Mortality Assumption

The following table uses the General Healthy Retirees amount-weighted mortality tables and applies to SERS retirees covered under the Regular Benefit formula.

| Retiree Experience | General Retirees Liability Weighted Deaths (\$ in 10,000) | | | |
|--------------------|---|----------|---|--|
| | Expected Using Current Mortality Table | Actual | Expected Using Baseline Mortality Table Without Scaling Pub-2010 General Healthy Retiree ^a | Expected Using Proposed Mortality Table With Scaling Pub-2010 General Healthy Retiree ^b |
| Male Retirees | \$48,624 | \$54,752 | \$49,418 | \$49,127 |
| Female Retirees | \$36,839 | \$42,902 | \$38,779 | \$38,393 |

^a Baseline Table: Pub 2010 General Healthy Retiree, set forward by one year for males and two years for females.

^b Proposed Table: Pub 2010 General Healthy Retiree, set forward one year for females, with a scaling factor of 111% for males and females.

When compared to the current mortality tables the experience on a liability weighted basis shows that actual experience is above expectation for both males and females.

When compared to the current mortality tables, the proposed mortality tables are expected to produce slightly higher liability weighted deaths overall.

We applied credibility and “best-fit” factors to the baseline mortality tables to recognize a portion of the observed mortality experience. The credibility factor applies more weight to the observed mortality experience as the sample size of the group and number of deaths increases. The “best-fit” factor compares actual deaths during the experience period to expected deaths during the period using a base mortality table.

The following table shows the development of the scaling factor that is applied to the recommended base mortality tables (Pub-2010 General Healthy Retiree Mortality) for SERS annuitants covered under the Regular Benefit Formula.

| Retiree Experience | General Retirees Liability Weighted Deaths (\$ in 10,000) | | | Credibility Factor (d)=(b/a) ^{1/2} | Best Fit Factor (e)=(b)/(c) | Scaling Factor Applied to Baseline Table (d) x (e) + [1-(d)] x 100% |
|--------------------|---|---------------------|--|--|--------------------------------|--|
| | Fully Credible Target Deaths Using Baseline Table ^{a,b} (a) | Observed Deaths (b) | Expected Deaths Using Baseline Table (c) | | | |
| Male Retirees | \$56,210 | \$54,752 | \$49,418 | 99% | 111% | 111% |
| Female Retirees | \$40,767 | \$42,902 | \$38,779 | 100% | 111% | 111% |

^a Baseline Table: Pub 2010 General Healthy Retiree, set forward by one year for males and two years for females.

^b Minimum number of expected liability weighted deaths needed for plan experience to be fully credible.

Mortality Assumption

The following table uses the Public Safety Healthy Retirees amount-weighted mortality tables and applies to SERS retirees covered under Alternative Benefit Formula.

| Retiree Experience | Public Safety Retirees Liability Weighted Deaths (\$ in 10,000) | | | |
|--------------------|---|----------|---|--|
| | Expected Using Current Mortality Table | Actual | Expected Using Baseline Mortality Table Without Scaling Pub-2010 Public Safety Healthy Retiree ^a | Expected Using Proposed Mortality Table With Scaling Pub-2010 Public Safety Healthy Retiree ^b |
| Male Retirees | \$35,802 | \$34,105 | \$29,390 | \$32,242 |
| Female Retirees | \$5,038 | \$5,579 | \$4,663 | \$4,912 |

^a Baseline Table: Pub 2010 Public Safety Healthy Retiree

^b Proposed Table: Pub 2010 Public Safety Healthy Retiree, with a scaling factor of 110% for males and 105% for females.

Although the experience has limited credibility, when compared to the current mortality table the experience on a liability weighted basis shows that actual experience is below expectation for males and above expectation for females.

When compared to the current mortality tables, the proposed mortality tables are expected to produce slightly lower liability weighted deaths overall.

We applied credibility and “best-fit” factors to the baseline mortality tables to recognize a portion of the observed mortality experience. The credibility factor applies more weight to the observed mortality experience as the sample size of the group and number of deaths increases. The “best-fit” factor compares actual deaths during the experience period to expected deaths during the period using a base mortality table.

The following table shows the development of the scaling factor that is applied to the recommended base mortality tables (Pub-2010 Public Safety Healthy Retiree Mortality) for SERS annuitants covered under the Alternative Benefit Formula.

| Retiree Experience | Public Safety Retirees Liability Weighted Deaths (\$ in 10,000) | | | Credibility Factor (d)=(b/a) ^{1/2} | Best Fit Factor (e)=(b)/(c) | Scaling Factor Applied to Baseline Table (d) x (e) + [1-(d)] x 100% |
|--------------------|--|---------------------------|---|---|--------------------------------|---|
| | Fully Credible Target Deaths Using Baseline Table ^{a,b} (a) | Observed Deaths (b) | Expected Deaths Using Baseline Table (c) | | | |
| Male Retirees | \$93,248 | \$34,105 | \$29,390 | 60% | 116% | 110% |
| Female Retirees | \$75,899 | \$5,579 | \$4,663 | 27% | 120% | 105% |

^a Baseline Table: Pub 2010 Public Safety Healthy Retiree

^b Minimum number of expected liability weighted deaths needed for plan experience to be fully credible.

Mortality Assumption

The experience for active members is even less credible when compared to the experience of retired members.

Current pre-retirement tables are based on 75 percent for males and 90 percent for females of the RP-2014 Total Employee mortality table. These tables also include generational mortality improvements using the MP-2014 two dimensional mortality improvement scales. Five percent of deaths among active employees are assumed to be in the performance of their duty.

The following tables use the General Employees headcount-weighted mortality tables and apply to SERS members covered under the SERS Regular Benefit Formula.

| Pre-Retirement Experience | General Employees Headcount Weighted Deaths | | | |
|---------------------------|---|--------|--|---|
| | Expected Using Current Mortality Table | Actual | Expected Using Baseline Mortality Table Without Scaling Pub-2010 General Employee ^a | Expected Using Proposed Mortality Table With Scaling Pub-2010 General Employee ^b |
| Male Members | 109 | 72 | 128 | 98 |
| Female Members | 91 | 75 | 92 | 80 |

^a Baseline Table: Pub 2010 General Employee

^b Proposed Table: Pub 2010 General Employee, set back by two year for males and one year for females, with a scaling factor of 89% for males and 95% for females.

The following table shows the development of the scaling factor that is applied to the recommended base mortality table (Pub-2010 General Employee) for SERS employees covered under the Regular Benefit Formula.

| Active Member Experience | General Employees Headcount Weighted Deaths | | | Credibility Factor (d)=(b/a) ^{1/2} | Best Fit Factor (e)=(b)/(c) | Scaling Factor Applied to Baseline Table (d) x (e) + [1-(d)] x 100% |
|--------------------------|--|---------------------|--|---|-----------------------------|---|
| | Fully Credible Target Deaths Using Baseline Table ^a (a) | Observed Deaths (b) | Expected Deaths Using Baseline Table (c) | | | |
| Male Employees | 1,082 | 72 | 128 | 26% | 56% | 89% |
| Female Employees | 1,082 | 75 | 92 | 26% | 81% | 95% |

^a Baseline Table: Pub 2010 General Employee

Mortality Assumption

The following tables use the Public Safety Employees headcount-weighted mortality tables and apply to SERS members covered under the Alternative Benefit Formula.

| | Public Safety Headcount Weighted Deaths | | | |
|------------------------------|--|--------|--|---|
| Pre-Retirement Experience | Expected Using Current Mortality Table | Actual | Expected Using Baseline Mortality Table Without Scaling Pub-2010 Public Safety Employee ^a | Expected Using Proposed Mortality Table With Scaling Pub-2010 Public Safety Employee ^b |
| Male Members | 46 | 40 | 51 | 49 |
| Female Members | 10 | 19 | 12 | 14 |

^a *Baseline Table: Pub 2010 Public Safety Employee*

^b *Proposed Table: Pub 2010 Public Safety Employee, with a scaling factor of 96% for males and 108% for females.*

The following table shows the development of the scaling factor that is applied to the recommended base mortality table (Pub-2010 Public Safety Employee) for SERS employees covered under the Alternative Benefit Formula.

| | Public Safety Headcount Weighted Deaths | | | | | |
|-----------------------------|--|---------------------------|---|---|--------------------------------|---|
| Active Member Experience | Fully Credible Target Deaths Using Baseline Table ^a (a) | Observed Deaths (b) | Expected Deaths Using Baseline Table (c) | Credibility Factor (d)=(b/a) ^{1/2} | Best Fit Factor (e)=(b)/(c) | Scaling Factor Applied to Baseline Table (d) x (e) + [1-(d)] x 100% |
| Male Employees | 1,082 | 40 | 51 | 19% | 78% | 96% |
| Female Employees | 1,082 | 19 | 12 | 13% | 158% | 108% |

^a *Baseline Table: Pub 2010 Public Safety Employee*

Mortality Assumption

Recommendation

We reviewed the mortality experience separately for active members and retirees during the three-year study period. Details of the results are shown on the following pages.

Following is a summary of the current mortality assumptions:

| Applicable Group | Base Table with 2014 Base Year | Male Set Back Years | Female Set Back Years | Male Multiplier | Female Multiplier |
|------------------|---------------------------------------|---------------------|-----------------------|-----------------|-------------------|
| Pre-retirement | RP-2014 Employee, sex distinct | 0 | 0 | 75% | 90% |
| Post-retirement | RP-2014 Healthy Retiree, sex distinct | 0 | 0 | 105% | 105% |

Following is a summary of the recommended mortality assumptions:

| General Employees and Retirees | Proposed Mortality Table | Male Set Back Years | Female Set Back Years | Male Scaling Factor | Female Scaling Factor |
|--------------------------------|---|---------------------|-----------------------|---------------------|-----------------------|
| Pre-retirement | Pub-2010 General Employee, sex distinct | 2 | 1 | 89% | 95% |
| Post-retirement | Pub-2010 General Healthy Retiree sex distinct | 0 | -1 | 111% | 111% |

| Public Safety Employees and Retirees | Proposed Mortality Table | Male Set Back Years | Female Set Back Years | Male Scaling Factor | Female Scaling Factor |
|--------------------------------------|--|---------------------|-----------------------|---------------------|-----------------------|
| Pre-retirement | Pub-2010 Public Safety Employee, sex distinct | 0 | 0 | 96% | 108% |
| Post-retirement | Pub-2010 Public Safety Healthy Retiree, sex distinct | 0 | 0 | 110% | 105% |

Future mortality improvements are reflected by projecting the base mortality tables forward from the year 2010 using the MP-2018 projection scale.

Mortality Assumption

A Note about Mortality Rates

The recommended mortality assumptions include generational mortality improvements, which means that the probability of a 60-year-old retired male dying in any particular year is lower for a 60-year old born in 1994 than a 60-year-old born in 1954.

The use of generational mortality tables is based on the assumption that life expectancy increases from generation to generation. Simply put, this means that the life expectancy of someone born in 1994 is greater than that of someone born in 1954.

The following tables contain the mortality experience for the experience study period:

- Table II(a) and Graphs II(a)(i) and II(a)(ii) – Post-Retirement Mortality Experience – General
- Table II(b) and Graphs II(b)(i) and II(b)(ii) – Post-Retirement Mortality Experience – Public Safety
- Table II(c) and Graphs II(c)(i) and II(c)(ii) – Pre-Retirement Mortality Experience – General
- Table II(d) and Graphs II(d)(i) and II(d)(ii) – Pre-Retirement Mortality Experience – Public Safety

Mortality Assumption

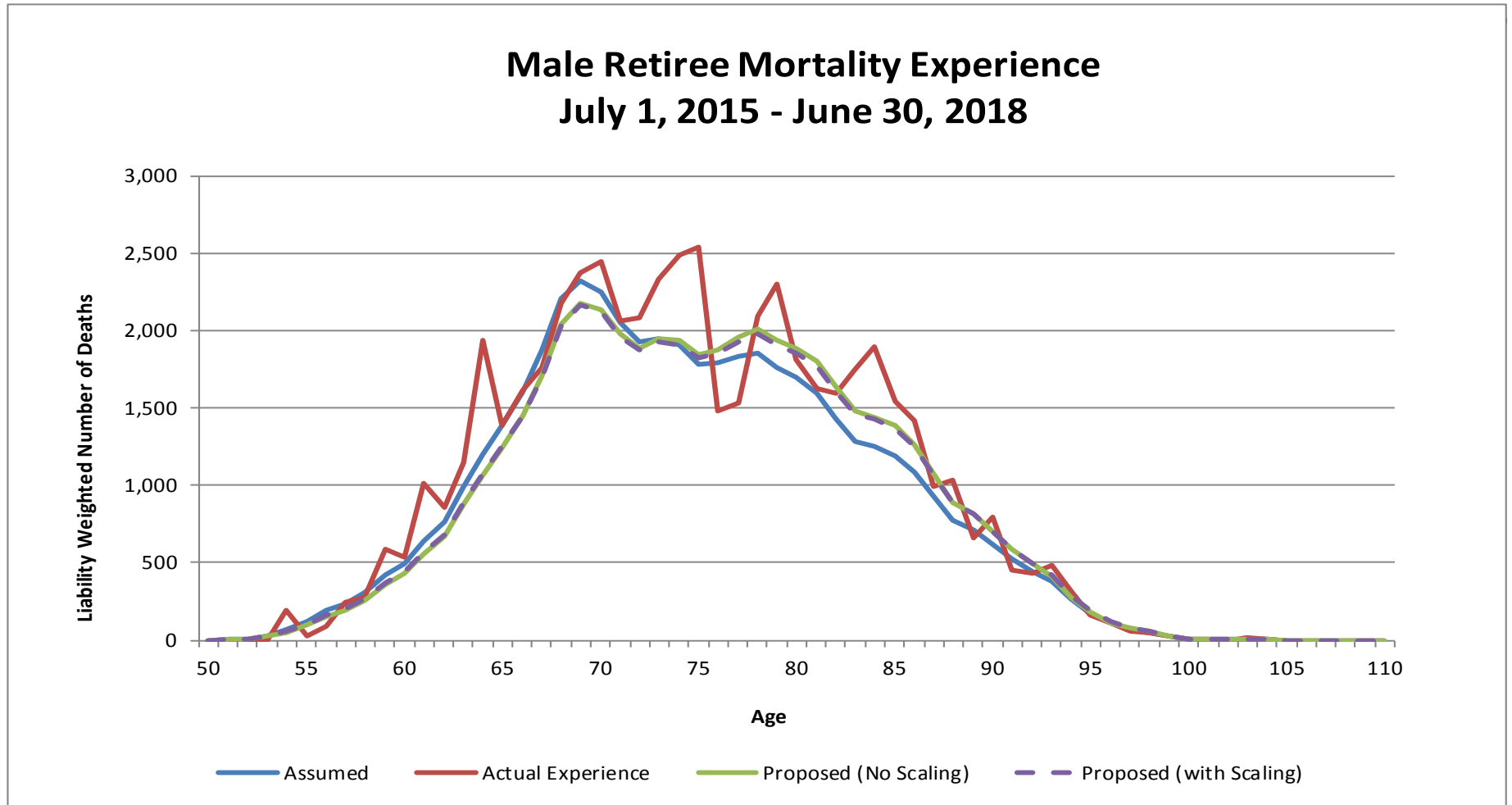
Table II(a) General

| Male Retiree Mortality Experience | | | | | | | | | |
|-------------------------------------|-----------------------------------|------------------|---------------|---------------------|---------------|-------------------|----------------------|---------------|-------------------|
| Age | Actual Experience | | | Current Assumptions | | | Proposed Assumptions | | |
| | Liability Weighted (\$ in 10,000) | | Actual Rate | Expected Deaths | Assumed Rate | Actual / Expected | Expected Deaths | Proposed Rate | Actual / Expected |
| | Exposures | Deaths | | | | | | | |
| Under 54 | \$ 19,095 | \$ 190 | 0.995% | \$ 101 | 0.529% | 1.88 | \$ 79 | 0.416% | 2.39 |
| 55-59 | 186,807 | 1,219 | 0.653% | 1,280 | 0.685% | 0.95 | 1,083 | 0.580% | 1.13 |
| 60-64 | 435,427 | 5,486 | 1.260% | 4,086 | 0.938% | 1.34 | 3,651 | 0.838% | 1.50 |
| 65-69 | 698,286 | 9,310 | 1.333% | 9,403 | 1.347% | 0.99 | 8,583 | 1.229% | 1.08 |
| 70-74 | 502,501 | 11,406 | 2.270% | 10,081 | 2.006% | 1.13 | 9,776 | 1.945% | 1.17 |
| 75-79 | 276,191 | 9,931 | 3.596% | 9,022 | 3.266% | 1.10 | 9,466 | 3.427% | 1.05 |
| 80-84 | 133,677 | 8,655 | 6.475% | 7,252 | 5.425% | 1.19 | 8,116 | 6.071% | 1.07 |
| 85-89 | 50,140 | 5,646 | 11.261% | 4,702 | 9.377% | 1.20 | 5,386 | 10.742% | 1.05 |
| 90-94 | 14,000 | 2,472 | 17.656% | 2,237 | 15.976% | 1.11 | 2,488 | 17.774% | 0.99 |
| 95-99 | 1,784 | 412 | 23.106% | 431 | 24.182% | 0.96 | 466 | 26.150% | 0.88 |
| 100-104 | 83 | 24 | 29.065% | 29 | 35.097% | 0.83 | 32 | 38.017% | 0.76 |
| 105+ | - | - | | - | | | - | | |
| Totals: | \$ 2,317,992 | \$ 54,752 | 2.362% | \$ 48,624 | 2.098% | 1.13 | \$ 49,127 | 2.119% | 1.11 |
| Female Retiree Mortality Experience | | | | | | | | | |
| Under 54 | \$ 30,268 | \$ 123 | 0.408% | \$ 104 | 0.343% | 1.19 | \$ 96 | 0.317% | 1.29 |
| 55-59 | 306,753 | 1,783 | 0.581% | 1,359 | 0.443% | 1.31 | 1,250 | 0.407% | 1.43 |
| 60-64 | 645,624 | 4,757 | 0.737% | 4,147 | 0.642% | 1.15 | 3,691 | 0.572% | 1.29 |
| 65-69 | 709,387 | 7,930 | 1.118% | 6,931 | 0.977% | 1.14 | 6,276 | 0.885% | 1.26 |
| 70-74 | 444,665 | 8,419 | 1.893% | 6,896 | 1.551% | 1.22 | 6,741 | 1.516% | 1.25 |
| 75-79 | 238,300 | 6,385 | 2.680% | 6,044 | 2.536% | 1.06 | 6,501 | 2.728% | 0.98 |
| 80-84 | 108,959 | 5,681 | 5.214% | 4,651 | 4.268% | 1.22 | 5,471 | 5.021% | 1.04 |
| 85-89 | 47,508 | 4,126 | 8.684% | 3,563 | 7.499% | 1.16 | 4,483 | 9.436% | 0.92 |
| 90-94 | 17,716 | 2,723 | 15.369% | 2,255 | 12.728% | 1.21 | 2,822 | 15.928% | 0.96 |
| 95-99 | 3,662 | 831 | 22.692% | 742 | 20.266% | 1.12 | 887 | 24.217% | 0.94 |
| 100-104 | 471 | 141 | 29.936% | 139 | 29.604% | 1.01 | 165 | 34.935% | 0.86 |
| 105+ | 23 | 4 | 16.601% | 10 | 43.915% | 0.38 | 11 | 48.932% | 0.34 |
| Totals: | \$ 2,553,334 | \$ 42,902 | 1.680% | \$ 36,839 | 1.443% | 1.16 | \$ 38,393 | 1.504% | 1.12 |
| Grand Totals: | \$ 4,871,325 | \$ 97,654 | 2.005% | \$ 85,463 | 1.754% | 1.14 | \$ 87,520 | 1.797% | 1.12 |

Expected deaths under the current and proposed assumptions are on a liability weighted basis.

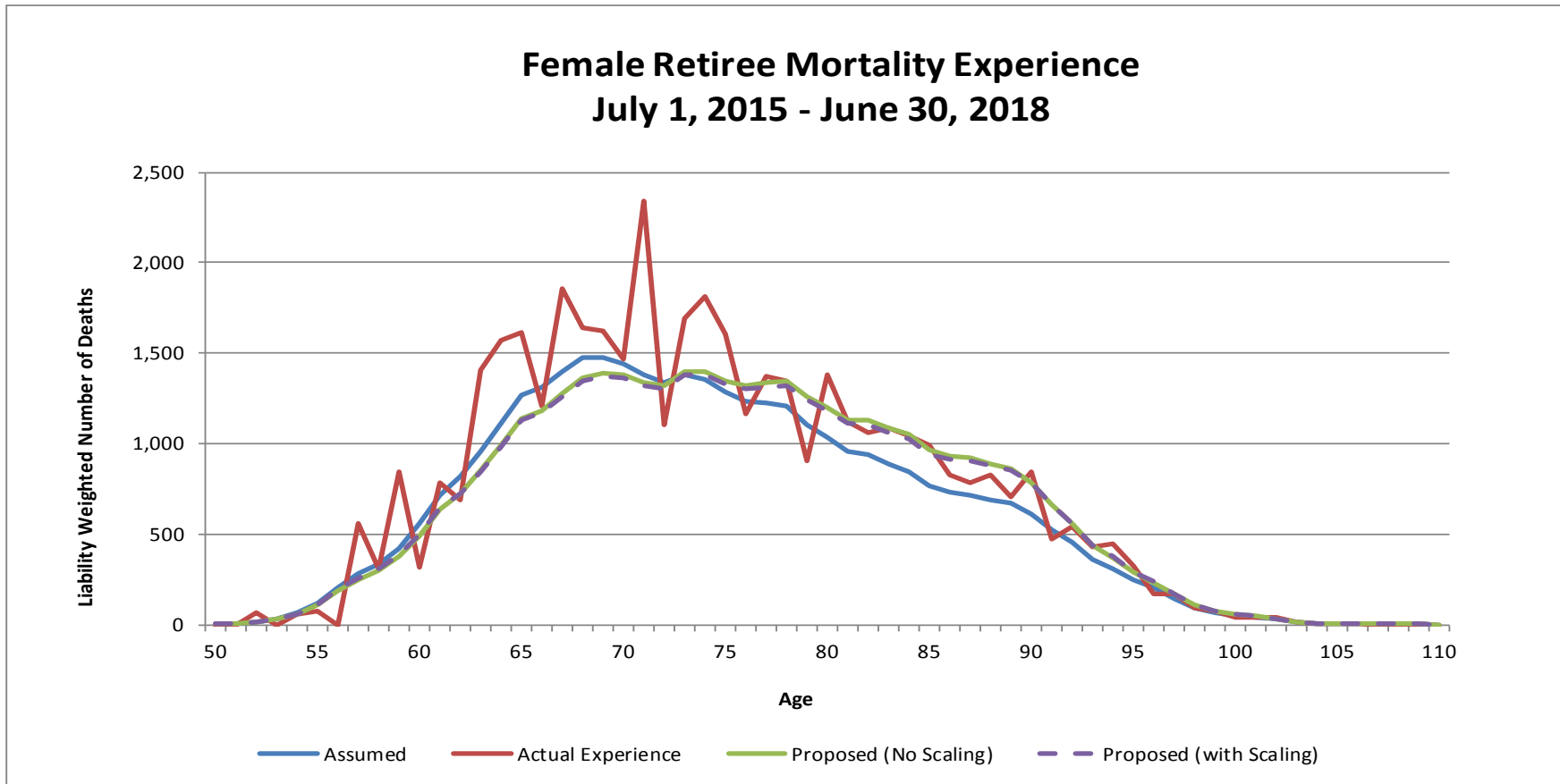
Mortality Assumption

Graph II(a)(i) General Male



Mortality Assumption

Graph II(a)(ii) General Female



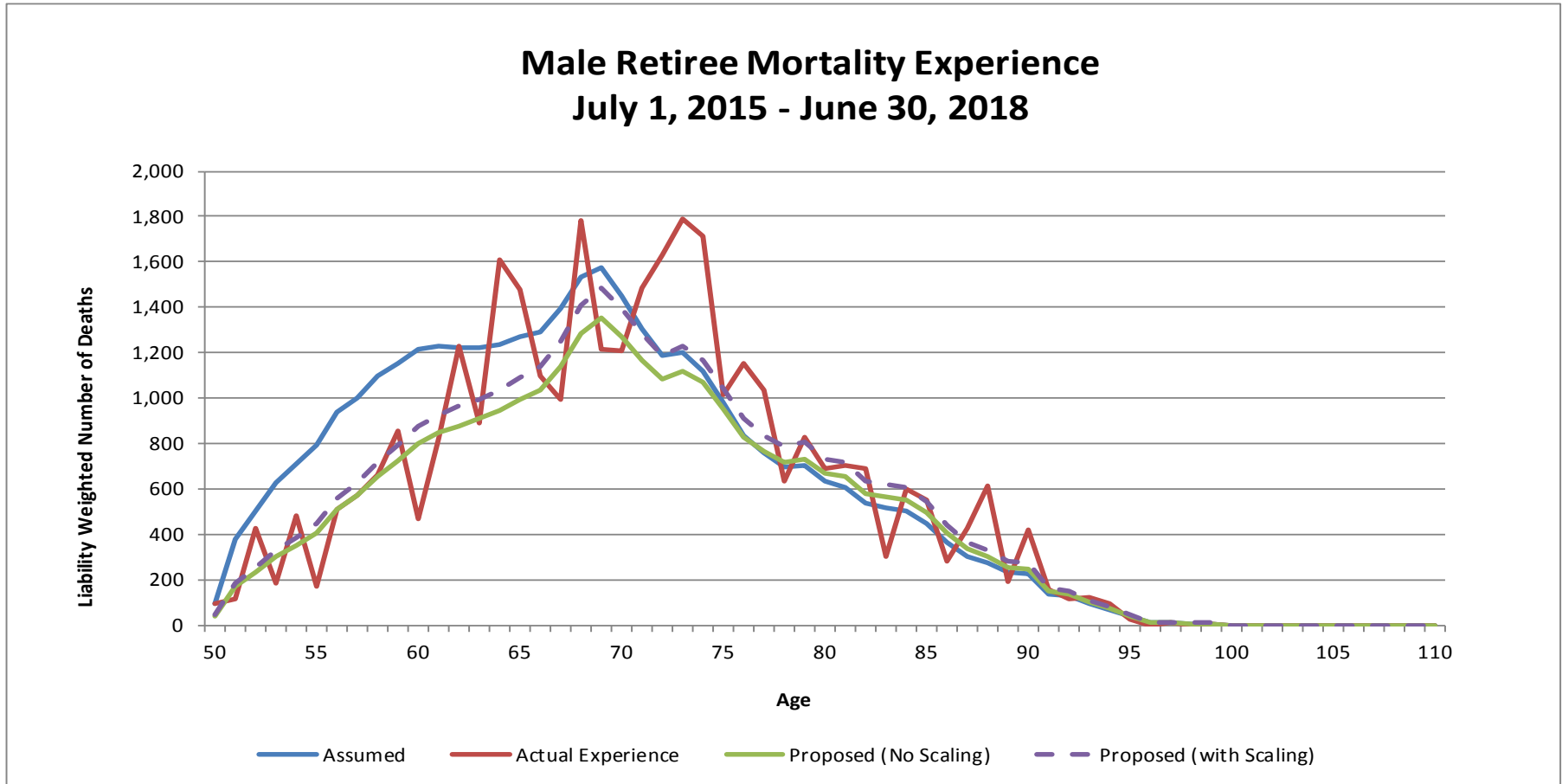
Mortality Assumption

Table II(b) Public Safety

| Male Retiree Mortality Experience | | | | | | | | | | |
|-------------------------------------|-----------------------------------|------------------|---------------|---------------------|---------------|-------------|----------------------|---------------|-------------|--|
| Age | Actual Experience | | | Current Assumptions | | | Proposed Assumptions | | | |
| | Liability Weighted (\$ in 10,000) | | Actual | Expected | Assumed | Actual / | Expected | Proposed | Actual / | |
| | Exposures | Deaths | Rate | Deaths | Rate | Expected | Deaths | Rate | Expected | |
| Under 54 | \$ 465,193 | \$ 1,298 | 0.279% | \$ 2,300 | 0.495% | 0.56 | \$ 1,194 | 0.257% | 1.09 | |
| 55-59 | 743,799 | 2,764 | 0.372% | 4,976 | 0.669% | 0.56 | 3,135 | 0.421% | 0.88 | |
| 60-64 | 672,678 | 5,019 | 0.746% | 6,126 | 0.911% | 0.82 | 4,800 | 0.714% | 1.05 | |
| 65-69 | 530,066 | 6,566 | 1.239% | 7,062 | 1.332% | 0.93 | 6,363 | 1.200% | 1.03 | |
| 70-74 | 313,487 | 7,828 | 2.497% | 6,263 | 1.998% | 1.25 | 6,263 | 1.998% | 1.25 | |
| 75-79 | 123,586 | 4,657 | 3.768% | 3,961 | 3.205% | 1.18 | 4,375 | 3.540% | 1.06 | |
| 80-84 | 51,308 | 2,980 | 5.807% | 2,790 | 5.437% | 1.07 | 3,311 | 6.454% | 0.90 | |
| 85-89 | 17,342 | 2,054 | 11.844% | 1,609 | 9.277% | 1.28 | 1,957 | 11.285% | 1.05 | |
| 90-94 | 4,117 | 901 | 21.892% | 647 | 15.724% | 1.39 | 770 | 18.692% | 1.17 | |
| 95-99 | 283 | 39 | 13.674% | 68 | 23.973% | 0.57 | 75 | 26.446% | 0.52 | |
| 100-104 | - | - | - | - | - | - | - | - | - | |
| 105+ | - | - | - | - | - | - | - | - | - | |
| Totals: | \$ 2,921,859 | \$ 34,105 | 1.167% | \$ 35,802 | 1.225% | 0.95 | \$ 32,242 | 1.103% | 1.06 | |
| Female Retiree Mortality Experience | | | | | | | | | | |
| Under 54 | \$ 66,789 | \$ 88 | 0.132% | \$ 218 | 0.326% | 0.40 | \$ 143 | 0.214% | 0.62 | |
| 55-59 | 154,977 | 241 | 0.155% | 672 | 0.434% | 0.36 | 568 | 0.366% | 0.42 | |
| 60-64 | 166,935 | 1,126 | 0.675% | 1,052 | 0.630% | 1.07 | 986 | 0.591% | 1.14 | |
| 65-69 | 110,724 | 1,816 | 1.640% | 1,070 | 0.966% | 1.70 | 1,038 | 0.937% | 1.75 | |
| 70-74 | 57,788 | 749 | 1.295% | 895 | 1.548% | 0.84 | 917 | 1.587% | 0.82 | |
| 75-79 | 26,327 | 876 | 3.329% | 650 | 2.470% | 1.35 | 716 | 2.721% | 1.22 | |
| 80-84 | 5,750 | 229 | 3.989% | 241 | 4.191% | 0.95 | 275 | 4.790% | 0.83 | |
| 85-89 | 2,062 | 318 | 15.445% | 153 | 7.410% | 2.08 | 173 | 8.389% | 1.84 | |
| 90-94 | 660 | 126 | 19.155% | 81 | 12.241% | 1.56 | 89 | 13.543% | 1.41 | |
| 95-99 | 31 | 9 | 27.969% | 6 | 19.678% | 1.42 | 7 | 20.990% | 1.33 | |
| 100-104 | - | - | - | - | - | - | - | - | - | |
| 105+ | - | - | - | - | - | - | - | - | - | |
| Totals: | \$ 592,043 | \$ 5,579 | 0.942% | \$ 5,038 | 0.851% | 1.11 | \$ 4,912 | 0.830% | 1.14 | |
| Grand Totals: | \$ 3,513,903 | \$ 39,685 | 1.129% | \$ 40,840 | 1.162% | 0.97 | \$ 37,154 | 1.057% | 1.07 | |

