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OKLAHOMA PUBLIC EMPLOYEES RETIREMENT SYSTEM

**Experience Study**  
**For the Three-Year Period**  
**Ending June 30, 2010**





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# Cavanaugh Macdonald

## CONSULTING, LLC

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May 9, 2011

Board of Trustees  
Oklahoma Public Employees Retirement System  
5801 N. Broadway Extension, Suite 400  
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Dear Members of the Board:

We are pleased to submit the results of a study of the economic and demographic experience for the Oklahoma Public Employees Retirement System (OPERS) and the Uniform Retirement System for Justices and Judges (URSJJ). The purpose of this investigation is to assess the reasonability of the actuarial assumptions for the System. This investigation covers the three-year period from July 1, 2007 to June 30, 2010. As a result of the investigation, it is recommended that revised assumptions be adopted by the Board for future use.

The experience study includes all active and retired members, including OPERS regular members, elected officials, hazardous duty members, and URSJJ members. The mortality and disability experience was studied separately for males and females. Incidences of retirement and compensation increases were investigated without regard to gender. The withdrawal assumption was studied for males and females, but was concluded to be similar enough that a unisex assumption could be used.

This report shows comparisons between the actual and expected cases of separation from active service, actual and expected number of deaths, and actual and expected salary increases. Tables and graphs are used to show the actual decrement rates, the expected decrement rates and, where applicable, the proposed decrement rates.

The recommended decrement tables are shown in Appendix D of this report for OPERS and Appendix E for URSJJ. In the actuary's judgment, the recommended rates are suitable for use until further experience indicates that modifications are needed.

Actuarial assumptions are used to measure and budget future costs. Changing assumptions will not change the actual cost of future benefits. Once the assumptions have been adopted, the actuarial valuation measures the adequacy of the statutory contribution rates.

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The experience study was performed by, and under the supervision of, independent actuaries who are members of the American Academy of Actuaries with experience in performing valuations for public retirement systems. The undersigned meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,

A handwritten signature in blue ink, appearing to read 'Alisa Bennett', with a stylized, cursive script.

Alisa Bennett, FSA, EA, FCA, MAAA

Principal and Consulting Actuary

A handwritten signature in blue ink, appearing to read 'Patrice Beckham', with a stylized, cursive script.

Patrice Beckham, FSA, EA, FCA, MAAA

Consulting Actuary

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Brent Banister, PhD, FSA, EA, FCA, MAAA

Senior Actuary



### Summary of Results

The following summarizes the findings and recommendations with regard to the assumptions utilized by the Oklahoma Public Employees Retirement System. Explanations for the recommendations are found in the sections that follow.

#### **Recommended Economic Assumption Changes**

The table below lists the three economic assumptions used in the actuarial valuation and their current and proposed rates. We recommend no change to the assumed rate of price inflation or the assumed rate of return on assets. We recommend lowering the assumed rate of real wage growth from 1.25% to 1.00%.

| Item              | Current | Proposed |
|-------------------|---------|----------|
| Price Inflation   | 3.00%   | 3.00%    |
| Investment Return | 7.50%   | 7.50%    |
| Real Wage Growth  | 1.25%   | 1.00%    |

#### **Recommended Demographic Assumption Changes**

The table below lists the demographic assumptions that we recommend be changed based on the experience of the last three years.

| Assumption Changes                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>OPERS</b><br>Adjust rates of withdrawal<br>Decrease rates of disability retirements<br>Decrease probability of electing a vested benefit<br>Decrease salary scale |
| <b>URSJJ</b><br>Decrease salary scale                                                                                                                                |

#### **Recommended Method Changes**

In keeping with the real wage growth change, we recommend that the payroll growth assumption for amortization as a level percent of pay be reduced from 4.25% to 4.00%. We also recommend the elimination of the COLA reserve, provided HB 2132 is enacted.



### **Financial Impact**

The table below highlights the impact on the Oklahoma Public Employees Retirement System (OPERS) and the Uniform Retirement System for Justices and Judges (URSJJ) if the proposed assumptions are adopted and HB 2132 is enacted. (If the legislation is not enacted, the middle column will be the ultimate result.) The table shows the change in the unfunded accrued liability (UAL), funded ratio and employer contribution rate for both Plans of the System as of June 30, 2010.

|                                      | <b>Before Change</b> | <b>After Assumption Changes</b> | <b>After Removing COLA Reserve</b> |
|--------------------------------------|----------------------|---------------------------------|------------------------------------|
| <b>OPERS</b>                         |                      |                                 |                                    |
| Unfunded Actuarial Accrued Liability | \$3,274,211,426      | \$3,245,252,698                 | \$1,645,901,960                    |
| Funded Ratio                         | 66.0%                | 66.2%                           | 79.4%                              |
| Employer Contribution Rate           | 23.87%               | 23.71%                          | 14.61%                             |
| <b>URSJJ</b>                         |                      |                                 |                                    |
| Unfunded Actuarial Accrued Liability | \$52,755,106         | \$51,944,237                    | \$7,913,056                        |
| Funded Status                        | 81.3%                | 81.6%                           | 96.7%                              |
| Employer Contribution Rate           | 35.74%               | 35.15%                          | 20.74%                             |

As requested, for illustrative purposes only, below are the results with all changes, including removal of the COLA, using a 7.25% and 7.00% rate of return on assets assumption.

| <b>After Assumption Changes and<br/>After Removing COLA Reserve</b> |                 |                 |
|---------------------------------------------------------------------|-----------------|-----------------|
|                                                                     | <b>7.25%</b>    | <b>7.00%</b>    |
| <b>OPERS</b>                                                        |                 |                 |
| Unfunded Actuarial Accrued Liability                                | \$1,905,985,217 | \$2,106,607,118 |
| Funded Ratio                                                        | 76.9%           | 75.1%           |
| Employer Contribution Rate                                          | 16.21%          | 17.57%          |
| <b>URSJJ</b>                                                        |                 |                 |
| Unfunded Actuarial Accrued Liability                                | \$11,736,288    | \$17,434,215    |
| Funded Status                                                       | 95.1%           | 93.0%           |
| Employer Contribution Rate                                          | 22.72%          | 25.34%          |



### Economic Assumptions

There are three economic assumptions used in performing the actuarial valuation for the Oklahoma Public Employees Retirement System (OPERS) and the Uniform Retirement System for Justices and Judges (URSJJ). The assumptions are:

- Price Inflation
- Investment Return
- Wage Inflation

The Actuarial Standards Board has issued Actuarial Standard of Practice (ASOP) No. 27, “*Selection of Economic Assumptions for Measuring Pension Obligations*”, which provides guidance to actuaries in selecting economic assumptions for measuring obligations under defined benefit plans. As noted in ASOP No. 27, because no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes based on a mixture of past experience and future expectations. These estimates therefore are best stated as a range utilizing the actuary’s professional judgment. In setting the range and the single point within that range to use, the actuary should consider a number of factors, including the purpose and nature of the measurement, and appropriate recent and long-term historical economic data. However, the standard explicitly advises the actuary not to give undue weight to recent experience.

Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period.

In our opinion, the economic assumptions recommended in this report have been developed in accordance with ASOP No. 27. The following table shows our recommendations followed by explanations of each assumption.

| Item                | Current     | Proposed     |
|---------------------|-------------|--------------|
| Price Inflation     | 3.00%       | 3.00%        |
| Real Rate of Return | <u>4.50</u> | <u>4.50%</u> |
| Investment Return   | 7.50%       | 7.50%        |
| Price Inflation     | 3.00%       | 3.00%        |
| Real Wage Growth    | <u>1.25</u> | <u>1.00</u>  |
| Wage Inflation      | 4.25%       | 4.00%        |



### Price Inflation

**Background:** As seen in the table on the previous page, assumed price inflation is used as a component for both the investment return assumption and the wage inflation assumption. The latter two assumptions will be discussed in detail in the following sections.

It is important that the price inflation assumption be consistently applied throughout the economic assumptions utilized in an actuarial valuation. This is called for in ASOP No. 27 and is also required to meet the parameters for determining pension liabilities and expense under Governmental Accounting Standards Board (GASB) Statements No. 25 and 27.

The current price inflation assumption is 3.00% per year.

**Past Experience:** The Consumer Price Index, US City Average, All Urban Consumers, CPI (U), has been used as the basis for reviewing historical levels of price inflation. The level of that index in June of each of the last 50 years is provided in Appendix A.

In analyzing this data, average rates of inflation have been determined by measuring the compound growth rate of the CPI (U) over various time periods. The results are as follows:

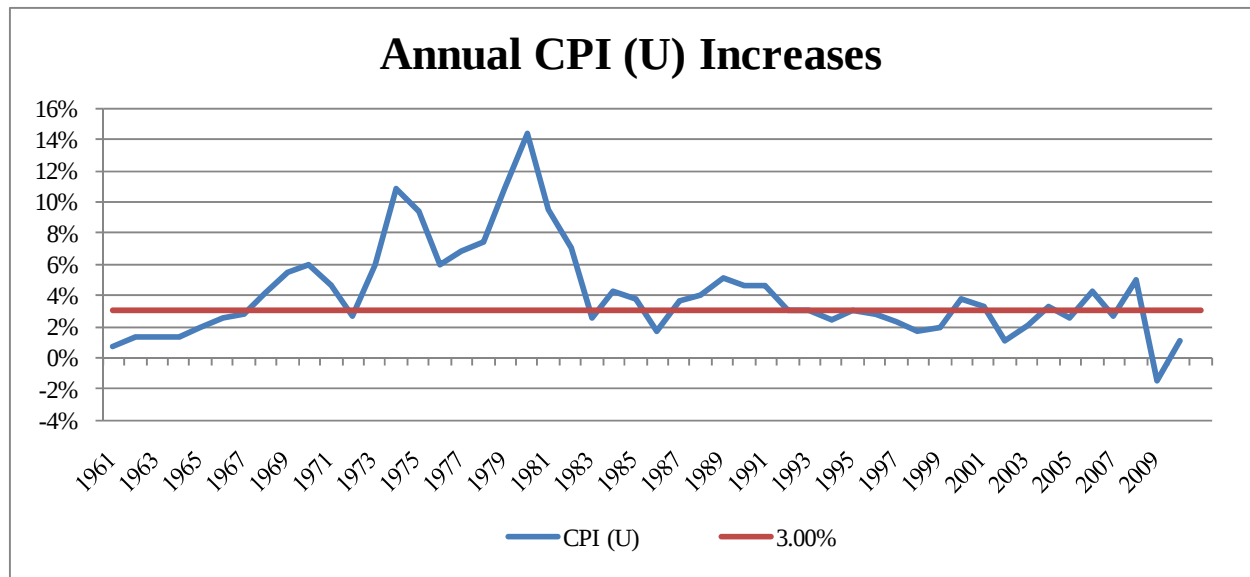
| Period      | Average Annual Rate of Inflation |
|-------------|----------------------------------|
| 2005 – 2010 | 2.30%                            |
| 2000 – 2010 | 2.37%                            |
| 1990 – 2010 | 2.62%                            |
| 1980 – 2010 | 3.28%                            |
| 1970 - 2010 | 4.41%                            |
| 1960 – 2010 | 4.07%                            |
| 1926 - 2010 | 3.03%                            |

Over shorter historic periods, the average annual rate of increase in the CPI-U has been below 3.00%. The years of high inflation occurring from 1973 to 1982 has a significant impact on the averages over periods which include these rates. We should add that since 1926, the average annual rate of inflation was 3.03%.



## Section II: Economic Assumptions

The graph below shows the annual increases in the CPI (U) over a 50-year period.



Additional information to consider when determining the reasonable range is obtained from measuring the spread on inflation protected treasury bills (TIPS) and from the prevailing economic forecasts. The spread between the nominal yield on treasury securities and the inflation indexed nominal yield on TIPS of the same maturity is referred to as the “breakeven rate of inflation” and represents the bond market’s expectation of inflation over the maturity of the bond. The table below provides the calculation of the breakeven rate of inflation as of December 31, 2010 over various periods.

| Years to Maturity | Bond Nominal Yield | TIPS Nominal Yield | Breakeven Rate of Inflation |
|-------------------|--------------------|--------------------|-----------------------------|
| 10                | 3.30%              | 1.00%              | 2.30%                       |
| 20                | 4.13%              | 1.59%              | 2.54%                       |
| 30                | 4.34%              | 1.86%              | 2.48%                       |

The bond market’s expectation for the rate of inflation is significantly lower than historical average annual rates. Additionally, based upon information provided from the “Survey of Professional Forecasters” published by the Philadelphia Federal Reserve Bank, the median annual rate of inflation for the ten years beginning January 1, 2011 is 2.20%.



**Recommendation:** It is difficult to accurately predict inflation. Current economic forecasts and the bond market suggest lower inflation over the next ten to twenty years when compared to the historical averages, which is a shorter time period than appropriate for our purposes. In the 2009 OASDI Trustees Report, the Chief Actuary for Social Security bases the 75-year cost projections on an intermediate inflation assumption of 2.8% with a range of 1.8% - 3.8%. We concur in general with a range of 2.0% - 4.0%, and recommend continued use of a 3.0% per year rate recognizing the likely inflation pressures built into the economy at the current time.

| Price Inflation Assumption |             |
|----------------------------|-------------|
| Current                    | 3.0%        |
| Reasonable Range           | 2.00 - 4.0% |
| Recommended                | 3.0%        |



### Investment Return

**Background:** The assumed investment return is one of the most significant assumptions in the annual actuarial valuation process as it is used to discount the expected benefit payments for all active, inactive and retired members of the System. Minor changes in this assumption can have a major impact on valuation results. The investment return assumption should reflect the asset allocation target for the funds set by the Board.

The current assumption is 7.50%, consisting of a price inflation assumption of 3.00% and a real rate of return assumption of 4.50%. The return is net of all investment expenses.

**Past Experience:** The actuarial value of assets of the System are developed using a widely accepted asset-smoothing methodology that fully recognizes investment gains and losses over a five-year period. The recent experience for the retirement funds over the last twelve years is shown in the table below.

| Year Ending 6/30 | Market Value (\$ million) | Market Value Rate of Return | Actuarial Value (\$ million) |
|------------------|---------------------------|-----------------------------|------------------------------|
| 1999             | \$ 4,831                  | 9.2%                        | \$ 4,262                     |
| 2000             | 5,246                     | 9.9                         | 4,786                        |
| 2001             | 4,815                     | (6.0)                       | 5,110                        |
| 2002             | 4,486                     | (5.3)                       | 5,300                        |
| 2003             | 4,619                     | 5.4                         | 5,355                        |
| 2004             | 5,126                     | 14.0                        | 5,412                        |
| 2005             | 5,504                     | 10.3                        | 5,451                        |
| 2006             | 5,817                     | 7.9                         | 5,654                        |
| 2007             | 6,640                     | 16.3                        | 6,110                        |
| 2008             | 6,255                     | (4.2)                       | 6,492                        |
| 2009             | 5,174                     | (15.4)                      | 6,208                        |
| 2010             | 5,774                     | 13.9                        | 6,348                        |

Because of the significant variability in past year-to-year results and the inter-play of inflation on those results in the short term, we prefer to base our investment return assumption on the capital market assumptions utilized by the Board in setting investment policy and the asset allocation established by the Board as a result of that policy. This approach is referred to as the building block method in ASOP No. 27.



## Section II: Economic Assumptions

**Historical Analysis:** The historical 50-year real rate of return of the S&P 500 has averaged 5.46%, and the 50-year real rate of return of intermediate high quality bonds has averaged 2.84%. By weighting these rates by common allocation of large retirement funds (30%/70% to 70%/30%) we construct the reasonable range for real rates of return to be from 3.95% to 5.01%. The table below shows various annualized rates of return based on different time periods and different allocations between equities and bonds. OPERS current asset allocation (shown in Appendix B) is 64% equities and 36% fixed income.

| Time<br>Span In<br>Years | Real Returns by Portfolio Allocation<br>Equities vs. Bonds |         |         |             |
|--------------------------|------------------------------------------------------------|---------|---------|-------------|
|                          | 30%/70%                                                    | 35%/65% | 65%/35% | 70%/30%     |
| 10                       | 2.66%                                                      | 2.52%   | 1.32%   | 1.06%       |
| 20                       | 5.20                                                       | 5.37    | 6.15    | 6.24        |
| 30                       | 6.19                                                       | 6.33    | 6.99    | 7.07        |
| 40                       | 4.33                                                       | 4.48    | 5.16    | 5.25        |
| <b>50</b>                | <b>3.95</b>                                                | 4.11    | 4.91    | <b>5.01</b> |

**OPERS Analysis:** The current capital market assumptions and asset allocation are shown in Appendix B. Using statistical distribution properties provides an expected range of real rates of return over various time horizons. Looking at one year results produces an expected real return with a high standard deviation, which means there is high volatility. Over larger time horizons, the median return does not change much but the volatility declines significantly. The following table provides a summary of results.

| Time<br>Span In<br>Years | Real Returns by Percentile |                  |                  |                  |                  |
|--------------------------|----------------------------|------------------|------------------|------------------|------------------|
|                          | 5 <sup>th</sup>            | 25 <sup>th</sup> | 50 <sup>th</sup> | 75 <sup>th</sup> | 95 <sup>th</sup> |
| 1                        | -12.10%                    | -2.63%           | 4.54%            | 12.25%           | 24.35%           |
| 5                        | -3.26%                     | 1.27%            | 4.54%            | 7.92%            | 12.98%           |
| 10                       | -1.04%                     | 2.22%            | 4.54%            | 6.92%            | 10.44%           |
| 20                       | 0.57%                      | 2.90%            | 4.54%            | 6.22%            | 8.68%            |
| 30                       | 1.29%                      | 3.20%            | 4.54%            | 5.91%            | 7.91%            |
| 50                       | 2.01%                      | 3.50%            | 4.54%            | 5.60%            | 7.14%            |
| <b>75</b>                | 2.47%                      | <b>3.69%</b>     | 4.54%            | <b>5.41%</b>     | 6.66%            |

The chart above shows the percentile rankings for expected returns. Thus for the 20-year time span, 5% of the resulting real rates of return are expected to be below 0.57% and 95% expected to be above that. As the time span increases, the results begin to merge. Over a 75-year time span, the results indicate there is a 25% chance that real return will be below 3.69% and a 25% chance they will be above 5.41%. In other words there is a 50% chance the real returns will be between 3.69% and 5.41%.



**Administrative and Investment Expenses (\$ thousands):** Administrative expenses are directly reflected as a separate component in the calculation of the contribution rate. However, the investment return is assumed to be net of all investment-related expenses. The table below shows the ratio of expenses to OPERS Plan assets over the last eight years. The expense ratio is calculated as the total expense divided by the ending asset balance at fair market value.

| \$ million | Market Value Assets | Investment Expense | Expense Ratio |
|------------|---------------------|--------------------|---------------|
| 2003       | \$ 4,619            | \$ 5.5             | 0.11%         |
| 2004       | 5,126               | 6.3                | 0.12          |
| 2005       | 5,504               | 6.8                | 0.12          |
| 2006       | 5,817               | 6.1                | 0.10          |
| 2007       | 6,640               | 6.2                | 0.09          |
| 2008       | 6,255               | 5.9                | 0.09          |
| 2009       | 5,174               | 5.6                | 0.11          |
| 2010       | 5,774               | 6.5                | 0.11          |

Over the three-year period the expense ratio averaged approximately 0.10%. This assumption does not have a direct impact on the actuarial valuation results, but it does provide a measure of gross return on investments that will be needed to meet the actuarial assumption used for the valuation. For example, if the investment return assumption is set at 7.50%, then OPERS would need to earn a gross return of 7.60% in order to meet the 7.50% for funding purposes.

**Recommendation:** Using the building block approach of ASOP No. 27 and the projection results outlined above, we recommend a range for the investment return assumption of the 25<sup>th</sup> to 75<sup>th</sup> percentile real returns over the 75-year time span plus the recommended inflation assumption less the recommended expense ratio assumption. The following table details the range.

| Item                  | 25 <sup>th</sup> Percentile | 50 <sup>th</sup> Percentile | 75 <sup>th</sup> Percentile |
|-----------------------|-----------------------------|-----------------------------|-----------------------------|
| Real Rate of Return   | 3.69%                       | 4.54%                       | 5.41%                       |
| Inflation             | 3.00                        | 3.00                        | 3.00                        |
| Expenses              | <u>(0.10)</u>               | <u>(0.10)</u>               | <u>(0.10)</u>               |
| Net Investment Return | 6.59%                       | 7.44%                       | 8.31%                       |



## Section II: Economic Assumptions

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The 50th percentile net return is 7.44% compared to the current assumed rate of return is 7.50%. The current assumed rate falls within the reasonable range of 6.59% to 8.31%. At this time we are recommending continued use of the assumed rate of return of 7.50%.

| Investment Return Assumption |               |
|------------------------------|---------------|
| Current                      | 7.50%         |
| Reasonable Range             | 6.59% - 8.31% |
| Recommended                  | 7.50%         |



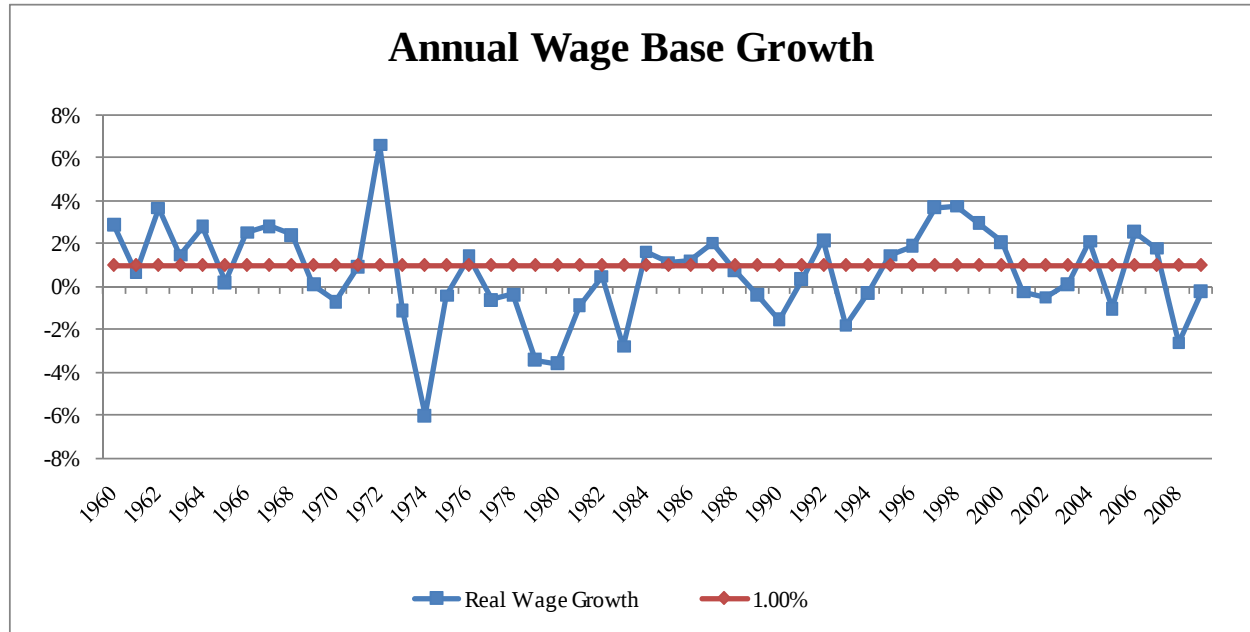
### Wage Inflation

**Background:** The assumed future increases in salaries consist of an inflation component and a component for promotion and longevity, often called merit increases. Merit increases are generally age and/or service related, and will be studied in the demographic assumption section of the report. Wage inflation normally is above price inflation, which reflects the overall return on labor in the economy. The current wage inflation assumption is 4.25%, or 1.25% above price inflation.

**Past Experience:** The Social Security Administration publishes data on wage growth in the United States. Appendix C shows the last 50 calendar years' data. As we did in our analysis of inflation, in the table below, we show the wage inflation and a comparison with the price inflation over various time periods. Since wage data is only available through 2009 we use that year as the end point.

| Period    | Wage Inflation | Price Inflation | Real Wage Growth |
|-----------|----------------|-----------------|------------------|
| 1999-2009 | 2.94%          | 2.79%           | 0.15%            |
| 1989-2009 | 3.59           | 2.88            | 0.72             |
| 1979-2009 | 4.31           | 3.76            | 0.55             |
| 1969-2009 | 4.95           | 4.57            | 0.38             |
| 1959-2009 | 4.83           | 4.12            | 0.71             |

Thus, over the last 50 years, annual real wage growth has averaged 0.71%. The graph on the following page shows the annual increases in real wage growth over the entire 50-year period.



**OPERS Wage Inflation Experience:** The table below shows the OPERS Plan payroll over the last seven years.

| \$ million | Payroll    | Increase over prior year |
|------------|------------|--------------------------|
| 2004       | \$ 1,384.0 |                          |
| 2005       | 1,454.2    | 5.1%                     |
| 2006       | 1,568.3    | 7.8%                     |
| 2007       | 1,626.7    | 3.7%                     |
| 2008       | 1,682.7    | 3.4%                     |
| 2009       | 1,733.0    | 3.0%                     |
| 2010       | 1,683.7    | (2.8)%                   |

Over the last 7 years, annual real wage growth has averaged 3.3%. However, as we stated in the price inflation section above, 7 years is a shorter time period than appropriate for our purposes. Also, it must be noted that the 7 year period shown above coincides with a period of low price inflation.



**Recommendation:** As we did with price inflation, we again look at the 2010 OASDI Trustees Report. The Chief Actuary for Social Security bases the 75-year cost projections on a national wage growth assumption 1.1% greater than the price inflation assumption of 2.8%. We concur in general with a range of .5% - 1.5%. We recommend a change to 1.0% for the real wage growth assumption.

| Wage Inflation Assumption |                  |             |
|---------------------------|------------------|-------------|
| Current                   | 4.25%            |             |
|                           | Reasonable Range |             |
| Real Wage Growth          | 0.50%            | 1.50%       |
| Inflation                 | <u>3.00</u>      | <u>3.00</u> |
| Total                     | 3.50%            | 4.50%       |
| Recommended               | 4.00%            |             |



### **Demographic Assumptions**

There are several demographic assumptions used in the actuarial valuations performed for the Oklahoma Public Employees Retirement System (OPERS) and the Uniform Retirement System for Justices and Judges (URSJJ). They are:

- Rates of Mortality
- Rates of Service Retirement
- Rates of Disability Retirement
- Rates of Withdrawal
- Probability of Electing a Vested Benefit
- Rates of Salary Increase for Merit and Promotions

The Actuarial Standards Board has issued Actuarial Standard of Practice (ASOP) No. 35, *“Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations”*, which provides guidance to actuaries in selecting demographic assumptions for measuring obligations under defined benefit plans. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP No. 35.

The purpose of a study of demographic experience is to compare what actually happened to the membership during the study period (June 30, 2007 through June 30, 2010) with what was expected to happen based on the assumptions used in the most recent actuarial valuations.

Detailed tabulations by age, service and/or gender are performed over the entire study period. These tabulations look at all active and retired members during the period as well as separately identifying those who experience a demographic event, also referred to as a decrement. In addition, the tabulation of all members together with the current assumptions permits the calculation of the number of expected decrements during the study period.

If the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements, or rates of decrement, by age, gender, or service does not follow the expected pattern, new assumptions are recommended. Recommended changes usually do not follow the exact actual experience during the observation period. Judgment is required to extrapolate future experience from past trends and current member behavior. In addition non-recurring events, such as early retirement windows, need to be taken into account in determining the weight to give to recent experience.

It is important to note that during this study period, the United States experienced a significant recession and turmoil in the financial markets. As we note in several places on the following pages, these events could be reasonably expected to result in System members making adjustments in behavior. The impact on tax revenues and governmental budgets also has had some impact on salaries and employment levels. Consequently, we believe it is important to be



### Section III: Demographic Assumptions

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cautious in making changes to assumptions since the time period studied may be atypical. Where we do recommend changes, we have looked for confirmation by seeing if the changes are consistent with the prior experience study.

The remainder of this section presents the results of the demographic study. We have prepared graphs and tables that show a comparison of the actual and expected decrements and the overall ratio of actual to expected results under the current assumptions. If a change is being proposed, the revised actual to expected ratios are shown as well. These tables are presented in Appendices F and G.

#### **Mortality Tables**

Mortality tables are a fundamental assumption in actuarial valuations. Because benefits are typically paid over a retiree's lifetime, it is important to appropriately reflect what a typical lifetime looks like. In addition, deaths before retirement may also result in the payout of benefits to a spouse or survivor. For valuation purposes, we must consider mortality tables for retirees, beneficiaries of retirees, disabled retirees, and active members.

##### **Retiree Mortality:**

The post-retirement mortality rates used in the actuarial valuation project the percentage of retirees who are expected to die in a given future year. This assumption is a very important demographic assumption since it typically has the most significant impact on liability projections.

Based upon the long term trend of mortality improvement, actuaries seek to account for future improvements in longevity, either by directly projecting future improvements or by maintaining a sufficient margin in expected rates of mortality to allow for future improvement. While the direct projection – also called generational mortality – may better predict future payouts, it is not an appropriate approach for OPERS. Because the guiding statutes appear to require that actuarial factors for optional form of payments, etc. be the same as the assumption used in the valuation, the generational approach cannot be used. (It would require a new set of factors each year, something which is not desirable from a member planning perspective and which would be a burdensome administrative challenge.) Consequently, we propose that the selected table reflect some degree of future improvement now, thereby providing a margin for improvement. The current table is the RP-2000 Combined Table, projected to 2010.