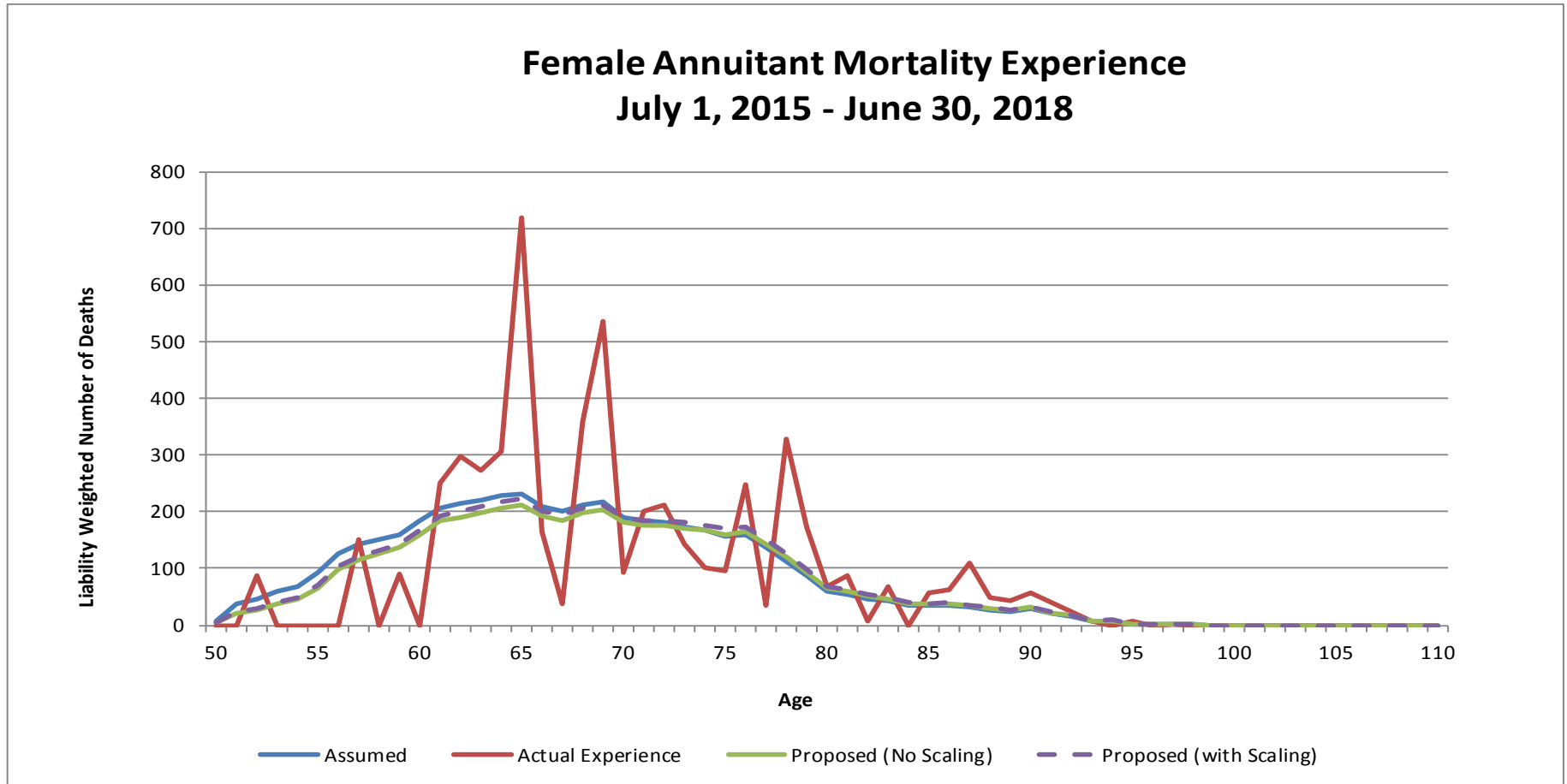
Mortality Assumption

Graph II(b)(i) Public Safety Male



Mortality Assumption

Graph II(b)(ii) Public Safety Female



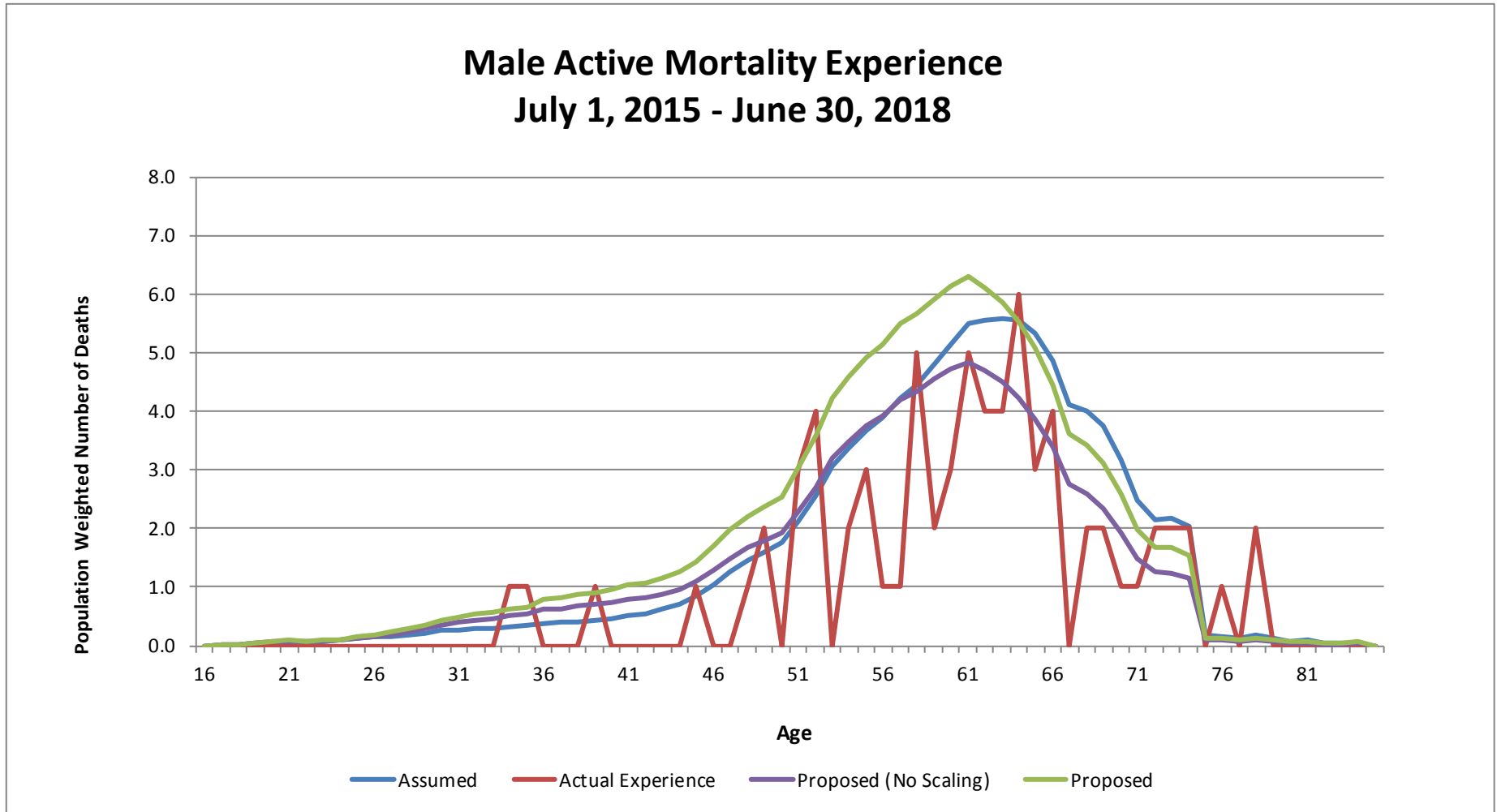
Mortality Assumption

Table II(c) Active General

| Male Active Mortality Experience | | | | | | | | | |
|------------------------------------|---------------------|------------|---------------|---------------------|---------------|-------------------|----------------------|---------------|-------------------|
| Age | Actual Experience | | | Current Assumptions | | | Proposed Assumptions | | |
| | Population Weighted | | | Expected Deaths | Assumed Rate | Actual / Expected | Expected Deaths | Proposed Rate | Actual / Expected |
| | Exposures | Deaths | Actual Rate | | | | | | |
| Under 20 | 151 | 0 | 0.000% | 0 | 0.000% | | 0 | 0.000% | |
| 20-24 | 1,147 | 0 | 0.000% | 0 | 0.000% | | 0 | 0.000% | |
| 25-29 | 2,710 | 0 | 0.000% | 1 | 0.037% | 0.00 | 1 | 0.037% | 0.00 |
| 30-34 | 4,355 | 1 | 0.023% | 1 | 0.023% | 1.00 | 2 | 0.046% | 0.50 |
| 35-39 | 5,102 | 2 | 0.039% | 2 | 0.039% | 1.00 | 3 | 0.059% | 0.67 |
| 40-44 | 5,630 | 0 | 0.000% | 3 | 0.053% | 0.00 | 4 | 0.071% | 0.00 |
| 45-49 | 7,370 | 4 | 0.054% | 6 | 0.081% | 0.67 | 7 | 0.095% | 0.57 |
| 50-54 | 8,949 | 9 | 0.101% | 13 | 0.145% | 0.69 | 14 | 0.156% | 0.64 |
| 55-59 | 8,856 | 12 | 0.136% | 21 | 0.237% | 0.57 | 21 | 0.237% | 0.57 |
| 60-64 | 6,728 | 22 | 0.327% | 27 | 0.401% | 0.81 | 23 | 0.342% | 0.96 |
| 65-69 | 3,224 | 11 | 0.341% | 22 | 0.682% | 0.50 | 15 | 0.465% | 0.73 |
| 70-74 | 1,067 | 8 | 0.750% | 12 | 1.125% | 0.67 | 7 | 0.656% | 1.14 |
| 75 and over | 49 | 3 | 6.122% | 1 | 2.041% | 3.00 | 1 | 2.041% | 3.00 |
| Totals: | 55,338 | 72 | 0.130% | 109 | 0.197% | 0.66 | 98 | 0.177% | 0.73 |
| Less than 60: | 44,270 | 28 | 0.063% | 47 | 0.106% | 0.60 | 52 | 0.117% | 0.54 |
| Female Active Mortality Experience | | | | | | | | | |
| Age | Population Weighted | | | Expected Deaths | Assumed Rate | Actual / Expected | Expected Deaths | Proposed Rate | Actual / Expected |
| | Exposures | Deaths | Actual Rate | | | | | | |
| Under 20 | 93 | 0 | 0.000% | 0 | 0.014% | 0.00 | 0 | 0.000% | |
| 20-24 | 1,075 | 0 | 0.000% | 0 | 0.014% | 0.00 | 0 | 0.000% | |
| 25-29 | 3,757 | 1 | 0.027% | 1 | 0.017% | 1.59 | 1 | 0.027% | 1.00 |
| 30-34 | 5,786 | 1 | 0.017% | 1 | 0.022% | 0.79 | 1 | 0.017% | 1.00 |
| 35-39 | 7,163 | 1 | 0.014% | 2 | 0.029% | 0.49 | 2 | 0.028% | 0.50 |
| 40-44 | 8,210 | 1 | 0.012% | 3 | 0.042% | 0.29 | 4 | 0.049% | 0.25 |
| 45-49 | 10,663 | 7 | 0.066% | 8 | 0.071% | 0.92 | 7 | 0.066% | 1.00 |
| 50-54 | 12,822 | 14 | 0.109% | 15 | 0.117% | 0.93 | 13 | 0.101% | 1.08 |
| 55-59 | 12,947 | 22 | 0.170% | 22 | 0.172% | 0.99 | 20 | 0.154% | 1.10 |
| 60-64 | 8,717 | 16 | 0.184% | 21 | 0.246% | 0.75 | 19 | 0.218% | 0.84 |
| 65-69 | 3,051 | 6 | 0.197% | 11 | 0.375% | 0.52 | 9 | 0.295% | 0.67 |
| 70-74 | 838 | 3 | 0.358% | 5 | 0.639% | 0.56 | 4 | 0.477% | 0.75 |
| 75 and over | 18 | 3 | 16.667% | 0 | 1.122% | 14.86 | 0 | 0.000% | |
| Totals: | 75,140 | 75 | 0.100% | 91 | 0.121% | 0.82 | 80 | 0.106% | 0.94 |
| Less than 60: | 62,516 | 47 | 0.075% | 53 | 0.084% | 0.89 | 48 | 0.077% | 0.98 |
| Grand Totals: | 130,478 | 147 | 0.113% | 200 | 0.153% | 0.74 | 178 | 0.136% | 0.83 |
| Less than 60: | 106,786 | 75 | 0.070% | 100 | 0.093% | 0.75 | 100 | 0.094% | 0.75 |

Mortality Assumption

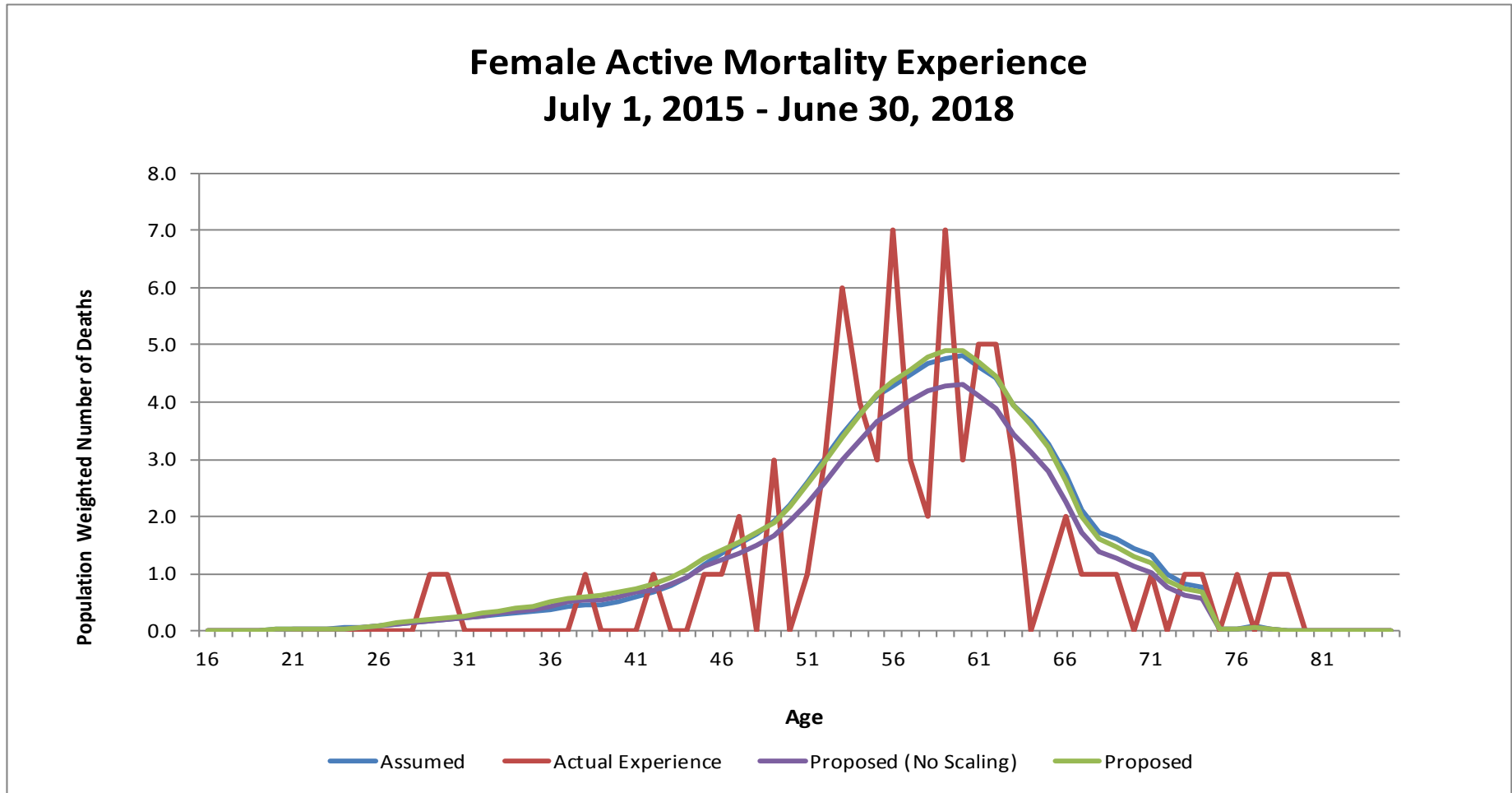
Graph II(c)(i) Active General Male



Expected deaths under the current and proposed assumptions are on a population weighted basis.

Mortality Assumption

Graph II(c)(ii) Active General Female



Expected deaths under the current and proposed assumptions are on a population weighted basis.

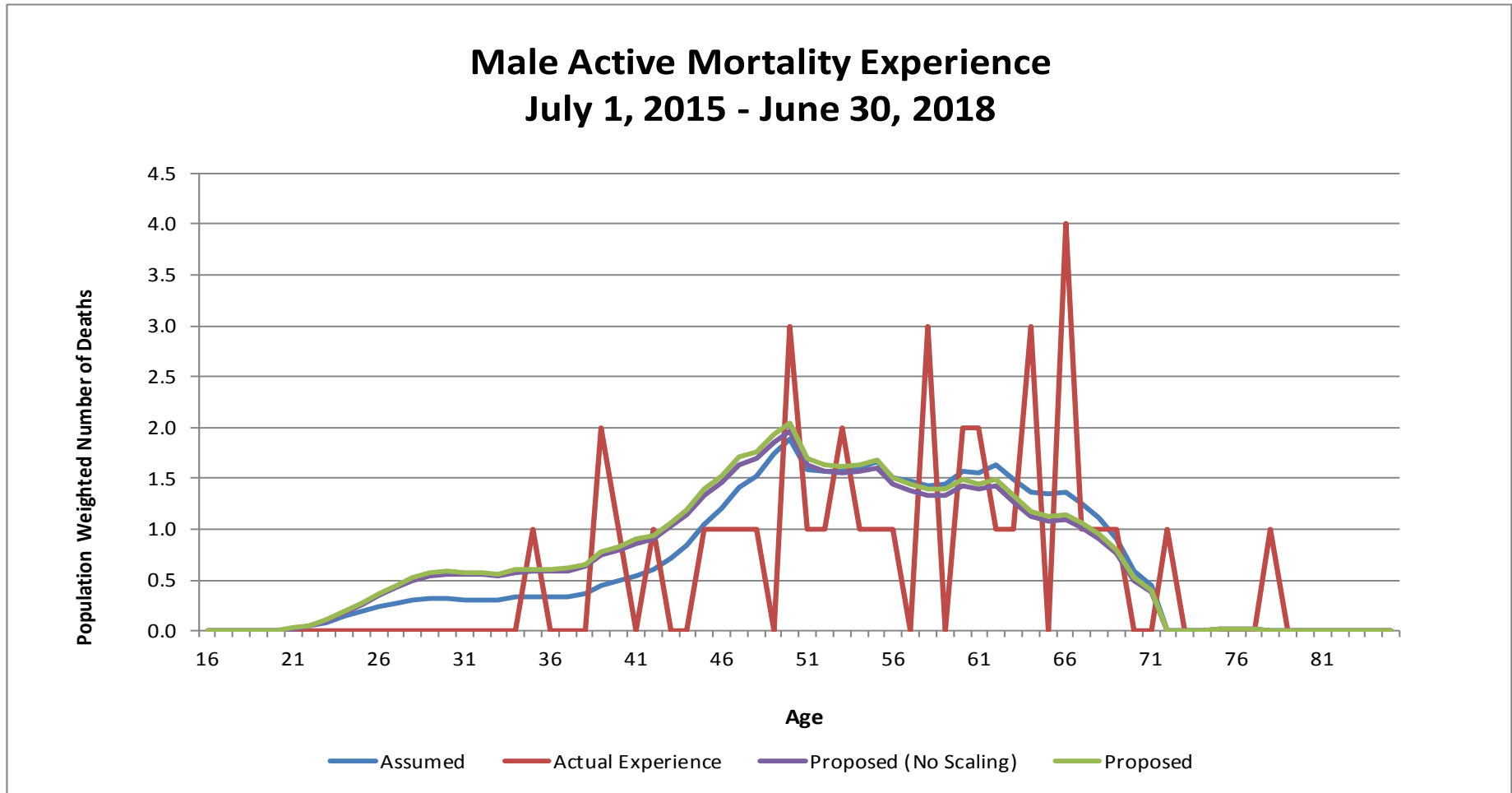
Mortality Assumption

Table II(d) Active Public Safety

| Male Active Mortality Experience | | | | | | | | | |
|------------------------------------|---------------------|-----------|---------------|---------------------|-----------------|----------------------|----------------------|------------------|----------------------|
| Age | Actual Experience | | | Current Assumptions | | | Proposed Assumptions | | |
| | Population Weighted | | | Expected Deaths | Assumed Rate | Actual / Expected | Expected Deaths | Proposed Rate | Actual / Expected |
| | Exposures | Deaths | Actual Rate | | | | | | |
| Under 20 | 3 | 0 | 0.000% | 0 | 0.000% | | 0 | 0.000% | |
| 20-24 | 869 | 0 | 0.000% | 0 | 0.000% | | 0 | 0.000% | |
| 25-29 | 4,245 | 0 | 0.000% | 1 | 0.024% | 0.00 | 2 | 0.047% | 0.00 |
| 30-34 | 4,768 | 0 | 0.000% | 2 | 0.042% | 0.00 | 3 | 0.063% | 0.00 |
| 35-39 | 4,748 | 3 | 0.063% | 2 | 0.042% | 1.50 | 3 | 0.063% | 1.00 |
| 40-44 | 6,311 | 2 | 0.032% | 3 | 0.048% | 0.67 | 5 | 0.079% | 0.40 |
| 45-49 | 8,326 | 4 | 0.048% | 7 | 0.084% | 0.57 | 8 | 0.096% | 0.50 |
| 50-54 | 5,967 | 8 | 0.134% | 8 | 0.134% | 1.00 | 8 | 0.134% | 1.00 |
| 55-59 | 3,236 | 5 | 0.155% | 8 | 0.247% | 0.63 | 7 | 0.216% | 0.71 |
| 60-64 | 1,892 | 9 | 0.476% | 8 | 0.423% | 1.13 | 7 | 0.370% | 1.29 |
| 65-69 | 873 | 7 | 0.802% | 6 | 0.687% | 1.17 | 5 | 0.573% | 1.40 |
| 70-74 | 105 | 1 | 0.952% | 1 | 0.952% | 1.00 | 1 | 0.952% | 1.00 |
| 75 and over | 3 | 1 | 33.333% | 0 | 0.000% | | 0 | 0.000% | |
| Totals: | 41,346 | 40 | 0.097% | 46 | 0.111% | 0.87 | 49 | 0.119% | 0.82 |
| Less than 60: | 38,473 | 22 | 0.057% | 31 | 0.081% | 0.71 | 36 | 0.094% | 0.61 |
| Female Active Mortality Experience | | | | | | | | | |
| Age | Population Weighted | | | Expected Deaths | Assumed Rate | Actual / Expected | Expected Deaths | Proposed Rate | Actual / Expected |
| | Exposures | Deaths | Actual Rate | | | | | | |
| Under 20 | 0 | 0 | | 0 | | | 0 | | |
| 20-24 | 222 | 0 | 0.000% | 0 | 0.000% | | 0 | 0.000% | |
| 25-29 | 1,092 | 0 | 0.000% | 0 | 0.000% | | 0 | 0.000% | |
| 30-34 | 1,234 | 0 | 0.000% | 0 | 0.000% | | 1 | 0.081% | 0.00 |
| 35-39 | 1,231 | 0 | 0.000% | 0 | 0.000% | | 1 | 0.081% | 0.00 |
| 40-44 | 1,859 | 0 | 0.000% | 1 | 0.054% | 0.00 | 1 | 0.054% | 0.00 |
| 45-49 | 2,396 | 3 | 0.125% | 2 | 0.083% | 1.50 | 2 | 0.083% | 1.50 |
| 50-54 | 2,110 | 5 | 0.237% | 2 | 0.095% | 2.50 | 3 | 0.142% | 1.67 |
| 55-59 | 1,410 | 5 | 0.355% | 2 | 0.142% | 2.50 | 3 | 0.213% | 1.67 |
| 60-64 | 840 | 5 | 0.595% | 2 | 0.238% | 2.50 | 2 | 0.238% | 2.50 |
| 65-69 | 188 | 1 | 0.532% | 1 | 0.532% | 1.00 | 1 | 0.532% | 1.00 |
| 70-74 | 22 | 0 | 0.000% | 0 | 0.000% | | 0 | 0.000% | |
| 75 and over | 0 | 0 | | 0 | | | 0 | | |
| Totals: | 12,604 | 19 | 0.151% | 10 | 0.079% | 1.90 | 14 | 0.111% | 1.36 |
| Less than 60: | 11,554 | 13 | 0.113% | 7 | 0.061% | 1.86 | 11 | 0.095% | 1.18 |
| Grand Totals: | 53,950 | 59 | 0.109% | 56 | 0.104% | 1.05 | 63 | 0.117% | 0.94 |
| Less than 60: | 50,027 | 35 | 0.070% | 38 | 0.076% | 0.92 | 47 | 0.094% | 0.74 |

Mortality Assumption

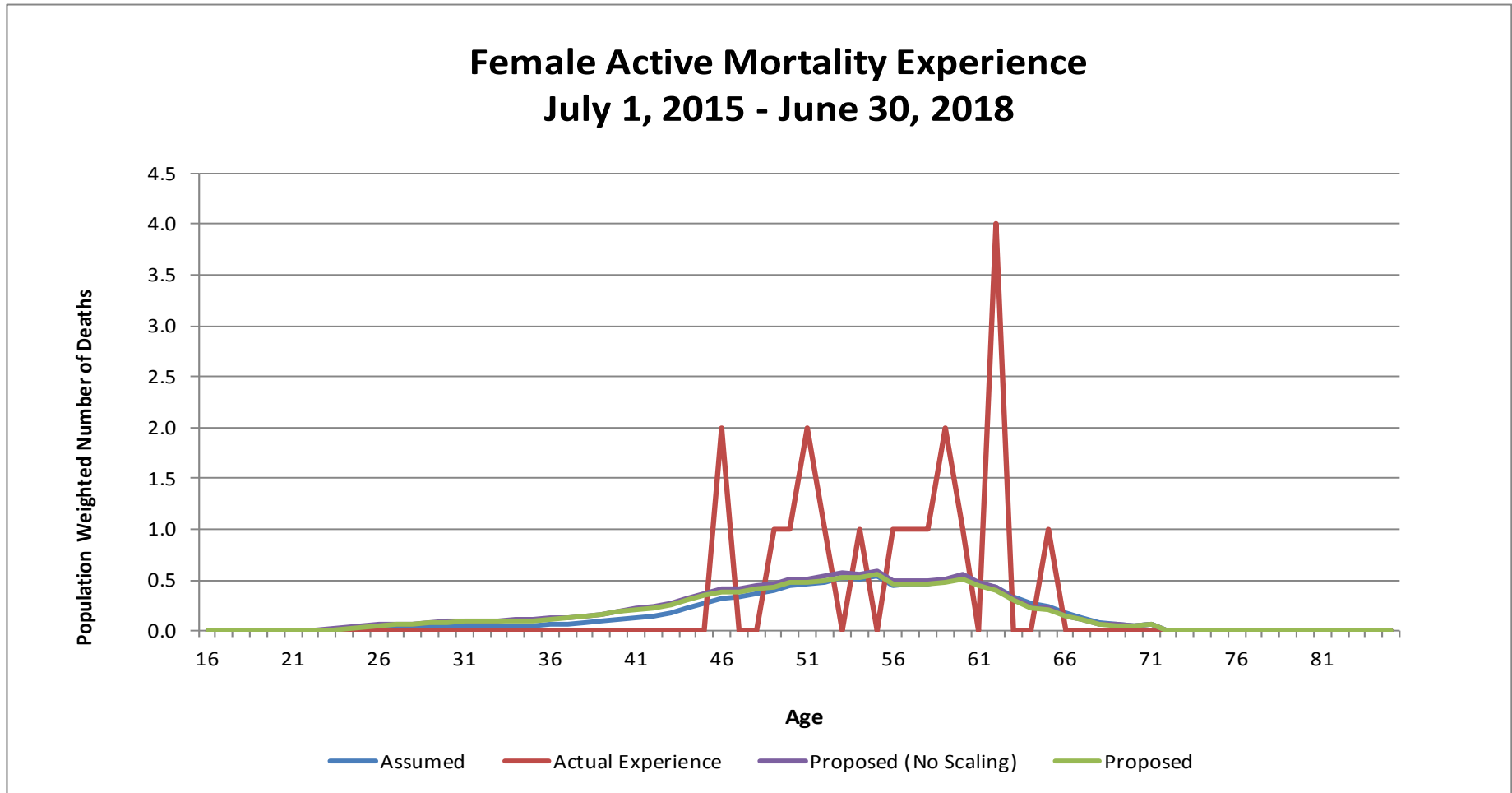
Graph II(d)(i) Active Public Safety Male



Expected deaths under the current and proposed assumptions are on a population weighted basis.

Mortality Assumption

Graph II(d)(ii) Active Public Safety Female



Expected deaths under the current and proposed assumptions are on a population weighted basis.

Retirement Assumption

Retirement

The System provisions establish the minimum eligibility requirements for retirement as follows: Upon termination of State service, a member is eligible for a pension at age 60 with at least eight years of pension credit or at any age with 35 or more years of credit.

General formula members are eligible for a retirement annuity if the sum of the member's age plus years (and whole months) of pension credit equals or exceeds 85. General formula members between ages 55 and 60 with at least 25 years of pension credit are eligible for a retirement annuity reduced by one-half of 1 percent for each month the member is under age 60. Certain positions in the Department of Corrections were placed under the general formula effective July 1, 2005.