Graphs showing actual versus expected post-retirement mortality rates for OPERS members are shown in Appendix F in Table F-1 for males and F-2 for females, and Appendix G has the corresponding numerical data. The analysis of the actual post-retirement mortality experience over the three-year experience study period yields actual/expected ratios of 128% and 119% respectively for males and females. The actual/expected ratios in the prior experience study were 132% and 120% respectively for males and females. This indicates that mortality has improved slightly since the previous experience study, but significant margin still exists for mortality improvements. Thus we do not recommend any change at this time.



### Section III: Demographic Assumptions

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Because of the small URSJJ retiree population, we cannot obtain credible analysis of retiree mortality experience. Drawing upon general background on factors affecting mortality, we do anticipate that this group will have better mortality (i.e. live longer) than the broader OPERS membership. This has been recognized by setting the OPERS table back one year, so a 65-year old URSJJ retiree is treated as having the same mortality as a 64-year old OPERS member. We recommend continuing with this table.

#### **Beneficiary Mortality:**

For benefits payable with a joint and survivor option, an assumption is needed regarding the beneficiary's lifetime. Because many members take a lifetime only benefit, there is less data available for beneficiaries. Further, data tracking of beneficiaries is less precise during the years when the member is alive. Consequently, we do not find sufficiently credible data to analyze this group separately. We recommend that for both OPERS and URSJJ that the same table used for retirees also be used for beneficiaries.

#### **Disabled Retiree Mortality:**

Members who retire under the disability retirement provisions are generally expected to be less healthy than the overall population. Currently, the assumption for this group is the same as the regular members with a 15-year age set forward. Because of the limited data for this group, it is difficult to analyze the actual mortality patterns. At ages under 65 (which includes about 2/3rds of disabled retirees), the actual to expected ratio is 148% for males and 161% for females. At ages above 65, there is no longer any margin. One possible reason for this is that many individuals who leave employment under the disability provisions do so with serious and often terminal illnesses, and die within a few years. Those who survive a few years have better mortality than what is assumed, although still below that of healthy retirees. Because the majority of disabled retirees are in ages where there is a large margin, we believe the net result is still appropriate. We recommend that the current assumption be retained, but we will continue to accumulate data to see if any revisions are warranted, especially at older ages, in the next study.

#### **Active Member Mortality:**

For active members, the mortality assumption is less significant since it is only a small reason that employment ends and benefits begin. Further, there is no need for a margin for future improvements as there is for retirees. We had the following experience over the study period:

|         | Actual Deaths | Expected Deaths | A/E Ratio |
|---------|---------------|-----------------|-----------|
| Males   | 103           | 115             | 90%       |
| Females | 76            | 110             | 69%       |



### Section III: Demographic Assumptions

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While there were fewer deaths than expected, we note that changing the table would have a negligible impact and therefore recommend continuing to use the same table for active members as is used for retired members. For hazardous duty members, the current assumption is that the death rates should be 10% higher to reflect an increased risk of death in the line of duty. With only 8 total deaths in this group over the study period, we cannot assess the adequacy of this assumption, but we find it reasonable and recommend its continued use.

#### **Rates of Retirement**

The service retirement rates used in the actuarial valuations project the percentage of employees who are expected to retire during a given year. This assumption does not include the retirement patterns of the individuals who terminated from active membership prior to their retirement.

The System provides for two types of retirements based on different eligibility requirements. The first one is for an unreduced retirement benefit. The second one is for an early retirement benefit which is reduced. Separate assumptions have been developed for each type of retirement benefit.

#### **Regular OPERS Members**

OPERS provides for a normal, unreduced retirement benefit upon the earlier of (a) age 62 and six years of service or (b) “Rule of 80” (if hired prior to July 1, 1992) or “Rule of 90” (if hired on or after July 1, 1992). OPERS also provides for an early, reduced retirement benefit upon reaching age 55 and completing ten years of creditable service. Under the provisions for early retirement, the benefit is reduced  $1/15^{\text{th}}$  for each of the first five years and  $1/30^{\text{th}}$  per year for the next two years.

Graphs and detailed tables showing actual versus expected retirement rates are shown in Appendices F-3, F-4, G-3, and G-4. The analysis of the actual retirement experience over the three-year period yields an actual/expected ratio of 77% for early retirement and 83% for normal retirements.

For normal retirement, actual retirements at the younger ages were less than expected. Similarly, we note that early retirement at age 61 was much less than expected. In light of the economic environment during the study period, we are not surprised that many members decided to defer retirement. If this change was not just temporary, we expect that it will be evident in the next study at which time permanent adjustments can be made. We recommend no change to these retirement rates at this time.

#### **Elected Officials**

Elected officials may retire with a normal, unreduced retirement benefit upon the earlier of (a) age 60 and six years of elected service or (b) “Rule of 80”. They may also retire with an early, reduced retirement benefit upon reaching age 55 and completing ten years of creditable service. Under the provisions for early retirement, the benefit is reduced 6% per year before age 60.



### Section III: Demographic Assumptions

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Graphs and detailed tables showing actual versus expected retirement rates are shown in Appendices F-5, F-6, G-5, and G-6. The analysis of the actual retirement experience over the three-year period yields an actual/expected ratio of 47% for early retirement and 46% for unreduced.

Elected members went through only one even year election cycle during the study period, so retirements would be expected to be low. The assumed rates of unreduced retirement for elected officials were adjusted in the prior experience study, so we recommend more time for the actual experience to unfold before recommending any further changes. We recommend no change to the elected officials retirement rates at this time.

#### **Hazardous Duty**

Hazardous Duty members may retire with a normal, unreduced retirement benefit upon the earlier of (a) 20 years of hazardous duty service, (b) age 62 with 6 years of service, or (c) “Rule of 80” (if hired prior to July 1, 1992) or “Rule of 90” (if hired on or after July 1, 1992). They may also retire with an early, reduced retirement benefit upon reaching age 55 and completing ten years of creditable service. Under the provisions for early retirement, the benefit is reduced 1/15<sup>th</sup> for each of the first five years before age 62 and 1/30<sup>th</sup> per year for the next two years.

Graphs and detailed tables showing actual versus expected retirement rates are shown in Appendices F-7 to F-9 and G-7 to G-9. Note that unreduced retirement has an assumption that is split into a service based component (for those eligible for the 20 years of service) and an age based component (for those eligible due to age, but with less than 20 years of service). Early retirement had an actual to expected ratio of 115% and the service-based unreduced component had a ratio of 107%, indicating slightly higher than expected usage, while the age-based unreduced retirement had a ratio of 91%, indicating that retirements were delayed past what was expected.

Because of the small size of the group, the observed patterns are not significant enough departures to suggest any significant change in behavior has occurred. We recommend no change to the normal retirement rates at this time.

#### **URSJJ**

URSJJ members may retire with a normal, unreduced retirement benefit upon the earlier of (a) 65 with eight years of service, (b) age 60 with ten years of service or (c) “Rule of 80”. No early retirement option is available for judges.

Detailed tables showing actual versus expected retirement rates are shown in Appendices F-10 and G-10. The analysis of the actual retirement experience over the three-year period yields an actual/expected ratio of 55%.

Since the actual/expected ratio was 116% during the prior experience study period, we do not see a pattern emerging at this point. Because of the relatively small size of the active population, we are not surprised to see such variation. We recommend no change to the normal retirement rates at this time, but continued analysis over the next experience study period.



### **Rates of Disability Retirement**

The rates of disability used in the actuarial valuation project the percentage of employees who are expected to become disabled each year and begin to receive a disability retirement benefit. In order to qualify for disability benefits, the member must have at least eight years of service and qualify for Social Security or Railroad Retirement Board disability benefits.

Graphs and detailed tables showing actual versus expected disability rates are shown in Appendices F-11 to F-13 and G-11 to G-13.

OPERS disability experience was investigated separately for males and females. The analysis of the actual disability experience for male and females members over the three-year experience period yields an actual/expected ratio of 47% and 72% respectively. We recommend lowering the rates at older ages, which changes the ratios to 57% and 81% respectively.

In making this change, we considered two factors. First, the prior study produced a similar pattern of results, adding credibility to our analysis. Secondly, disability utilization is sometimes correlated with the economy in that individuals are often more prone to push for receiving a disability award when other job prospects are bleak. Since we observed fewer disabilities than expected in a period with high unemployment, we have additional confidence in lowering the rates.

The same disability rates that are used for regular OPERS members are also used for the hazardous duty members. We analyzed the hazardous duty males (there are not enough females to be credible) to see if the same rates are still appropriate. While it appears that hazardous duty members do have higher disability utilization than regular members, the analysis suggests that we can use the same set of rates for both groups.

### **Rates of Withdrawal**

The rates of withdrawal are used to determine the expected number of separations from active service that will occur prior to attaining the eligibility requirement for a retirement benefit as a result of resignation or dismissal.

The current URSJJ termination rates are 2% for all years of service. Termination from employment for reasons other than death, disability or retirement is uncommon in Judges' systems across the country. Actual experience suggests lower termination rates may be appropriate, but is based on limited data. We recommend this assumption be maintained for another experience study cycle, but continue to be monitored.



### Section III: Demographic Assumptions

The current OPERS assumption utilizes a service based approach that sets the withdrawal rates based on years of service. The prior experience study increased the initial or select service period to ten years and grouped members with five through nine years of service together for purposes of developing the termination of employment rates.

Withdrawal experience was investigated both with and without regard to gender. No appreciable difference was discovered, so we recommend continuing to use unisex rates. We also examined withdrawal rates on a duration basis only, but did not find the quality of fit to be a compelling reason to change.

The analysis of the actual withdrawal experience for all members over the three-year period indicates an overall actual/expected ratio of 97%. This ratio indicates that a few less members withdrew during the study period than expected. Appendices F-14 through F-23 and G-14 through G-23 show in detail the actual/expected ratio by years of service.

| Service | Exposure | Actual Withdrawals | Expected Withdrawals | A/E Ratio | Proposed Expected | Proposed A/E Ratio |
|---------|----------|--------------------|----------------------|-----------|-------------------|--------------------|
| Under 2 | 14,876   | 3,094              | 3,199                | 97%       | 3,199             | 97%                |
| 2       | 8,833    | 1,312              | 1,310                | 100%      | 1,310             | 100%               |
| 3       | 7,419    | 907                | 975                  | 93%       | 975               | 93%                |
| 4       | 5,755    | 578                | 623                  | 93%       | 623               | 93%                |
| 5       | 4,477    | 412                | 342                  | 120%      | 369               | 112%               |
| 6       | 4,000    | 325                | 300                  | 108%      | 312               | 104%               |
| 7       | 4,013    | 301                | 293                  | 103%      | 293               | 103%               |
| 8       | 3,881    | 278                | 276                  | 101%      | 276               | 101%               |
| 9       | 3,586    | 204                | 248                  | 82%       | 214               | 95%                |
| Over 9  | 32,058   | 1,061              | 1,211                | 88%       | 1,132             | 94%                |
| Total   | 88,898   | 8,472              | 8,777                | 97%       | 8,703             | 97%                |

The data reflect a general increase in the rates of withdrawal for those members with five, six or ten or more years of service and a general decrease in rates of withdrawal for members with nine years of service. As a result, we recommend adjusting withdrawal rates to more closely reflect the actual experience. The complete tables of recommended withdrawal rates are shown in Appendix G.

#### Probability of Electing a Vested Benefit

When a vested member terminates employment, the member (eventually) chooses to either take a deferred retirement benefit or to receive a refund of member contributions in lieu of the deferred benefit. In the last experience study, an assumption for the frequency of this election was introduced for OPERS regular members. Because of the benefit structure, retirement eligibility, and demographic make-up of elected officials, hazardous duty members, and URSJJ members, these members are not expected to take a refund.

Appendices F-24 and G-24 show the analysis of the last three years' experience. Based on this, we have proposed lowering the rates of electing a vested benefit at most ages. When the initial



rates were set last time, they were intentionally set high because it was a new assumption. Because the recent experience continues to reflect the lower rates observed last time, we have some additional confidence in this adjustment. Because the recent economic situation has been so negative, we suspect that some members withdrew their money because of pressing needs who would not have done so in more normal times. Consequently, we are still being cautious in moving toward the observed rates.

### **Rates of Salary Increase**

Under the “building block” approach recommended in ASOP 27, this assumption is composed of three components; inflation, productivity (real wage increases), and merit/promotion. The inflation and productivity components are combined to produce the assumed rates of wage inflation. The rate represents the “across the board” average annual increase in salaries shown in the experience data. The merit component includes the additional increases in salary due to performance, seniority, promotions, etc.

The past three years salary experience has been influenced by a number of factors. With pressures on state and local budgets, employers responded with strategies such as pay freezes or cuts and furloughs. As a result, our analysis was very limited in usefulness. By aggregating all experience, we observe a pattern of wage growth that trends downward with age, just as assumed. We do note that actual increases at younger age were higher than expected, but at most ages, they were lower. However, in light of the broader issues affecting pay during this period, we are not comfortable making any adjustments.

Detailed salary increase rates at all ages are shown in Appendices F-25 and G-25. Since we lowered the wage growth assumption from 4.25% to 4.0%, we recommend a similar decrease in the age by age salary scale for all members.

For URSJJ, a flat 5.5% assumption was used. The same data issues noted above are valid here as well. With the wage growth assumption being reduced from 4.25% to 4.0%, we recommend reducing the assumption to 5.25%.

### **Miscellaneous Assumptions**

**Percent Married:** Currently 85% of members are assumed to be married with the husband four years older than the wife. This is a common and reasonable assumption and we recommend maintaining this assumption.

**Missing Data:** In preparing the valuation data, certain data items are missing, unavailable, or unreasonable. In such cases, we have developed assumptions for what the data element should be. These assumptions are described in Appendices D and E. We recommend keeping these assumptions.



## Actuarial Methods

Actuarial valuations utilize methods to determine the liabilities, assets, and costs. While these are not like other assumptions that may change over time, an experience study is still a good opportunity to review these methods to see if they are still appropriate for systematically funding the promised benefits. Significant methods are described below.

**Actuarial Cost Method:** The cost method is used to allocate the present value of benefits between past service (actuarial accrued liability) and future service (normal cost). Currently the valuation uses the entry age normal cost method. This is the most widely used cost method of large public sector plans and has demonstrated the highest degree of stability as compared to alternative methods. We recommend no change in the use of this method.

**Actuarial Value of Assets:** The purpose of the asset smoothing is to dampen the impact that market volatility has on valuation results by spreading the unexpected market gains and losses over several years. Currently the System uses a smoothing method that recognizes 20% of the difference between the market value of assets and the expected actuarial value of assets, based on the assumed rate of return. The actuarial value of assets cannot be less than 80% or more than 120% of market value. We recommend no change in the use of this method.

**Amortization Method:** The unfunded actuarial accrued liability is amortized using a level percentage of payroll method over the amortization period. The period is a fixed 20 year period, starting July 1, 2007. The payroll growth assumption is used to determine the percentage of payroll required over the remaining amortization period to fully amortize the unfunded liability. The current wage inflation assumption is being changed from 4.25% to 4.00%. We recommend the same change for the payroll growth assumption be made.

**COLA Reserve:** Historically, the Legislature has granted COLAs that have averaged around 4% every other year. To reflect this, a 2% COLA is built into actuarial liability and cost calculations. Each year, the COLA reserve is credited with an amount equal to 2% of the retiree liability plus interest on the prior year reserve. When a COLA is granted, the reserve is reduced by the resulting increase in liability. HB 2132 will restrict COLAs that are not otherwise directly funded. Consequently, we propose eliminating the COLA reserve provided the legislation is signed into law. (If the legislation is not passed, we will continue with the current methodology.)

**Historical June CPI (U) Index**

| Year | CPI (U) | Year | CPI (U) |
|------|---------|------|---------|
| 1959 | 29.10   | 1985 | 107.60  |
| 1960 | 29.60   | 1986 | 109.50  |
| 1961 | 29.80   | 1987 | 113.50  |
| 1962 | 30.20   | 1988 | 118.00  |
| 1963 | 30.60   | 1989 | 124.10  |
| 1964 | 31.00   | 1990 | 129.90  |
| 1965 | 31.60   | 1991 | 136.00  |
| 1966 | 32.40   | 1992 | 140.20  |
| 1967 | 33.30   | 1993 | 144.40  |
| 1968 | 34.70   | 1994 | 148.00  |
| 1969 | 36.60   | 1995 | 152.50  |
| 1970 | 38.80   | 1996 | 156.70  |
| 1971 | 40.60   | 1997 | 160.30  |
| 1972 | 41.70   | 1998 | 163.00  |
| 1973 | 44.20   | 1999 | 166.20  |
| 1974 | 49.00   | 2000 | 172.40  |
| 1975 | 53.60   | 2001 | 178.00  |
| 1976 | 56.80   | 2002 | 179.90  |
| 1977 | 60.70   | 2003 | 183.70  |
| 1978 | 65.20   | 2004 | 189.70  |
| 1979 | 72.30   | 2005 | 194.50  |
| 1980 | 82.70   | 2006 | 202.90  |
| 1981 | 90.60   | 2007 | 208.35  |
| 1982 | 97.00   | 2008 | 218.82  |
| 1983 | 99.50   | 2009 | 215.69  |
| 1984 | 103.70  | 2010 | 217.96  |



## Capital Market Assumptions and Asset Allocation

### Rates of Return and Standard Deviation by Asset Class

| Asset Class           | Arithmetic Mean Return | Standard Deviation |
|-----------------------|------------------------|--------------------|
| US Large Cap Equity   | 9.42%                  | 17.00%             |
| US Small Cap Equity   | 10.38%                 | 20.50%             |
| US Fixed              | 3.30%                  | 4.50%              |
| International Stock   | 9.57%                  | 18.00%             |
| Emerging Market Stock | 12.27%                 | 29.00%             |
| TIPS                  | 3.20%                  | 4.50%              |
| US Government Bonds   | 3.17%                  | 6.00%              |

### Asset Class Correlation Coefficients

|               | US Lrg | US Sml | Fixed | Intl  | EM    | TIPS | US Gov |
|---------------|--------|--------|-------|-------|-------|------|--------|
| US Large Cap  | 1.00   | 0.85   | 0.18  | 0.81  | 0.58  | 0.08 | -0.03  |
| US Small Cap  | 0.85   | 1.00   | 0.10  | 0.73  | 0.66  | 0.08 | -0.03  |
| US Fixed      | 0.18   | 0.10   | 1.00  | 0.10  | -0.09 | 0.39 | 0.27   |
| Intl Stock    | 0.81   | 0.73   | 0.10  | 1.00  | 0.73  | 0.05 | -0.02  |
| EM Stock      | 0.58   | 0.66   | -0.09 | 0.73  | 1.00  | 0.05 | -0.12  |
| TIPS          | 0.08   | 0.08   | 0.39  | 0.05  | 0.05  | 1.00 | 0.08   |
| US Government | -0.03  | -0.03  | 0.27  | -0.02 | -0.12 | 0.08 | 1.00   |

### Asset Allocation Targets

| Asset Class           | Allocation Percentages |
|-----------------------|------------------------|
| US Large Cap Equity   | 35.0%                  |
| US Small Cap Equity   | 5.0%                   |
| US Fixed              | 28.8%                  |
| International Stock   | 19.0%                  |
| Emerging Market Stock | 5.0%                   |
| TIPS                  | 3.6%                   |
| US Government Bonds   | 3.6%                   |



### Social Security Administration Wage Index

| Year | Wage Index | Annual Increase | Year | Wage Index  | Annual Increase |
|------|------------|-----------------|------|-------------|-----------------|
| 1957 | \$3,641.72 |                 | 1984 | \$16,135.07 | 5.88%           |
| 1958 | 3,673.80   | 0.88%           | 1985 | 16,822.51   | 4.26            |
| 1959 | 3,855.80   | 4.95            | 1986 | 17,321.82   | 2.97            |
| 1960 | 4,007.12   | 3.92            | 1987 | 18,426.51   | 6.38            |
| 1961 | 4,086.76   | 1.99            | 1988 | 19,334.04   | 4.93            |
| 1962 | 4,291.40   | 5.01            | 1989 | 20,099.55   | 3.96            |
| 1963 | 4,396.64   | 2.45            | 1990 | 21,027.98   | 4.62            |
| 1964 | 4,576.32   | 4.09            | 1991 | 21,811.60   | 3.73            |
| 1965 | 4,658.72   | 1.80            | 1992 | 22,935.42   | 5.15            |
| 1966 | 4,938.36   | 6.00            | 1993 | 23,132.67   | 0.86            |
| 1967 | 5,213.44   | 5.57            | 1994 | 23,753.53   | 2.68            |
| 1968 | 5,571.76   | 6.87            | 1995 | 24,705.66   | 4.01            |
| 1969 | 5,893.76   | 5.78            | 1996 | 25,913.90   | 4.89            |
| 1970 | 6,186.24   | 4.96            | 1997 | 27,426.00   | 5.84            |
| 1971 | 6,497.08   | 5.02            | 1998 | 28,861.44   | 5.23            |
| 1972 | 7,133.80   | 9.80            | 1999 | 30,469.84   | 5.57            |
| 1973 | 7,580.16   | 6.26            | 2000 | 32,154.82   | 5.53            |
| 1974 | 8,030.76   | 5.94            | 2001 | 32,921.92   | 2.39            |
| 1975 | 8,630.92   | 7.47            | 2002 | 33,252.09   | 1.00            |
| 1976 | 9,226.48   | 6.90            | 2003 | 34,064.95   | 2.44            |
| 1977 | 9,779.44   | 5.99            | 2004 | 35,648.55   | 4.65            |
| 1978 | 10,556.03  | 7.94            | 2005 | 36,952.94   | 3.66            |
| 1979 | 11,479.46  | 8.75            | 2006 | 38,651.41   | 4.60            |
| 1980 | 12,513.46  | 9.01            | 2007 | 40,405.48   | 4.54            |
| 1981 | 13,773.10  | 10.07           | 2008 | 41,334.97   | 2.30            |
| 1982 | 14,531.34  | 5.51            | 2009 | 40,711.61   | -1.51           |
| 1983 | 15,239.24  | 4.87            |      |             |                 |



## Oklahoma Public Employees Retirement System

### Actuarial Cost Method

Liabilities and contributions shown in this report are computed using the Individual Entry Age method of funding.

Sometimes called the “funding method,” this is a particular technique used by actuaries for establishing the amount of the annual actuarial cost of pension benefits, or normal cost, and the related unfunded actuarial accrued liability. Ordinarily the annual contribution to the System is comprised of (1) the normal cost and (2) an amortization payment on the unfunded actuarial accrued liability.

Under the Entry Age Actuarial Cost Method, the **Normal Cost** is computed as the level percentage of pay which, if paid from the earliest time each member would have been eligible to join the System if it then existed (thus entry age) until his retirement or termination, would accumulate with interest at the rate assumed in the valuation to a fund sufficient to pay all benefits under the System.

The **Actuarial Accrued Liability** under this method, at any point in time, is the theoretical amount of the fund that would have accumulated had annual contributions equal to the normal cost been made in prior years (it does not represent the liability for benefits accrued to the valuation date). The **Unfunded Actuarial Accrued Liability** is the excess of the actuarial accrued liability over the actuarial value of System assets on the valuation date.

Under this method, experience gains or losses, i.e. decreases or increases in actuarial accrued liabilities attributable to deviations in experience from the actuarial assumptions, adjust the unfunded actuarial accrued liability.

### Asset Valuation Method

The actuarial value of assets is based on a five-year moving average of expected and actual market values determined as follows:

- at the beginning of each fiscal year, a preliminary expected actuarial asset value is calculated as the sum of the previous year’s actuarial value increased with a year’s interest at the System valuation rate plus net cash flow adjusted for interest (at the same rate) to the end of the previous fiscal year;
- the expected actuarial asset value is set equal to the preliminary expected actuarial value plus the unrecognized investment gains and losses as of the beginning of the previous fiscal year;
- the difference between the expected actuarial asset value and the market value is the investment gain or loss for the previous year;



## **Oklahoma Public Employees Retirement System**

- the (final) actuarial asset value is the preliminary value plus 20% of the investment gains and losses for each of the five previous fiscal years, but in no case more than 120% of the market value or less than 80% of the market value.

### **Amortization Method**

Effective July 1, 2008, the unfunded actuarial accrued liability is amortized as a level percent of payroll over a 20-year closed period commencing July 1, 2007. Given a stable active workforce, this amortization method is expected to produce a payment stream that is constant as a percent of covered payroll.

### **Valuation Procedures**

The actuarial accrued liability held for nonvested, inactive members who have a break in service, or for nonvested members who have quit or been terminated, even if a break in service has not occurred as of the valuation date, is equal to the amount of the individual's unclaimed contributions.

The wages used in the projection of benefits and liabilities are considered earnings for the year ending June 30, 2010, increased by the salary scale to develop expected earnings for the current valuation year.

Earnings are annualized for members with less than twelve months of reported earnings.

In computing accrued benefits, average earnings are determined using actual pay history provided for valuation purposes.

The calculations for the required employer contribution are determined as of mid-year. This is a reasonable estimate since contributions are made on a monthly basis throughout the year.

We do not value the 415 limit for active participants. The impact was assumed to be *de minimus*.

The compensation limitation under IRC Section 401(a)(17) is considered in this valuation.

Liability is included for members who appear to be deferred vested, but who are not in the vested data provided. An estimated benefit was calculated based on pay and service from prior valuations. A corrected benefit and status will be provided by the System when the actual benefit and status have been finalized.

Members who are contributing to the System, but have not yet filled out an enrollment application, are included as active members. Service for this group was provided by the System.



## **Oklahoma Public Employees Retirement System**

### **Valuation Procedures**

(continued)

A liability is included for contribution amounts due to be refunded to terminated vested members who made voluntary contributions to increase the maximum compensation limit prior to July 1, 1998. The System supplied the included amounts.

If HB 2132 is passed, the remainder of this paragraph will not apply. The System uses an assumption of a 2% annual COLA each year in developing liabilities and contribution rates. The System does not have an automatic COLA provision, but ad hoc COLAs have historically been granted by the Legislature every other year. In order to avoid actuarial gains in the year in which a COLA is not granted and an actuarial loss in the years in which a COLA is granted, the System's liabilities include a "COLA Reserve". The COLA Reserve is included in the actuarial accrued liability to account for expected cost of living adjustments to the benefits of retired participants that have not been granted by the valuation date. Any ad hoc increase granted will decrease the reserve amount by the cost of the increase. When the cost of an ad hoc increase is greater than the amount of the reserve, the reserve is set to zero and the period for calculating ungranted increases is set to the valuation date.



## Oklahoma Public Employees Retirement System

### SUMMARY OF ACTUARIAL ASSUMPTIONS

#### Economic Assumptions

**Investment Return:** 7.5% net of investment expenses per annum, compounded annually

**Salary Increases:** Sample rates below (midpoint of range shown):

| <u>Nearest Age</u> | <u>% Increase</u> |
|--------------------|-------------------|
| 20 - 24            | 8.75              |
| 25 - 29            | 7.75              |
| 30 - 34            | 6.45              |
| 35 - 39            | 5.85              |
| 40 - 44            | 5.55              |
| 45 - 49            | 5.15              |
| 50 - 54            | 4.85              |
| 55 - 59            | 4.85              |
| 60 - 64            | 4.85              |
| 65+                | 4.85              |

**Payroll Growth:** 4.00% per year

#### **Ad hoc benefit increase assumptions**

Monthly benefits 2% per year (If HB 2132 passes, this will be 0%)

Medical Supplement No increases assumed

**Projection of 401(a)(17) compensation limit:** Projected with inflation at 3.0%



## Oklahoma Public Employees Retirement System

### Demographic Assumptions

| Retirement age:<br>Non-elected members |                    | Annual Rates of Retirement<br>Per 100 Eligible Members |                                             |
|----------------------------------------|--------------------|--------------------------------------------------------|---------------------------------------------|
|                                        |                    | Those Eligible<br>For Unreduced<br>Retirement          | Those Eligible<br>For Reduced<br>Retirement |
|                                        | <u>Nearest Age</u> |                                                        |                                             |
|                                        | 50                 | 20                                                     | N/A                                         |
|                                        | 51                 | 20                                                     | N/A                                         |
|                                        | 52                 | 20                                                     | N/A                                         |
|                                        | 53                 | 20                                                     | N/A                                         |
|                                        | 54                 | 20                                                     | N/A                                         |
|                                        | 55                 | 10                                                     | 4                                           |
|                                        | 56                 | 10                                                     | 5                                           |
|                                        | 57                 | 11                                                     | 5                                           |
|                                        | 58                 | 12                                                     | 6                                           |
|                                        | 59                 | 13                                                     | 7                                           |
|                                        | 60                 | 14                                                     | 7                                           |
|                                        | 61                 | 20                                                     | 20                                          |
|                                        | 62                 | 30                                                     | N/A                                         |
|                                        | 63                 | 15                                                     | N/A                                         |
|                                        | 64                 | 15                                                     | N/A                                         |
|                                        | 65                 | 30                                                     | N/A                                         |
|                                        | 66                 | 20                                                     | N/A                                         |
|                                        | 67                 | 20                                                     | N/A                                         |
|                                        | 68                 | 20                                                     | N/A                                         |
|                                        | 69                 | 25                                                     | N/A                                         |
|                                        | 70                 | 100                                                    | N/A                                         |



**Oklahoma Public Employees Retirement System**

**Demographic Assumptions (continued)**

**Retirement age (continued):**  
Elected members

|                    | Annual Rates of Retirement<br>Per 100 Eligible Members |                                             |
|--------------------|--------------------------------------------------------|---------------------------------------------|
|                    | Those Eligible<br>For Unreduced<br>Retirement          | Those Eligible<br>For Reduced<br>Retirement |
| <u>Nearest Age</u> |                                                        |                                             |
| 50                 | 30                                                     | N/A                                         |
| 51                 | 30                                                     | N/A                                         |
| 52                 | 30                                                     | N/A                                         |
| 53                 | 30                                                     | N/A                                         |
| 54                 | 30                                                     | N/A                                         |
| 55                 | 10                                                     | 10                                          |
| 56                 | 10                                                     | 10                                          |
| 57                 | 20                                                     | 10                                          |
| 58                 | 20                                                     | 10                                          |
| 59                 | 20                                                     | 10                                          |
| 60                 | 20                                                     | N/A                                         |
| 61                 | 20                                                     | N/A                                         |
| 62                 | 20                                                     | N/A                                         |
| 63                 | 20                                                     | N/A                                         |
| 64                 | 20                                                     | N/A                                         |
| 65                 | 20                                                     | N/A                                         |
| 66                 | 40                                                     | N/A                                         |
| 67                 | 40                                                     | N/A                                         |
| 68                 | 40                                                     | N/A                                         |
| 69                 | 40                                                     | N/A                                         |
| 70                 | 100                                                    | N/A                                         |



## Oklahoma Public Employees Retirement System

### Demographic Assumptions (continued)

**Retirement age (continued):**  
Hazardous Duty

Annual Rates of Retirement  
Per 100 Eligible Members

| <u>Service</u> | <u>Rate</u> | <u>Nearest Age</u> | Less than 20<br>Years of<br><u>Service</u> |
|----------------|-------------|--------------------|--------------------------------------------|
| 20             | 20          | 50                 | N/A                                        |
| 21 - 24        | 15          | 51                 | N/A                                        |
| 25 – 29        | 20          | 52                 | N/A                                        |
| 30 – 34        | 25          | 53                 | N/A                                        |
| 35+            | 100         | 54                 | N/A                                        |
|                |             | 55                 | 4                                          |
|                |             | 56                 | 5                                          |
|                |             | 57                 | 5                                          |
|                |             | 58                 | 6                                          |
|                |             | 59                 | 7                                          |
|                |             | 60                 | 7                                          |
|                |             | 61                 | 20                                         |
|                |             | 62                 | 40                                         |
|                |             | 63                 | 22                                         |
|                |             | 64                 | 25                                         |
|                |             | 65                 | 40                                         |
|                |             | 66                 | 25                                         |
|                |             | 67                 | 23                                         |
|                |             | 68                 | 22                                         |
|                |             | 69                 | 21                                         |
|                |             | 70                 | 100                                        |



## Oklahoma Public Employees Retirement System

### Demographic Assumptions (continued)

#### **Mortality Rates**

|                                                   |                                                                                                                                                                                                |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Active participants and<br>nondisabled pensioners | RP-2000 Combined Active/Retiree Healthy Mortality<br>Table projected to 2010 using Scale AA.                                                                                                   |
| Disabled pensioners                               | RP-2000 Combined Active/Retiree Healthy Mortality<br>Table projected to 2010 using Scale AA set forward 15<br>years for disabled experience.                                                   |
| Hazardous Duty members                            | For Department of Corrections officers, we assumed the<br>mortality rate is 10% higher than the above table while<br>the participant is active. This 10% is assumed to be in-<br>line-of-duty. |

#### **Disability Rates:**

Graduated rates  
  
Disabled rates per 100 members

|            |             |               |
|------------|-------------|---------------|
| Nearest    |             |               |
| <u>Age</u> | <u>Male</u> | <u>Female</u> |
| 20         | 0.01        | 0.01          |
| 30         | 0.02        | 0.03          |
| 40         | 0.08        | 0.10          |
| 50         | 0.25        | 0.29          |
| 60         | 0.75        | 0.45          |



## Oklahoma Public Employees Retirement System

### Withdrawal Rates:

|            | 0 - 2        | 2 - 3        | 3 - 4        | 4 - 5        | 5 - 6        | 6 - 7        | 7 - 8        | 8 - 9        | 9 - 10       | Over 10      |
|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| <u>Age</u> | <u>Years</u> | <u>Years</u> | <u>Years</u> | <u>Years</u> | <u>Years</u> | <u>Years</u> | <u>Years</u> | <u>Years</u> | <u>Years</u> | <u>Years</u> |
| 25         | 0.2600       | 0.2000       | 0.1709       | 0.1369       | 0.1426       | 0.1426       | 0.1426       | 0.1426       | 0.1426       | 0.0700       |
| 30         | 0.2400       | 0.1750       | 0.1554       | 0.1268       | 0.1050       | 0.1050       | 0.1050       | 0.1050       | 0.1004       | 0.0700       |
| 35         | 0.2150       | 0.1590       | 0.1365       | 0.1215       | 0.0870       | 0.0860       | 0.0850       | 0.0850       | 0.0769       | 0.0580       |
| 40         | 0.1930       | 0.1400       | 0.1208       | 0.1094       | 0.0770       | 0.0748       | 0.0725       | 0.0725       | 0.0589       | 0.0440       |
| 45         | 0.1880       | 0.1200       | 0.1132       | 0.0945       | 0.0670       | 0.0635       | 0.0600       | 0.0600       | 0.0468       | 0.0320       |
| 50         | 0.1830       | 0.0970       | 0.1030       | 0.0835       | 0.0650       | 0.0575       | 0.0500       | 0.0500       | 0.0436       | 0.0300       |
| 55         | 0.1800       | 0.0900       | 0.0869       | 0.0705       | 0.0650       | 0.0575       | 0.0500       | 0.0500       | 0.0436       | 0.0300       |

### Probability of Electing Vested Benefit:

| Regular Members Only |             |
|----------------------|-------------|
| <u>Age</u>           | <u>Rate</u> |
| Under 34             | 70%         |
| 34- 38               | 75%         |
| 39 - 46              | 80%         |
| 47                   | 85%         |
| 48                   | 90%         |
| 49                   | 95%         |
| 50+                  | 100%        |

### Marital Status:

Percentage Married 85%

Age difference Males are assumed to be four years older than spouses.

### Children:

Special death benefits are provided upon the in-line-of-duty death of Department of Corrections employees who have young children. We have assumed the average age of the youngest child of such employees is nine and that 50% of such children will attend an institution of higher education to age 22.



**Form of Payment:**

Participants are assumed to elect a life-only form of payment.

**Assumed age for commencement  
of deferred benefits:**

Currently active members assumed to terminate in the future prior to retirement eligibility are assumed to commence benefits at age 62 (non-elected members) or age 60 (elected members). Currently inactive members with deferred benefits are assumed to commence benefits on a date provided by OPERS.

**Provision for expenses:**

Administrative expenses, as budgeted by the Oklahoma Public Employees retirement System.



**State of Oklahoma**  
**Uniform Retirement System of Justices & Judges**

**Entry Age Actuarial Cost Method**

Liabilities and contributions shown in this report are computed using the individual Entry Age Level Percent of Pay actuarial cost. Sometimes called the “funding method,” this is a particular technique used by actuaries for establishing the amount of the annual actuarial cost of pension benefits, or normal cost, and the related unfunded actuarial accrued liability. Ordinarily the annual contribution to the System is comprised of (1) the normal cost and (2) an amortization payment on the unfunded actuarial accrued liability.

Under the Entry Age Actuarial Cost method, the **Normal Cost** is computed as the level percentage of pay which, if paid from the earliest time each member would have been eligible to join the System if it then existed (thus, entry age) until his retirement or termination, would accumulate with interest at the rate assumed in the valuation to a fund sufficient to pay all benefits under the System.

The **Actuarial Accrued Liability** under this method, at any point in time, is the theoretical amount of the fund that would have accumulated had annual contributions equal to the normal cost been made in prior years (it does not represent the liability for benefits accrued to the valuation date). The **Unfunded Actuarial Accrued Liability** is the excess of the actuarial accrued liability over the actuarial value of System assets actually on hand on the valuation date.

Under this method, experience gains or losses, i.e. decreases or increases in actuarial accrued liabilities attributable to deviations in experience from the actuarial assumptions, adjust the unfunded actuarial accrued liability.

**Asset Valuation Method**

The actuarial value of assets is based on a five-year moving average of expected and actual market values determined as follows:

- at the beginning of each fiscal year, a preliminary expected actuarial asset value is calculated as the sum of the previous year’s actuarial value increased with a year’s interest at the System valuation rate plus net cash flow adjusted for interest (at the same rate) to the end of the previous fiscal year;
- the expected actuarial asset value is set equal to the preliminary expected actuarial value plus the unrecognized investment gains and losses as of the beginning of the previous fiscal year;
- the difference between the expected actuarial asset value and the market value is the investment gain or loss for the previous fiscal year;
- the (final) actuarial asset value is the preliminary value plus 20% of the investment gains and losses for each of the five previous fiscal years, but in no case more than 120% of the market value or less than 80% of the market value.



**State of Oklahoma  
Uniform Retirement System of Justices & Judges**

**Amortization Method**

The Unfunded Actuarial Accrued Liability is amortized as a level percentage of payroll over a 20-year period commencing July 1, 2007. Given a stable active workforce, this amortization method is expected to produce a payment stream that remains level as a percent of covered payroll.

**Valuation Procedures**

The actuarial accrued liability held for nonvested, inactive members who have a break in service, or for nonvested members who have quit or been terminated, even if a break in service has not occurred as of the valuation date, is equal to the amount of the individual's unclaimed contributions.

The wages used in the projection of benefits and liabilities are actual earnings for the year ending June 30, 2010 increased by the salary scale to develop expected earnings for the current valuation year. Earnings are annualized for members with less than twelve months of reported earnings.

In computing accrued benefits, average earnings are determined using actual pay history provided for valuation purposes.

The calculations for the required employer contribution are determined as of mid-year. This is a reasonable estimate since contributions are made on a monthly basis throughout the year.

We do not value the 415 limit for active participants. The impact was assumed to be *de minimus*.

The compensation limitation under IRC Section 401(a)(17) is considered in this valuation.

Liability is included for members who appear to be deferred vested, but who are not in the vested data provided. An estimated benefit was calculated based on pay and service reported for prior valuations. A corrected benefit and status will be provided by the System when the actual benefit and status have been finalized.

Members who are contributing to the System, but have not yet filled out an enrollment application, are included as active members. Where data elements are missing, reasonable estimates are used. Service is estimated based on hours worked. Age is based on average entry age for other members. Gender is assigned in proportion to the overall group.



**State of Oklahoma  
Uniform Retirement System of Justices & Judges**

If HB 2132 passes, this paragraph will not apply. The System uses an assumption of a 2% annual COLA each year in developing liabilities and contribution rates. The System does not have an automatic COLA provision, but ad hoc COLAs have historically been granted by the Legislature every other year, with the exception of 2010. In order to avoid actuarial gains in the years in which a COLA is not granted and an actuarial loss in the years in which a COLA is granted, the System's liabilities include a "COLA Reserve". The COLA Reserve is included in the actuarial accrued liability to account for expected cost of living adjustments to the benefits of retired participants that have not been granted by the valuation date. Any ad hoc increase granted will decrease the reserve amount by the cost of the benefit increase. When the cost of an ad hoc increase is greater than the amount of the reserve, the reserve is set to zero and the period for calculating ungranted COLA increases is set to the valuation date.

**Economic Assumptions**

|                                                    |                                                                |
|----------------------------------------------------|----------------------------------------------------------------|
| <b>Investment Return:</b>                          | 7.5% net of investment expenses per annum, compounded annually |
| <b>Salary Increases:</b>                           | 5.25% per year                                                 |
| <b>Payroll Growth:</b>                             | 4.00% per year                                                 |
| <b>Ad hoc benefit increase assumption:</b>         |                                                                |
| <b>Monthly benefits</b>                            | 2% per year (If HB 2132 passes, this will be 0%)               |
| <b>Medical supplement</b>                          | No increases assumed                                           |
| <b>Projection of 410(a)(17) compensation limit</b> | Projected with inflation at 3.0%                               |

**Demographic Assumptions**

**Retirement age:**

Active members

| <u>Attained Age</u> | <u>Annual Rates of Retirement<br/>Per 100 Eligible Members</u> |
|---------------------|----------------------------------------------------------------|
| Below 62            | 10                                                             |
| 62 - 65             | 25                                                             |
| 66 - 67             | 10                                                             |
| 68 - 69             | 30                                                             |
| 70                  | 20                                                             |
| 71 - 74             | 10                                                             |
| 75+                 | 100                                                            |

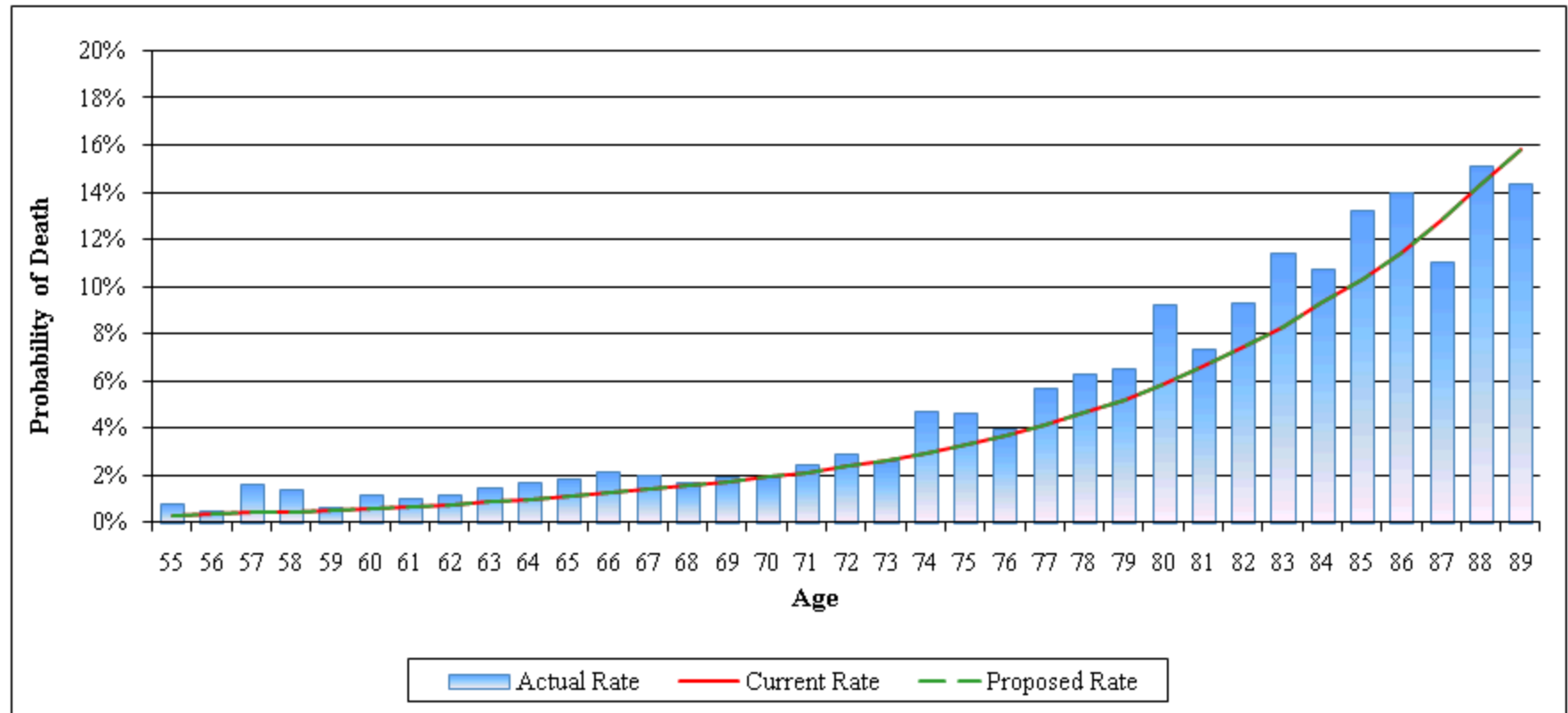



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**State of Oklahoma**  
**Uniform Retirement System of Justices & Judges**

|                                                   |                                                                                                                                                                                                                                        |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Deferred vested members                           | Participants with deferred benefits are assumed to commence benefits on a date provided by URSJJ. Actives expected to terminate with a vested benefit are expected to commence benefits at age 60.                                     |
| <b>Mortality Rates:</b>                           |                                                                                                                                                                                                                                        |
| Active Participants and<br>nondisabled pensioners | RP-2000 Combined Active/Retired Healthy Mortality Table projected to 2010 using Scale AA, setback 1 year.                                                                                                                              |
| Disabled pensioners                               | RP-2000 Combined Active/Retired Healthy Mortality Table projected to 2010 using Scale AA set forward 14 years.                                                                                                                         |
| <b>Separation Rates:</b>                          |                                                                                                                                                                                                                                        |
| Separation for all reasons other<br>than death    | 2% for all years of service.                                                                                                                                                                                                           |
| <b>Disability Rates:</b>                          | 0%                                                                                                                                                                                                                                     |
| <b>Marital Status:</b>                            |                                                                                                                                                                                                                                        |
| Age difference                                    | Males are assumed to be four years older than spouses.                                                                                                                                                                                 |
| Percentage married                                | 85%                                                                                                                                                                                                                                    |
| <b>Other Assumptions:</b>                         |                                                                                                                                                                                                                                        |
| Provisions for expenses                           | Administrative expenses, as budgeted for the Oklahoma Uniform Retirement System for Justices and Judges.                                                                                                                               |
| Form of payment                                   | Active members who were contributing 8% of pay as of August 31, 2005, are assumed to retire with an unreduced benefit payable as a 50% Joint and Survivor annuity. All other members are assumed to retire with a single life annuity. |

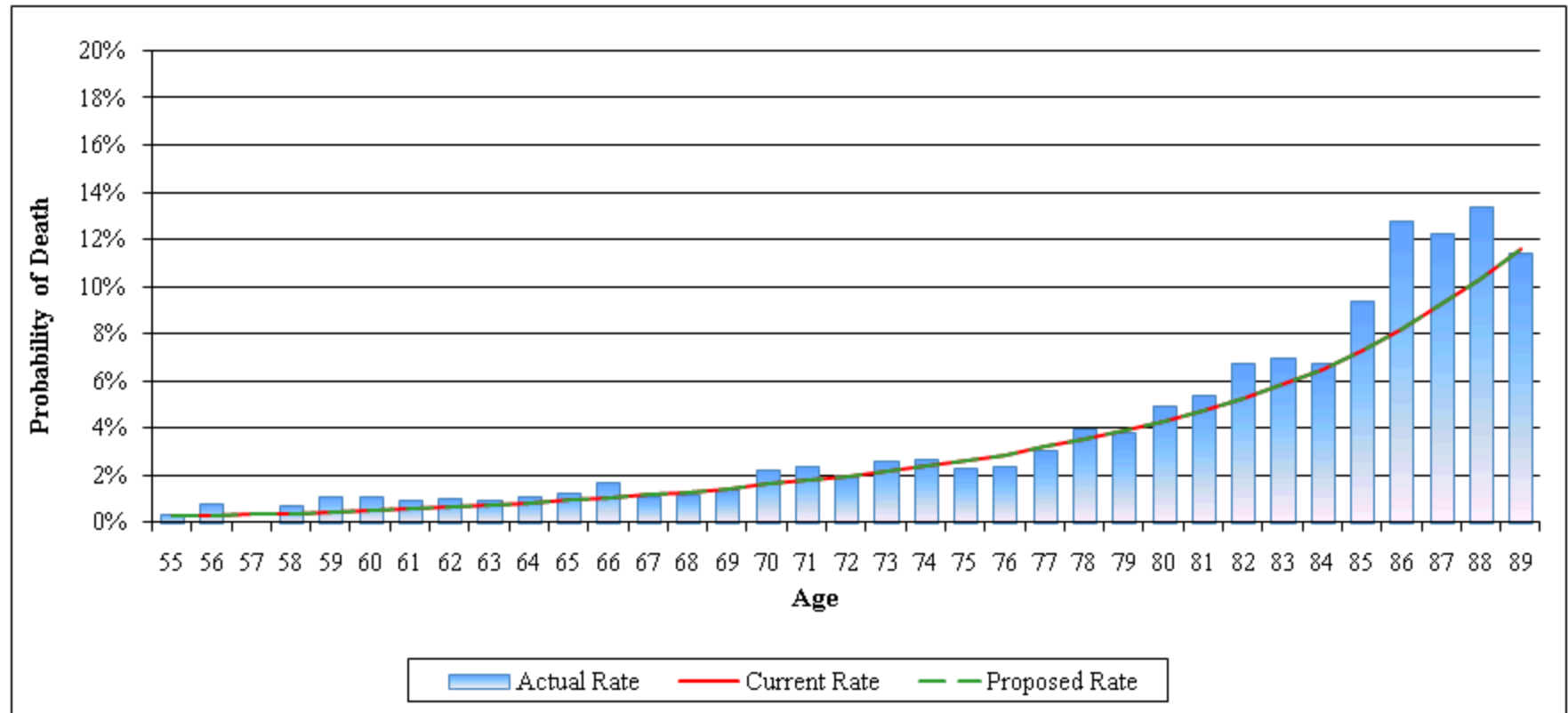
**Appendix F-1**  
**Probability of Death - Healthy Retirees**  
**OPERS - Males**



|                 | Actual | Expected - Current Assumptions | Expected - Proposed Assumptions |
|-----------------|--------|--------------------------------|---------------------------------|
| Total Count     | 1,130  | 884                            | 884                             |
| Actual/Expected |        | 128%                           | 128%                            |

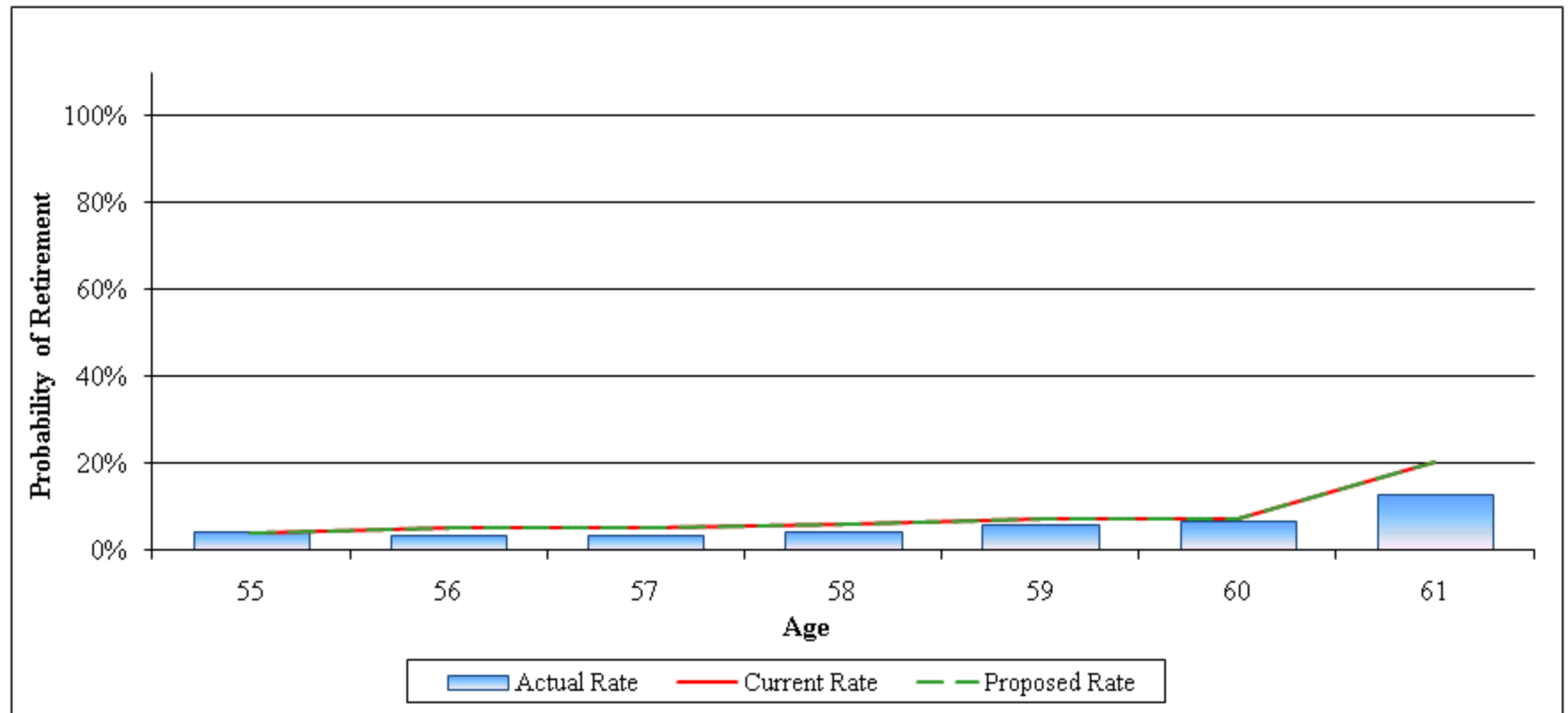


**Appendix F-2**  
**Probability of Death - Healthy Retirees**  
**OPERS - Females**



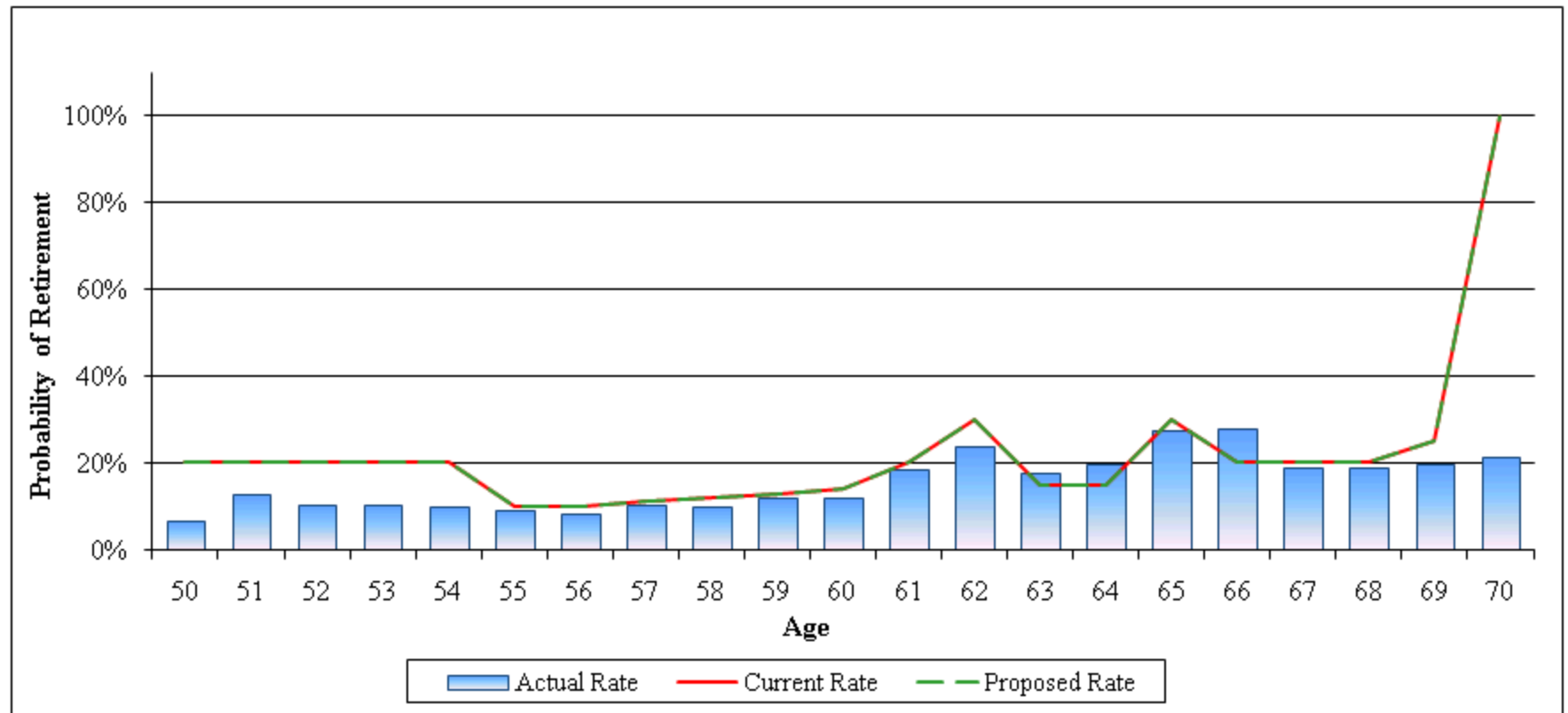
|                 | Actual | Expected - Current Assumptions | Expected - Proposed Assumptions |
|-----------------|--------|--------------------------------|---------------------------------|
| Total Count     | 972    | 815                            | 815                             |
| Actual/Expected |        | 119%                           | 119%                            |

**Appendix F-3**  
**Retirement Rates**  
**Regular - Early**



|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 441    | 572                                  | 572                                   |
| Actual/Expected |        | 77%                                  | 77%                                   |