Members serving in a position in which service toward the Alternative Retirement Annuity may be earned are eligible to receive the Alternative Retirement Annuity at age 50 with at least 25 years of alternative pension credit or at age 55 with at least 20 years of alternative pension credit in such a position. Security employees of the Department of Human Services were placed under the alternative formula effective January 1, 2001. Certain members of the Department of Transportation and the Toll Highway Authority were placed under the alternative formula effective August 1, 2001.

The above provisions apply to Tier 1 members only.

Retirement cost, however, is determined not by the minimum eligibility requirements but by the ages at which members actually retire. The valuation does not assume that everyone retires at earliest eligibility. The assumption about the timing of retirement once eligibility has been established is a major component in cost calculations. Note that higher rates of retirement at earlier retirement ages or years of service upon attaining retirement eligibility generally result in higher actuarially determined contributions, and vice versa.

Experience during the last three years was considered in the analysis shown on the following pages. The "Exposures" column shows the number of employees eligible to retire at various years of service or ages throughout the experience period. An individual could potentially be counted up to three times if eligible each year in the period. By tabulating employees in this fashion we are able to answer the question: "For all employees eligible at condition X, how many retired?"

Retirement Assumption

Tier One

Normal Retirement Experience – Regular Formula

Current and past experience has shown that retirement rates under this System are correlated with age. Currently, the System uses age-based rates with higher rates at key ages, with 100 percent retirement at age 75. We recommend the following changes:

- For both male and female members, an increase in overall rates to reflect the actual experience of the System.

Applying the proposed rates to historical data generates the following number of retirements by age at retirement:

| Nearest Age | Regular Formula - Number of Retirements | | | | | |
|----------------------------|---|--------------------|---------------------|----------------|--------------------|---------------------|
| | Male Members | | | Female Members | | |
| | Actual | Current Assumption | Proposed Assumption | Actual | Current Assumption | Proposed Assumption |
| 50-54 | 132 | 111 | 127 | 232 | 207 | 233 |
| 55-59 | 480 | 397 | 480 | 793 | 614 | 800 |
| 60-64 | 849 | 774 | 858 | 1330 | 1220 | 1346 |
| 65-69 | 634 | 544 | 652 | 682 | 590 | 716 |
| 70-74 | 161 | 147 | 183 | 172 | 144 | 170 |
| 75+ | 65 | 319 | 319 | 65 | 317 | 317 |
| Total | 2,321 | 2,292 | 2,619 | 3,274 | 3,092 | 3,582 |
| Total Excluding 75+ | 2,256 | 1,973 | 2,300 | 3,209 | 2,775 | 3,265 |

Early Retirement Experience – Regular Formula

Early retirement experience for male and female members was generally lower than the current early retirement rates. We recommend the following changes:

- For male members, we recommend a decrease in the rates at ages 55, 56, 58, and 59 and no change to the rate at age 57.
- For female members, we recommend a decrease in the rates from ages 55 to 59.

Retirement Experience and Recommendations

The tables and graphs on the following pages show experience for normal and early retirement.

- Table III(a) and Graph III(a) – Normal Retirement Experience – Male
- Table III(b) and Graph III(b) – Normal Retirement Experience – Female
- Table III(c) and Graph III(c) – Early Retirement Experience – Male
- Table III(d) and Graph III(d) – Early Retirement Experience – Female

Retirement Assumption

Tier One Regular Formula Male Normal Retirement

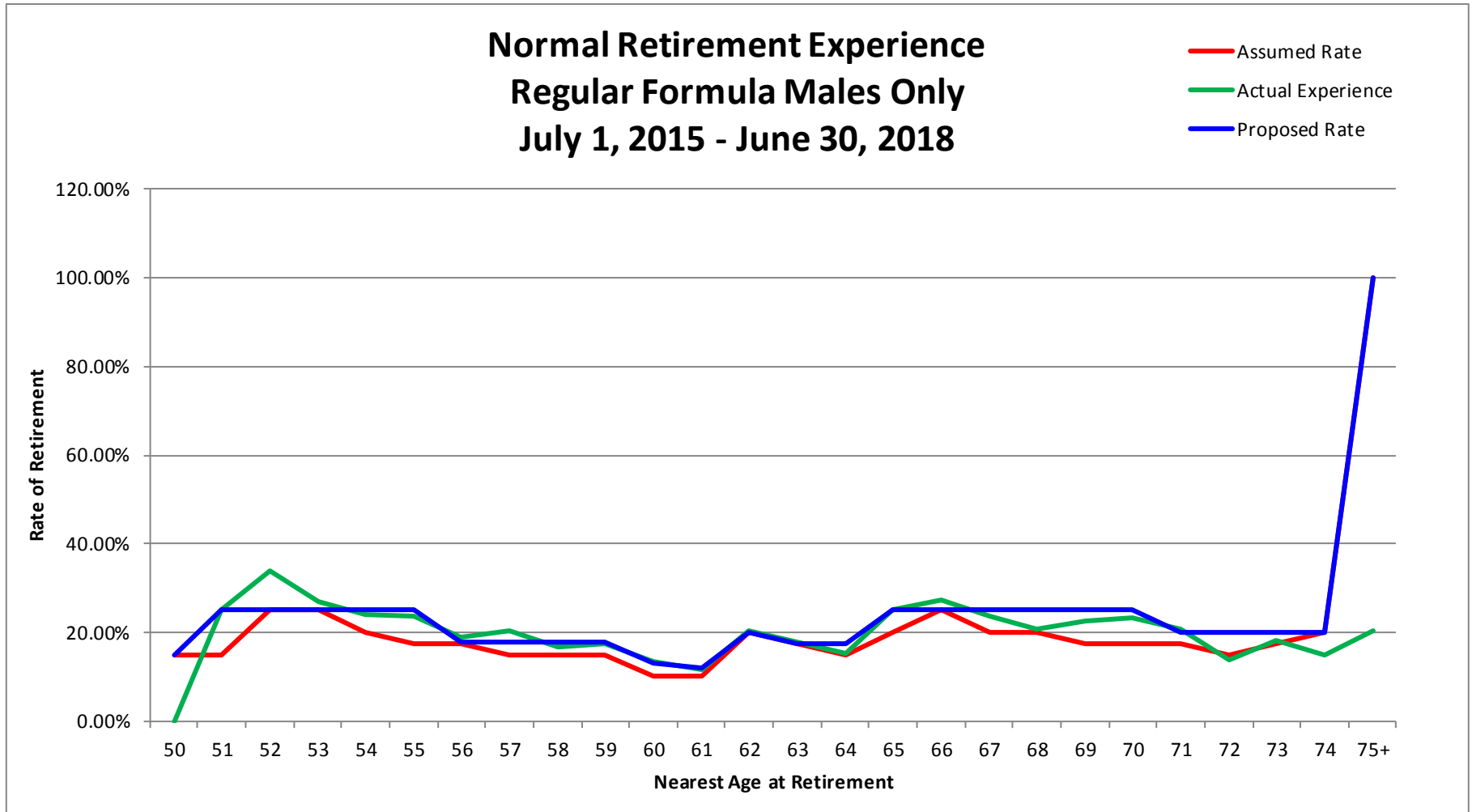
Table III(a)

| Normal Retirement Experience- Regular Formula Male Members | | | | | | | | | |
|--|-------------------|--------------|----------------|-------------------------|-----------------|----------------------|-------------------------|------------------|----------------------|
| Nearest Age @ Retirement | Actual Experience | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Retirements | Actual Rate | Expected Retirements | Assumed Rate | Actual / Expected | Expected Retirements | Proposed Rate | Actual / Expected |
| 50 | 0 | 0 | | 0 | 15.0% | | 0 | 15.0% | |
| 51 | 4 | 1 | 25.0% | 1 | 15.0% | 1.0 | 1 | 25.0% | 1.0 |
| 52 | 53 | 18 | 34.0% | 13 | 25.0% | 1.4 | 13 | 25.0% | 1.4 |
| 53 | 145 | 39 | 26.9% | 36 | 25.0% | 1.1 | 36 | 25.0% | 1.1 |
| 54 | 306 | 74 | 24.2% | 61 | 20.0% | 1.2 | 77 | 25.0% | 1.0 |
| 55 | 410 | 97 | 23.7% | 72 | 17.5% | 1.3 | 103 | 25.0% | 0.9 |
| 56 | 462 | 88 | 19.0% | 81 | 17.5% | 1.1 | 83 | 18.0% | 1.1 |
| 57 | 499 | 101 | 20.2% | 75 | 15.0% | 1.3 | 90 | 18.0% | 1.1 |
| 58 | 548 | 92 | 16.8% | 82 | 15.0% | 1.1 | 99 | 18.0% | 0.9 |
| 59 | 583 | 102 | 17.5% | 87 | 15.0% | 1.2 | 105 | 18.0% | 1.0 |
| 60 | 1,264 | 170 | 13.4% | 126 | 10.0% | 1.3 | 164 | 13.0% | 1.0 |
| 61 | 1,194 | 138 | 11.6% | 119 | 10.0% | 1.2 | 143 | 12.0% | 1.0 |
| 62 | 1,106 | 225 | 20.3% | 221 | 20.0% | 1.0 | 221 | 20.0% | 1.0 |
| 63 | 1,001 | 180 | 18.0% | 175 | 17.5% | 1.0 | 175 | 17.5% | 1.0 |
| 64 | 887 | 136 | 15.3% | 133 | 15.0% | 1.0 | 155 | 17.5% | 0.9 |
| 65 | 767 | 192 | 25.0% | 153 | 20.0% | 1.3 | 192 | 25.0% | 1.0 |
| 66 | 622 | 170 | 27.3% | 156 | 25.0% | 1.1 | 156 | 25.0% | 1.1 |
| 67 | 463 | 109 | 23.5% | 93 | 20.0% | 1.2 | 116 | 25.0% | 0.9 |
| 68 | 408 | 85 | 20.8% | 82 | 20.0% | 1.0 | 102 | 25.0% | 0.8 |
| 69 | 345 | 78 | 22.6% | 60 | 17.5% | 1.3 | 86 | 25.0% | 0.9 |
| 70 | 257 | 60 | 23.3% | 45 | 17.5% | 1.3 | 64 | 25.0% | 0.9 |
| 71 | 179 | 37 | 20.7% | 31 | 17.5% | 1.2 | 36 | 20.0% | 1.0 |
| 72 | 153 | 21 | 13.7% | 23 | 15.0% | 0.9 | 31 | 20.0% | 0.7 |
| 73 | 138 | 25 | 18.1% | 24 | 17.5% | 1.0 | 28 | 20.0% | 0.9 |
| 74 | 122 | 18 | 14.8% | 24 | 20.0% | 0.8 | 24 | 20.0% | 0.8 |
| 75+ | 319 | 65 | 20.4% | 319 | 100.0% | 0.2 | 319 | 100.0% | 0.2 |
| Totals: | 12,235 | 2,321 | 19.0% | 2,292 | 18.7% | 1.0 | 2,619 | 21.4% | 0.9 |
| Excluding 75+: | 11,916 | 2,256 | 18.9% | 1,973 | 16.6% | 1.1 | 2,300 | 19.3% | 1.0 |

Retirement Assumption

Tier One

Graph III(a)



Retirement Assumption

Tier One Regular Formula Female Normal Retirement

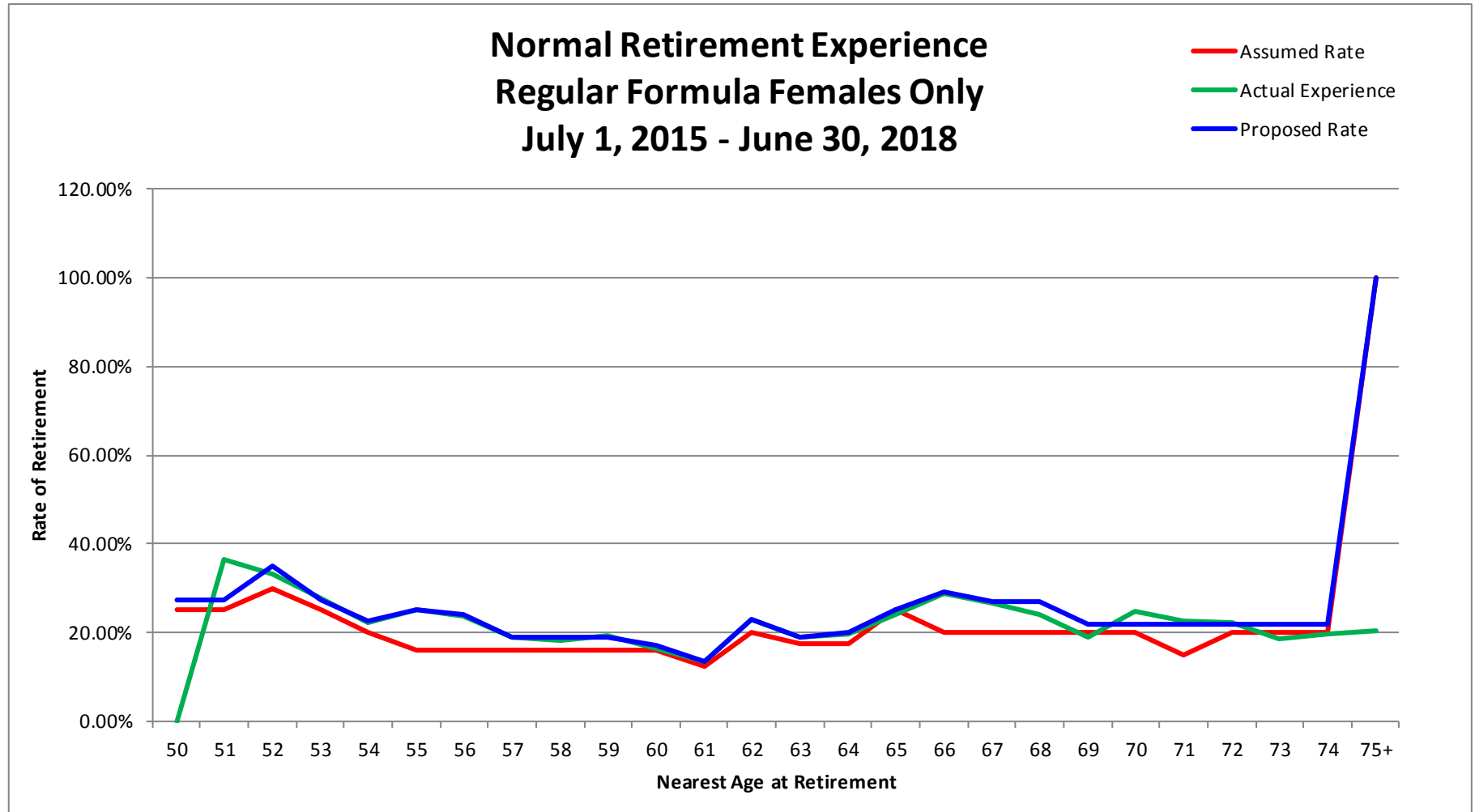
Table III(b)

| Normal Retirement Experience - Regular Formula Female Members | | | | | | | | | |
|---|-------------------|--------------|--------------|---------------------|--------------|------------|----------------------|--------------|------------|
| Nearest Age @ Retirement | Actual Experience | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Retirements | Actual | Expected | Assumed | Actual / | Expected | Proposed | Actual / |
| | | | Rate | Retirements | Rate | Expected | Retirements | Rate | Expected |
| 50 | 0 | 0 | | 0 | 25.0% | | 0 | 27.5% | |
| 51 | 22 | 8 | 36.4% | 6 | 25.0% | 1.3 | 6 | 27.5% | 1.3 |
| 52 | 144 | 48 | 33.3% | 43 | 30.0% | 1.1 | 50 | 35.0% | 1.0 |
| 53 | 272 | 75 | 27.6% | 68 | 25.0% | 1.1 | 75 | 27.5% | 1.0 |
| 54 | 452 | 101 | 22.3% | 90 | 20.0% | 1.1 | 102 | 22.5% | 1.0 |
| 55 | 598 | 151 | 25.3% | 96 | 16.0% | 1.6 | 150 | 25.0% | 1.0 |
| 56 | 697 | 165 | 23.7% | 112 | 16.0% | 1.5 | 167 | 24.0% | 1.0 |
| 57 | 782 | 148 | 18.9% | 125 | 16.0% | 1.2 | 149 | 19.0% | 1.0 |
| 58 | 861 | 157 | 18.2% | 138 | 16.0% | 1.1 | 164 | 19.0% | 1.0 |
| 59 | 896 | 172 | 19.2% | 143 | 16.0% | 1.2 | 170 | 19.0% | 1.0 |
| 60 | 1,855 | 306 | 16.5% | 297 | 16.0% | 1.0 | 315 | 17.0% | 1.0 |
| 61 | 1,670 | 223 | 13.4% | 209 | 12.5% | 1.1 | 225 | 13.5% | 1.0 |
| 62 | 1,521 | 347 | 22.8% | 304 | 20.0% | 1.1 | 350 | 23.0% | 1.0 |
| 63 | 1,264 | 240 | 19.0% | 221 | 17.5% | 1.1 | 240 | 19.0% | 1.0 |
| 64 | 1,079 | 214 | 19.8% | 189 | 17.5% | 1.1 | 216 | 20.0% | 1.0 |
| 65 | 890 | 215 | 24.2% | 223 | 25.0% | 1.0 | 223 | 25.0% | 1.0 |
| 66 | 678 | 194 | 28.6% | 136 | 20.0% | 1.4 | 197 | 29.0% | 1.0 |
| 67 | 488 | 129 | 26.4% | 98 | 20.0% | 1.3 | 132 | 27.0% | 1.0 |
| 68 | 361 | 87 | 24.1% | 72 | 20.0% | 1.2 | 97 | 27.0% | 0.9 |
| 69 | 303 | 57 | 18.8% | 61 | 20.0% | 0.9 | 67 | 22.0% | 0.9 |
| 70 | 242 | 60 | 24.8% | 48 | 20.0% | 1.3 | 53 | 22.0% | 1.1 |
| 71 | 200 | 45 | 22.5% | 30 | 15.0% | 1.5 | 44 | 22.0% | 1.0 |
| 72 | 139 | 31 | 22.3% | 28 | 20.0% | 1.1 | 31 | 22.0% | 1.0 |
| 73 | 103 | 19 | 18.4% | 21 | 20.0% | 0.9 | 23 | 22.0% | 0.8 |
| 74 | 87 | 17 | 19.5% | 17 | 20.0% | 1.0 | 19 | 22.0% | 0.9 |
| 75+ | 317 | 65 | 20.5% | 317 | 100.0% | 0.2 | 317 | 100.0% | 0.2 |
| Totals: | 15,921 | 3,274 | 20.6% | 3,092 | 19.4% | 1.1 | 3,582 | 22.5% | 0.9 |
| Excluding 75+: | 15,604 | 3,209 | 20.6% | 2,775 | 17.8% | 1.2 | 3,265 | 20.9% | 1.0 |

Retirement Assumption

Tier One

Graph III(b)



Retirement Assumption

Tier One Regular Formula Male Early Retirement

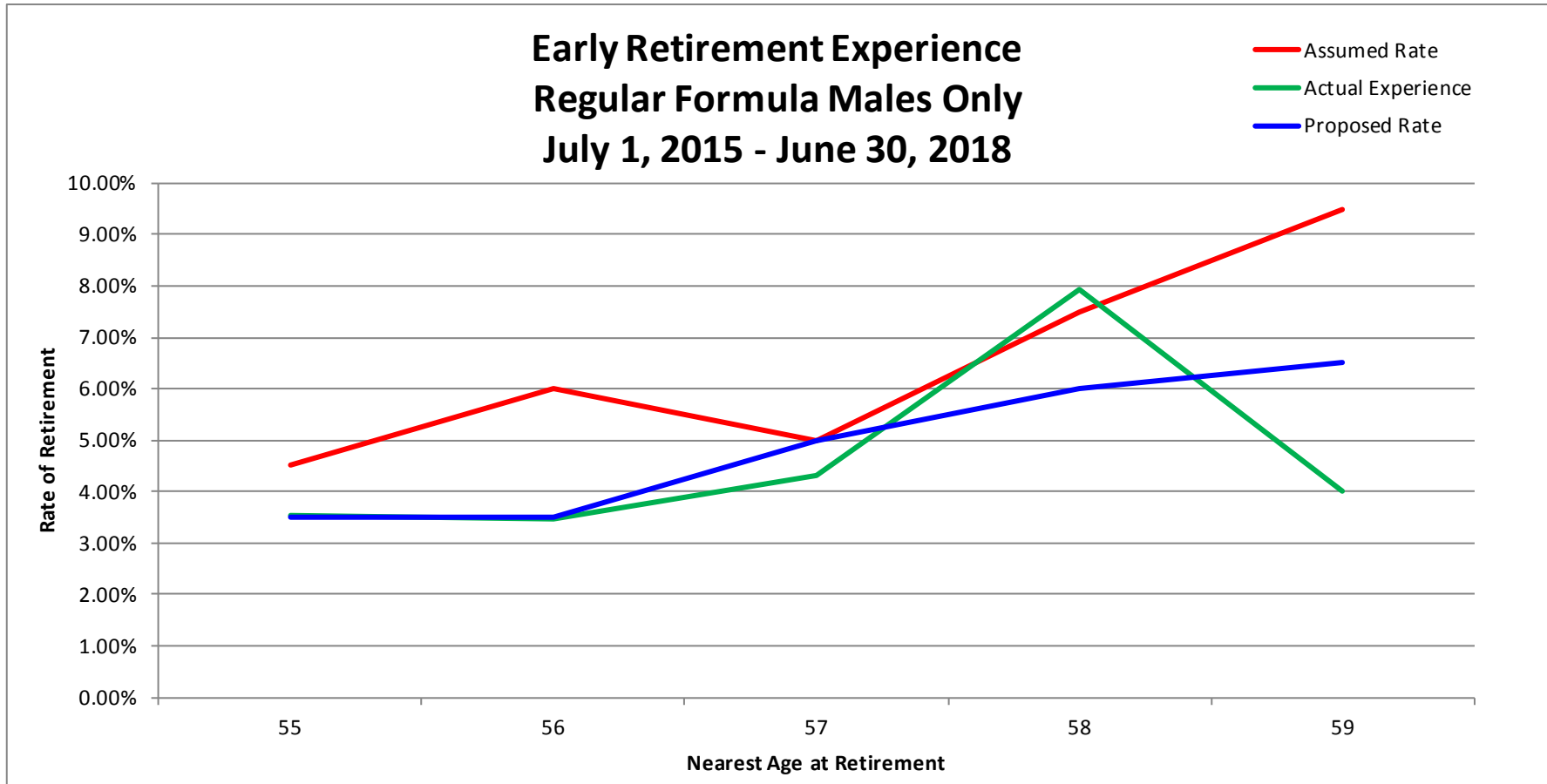
Table III(c)

| Early Retirement Experience - Regular Formula Male Members | | | | | | | | | |
|--|-------------------|-------------|----------------|-------------------------|-----------------|----------------------|-------------------------|------------------|----------------------|
| Nearest Age @ Retirement | Actual Experience | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Retirements | Actual Rate | Expected Retirements | Assumed Rate | Actual / Expected | Expected Retirements | Proposed Rate | Actual / Expected |
| 55 | 369 | 13 | 3.5% | 17 | 4.5% | 0.8 | 13 | 3.5% | 1.0 |
| 56 | 259 | 9 | 3.5% | 16 | 6.0% | 0.6 | 9 | 3.5% | 1.0 |
| 57 | 185 | 8 | 4.3% | 9 | 5.0% | 0.9 | 9 | 5.0% | 0.9 |
| 58 | 101 | 8 | 7.9% | 8 | 7.5% | 1.0 | 6 | 6.0% | 1.3 |
| 59 | 50 | 2 | 4.0% | 5 | 9.5% | 0.4 | 3 | 6.5% | 0.7 |
| Totals: | 964 | 40 | 4.1% | 55 | 5.7% | 0.7 | 40 | 4.1% | 1.0 |

Retirement Assumption

Tier One

Graph III(c)



Retirement Assumption

Tier One Regular Formula Female Early Retirement

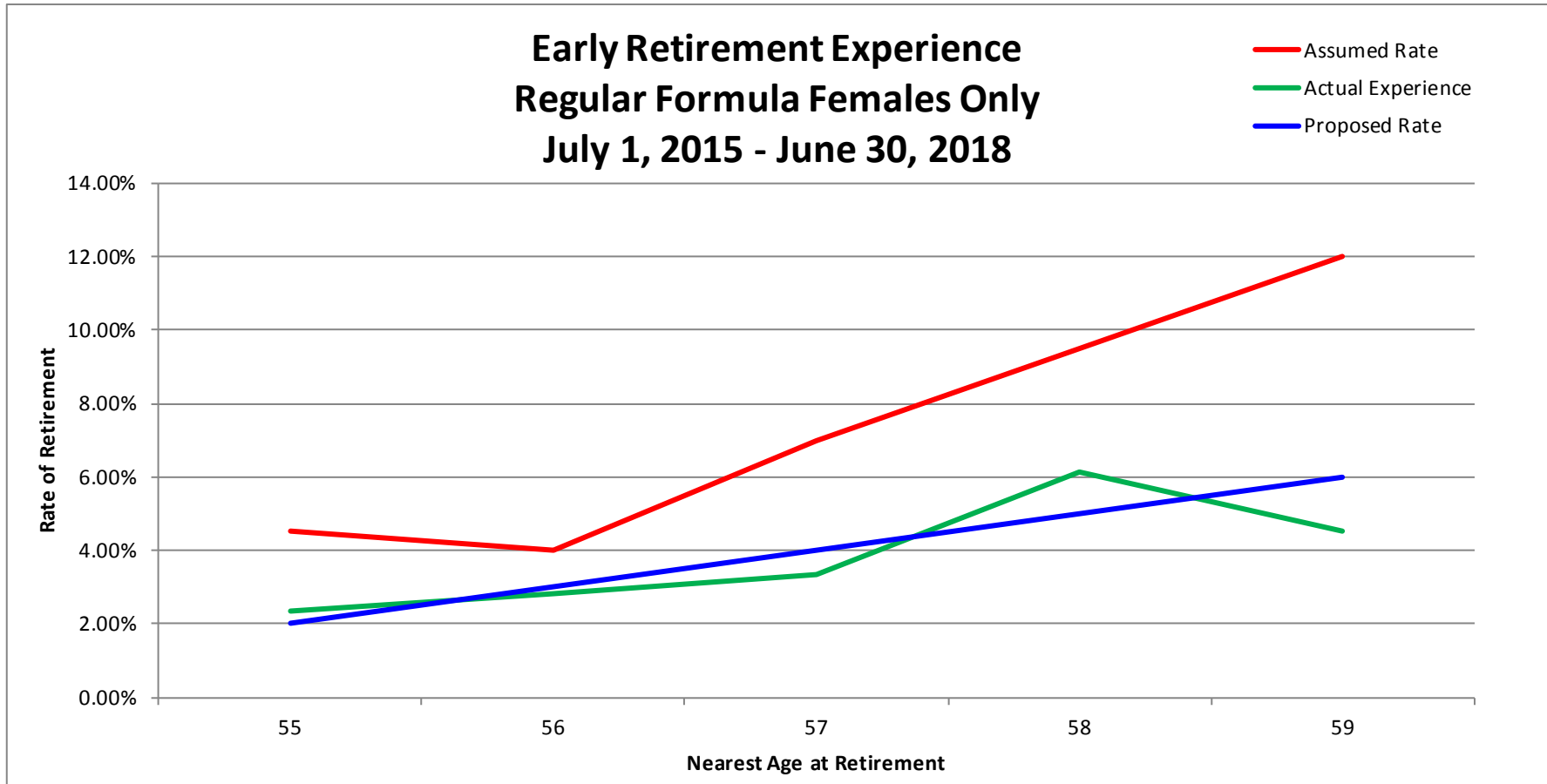
Table III(d)

| Early Retirement Experience - Regular Formula Female Members | | | | | | | | | |
|--|-------------------|-------------|----------------|-------------------------|-----------------|----------------------|-------------------------|------------------|----------------------|
| Nearest Age @ Retirement | Actual Experience | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Retirements | Actual Rate | Expected Retirements | Assumed Rate | Actual / Expected | Expected Retirements | Proposed Rate | Actual / Expected |
| 55 | 508 | 12 | 2.4% | 23 | 4.5% | 0.5 | 10 | 2.0% | 1.2 |
| 56 | 354 | 10 | 2.8% | 14 | 4.0% | 0.7 | 11 | 3.0% | 0.9 |
| 57 | 239 | 8 | 3.3% | 17 | 7.0% | 0.5 | 10 | 4.0% | 0.8 |
| 58 | 163 | 10 | 6.1% | 15 | 9.5% | 0.7 | 8 | 5.0% | 1.3 |
| 59 | 66 | 3 | 4.5% | 8 | 12.0% | 0.4 | 4 | 6.0% | 0.8 |
| Totals: | 1,330 | 43 | 3.2% | 77 | 5.8% | 0.6 | 43 | 3.2% | 1.0 |

Retirement Assumption

Tier One

Graph III(d)



Retirement Assumption

Tier One

Normal Retirement Experience – Alternative Formula

Current and past experience has shown that retirement rates under this System are correlated with age. Currently, the System uses age-based rates with higher rates at key ages, with 100 percent retirement at age 72.

Generally speaking, members are eligible to receive alternative formula benefits provided they are age 50 with at least 25 years of alternative formula pension credit or at age 55 with at least 20 years of alternative formula pension credit. During the analysis, it was noted that a number of members working in positions in which alternative formula pension credit is accrued were retiring based upon regular formula eligibility. As a result, we continue to recommend that this experience be recognized and accounted for in the valuation. We have developed separate rates for those members who could potentially retire based upon regular formula eligibility and benefit provisions.

For member's eligible for retirement based upon the alternative formula eligibility, we are recommending changes to the rates to reflect the actual experience of the System.