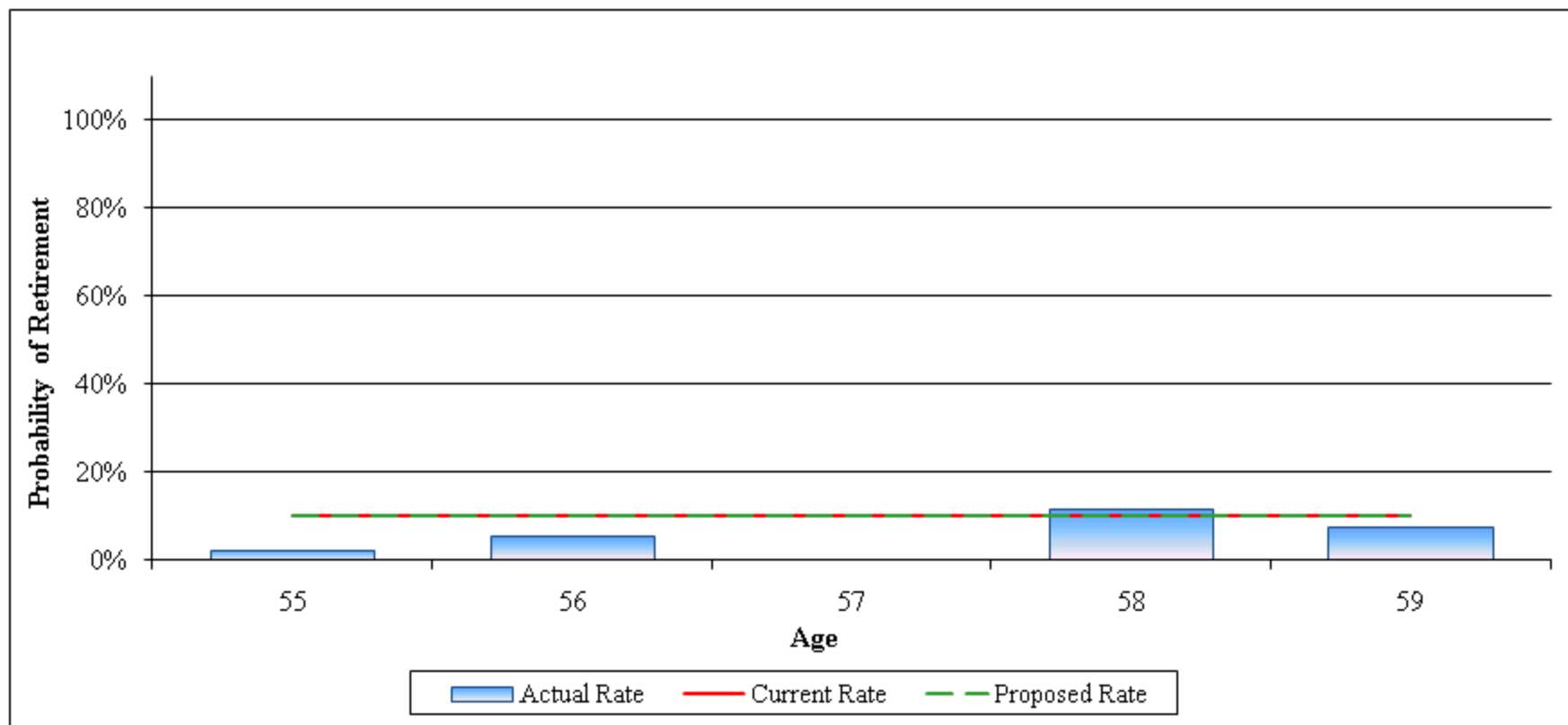
**Appendix F-4**  
**Retirement Rates**  
**Regular - Unreduced**



|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 2,747  | 3,297                                | 3,297                                 |
| Actual/Expected |        | 83%                                  | 83%                                   |

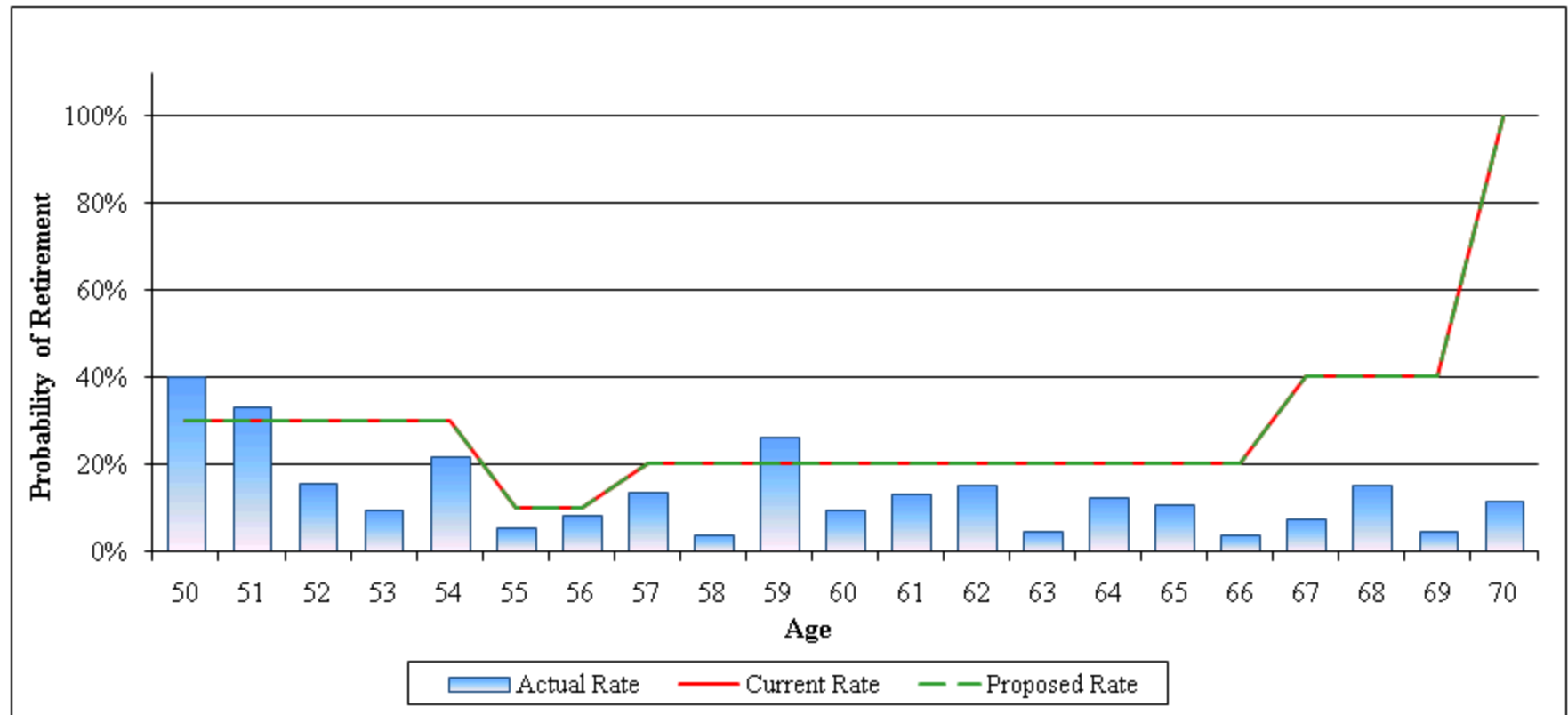


**Appendix F-5**  
**Retirement Rates**  
**Elected Officials - Early**



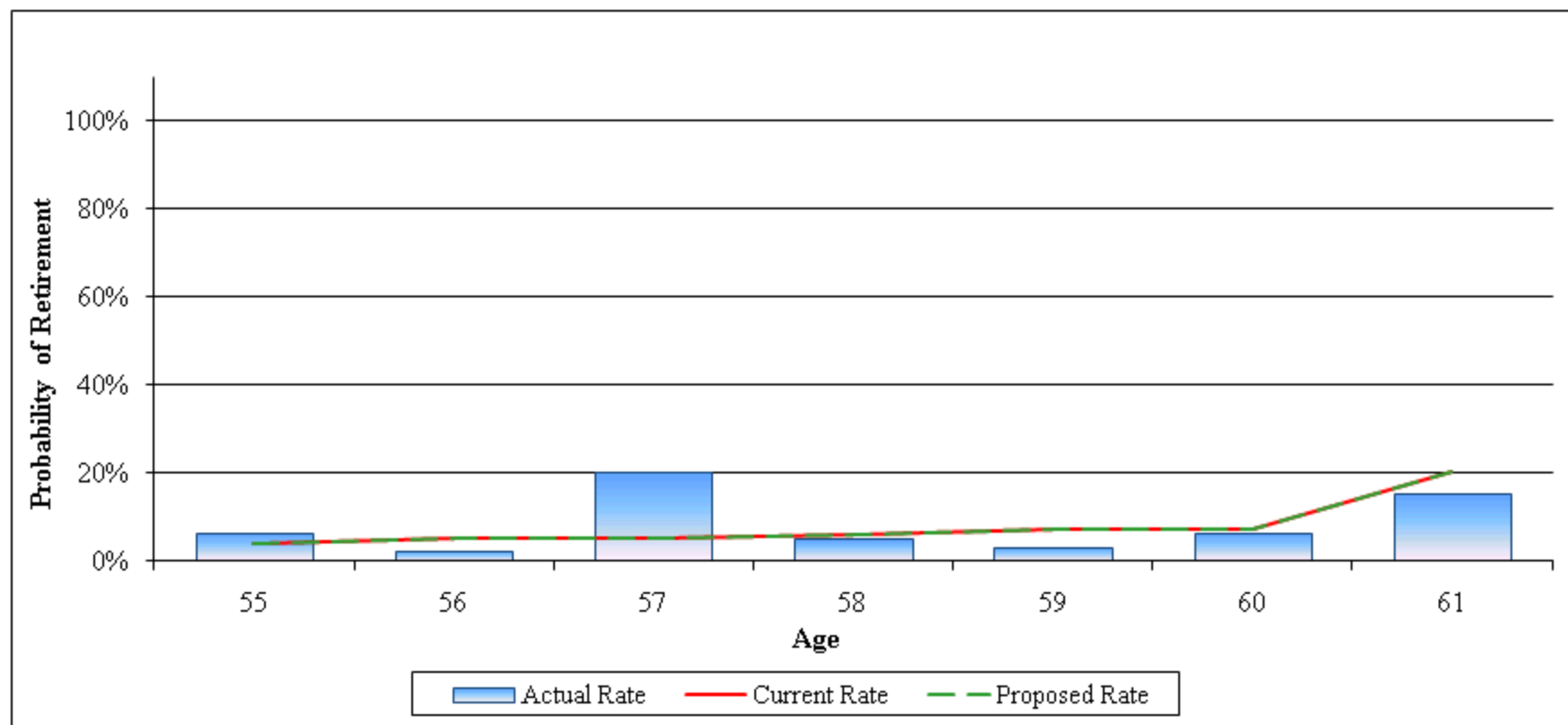
|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 9      | 19                                   | 19                                    |
| Actual/Expected |        | 47%                                  | 47%                                   |

**Appendix F-6**  
**Retirement Rates**  
**Elected Officials - Unreduced**



|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 89     | 192                                  | 192                                   |
| Actual/Expected |        | 46%                                  | 46%                                   |

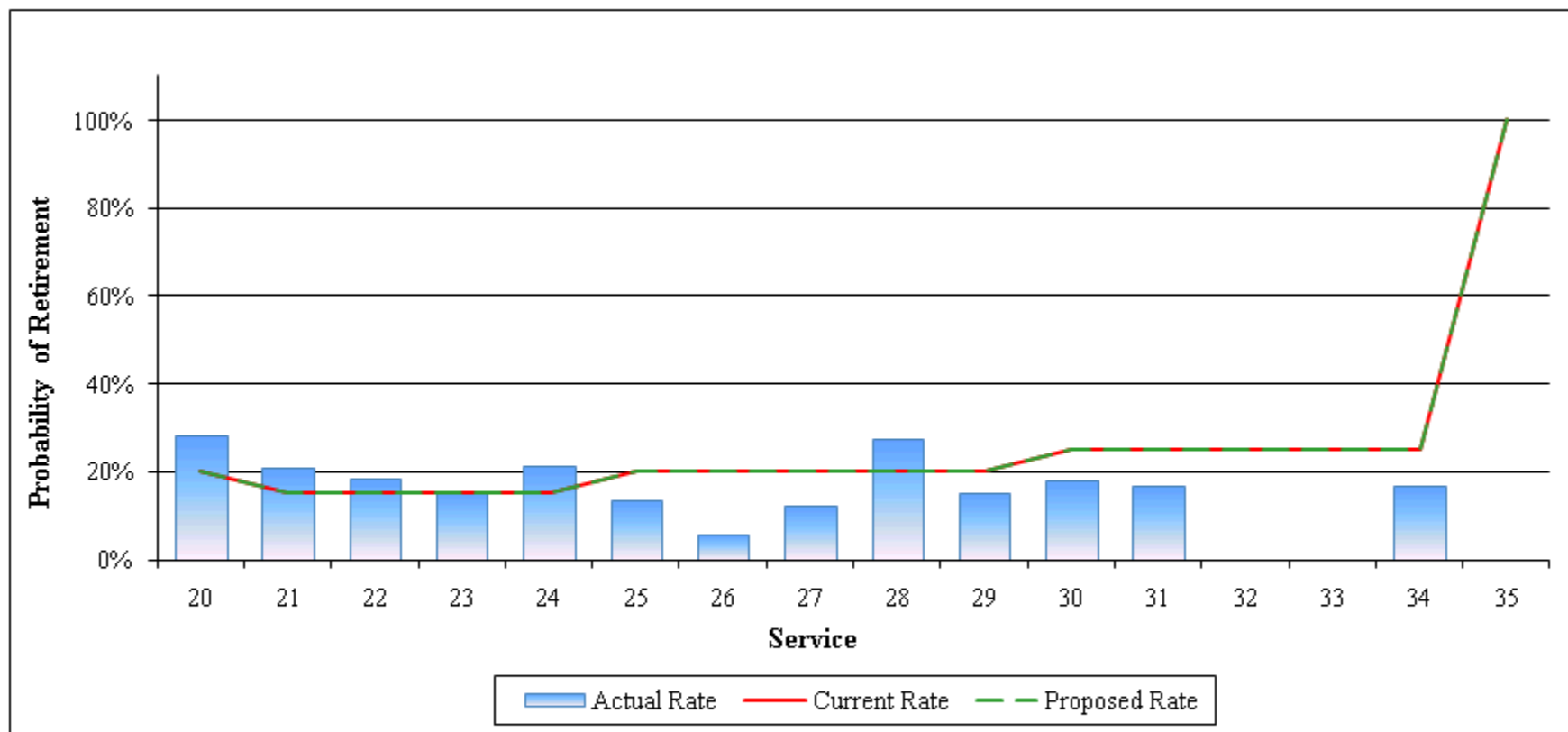
**Appendix F-7**  
**Retirement Rates**  
**Hazardous Duty - Early**



|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 23     | 20                                   | 20                                    |
| Actual/Expected |        | 115%                                 | 115%                                  |

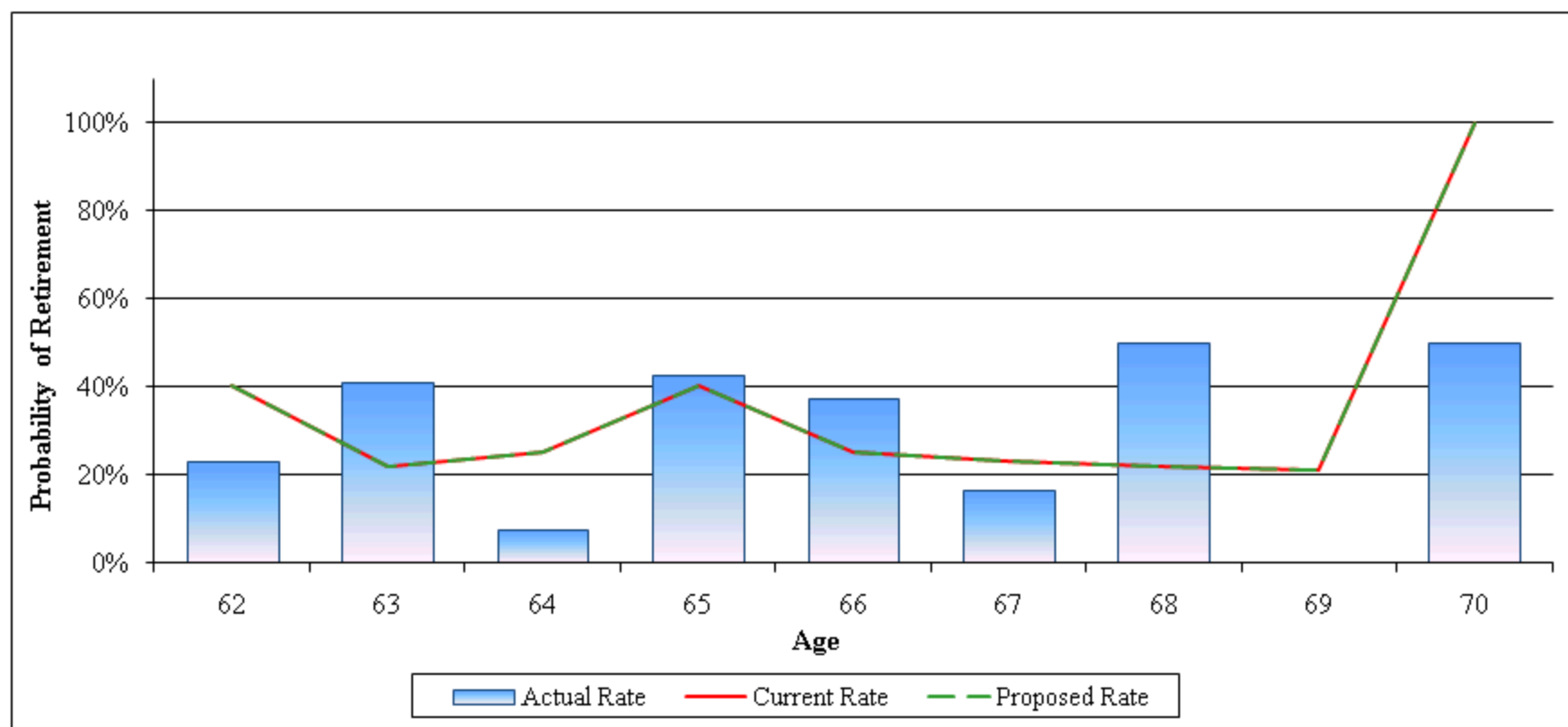


**Appendix F-8**  
**Retirement Rates**  
**Hazardous Duty - Unreduced**



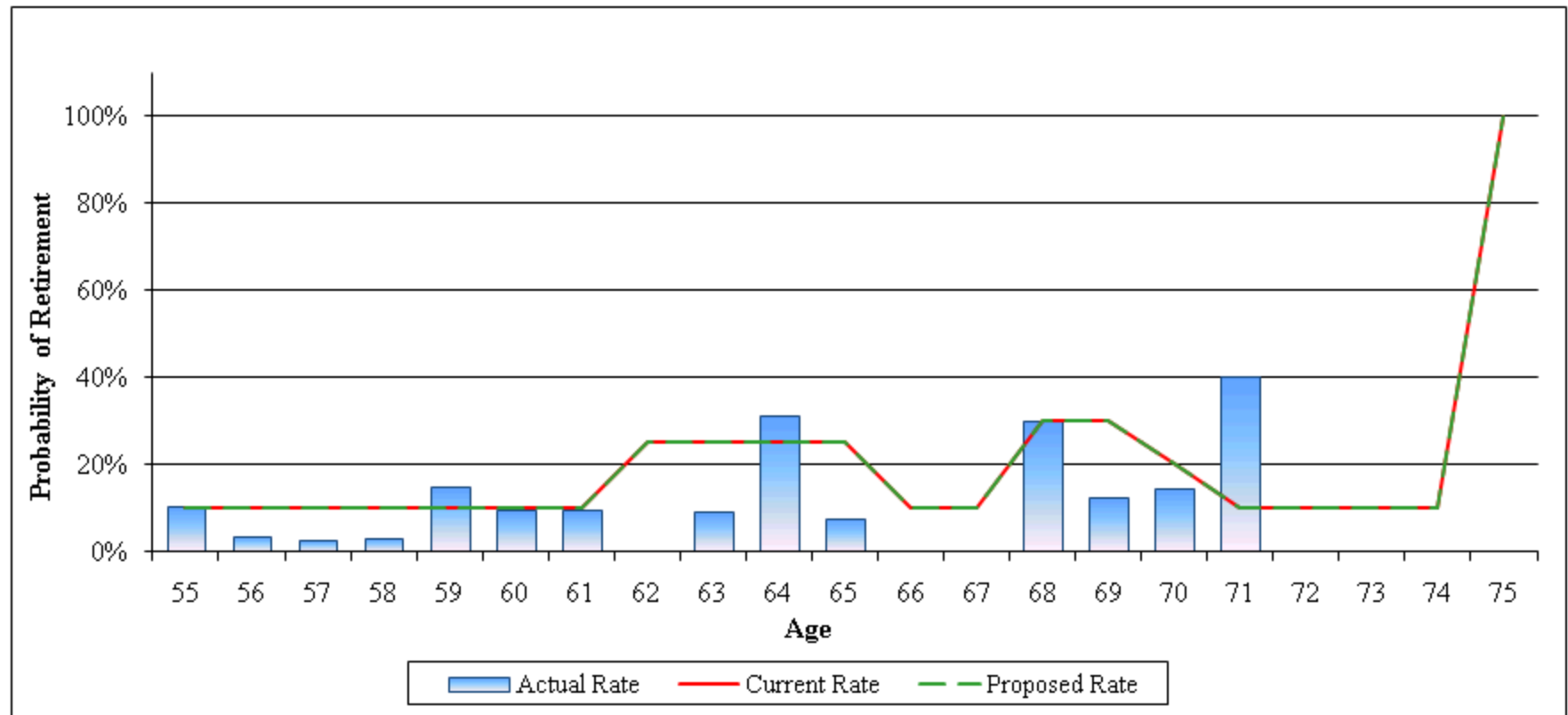
|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 129    | 121                                  | 121                                   |
| Actual/Expected |        | 107%                                 | 107%                                  |

**Appendix F-9**  
**Retirement Rates**  
**Hazardous Duty - Unreduced (Age)**



|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 29     | 32                                   | 32                                    |
| Actual/Expected |        | 91%                                  | 91%                                   |

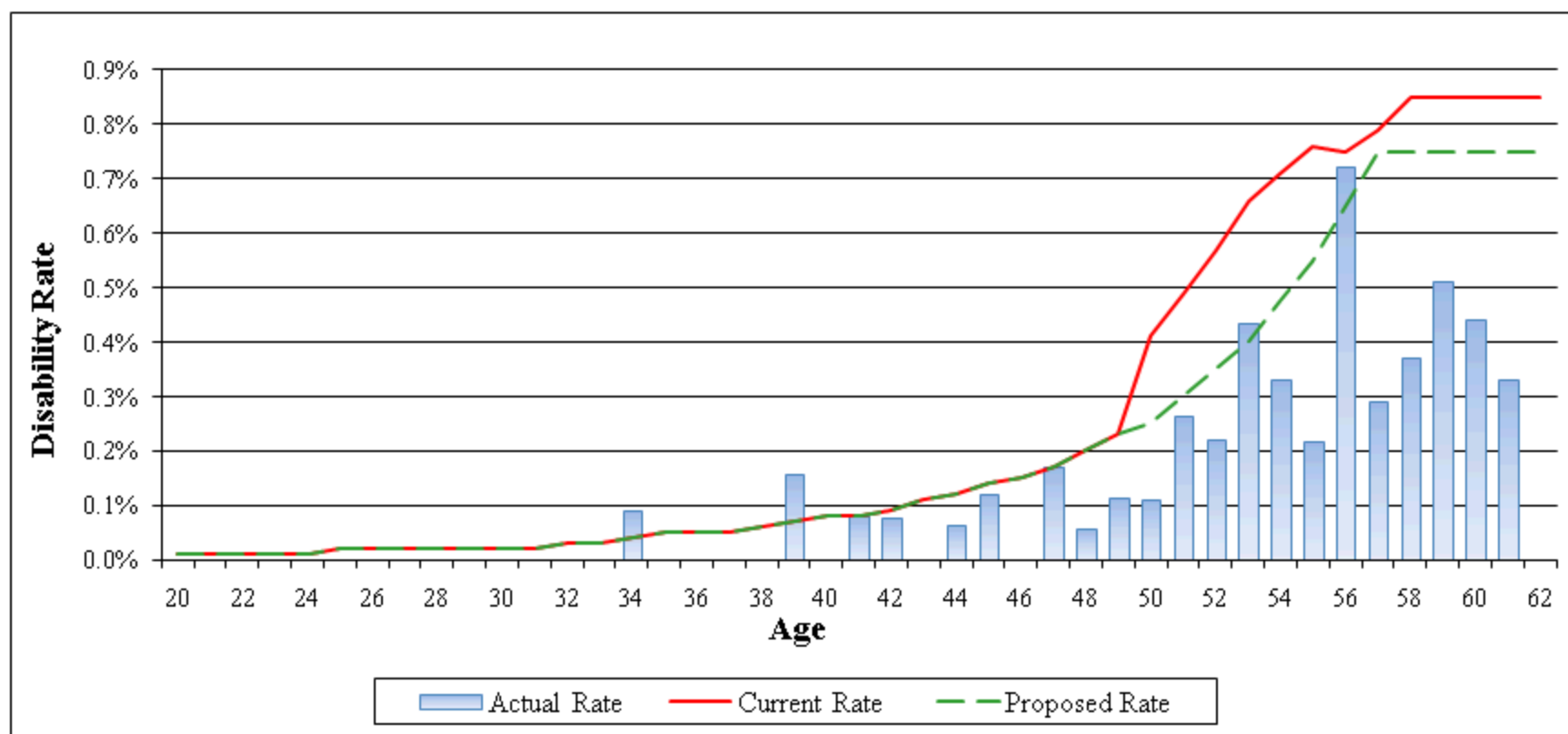
**Appendix F-10**  
**Retirement Rates**  
**URSJJ**



|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 29     | 53                                   | 53                                    |
| Actual/Expected |        | 55%                                  | 55%                                   |



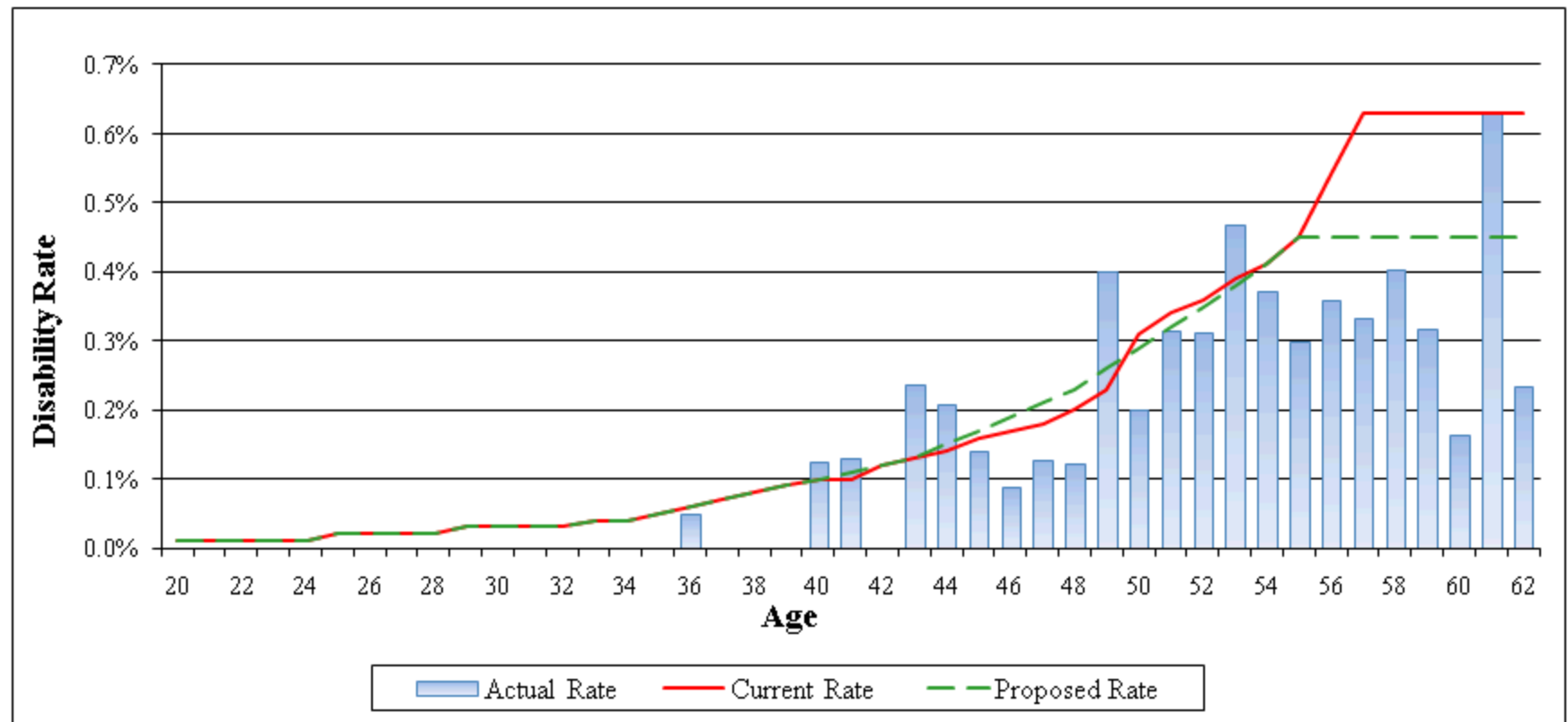
**Appendix F-11**  
**Rate of Disability - Active Lives**  
**OPERS - Males**



|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 87     | 185                                  | 152                                   |
| Actual/Expected |        | 47%                                  | 57%                                   |



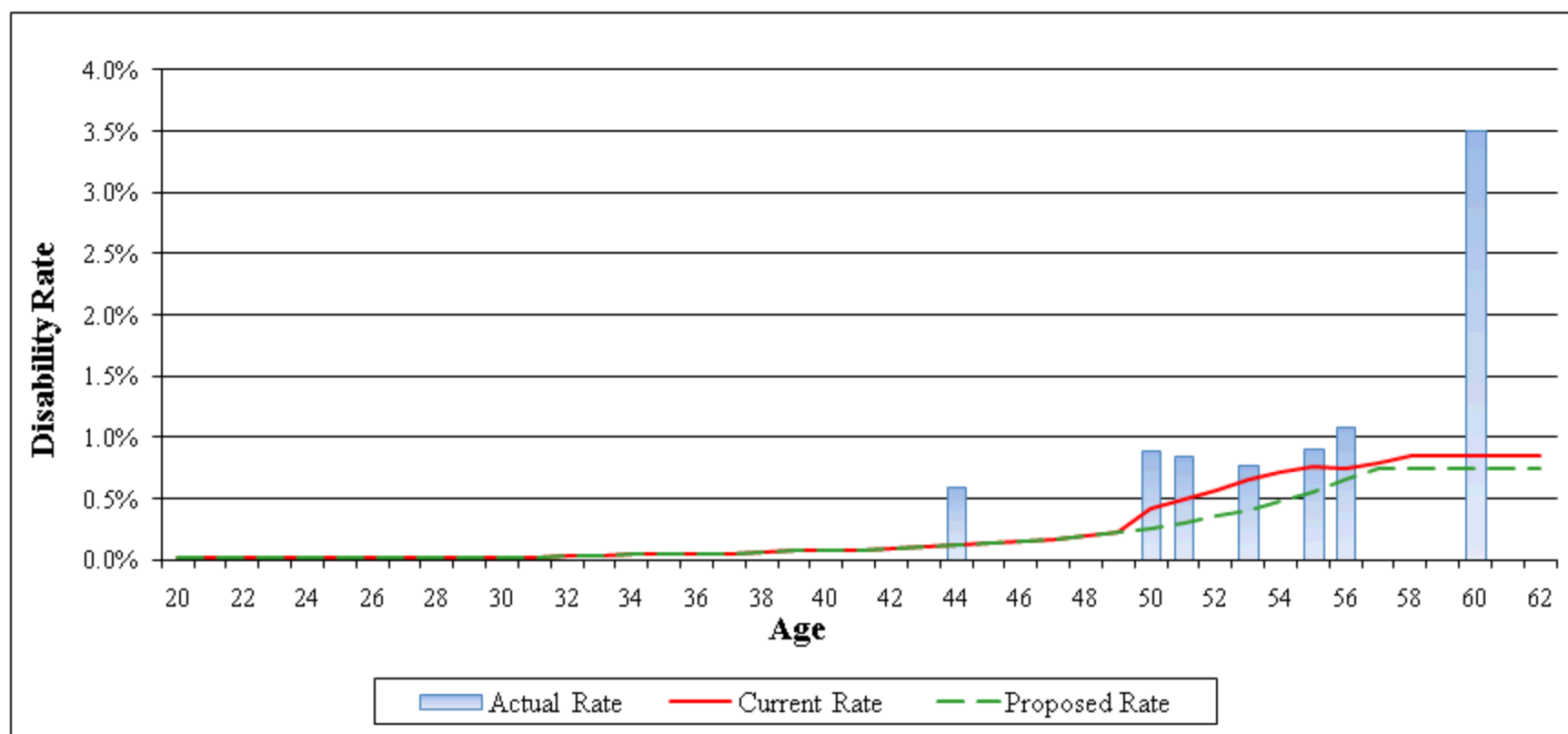
**Appendix F-12**  
**Rate of Disability - Active Lives**  
**OPERS - Females**



|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 128    | 177                                  | 158                                   |
| Actual/Expected |        | 72%                                  | 81%                                   |

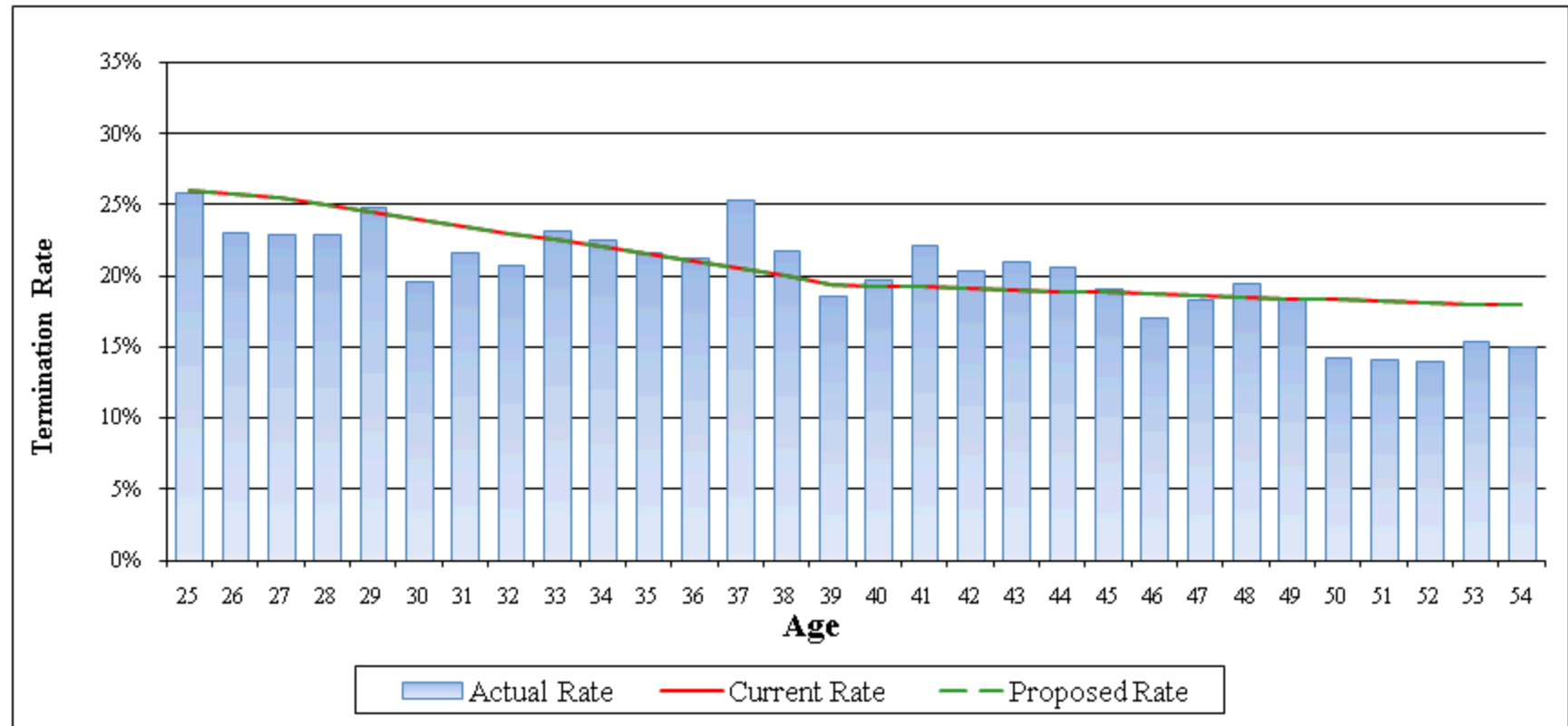


**Appendix F-13**  
**Rate of Disability - Active Lives**  
**Hazardous Duty - Males**



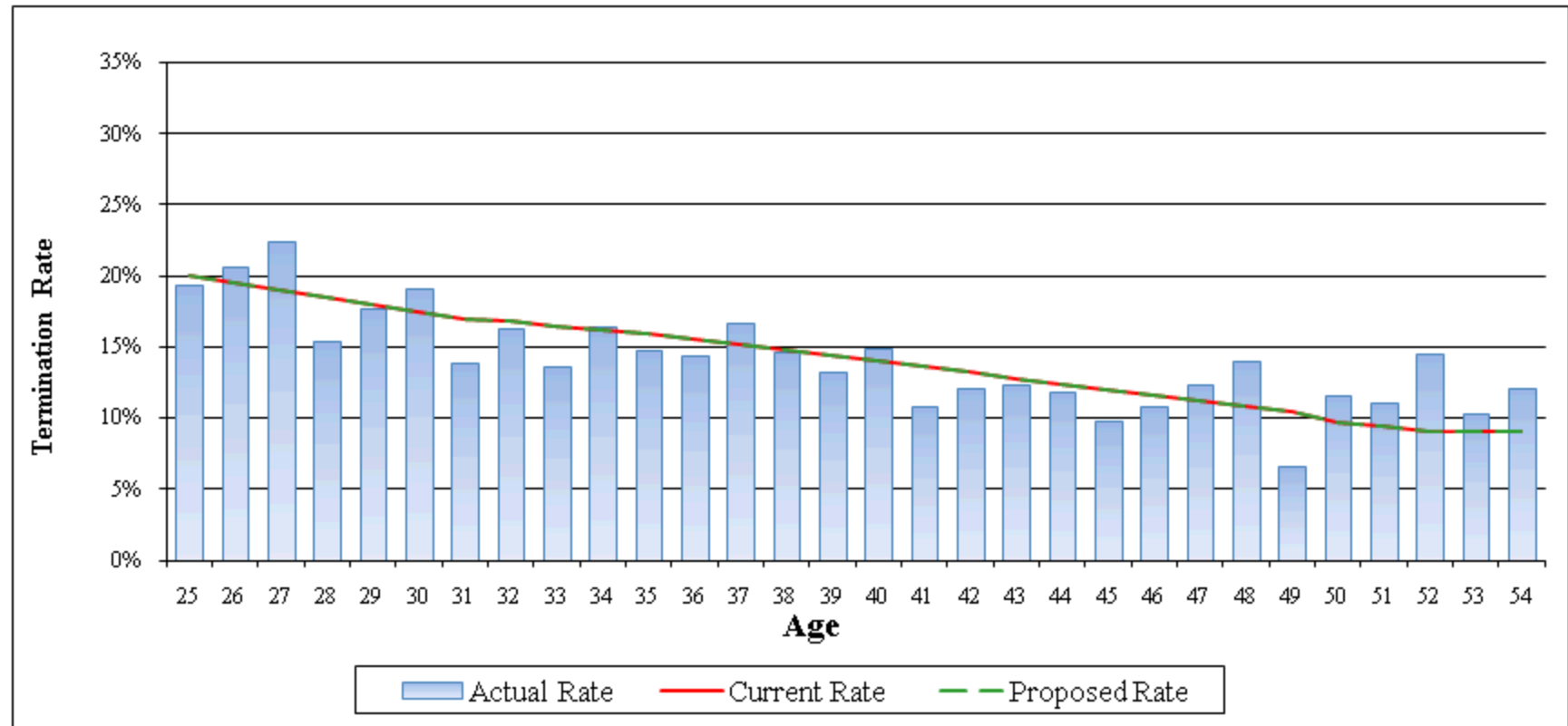
|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 8      | 11                                   | 9                                     |
| Actual/Expected |        | 73%                                  | 89%                                   |

**Appendix F-14**  
**Rate of Termination of Employment**  
**OPERS - Less Than 2 Years**



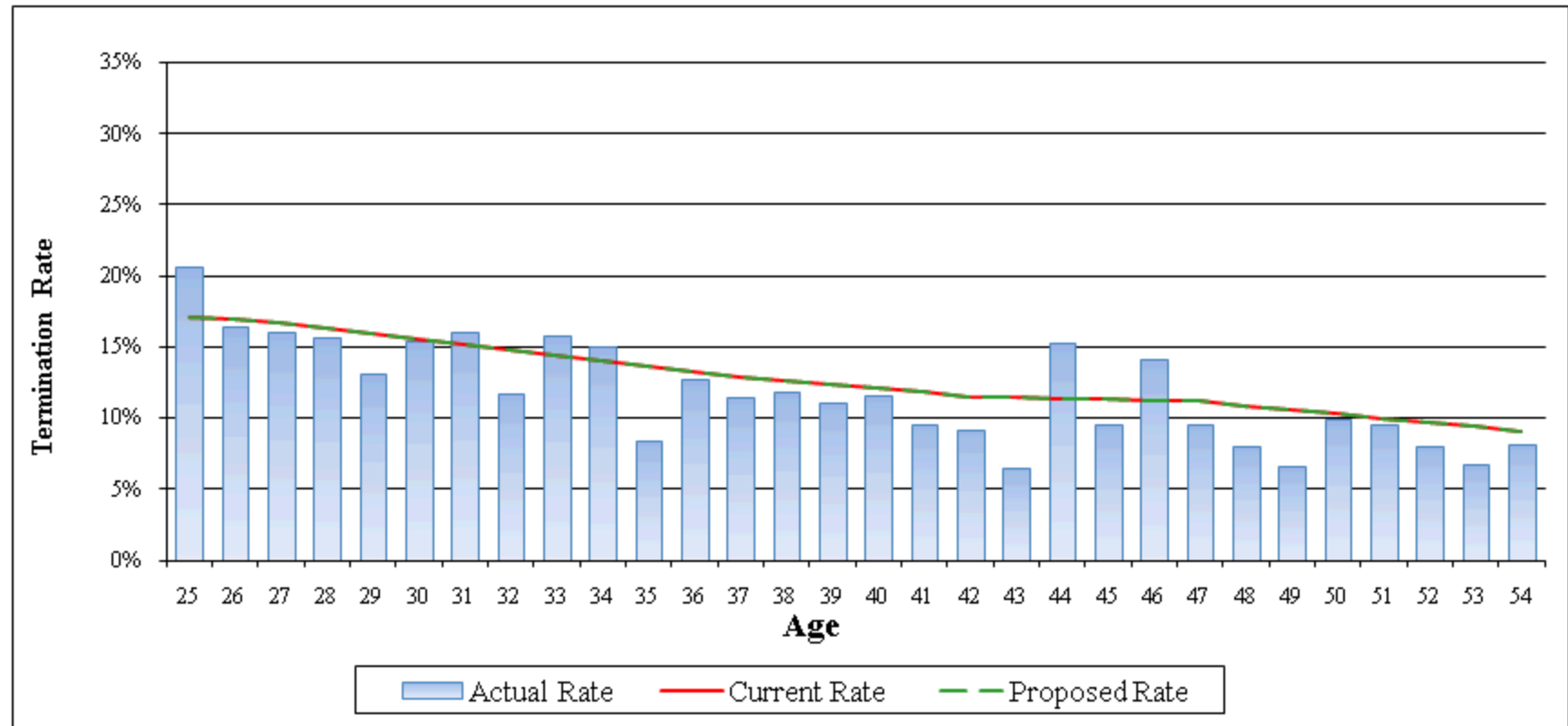
|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 3,094  | 3,199                                | 3,199                                 |
| Actual/Expected |        | 97%                                  | 97%                                   |

**Appendix F-15**  
**Rate of Termination of Employment**  
**OPERS - 2 Years**



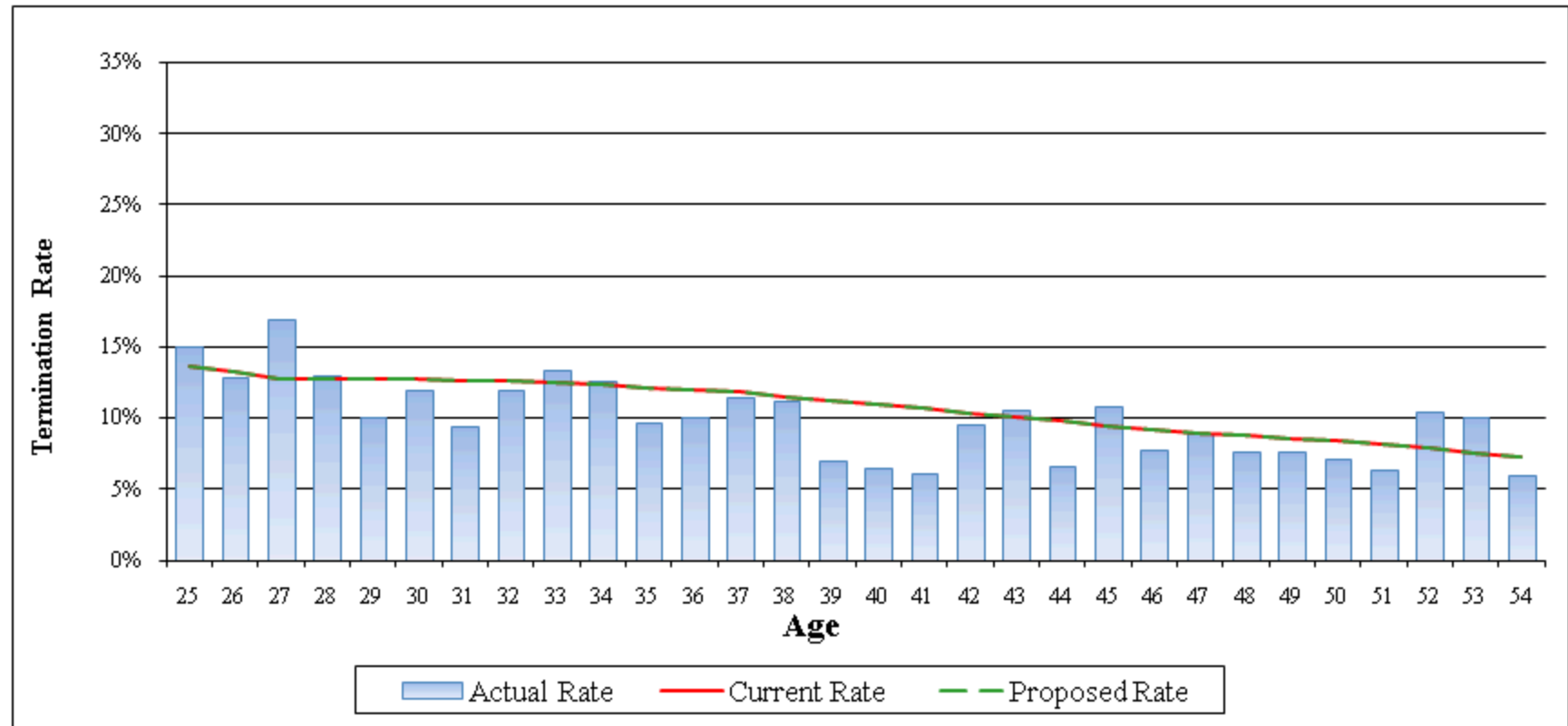
|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 1,312  | 1,310                                | 1,310                                 |
| Actual/Expected |        | 100%                                 | 100%                                  |

**Appendix F-16**  
**Rate of Termination of Employment**  
**OPERS - 3 Years**



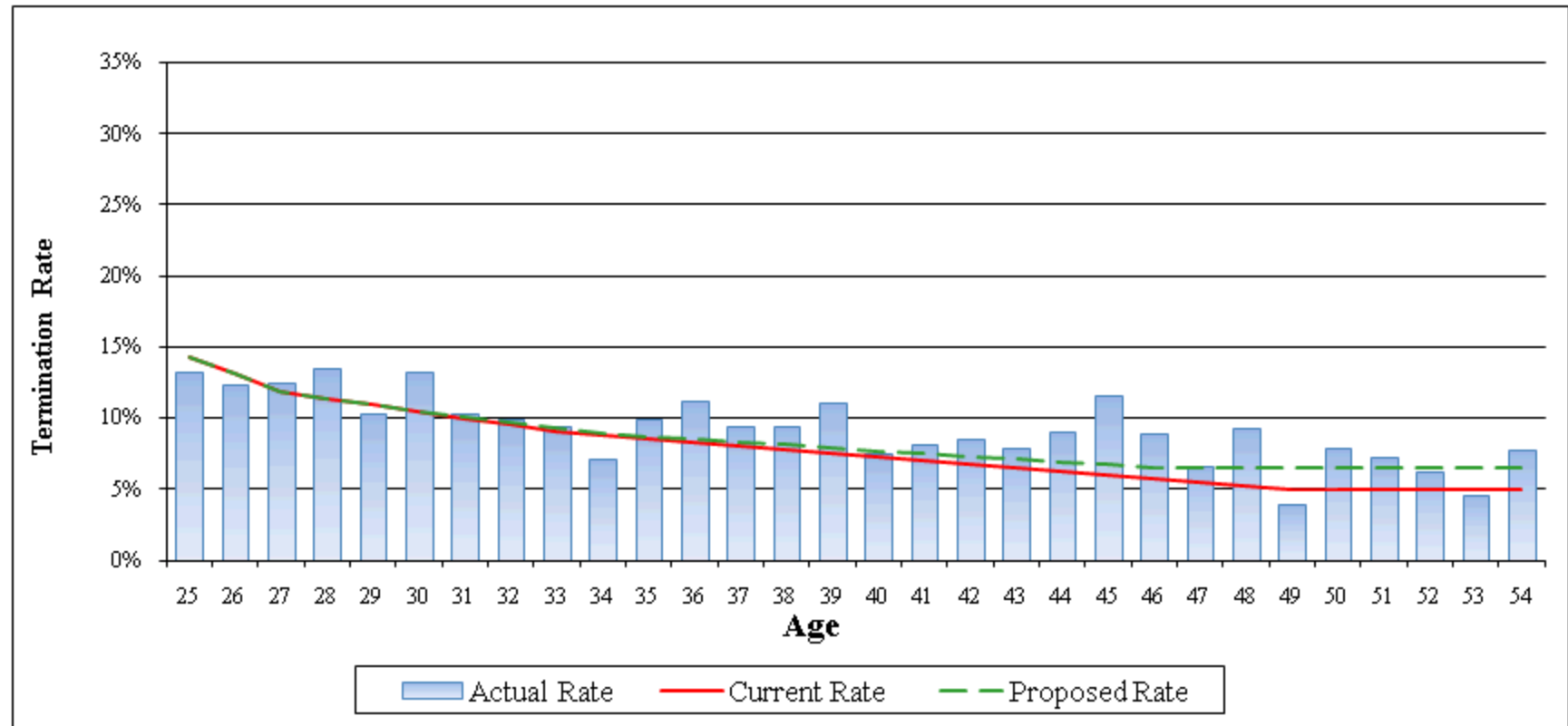
|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 907    | 975                                  | 975                                   |
| Actual/Expected |        | 93%                                  | 93%                                   |

**Appendix F-17**  
**Rate of Termination of Employment**  
**OPERS - 4 Years**



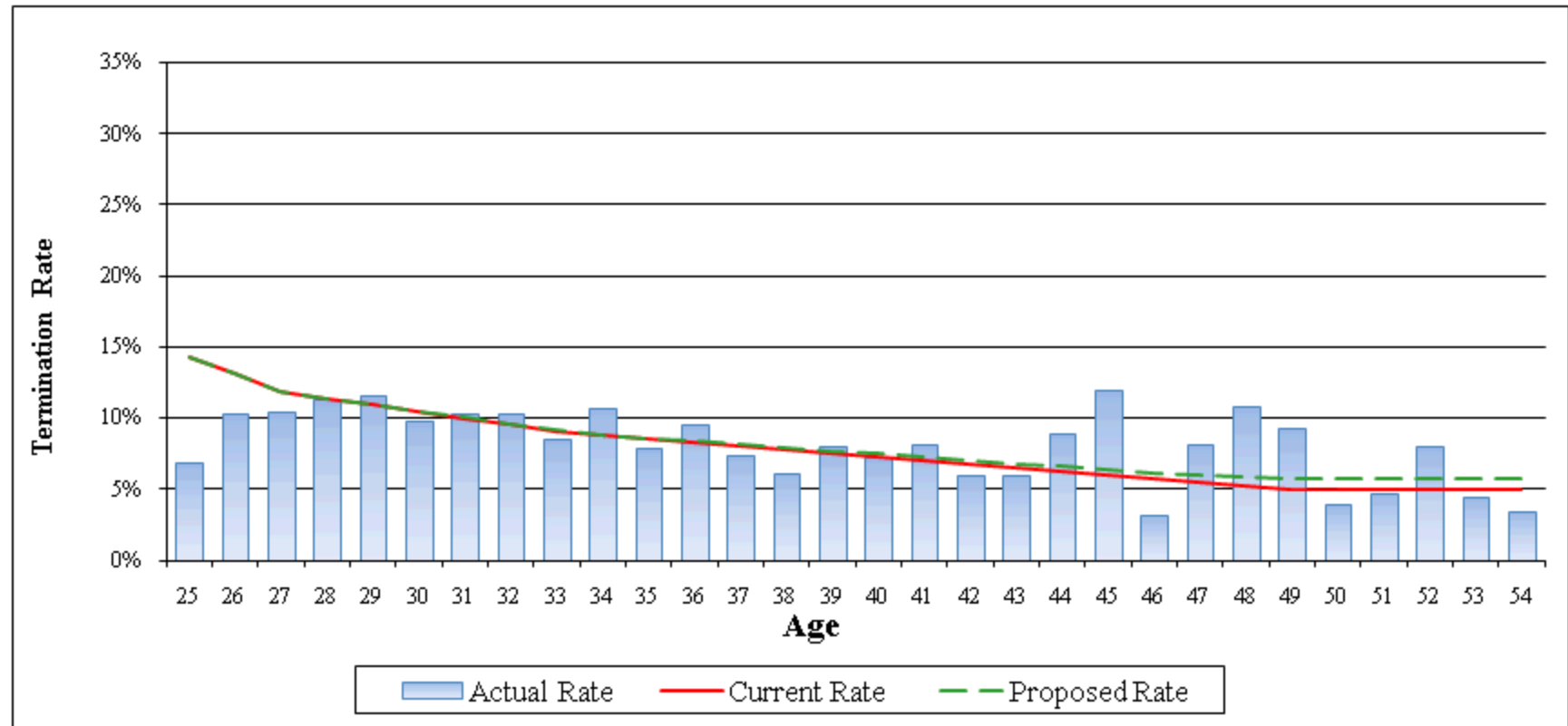
|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 578    | 623                                  | 623                                   |
| Actual/Expected |        | 93%                                  | 93%                                   |

**Appendix F-18**  
**Rate of Termination of Employment**  
**OPERS - 5 Years**



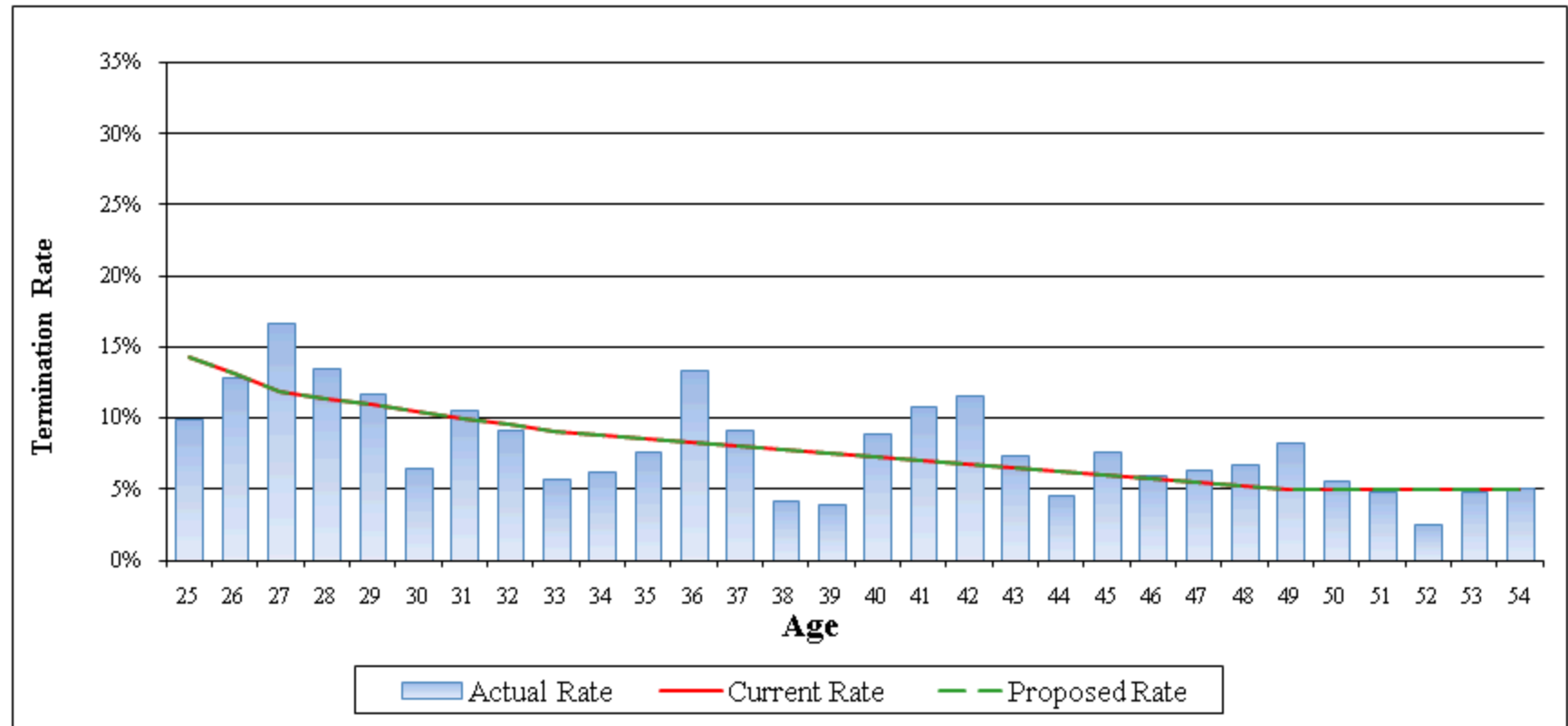
|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 412    | 342                                  | 369                                   |
| Actual/Expected |        | 120%                                 | 112%                                  |