For alternative formula members eligible for retirement under the alternative formula provisions, applying the proposed rates to historical data generates the following number of retirements by age at retirement:

| Nearest Age | Alternative Formula - Number of Retirements | | | | | |
|----------------------------|---|--------------------|---------------------|----------------|--------------------|---------------------|
| | Male Members | | | Female Members | | |
| | Actual | Current Assumption | Proposed Assumption | Actual | Current Assumption | Proposed Assumption |
| 50-54 | 779 | 754 | 779 | 151 | 178 | 157 |
| 55-59 | 402 | 387 | 417 | 188 | 139 | 185 |
| 60-64 | 240 | 269 | 252 | 119 | 129 | 127 |
| 65-69 | 95 | 140 | 107 | 43 | 36 | 41 |
| 70-74 | 16 | 31 | 33 | 5 | 12 | 12 |
| 75+ | 2 | 21 | 21 | 1 | 6 | 6 |
| Total | 1,534 | 1,602 | 1,609 | 507 | 500 | 528 |
| Total Excluding 75+ | 1,532 | 1,581 | 1,588 | 506 | 494 | 522 |

Retirement Assumption

Tier One

For alternative formula members eligible for retirement under the regular formula provisions, applying the proposed rates to historical data generates the following number of retirements by age at retirement:

| Nearest Age | Alternative Formula - Number of Retirements | | | | | |
|----------------------------|---|--------------------|---------------------|----------------|--------------------|---------------------|
| | Male Members | | | Female Members | | |
| | Actual | Current Assumption | Proposed Assumption | Actual | Current Assumption | Proposed Assumption |
| 60-64 | 77 | 82 | 80 | 44 | 37 | 45 |
| 65-69 | 102 | 109 | 105 | 17 | 25 | 24 |
| 70-71 | 15 | 13 | 15 | 3 | 5 | 5 |
| 72+ | 11 | 60 | 60 | 5 | 20 | 20 |
| Total | 205 | 264 | 260 | 69 | 87 | 94 |
| Total Excluding 72+ | 194 | 204 | 200 | 64 | 67 | 74 |

The tables and graphs on the following pages show experience for normal and early retirement.

- Table III(e) and Graph III(e) – Normal Retirement Experience – Alternative Formula Male Members – Eligible for Retirement Under the Alternative Formula Provisions
- Table III(f) and Graph III(f) – Normal Retirement Experience – Alternative Formula Female Members – Eligible for Retirement Under the Alternative Formula Provisions
- Table III(g) and Graph III(g) – Normal Retirement Experience – Alternative Formula Male Members – Eligible for Retirement Under the Regular Formula Provisions
- Table III(h) and Graph III(h) – Normal Retirement Experience – Alternative Formula Female Members – Eligible for Retirement Under the Regular Formula Provisions

Retirement Assumption

Tier One Alternative Formula Male

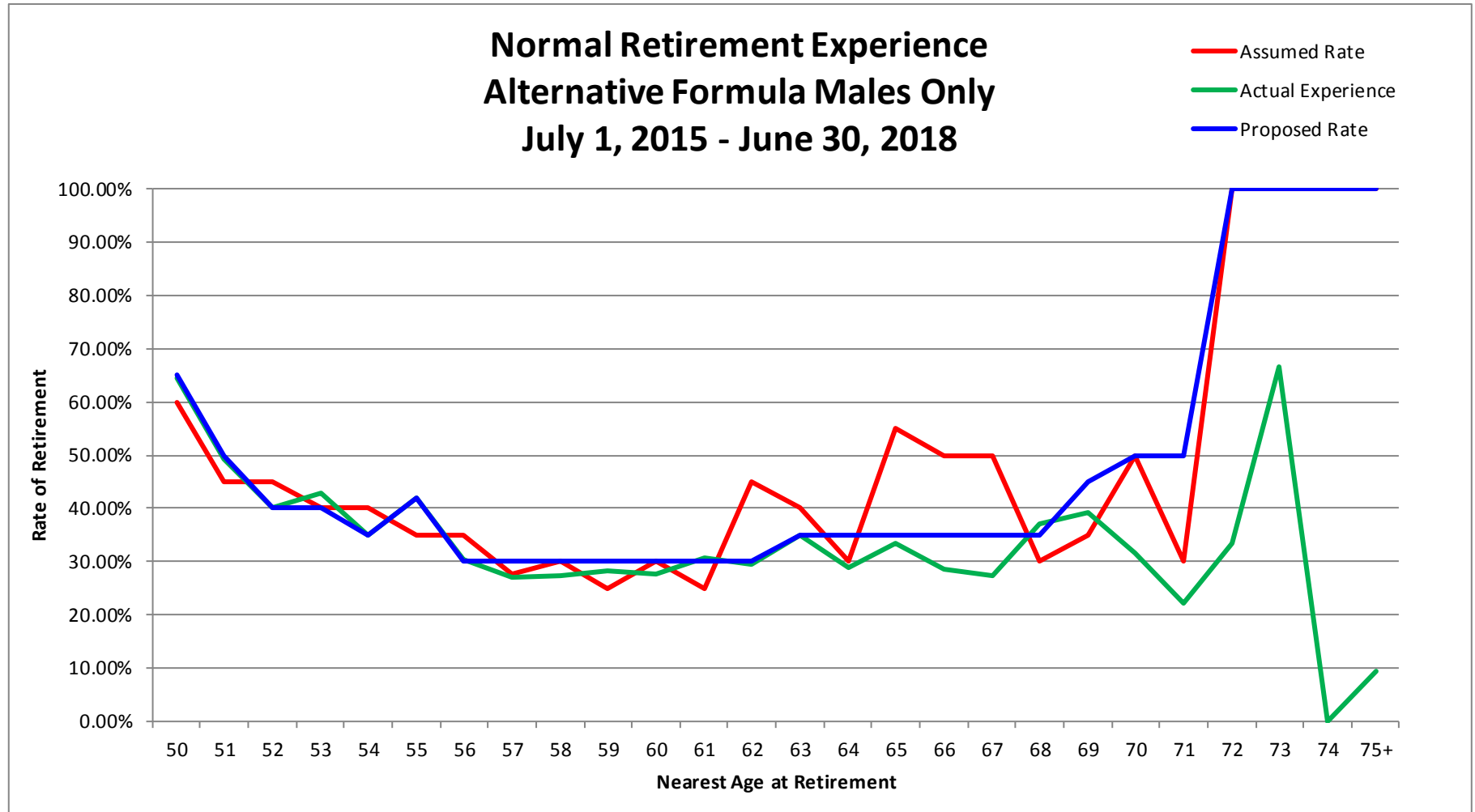
Table III(e)

| Normal Retirement Experience - Alternative Formula Male Members | | | | | | | | | |
|---|-------------------|--------------|----------------|-------------------------|-----------------|----------------------|-------------------------|------------------|----------------------|
| Nearest Age @ Retirement | Actual Experience | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Retirements | Actual Rate | Expected Retirements | Assumed Rate | Actual / Expected | Expected Retirements | Proposed Rate | Actual / Expected |
| 50 | 609 | 393 | 64.5% | 365 | 60.0% | 1.1 | 396 | 65.0% | 1.0 |
| 51 | 287 | 141 | 49.1% | 129 | 45.0% | 1.1 | 144 | 50.0% | 1.0 |
| 52 | 220 | 88 | 40.0% | 99 | 45.0% | 0.9 | 88 | 40.0% | 1.0 |
| 53 | 207 | 89 | 43.0% | 83 | 40.0% | 1.1 | 83 | 40.0% | 1.1 |
| 54 | 194 | 68 | 35.1% | 78 | 40.0% | 0.9 | 68 | 35.0% | 1.0 |
| 55 | 388 | 163 | 42.0% | 136 | 35.0% | 1.2 | 163 | 42.0% | 1.0 |
| 56 | 240 | 73 | 30.4% | 84 | 35.0% | 0.9 | 72 | 30.0% | 1.0 |
| 57 | 212 | 57 | 26.9% | 58 | 27.5% | 1.0 | 64 | 30.0% | 0.9 |
| 58 | 206 | 56 | 27.2% | 62 | 30.0% | 0.9 | 62 | 30.0% | 0.9 |
| 59 | 188 | 53 | 28.2% | 47 | 25.0% | 1.1 | 56 | 30.0% | 0.9 |
| 60 | 229 | 63 | 27.5% | 69 | 30.0% | 0.9 | 69 | 30.0% | 0.9 |
| 61 | 179 | 55 | 30.7% | 45 | 25.0% | 1.2 | 54 | 30.0% | 1.0 |
| 62 | 159 | 47 | 29.6% | 72 | 45.0% | 0.7 | 48 | 30.0% | 1.0 |
| 63 | 132 | 46 | 34.8% | 53 | 40.0% | 0.9 | 46 | 35.0% | 1.0 |
| 64 | 100 | 29 | 29.0% | 30 | 30.0% | 1.0 | 35 | 35.0% | 0.8 |
| 65 | 96 | 32 | 33.3% | 53 | 55.0% | 0.6 | 34 | 35.0% | 0.9 |
| 66 | 70 | 20 | 28.6% | 35 | 50.0% | 0.6 | 25 | 35.0% | 0.8 |
| 67 | 55 | 15 | 27.3% | 28 | 50.0% | 0.5 | 19 | 35.0% | 0.8 |
| 68 | 46 | 17 | 37.0% | 14 | 30.0% | 1.2 | 16 | 35.0% | 1.1 |
| 69 | 28 | 11 | 39.3% | 10 | 35.0% | 1.1 | 13 | 45.0% | 0.8 |
| 70 | 19 | 6 | 31.6% | 10 | 50.0% | 0.6 | 10 | 50.0% | 0.6 |
| 71 | 9 | 2 | 22.2% | 3 | 30.0% | 0.7 | 5 | 50.0% | 0.4 |
| 72 | 6 | 2 | 33.3% | 6 | 100.0% | 0.3 | 6 | 100.0% | 0.3 |
| 73 | 9 | 6 | 66.7% | 9 | 100.0% | 0.7 | 9 | 100.0% | 0.7 |
| 74 | 3 | 0 | 0.0% | 3 | 100.0% | 0.0 | 3 | 100.0% | 0.0 |
| 75+ | 21 | 2 | 9.5% | 21 | 100.0% | 0.1 | 21 | 100.0% | 0.1 |
| Totals: | 3,912 | 1,534 | 39.2% | 1,602 | 41.0% | 1.0 | 1,609 | 41.1% | 1.0 |
| Excluding 75+: | 3,891 | 1,532 | 39.4% | 1,581 | 40.6% | 1.0 | 1,588 | 40.8% | 1.0 |

Retirement Assumption

Tier One

Graph III(e)



Retirement Assumption

Tier One Alternative Formula Female

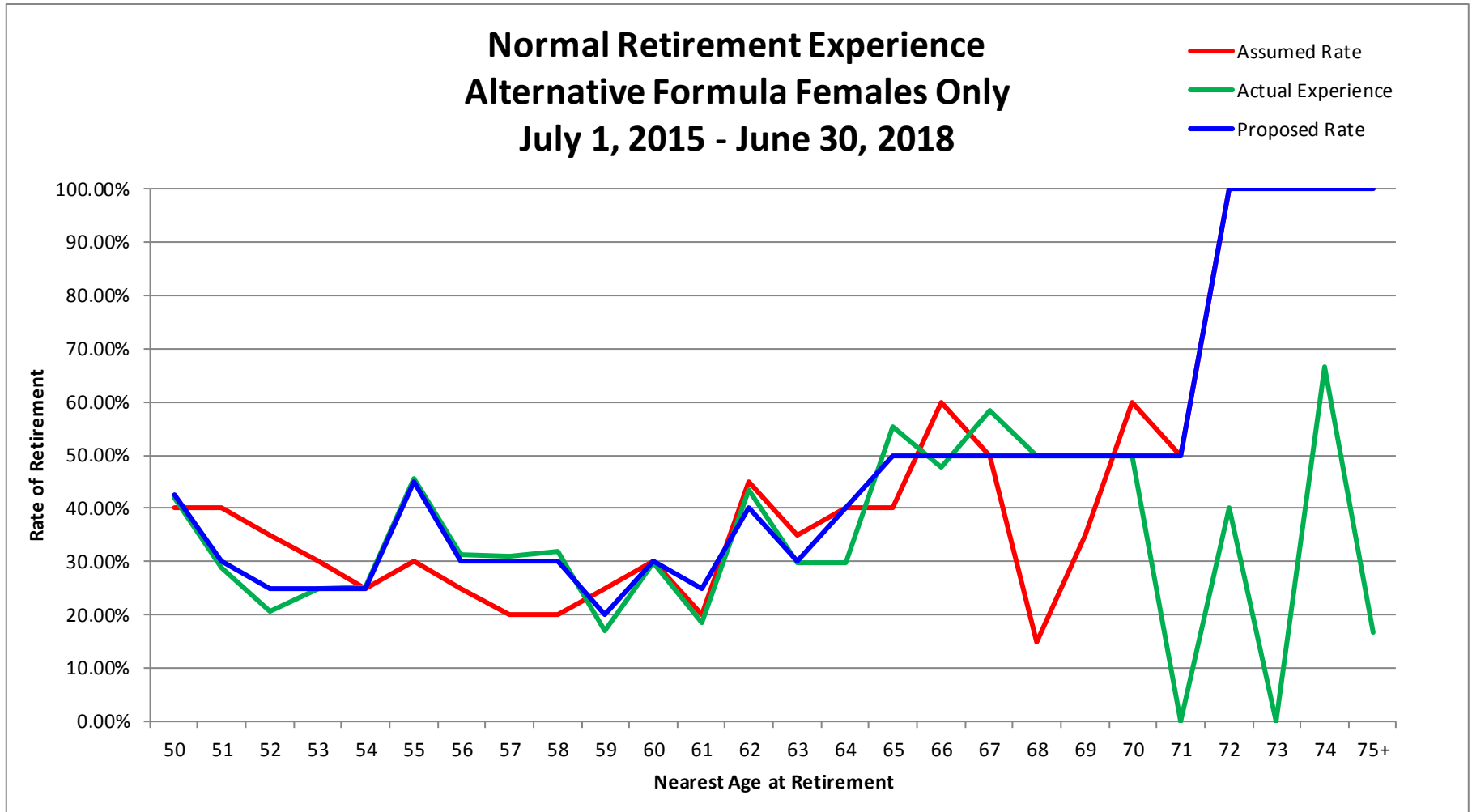
Table III(f)

| Normal Retirement Experience - Alternative Formula Female Members | | | | | | | | | |
|---|-------------------|-------------|----------------|-------------------------|-----------------|----------------------|-------------------------|------------------|----------------------|
| Nearest Age @ Retirement | Actual Experience | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Retirements | Actual Rate | Expected Retirements | Assumed Rate | Actual / Expected | Expected Retirements | Proposed Rate | Actual / Expected |
| 50 | 138 | 58 | 42.0% | 55 | 40.0% | 1.1 | 59 | 42.5% | 1.0 |
| 51 | 97 | 28 | 28.9% | 39 | 40.0% | 0.7 | 29 | 30.0% | 1.0 |
| 52 | 97 | 20 | 20.6% | 34 | 35.0% | 0.6 | 24 | 25.0% | 0.8 |
| 53 | 92 | 23 | 25.0% | 28 | 30.0% | 0.8 | 23 | 25.0% | 1.0 |
| 54 | 87 | 22 | 25.3% | 22 | 25.0% | 1.0 | 22 | 25.0% | 1.0 |
| 55 | 173 | 79 | 45.7% | 52 | 30.0% | 1.5 | 78 | 45.0% | 1.0 |
| 56 | 115 | 36 | 31.3% | 29 | 25.0% | 1.2 | 35 | 30.0% | 1.0 |
| 57 | 103 | 32 | 31.1% | 21 | 20.0% | 1.5 | 31 | 30.0% | 1.0 |
| 58 | 88 | 28 | 31.8% | 18 | 20.0% | 1.6 | 26 | 30.0% | 1.1 |
| 59 | 77 | 13 | 16.9% | 19 | 25.0% | 0.7 | 15 | 20.0% | 0.9 |
| 60 | 114 | 34 | 29.8% | 34 | 30.0% | 1.0 | 34 | 30.0% | 1.0 |
| 61 | 102 | 19 | 18.6% | 20 | 20.0% | 1.0 | 26 | 25.0% | 0.7 |
| 62 | 90 | 39 | 43.3% | 41 | 45.0% | 1.0 | 36 | 40.0% | 1.1 |
| 63 | 54 | 16 | 29.6% | 19 | 35.0% | 0.8 | 16 | 30.0% | 1.0 |
| 64 | 37 | 11 | 29.7% | 15 | 40.0% | 0.7 | 15 | 40.0% | 0.7 |
| 65 | 38 | 21 | 55.3% | 15 | 40.0% | 1.4 | 19 | 50.0% | 1.1 |
| 66 | 21 | 10 | 47.6% | 13 | 60.0% | 0.8 | 11 | 50.0% | 0.9 |
| 67 | 12 | 7 | 58.3% | 6 | 50.0% | 1.2 | 6 | 50.0% | 1.2 |
| 68 | 6 | 3 | 50.0% | 1 | 15.0% | 3.0 | 3 | 50.0% | 1.0 |
| 69 | 4 | 2 | 50.0% | 1 | 35.0% | 2.0 | 2 | 50.0% | 1.0 |
| 70 | 2 | 1 | 50.0% | 1 | 60.0% | 1.0 | 1 | 50.0% | 1.0 |
| 71 | 2 | 0 | 0.0% | 1 | 50.0% | 0.0 | 1 | 50.0% | 0.0 |
| 72 | 5 | 2 | 40.0% | 5 | 100.0% | 0.4 | 5 | 100.0% | 0.4 |
| 73 | 2 | 0 | 0.0% | 2 | 100.0% | 0.0 | 2 | 100.0% | 0.0 |
| 74 | 3 | 2 | 66.7% | 3 | 100.0% | 0.7 | 3 | 100.0% | 0.7 |
| 75+ | 6 | 1 | 16.7% | 6 | 100.0% | 0.2 | 6 | 100.0% | 0.2 |
| Totals: | 1,565 | 507 | 32.4% | 500 | 31.9% | 1.0 | 528 | 33.7% | 1.0 |
| Excluding 75+: | 1,559 | 506 | 32.5% | 494 | 31.7% | 1.0 | 522 | 33.5% | 1.0 |

Retirement Assumption

Tier One

Graph III(f)



Retirement Assumption

Tier One Alternative Formula Male Eligible for Retirement Under the Regular Formula Provisions

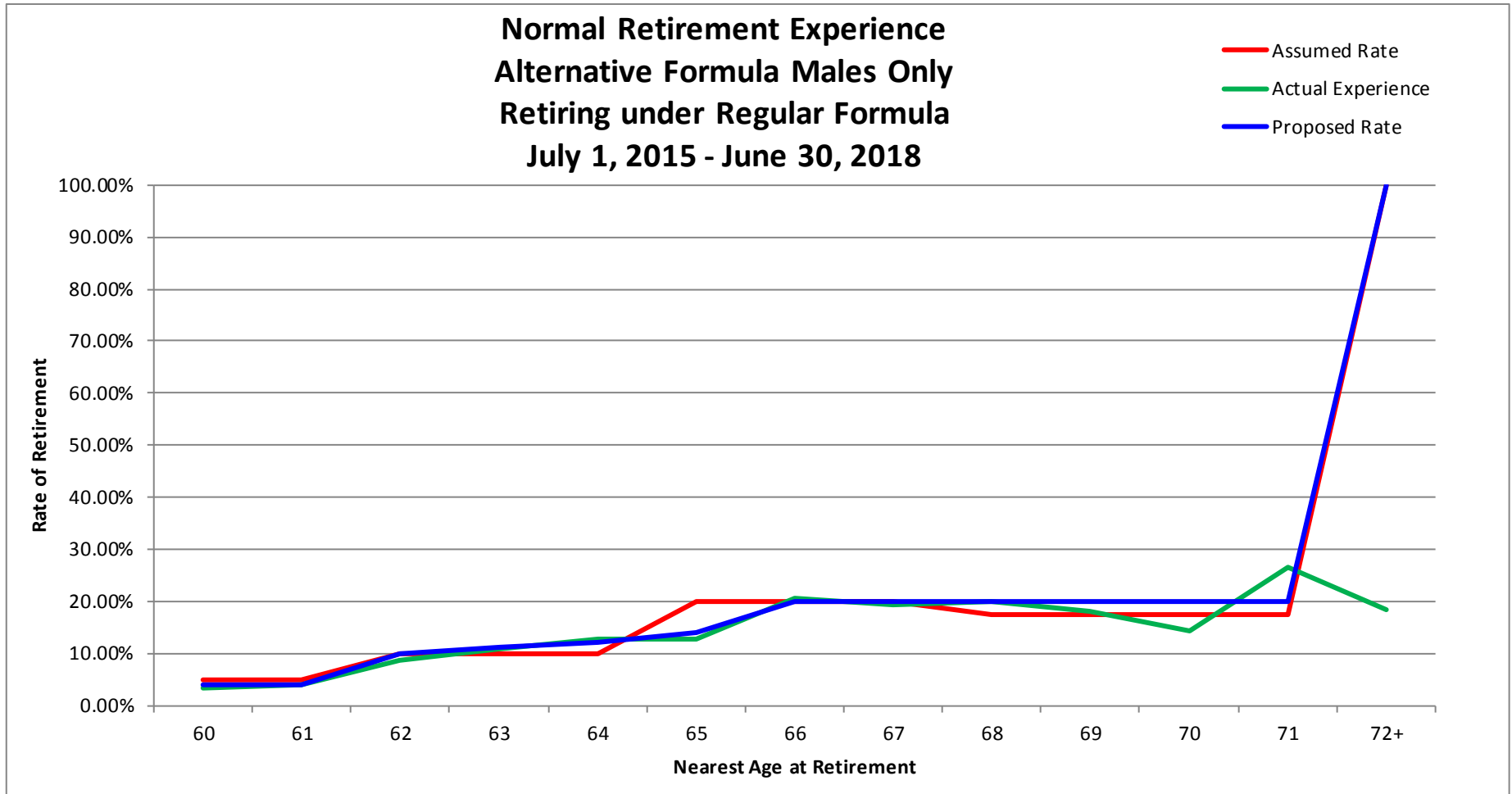
Table III(g)

| Normal Retirement Experience - Alternative Formula Male Members - Eligible for Retirement under the Regular Formula Provisions | | | | | | | | | |
|--|-------------------|-------------|----------------|-------------------------|-----------------|----------------------|-------------------------|------------------|----------------------|
| Nearest Age @ Retirement | Actual Experience | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Retirements | Actual Rate | Expected Retirements | Assumed Rate | Actual / Expected | Expected Retirements | Proposed Rate | Actual / Expected |
| 60 | 232 | 8 | 3.4% | 12 | 5.0% | 0.7 | 9 | 4.0% | 0.9 |
| 61 | 230 | 9 | 3.9% | 12 | 5.0% | 0.8 | 9 | 4.0% | 1.0 |
| 62 | 231 | 20 | 8.7% | 23 | 10.0% | 0.9 | 23 | 10.0% | 0.9 |
| 63 | 185 | 20 | 10.8% | 19 | 10.0% | 1.1 | 20 | 11.0% | 1.0 |
| 64 | 159 | 20 | 12.6% | 16 | 10.0% | 1.3 | 19 | 12.0% | 1.1 |
| 65 | 135 | 17 | 12.6% | 27 | 20.0% | 0.6 | 19 | 14.0% | 0.9 |
| 66 | 142 | 29 | 20.4% | 28 | 20.0% | 1.0 | 28 | 20.0% | 1.0 |
| 67 | 120 | 23 | 19.2% | 24 | 20.0% | 1.0 | 24 | 20.0% | 1.0 |
| 68 | 95 | 19 | 20.0% | 17 | 17.5% | 1.1 | 19 | 20.0% | 1.0 |
| 69 | 77 | 14 | 18.2% | 13 | 17.5% | 1.1 | 15 | 20.0% | 0.9 |
| 70 | 42 | 6 | 14.3% | 7 | 17.5% | 0.9 | 8 | 20.0% | 0.8 |
| 71 | 34 | 9 | 26.5% | 6 | 17.5% | 1.5 | 7 | 20.0% | 1.3 |
| 72+ | 60 | 11 | 18.3% | 60 | 100.0% | 0.2 | 60 | 100.0% | 0.2 |
| Totals: | 1,742 | 205 | 11.8% | 264 | 15.2% | 0.8 | 260 | 14.9% | 0.8 |
| Excluding 72+: | 1,682 | 194 | 11.5% | 204 | 12.1% | 1.0 | 200 | 11.9% | 1.0 |

Retirement Assumption

Tier One

Graph III(g)



Retirement Assumption

Tier One Alternative Formula Female Eligible for Retirement Under the Regular Formula Provisions

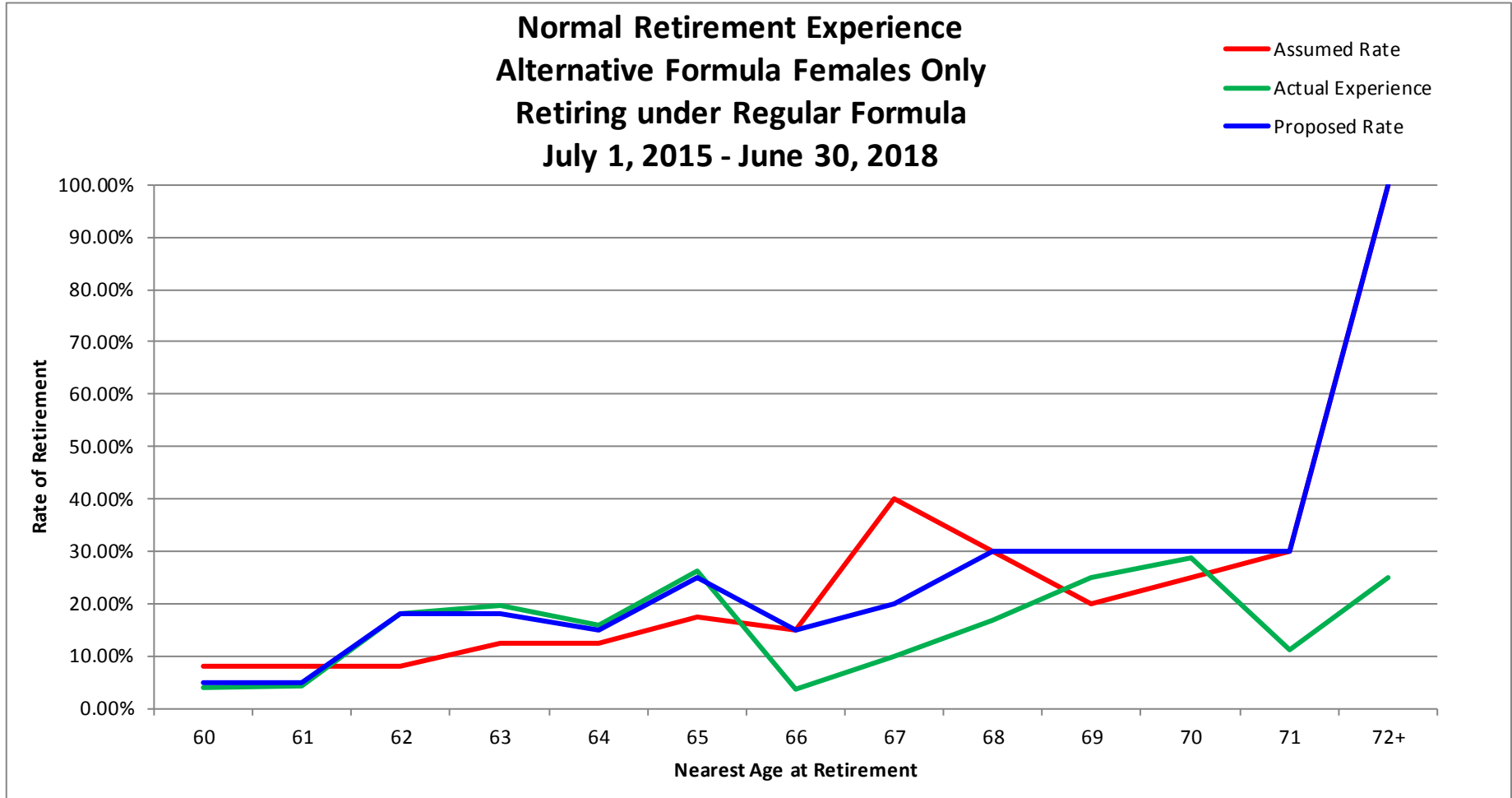
Table III(h)

| Normal Retirement Experience - Alternative Formula Female Members - Eligible for Retirement under the Regular Formula Provisions | | | | | | | | | |
|--|-------------------|-------------|--------------|----------------------|--------------|-------------------|----------------------|---------------|-------------------|
| Nearest Age @ Retirement | Actual Experience | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Retirements | Actual Rate | Expected Retirements | Assumed Rate | Actual / Expected | Expected Retirements | Proposed Rate | Actual / Expected |
| 60 | 123 | 5 | 4.1% | 10 | 8.0% | 0.5 | 6 | 5.0% | 0.8 |
| 61 | 92 | 4 | 4.3% | 7 | 8.0% | 0.6 | 5 | 5.0% | 0.8 |
| 62 | 77 | 14 | 18.2% | 6 | 8.0% | 2.3 | 14 | 18.0% | 1.0 |
| 63 | 66 | 13 | 19.7% | 8 | 12.5% | 1.6 | 12 | 18.0% | 1.1 |
| 64 | 50 | 8 | 16.0% | 6 | 12.5% | 1.3 | 8 | 15.0% | 1.0 |
| 65 | 38 | 10 | 26.3% | 7 | 17.5% | 1.4 | 10 | 25.0% | 1.0 |
| 66 | 27 | 1 | 3.7% | 4 | 15.0% | 0.3 | 4 | 15.0% | 0.3 |
| 67 | 20 | 2 | 10.0% | 8 | 40.0% | 0.3 | 4 | 20.0% | 0.5 |
| 68 | 12 | 2 | 16.7% | 4 | 30.0% | 0.5 | 4 | 30.0% | 0.5 |
| 69 | 8 | 2 | 25.0% | 2 | 20.0% | 1.0 | 2 | 30.0% | 1.0 |
| 70 | 7 | 2 | 28.6% | 2 | 25.0% | 1.0 | 2 | 30.0% | 1.0 |
| 71 | 9 | 1 | 11.1% | 3 | 30.0% | 0.3 | 3 | 30.0% | 0.3 |
| 72+ | 20 | 5 | 25.0% | 20 | 100.0% | 0.3 | 20 | 100.0% | 0.3 |
| Totals: | 549 | 69 | 12.6% | 87 | 15.8% | 0.8 | 94 | 17.1% | 0.7 |
| Excluding 72+: | 529 | 64 | 12.1% | 67 | 12.7% | 1.0 | 74 | 14.0% | 0.9 |

Retirement Assumption

Tier One

Graph III(h)



Retirement Assumption

Tier Two Regular Formula

Currently, there are no Tier Two members eligible for retirement. Therefore, the retirement assumptions can only be developed based upon our future expectation of the group's behavior.