**Appendix F-19**  
**Rate of Termination of Employment**  
**OPERS - 6 Years**



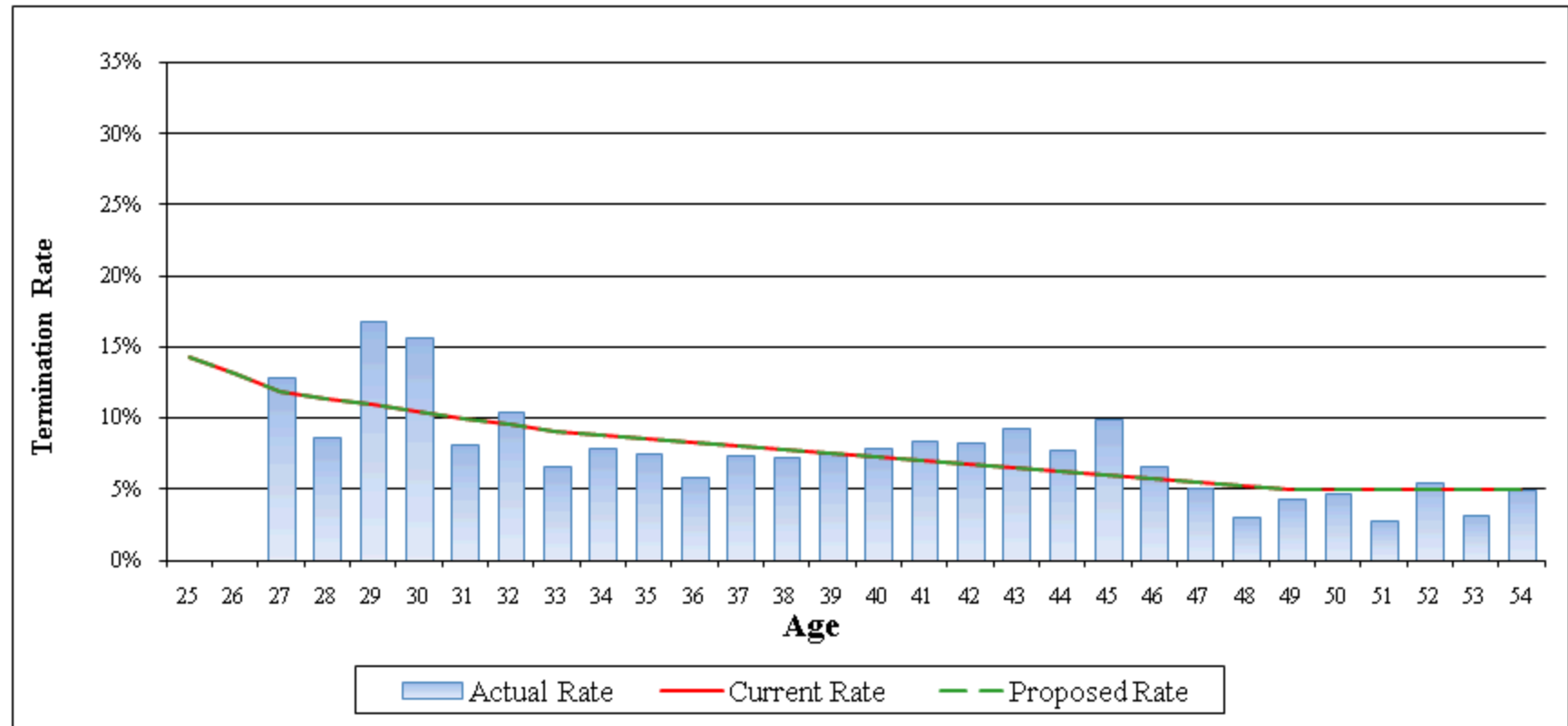
|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 325    | 300                                  | 312                                   |
| Actual/Expected |        | 108%                                 | 104%                                  |

**Appendix F-20**  
**Rate of Termination of Employment**  
**OPERS - 7 Years**



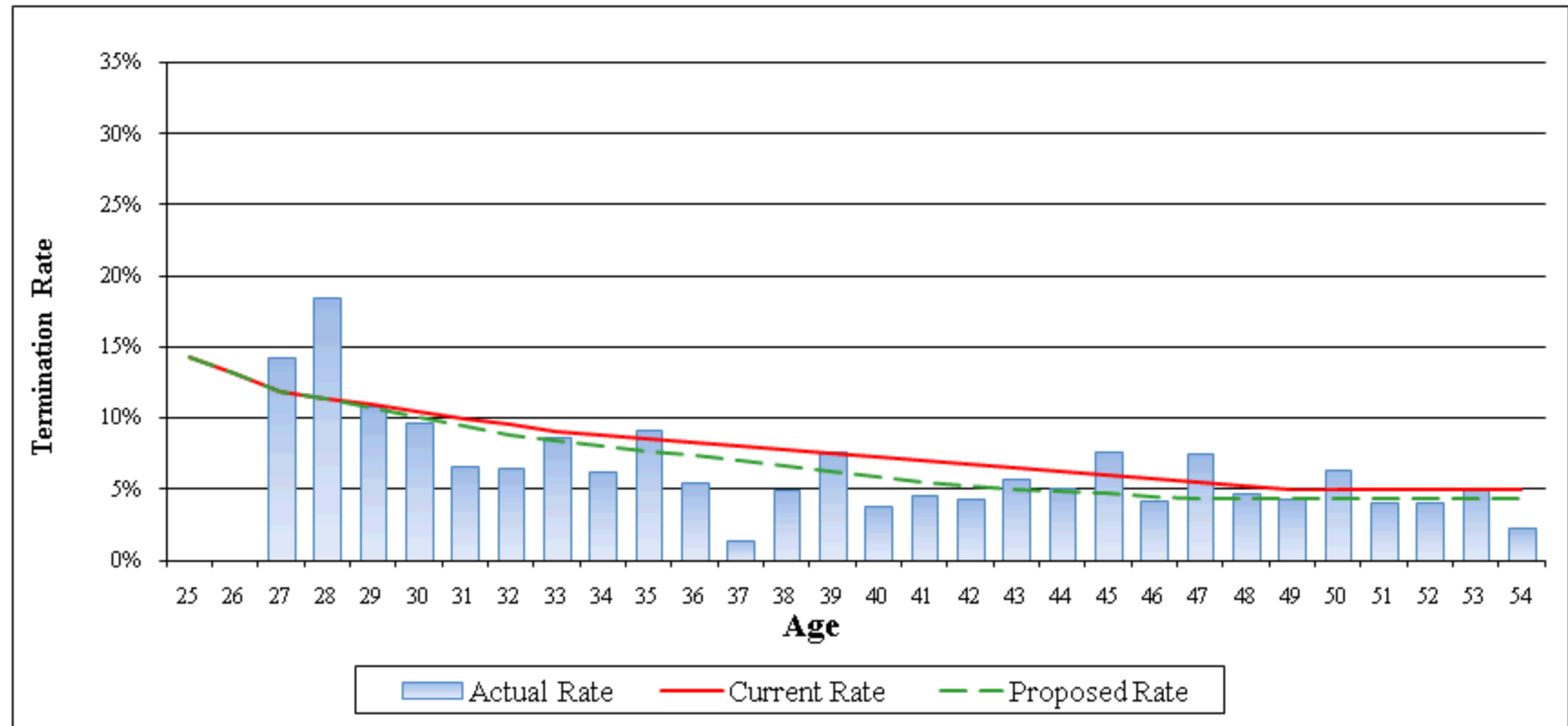
|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 301    | 293                                  | 293                                   |
| Actual/Expected |        | 103%                                 | 103%                                  |

**Appendix F-21**  
**Rate of Termination of Employment**  
**OPERS - 8 Years**



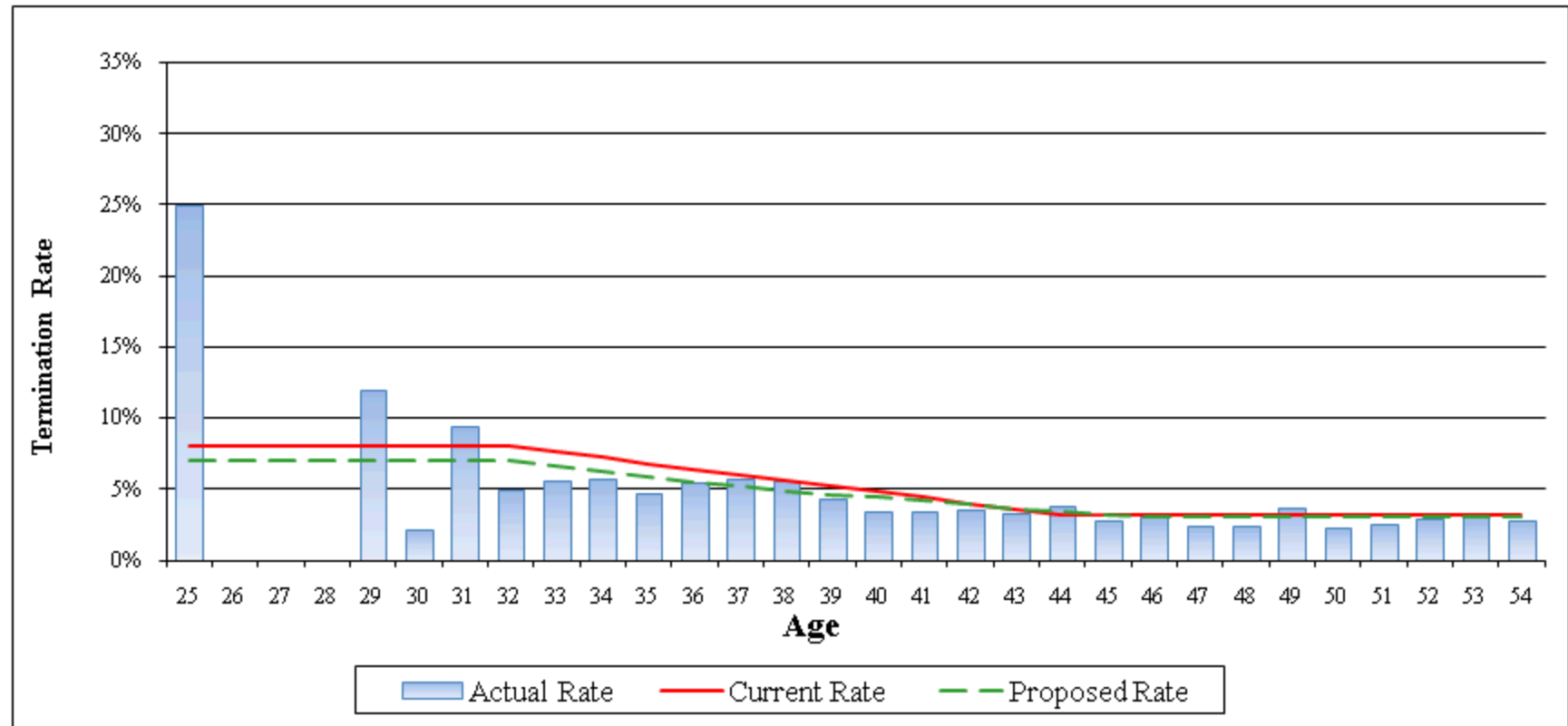
|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 278    | 276                                  | 276                                   |
| Actual/Expected |        | 101%                                 | 101%                                  |

**Appendix F-22**  
**Rate of Termination of Employment**  
**OPERS - 9 Years**



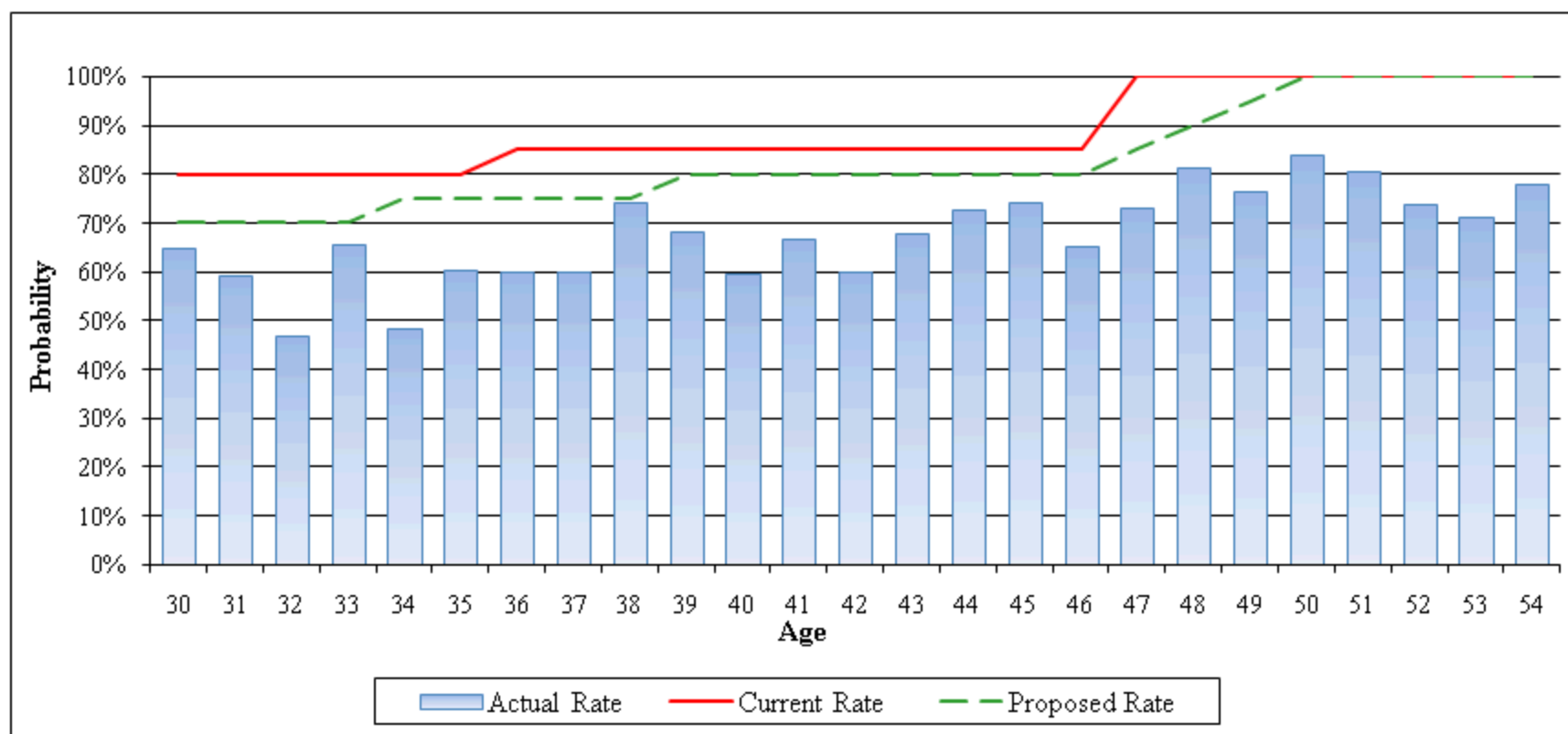
|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 204    | 248                                  | 214                                   |
| Actual/Expected |        | 82%                                  | 95%                                   |

**Appendix F-23**  
**Rate of Termination of Employment**  
**OPERS - More Than 9 Years**



|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 1,061  | 1,211                                | 1,132                                 |
| Actual/Expected |        | 88%                                  | 94%                                   |

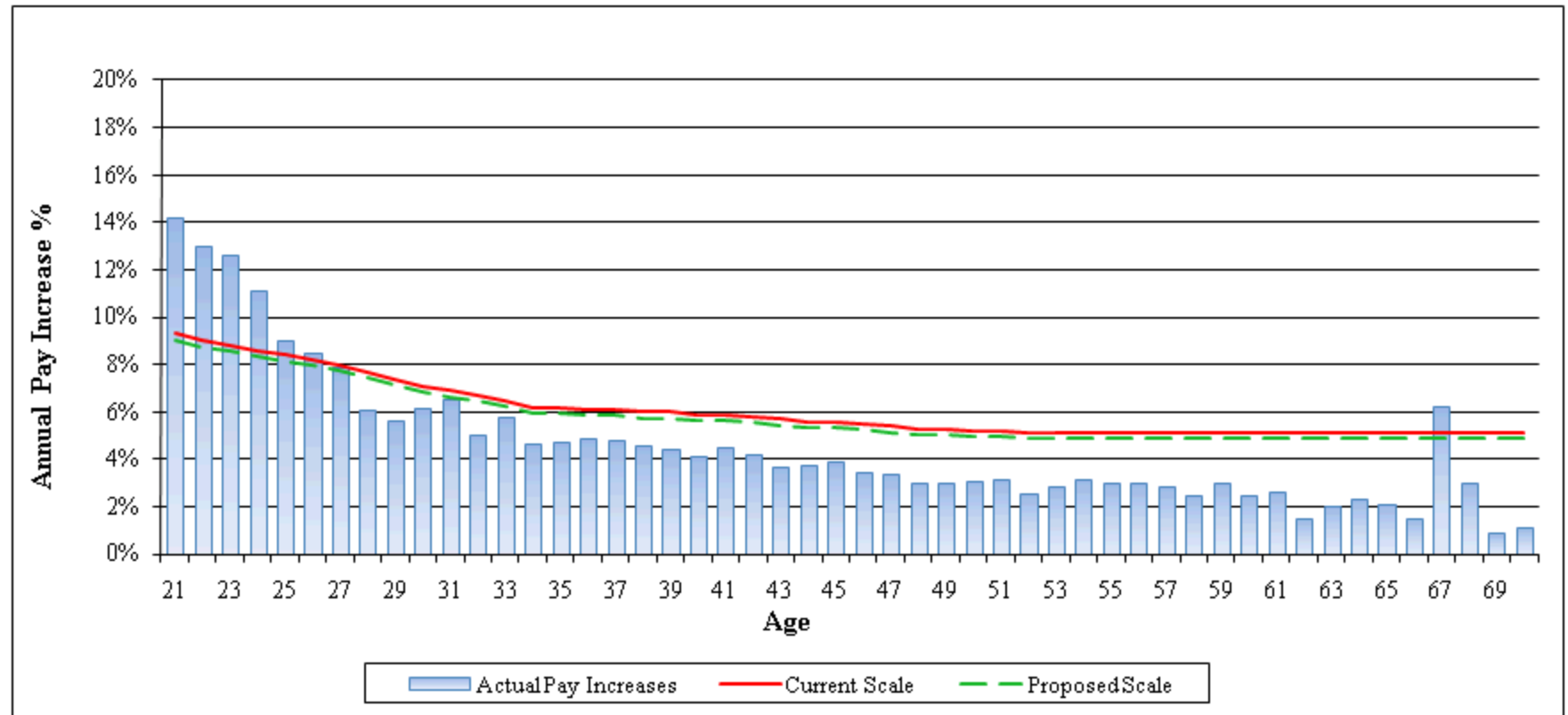
**Appendix F-24**  
**Probability of Contributions Remaining with the System**  
**OPERS - Regular**



|                 | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|-----------------|--------|--------------------------------------|---------------------------------------|
| Total Count     | 981    | 1,269                                | 1,193                                 |
| Actual/Expected |        | 77%                                  | 82%                                   |



**Appendix F-25**  
**Total Salary Scale**  
**OPERS**



|                  | Actual | Expected -<br>Current<br>Assumptions | Expected -<br>Proposed<br>Assumptions |
|------------------|--------|--------------------------------------|---------------------------------------|
| Average Increase | 3.74%  | 5.63%                                | 5.38%                                 |
| Actual/Expected  |        | 66%                                  | 70%                                   |



Appendix G-1  
Probability of Death - Healthy Retirees  
OPERS - Males

| Age | Exposure | Actual<br>Deaths | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 55  | 256      | 2                | 0.8%           | 0.8                 | 0.3%            | 0.8                  | 0.3%             |
| 56  | 403      | 2                | 0.5%           | 1.4                 | 0.4%            | 1.4                  | 0.4%             |
| 57  | 486      | 8                | 1.6%           | 1.9                 | 0.4%            | 1.9                  | 0.4%             |
| 58  | 559      | 8                | 1.4%           | 2.5                 | 0.4%            | 2.5                  | 0.4%             |
| 59  | 626      | 4                | 0.6%           | 3.2                 | 0.5%            | 3.2                  | 0.5%             |
| 60  | 763      | 9                | 1.2%           | 4.4                 | 0.6%            | 4.4                  | 0.6%             |
| 61  | 848      | 9                | 1.1%           | 5.6                 | 0.7%            | 5.6                  | 0.7%             |
| 62  | 995      | 12               | 1.2%           | 7.5                 | 0.8%            | 7.5                  | 0.8%             |
| 63  | 1,198    | 18               | 1.5%           | 10.4                | 0.9%            | 10.4                 | 0.9%             |
| 64  | 1,268    | 22               | 1.7%           | 12.4                | 1.0%            | 12.4                 | 1.0%             |
| 65  | 1,366    | 25               | 1.8%           | 15.1                | 1.1%            | 15.1                 | 1.1%             |
| 66  | 1,410    | 30               | 2.1%           | 17.8                | 1.3%            | 17.8                 | 1.3%             |
| 67  | 1,369    | 27               | 2.0%           | 19.3                | 1.4%            | 19.3                 | 1.4%             |
| 68  | 1,350    | 23               | 1.7%           | 21.0                | 1.6%            | 21.0                 | 1.6%             |
| 69  | 1,297    | 25               | 1.9%           | 22.3                | 1.7%            | 22.3                 | 1.7%             |
| 70  | 1,250    | 24               | 1.9%           | 23.9                | 1.9%            | 23.9                 | 1.9%             |
| 71  | 1,248    | 31               | 2.5%           | 26.4                | 2.1%            | 26.4                 | 2.1%             |
| 72  | 1,226    | 36               | 2.9%           | 28.8                | 2.3%            | 28.8                 | 2.3%             |
| 73  | 1,239    | 32               | 2.6%           | 32.4                | 2.6%            | 32.4                 | 2.6%             |
| 74  | 1,123    | 53               | 4.7%           | 32.7                | 2.9%            | 32.7                 | 2.9%             |
| 75  | 1,083    | 50               | 4.6%           | 35.6                | 3.3%            | 35.6                 | 3.3%             |
| 76  | 958      | 38               | 4.0%           | 35.1                | 3.7%            | 35.1                 | 3.7%             |
| 77  | 942      | 54               | 5.7%           | 38.8                | 4.1%            | 38.8                 | 4.1%             |
| 78  | 855      | 54               | 6.3%           | 39.5                | 4.6%            | 39.5                 | 4.6%             |
| 79  | 782      | 51               | 6.5%           | 40.6                | 5.2%            | 40.6                 | 5.2%             |
| 80  | 705      | 65               | 9.2%           | 41.0                | 5.8%            | 41.0                 | 5.8%             |
| 81  | 640      | 47               | 7.3%           | 42.1                | 6.6%            | 42.1                 | 6.6%             |
| 82  | 578      | 54               | 9.3%           | 42.9                | 7.4%            | 42.9                 | 7.4%             |
| 83  | 517      | 59               | 11.4%          | 42.8                | 8.3%            | 42.8                 | 8.3%             |
| 84  | 464      | 50               | 10.8%          | 43.2                | 9.3%            | 43.2                 | 9.3%             |
| 85  | 416      | 55               | 13.2%          | 42.9                | 10.3%           | 42.9                 | 10.3%            |
| 86  | 365      | 51               | 14.0%          | 41.8                | 11.4%           | 41.8                 | 11.4%            |
| 87  | 317      | 35               | 11.0%          | 40.6                | 12.8%           | 40.6                 | 12.8%            |
| 88  | 251      | 38               | 15.1%          | 36.0                | 14.3%           | 36.0                 | 14.3%            |
| 89  | 202      | 29               | 14.4%          | 32.0                | 15.8%           | 32.0                 | 15.8%            |
|     | 29,355   | 1,130            | 3.8%           | 884.5               | 3.0%            | 884.5                | 3.0%             |



Appendix G-2  
Probability of Death - Healthy Retirees  
OPERS - Females

| Age    | Exposure | Actual<br>Deaths | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|--------|----------|------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 55     | 324      | 1                | 0.3%           | 0.8                 | 0.3%            | 0.8                  | 0.3%             |
| 56     | 488      | 4                | 0.8%           | 1.4                 | 0.3%            | 1.4                  | 0.3%             |
| 57     | 601      | -                | 0.0%           | 2.0                 | 0.3%            | 2.0                  | 0.3%             |
| 58     | 703      | 5                | 0.7%           | 2.6                 | 0.4%            | 2.6                  | 0.4%             |
| 59     | 802      | 9                | 1.1%           | 3.4                 | 0.4%            | 3.4                  | 0.4%             |
| 60     | 889      | 10               | 1.1%           | 4.3                 | 0.5%            | 4.3                  | 0.5%             |
| 61     | 957      | 9                | 0.9%           | 5.3                 | 0.6%            | 5.3                  | 0.6%             |
| 62     | 1,094    | 11               | 1.0%           | 6.9                 | 0.6%            | 6.9                  | 0.6%             |
| 63     | 1,399    | 13               | 0.9%           | 10.2                | 0.7%            | 10.2                 | 0.7%             |
| 64     | 1,497    | 17               | 1.1%           | 12.3                | 0.8%            | 12.3                 | 0.8%             |
| 65     | 1,557    | 20               | 1.3%           | 14.4                | 0.9%            | 14.4                 | 0.9%             |
| 66     | 1,598    | 27               | 1.7%           | 16.6                | 1.0%            | 16.6                 | 1.0%             |
| 67     | 1,547    | 17               | 1.1%           | 17.9                | 1.2%            | 17.9                 | 1.2%             |
| 68     | 1,490    | 17               | 1.1%           | 19.1                | 1.3%            | 19.1                 | 1.3%             |
| 69     | 1,444    | 20               | 1.4%           | 20.4                | 1.4%            | 20.4                 | 1.4%             |
| 70     | 1,359    | 30               | 2.2%           | 21.6                | 1.6%            | 21.6                 | 1.6%             |
| 71     | 1,278    | 30               | 2.3%           | 22.4                | 1.7%            | 22.4                 | 1.7%             |
| 72     | 1,259    | 25               | 2.0%           | 24.5                | 1.9%            | 24.5                 | 1.9%             |
| 73     | 1,226    | 32               | 2.6%           | 26.3                | 2.1%            | 26.3                 | 2.1%             |
| 74     | 1,216    | 33               | 2.7%           | 28.9                | 2.4%            | 28.9                 | 2.4%             |
| 75     | 1,129    | 26               | 2.3%           | 29.3                | 2.6%            | 29.3                 | 2.6%             |
| 76     | 1,094    | 26               | 2.4%           | 31.3                | 2.9%            | 31.3                 | 2.9%             |
| 77     | 1,040    | 32               | 3.1%           | 33.1                | 3.2%            | 33.1                 | 3.2%             |
| 78     | 957      | 38               | 4.0%           | 33.5                | 3.5%            | 33.5                 | 3.5%             |
| 79     | 896      | 34               | 3.8%           | 34.7                | 3.9%            | 34.7                 | 3.9%             |
| 80     | 843      | 42               | 5.0%           | 36.1                | 4.3%            | 36.1                 | 4.3%             |
| 81     | 792      | 43               | 5.4%           | 37.5                | 4.7%            | 37.5                 | 4.7%             |
| 82     | 753      | 51               | 6.8%           | 39.5                | 5.2%            | 39.5                 | 5.2%             |
| 83     | 686      | 48               | 7.0%           | 40.0                | 5.8%            | 40.0                 | 5.8%             |
| 84     | 633      | 43               | 6.8%           | 41.0                | 6.5%            | 41.0                 | 6.5%             |
| 85     | 554      | 52               | 9.4%           | 40.4                | 7.3%            | 40.4                 | 7.3%             |
| 86     | 539      | 69               | 12.8%          | 44.3                | 8.2%            | 44.3                 | 8.2%             |
| 87     | 440      | 54               | 12.3%          | 40.7                | 9.3%            | 40.7                 | 9.3%             |
| 88     | 373      | 50               | 13.4%          | 38.5                | 10.3%           | 38.5                 | 10.3%            |
| 89     | 298      | 34               | 11.4%          | 34.5                | 11.6%           | 34.5                 | 11.6%            |
| 33,755 |          | 972              | 2.9%           | 815.3               | 2.4%            | 815.3                | 2.4%             |



Appendix G-3  
Retirement Rates  
Regular - Early

| Age | Exposure | Actual<br>Retirements | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|-----------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 55  | 1,587    | 65                    | 4.1%           | 63.5                | 4.0%            | 63.5                 | 4.0%             |
| 56  | 1,454    | 50                    | 3.4%           | 72.7                | 5.0%            | 72.7                 | 5.0%             |
| 57  | 1,297    | 47                    | 3.6%           | 64.9                | 5.0%            | 64.9                 | 5.0%             |
| 58  | 1,166    | 48                    | 4.1%           | 70.0                | 6.0%            | 70.0                 | 6.0%             |
| 59  | 1,080    | 65                    | 6.0%           | 75.6                | 7.0%            | 75.6                 | 7.0%             |
| 60  | 972      | 66                    | 6.8%           | 68.0                | 7.0%            | 68.0                 | 7.0%             |
| 61  | 786      | 100                   | 12.7%          | 157.2               | 20.0%           | 157.2                | 20.0%            |
|     | 8,342    | 441                   | 5.3%           | 571.8               | 6.9%            | 571.8                | 6.9%             |