We are recommending no changes to the retirement rates for Tier Two members eligible for regular formula benefits.

| | Members Eligible For Early Retirement | |
|------------------------------|---------------------------------------|--------|
| Nearest Age at Retirement | Current and Proposed Assumed Rate | |
| | Male | Female |
| 62 | 30% | 30% |
| 63 | 15% | 15% |
| 64 | 15% | 15% |
| 65 | 15% | 15% |
| 66 | 15% | 15% |

| | Members Eligible For Normal Retirement | |
|------------------------------|--|--------|
| Nearest Age at Retirement | Current and Proposed Assumed Rate | |
| | Male | Female |
| 67 | 50% | 50% |
| 68 | 35% | 35% |
| 69 | 35% | 35% |
| 70 | 35% | 35% |
| 71 | 20% | 20% |
| 72 | 20% | 20% |
| 73 | 20% | 20% |
| 74 | 20% | 20% |
| 75 | 100% | 100% |

Retirement Assumption

Tier Two Alternative Formula

For Tier Two members eligible for alternative formula benefits, we recommend rates that are consistent with the age-based retirement rates developed for Tier One members retiring with alternative formula benefits for ages 61 and older. For members retiring at age 60, we recommend no change.

| Nearest Age at Retirement | Members Eligible For Normal Retirement | | | |
|------------------------------|--|--------|-----------------------|--------|
| | Current Assumed Rate | | Proposed Assumed Rate | |
| | Male | Female | Male | Female |
| 60 | 50% | 50% | 50% | 50% |
| 61 | 25% | 20% | 30% | 25% |
| 62 | 45% | 45% | 30% | 40% |
| 63 | 40% | 35% | 35% | 30% |
| 64 | 30% | 40% | 35% | 40% |
| 65 | 55% | 40% | 35% | 50% |
| 66 | 50% | 60% | 35% | 50% |
| 67 | 50% | 50% | 35% | 50% |
| 68 | 30% | 15% | 35% | 50% |
| 69 | 35% | 35% | 45% | 50% |
| 70 | 50% | 60% | 50% | 50% |
| 71 | 30% | 50% | 50% | 50% |
| 72 | 100% | 100% | 100% | 100% |

Turnover Assumption

Turnover

Currently, turnover rates are based solely on service. The experience supports maintaining this structure.

Turnover experience during the last three years was considered in the analysis shown on the following pages. The “Exposures” column shows the number of employees at various years of service throughout the experience period.

The “Turnover” column shows the number of employees at various ages who have gone from active status for reasons other than retirement and death. This includes members moving to inactive status and members terminating and receiving a refund of contributions, and disabled members.

This assumption was analyzed for both Tier One and Tier Two members.

There were more terminations than expected under the current assumptions. Based on our analysis, we recommend increasing the rates for Tier One members and Tier Two members.

The tables and graphs on the following pages show termination experience by age.

- Table IV(a) and Graph IV(a) – Regular Formula Tier 1 by Service – Male
- Table IV(b) and Graph IV(b) – Regular Formula Tier 1 by Service – Female
- Table IV(c) and Graph IV(c) – Alternative Formula Tier 1 by Service – Male
- Table IV(d) and Graph IV(d) – Alternative Formula Tier 1 by Service – Female
- Table IV(e) and Graph IV(e) – Regular Formula Tier 2 by Service – Male
- Table IV(f) and Graph IV(f) – Regular Formula Tier 2 by Service – Female
- Table IV(g) and Graph IV(g) – Alternative Formula Tier 2 by Service – Male
- Table IV(h) and Graph IV(h) – Alternative Formula Tier 2 by Service – Female

Analysis of Experience and Recommendations

Table IV(a)

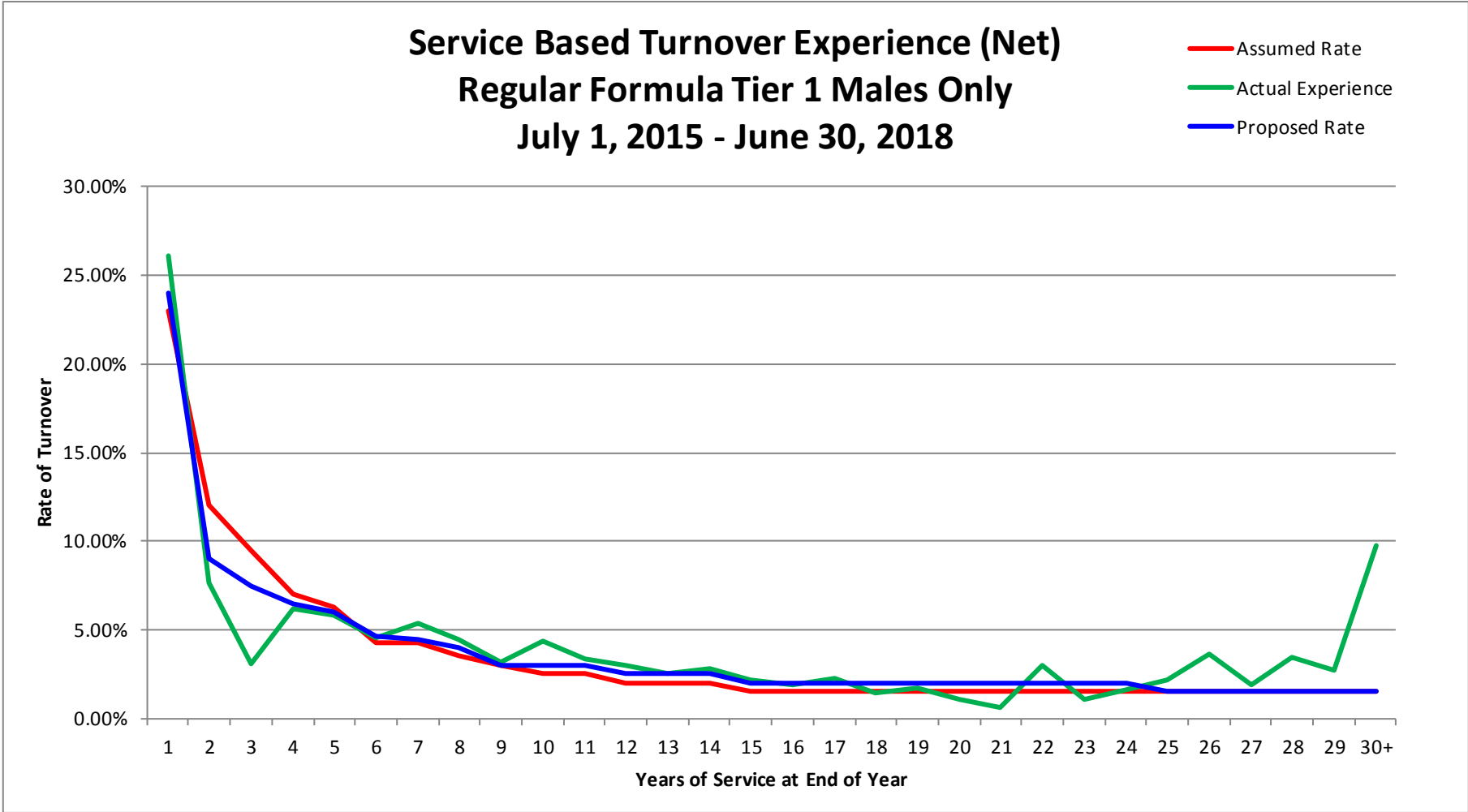
| Termination Experience by Service - Regular Formula Male Tier 1 Members | | | | | | | | | | | |
|---|-------------------|--------------|------------|-----------------|-----------------------------|----------------------|-----------------|----------------------------------|----------------------|------------------|----------------------------------|
| Service (End of Year) | Actual Experience | | | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Turnover | Rehires | Net Turnover | Actual Rate ¹ | Expected Turnover | Assumed Rate | Actual/ Expected ² | Expected Turnover | Proposed Rate | Actual/ Expected ² |
| 1 | 111 | 29 | 0 | 29 | 26.13% | 26 | 23.00% | 0.9 | 27 | 24.00% | 0.9 |
| 2 | 446 | 67 | 33 | 34 | 7.62% | 54 | 12.00% | 1.6 | 40 | 9.00% | 1.2 |
| 3 | 555 | 46 | 29 | 17 | 3.06% | 53 | 9.50% | 3.1 | 42 | 7.50% | 2.5 |
| 4 | 553 | 45 | 11 | 34 | 6.15% | 39 | 7.00% | 1.1 | 36 | 6.50% | 1.1 |
| 5 | 565 | 45 | 12 | 33 | 5.84% | 35 | 6.25% | 1.1 | 34 | 6.00% | 1.0 |
| 6 | 924 | 53 | 11 | 42 | 4.55% | 39 | 4.25% | 0.9 | 43 | 4.60% | 1.0 |
| 7 | 1,193 | 75 | 11 | 64 | 5.36% | 51 | 4.25% | 0.8 | 54 | 4.50% | 0.8 |
| 8 | 1,308 | 70 | 12 | 58 | 4.43% | 46 | 3.50% | 0.8 | 52 | 4.00% | 0.9 |
| 9 | 1,043 | 41 | 8 | 33 | 3.16% | 31 | 3.00% | 0.9 | 31 | 3.00% | 0.9 |
| 10 | 1,116 | 55 | 6 | 49 | 4.39% | 28 | 2.50% | 0.6 | 33 | 3.00% | 0.7 |
| 11 | 1,038 | 45 | 10 | 35 | 3.37% | 26 | 2.50% | 0.7 | 31 | 3.00% | 0.9 |
| 12 | 979 | 38 | 9 | 29 | 2.96% | 20 | 2.00% | 0.7 | 24 | 2.50% | 0.8 |
| 13 | 930 | 36 | 12 | 24 | 2.58% | 19 | 2.00% | 0.8 | 23 | 2.50% | 1.0 |
| 14 | 982 | 34 | 6 | 28 | 2.85% | 20 | 2.00% | 0.7 | 25 | 2.50% | 0.9 |
| 15 | 1,118 | 29 | 5 | 24 | 2.15% | 17 | 1.50% | 0.7 | 22 | 2.00% | 0.9 |
| 16 | 1,330 | 35 | 10 | 25 | 1.88% | 20 | 1.50% | 0.8 | 27 | 2.00% | 1.1 |
| 17 | 1,473 | 38 | 5 | 33 | 2.24% | 22 | 1.50% | 0.7 | 29 | 2.00% | 0.9 |
| 18 | 1,482 | 28 | 7 | 21 | 1.42% | 22 | 1.50% | 1.0 | 30 | 2.00% | 1.4 |
| 19 | 1,266 | 24 | 2 | 22 | 1.74% | 19 | 1.50% | 0.9 | 25 | 2.00% | 1.1 |
| 20 | 982 | 16 | 5 | 11 | 1.12% | 15 | 1.50% | 1.4 | 20 | 2.00% | 1.8 |
| 21 | 795 | 11 | 6 | 5 | 0.63% | 12 | 1.50% | 2.4 | 16 | 2.00% | 3.2 |
| 22 | 813 | 25 | 1 | 24 | 2.95% | 12 | 1.50% | 0.5 | 16 | 2.00% | 0.7 |
| 23 | 856 | 14 | 5 | 9 | 1.05% | 13 | 1.50% | 1.4 | 17 | 2.00% | 1.9 |
| 24 | 838 | 19 | 5 | 14 | 1.67% | 13 | 1.50% | 0.9 | 17 | 2.00% | 1.2 |
| 25 | 684 | 18 | 3 | 15 | 2.19% | 10 | 1.50% | 0.7 | 10 | 1.50% | 0.7 |
| 26 | 598 | 24 | 2 | 22 | 3.68% | 9 | 1.50% | 0.4 | 9 | 1.50% | 0.4 |
| 27 | 641 | 15 | 3 | 12 | 1.87% | 10 | 1.50% | 0.8 | 10 | 1.50% | 0.8 |
| 28 | 610 | 23 | 2 | 21 | 3.44% | 9 | 1.50% | 0.4 | 9 | 1.50% | 0.4 |
| 29 | 521 | 15 | 1 | 14 | 2.69% | 8 | 1.50% | 0.6 | 8 | 1.50% | 0.6 |
| 30+ | 982 | 96 | 0 | 96 | 9.78% | 15 | 1.50% | 0.2 | 15 | 1.50% | 0.2 |
| | 26,732 | 1,109 | 232 | 877 | 3.28% | 713 | 2.67% | 0.8 | 775 | 2.90% | 0.9 |

¹ Reflects actual turnover net of inactive members who returned to active service.

² Actual to expected ratio based on net turnover.

Analysis of Experience and Recommendations

Graph IV(a)



Analysis of Experience and Recommendations

Table IV(b)

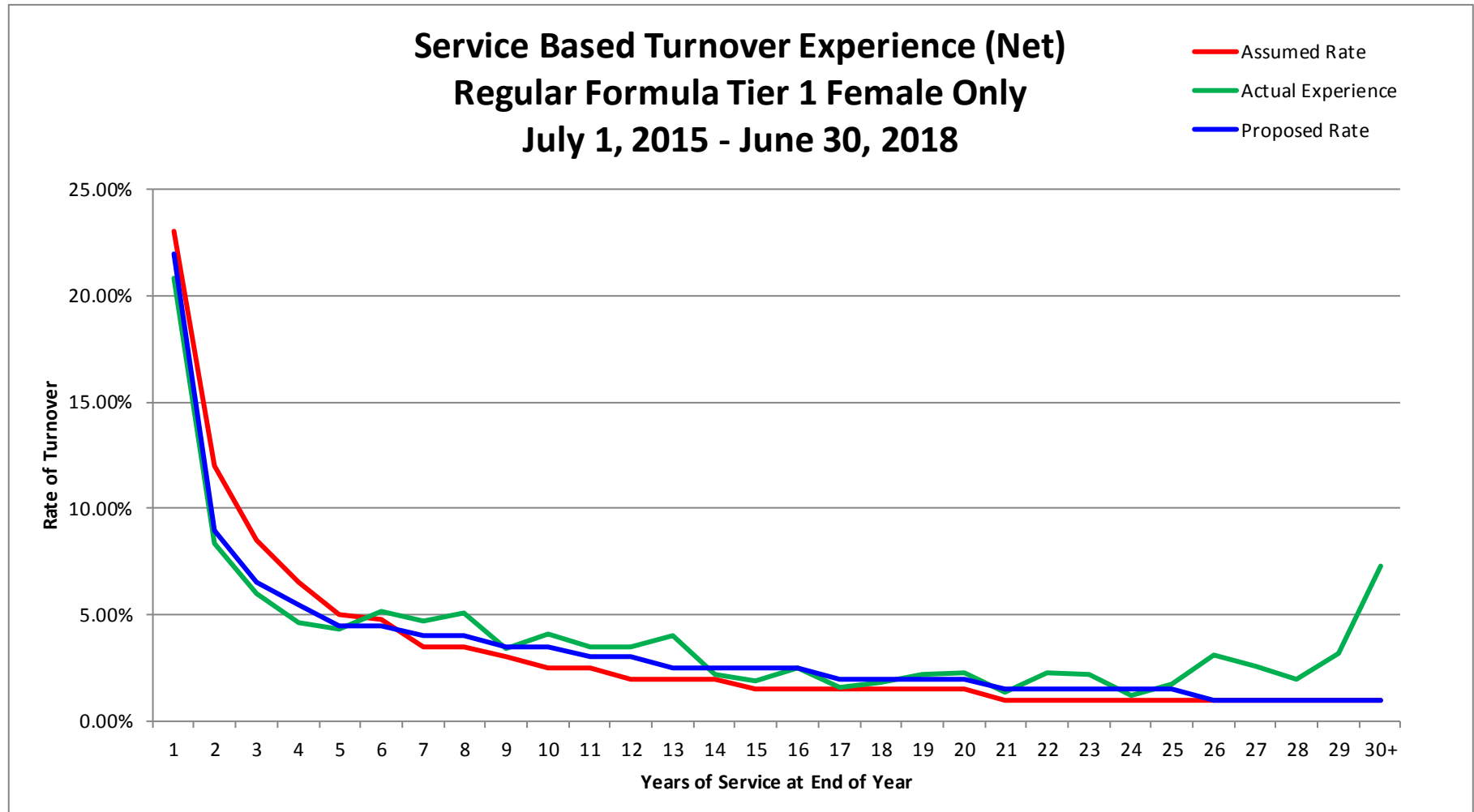
| Termination Experience by Service - Regular Formula Female Tier 1 Members | | | | | | | | | | | |
|---|-------------------|--------------|------------|-----------------|-----------------------------|----------------------|-----------------|----------------------------------|----------------------|------------------|----------------------------------|
| Service (End of Year) | Actual Experience | | | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Turnover | Rehires | Net Turnover | Actual Rate ¹ | Expected Turnover | Assumed Rate | Actual/ Expected ² | Expected Turnover | Proposed Rate | Actual/ Expected ² |
| 1 | 120 | 25 | 0 | 25 | 20.83% | 28 | 23.00% | 1.1 | 26 | 22.00% | 1.0 |
| 2 | 742 | 92 | 30 | 62 | 8.36% | 89 | 12.00% | 1.4 | 67 | 9.00% | 1.1 |
| 3 | 1,051 | 85 | 22 | 63 | 5.99% | 89 | 8.50% | 1.4 | 68 | 6.50% | 1.1 |
| 4 | 1,045 | 68 | 20 | 48 | 4.59% | 68 | 6.50% | 1.4 | 57 | 5.50% | 1.2 |
| 5 | 964 | 59 | 17 | 42 | 4.36% | 48 | 5.00% | 1.1 | 43 | 4.50% | 1.0 |
| 6 | 1,352 | 88 | 18 | 70 | 5.18% | 64 | 4.75% | 0.9 | 61 | 4.50% | 0.9 |
| 7 | 1,541 | 84 | 12 | 72 | 4.67% | 54 | 3.50% | 0.8 | 62 | 4.00% | 0.9 |
| 8 | 1,768 | 107 | 17 | 90 | 5.09% | 62 | 3.50% | 0.7 | 71 | 4.00% | 0.8 |
| 9 | 1,570 | 75 | 21 | 54 | 3.44% | 47 | 3.00% | 0.9 | 55 | 3.50% | 1.0 |
| 10 | 1,757 | 89 | 17 | 72 | 4.10% | 44 | 2.50% | 0.6 | 61 | 3.50% | 0.8 |
| 11 | 1,675 | 78 | 20 | 58 | 3.46% | 42 | 2.50% | 0.7 | 50 | 3.00% | 0.9 |
| 12 | 1,511 | 64 | 11 | 53 | 3.51% | 30 | 2.00% | 0.6 | 45 | 3.00% | 0.8 |
| 13 | 1,376 | 64 | 9 | 55 | 4.00% | 28 | 2.00% | 0.5 | 34 | 2.50% | 0.6 |
| 14 | 1,345 | 45 | 15 | 30 | 2.23% | 27 | 2.00% | 0.9 | 34 | 2.50% | 1.1 |
| 15 | 1,614 | 53 | 23 | 30 | 1.86% | 24 | 1.50% | 0.8 | 40 | 2.50% | 1.3 |
| 16 | 2,020 | 66 | 16 | 50 | 2.48% | 30 | 1.50% | 0.6 | 51 | 2.50% | 1.0 |
| 17 | 2,319 | 52 | 16 | 36 | 1.55% | 35 | 1.50% | 1.0 | 46 | 2.00% | 1.3 |
| 18 | 2,301 | 52 | 10 | 42 | 1.83% | 35 | 1.50% | 0.8 | 46 | 2.00% | 1.1 |
| 19 | 1,840 | 48 | 8 | 40 | 2.17% | 28 | 1.50% | 0.7 | 37 | 2.00% | 0.9 |
| 20 | 1,410 | 42 | 10 | 32 | 2.27% | 21 | 1.50% | 0.7 | 28 | 2.00% | 0.9 |
| 21 | 1,162 | 25 | 9 | 16 | 1.38% | 12 | 1.00% | 0.8 | 17 | 1.50% | 1.1 |
| 22 | 1,233 | 33 | 5 | 28 | 2.27% | 12 | 1.00% | 0.4 | 18 | 1.50% | 0.6 |
| 23 | 1,269 | 30 | 2 | 28 | 2.21% | 13 | 1.00% | 0.5 | 19 | 1.50% | 0.7 |
| 24 | 1,162 | 22 | 8 | 14 | 1.20% | 12 | 1.00% | 0.9 | 17 | 1.50% | 1.2 |
| 25 | 915 | 22 | 6 | 16 | 1.75% | 9 | 1.00% | 0.6 | 14 | 1.50% | 0.9 |
| 26 | 738 | 25 | 2 | 23 | 3.12% | 7 | 1.00% | 0.3 | 7 | 1.00% | 0.3 |
| 27 | 819 | 23 | 2 | 21 | 2.56% | 8 | 1.00% | 0.4 | 8 | 1.00% | 0.4 |
| 28 | 806 | 22 | 6 | 16 | 1.99% | 8 | 1.00% | 0.5 | 8 | 1.00% | 0.5 |
| 29 | 746 | 28 | 4 | 24 | 3.22% | 7 | 1.00% | 0.3 | 7 | 1.00% | 0.3 |
| 30+ | 1,585 | 121 | 6 | 115 | 7.26% | 6 | 1.00% | 0.1 | 16 | 1.00% | 0.1 |
| | 39,756 | 1,687 | 362 | 1,325 | 3.33% | 987 | 2.48% | 0.7 | 1,113 | 2.80% | 0.8 |

¹ Reflects actual turnover net of inactive members who returned to active service.

² Actual to expected ratio based on net turnover.

Analysis of Experience and Recommendations

Graph IV(b)



Analysis of Experience and Recommendations

Table IV(c)

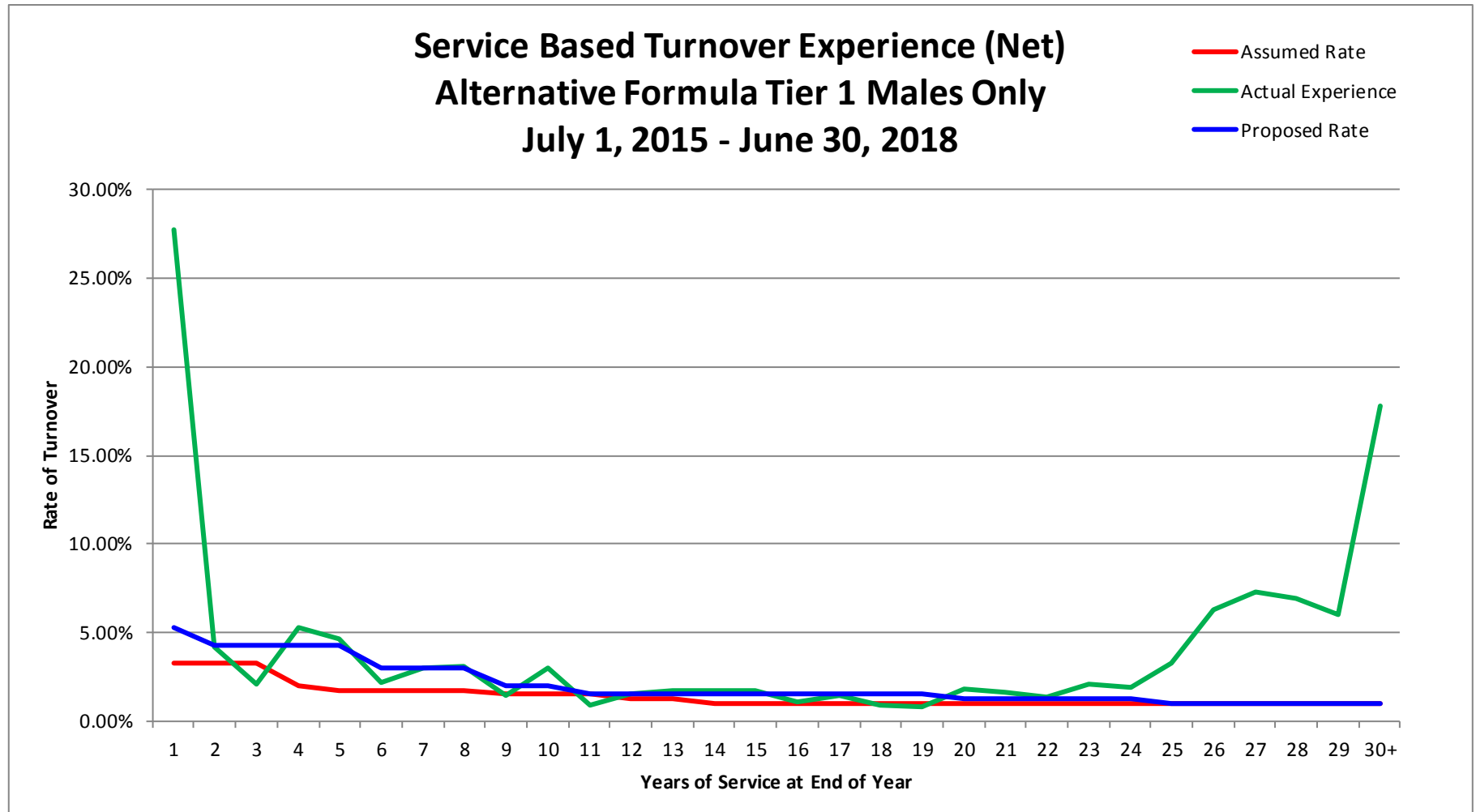
| Termination Experience by Service- Alternative Formula Male Tier 1 Members | | | | | | | | | | | |
|--|-------------------|------------|------------|-----------------|-----------------------------|----------------------|-----------------|----------------------------------|----------------------|------------------|----------------------------------|
| Service (End of Year) | Actual Experience | | | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Turnover | Rehires | Net Turnover | Actual Rate ¹ | Expected Turnover | Assumed Rate | Actual/ Expected ² | Expected Turnover | Proposed Rate | Actual/ Expected ² |
| 1 | 18 | 5 | 0 | 5 | 27.78% | 1 | 3.25% | 0.2 | 1 | 5.25% | 0.2 |
| 2 | 169 | 23 | 16 | 7 | 4.14% | 5 | 3.25% | 0.7 | 7 | 4.25% | 1.0 |
| 3 | 283 | 21 | 15 | 6 | 2.12% | 9 | 3.25% | 1.5 | 12 | 4.25% | 2.0 |
| 4 | 320 | 29 | 12 | 17 | 5.31% | 6 | 2.00% | 0.4 | 14 | 4.25% | 0.8 |
| 5 | 344 | 21 | 5 | 16 | 4.65% | 6 | 1.75% | 0.4 | 15 | 4.25% | 0.9 |
| 6 | 950 | 34 | 13 | 21 | 2.21% | 17 | 1.75% | 0.8 | 29 | 3.00% | 1.4 |
| 7 | 1,289 | 51 | 12 | 39 | 3.03% | 23 | 1.75% | 0.6 | 39 | 3.00% | 1.0 |
| 8 | 1,404 | 49 | 6 | 43 | 3.06% | 25 | 1.75% | 0.6 | 42 | 3.00% | 1.0 |
| 9 | 883 | 23 | 10 | 13 | 1.47% | 13 | 1.50% | 1.0 | 18 | 2.00% | 1.4 |
| 10 | 789 | 27 | 3 | 24 | 3.04% | 12 | 1.50% | 0.5 | 16 | 2.00% | 0.7 |
| 11 | 672 | 9 | 3 | 6 | 0.89% | 10 | 1.50% | 1.7 | 10 | 1.50% | 1.7 |
| 12 | 793 | 17 | 5 | 12 | 1.51% | 10 | 1.25% | 0.8 | 12 | 1.50% | 1.0 |
| 13 | 866 | 17 | 2 | 15 | 1.73% | 11 | 1.25% | 0.7 | 13 | 1.50% | 0.9 |
| 14 | 990 | 21 | 4 | 17 | 1.72% | 10 | 1.00% | 0.6 | 15 | 1.50% | 0.9 |
| 15 | 1,468 | 32 | 7 | 25 | 1.70% | 15 | 1.00% | 0.6 | 22 | 1.50% | 0.9 |
| 16 | 1,695 | 35 | 16 | 19 | 1.12% | 17 | 1.00% | 0.9 | 25 | 1.50% | 1.3 |
| 17 | 2,017 | 40 | 10 | 30 | 1.49% | 20 | 1.00% | 0.7 | 30 | 1.50% | 1.0 |
| 18 | 1,913 | 30 | 12 | 18 | 0.94% | 19 | 1.00% | 1.1 | 29 | 1.50% | 1.6 |
| 19 | 1,818 | 20 | 6 | 14 | 0.77% | 18 | 1.00% | 1.3 | 27 | 1.50% | 1.9 |
| 20 | 1,516 | 34 | 6 | 28 | 1.85% | 15 | 1.00% | 0.5 | 19 | 1.25% | 0.7 |
| 21 | 1,255 | 23 | 3 | 20 | 1.59% | 13 | 1.00% | 0.7 | 16 | 1.25% | 0.8 |
| 22 | 1,168 | 19 | 3 | 16 | 1.37% | 12 | 1.00% | 0.8 | 15 | 1.25% | 0.9 |
| 23 | 1,055 | 27 | 5 | 22 | 2.09% | 11 | 1.00% | 0.5 | 13 | 1.25% | 0.6 |
| 24 | 826 | 19 | 3 | 16 | 1.94% | 8 | 1.00% | 0.5 | 10 | 1.25% | 0.6 |
| 25 | 543 | 21 | 3 | 18 | 3.31% | 5 | 1.00% | 0.3 | 5 | 1.00% | 0.3 |
| 26 | 350 | 24 | 2 | 22 | 6.29% | 4 | 1.00% | 0.2 | 4 | 1.00% | 0.2 |
| 27 | 317 | 25 | 2 | 23 | 7.26% | 3 | 1.00% | 0.1 | 3 | 1.00% | 0.1 |
| 28 | 260 | 18 | 0 | 18 | 6.92% | 3 | 1.00% | 0.2 | 3 | 1.00% | 0.2 |
| 29 | 149 | 9 | 0 | 9 | 6.04% | 1 | 1.00% | 0.1 | 1 | 1.00% | 0.1 |
| 30+ | 90 | 19 | 3 | 16 | 17.78% | 1 | 1.00% | 0.1 | 1 | 1.00% | 0.1 |
| | 26,210 | 742 | 187 | 555 | 2.12% | 323 | 1.23% | 0.6 | 466 | 1.78% | 0.8 |

¹ Reflects actual turnover net of inactive members who returned to active service.

² Actual to expected ratio based on net turnover.

Analysis of Experience and Recommendations

Graph IV(c)



Analysis of Experience and Recommendations

Table IV(d)

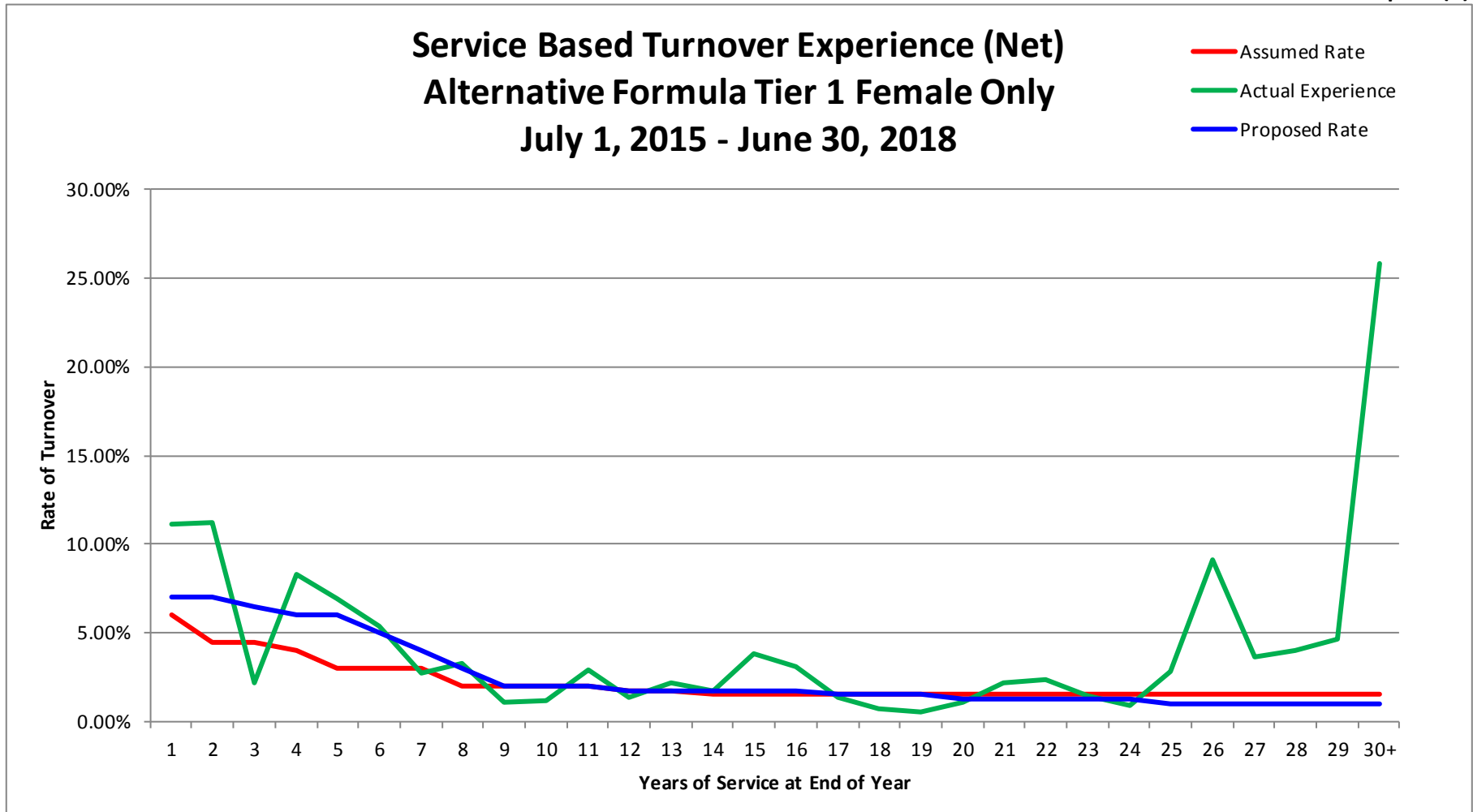
| Termination Experience by Service - Alternative Formula Female Tier 1 Members | | | | | | | | | | | |
|---|-------------------|------------|-----------|-----------------|-----------------------------|----------------------|-----------------|----------------------------------|----------------------|------------------|----------------------------------|
| Service (End of Year) | Actual Experience | | | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Turnover | Rehires | Net Turnover | Actual Rate ¹ | Expected Turnover | Assumed Rate | Actual/ Expected ² | Expected Turnover | Proposed Rate | Actual/ Expected ² |
| 1 | 9 | 1 | 0 | 1 | 11.11% | 1 | 6.00% | 1.0 | 1 | 7.00% | 1.0 |
| 2 | 107 | 15 | 3 | 12 | 11.21% | 5 | 4.50% | 0.4 | 7 | 7.00% | 0.6 |
| 3 | 183 | 12 | 8 | 4 | 2.19% | 8 | 4.50% | 2.0 | 12 | 6.50% | 3.0 |
| 4 | 180 | 17 | 2 | 15 | 8.33% | 7 | 4.00% | 0.5 | 11 | 6.00% | 0.7 |
| 5 | 145 | 13 | 3 | 10 | 6.90% | 4 | 3.00% | 0.4 | 9 | 6.00% | 0.9 |
| 6 | 241 | 20 | 7 | 13 | 5.39% | 7 | 3.00% | 0.5 | 12 | 5.00% | 0.9 |
| 7 | 331 | 18 | 9 | 9 | 2.72% | 10 | 3.00% | 1.1 | 13 | 4.00% | 1.4 |
| 8 | 363 | 14 | 2 | 12 | 3.31% | 7 | 2.00% | 0.6 | 11 | 3.00% | 0.9 |
| 9 | 290 | 7 | 4 | 3 | 1.03% | 6 | 2.00% | 2.0 | 6 | 2.00% | 2.0 |
| 10 | 247 | 7 | 4 | 3 | 1.21% | 5 | 2.00% | 1.7 | 5 | 2.00% | 1.7 |
| 11 | 207 | 7 | 1 | 6 | 2.90% | 4 | 2.00% | 0.7 | 4 | 2.00% | 0.7 |
| 12 | 227 | 5 | 2 | 3 | 1.32% | 4 | 1.75% | 1.3 | 4 | 1.75% | 1.3 |
| 13 | 231 | 9 | 4 | 5 | 2.16% | 4 | 1.75% | 0.8 | 4 | 1.75% | 0.8 |
| 14 | 230 | 7 | 3 | 4 | 1.74% | 3 | 1.50% | 0.8 | 4 | 1.75% | 1.0 |
| 15 | 339 | 16 | 3 | 13 | 3.83% | 5 | 1.50% | 0.4 | 6 | 1.75% | 0.5 |
| 16 | 424 | 17 | 4 | 13 | 3.07% | 6 | 1.50% | 0.5 | 7 | 1.75% | 0.5 |
| 17 | 532 | 11 | 4 | 7 | 1.32% | 8 | 1.50% | 1.1 | 8 | 1.50% | 1.1 |
| 18 | 557 | 11 | 7 | 4 | 0.72% | 8 | 1.50% | 2.0 | 8 | 1.50% | 2.0 |
| 19 | 536 | 8 | 5 | 3 | 0.56% | 8 | 1.50% | 2.7 | 8 | 1.50% | 2.7 |
| 20 | 445 | 8 | 3 | 5 | 1.12% | 7 | 1.50% | 1.4 | 6 | 1.25% | 1.2 |
| 21 | 373 | 11 | 3 | 8 | 2.14% | 6 | 1.50% | 0.8 | 5 | 1.25% | 0.6 |
| 22 | 339 | 10 | 2 | 8 | 2.36% | 5 | 1.50% | 0.6 | 4 | 1.25% | 0.5 |
| 23 | 284 | 8 | 4 | 4 | 1.41% | 4 | 1.50% | 1.0 | 4 | 1.25% | 1.0 |
| 24 | 224 | 3 | 1 | 2 | 0.89% | 3 | 1.50% | 1.5 | 3 | 1.25% | 1.5 |
| 25 | 140 | 4 | 0 | 4 | 2.86% | 2 | 1.50% | 0.5 | 1 | 1.00% | 0.3 |
| 26 | 88 | 8 | 0 | 8 | 9.09% | 1 | 1.50% | 0.1 | 1 | 1.00% | 0.1 |
| 27 | 83 | 6 | 3 | 3 | 3.61% | 1 | 1.50% | 0.3 | 1 | 1.00% | 0.3 |
| 28 | 75 | 3 | 0 | 3 | 4.00% | 1 | 1.50% | 0.3 | 1 | 1.00% | 0.3 |
| 29 | 43 | 2 | 0 | 2 | 4.65% | 1 | 1.50% | 0.5 | 0 | 1.00% | 0.0 |
| 30+ | 31 | 8 | 0 | 8 | 25.81% | 0 | 1.50% | 0.0 | 0 | 1.00% | 0.0 |
| | 7,504 | 286 | 91 | 195 | 2.60% | 141 | 1.88% | 0.7 | 166 | 2.21% | 0.9 |

¹ Reflects actual turnover net of inactive members who returned to active service.

² Actual to expected ratio based on net turnover.

Analysis of Experience and Recommendations

Graph IV(d)



Analysis of Experience and Recommendations

Table IV(e)

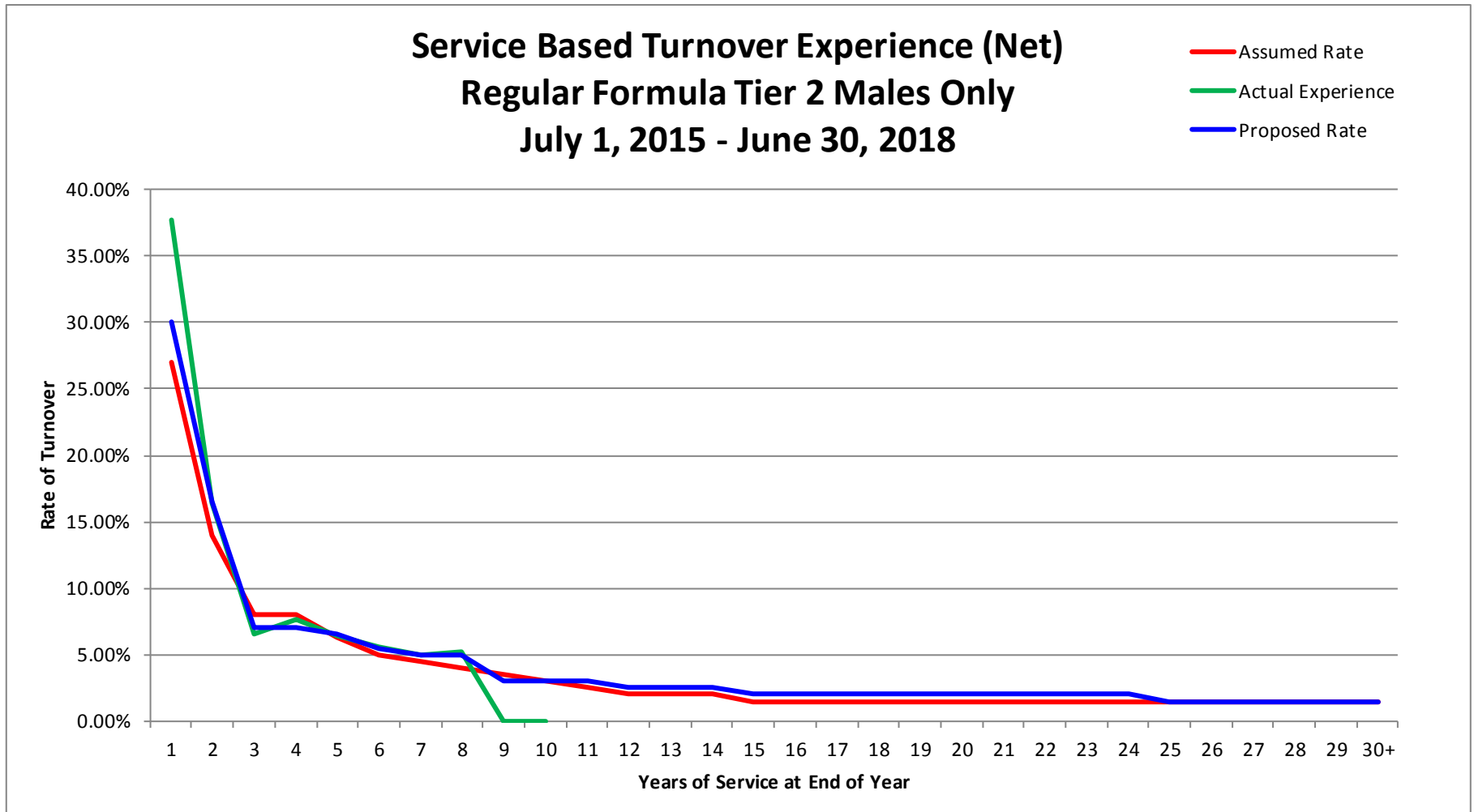
| Termination Experience by Service - Regular Formula Male Tier 2 Members | | | | | | | | | | | |
|---|-------------------|----------|---------|-----------------|-----------------------------|----------------------|-----------------|----------------------------------|----------------------|------------------|----------------------------------|
| Service (End of Year) | Actual Experience | | | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Turnover | Rehires | Net Turnover | Actual Rate ¹ | Expected Turnover | Assumed Rate | Actual/ Expected ² | Expected Turnover | Proposed Rate | Actual/ Expected ² |
| 1 | 1,062 | 401 | 0 | 401 | 37.76% | 287 | 27.00% | 0.7 | 319 | 30.00% | 0.8 |
| 2 | 3,856 | 842 | 210 | 632 | 16.39% | 540 | 14.00% | 0.9 | 636 | 16.50% | 1.0 |
| 3 | 3,292 | 337 | 120 | 217 | 6.59% | 263 | 8.00% | 1.2 | 230 | 7.00% | 1.1 |
| 4 | 2,842 | 258 | 40 | 218 | 7.67% | 227 | 8.00% | 1.0 | 199 | 7.00% | 0.9 |
| 5 | 2,191 | 156 | 14 | 142 | 6.48% | 137 | 6.25% | 1.0 | 142 | 6.50% | 1.0 |
| 6 | 1,411 | 85 | 6 | 79 | 5.60% | 71 | 5.00% | 0.9 | 78 | 5.50% | 1.0 |
| 7 | 784 | 41 | 2 | 39 | 4.97% | 35 | 4.50% | 0.9 | 39 | 5.00% | 1.0 |
| 8 | 248 | 14 | 1 | 13 | 5.24% | 10 | 4.00% | 0.8 | 12 | 5.00% | 0.9 |
| 9 | 11 | 0 | 0 | 0 | 0.00% | 0 | 3.50% | | 0 | 3.00% | |
| 10 | 8 | 0 | 0 | 0 | 0.00% | 0 | 3.00% | | 0 | 3.00% | |
| 11 | 4 | 0 | 0 | 0 | 0.00% | 0 | 2.50% | | 0 | 3.00% | |
| 12 | 5 | 2 | 0 | 2 | 40.00% | 0 | 2.00% | 0.1 | 0 | 2.50% | 0.1 |
| 13 | 8 | 4 | 0 | 4 | 50.00% | 0 | 2.00% | 0.0 | 0 | 2.50% | 0.1 |
| 14 | 2 | 0 | 0 | 0 | 0.00% | 0 | 2.00% | | 0 | 2.50% | |
| 15 | 1 | 1 | 0 | 1 | 100.00% | 0 | 1.50% | 0.0 | 0 | 2.00% | 0.0 |
| 16 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.00% | |
| 17 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.00% | |
| 18 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.00% | |
| 19 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.00% | |
| 20 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.00% | |
| 21 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.00% | |
| 22 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.00% | |
| 23 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.00% | |
| 24 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.00% | |
| 25 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 26 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 27 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 28 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 29 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 30+ | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| | 15,725 | 2,141 | 393 | 1,748 | 11.12% | 1,571 | 9.99% | 0.9 | 1,656 | 10.53% | 0.9 |

¹ Reflects actual turnover net of inactive members who returned to active service.

² Actual to expected ratio based on net turnover.

Analysis of Experience and Recommendations

Graph IV(e)



Analysis of Experience and Recommendations

Table IV(f)

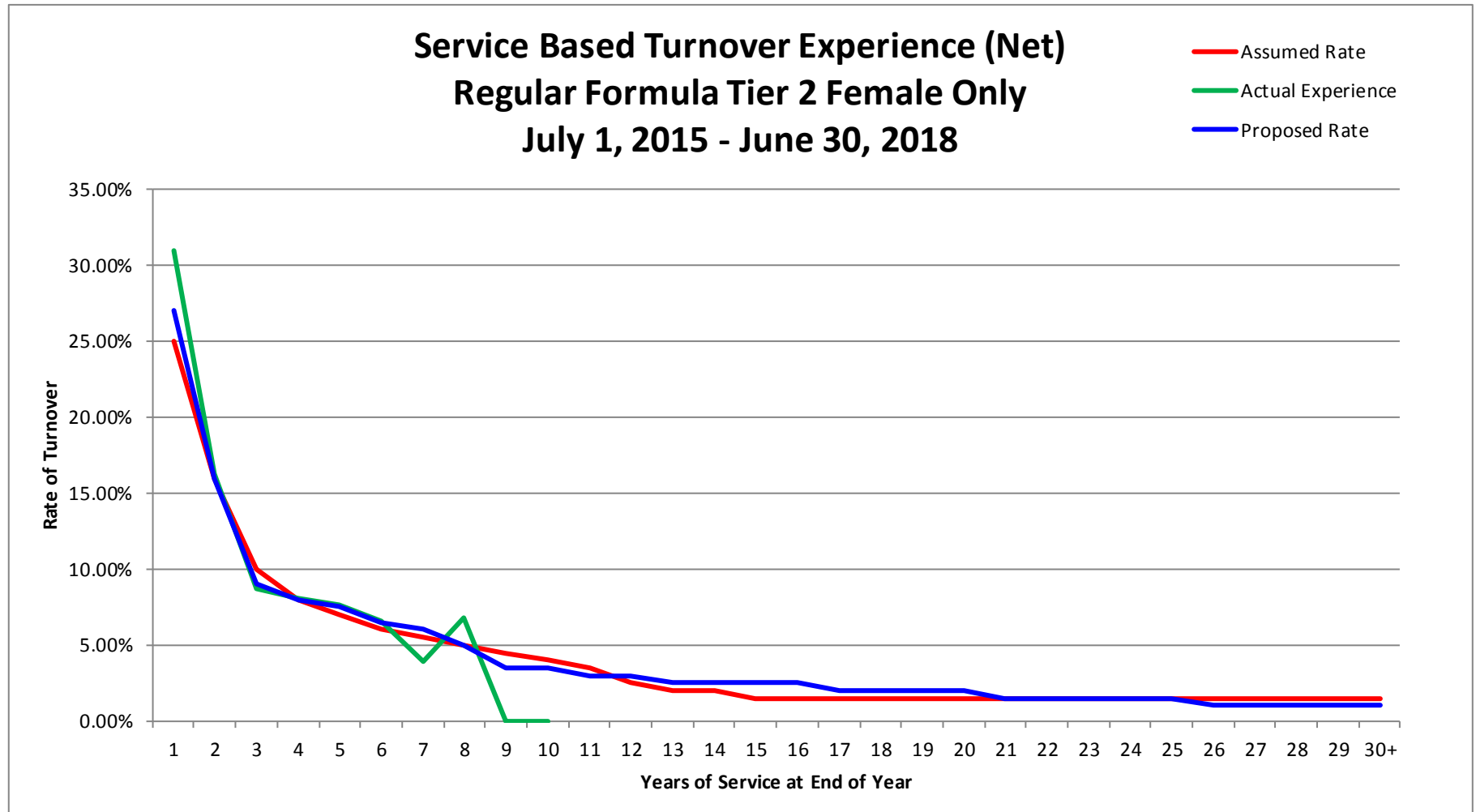
| Termination Experience by Service - Regular Formula Female Tier 2 Members | | | | | | | | | | | |
|---|-------------------|----------|---------|-----------------|-----------------------------|----------------------|-----------------|----------------------------------|----------------------|------------------|----------------------------------|
| Service (End of Year) | Actual Experience | | | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Turnover | Rehires | Net Turnover | Actual Rate ¹ | Expected Turnover | Assumed Rate | Actual/ Expected ² | Expected Turnover | Proposed Rate | Actual/ Expected ² |
| 1 | 1,021 | 316 | 0 | 316 | 30.95% | 255 | 25.00% | 0.8 | 276 | 27.00% | 0.9 |
| 2 | 4,587 | 825 | 79 | 746 | 16.26% | 734 | 16.00% | 1.0 | 734 | 16.00% | 1.0 |
| 3 | 4,373 | 454 | 75 | 379 | 8.67% | 437 | 10.00% | 1.2 | 394 | 9.00% | 1.0 |
| 4 | 3,623 | 324 | 32 | 292 | 8.06% | 290 | 8.00% | 1.0 | 290 | 8.00% | 1.0 |
| 5 | 2,514 | 215 | 22 | 193 | 7.68% | 176 | 7.00% | 0.9 | 189 | 7.50% | 1.0 |
| 6 | 1,338 | 106 | 18 | 88 | 6.58% | 80 | 6.00% | 0.9 | 87 | 6.50% | 1.0 |
| 7 | 711 | 42 | 14 | 28 | 3.94% | 39 | 5.50% | 1.4 | 43 | 6.00% | 1.5 |
| 8 | 279 | 20 | 1 | 19 | 6.81% | 14 | 5.00% | 0.7 | 14 | 5.00% | 0.7 |
| 9 | 2 | 0 | 0 | 0 | 0.00% | 0 | 4.50% | | 0 | 3.50% | |
| 10 | 0 | 0 | 0 | 0 | | 0 | 4.00% | | 0 | 3.50% | |
| 11 | 0 | 0 | 0 | 0 | | 0 | 3.50% | | 0 | 3.00% | |
| 12 | 1 | 1 | 0 | 1 | 100.00% | 0 | 2.50% | 0.0 | 0 | 3.00% | 0.0 |
| 13 | 1 | 0 | 0 | 0 | 0.00% | 0 | 2.00% | | 0 | 2.50% | |
| 14 | 0 | 0 | 0 | 0 | | 0 | 2.00% | | 0 | 2.50% | |
| 15 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.50% | |
| 16 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.50% | |
| 17 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.00% | |
| 18 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.00% | |
| 19 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.00% | |
| 20 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 2.00% | |
| 21 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 22 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 23 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 24 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 25 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 26 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.00% | |
| 27 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.00% | |
| 28 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.00% | |
| 29 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.00% | |
| 30+ | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.00% | |
| | 18,450 | 2,303 | 241 | 2,062 | 11.18% | 2,025 | 10.98% | 1.0 | 2,027 | 10.99% | 1.0 |

¹ Reflects actual turnover net of inactive members who returned to active service.

² Actual to expected ratio based on net turnover.

Analysis of Experience and Recommendations

Graph IV(f)



Analysis of Experience and Recommendations

Table IV(g)

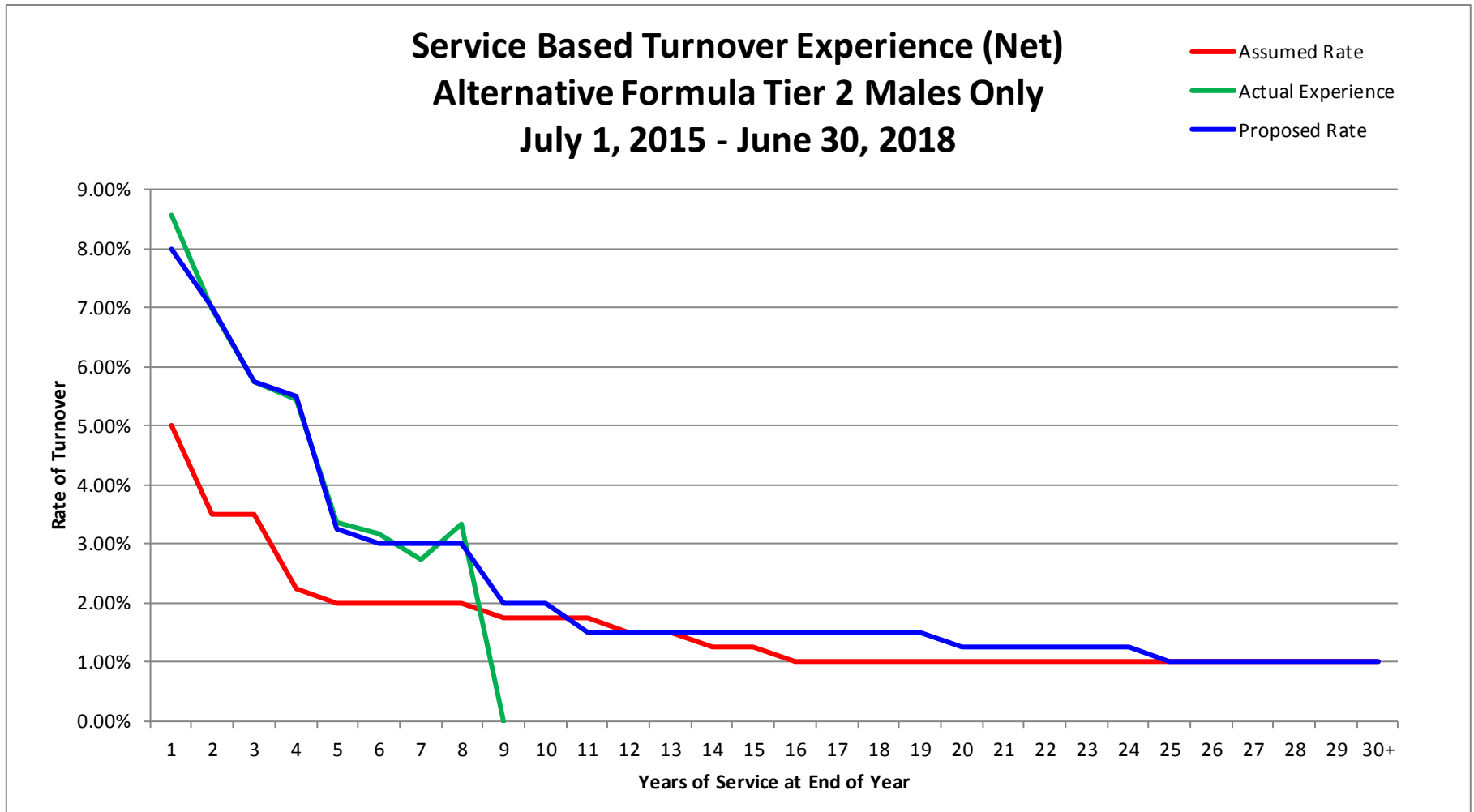
| Termination Experience by Service - Alternative Formula Male Tier 2 Members | | | | | | | | | | | |
|---|-------------------|------------|-----------|-----------------|-----------------------------|----------------------|-----------------|----------------------------------|----------------------|------------------|----------------------------------|
| Service (End of Year) | Actual Experience | | | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Turnover | Rehires | Net Turnover | Actual Rate ¹ | Expected Turnover | Assumed Rate | Actual/ Expected ² | Expected Turnover | Proposed Rate | Actual/ Expected ² |
| 1 | 514 | 44 | 0 | 44 | 8.56% | 26 | 5.00% | 0.6 | 41 | 8.00% | 0.9 |
| 2 | 2,396 | 188 | 21 | 167 | 6.97% | 84 | 3.50% | 0.5 | 168 | 7.00% | 1.0 |
| 3 | 2,157 | 137 | 13 | 124 | 5.75% | 75 | 3.50% | 0.6 | 124 | 5.75% | 1.0 |
| 4 | 1,743 | 105 | 10 | 95 | 5.45% | 39 | 2.25% | 0.4 | 96 | 5.50% | 1.0 |
| 5 | 1,189 | 48 | 8 | 40 | 3.36% | 24 | 2.00% | 0.6 | 39 | 3.25% | 1.0 |
| 6 | 886 | 30 | 2 | 28 | 3.16% | 18 | 2.00% | 0.6 | 27 | 3.00% | 1.0 |
| 7 | 475 | 14 | 1 | 13 | 2.74% | 10 | 2.00% | 0.8 | 14 | 3.00% | 1.1 |
| 8 | 210 | 7 | 0 | 7 | 3.33% | 4 | 2.00% | 0.6 | 6 | 3.00% | 0.9 |
| 9 | 4 | 0 | 0 | 0 | 0.00% | 0 | 1.75% | | 0 | 2.00% | |
| 10 | 4 | 0 | 0 | 0 | 0.00% | 0 | 1.75% | | 0 | 2.00% | |
| 11 | 3 | 0 | 0 | 0 | 0.00% | 0 | 1.75% | | 0 | 1.50% | |
| 12 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 13 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 14 | 0 | 0 | 0 | 0 | | 0 | 1.25% | | 0 | 1.50% | |
| 15 | 0 | 0 | 0 | 0 | | 0 | 1.25% | | 0 | 1.50% | |
| 16 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.50% | |
| 17 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.50% | |
| 18 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.50% | |
| 19 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.50% | |
| 20 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.25% | |
| 21 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.25% | |
| 22 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.25% | |
| 23 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.25% | |
| 24 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.25% | |
| 25 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.00% | |
| 26 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.00% | |
| 27 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.00% | |
| 28 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.00% | |
| 29 | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.00% | |
| 30+ | 0 | 0 | 0 | 0 | | 0 | 1.00% | | 0 | 1.00% | |
| | 9,581 | 573 | 55 | 518 | 5.41% | 280 | 2.92% | 0.5 | 515 | 5.38% | 1.0 |

¹ Reflects actual turnover net of inactive members who returned to active service.

² Actual to expected ratio based on net turnover.