Appendix G-4  
Retirement Rates  
Regular - Unreduced

| Age    | Exposure | Actual<br>Retirements | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|--------|----------|-----------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 50     | 160      | 11                    | 6.9%           | 32.0                | 20.0%           | 32.0                 | 20.0%            |
| 51     | 353      | 45                    | 12.7%          | 70.6                | 20.0%           | 70.6                 | 20.0%            |
| 52     | 575      | 60                    | 10.4%          | 115.0               | 20.0%           | 115.0                | 20.0%            |
| 53     | 732      | 77                    | 10.5%          | 146.4               | 20.0%           | 146.4                | 20.0%            |
| 54     | 803      | 80                    | 10.0%          | 160.6               | 20.0%           | 160.6                | 20.0%            |
| 55     | 880      | 82                    | 9.3%           | 88.0                | 10.0%           | 88.0                 | 10.0%            |
| 56     | 922      | 77                    | 8.4%           | 92.2                | 10.0%           | 92.2                 | 10.0%            |
| 57     | 958      | 99                    | 10.3%          | 105.4               | 11.0%           | 105.4                | 11.0%            |
| 58     | 984      | 98                    | 10.0%          | 118.1               | 12.0%           | 118.1                | 12.0%            |
| 59     | 1,020    | 124                   | 12.2%          | 132.6               | 13.0%           | 132.6                | 13.0%            |
| 60     | 1,083    | 128                   | 11.8%          | 151.6               | 14.0%           | 151.6                | 14.0%            |
| 61     | 1,083    | 199                   | 18.4%          | 216.6               | 20.0%           | 216.6                | 20.0%            |
| 62     | 1,946    | 467                   | 24.0%          | 583.8               | 30.0%           | 583.8                | 30.0%            |
| 63     | 1,387    | 246                   | 17.7%          | 208.1               | 15.0%           | 208.1                | 15.0%            |
| 64     | 1,162    | 228                   | 19.6%          | 174.3               | 15.0%           | 174.3                | 15.0%            |
| 65     | 958      | 265                   | 27.7%          | 287.4               | 30.0%           | 287.4                | 30.0%            |
| 66     | 659      | 183                   | 27.8%          | 131.8               | 20.0%           | 131.8                | 20.0%            |
| 67     | 477      | 91                    | 19.1%          | 95.4                | 20.0%           | 95.4                 | 20.0%            |
| 68     | 404      | 76                    | 18.8%          | 80.8                | 20.0%           | 80.8                 | 20.0%            |
| 69     | 316      | 62                    | 19.6%          | 79.0                | 25.0%           | 79.0                 | 25.0%            |
| 70     | 227      | 49                    | 21.6%          | 227.0               | 100.0%          | 227.0                | 100.0%           |
| 17,089 |          | 2,747                 | 16.1%          | 3,296.6             | 19.3%           | 3,296.6              | 19.3%            |



Appendix G-5  
Retirement Rates  
Elected Officials - Early

| Age | Exposure | Actual<br>Retirements | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|-----------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 55  | 47       | 1                     | 2.1%           | 4.7                 | 10.0%           | 4.7                  | 10.0%            |
| 56  | 53       | 3                     | 5.7%           | 5.3                 | 10.0%           | 5.3                  | 10.0%            |
| 57  | 35       | -                     | 0.0%           | 3.5                 | 10.0%           | 3.5                  | 10.0%            |
| 58  | 26       | 3                     | 11.5%          | 2.6                 | 10.0%           | 2.6                  | 10.0%            |
| 59  | 26       | 2                     | 7.7%           | 2.6                 | 10.0%           | 2.6                  | 10.0%            |
|     | 187      | 9                     | 4.8%           | 18.7                | 10.0%           | 18.7                 | 10.0%            |



Appendix G-6  
Retirement Rates  
Elected Officials - Unreduced

| Age | Exposure | Actual<br>Retirements | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|-----------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 50  | 5        | 2                     | 40.0%          | 1.5                 | 30.0%           | 1.5                  | 30.0%            |
| 51  | 9        | 3                     | 33.3%          | 2.7                 | 30.0%           | 2.7                  | 30.0%            |
| 52  | 19       | 3                     | 15.8%          | 5.7                 | 30.0%           | 5.7                  | 30.0%            |
| 53  | 21       | 2                     | 9.5%           | 6.3                 | 30.0%           | 6.3                  | 30.0%            |
| 54  | 23       | 5                     | 21.7%          | 6.9                 | 30.0%           | 6.9                  | 30.0%            |
| 55  | 19       | 1                     | 5.3%           | 1.9                 | 10.0%           | 1.9                  | 10.0%            |
| 56  | 24       | 2                     | 8.3%           | 2.4                 | 10.0%           | 2.4                  | 10.0%            |
| 57  | 29       | 4                     | 13.8%          | 5.8                 | 20.0%           | 5.8                  | 20.0%            |
| 58  | 26       | 1                     | 3.8%           | 5.2                 | 20.0%           | 5.2                  | 20.0%            |
| 59  | 19       | 5                     | 26.3%          | 3.8                 | 20.0%           | 3.8                  | 20.0%            |
| 60  | 82       | 8                     | 9.8%           | 16.4                | 20.0%           | 16.4                 | 20.0%            |
| 61  | 83       | 11                    | 13.3%          | 16.6                | 20.0%           | 16.6                 | 20.0%            |
| 62  | 65       | 10                    | 15.4%          | 13.0                | 20.0%           | 13.0                 | 20.0%            |
| 63  | 62       | 3                     | 4.8%           | 12.4                | 20.0%           | 12.4                 | 20.0%            |
| 64  | 72       | 9                     | 12.5%          | 14.4                | 20.0%           | 14.4                 | 20.0%            |
| 65  | 64       | 7                     | 10.9%          | 12.8                | 20.0%           | 12.8                 | 20.0%            |
| 66  | 51       | 2                     | 3.9%           | 10.2                | 20.0%           | 10.2                 | 20.0%            |
| 67  | 39       | 3                     | 7.7%           | 15.6                | 40.0%           | 15.6                 | 40.0%            |
| 68  | 33       | 5                     | 15.2%          | 13.2                | 40.0%           | 13.2                 | 40.0%            |
| 69  | 21       | 1                     | 4.8%           | 8.4                 | 40.0%           | 8.4                  | 40.0%            |
| 70  | 17       | 2                     | 11.8%          | 17.0                | 100.0%          | 17.0                 | 100.0%           |
| 783 |          | 89                    | 11.4%          | 192.2               | 24.5%           | 192.2                | 24.5%            |



Appendix G-7  
Retirement Rates  
Hazardous Duty - Early

| Age | Exposure | Actual<br>Retirements | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|-----------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 55  | 63       | 4                     | 6.3%           | 2.5                 | 4.0%            | 2.5                  | 4.0%             |
| 56  | 50       | 1                     | 2.0%           | 2.5                 | 5.0%            | 2.5                  | 5.0%             |
| 57  | 45       | 9                     | 20.0%          | 2.3                 | 5.0%            | 2.3                  | 5.0%             |
| 58  | 39       | 2                     | 5.1%           | 2.3                 | 6.0%            | 2.3                  | 6.0%             |
| 59  | 35       | 1                     | 2.9%           | 2.5                 | 7.0%            | 2.5                  | 7.0%             |
| 60  | 32       | 2                     | 6.3%           | 2.2                 | 7.0%            | 2.2                  | 7.0%             |
| 61  | 26       | 4                     | 15.4%          | 5.2                 | 20.0%           | 5.2                  | 20.0%            |
|     | 290      | 23                    | 7.9%           | 19.5                | 6.7%            | 19.5                 | 6.7%             |



Appendix G-8  
Retirement Rates  
Hazardous Duty - Unreduced

| Duration | Exposure | Actual<br>Retirements | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|----------|----------|-----------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 20       | 169      | 48                    | 28.4%          | 33.8                | 20.0%           | 33.8                 | 20.0%            |
| 21       | 95       | 20                    | 21.1%          | 14.3                | 15.0%           | 14.3                 | 15.0%            |
| 22       | 71       | 13                    | 18.3%          | 10.7                | 15.0%           | 10.7                 | 15.0%            |
| 23       | 57       | 9                     | 15.8%          | 8.6                 | 15.0%           | 8.6                  | 15.0%            |
| 24       | 56       | 12                    | 21.4%          | 8.4                 | 15.0%           | 8.4                  | 15.0%            |
| 25       | 44       | 6                     | 13.6%          | 8.8                 | 20.0%           | 8.8                  | 20.0%            |
| 26       | 35       | 2                     | 5.7%           | 7.0                 | 20.0%           | 7.0                  | 20.0%            |
| 27       | 32       | 4                     | 12.5%          | 6.4                 | 20.0%           | 6.4                  | 20.0%            |
| 28       | 29       | 8                     | 27.6%          | 5.8                 | 20.0%           | 5.8                  | 20.0%            |
| 29       | 20       | 3                     | 15.0%          | 4.0                 | 20.0%           | 4.0                  | 20.0%            |
| 30       | 11       | 2                     | 18.2%          | 2.8                 | 25.0%           | 2.8                  | 25.0%            |
| 31       | 6        | 1                     | 16.7%          | 1.5                 | 25.0%           | 1.5                  | 25.0%            |
| 32       | 8        | -                     | 0.0%           | 2.0                 | 25.0%           | 2.0                  | 25.0%            |
| 33       | 9        | -                     | 0.0%           | 2.3                 | 25.0%           | 2.3                  | 25.0%            |
| 34       | 6        | 1                     | 16.7%          | 1.5                 | 25.0%           | 1.5                  | 25.0%            |
| 35       | 3        | -                     | 0.0%           | 3.0                 | 100.0%          | 3.0                  | 100.0%           |
|          | 651      | 129                   | 19.8%          | 120.7               | 18.5%           | 120.7                | 18.5%            |



Appendix G-9  
Retirement Rates  
Hazardous Duty - Unreduced (Age)

| Age | Exposure | Actual<br>Retirements | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|-----------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 62  | 35       | 8                     | 22.9%          | 14.0                | 40.0%           | 14.0                 | 40.0%            |
| 63  | 22       | 9                     | 40.9%          | 4.8                 | 22.0%           | 4.8                  | 22.0%            |
| 64  | 13       | 1                     | 7.7%           | 3.3                 | 25.0%           | 3.3                  | 25.0%            |
| 65  | 7        | 3                     | 42.9%          | 2.8                 | 40.0%           | 2.8                  | 40.0%            |
| 66  | 8        | 3                     | 37.5%          | 2.0                 | 25.0%           | 2.0                  | 25.0%            |
| 67  | 6        | 1                     | 16.7%          | 1.4                 | 23.0%           | 1.4                  | 23.0%            |
| 68  | 6        | 3                     | 50.0%          | 1.3                 | 22.0%           | 1.3                  | 22.0%            |
| 69  | 2        | -                     | 0.0%           | 0.4                 | 21.0%           | 0.4                  | 21.0%            |
| 70  | 2        | 1                     | 50.0%          | 2.0                 | 100.0%          | 2.0                  | 100.0%           |
|     | 101      | 29                    | 28.7%          | 32.0                | 31.7%           | 32.0                 | 31.7%            |



Appendix G-10  
Retirement Rates  
URSJJ

| Age | Exposure | Actual<br>Retirements | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|-----------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 55  | 29       | 3                     | 10.3%          | 2.9                 | 10.0%           | 2.9                  | 10.0%            |
| 56  | 30       | 1                     | 3.3%           | 3.0                 | 10.0%           | 3.0                  | 10.0%            |
| 57  | 37       | 1                     | 2.7%           | 3.7                 | 10.0%           | 3.7                  | 10.0%            |
| 58  | 35       | 1                     | 2.9%           | 3.5                 | 10.0%           | 3.5                  | 10.0%            |
| 59  | 27       | 4                     | 14.8%          | 2.7                 | 10.0%           | 2.7                  | 10.0%            |
| 60  | 21       | 2                     | 9.5%           | 2.1                 | 10.0%           | 2.1                  | 10.0%            |
| 61  | 21       | 2                     | 9.5%           | 2.1                 | 10.0%           | 2.1                  | 10.0%            |
| 62  | 25       | -                     | 0.0%           | 6.3                 | 25.0%           | 6.3                  | 25.0%            |
| 63  | 22       | 2                     | 9.1%           | 5.5                 | 25.0%           | 5.5                  | 25.0%            |
| 64  | 16       | 5                     | 31.3%          | 4.0                 | 25.0%           | 4.0                  | 25.0%            |
| 65  | 13       | 1                     | 7.7%           | 3.3                 | 25.0%           | 3.3                  | 25.0%            |
| 66  | 11       | -                     | 0.0%           | 1.1                 | 10.0%           | 1.1                  | 10.0%            |
| 67  | 10       | -                     | 0.0%           | 1.0                 | 10.0%           | 1.0                  | 10.0%            |
| 68  | 10       | 3                     | 30.0%          | 3.0                 | 30.0%           | 3.0                  | 30.0%            |
| 69  | 8        | 1                     | 12.5%          | 2.4                 | 30.0%           | 2.4                  | 30.0%            |
| 70  | 7        | 1                     | 14.3%          | 1.4                 | 20.0%           | 1.4                  | 20.0%            |
| 71  | 5        | 2                     | 40.0%          | 0.5                 | 10.0%           | 0.5                  | 10.0%            |
| 72  | 4        | -                     | 0.0%           | 0.4                 | 10.0%           | 0.4                  | 10.0%            |
| 73  | 5        | -                     | 0.0%           | 0.5                 | 10.0%           | 0.5                  | 10.0%            |
| 74  | 5        | -                     | 0.0%           | 0.5                 | 10.0%           | 0.5                  | 10.0%            |
| 75  | 3        | -                     | 0.0%           | 3.0                 | 100.0%          | 3.0                  | 100.0%           |
|     | 344      | 29                    | 8.4%           | 52.8                | 15.3%           | 52.8                 | 15.3%            |



Appendix G-11  
Rate of Disability - Active Lives  
OPERS - Males

| Age | Exposure | Actual<br>Disabilities | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|------------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 20  | 172      | -                      | 0.000%         | 0.0                 | 0.010%          | 0.0                  | 0.010%           |
| 21  | 260      | -                      | 0.000%         | 0.0                 | 0.010%          | 0.0                  | 0.010%           |
| 22  | 378      | -                      | 0.000%         | 0.0                 | 0.010%          | 0.0                  | 0.010%           |
| 23  | 512      | -                      | 0.000%         | 0.1                 | 0.010%          | 0.1                  | 0.010%           |
| 24  | 674      | -                      | 0.000%         | 0.1                 | 0.010%          | 0.1                  | 0.010%           |
| 25  | 788      | -                      | 0.000%         | 0.2                 | 0.020%          | 0.2                  | 0.020%           |
| 26  | 827      | -                      | 0.000%         | 0.2                 | 0.020%          | 0.2                  | 0.020%           |
| 27  | 925      | -                      | 0.000%         | 0.2                 | 0.020%          | 0.2                  | 0.020%           |
| 28  | 928      | -                      | 0.000%         | 0.2                 | 0.020%          | 0.2                  | 0.020%           |
| 29  | 960      | -                      | 0.000%         | 0.2                 | 0.020%          | 0.2                  | 0.020%           |
| 30  | 943      | -                      | 0.000%         | 0.2                 | 0.020%          | 0.2                  | 0.020%           |
| 31  | 964      | -                      | 0.000%         | 0.2                 | 0.020%          | 0.2                  | 0.020%           |
| 32  | 1,006    | -                      | 0.000%         | 0.3                 | 0.030%          | 0.3                  | 0.030%           |
| 33  | 1,042    | -                      | 0.000%         | 0.3                 | 0.030%          | 0.3                  | 0.030%           |
| 34  | 1,110    | 1                      | 0.090%         | 0.4                 | 0.040%          | 0.4                  | 0.040%           |
| 35  | 1,100    | -                      | 0.000%         | 0.6                 | 0.050%          | 0.6                  | 0.050%           |
| 36  | 1,547    | -                      | 0.000%         | 0.8                 | 0.050%          | 0.8                  | 0.050%           |
| 37  | 1,302    | -                      | 0.000%         | 0.7                 | 0.050%          | 0.7                  | 0.050%           |
| 38  | 1,490    | -                      | 0.000%         | 0.9                 | 0.060%          | 0.9                  | 0.060%           |
| 39  | 1,270    | 2                      | 0.157%         | 0.9                 | 0.070%          | 0.9                  | 0.070%           |
| 40  | 1,221    | -                      | 0.000%         | 1.0                 | 0.080%          | 1.0                  | 0.080%           |
| 41  | 1,220    | 1                      | 0.082%         | 1.0                 | 0.080%          | 1.0                  | 0.080%           |
| 42  | 1,278    | 1                      | 0.078%         | 1.2                 | 0.090%          | 1.2                  | 0.090%           |
| 43  | 1,365    | -                      | 0.000%         | 1.5                 | 0.110%          | 1.5                  | 0.110%           |
| 44  | 1,538    | 1                      | 0.065%         | 1.8                 | 0.120%          | 1.8                  | 0.120%           |
| 45  | 1,676    | 2                      | 0.119%         | 2.3                 | 0.140%          | 2.3                  | 0.140%           |
| 46  | 1,719    | -                      | 0.000%         | 2.6                 | 0.150%          | 2.6                  | 0.150%           |
| 47  | 1,760    | 3                      | 0.170%         | 3.0                 | 0.170%          | 3.0                  | 0.170%           |
| 48  | 1,745    | 1                      | 0.057%         | 3.5                 | 0.200%          | 3.5                  | 0.200%           |
| 49  | 1,774    | 2                      | 0.113%         | 4.1                 | 0.230%          | 4.1                  | 0.230%           |
| 50  | 1,793    | 2                      | 0.112%         | 7.4                 | 0.410%          | 4.5                  | 0.250%           |
| 51  | 1,881    | 5                      | 0.266%         | 9.2                 | 0.490%          | 5.6                  | 0.300%           |
| 52  | 1,821    | 4                      | 0.220%         | 10.4                | 0.570%          | 6.4                  | 0.350%           |
| 53  | 1,840    | 8                      | 0.435%         | 12.1                | 0.660%          | 7.4                  | 0.400%           |
| 54  | 1,819    | 6                      | 0.330%         | 12.9                | 0.710%          | 8.6                  | 0.475%           |
| 55  | 1,839    | 4                      | 0.218%         | 14.0                | 0.760%          | 10.1                 | 0.550%           |
| 56  | 1,800    | 13                     | 0.722%         | 13.5                | 0.750%          | 11.7                 | 0.650%           |
| 57  | 1,720    | 5                      | 0.291%         | 13.6                | 0.790%          | 12.9                 | 0.750%           |
| 58  | 1,610    | 6                      | 0.373%         | 13.7                | 0.850%          | 12.1                 | 0.750%           |
| 59  | 1,559    | 8                      | 0.513%         | 13.3                | 0.850%          | 11.7                 | 0.750%           |
| 60  | 1,587    | 7                      | 0.441%         | 13.5                | 0.850%          | 11.9                 | 0.750%           |
| 61  | 1,504    | 5                      | 0.332%         | 12.8                | 0.850%          | 11.3                 | 0.750%           |
| 62  | 1,276    | -                      | 0.000%         | 10.8                | 0.850%          | 9.6                  | 0.750%           |
|     | 55,543   | 87                     | 0.157%         | 185.3               | 0.334%          | 152.0                | 0.274%           |



Appendix G-12  
Rate of Disability - Active Lives  
OPERS - Females

| Age | Exposure | Actual<br>Disabilities | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|------------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 20  | 124      | -                      | 0.000%         | 0.0                 | 0.010%          | 0.0                  | 0.010%           |
| 21  | 196      | -                      | 0.000%         | 0.0                 | 0.010%          | 0.0                  | 0.010%           |
| 22  | 317      | -                      | 0.000%         | 0.0                 | 0.010%          | 0.0                  | 0.010%           |
| 23  | 540      | -                      | 0.000%         | 0.1                 | 0.010%          | 0.1                  | 0.010%           |
| 24  | 805      | -                      | 0.000%         | 0.1                 | 0.010%          | 0.1                  | 0.010%           |
| 25  | 956      | -                      | 0.000%         | 0.2                 | 0.020%          | 0.2                  | 0.020%           |
| 26  | 1,173    | -                      | 0.000%         | 0.2                 | 0.020%          | 0.2                  | 0.020%           |
| 27  | 1,249    | -                      | 0.000%         | 0.2                 | 0.020%          | 0.2                  | 0.020%           |
| 28  | 1,243    | -                      | 0.000%         | 0.2                 | 0.020%          | 0.2                  | 0.020%           |
| 29  | 1,214    | -                      | 0.000%         | 0.4                 | 0.030%          | 0.4                  | 0.030%           |
| 30  | 1,216    | -                      | 0.000%         | 0.4                 | 0.030%          | 0.4                  | 0.030%           |
| 31  | 1,197    | -                      | 0.000%         | 0.4                 | 0.030%          | 0.4                  | 0.030%           |
| 32  | 1,301    | -                      | 0.000%         | 0.4                 | 0.030%          | 0.4                  | 0.030%           |
| 33  | 1,317    | -                      | 0.000%         | 0.5                 | 0.040%          | 0.5                  | 0.040%           |
| 34  | 1,354    | -                      | 0.000%         | 0.5                 | 0.040%          | 0.5                  | 0.040%           |
| 35  | 1,353    | -                      | 0.000%         | 0.7                 | 0.050%          | 0.7                  | 0.050%           |
| 36  | 2,004    | 1                      | 0.050%         | 1.2                 | 0.060%          | 1.2                  | 0.060%           |
| 37  | 1,701    | -                      | 0.000%         | 1.2                 | 0.070%          | 1.2                  | 0.070%           |
| 38  | 1,933    | -                      | 0.000%         | 1.5                 | 0.080%          | 1.5                  | 0.080%           |
| 39  | 1,544    | -                      | 0.000%         | 1.4                 | 0.090%          | 1.4                  | 0.090%           |
| 40  | 1,587    | 2                      | 0.126%         | 1.6                 | 0.100%          | 1.6                  | 0.100%           |
| 41  | 1,535    | 2                      | 0.130%         | 1.5                 | 0.100%          | 1.7                  | 0.110%           |
| 42  | 1,599    | -                      | 0.000%         | 1.9                 | 0.120%          | 1.9                  | 0.120%           |
| 43  | 1,696    | 4                      | 0.236%         | 2.2                 | 0.130%          | 2.2                  | 0.130%           |
| 44  | 1,932    | 4                      | 0.207%         | 2.7                 | 0.140%          | 2.9                  | 0.150%           |
| 45  | 2,117    | 3                      | 0.142%         | 3.4                 | 0.160%          | 3.6                  | 0.170%           |
| 46  | 2,260    | 2                      | 0.088%         | 3.8                 | 0.170%          | 4.3                  | 0.190%           |
| 47  | 2,364    | 3                      | 0.127%         | 4.3                 | 0.180%          | 5.0                  | 0.210%           |
| 48  | 2,468    | 3                      | 0.122%         | 4.9                 | 0.200%          | 5.7                  | 0.230%           |
| 49  | 2,497    | 10                     | 0.400%         | 5.7                 | 0.230%          | 6.5                  | 0.260%           |
| 50  | 2,482    | 5                      | 0.201%         | 7.7                 | 0.310%          | 7.2                  | 0.290%           |
| 51  | 2,546    | 8                      | 0.314%         | 8.7                 | 0.340%          | 8.1                  | 0.320%           |
| 52  | 2,557    | 8                      | 0.313%         | 9.2                 | 0.360%          | 8.9                  | 0.350%           |
| 53  | 2,561    | 12                     | 0.469%         | 10.0                | 0.390%          | 9.7                  | 0.380%           |
| 54  | 2,424    | 9                      | 0.371%         | 9.9                 | 0.410%          | 9.9                  | 0.410%           |
| 55  | 2,339    | 7                      | 0.299%         | 10.5                | 0.450%          | 10.5                 | 0.450%           |
| 56  | 2,225    | 8                      | 0.360%         | 12.0                | 0.540%          | 10.0                 | 0.450%           |
| 57  | 2,105    | 7                      | 0.333%         | 13.3                | 0.630%          | 9.5                  | 0.450%           |
| 58  | 1,987    | 8                      | 0.403%         | 12.5                | 0.630%          | 8.9                  | 0.450%           |
| 59  | 1,893    | 6                      | 0.317%         | 11.9                | 0.630%          | 8.5                  | 0.450%           |
| 60  | 1,821    | 3                      | 0.165%         | 11.5                | 0.630%          | 8.2                  | 0.450%           |
| 61  | 1,591    | 10                     | 0.629%         | 10.0                | 0.630%          | 7.2                  | 0.450%           |
| 62  | 1,280    | 3                      | 0.234%         | 8.1                 | 0.630%          | 5.8                  | 0.450%           |
|     | 70,603   | 128                    | 0.181%         | 177.1               | 0.251%          | 157.5                | 0.223%           |



Appendix G-13  
Rate of Disability - Active Lives  
Hazardous Duty - Males

| Age | Exposure | Actual<br>Disabilities | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|------------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 20  | 1        | -                      | 0.000%         | 0.0                 | 0.010%          | 0.0                  | 0.010%           |
| 21  | 6        | -                      | 0.000%         | 0.0                 | 0.010%          | 0.0                  | 0.010%           |
| 22  | 45       | -                      | 0.000%         | 0.0                 | 0.010%          | 0.0                  | 0.010%           |
| 23  | 93       | -                      | 0.000%         | 0.0                 | 0.010%          | 0.0                  | 0.010%           |
| 24  | 130      | -                      | 0.000%         | 0.0                 | 0.010%          | 0.0                  | 0.010%           |
| 25  | 139      | -                      | 0.000%         | 0.0                 | 0.020%          | 0.0                  | 0.020%           |
| 26  | 123      | -                      | 0.000%         | 0.0                 | 0.020%          | 0.0                  | 0.020%           |
| 27  | 135      | -                      | 0.000%         | 0.0                 | 0.020%          | 0.0                  | 0.020%           |
| 28  | 116      | -                      | 0.000%         | 0.0                 | 0.020%          | 0.0                  | 0.020%           |
| 29  | 133      | -                      | 0.000%         | 0.0                 | 0.020%          | 0.0                  | 0.020%           |
| 30  | 157      | -                      | 0.000%         | 0.0                 | 0.020%          | 0.0                  | 0.020%           |
| 31  | 165      | -                      | 0.000%         | 0.0                 | 0.020%          | 0.0                  | 0.020%           |
| 32  | 158      | -                      | 0.000%         | 0.0                 | 0.030%          | 0.0                  | 0.030%           |
| 33  | 156      | -                      | 0.000%         | 0.0                 | 0.030%          | 0.0                  | 0.030%           |
| 34  | 223      | -                      | 0.000%         | 0.1                 | 0.040%          | 0.1                  | 0.040%           |
| 35  | 178      | -                      | 0.000%         | 0.1                 | 0.050%          | 0.1                  | 0.050%           |
| 36  | 215      | -                      | 0.000%         | 0.1                 | 0.050%          | 0.1                  | 0.050%           |
| 37  | 169      | -                      | 0.000%         | 0.1                 | 0.050%          | 0.1                  | 0.050%           |
| 38  | 181      | -                      | 0.000%         | 0.1                 | 0.060%          | 0.1                  | 0.060%           |
| 39  | 205      | -                      | 0.000%         | 0.1                 | 0.070%          | 0.1                  | 0.070%           |
| 40  | 170      | -                      | 0.000%         | 0.1                 | 0.080%          | 0.1                  | 0.080%           |
| 41  | 165      | -                      | 0.000%         | 0.1                 | 0.080%          | 0.1                  | 0.080%           |
| 42  | 155      | -                      | 0.000%         | 0.1                 | 0.090%          | 0.1                  | 0.090%           |
| 43  | 177      | -                      | 0.000%         | 0.2                 | 0.110%          | 0.2                  | 0.110%           |
| 44  | 168      | 1                      | 0.595%         | 0.2                 | 0.120%          | 0.2                  | 0.120%           |
| 45  | 171      | -                      | 0.000%         | 0.2                 | 0.140%          | 0.2                  | 0.140%           |
| 46  | 143      | -                      | 0.000%         | 0.2                 | 0.150%          | 0.2                  | 0.150%           |
| 47  | 131      | -                      | 0.000%         | 0.2                 | 0.170%          | 0.2                  | 0.170%           |
| 48  | 128      | -                      | 0.000%         | 0.3                 | 0.200%          | 0.3                  | 0.200%           |
| 49  | 118      | -                      | 0.000%         | 0.3                 | 0.230%          | 0.3                  | 0.230%           |
| 50  | 113      | 1                      | 0.885%         | 0.5                 | 0.410%          | 0.3                  | 0.250%           |
| 51  | 117      | 1                      | 0.855%         | 0.6                 | 0.490%          | 0.4                  | 0.300%           |
| 52  | 118      | -                      | 0.000%         | 0.7                 | 0.570%          | 0.4                  | 0.350%           |
| 53  | 130      | 1                      | 0.769%         | 0.9                 | 0.660%          | 0.5                  | 0.400%           |
| 54  | 124      | -                      | 0.000%         | 0.9                 | 0.710%          | 0.6                  | 0.475%           |
| 55  | 110      | 1                      | 0.909%         | 0.8                 | 0.760%          | 0.6                  | 0.550%           |
| 56  | 92       | 1                      | 1.087%         | 0.7                 | 0.750%          | 0.6                  | 0.650%           |
| 57  | 75       | -                      | 0.000%         | 0.6                 | 0.790%          | 0.6                  | 0.750%           |
| 58  | 65       | -                      | 0.000%         | 0.6                 | 0.850%          | 0.5                  | 0.750%           |
| 59  | 64       | -                      | 0.000%         | 0.5                 | 0.850%          | 0.5                  | 0.750%           |
| 60  | 57       | 2                      | 3.509%         | 0.5                 | 0.850%          | 0.4                  | 0.750%           |
| 61  | 49       | -                      | 0.000%         | 0.4                 | 0.850%          | 0.4                  | 0.750%           |
| 62  | 37       | -                      | 0.000%         | 0.3                 | 0.850%          | 0.3                  | 0.750%           |
|     | 5,405    | 8                      | 0.148%         | 10.8                | 0.200%          | 8.9                  | 0.165%           |