Analysis of Experience and Recommendations

Graph IV(g)



Analysis of Experience and Recommendations

Table IV(h)

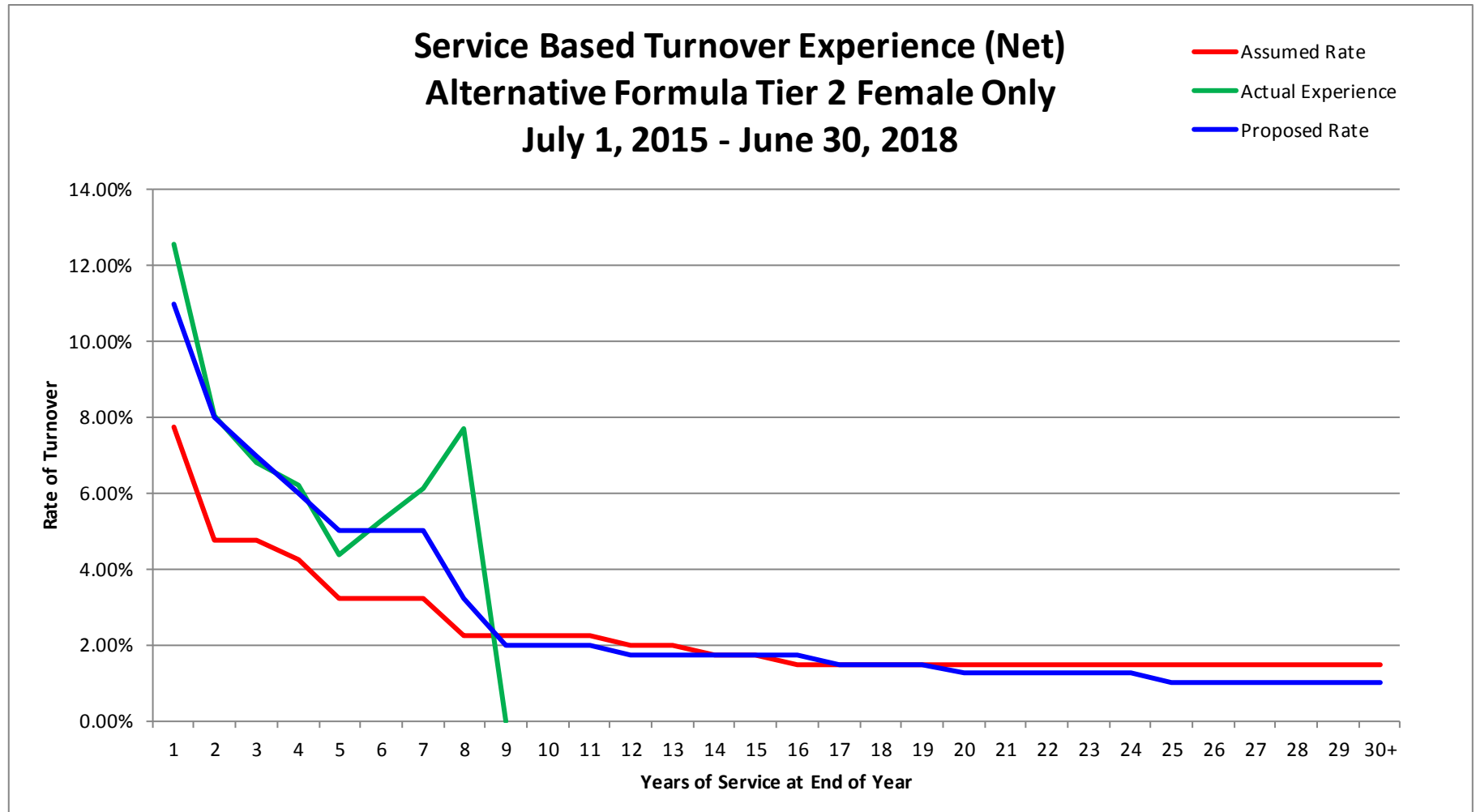
| Termination Experience by Service - Alternative Formula Female Tier 2 Members | | | | | | | | | | | |
|---|-------------------|----------|---------|-----------------|-----------------------------|----------------------|-----------------|----------------------------------|----------------------|------------------|----------------------------------|
| Service (End of Year) | Actual Experience | | | | | Current Assumptions | | | Proposed Assumptions | | |
| | Exposures | Turnover | Rehires | Net Turnover | Actual Rate ¹ | Expected Turnover | Assumed Rate | Actual/ Expected ² | Expected Turnover | Proposed Rate | Actual/ Expected ² |
| 1 | 159 | 20 | 0 | 20 | 12.58% | 12 | 7.75% | 0.6 | 17 | 11.00% | 0.9 |
| 2 | 794 | 78 | 14 | 64 | 8.06% | 38 | 4.75% | 0.6 | 64 | 8.00% | 1.0 |
| 3 | 747 | 54 | 3 | 51 | 6.83% | 35 | 4.75% | 0.7 | 52 | 7.00% | 1.0 |
| 4 | 548 | 40 | 6 | 34 | 6.20% | 23 | 4.25% | 0.7 | 33 | 6.00% | 1.0 |
| 5 | 364 | 21 | 5 | 16 | 4.40% | 12 | 3.25% | 0.8 | 18 | 5.00% | 1.1 |
| 6 | 227 | 14 | 2 | 12 | 5.29% | 7 | 3.25% | 0.6 | 11 | 5.00% | 0.9 |
| 7 | 131 | 8 | 0 | 8 | 6.11% | 4 | 3.25% | 0.5 | 7 | 5.00% | 0.9 |
| 8 | 52 | 4 | 0 | 4 | 7.69% | 1 | 2.25% | 0.3 | 2 | 3.25% | 0.5 |
| 9 | 0 | 0 | 0 | 0 | | 0 | 2.25% | | 0 | 2.00% | |
| 10 | 0 | 0 | 0 | 0 | | 0 | 2.25% | | 0 | 2.00% | |
| 11 | 0 | 0 | 0 | 0 | | 0 | 2.25% | | 0 | 2.00% | |
| 12 | 0 | 0 | 0 | 0 | | 0 | 2.00% | | 0 | 1.75% | |
| 13 | 0 | 0 | 0 | 0 | | 0 | 2.00% | | 0 | 1.75% | |
| 14 | 0 | 0 | 0 | 0 | | 0 | 1.75% | | 0 | 1.75% | |
| 15 | 0 | 0 | 0 | 0 | | 0 | 1.75% | | 0 | 1.75% | |
| 16 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.75% | |
| 17 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 18 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 19 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.50% | |
| 20 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.25% | |
| 21 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.25% | |
| 22 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.25% | |
| 23 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.25% | |
| 24 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.25% | |
| 25 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.00% | |
| 26 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.00% | |
| 27 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.00% | |
| 28 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.00% | |
| 29 | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.00% | |
| 30+ | 0 | 0 | 0 | 0 | | 0 | 1.50% | | 0 | 1.00% | |
| | 3,022 | 239 | 30 | 209 | 6.92% | 132 | 4.37% | 0.6 | 204 | 6.75% | 1.0 |

¹ Reflects actual turnover net of inactive members who returned to active service.

² Actual to expected ratio based on net turnover.

Analysis of Experience and Recommendations

Graph IV(h)



Analysis of Experience and Recommendations

Marriage Assumption

85.0 percent of active male participants and 65.0 percent of active female participants are assumed to be married. The female spouse is assumed to be three years younger than the male spouse for active member valuation purposes. Actual marital status at benefit commencement is used for retirees.

Load for Inactive Members Eligible for Deferred Vested Pension Benefits

Currently, deferred vested liability is increased by 15% to account for increases in final average salary due primarily to participation in a reciprocal system.

For inactive members who retired from July 1, 2015, to June 30, 2018, the ratio of actual retirement benefits to estimated retirement benefits was approximately 11 percent for Regular Formula members and 9 percent for Alternative Formula members. We recommend an assumption of 11 percent for Regular Formula members and 9 percent for Alternative Formula members.

| | 2016 | 2017 | 2018 | Total |
|--|----------|----------|---------|----------|
| Number of deferred vested members who retired during the year | | | | |
| Regular formula members | 225 | 195 | 183 | 603 |
| Alternative formula members | 64 | 56 | 55 | 175 |
| Average estimated monthly benefits | | | | |
| Regular formula members | \$ 1,403 | \$ 1,353 | \$1,320 | \$ 1,362 |
| Alternative formula members | \$ 2,937 | \$ 3,408 | \$2,899 | \$ 3,076 |
| Average updated monthly benefits at retirement | | | | |
| Regular formula members | \$ 1,532 | \$ 1,496 | \$1,480 | \$ 1,505 |
| Alternative formula members | \$ 3,122 | \$ 3,678 | \$3,269 | \$ 3,346 |
| Average percentage increase in estimated benefits at retirement | | | | |
| Regular formula members | 9% | 11% | 12% | 11% |
| Alternative formula members | 6% | 8% | 13% | 9% |

For regular formula members, four-year final average salary is based on annualized salary at year of termination and assumes historical salary increases of 4.5% per year prior to the year of termination. For alternative formula members, final one-year average salary is based on annualized salary at year of termination.

Data excludes member records with percentage increases in the top 9% and bottom 9%.

Analysis of Experience and Recommendations

Unused Sick Leave and Optional Service Purchases

Members who have accumulated unused sick leave and vacation days at retirement are eligible to receive additional service credit to increase their retirement benefits. In addition, members who qualify for optional service may purchase optional service credit prior to retirement. We have reviewed data provided by the System regarding the number of new retirees each year that have either received additional service credit for unused sick leave or have purchased optional service. Based on this analysis, we recommend increasing each current and future active member's service by 4.5 months to reflect additional service credit received at retirement.

| Fiscal Year | New Retirees | New Retirees with Unused Sick Leave | New Retirees with No Unused Sick Leave | Total Unused Sick Leave Years | Average Unused Sick Leave Years |
|--------------|--------------|-------------------------------------|--|-------------------------------|---------------------------------|
| 2016 | 3,442 | 2,555 | 887 | 721 | 0.210 |
| 2017 | 3,313 | 2,427 | 886 | 700 | 0.211 |
| 2018 | 3,063 | 2,189 | 874 | 603 | 0.197 |
| Total | 9,818 | 7,171 | 2,647 | 2,025 | 0.206 |

Percent of New Retirees who Receive Additional Service Due to Unused Sick Leave **73.04%**

Average Years of Unused Sick Leave for New Retirees During Fiscal Years 2016-2018 **0.2059**

Expected Years of Unused Sick Leave at Retirement for Current and Future Active Members **0.1504**

| Fiscal Year | New Retirees | New Retirees with Optional Service | New Retirees with No Optional Service | Total Optional Service Years | Average Optional Service Years |
|--------------|--------------|------------------------------------|---------------------------------------|------------------------------|--------------------------------|
| 2016 | 1,821 | 1,797 | 24 | 412 | 0.226 |
| 2017 | 1,777 | 1,734 | 43 | 395 | 0.222 |
| 2018 | 1,584 | 1,559 | 25 | 360 | 0.227 |
| Total | 5,182 | 5,090 | 92 | 1,167 | 0.225 |

Percent of New Retirees who Purchase Optional Service **98.22%**

Average Years of Optional Service for New Retirees During Fiscal Years 2016-2018 **0.2253**

Expected Years of Optional Service Purchased at Retirement for Current and Future Active Members **0.2213**

Total Years Service is Increased **0.3717**

Analysis of Experience and Recommendations

Disability

Because members who receive disability benefits typically spend less than one year on disability, they are assumed to return to work and are considered active members. There is currently a load of 1.65 percent of pay on the normal cost applied to reflect the near-term cash flow. We have reviewed the history of disability benefit payments as disclosed in the System's Financial Statements. Based on this analysis, we recommend maintaining the load on the normal cost as a percentage of pay, which is approximately equal to 110 percent of the most recent disability benefit payments to reflect the near-term cash flow. This assumption will be updated at each valuation date as experience emerges.

| | Total Disability Benefit Payments | Covered Payroll | Disability Payments as a % of Payroll | Annual Increase in Disability Payments |
|-------------|-----------------------------------|------------------|---------------------------------------|--|
| 2018 | \$ 62,093,337 | \$ 4,243,742,000 | 1.46% | 0.98% |
| 2017 | 61,492,093 | 4,195,778,000 | 1.47% | 2.78% |
| 2016 | 59,829,576 | 4,284,362,000 | 1.40% | 0.67% |

SECTION D

COST IMPACT

Cost Impact

The impact of adopting the recommended assumptions is summarized in the tables below. The results are based on the June 30, 2018, actuarial valuation.

| | Valuation Baseline | After Impact of Buyout Program | Experience Study | | |
|---|--------------------|--------------------------------|---|--|---|
| | | | 7.00% Discount Rate Changing Mortality Tables | 7.00% Discount Rate Changing all Demographic Assumptions | 6.75% Discount Rate 2.25% Inflation Rate Changing all Demographic Assumptions |
| 1 Number of Members | | | | | |
| a. Active | 61,397 | 61,397 | 61,397 | 61,397 | 61,397 |
| b. Inactive: | | | | | |
| i. Eligible for deferred vested pension benefits (61 based on SERS service alone. An additional 140 are eligible when reciprocal service is added to SERS service). | 3,925 | 3,925 | 3,925 | 3,925 | 3,925 |
| ii. Eligible for return of contributions only | 20,817 | 20,817 | 20,817 | 20,817 | 20,817 |
| c. Current Benefit Recipients: | | | | | |
| i. Retirement annuities | 59,749 | 59,749 | 59,749 | 59,749 | 59,749 |
| ii. Survivor annuities | 11,344 | 11,344 | 11,344 | 11,344 | 11,344 |
| iii. Disability annuities | 2,086 | 2,086 | 2,086 | 2,086 | 2,086 |
| d. Eligible for Deferred Benefits: | | | | | |
| i. Retirement annuities | 61 | 61 | 61 | 61 | 61 |
| ii. Survivor annuities | 140 | 140 | 140 | 140 | 140 |
| e. Total | 159,519 | 159,519 | 159,519 | 159,519 | 159,519 |
| 2 Covered Payroll Provided by System | \$ 4,243,741,707 | \$ 4,243,741,707 | \$ 4,243,741,707 | \$ 4,243,741,707 | \$ 4,243,741,707 |
| 3 Annualized Benefit Payments Currently Being Made | | | | | |
| a. Retirement (Includes those eligible for deferred benefits) | \$ 2,283,947,054 | \$ 2,283,947,054 | \$ 2,283,947,054 | \$ 2,283,947,054 | \$ 2,283,947,054 |
| b. Survivor (Includes those eligible for deferred benefits) | 159,503,423 | 159,503,423 | 159,503,423 | 159,503,423 | 159,503,423 |
| c. Disability | 55,350,641 | 55,350,641 | 55,350,641 | 55,350,641 | 55,350,641 |
| d. Total | \$ 2,498,801,118 | \$ 2,498,801,118 | \$ 2,498,801,118 | \$ 2,498,801,118 | \$ 2,498,801,118 |
| 4 Actuarial Liability—Annuitants | | | | | |
| a. Current Benefit Recipients: | | | | | |
| i. Retirement annuities | \$ 31,269,280,905 | \$ 31,269,280,905 | \$ 30,004,923,631 | \$ 30,004,923,631 | \$ 30,745,539,405 |
| ii. Survivor annuities | 1,743,964,994 | 1,743,964,994 | 1,643,313,154 | 1,643,313,154 | 1,679,445,535 |
| iii. Disability annuities | 540,719,516 | 528,901,893 | 515,559,497 | 523,656,739 | 540,449,290 |
| b. Eligible for Deferred Benefits: | | | | | |
| i. Retirement annuities | 6,459,891 | 6,459,891 | 6,332,411 | 6,332,411 | 6,527,406 |
| ii. Survivor annuities | 9,562,262 | 9,562,262 | 9,332,111 | 9,332,111 | 9,623,820 |
| c. Total | \$ 33,569,987,568 | \$ 33,558,169,945 | \$ 32,179,460,804 | \$ 32,187,558,046 | \$ 32,981,585,456 |

Cost Impact

| | Valuation Baseline | After Impact of Buyout Program | Experience Study | | |
|---|--------------------------|-----------------------------------|---|---|--|
| | | | 7.00% Discount Rate Changing Mortality Tables | 7.00% Discount Rate Changing all Demographic Assumptions | 6.75% Discount Rate 2.25% Inflation Rate Changing all Demographic Assumptions |
| 5 Actuarial Liability—Inactive Members | | | | | |
| a. Eligible for Deferred Vested Pension Benefits | \$ 698,783,649 | \$ 628,905,266 | \$ 615,848,936 | \$ 591,563,815 | \$ 619,345,457 |
| b. Eligible for Return of Contributions Only | 44,938,026 | 44,938,026 | 44,938,026 | 44,938,026 | 44,938,026 |
| c. Total | \$ 743,721,675 | \$ 673,843,292 | \$ 660,786,962 | \$ 636,501,841 | \$ 664,283,483 |
| 6 Active Members | | | | | |
| a. Pension Benefits | \$ 9,271,238,377 | \$ 9,282,566,511 | \$ 9,182,705,396 | \$ 9,271,141,590 | \$ 9,522,541,297 |
| b. Cost-of-Living Adjustments | 3,903,349,610 | 3,693,361,521 | 3,514,545,839 | 3,575,895,263 | 3,755,296,491 |
| c. Death Benefits | | | | | |
| i. Occupational | \$ 10,409,553 | \$ 10,409,553 | \$ 9,614,496 | \$ 9,099,040 | \$ 9,337,605 |
| ii. Non-occupational | 95,517,967 | 95,517,967 | 87,443,535 | 81,780,029 | 83,801,717 |
| iii. Refund | 34,651,163 | 34,651,163 | 34,334,435 | 38,291,788 | 38,453,284 |
| iv. Total | \$ 140,578,683 | \$ 140,578,683 | \$ 131,392,466 | \$ 129,170,857 | \$ 131,592,606 |
| d. Disability | \$ - | \$ - | \$ - | \$ - | \$ - |
| e. Withdrawal | 296,806,880 | 284,942,881 | 282,767,115 | 334,722,375 | 352,260,152 |
| f. Total | \$ 13,611,973,550 | \$ 13,401,449,596 | \$ 13,111,410,816 | \$ 13,310,930,085 | \$ 13,761,690,546 |
| 7 Total Actuarial Liability (4 + 5 + 6) | \$ 47,925,682,793 | \$ 47,633,462,833 | \$ 45,951,658,582 | \$ 46,134,989,972 | \$ 47,407,559,485 |
| 8 Market Value of Assets (MVA) | \$ 17,463,278,241 | \$ 17,463,278,241 | \$ 17,463,278,241 | \$ 17,463,278,241 | \$ 17,463,278,241 |
| 9 Unfunded Actuarial Liability Based on MVA (7 – 8) | \$ 30,462,404,552 | \$ 30,170,184,592 | \$ 28,488,380,341 | \$ 28,671,711,731 | \$ 29,944,281,244 |
| 10 Funded Percentage Based on MVA (8 ÷ 7) | 36.44% | 36.66% | 38.00% | 37.85% | 36.84% |
| 11 Actuarial Value of Assets (AVA) | \$ 17,478,139,578 | \$ 17,478,139,578 | \$ 17,478,139,578 | \$ 17,478,139,578 | \$ 17,478,139,578 |
| 12 Unfunded Actuarial Liability Based on AVA (7 – 11) | \$ 30,447,543,215 | \$ 30,155,323,255 | \$ 28,473,519,004 | \$ 28,656,850,394 | \$ 29,929,419,907 |
| 13 Funded Percentage Based on AVA (11 ÷ 7) ^a | 36.47% | 36.69% | 38.04% | 37.88% | 36.87% |
| 14 Total Normal Cost | 875,926,741 | 868,095,065 | 851,675,660 | 855,189,171 | 880,263,822 |
| 15 Employee Contributions | \$ 243,122,845 | \$ 243,122,845 | \$ 243,122,845 | \$ 243,122,845 | \$ 243,122,845 |
| 16 Annual Employer Normal Cost (% uncapped payroll) | \$ 632,803,896 14.91% | \$ 624,972,220 14.73% | \$ 608,552,815 14.34% | \$ 612,066,326 14.42% | \$ 637,140,977 15.01% |

^a The funded status measure is appropriate for assessing the need for future contributions. The funded status is not appropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations.

Cost Impact

| Actuarial Valuation Date: June 30, 2018 | | | | | |
|---|--------------------|--------------------------------|---|--|---|
| Fiscal Year Ending: June 30, 2020 | Valuation Baseline | After Impact of Buyout Program | 7.00% Discount Rate Changing Mortality Tables | 7.00% Discount Rate Changing all Demographic Assumptions | 6.75% Discount Rate 2.25% Inflation Rate Changing all Demographic Assumptions |
| Estimated Statutory Contributions: | | | | | |
| · Annual Amount | \$ 2,291,249,000 | \$ 2,271,214,000 | \$ 2,230,244,000 | \$ 2,161,231,000 | \$ 2,259,843,000 |
| · Percentage of Projected Capped Payroll for Fiscal Year | 52.150% | 51.694% | 50.759% | 49.326% | 51.701% |
| Actuarially Determined Contribution^a (ADC): | | | | | |
| · Annual Amount | \$ 2,834,360,456 | \$ 2,805,399,365 | \$ 2,667,526,705 | \$ 2,690,836,549 | \$ 2,804,081,035 |
| · Percentage of Projected Capped Payroll for Fiscal Year | 64.512% | 63.852% | 60.711% | 61.413% | 64.152% |
| Membership | | | | | |
| · Number of | | | | | |
| - Active Members | 61,397 | 61,397 | 61,397 | 61,397 | 61,397 |
| - Members Receiving Payments | 73,179 | 73,179 | 73,179 | 73,179 | 73,179 |
| - Inactive Members | 201 | 201 | 201 | 201 | 201 |
| - Total | 134,777 | 134,777 | 134,777 | 134,777 | 134,777 |
| · Covered Uncapped Payroll Provided by System | \$ 4,243,741,707 | \$ 4,243,741,707 | \$ 4,243,741,707 | \$ 4,243,741,707 | \$ 4,243,741,707 |
| · Projected Capped Payroll For Fiscal Year | \$ 4,393,573,724 | \$ 4,393,573,724 | \$ 4,393,789,938 | \$ 4,381,525,332 | \$ 4,370,984,543 |
| · Annualized Benefit Payments | \$ 2,498,801,118 | \$ 2,498,801,118 | \$ 2,498,801,118 | \$ 2,498,801,118 | \$ 2,498,801,118 |
| Assets | | | | | |
| · Market Value of Assets (MVA) | \$ 17,463,278,241 | \$ 17,463,278,241 | \$ 17,463,278,241 | \$ 17,463,278,241 | \$ 17,463,278,241 |
| · Actuarial Value of Assets (AVA) | \$ 17,478,139,578 | \$ 17,478,139,578 | \$ 17,478,139,578 | \$ 17,478,139,578 | \$ 17,478,139,578 |
| · Return on MVA | 7.68% | 7.68% | 7.68% | 7.68% | 7.68% |
| · Return on AVA | 7.58% | 7.58% | 7.58% | 7.58% | 7.58% |
| · Ratio – AVA to MVA | 100.09% | 100.09% | 100.09% | 100.09% | 100.09% |
| Actuarial Information | | | | | |
| · Employer Normal Cost Amount | \$ 632,803,896 | \$ 624,972,220 | \$ 608,552,815 | \$ 612,066,326 | \$ 637,140,977 |
| · Actuarial Accrued Liability (AAL) | \$ 47,925,682,793 | \$ 47,633,462,833 | \$ 45,951,658,582 | \$ 46,134,989,972 | \$ 47,407,559,485 |
| · Unfunded Actuarial Accrued Liability (UAAL) | \$ 30,447,543,215 | \$ 30,155,323,255 | \$ 28,473,519,004 | \$ 28,656,850,394 | \$ 29,929,419,907 |
| · Funded Ratio based on AVA | 36.47% | 36.69% | 38.04% | 37.88% | 36.87% |
| · UAAL as % of Covered Payroll | 717.47% | 710.58% | 670.95% | 675.27% | 705.26% |
| · Funded Ratio based on MVA | 36.44% | 36.66% | 38.00% | 37.85% | 36.84% |

^a For contributions in fiscal years ending on and after June 30, 2017, the Board adopted a recommended policy used to develop the Actuarially Determined Contribution (ADC) as defined in GASB Statements Nos. 67 and 68. The policy adopted by the Board calculates the ADC as the Normal Cost plus a 25-year level percent of capped payroll closed-period amortization of the Unfunded Accrued Liability. As of June 30, 2018, the remaining amortization period is 22 years. The ADC is used for financial reporting purposes only.

Cost Impact

Actuarial Accrued Liability and Actuarial Value of Assets
Determined as of June 30, 2018
(\$ in millions)

| Year | Actuarial Accrued Liability | | | | | Actuarial Value of Assets | | | | |
|------|-----------------------------|--------------------------------|---|--|---|---------------------------|--------------------------------|---|--|---|
| | Valuation Baseline | After Impact of Buyout Program | Experience Study | | | Valuation Baseline | After Impact of Buyout Program | Experience Study | | |
| | | | 7.00% Discount Rate Changing Mortality Tables | 7.00% Discount Rate Changing all Demographic Assumptions | 6.75% Discount Rate 2.25% Inflation Rate Changing all Demographic Assumptions | | | 7.00% Discount Rate Changing Mortality Tables | 7.00% Discount Rate Changing all Demographic Assumptions | 6.75% Discount Rate 2.25% Inflation Rate Changing all Demographic Assumptions |
| 2019 | \$ 49,507 | \$ 49,189 | \$ 47,375 | \$ 47,568 | \$ 48,839 | \$ 18,338 | \$ 18,320 | \$ 18,322 | \$ 18,316 | \$ 18,273 |
| 2020 | 51,056 | 50,718 | 48,767 | 48,957 | 50,221 | 19,363 | 19,332 | 19,298 | 19,204 | 19,214 |
| 2021 | 52,569 | 52,221 | 50,127 | 50,302 | 51,553 | 20,695 | 20,654 | 20,559 | 20,384 | 20,443 |
| 2022 | 54,037 | 53,682 | 51,441 | 51,591 | 52,824 | 21,929 | 21,881 | 21,698 | 21,449 | 21,554 |
| 2023 | 55,450 | 55,088 | 52,697 | 52,812 | 54,022 | 23,115 | 23,060 | 22,758 | 22,451 | 22,597 |
| 2028 | 61,420 | 61,032 | 57,847 | 57,687 | 58,700 | 28,719 | 28,629 | 27,512 | 26,945 | 27,241 |
| 2033 | 65,491 | 65,096 | 61,094 | 60,559 | 61,264 | 34,329 | 34,201 | 32,121 | 31,229 | 31,563 |
| 2038 | 67,726 | 67,345 | 62,609 | 61,678 | 61,991 | 42,699 | 42,524 | 39,359 | 38,190 | 38,437 |
| 2043 | 68,738 | 68,392 | 63,112 | 61,831 | 61,678 | 55,228 | 54,981 | 50,616 | 49,334 | 49,238 |
| 2045 | 69,049 | 68,724 | 63,294 | 61,896 | 61,535 | 62,143 | 61,855 | 56,962 | 55,703 | 55,379 |

Normal cost rate includes administrative expenses.

State contribution based on the requirements of Public Act 88-0593, as amended by Public Act 90-0065, Public Act 94-0004, Public Act 96-0043, and Public Act 100-0023.

Total expenses include benefit payments, refunds, and administrative expenses.

Actuarial accrued liability and assets are measured at Plan Year End.

Total payroll is capped for members hired after December 31, 2010, as defined in Public Act 96-0889.

Cost Impact

Required State Contribution Determined as of June 30, 2018 (\$ in millions)

| Year | Contribution Dollar | | | | |
|-------------------------------------|---------------------|--------------------------------|---|--|---|
| | Valuation Baseline | After Impact of Buyout Program | Experience Study | | |
| | | | 7.00% Discount Rate Changing Mortality Tables | 7.00% Discount Rate Changing all Demographic Assumptions | 6.75% Discount Rate 2.25% Inflation Rate Changing all Demographic Assumptions |
| 2019 | \$ 2,136 | \$ 2,116 | \$ 2,116 | \$ 2,116 | \$ 2,116 |
| 2020 | 2,291 | 2,271 | 2,230 | 2,161 | 2,260 |
| 2021 | 2,410 | 2,389 | 2,322 | 2,271 | 2,366 |
| 2022 | 2,525 | 2,504 | 2,409 | 2,378 | 2,468 |
| 2023 | 2,562 | 2,540 | 2,416 | 2,408 | 2,493 |
| 2028 | 2,814 | 2,790 | 2,622 | 2,634 | 2,694 |
| 2033 | 3,156 | 3,129 | 2,940 | 2,953 | 2,983 |
| 2038 | 3,846 | 3,816 | 3,601 | 3,625 | 3,627 |
| 2043 | 4,388 | 4,354 | 4,108 | 4,147 | 4,115 |
| 2045 | 4,621 | 4,585 | 4,327 | 4,372 | 4,333 |
| Total Cont. Through 2045 | \$ 88,736 | \$ 88,020 | \$ 83,284 | \$ 83,601 | \$ 84,439 |
| Present Value of Total Cont. | \$ 36,404 | \$ 36,104 | \$ 34,313 | \$ 34,325 | \$ 35,845 |

| Year | Contribution Percent | | | | |
|------|----------------------|--------------------------------|---|--|---|
| | Valuation Baseline | After Impact of Buyout Program | Experience Study | | |
| | | | 7.00% Discount Rate Changing Mortality Tables | 7.00% Discount Rate Changing all Demographic Assumptions | 6.75% Discount Rate 2.25% Inflation Rate Changing all Demographic Assumptions |
| 2019 | 49.59% | 49.13% | 49.13% | 49.13% | 49.13% |
| 2020 | 52.15% | 51.69% | 50.76% | 49.33% | 51.70% |
| 2021 | 53.75% | 53.29% | 51.77% | 50.91% | 53.29% |
| 2022 | 55.23% | 54.77% | 52.68% | 52.39% | 54.76% |
| 2023 | 54.95% | 54.49% | 51.81% | 52.10% | 54.46% |
| 2028 | 54.57% | 54.12% | 50.86% | 51.71% | 54.03% |
| 2033 | 54.40% | 53.94% | 50.68% | 51.53% | 53.80% |
| 2038 | 58.44% | 57.99% | 54.73% | 55.63% | 58.16% |
| 2043 | 58.44% | 57.99% | 54.73% | 55.63% | 58.16% |
| 2045 | 58.44% | 57.99% | 54.73% | 55.63% | 58.16% |

Normal cost rate includes administrative expenses.

State contribution based on the requirements of Public Act 88-0593, as amended by Public Act 90-0065, Public Act 94-0004, Public Act 96-0043, and Public Act 100-0023.

Total expenses include benefit payments, refunds, and administrative expenses.

Actuarial accrued liability and assets are measured at Plan Year End.

Total payroll is capped for members hired after December 31, 2010, as defined in Public Act 96-0889.

Cost Impact

Unfunded Accrued Liability and Funded Ratio Determined as of June 30, 2018 (\$ in millions)

| Year | Unfunded Accrued Liability | | | | |
|------|----------------------------|--------------------------------|---|--|---|
| | Valuation Baseline | After Impact of Buyout Program | Experience Study | | |
| | | | 7.00% Discount Rate Changing Mortality Tables | 7.00% Discount Rate Changing all Demographic Assumptions | 6.75% Discount Rate 2.25% Inflation Rate Changing all Demographic Assumptions |
| 2019 | \$ 31,169 | \$ 30,869 | \$ 29,052 | \$ 29,252 | \$ 30,566 |
| 2020 | 31,693 | 31,387 | 29,468 | 29,753 | 31,007 |
| 2021 | 31,875 | 31,567 | 29,567 | 29,918 | 31,111 |
| 2022 | 32,109 | 31,801 | 29,744 | 30,142 | 31,271 |
| 2023 | 32,336 | 32,028 | 29,939 | 30,361 | 31,425 |
| 2028 | 32,701 | 32,403 | 30,335 | 30,742 | 31,459 |
| 2033 | 31,161 | 30,894 | 28,973 | 29,330 | 29,701 |
| 2038 | 25,028 | 24,821 | 23,250 | 23,488 | 23,554 |
| 2043 | 13,510 | 13,411 | 12,496 | 12,497 | 12,440 |
| 2045 | 6,906 | 6,869 | 6,332 | 6,193 | 6,157 |

| Year | Funded Ratio | | | | |
|------|--------------------|--------------------------------|---|--|---|
| | Valuation Baseline | After Impact of Buyout Program | Experience Study | | |
| | | | 7.00% Discount Rate Changing Mortality Tables | 7.00% Discount Rate Changing all Demographic Assumptions | 6.75% Discount Rate 2.25% Inflation Rate Changing all Demographic Assumptions |
| 2019 | 37.04% | 37.24% | 38.68% | 38.50% | 37.41% |
| 2020 | 37.93% | 38.12% | 39.57% | 39.23% | 38.26% |
| 2021 | 39.37% | 39.55% | 41.01% | 40.52% | 39.65% |
| 2022 | 40.58% | 40.76% | 42.18% | 41.58% | 40.80% |
| 2023 | 41.69% | 41.86% | 43.19% | 42.51% | 41.83% |
| 2028 | 46.76% | 46.91% | 47.56% | 46.71% | 46.41% |
| 2033 | 52.42% | 52.54% | 52.58% | 51.57% | 51.52% |
| 2038 | 63.05% | 63.14% | 62.87% | 61.92% | 62.00% |
| 2043 | 80.35% | 80.39% | 80.20% | 79.79% | 79.83% |
| 2045 | 90.00% | 90.00% | 90.00% | 90.00% | 90.00% |

Normal cost rate includes administrative expenses.

State contribution based on the requirements of Public Act 88-0593, as amended by Public Act 90-0065, Public Act 94-0004, Public Act 96-0043, and Public Act 100-0023.

Total expenses include benefit payments, refunds, and administrative expenses.

Actuarial accrued liability and assets are measured at Plan Year End.

Total payroll is capped for members hired after December 31, 2010, as defined in Public Act 96-0889.

SECTION E

RECOMMENDED ACTUARIAL ASSUMPTIONS

Recommended Actuarial Assumptions

Actuarial Cost Method as Mandated by 40 ILCS 5/14-131, Adopted June 30, 1989

The projected unit credit normal cost method is used. Under this method, the projected pension at retirement age is first calculated and the present value at the individual member's current or attained age is determined. The normal cost for the member for the current year is equal to the actuarial present value divided by the member's projected service at retirement. The normal cost for the plan for the year is the sum of the individual normal costs.

The actuarial liability at any point in time is the present value of the projected pensions at that time less the present value of future normal costs.

For ancillary benefits for active members, in particular death and survivor benefits, termination benefits and the postretirement increases, the same procedure as outlined above is followed.

Estimated annual administrative expenses are added to the normal cost.

For actuarial valuation purposes, as well as projection purposes, an actuarial value of assets is used.

Recommended Actuarial Assumptions

Mortality

Recommended mortality assumptions for general employees and retirees covered under the Regular Benefit Formula are shown in the following table.

| General Employees and Retirees | Proposed Mortality Table | Male Set Back Years | Female Set Back Years | Male Scaling Factor | Female Scaling Factor |
|--------------------------------|---|---------------------|-----------------------|---------------------|-----------------------|
| Pre-retirement | Pub-2010 General Employee, sex distinct | 2 | 1 | 89% | 95% |
| Post-retirement | Pub-2010 General Healthy Retiree sex distinct | 0 | -1 | 111% | 111% |

Recommended mortality assumptions for Public Safety employees and retirees covered under the Alternative Benefit Formula are shown in the following table.

| Public Safety Employees and Retirees | Proposed Mortality Table | Male Set Back Years | Female Set Back Years | Male Scaling Factor | Female Scaling Factor |
|--------------------------------------|--|---------------------|-----------------------|---------------------|-----------------------|
| Pre-retirement | Pub-2010 Public Safety Employee, sex distinct | 0 | 0 | 96% | 108% |
| Post-retirement | Pub-2010 Public Safety Healthy Retiree, sex distinct | 0 | 0 | 110% | 105% |

Interest

6.75 percent per year, compounded annually, net of investment expenses.

General Inflation

2.25 percent per year, compounded annually.

This assumption serves as the basis for the determination of Tier Two annual increases that are equal to the lesser of 3.0 percent or one-half of the annual increase in the consumer price index-u during the preceding 12-month calendar year and are not compounded.

Marriage Assumption

85.0 percent of active male participants and 65.0 percent of active female participants are assumed to be married. Actual marital status at benefit commencement is used for retirees.

Social Security Offset for Survivor Benefits

No offset assumption for male surviving spouses because it is assumed their own PIA is as great as their spouses' PIA. Sixty percent of married male members are assumed to have a dual income household. For the dual income household, it is assumed the offset at age 60 is 45.0 percent of the original survivor benefit. It is assumed the offset at age 62 is 10.0 percent of the original survivor benefit. Furthermore, it is assumed that 50 percent of retirees on or after July 1, 2009, will elect to

Recommended Actuarial Assumptions

remove the offset provision. In exchange for the removal, the member's retirement annuity is reduced by 3.825 percent monthly as mandated by Statutes.

Termination

Illustrative rates of withdrawal from the plan are as follows for Tier One members:

| Service Based Withdrawal - Tier 1 Members | | | | |
|---|---------------------------|---------|-------------------------------|---------|
| Service (End of Year) | Regular Formula Employees | | Alternative Formula Employees | |
| | Males | Females | Males | Females |
| 1 | 0.2400 | 0.2200 | 0.0525 | 0.0700 |
| 2 | 0.0900 | 0.0900 | 0.0425 | 0.0700 |
| 3 | 0.0750 | 0.0650 | 0.0425 | 0.0650 |
| 4 | 0.0650 | 0.0550 | 0.0425 | 0.0600 |
| 5 | 0.0600 | 0.0450 | 0.0425 | 0.0600 |
| 6 | 0.0460 | 0.0450 | 0.0300 | 0.0500 |
| 7 | 0.0450 | 0.0400 | 0.0300 | 0.0400 |
| 8 | 0.0400 | 0.0400 | 0.0300 | 0.0300 |
| 9 | 0.0300 | 0.0350 | 0.0200 | 0.0200 |
| 10 | 0.0300 | 0.0350 | 0.0200 | 0.0200 |
| 11 | 0.0300 | 0.0300 | 0.0150 | 0.0200 |
| 12 | 0.0250 | 0.0300 | 0.0150 | 0.0175 |
| 13 | 0.0250 | 0.0250 | 0.0150 | 0.0175 |
| 14 | 0.0250 | 0.0250 | 0.0150 | 0.0175 |
| 15 | 0.0200 | 0.0250 | 0.0150 | 0.0175 |
| 16 | 0.0200 | 0.0250 | 0.0150 | 0.0175 |
| 17 | 0.0200 | 0.0200 | 0.0150 | 0.0150 |
| 18 | 0.0200 | 0.0200 | 0.0150 | 0.0150 |
| 19 | 0.0200 | 0.0200 | 0.0150 | 0.0150 |
| 20 | 0.0200 | 0.0200 | 0.0125 | 0.0125 |
| 21 | 0.0200 | 0.0150 | 0.0125 | 0.0125 |
| 22 | 0.0200 | 0.0150 | 0.0125 | 0.0125 |
| 23 | 0.0200 | 0.0150 | 0.0125 | 0.0125 |
| 24 | 0.0200 | 0.0150 | 0.0125 | 0.0125 |
| 25 | 0.0150 | 0.0150 | 0.0100 | 0.0100 |
| 26 | 0.0150 | 0.0100 | 0.0100 | 0.0100 |
| 27 | 0.0150 | 0.0100 | 0.0100 | 0.0100 |
| 28 | 0.0150 | 0.0100 | 0.0100 | 0.0100 |
| 29 | 0.0150 | 0.0100 | 0.0100 | 0.0100 |
| 30+ | 0.0150 | 0.0100 | 0.0100 | 0.0100 |

It is assumed that terminated employees will not be rehired. The rates apply only to employees who have not fulfilled the service requirement necessary for retirement at any given age.

Recommended Actuarial Assumptions

Salary Increases

Illustrative rates of increase per individual employee per year, compounded annually:

| Age | Annual Increase |
|-----|-----------------|
| 25 | 7.42% |
| 30 | 5.95% |
| 35 | 5.05% |
| 40 | 4.72% |
| 45 | 4.33% |
| 50 | 4.01% |
| 55 | 3.80% |
| 60 | 3.60% |
| 65 | 3.22% |
| 70 | 3.00% |

The underlying salary increase assumption is based on a wage inflation assumption of 2.75 percent per year, comprised of 2.25 percent for general inflation plus 0.50 percent for productivity increases. The rates shown above include wage inflation plus an age-based component for merit, promotion and longevity. The ultimate age based component equals 0.25 percent.

Disability

Because members who receive disability benefits typically spend less than one year on disability, they are considered active members. Therefore a load of 1.65 percent of pay on the normal cost is applied to reflect the near-term cash flow. This assumption is based on 110 percent of the most recent disability benefit payment information as a percent of payroll and will be updated at each actuarial valuation date as experience emerges.

415(b) and 401(a)(17) Limits

No explicit assumption is made with respect to these items.

Accelerated Pension Benefit Payment Program Election Assumption

In accordance with Public Act 100-0587,

- Eligible Tier 1 active members may elect the “COLA Buyout”, through June 1, 2021, in which the member receives reduced and delayed COLA benefits at retirement and an accelerated pension benefit payment.
- Eligible inactive Tier 1 and Tier 2 members may elect the “Total Buyout”, through May 31, 2021, in which the member receives an accelerated pension benefit payment in lieu of an annuity at retirement.

With respect to the COLA Buyout, 21 percent of Regular Formula members and 28 percent of Alternative Formula members are assumed to elect the COLA Buyout. The election percentages are based on experience through March 2019, as provided by SERS. With respect to the Total Buyout, 10 percent are assumed to elect the Total Buyout. The election percentages apply until the end of each Buyout Program; i.e., June 1, 2021, for the COLA Buyout and May 31, 2021, for the Total Buyout.

Recommended Actuarial Assumptions

Population Projection

For purposes of determining annual appropriation as a percent of total covered payroll, the size of the active group is assumed to remain level at the number of actives as of the actuarial valuation date. New entrants are assumed to enter with an average age and an average pay as disclosed below. New entrants are assumed to have the same demographic profile as new entrants in the 15 years prior to the actuarial valuation date. The average increase in uncapped payroll for the projection period is 2.75 percent per year. New entrants not covered by Social Security are assumed to participate in the Tier 2 defined benefit plan.

| New Entrant Benefit Groups | | | | | | | | | | | | | | |
|----------------------------|---|-------------------------|---|---------------------|---|-----------------------|---|-----------------------|---|----------------------|---|-------------------|---------------|-------------------------|
| Age Group | New Entrants Eligible for Regular Formula Benefits who are Covered by Social Security | | New Entrants Eligible for Regular Formula Benefits who are not Covered by Social Security | | New Entrants in Positions Formerly Eligible for Alternative Formula Benefits who are Covered by Social Security and are now Eligible for Regular Formula Benefits | | New Entrants Eligible for Alternative Formula Benefits who are Covered by Social Security | | New Entrants in Positions Formerly Eligible for Alternative Formula Benefits who are not Covered by Social Security and are now Eligible for Regular Formula Benefits | | New Entrants Eligible for Alternative Formula Benefits who are not Covered by Social Security | | Total | |
| | No. | Salary | No. | Salary | No. | Salary | No. | Salary | No. | Salary | No. | Salary | No. | Salary |
| Under 20 | 101 | 3,273,076 | | | 56 | 2,425,780 | 22 | 978,753 | | | | | 179 | 6,677,609 |
| 20-24 | 2,286 | 86,829,284 | 10 | 418,906 | 1,423 | 63,650,527 | 491 | 22,438,208 | 289 | 18,562,326 | 5 | 169,062 | 4,504 | 192,068,313 |
| 25-29 | 4,041 | 177,773,635 | 25 | 1,297,493 | 1,656 | 77,279,917 | 595 | 29,241,086 | 428 | 28,564,422 | 4 | 120,065 | 6,749 | 314,276,618 |
| 30-34 | 3,524 | 169,882,758 | 14 | 837,406 | 912 | 45,057,917 | 436 | 23,439,515 | 179 | 12,477,619 | | | 5,065 | 251,695,215 |
| 35-39 | 3,055 | 156,381,078 | 6 | 283,250 | 569 | 29,566,514 | 357 | 19,986,299 | 73 | 5,283,936 | 1 | 57,836 | 4,061 | 211,558,913 |
| 40-44 | 2,949 | 154,235,971 | 7 | 392,812 | 475 | 26,765,580 | 247 | 14,608,427 | 29 | 2,038,070 | | | 3,707 | 198,040,860 |
| 45-49 | 2,562 | 136,201,912 | 7 | 429,992 | 367 | 20,777,405 | 222 | 13,610,301 | 11 | 710,889 | | | 3,169 | 171,730,499 |
| 50-54 | 2,111 | 114,617,227 | 8 | 545,402 | 218 | 12,704,620 | 111 | 6,962,010 | 10 | 754,393 | | | 2,458 | 135,583,652 |
| 55-59 | 1,306 | 67,398,379 | 7 | 499,479 | 125 | 7,268,553 | 60 | 3,395,667 | 10 | 791,970 | | | 1,508 | 79,354,048 |
| 60-64 | 485 | 25,340,644 | | | 33 | 2,187,453 | 14 | 969,273 | 3 | 252,896 | | | 535 | 28,750,266 |
| 65-69 | 34 | 1,848,921 | | | 4 | 236,547 | | | | | | | 38 | 2,085,468 |
| 70 & Over | | | | | | | | | | | | | | |
| Total | 22,454 | \$ 1,093,782,885 | 84 | \$ 4,704,740 | 5,838 | \$ 287,920,813 | 2,555 | \$ 135,629,539 | 1,032 | \$ 69,436,521 | 10 | \$ 346,963 | 31,973 | \$ 1,591,821,461 |
| Avg. Salary | | \$ 48,712 | | \$ 56,009 | | \$ 49,318 | | \$ 53,084 | | \$ 67,283 | | \$ 34,696 | | \$ 49,786 |
| Avg. Age | | 37.75 | | 35.76 | | 31.72 | | 33.31 | | 28.55 | | 25.49 | | 35.99 |
| Percent Male | | 43% | | 94% | | 75% | | 71% | | 89% | | 100% | | 52% |

Recommended Actuarial Assumptions

Retirement – Tier 1

Employees are assumed to retire in accordance with the rates shown below. The rates apply only to employees who have fulfilled the service requirement necessary for retirement at any given age.

| Retirement Rates for Regular Formula Employees | | |
|--|---------|---------|
| Age | Males | Females |
| 50 | 15.00% | 27.50% |
| 51 | 25.00% | 27.50% |
| 52 | 25.00% | 35.00% |
| 53 | 25.00% | 27.50% |
| 54 | 25.00% | 22.50% |
| 55 | 25.00% | 25.00% |
| 56 | 18.00% | 24.00% |
| 57 | 18.00% | 19.00% |
| 58 | 18.00% | 19.00% |
| 59 | 18.00% | 19.00% |
| 60 | 13.00% | 17.00% |
| 61 | 12.00% | 13.50% |
| 62 | 20.00% | 23.00% |
| 63 | 17.50% | 19.00% |
| 64 | 17.50% | 20.00% |
| 65 | 25.00% | 25.00% |
| 66 | 25.00% | 29.00% |
| 67 | 25.00% | 27.00% |
| 68 | 25.00% | 27.00% |
| 69 | 25.00% | 22.00% |
| 70 | 25.00% | 22.00% |
| 71 | 20.00% | 22.00% |
| 72 | 20.00% | 22.00% |
| 73 | 20.00% | 22.00% |
| 74 | 20.00% | 22.00% |
| 75 | 100.00% | 100.00% |

| Early Retirement Rates for Regular Formula Employees | | |
|--|-------|---------|
| Age | Males | Females |
| 55 | 3.50% | 2.00% |
| 56 | 3.50% | 3.00% |
| 57 | 5.00% | 4.00% |
| 58 | 6.00% | 5.00% |
| 59 | 6.50% | 6.00% |

Recommended Actuarial Assumptions

| Retirement Rates for Alternative Formula Employees | | | | |
|--|--|---------|--|---------|
| Age | Eligible for Alternative Formula Benefits Only | | Eligible for Regular Formula Benefits Only | |
| | Males | Females | Males | Females |
| 50 | 65.00% | 42.50% | N/A | N/A |
| 51 | 50.00% | 30.00% | N/A | N/A |
| 52 | 40.00% | 25.00% | N/A | N/A |
| 53 | 40.00% | 25.00% | N/A | N/A |
| 54 | 35.00% | 25.00% | N/A | N/A |
| 55 | 42.00% | 45.00% | N/A | N/A |
| 56 | 30.00% | 30.00% | N/A | N/A |
| 57 | 30.00% | 30.00% | N/A | N/A |
| 58 | 30.00% | 30.00% | N/A | N/A |
| 59 | 30.00% | 20.00% | N/A | N/A |
| 60 | 30.00% | 30.00% | 4.00% | 5.00% |
| 61 | 30.00% | 25.00% | 4.00% | 5.00% |
| 62 | 30.00% | 40.00% | 10.00% | 18.00% |
| 63 | 35.00% | 30.00% | 11.00% | 18.00% |
| 64 | 35.00% | 40.00% | 12.00% | 15.00% |
| 65 | 35.00% | 50.00% | 14.00% | 25.00% |
| 66 | 35.00% | 50.00% | 20.00% | 15.00% |
| 67 | 35.00% | 50.00% | 20.00% | 20.00% |
| 68 | 35.00% | 50.00% | 20.00% | 30.00% |
| 69 | 45.00% | 50.00% | 20.00% | 30.00% |
| 70 | 50.00% | 50.00% | 20.00% | 30.00% |
| 71 | 50.00% | 50.00% | 20.00% | 30.00% |
| 72 | 100.00% | 100.00% | 100.00% | 100.00% |

Assets

Assets available for benefits are determined as described on page E-13 of the valuation report. The asset valuation method is prescribed by statute, and does not appear to allow a corridor; therefore, a corridor has not been established.

Expenses

As estimated and advised by SERS staff, based on current expenses and are expected to increase in relation to the projected capped payroll.

Spouse's Age

The female spouse is assumed to be three years younger than the male spouse for active member valuation purposes.

Recommended Actuarial Assumptions

Children

It is assumed that married members have 2.2 children, one year apart in age.

The age of the youngest child of a deceased employee at his date of death is assumed to be as follows:

| Age at Death of Employee | Age of Youngest Child | Age at Death of Employee | Age of Youngest Child |
|--------------------------|-----------------------|--------------------------|-----------------------|
| 20 | 2 | 40 | 6 |
| 25 | 3 | 45 | 8 |
| 30 | 4 | 50 | 10 |
| 35 | 5 | 55 | 12 |
| | | 60 | 14 |

Overtime and Shift Differentials

Reported earnings include base pay alone. It is assumed that overtime and shift differentials will increase total payroll by 3.5 percent over reported earnings.

Load for Inactive Members Eligible for Deferred Vested Pension Benefits

Load of 11 percent for Regular Formula members and 9 percent for Alternative Formula members. The load reflects a liability attributable to inactive members eligible for deferred vested pension benefits for potential increases in final average salary due to participation in a reciprocal system after termination.

Unused Sick Leave and Optional Service Purchases

Current and future active member's service is increased 4.5 months to account for increases of service at retirement due to converting unused sick leave and vacation days and purchasing applicable optional service.

Missing Data

If year-to-date earnings were not available, then the monthly pay rate is used. If both year-to-date earnings and the monthly pay rate are not available, the annual rate of pay is assumed to be the rate of pay for the population as a whole on the actuarial valuation date. For members with less than a year of service, the annual rate of pay is based on the greater of year-to-date earnings or annualized pay rate. If a birth date was not available, the member was assumed to be age 35.

Decrement Timing

All decrements are assumed to occur mid-year.

Recommended Actuarial Assumptions

Decrement Relativity

Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.

Decrement Operation

Disability and turnover decrements do not operate after a member reaches retirement eligibility.

Eligibility Testing

Eligibility for benefits is determined based upon the age nearest birthday and service on the date the decrement is assumed to occur.

Assumptions as a Result of Public Act 96-0889 Adopted June 30, 2016

Members hired after December 31, 2010, are assumed to make contributions on salary up to the final average compensation cap in a given year until this plan provision or administrative procedure is clarified.

State contributions, expressed as a percentage of pay, are calculated based upon capped pay.

Members hired after December 31, 2010, eligible for the regular formula benefits will retire according to the following age-based retirement rates:

| Retirement Rates for Regular Formula Employees - Tier 2 Members | | | |
|---|--|-----|---|
| Age | Employees Eligible For Normal Retirement | Age | Employees Eligible For Early Retirement |
| 67 | 50.00% | 62 | 30.00% |
| 68 | 35.00% | 63 | 15.00% |
| 69 | 35.00% | 64 | 15.00% |
| 70 | 35.00% | 65 | 15.00% |
| 71 | 20.00% | 66 | 15.00% |
| 72 | 20.00% | | |
| 73 | 20.00% | | |
| 74 | 20.00% | | |
| 75 | 100.00% | | |

Recommended Actuarial Assumptions

Members hired after December 31, 2010, eligible for the alternative formula benefits will retire according to the following age-based retirement rates:

| Retirement Rates for Alternative Formula Employees Tier 2 Members | | |
|--|---------|---------|
| Age | Males | Females |
| 60 | 50.00% | 50.00% |
| 61 | 30.00% | 25.00% |
| 62 | 30.00% | 40.00% |
| 63 | 35.00% | 30.00% |
| 64 | 35.00% | 40.00% |
| 65 | 35.00% | 50.00% |
| 66 | 35.00% | 50.00% |
| 67 | 35.00% | 50.00% |
| 68 | 35.00% | 50.00% |
| 69 | 45.00% | 50.00% |
| 70 | 50.00% | 50.00% |
| 71 | 50.00% | 50.00% |
| 72 | 100.00% | 100.00% |

Recommended Actuarial Assumptions

Illustrative rates of withdrawal from the plan are as follows for members hired after December 31, 2010:

| Service Based Withdrawal - Tier 2 Members | | | | |
|---|---------------------------|---------|-------------------------------|---------|
| Service (End of Year) | Regular Formula Employees | | Alternative Formula Employees | |
| | Males | Females | Males | Females |
| 1 | 0.3000 | 0.2700 | 0.0800 | 0.1100 |
| 2 | 0.1650 | 0.1600 | 0.0700 | 0.0800 |
| 3 | 0.0700 | 0.0900 | 0.0575 | 0.0700 |
| 4 | 0.0700 | 0.0800 | 0.0550 | 0.0600 |
| 5 | 0.0650 | 0.0750 | 0.0325 | 0.0500 |
| 6 | 0.0550 | 0.0650 | 0.0300 | 0.0500 |
| 7 | 0.0500 | 0.0600 | 0.0300 | 0.0500 |
| 8 | 0.0500 | 0.0500 | 0.0300 | 0.0325 |
| 9 | 0.0300 | 0.0350 | 0.0200 | 0.0200 |
| 10 | 0.0300 | 0.0350 | 0.0200 | 0.0200 |
| 11 | 0.0300 | 0.0300 | 0.0150 | 0.0200 |
| 12 | 0.0250 | 0.0300 | 0.0150 | 0.0175 |
| 13 | 0.0250 | 0.0250 | 0.0150 | 0.0175 |
| 14 | 0.0250 | 0.0250 | 0.0150 | 0.0175 |
| 15 | 0.0200 | 0.0250 | 0.0150 | 0.0175 |
| 16 | 0.0200 | 0.0250 | 0.0150 | 0.0175 |
| 17 | 0.0200 | 0.0200 | 0.0150 | 0.0150 |
| 18 | 0.0200 | 0.0200 | 0.0150 | 0.0150 |
| 19 | 0.0200 | 0.0200 | 0.0150 | 0.0150 |
| 20 | 0.0200 | 0.0200 | 0.0125 | 0.0125 |
| 21 | 0.0200 | 0.0150 | 0.0125 | 0.0125 |
| 22 | 0.0200 | 0.0150 | 0.0125 | 0.0125 |
| 23 | 0.0200 | 0.0150 | 0.0125 | 0.0125 |
| 24 | 0.0200 | 0.0150 | 0.0125 | 0.0125 |
| 25 | 0.0150 | 0.0150 | 0.0100 | 0.0100 |
| 26 | 0.0150 | 0.0100 | 0.0100 | 0.0100 |
| 27 | 0.0150 | 0.0100 | 0.0100 | 0.0100 |
| 28 | 0.0150 | 0.0100 | 0.0100 | 0.0100 |
| 29 | 0.0150 | 0.0100 | 0.0100 | 0.0100 |
| 30+ | 0.0150 | 0.0100 | 0.0100 | 0.0100 |

Recommended Actuarial Assumptions

State Contributions under P.A. 93-0002

In general, for each year during the life of the GOB program, the state contributions to the System are to be calculated as follows:

1. Calculation of the contribution maximum
 - a. A projection of contributions will be made from the actuarial valuation date to June 30, 2045. Such projection will be based on hypothetical asset values determined using the following assumptions:
 - i) That the System had received no portion of the general obligation bond proceeds in excess of the scheduled contributions for the remainder of fiscal 2003 and for the entirety of 2004,
 - ii) That the hypothetical state contributions had been made each fiscal year from 2005 through the actuarial valuation date, based on the funding process in place prior to P.A. 93-0002 (without regard to prior state minimum requirements),
 - iii) That the actual amounts of member contributions and the actual cash outflows (benefit payments, refunds and administrative expenses) for each year prior to the actuarial valuation date were realized, and
 - iv) That the hypothetical fund earned returns in each prior fiscal year equal to the rate of total return actually earned by the retirement fund in that year.
 - b. The hypothetical asset values developed in a., above, will not exceed the actual assets of the fund.
 - c. A projection of maximum contributions for each year of the GOB program will be performed each year, by reducing the contributions produced in a., above, by the respective amount of debt service allocated to the System for each year.
2. Calculation of the contribution with GOB proceeds
 - a. The basic projection of state contributions from the actuarial valuation date through June 30, 2045, will be made, taking into account all assets of the System, including the GOB proceeds.
 - b. State contribution rates (expressed as a percentage of covered pay), in the pattern required by the funding sections of the statutes, are calculated.
 - c. In those projections, the dollars of state contributions which are added to assets each year during the GOB program are limited by the contribution maximum. Because the bonds are to be liquidated by the end of fiscal 2033, there is no contribution maximum thereafter.

Recommended Actuarial Assumptions

State Contributions under P.A. 94-0004

The following is an excerpt from the Illinois Compiled statutes 40 ILCS 5/14-108.3 (f)-(g):

(f) The System shall determine the amount of the increase in the present value of future benefits resulting from the granting of early retirement incentives under this Section and shall report that amount to the Governor and the Commission on Government Forecasting and Accountability on or after the effective date of this amendatory Act of the 93rd General Assembly and on or before November 15, 2004. Beginning with State fiscal year 2008, the increase reported under this subsection (f) shall be included in the calculation of the required State contribution under Section 14-131.

(g) In addition to the contributions otherwise required under this Article, the State shall appropriate and pay to the System an amount equal to \$70,000,000 in State fiscal years 2004 and 2005.

State Contributions under P.A. 96-0043

The following is an excerpt from the Illinois Compiled statutes 40 ILCS 5/14-131:

(g) For purposes of determining the required State contribution to the System, the value of the System's assets shall be equal to the actuarial value of the System's assets, which shall be calculated as follows:

As of June 30, 2008, the actuarial value of the System's assets shall be equal to the market value of the assets as of that date. In determining the actuarial value of the System's assets for fiscal years after June 30, 2008, any actuarial gains or losses from investment return incurred in a fiscal year shall be recognized in equal annual amounts over the five-year period following that fiscal year.

(h) For purposes of determining the required State contribution to the System for a particular year, the actuarial value of assets shall be assumed to earn a rate of return equal to the System's actuarially assumed rate of return.

Recommended Actuarial Assumptions

State Contributions under P.A. 100-0023

Public Act (“P.A.”) 100-0023, effective July 6, 2017, modified the State’s funding policy to include smoothing State contribution rate increases or decreases due to changes in actuarial assumptions, including investment return assumptions, over a five-year period in equal annual amounts beginning in fiscal year 2018. In addition, changes in actuarial or investment assumptions that increased or decreased the State contribution rate in fiscal years 2014 through 2017 are to be smoothed over a five-year period in equal annual amounts, applying only to the portion of the five-year phase-in that is applicable to fiscal years on and after 2018.

Following the preceding legislation we have calculated the required contribution and the results are shown in the summary section of this report.

Phase-in of the Financial Impact of Assumption Changes

Following is a table with the recognition schedule for the phase-in of actuarial assumption changes required under Public Act 100-0023. The following actuarial assumption changes were made:

1. Beginning with the June 30, 2014, actuarial valuation, there were changes to the economic and demographic assumptions.
2. Beginning with the June 30, 2016, actuarial valuation, there were changes to the economic and demographic assumptions.
3. Beginning with the June 30, 2018, actuarial valuation, there were changes to the economic and demographic assumptions due to an experience review.^a

^a The June 30, 2018, phase-in adjustments for the change in assumptions due to the experience review study will be re-measured as of June 30, 2019, and will become effective beginning with the June 30, 2019, actuarial valuation.

Recommended Actuarial Assumptions

| Valuation Year Ending June 30, | 2014 | 2015 | 2016 | 2017 | 2018 | 2018 | 2019 | 2020 | 2021 | 2022 |
|--|------------------------------|--------|--------------|--------|--------------|--------------|--------|--------|--------|--------|
| Applicable Fiscal Year Ending June 30, | 2016 | 2017 | 2018 | 2019 | 2020 | 2020 | 2021 | 2022 | 2023 | 2024 |
| | \$ in Millions | | | | | | | | | |
| | After Impact of GOB Proceeds | | | | | | | | | |
| Contribution Before Assumption Change | | | | | | | | | | |
| (1) Contribution Dollar | \$ 1,822.047 | \$ - | \$ 2,018.671 | \$ - | \$ 2,291.303 | \$ 2,271.196 | | | | |
| (2) Contribution Rate | 38.830% | 0.000% | 45.027% | 0.000% | 52.026% | 51.694% | | | | |
| Contribution After Assumption Change | | | | | | | | | | |
| (3) Contribution Dollar | \$ 2,044.868 | \$ - | \$ 2,327.633 | \$ - | \$ 2,302.720 | \$ 2,260.441 | | | | |
| (4) Contribution Rate | 43.880% | 0.000% | 52.095% | 0.000% | 52.411% | 51.715% | | | | |
| (5) Assumption Change Impact as a Percentage of Capped Payroll [(4) - (2)] | 5.050% | 0.000% | 7.068% | 0.000% | 0.385% | 0.021% | | | | |
| (6) Assumption Change Impact Recognized | | | | | | | | | | |
| This Year (5-year Recognition) | | | | | | | | | | |
| (6a) From This Year | 1.010% | 0.000% | 1.414% | 0.000% | | 0.081% | | | | |
| (6b) From One Year Ago | 0.000% | 1.010% | 0.000% | 1.414% | | 0.000% | 0.081% | | | |
| (6c) From Two Years Ago | 0.000% | 0.000% | 1.010% | 0.000% | | 1.414% | 0.000% | 0.081% | | |
| (6d) From Three Years Ago | 0.000% | 0.000% | 0.000% | 1.010% | | 0.000% | 1.414% | 0.000% | 0.081% | |
| (6e) From Four Years Ago | 0.000% | 0.000% | 0.000% | 0.000% | | 1.010% | 0.000% | 1.412% | 0.000% | 0.082% |
| (6f) Total Recognized Assumption Change Impact | 1.010% | 1.010% | 2.424% | 2.424% | | 2.505% | 1.495% | 1.493% | 0.081% | 0.082% |

The June 30, 2018, phase-in adjustments for the change in assumptions due to the experience review study will be re-measured as of June 30, 2019, and will become effective beginning with the June 30, 2019, actuarial valuation.