Appendix G-14  
Rate of Termination of Employment  
OPERS - Less Than 2 Years

| Age | Exposure | Actual Terminations | Actual Rate | Current Expected | Current Rate | Proposed Expected | Proposed Rate |
|-----|----------|---------------------|-------------|------------------|--------------|-------------------|---------------|
| 25  | 864      | 224                 | 25.9%       | 224.6            | 26.0%        | 224.6             | 26.0%         |
| 26  | 854      | 197                 | 23.1%       | 219.5            | 25.7%        | 219.5             | 25.7%         |
| 27  | 780      | 179                 | 22.9%       | 198.9            | 25.5%        | 198.9             | 25.5%         |
| 28  | 686      | 157                 | 22.9%       | 171.5            | 25.0%        | 171.5             | 25.0%         |
| 29  | 672      | 167                 | 24.9%       | 164.6            | 24.5%        | 164.6             | 24.5%         |
| 30  | 617      | 121                 | 19.6%       | 148.1            | 24.0%        | 148.1             | 24.0%         |
| 31  | 577      | 125                 | 21.7%       | 135.6            | 23.5%        | 135.6             | 23.5%         |
| 32  | 543      | 113                 | 20.8%       | 124.9            | 23.0%        | 124.9             | 23.0%         |
| 33  | 552      | 128                 | 23.2%       | 124.2            | 22.5%        | 124.2             | 22.5%         |
| 34  | 493      | 111                 | 22.5%       | 108.5            | 22.0%        | 108.5             | 22.0%         |
| 35  | 493      | 107                 | 21.7%       | 106.0            | 21.5%        | 106.0             | 21.5%         |
| 36  | 480      | 102                 | 21.3%       | 100.8            | 21.0%        | 100.8             | 21.0%         |
| 37  | 469      | 119                 | 25.4%       | 96.1             | 20.5%        | 96.1              | 20.5%         |
| 38  | 460      | 100                 | 21.7%       | 92.0             | 20.0%        | 92.0              | 20.0%         |
| 39  | 451      | 84                  | 18.6%       | 87.5             | 19.4%        | 87.5              | 19.4%         |
| 40  | 436      | 86                  | 19.7%       | 84.1             | 19.3%        | 84.1              | 19.3%         |
| 41  | 396      | 88                  | 22.2%       | 76.0             | 19.2%        | 76.0              | 19.2%         |
| 42  | 392      | 80                  | 20.4%       | 74.9             | 19.1%        | 74.9              | 19.1%         |
| 43  | 372      | 78                  | 21.0%       | 70.7             | 19.0%        | 70.7              | 19.0%         |
| 44  | 392      | 81                  | 20.7%       | 74.1             | 18.9%        | 74.1              | 18.9%         |
| 45  | 408      | 78                  | 19.1%       | 76.7             | 18.8%        | 76.7              | 18.8%         |
| 46  | 410      | 70                  | 17.1%       | 76.7             | 18.7%        | 76.7              | 18.7%         |
| 47  | 430      | 79                  | 18.4%       | 80.0             | 18.6%        | 80.0              | 18.6%         |
| 48  | 405      | 79                  | 19.5%       | 74.9             | 18.5%        | 74.9              | 18.5%         |
| 49  | 376      | 69                  | 18.4%       | 69.2             | 18.4%        | 69.2              | 18.4%         |
| 50  | 384      | 55                  | 14.3%       | 70.3             | 18.3%        | 70.3              | 18.3%         |
| 51  | 404      | 57                  | 14.1%       | 73.5             | 18.2%        | 73.5              | 18.2%         |
| 52  | 364      | 51                  | 14.0%       | 65.9             | 18.1%        | 65.9              | 18.1%         |
| 53  | 384      | 59                  | 15.4%       | 69.1             | 18.0%        | 69.1              | 18.0%         |
| 54  | 332      | 50                  | 15.1%       | 59.8             | 18.0%        | 59.8              | 18.0%         |
|     | 14,876   | 3,094               | 20.8%       | 3,198.7          | 21.5%        | 3,198.7           | 21.5%         |



Appendix G-15  
Rate of Termination of Employment  
OPERS - 2 Years

| Age | Exposure | Actual<br>Terminations | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|------------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 25  | 435      | 84                     | 19.3%          | 87.0                | 20.0%           | 87.0                 | 20.0%            |
| 26  | 460      | 95                     | 20.7%          | 89.7                | 19.5%           | 89.7                 | 19.5%            |
| 27  | 500      | 112                    | 22.4%          | 95.0                | 19.0%           | 95.0                 | 19.0%            |
| 28  | 434      | 67                     | 15.4%          | 80.3                | 18.5%           | 80.3                 | 18.5%            |
| 29  | 361      | 64                     | 17.7%          | 65.0                | 18.0%           | 65.0                 | 18.0%            |
| 30  | 339      | 65                     | 19.2%          | 59.3                | 17.5%           | 59.3                 | 17.5%            |
| 31  | 317      | 44                     | 13.9%          | 53.9                | 17.0%           | 53.9                 | 17.0%            |
| 32  | 349      | 57                     | 16.3%          | 58.6                | 16.8%           | 58.6                 | 16.8%            |
| 33  | 307      | 42                     | 13.7%          | 50.7                | 16.5%           | 50.7                 | 16.5%            |
| 34  | 360      | 59                     | 16.4%          | 58.3                | 16.2%           | 58.3                 | 16.2%            |
| 35  | 284      | 42                     | 14.8%          | 45.2                | 15.9%           | 45.2                 | 15.9%            |
| 36  | 265      | 38                     | 14.3%          | 41.3                | 15.6%           | 41.3                 | 15.6%            |
| 37  | 300      | 50                     | 16.7%          | 45.6                | 15.2%           | 45.6                 | 15.2%            |
| 38  | 279      | 41                     | 14.7%          | 41.3                | 14.8%           | 41.3                 | 14.8%            |
| 39  | 257      | 34                     | 13.2%          | 37.0                | 14.4%           | 37.0                 | 14.4%            |
| 40  | 241      | 36                     | 14.9%          | 33.7                | 14.0%           | 33.7                 | 14.0%            |
| 41  | 249      | 27                     | 10.8%          | 33.9                | 13.6%           | 33.9                 | 13.6%            |
| 42  | 214      | 26                     | 12.1%          | 28.2                | 13.2%           | 28.2                 | 13.2%            |
| 43  | 226      | 28                     | 12.4%          | 28.9                | 12.8%           | 28.9                 | 12.8%            |
| 44  | 229      | 27                     | 11.8%          | 28.4                | 12.4%           | 28.4                 | 12.4%            |
| 45  | 264      | 26                     | 9.8%           | 31.7                | 12.0%           | 31.7                 | 12.0%            |
| 46  | 221      | 24                     | 10.9%          | 25.6                | 11.6%           | 25.6                 | 11.6%            |
| 47  | 252      | 31                     | 12.3%          | 28.2                | 11.2%           | 28.2                 | 11.2%            |
| 48  | 243      | 34                     | 14.0%          | 26.2                | 10.8%           | 26.2                 | 10.8%            |
| 49  | 255      | 17                     | 6.7%           | 26.5                | 10.4%           | 26.5                 | 10.4%            |
| 50  | 234      | 27                     | 11.5%          | 22.7                | 9.7%            | 22.7                 | 9.7%             |
| 51  | 234      | 26                     | 11.1%          | 22.0                | 9.4%            | 22.0                 | 9.4%             |
| 52  | 241      | 35                     | 14.5%          | 21.7                | 9.0%            | 21.7                 | 9.0%             |
| 53  | 252      | 26                     | 10.3%          | 22.7                | 9.0%            | 22.7                 | 9.0%             |
| 54  | 231      | 28                     | 12.1%          | 20.8                | 9.0%            | 20.8                 | 9.0%             |
|     | 8,833    | 1,312                  | 14.9%          | 1,309.5             | 14.8%           | 1,309.5              | 14.8%            |



Appendix G-16  
Rate of Termination of Employment  
OPERS - 3 Years

| Age | Exposure | Actual Terminations | Actual Rate | Current Expected | Current Rate | Proposed Expected | Proposed Rate |
|-----|----------|---------------------|-------------|------------------|--------------|-------------------|---------------|
| 25  | 247      | 51                  | 20.6%       | 42.2             | 17.1%        | 42.2              | 17.1%         |
| 26  | 328      | 54                  | 16.5%       | 55.4             | 16.9%        | 55.4              | 16.9%         |
| 27  | 349      | 56                  | 16.0%       | 58.2             | 16.7%        | 58.2              | 16.7%         |
| 28  | 352      | 55                  | 15.6%       | 57.4             | 16.3%        | 57.4              | 16.3%         |
| 29  | 342      | 45                  | 13.2%       | 54.5             | 15.9%        | 54.5              | 15.9%         |
| 30  | 279      | 43                  | 15.4%       | 43.4             | 15.5%        | 43.4              | 15.5%         |
| 31  | 249      | 40                  | 16.1%       | 37.8             | 15.2%        | 37.8              | 15.2%         |
| 32  | 263      | 31                  | 11.8%       | 38.9             | 14.8%        | 38.9              | 14.8%         |
| 33  | 278      | 44                  | 15.8%       | 40.1             | 14.4%        | 40.1              | 14.4%         |
| 34  | 272      | 41                  | 15.1%       | 38.2             | 14.0%        | 38.2              | 14.0%         |
| 35  | 250      | 21                  | 8.4%        | 34.1             | 13.7%        | 34.1              | 13.7%         |
| 36  | 227      | 29                  | 12.8%       | 30.1             | 13.3%        | 30.1              | 13.3%         |
| 37  | 253      | 29                  | 11.5%       | 32.6             | 12.9%        | 32.6              | 12.9%         |
| 38  | 261      | 31                  | 11.9%       | 32.9             | 12.6%        | 32.9              | 12.6%         |
| 39  | 226      | 25                  | 11.1%       | 27.9             | 12.3%        | 27.9              | 12.3%         |
| 40  | 224      | 26                  | 11.6%       | 27.1             | 12.1%        | 27.1              | 12.1%         |
| 41  | 198      | 19                  | 9.6%        | 23.4             | 11.8%        | 23.4              | 11.8%         |
| 42  | 218      | 20                  | 9.2%        | 25.1             | 11.5%        | 25.1              | 11.5%         |
| 43  | 199      | 13                  | 6.5%        | 22.8             | 11.5%        | 22.8              | 11.5%         |
| 44  | 228      | 35                  | 15.4%       | 26.0             | 11.4%        | 26.0              | 11.4%         |
| 45  | 241      | 23                  | 9.5%        | 27.3             | 11.3%        | 27.3              | 11.3%         |
| 46  | 240      | 34                  | 14.2%       | 27.0             | 11.2%        | 27.0              | 11.2%         |
| 47  | 209      | 20                  | 9.6%        | 23.4             | 11.2%        | 23.4              | 11.2%         |
| 48  | 250      | 20                  | 8.0%        | 27.2             | 10.9%        | 27.2              | 10.9%         |
| 49  | 212      | 14                  | 6.6%        | 22.4             | 10.6%        | 22.4              | 10.6%         |
| 50  | 232      | 23                  | 9.9%        | 23.9             | 10.3%        | 23.9              | 10.3%         |
| 51  | 220      | 21                  | 9.5%        | 22.0             | 10.0%        | 22.0              | 10.0%         |
| 52  | 186      | 15                  | 8.1%        | 18.0             | 9.7%         | 18.0              | 9.7%          |
| 53  | 191      | 13                  | 6.8%        | 17.9             | 9.4%         | 17.9              | 9.4%          |
| 54  | 195      | 16                  | 8.2%        | 17.6             | 9.0%         | 17.6              | 9.0%          |
|     | 7,419    | 907                 | 12.2%       | 974.7            | 13.1%        | 974.7             | 13.1%         |



Appendix G-17  
Rate of Termination of Employment  
OPERS - 4 Years

| Age | Exposure | Actual<br>Terminations | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|------------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 25  | 100      | 15                     | 15.0%          | 13.7                | 13.7%           | 13.7                 | 13.7%            |
| 26  | 187      | 24                     | 12.8%          | 24.7                | 13.2%           | 24.7                 | 13.2%            |
| 27  | 248      | 42                     | 16.9%          | 31.6                | 12.7%           | 31.6                 | 12.7%            |
| 28  | 246      | 32                     | 13.0%          | 31.3                | 12.7%           | 31.3                 | 12.7%            |
| 29  | 237      | 24                     | 10.1%          | 30.1                | 12.7%           | 30.1                 | 12.7%            |
| 30  | 243      | 29                     | 11.9%          | 30.8                | 12.7%           | 30.8                 | 12.7%            |
| 31  | 201      | 19                     | 9.5%           | 25.5                | 12.7%           | 25.5                 | 12.7%            |
| 32  | 183      | 22                     | 12.0%          | 23.2                | 12.7%           | 23.2                 | 12.7%            |
| 33  | 194      | 26                     | 13.4%          | 24.2                | 12.5%           | 24.2                 | 12.5%            |
| 34  | 191      | 24                     | 12.6%          | 23.5                | 12.3%           | 23.5                 | 12.3%            |
| 35  | 217      | 21                     | 9.7%           | 26.4                | 12.1%           | 26.4                 | 12.1%            |
| 36  | 178      | 18                     | 10.1%          | 21.3                | 12.0%           | 21.3                 | 12.0%            |
| 37  | 183      | 21                     | 11.5%          | 21.6                | 11.8%           | 21.6                 | 11.8%            |
| 38  | 206      | 23                     | 11.2%          | 23.7                | 11.5%           | 23.7                 | 11.5%            |
| 39  | 201      | 14                     | 7.0%           | 22.6                | 11.2%           | 22.6                 | 11.2%            |
| 40  | 169      | 11                     | 6.5%           | 18.5                | 10.9%           | 18.5                 | 10.9%            |
| 41  | 165      | 10                     | 6.1%           | 17.6                | 10.7%           | 17.6                 | 10.7%            |
| 42  | 189      | 18                     | 9.5%           | 19.6                | 10.4%           | 19.6                 | 10.4%            |
| 43  | 180      | 19                     | 10.6%          | 18.1                | 10.1%           | 18.1                 | 10.1%            |
| 44  | 180      | 12                     | 6.7%           | 17.6                | 9.8%            | 17.6                 | 9.8%             |
| 45  | 194      | 21                     | 10.8%          | 18.3                | 9.4%            | 18.3                 | 9.4%             |
| 46  | 219      | 17                     | 7.8%           | 20.0                | 9.1%            | 20.0                 | 9.1%             |
| 47  | 201      | 18                     | 9.0%           | 18.0                | 9.0%            | 18.0                 | 9.0%             |
| 48  | 171      | 13                     | 7.6%           | 15.0                | 8.8%            | 15.0                 | 8.8%             |
| 49  | 210      | 16                     | 7.6%           | 18.0                | 8.6%            | 18.0                 | 8.6%             |
| 50  | 168      | 12                     | 7.1%           | 14.0                | 8.3%            | 14.0                 | 8.3%             |
| 51  | 203      | 13                     | 6.4%           | 16.5                | 8.1%            | 16.5                 | 8.1%             |
| 52  | 182      | 19                     | 10.4%          | 14.3                | 7.8%            | 14.3                 | 7.8%             |
| 53  | 159      | 16                     | 10.1%          | 12.1                | 7.6%            | 12.1                 | 7.6%             |
| 54  | 150      | 9                      | 6.0%           | 11.0                | 7.3%            | 11.0                 | 7.3%             |
|     | 5,755    | 578                    | 10.0%          | 622.7               | 10.8%           | 622.7                | 10.8%            |



Appendix G-18  
Rate of Termination of Employment  
OPERS - 5 Years

| Age | Exposure | Actual Terminations | Actual Rate | Current Expected | Current Rate | Proposed Expected | Proposed Rate |
|-----|----------|---------------------|-------------|------------------|--------------|-------------------|---------------|
| 25  | 53       | 7                   | 13.2%       | 7.6              | 14.3%        | 7.6               | 14.3%         |
| 26  | 73       | 9                   | 12.3%       | 9.5              | 13.1%        | 9.5               | 13.1%         |
| 27  | 136      | 17                  | 12.5%       | 16.2             | 11.9%        | 16.2              | 11.9%         |
| 28  | 177      | 24                  | 13.6%       | 20.0             | 11.3%        | 20.0              | 11.3%         |
| 29  | 165      | 17                  | 10.3%       | 18.0             | 10.9%        | 18.0              | 10.9%         |
| 30  | 174      | 23                  | 13.2%       | 18.3             | 10.5%        | 18.3              | 10.5%         |
| 31  | 174      | 18                  | 10.3%       | 17.4             | 10.0%        | 17.6              | 10.1%         |
| 32  | 162      | 16                  | 9.9%        | 15.4             | 9.5%         | 15.7              | 9.7%          |
| 33  | 137      | 13                  | 9.5%        | 12.3             | 9.0%         | 12.7              | 9.3%          |
| 34  | 167      | 12                  | 7.2%        | 14.6             | 8.8%         | 14.9              | 8.9%          |
| 35  | 140      | 14                  | 10.0%       | 11.9             | 8.5%         | 12.2              | 8.7%          |
| 36  | 170      | 19                  | 11.2%       | 14.0             | 8.3%         | 14.5              | 8.5%          |
| 37  | 160      | 15                  | 9.4%        | 12.8             | 8.0%         | 13.3              | 8.3%          |
| 38  | 149      | 14                  | 9.4%        | 11.5             | 7.8%         | 12.1              | 8.1%          |
| 39  | 153      | 17                  | 11.1%       | 11.5             | 7.5%         | 12.1              | 7.9%          |
| 40  | 147      | 11                  | 7.5%        | 10.7             | 7.3%         | 11.3              | 7.7%          |
| 41  | 135      | 11                  | 8.1%        | 9.5              | 7.0%         | 10.1              | 7.5%          |
| 42  | 141      | 12                  | 8.5%        | 9.5              | 6.8%         | 10.3              | 7.3%          |
| 43  | 165      | 13                  | 7.9%        | 10.7             | 6.5%         | 11.7              | 7.1%          |
| 44  | 144      | 13                  | 9.0%        | 9.0              | 6.3%         | 9.9               | 6.9%          |
| 45  | 164      | 19                  | 11.6%       | 9.8              | 6.0%         | 11.0              | 6.7%          |
| 46  | 169      | 15                  | 8.9%        | 9.7              | 5.8%         | 11.0              | 6.5%          |
| 47  | 196      | 13                  | 6.6%        | 10.8             | 5.5%         | 12.7              | 6.5%          |
| 48  | 151      | 14                  | 9.3%        | 7.9              | 5.3%         | 9.8               | 6.5%          |
| 49  | 127      | 5                   | 3.9%        | 6.4              | 5.0%         | 8.3               | 6.5%          |
| 50  | 164      | 13                  | 7.9%        | 8.2              | 5.0%         | 10.7              | 6.5%          |
| 51  | 165      | 12                  | 7.3%        | 8.3              | 5.0%         | 10.7              | 6.5%          |
| 52  | 161      | 10                  | 6.2%        | 8.1              | 5.0%         | 10.5              | 6.5%          |
| 53  | 129      | 6                   | 4.7%        | 6.5              | 5.0%         | 8.4               | 6.5%          |
| 54  | 129      | 10                  | 7.8%        | 6.5              | 5.0%         | 8.4               | 6.5%          |
|     | 4,477    | 412                 | 9.2%        | 342.4            | 7.6%         | 369.3             | 8.2%          |



Appendix G-19  
Rate of Termination of Employment  
OPERS - 6 Years

| Age | Exposure | Actual Terminations | Actual Rate | Current Expected | Current Rate | Proposed Expected | Proposed Rate |
|-----|----------|---------------------|-------------|------------------|--------------|-------------------|---------------|
| 25  | 29       | 2                   | 6.9%        | 4.1              | 14.3%        | 4.1               | 14.3%         |
| 26  | 58       | 6                   | 10.3%       | 7.6              | 13.1%        | 7.6               | 13.1%         |
| 27  | 67       | 7                   | 10.4%       | 8.0              | 11.9%        | 8.0               | 11.9%         |
| 28  | 123      | 14                  | 11.4%       | 13.9             | 11.3%        | 13.9              | 11.3%         |
| 29  | 146      | 17                  | 11.6%       | 15.9             | 10.9%        | 15.9              | 10.9%         |
| 30  | 142      | 14                  | 9.9%        | 14.9             | 10.5%        | 14.9              | 10.5%         |
| 31  | 145      | 15                  | 10.3%       | 14.5             | 10.0%        | 14.6              | 10.1%         |
| 32  | 175      | 18                  | 10.3%       | 16.6             | 9.5%         | 16.8              | 9.6%          |
| 33  | 153      | 13                  | 8.5%        | 13.8             | 9.0%         | 14.0              | 9.2%          |
| 34  | 140      | 15                  | 10.7%       | 12.3             | 8.8%         | 12.4              | 8.8%          |
| 35  | 151      | 12                  | 7.9%        | 12.8             | 8.5%         | 13.0              | 8.6%          |
| 36  | 147      | 14                  | 9.5%        | 12.1             | 8.3%         | 12.3              | 8.4%          |
| 37  | 150      | 11                  | 7.3%        | 12.0             | 8.0%         | 12.2              | 8.2%          |
| 38  | 147      | 9                   | 6.1%        | 11.4             | 7.8%         | 11.6              | 7.9%          |
| 39  | 150      | 12                  | 8.0%        | 11.3             | 7.5%         | 11.6              | 7.7%          |
| 40  | 123      | 9                   | 7.3%        | 8.9              | 7.3%         | 9.2               | 7.5%          |
| 41  | 110      | 9                   | 8.2%        | 7.7              | 7.0%         | 8.0               | 7.3%          |
| 42  | 117      | 7                   | 6.0%        | 7.9              | 6.8%         | 8.2               | 7.0%          |
| 43  | 117      | 7                   | 6.0%        | 7.6              | 6.5%         | 8.0               | 6.8%          |
| 44  | 167      | 15                  | 9.0%        | 10.4             | 6.3%         | 11.0              | 6.6%          |
| 45  | 142      | 17                  | 12.0%       | 8.5              | 6.0%         | 9.0               | 6.4%          |
| 46  | 157      | 5                   | 3.2%        | 9.0              | 5.8%         | 9.6               | 6.1%          |
| 47  | 134      | 11                  | 8.2%        | 7.4              | 5.5%         | 8.0               | 6.0%          |
| 48  | 167      | 18                  | 10.8%       | 8.8              | 5.3%         | 9.8               | 5.9%          |
| 49  | 129      | 12                  | 9.3%        | 6.5              | 5.0%         | 7.4               | 5.8%          |
| 50  | 128      | 5                   | 3.9%        | 6.4              | 5.0%         | 7.4               | 5.8%          |
| 51  | 147      | 7                   | 4.8%        | 7.4              | 5.0%         | 8.5               | 5.8%          |
| 52  | 163      | 13                  | 8.0%        | 8.2              | 5.0%         | 9.4               | 5.8%          |
| 53  | 158      | 7                   | 4.4%        | 7.9              | 5.0%         | 9.1               | 5.8%          |
| 54  | 118      | 4                   | 3.4%        | 5.9              | 5.0%         | 6.8               | 5.8%          |
|     | 4,000    | 325                 | 8.1%        | 299.6            | 7.5%         | 312.1             | 7.8%          |



Appendix G-20  
Rate of Termination of Employment  
OPERS - 7 Years

| Age | Exposure | Actual Terminations | Actual Rate | Current Expected | Current Rate | Proposed Expected | Proposed Rate |
|-----|----------|---------------------|-------------|------------------|--------------|-------------------|---------------|
| 25  | 10       | 1                   | 10.0%       | 1.4              | 14.3%        | 1.4               | 14.3%         |
| 26  | 31       | 4                   | 12.9%       | 4.1              | 13.1%        | 4.1               | 13.1%         |
| 27  | 54       | 9                   | 16.7%       | 6.4              | 11.9%        | 6.4               | 11.9%         |
| 28  | 74       | 10                  | 13.5%       | 8.4              | 11.3%        | 8.4               | 11.3%         |
| 29  | 111      | 13                  | 11.7%       | 12.1             | 10.9%        | 12.1              | 10.9%         |
| 30  | 154      | 10                  | 6.5%        | 16.2             | 10.5%        | 16.2              | 10.5%         |
| 31  | 152      | 16                  | 10.5%       | 15.2             | 10.0%        | 15.2              | 10.0%         |
| 32  | 163      | 15                  | 9.2%        | 15.5             | 9.5%         | 15.5              | 9.5%          |
| 33  | 158      | 9                   | 5.7%        | 14.2             | 9.0%         | 14.2              | 9.0%          |
| 34  | 161      | 10                  | 6.2%        | 14.1             | 8.8%         | 14.1              | 8.8%          |
| 35  | 144      | 11                  | 7.6%        | 12.2             | 8.5%         | 12.2              | 8.5%          |
| 36  | 164      | 22                  | 13.4%       | 13.5             | 8.3%         | 13.5              | 8.3%          |
| 37  | 164      | 15                  | 9.1%        | 13.1             | 8.0%         | 13.1              | 8.0%          |
| 38  | 144      | 6                   | 4.2%        | 11.2             | 7.8%         | 11.2              | 7.8%          |
| 39  | 150      | 6                   | 4.0%        | 11.3             | 7.5%         | 11.3              | 7.5%          |
| 40  | 145      | 13                  | 9.0%        | 10.5             | 7.3%         | 10.5              | 7.3%          |
| 41  | 120      | 13                  | 10.8%       | 8.4              | 7.0%         | 8.4               | 7.0%          |
| 42  | 121      | 14                  | 11.6%       | 8.2              | 6.8%         | 8.2               | 6.8%          |
| 43  | 122      | 9                   | 7.4%        | 7.9              | 6.5%         | 7.9               | 6.5%          |
| 44  | 151      | 7                   | 4.6%        | 9.4              | 6.3%         | 9.4               | 6.3%          |
| 45  | 156      | 12                  | 7.7%        | 9.4              | 6.0%         | 9.4               | 6.0%          |
| 46  | 135      | 8                   | 5.9%        | 7.8              | 5.8%         | 7.8               | 5.8%          |
| 47  | 171      | 11                  | 6.4%        | 9.4              | 5.5%         | 9.4               | 5.5%          |
| 48  | 133      | 9                   | 6.8%        | 7.0              | 5.3%         | 7.0               | 5.3%          |
| 49  | 158      | 13                  | 8.2%        | 7.9              | 5.0%         | 7.9               | 5.0%          |
| 50  | 142      | 8                   | 5.6%        | 7.1              | 5.0%         | 7.1               | 5.0%          |
| 51  | 164      | 8                   | 4.9%        | 8.2              | 5.0%         | 8.2               | 5.0%          |
| 52  | 159      | 4                   | 2.5%        | 8.0              | 5.0%         | 8.0               | 5.0%          |
| 53  | 166      | 8                   | 4.8%        | 8.3              | 5.0%         | 8.3               | 5.0%          |
| 54  | 136      | 7                   | 5.1%        | 6.8              | 5.0%         | 6.8               | 5.0%          |
|     | 4,013    | 301                 | 7.5%        | 293.0            | 7.3%         | 293.0             | 7.3%          |



Appendix G-21  
Rate of Termination of Employment  
OPERS - 8 Years

| Age | Exposure | Actual<br>Terminations | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|------------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 25  | -        | -                      | 0.0%           | -                   | 14.3%           | -                    | 14.3%            |
| 26  | 8        | -                      | 0.0%           | 1.0                 | 13.1%           | 1.0                  | 13.1%            |
| 27  | 31       | 4                      | 12.9%          | 3.7                 | 11.9%           | 3.7                  | 11.9%            |
| 28  | 46       | 4                      | 8.7%           | 5.2                 | 11.3%           | 5.2                  | 11.3%            |
| 29  | 77       | 13                     | 16.9%          | 8.4                 | 10.9%           | 8.4                  | 10.9%            |
| 30  | 102      | 16                     | 15.7%          | 10.7                | 10.5%           | 10.7                 | 10.5%            |
| 31  | 159      | 13                     | 8.2%           | 15.9                | 10.0%           | 15.9                 | 10.0%            |
| 32  | 154      | 16                     | 10.4%          | 14.6                | 9.5%            | 14.6                 | 9.5%             |
| 33  | 165      | 11                     | 6.7%           | 14.9                | 9.0%            | 14.9                 | 9.0%             |
| 34  | 153      | 12                     | 7.8%           | 13.4                | 8.8%            | 13.4                 | 8.8%             |
| 35  | 159      | 12                     | 7.5%           | 13.5                | 8.5%            | 13.5                 | 8.5%             |
| 36  | 136      | 8                      | 5.9%           | 11.2                | 8.3%            | 11.2                 | 8.3%             |
| 37  | 150      | 11                     | 7.3%           | 12.0                | 8.0%            | 12.0                 | 8.0%             |
| 38  | 178      | 13                     | 7.3%           | 13.8                | 7.8%            | 13.8                 | 7.8%             |
| 39  | 146      | 11                     | 7.5%           | 11.0                | 7.5%            | 11.0                 | 7.5%             |
| 40  | 151      | 12                     | 7.9%           | 10.9                | 7.3%            | 10.9                 | 7.3%             |
| 41  | 130      | 11                     | 8.5%           | 9.1                 | 7.0%            | 9.1                  | 7.0%             |
| 42  | 133      | 11                     | 8.3%           | 9.0                 | 6.8%            | 9.0                  | 6.8%             |
| 43  | 108      | 10                     | 9.3%           | 7.0                 | 6.5%            | 7.0                  | 6.5%             |
| 44  | 129      | 10                     | 7.8%           | 8.1                 | 6.3%            | 8.1                  | 6.3%             |
| 45  | 171      | 17                     | 9.9%           | 10.3                | 6.0%            | 10.3                 | 6.0%             |
| 46  | 151      | 10                     | 6.6%           | 8.7                 | 5.8%            | 8.7                  | 5.8%             |
| 47  | 156      | 8                      | 5.1%           | 8.6                 | 5.5%            | 8.6                  | 5.5%             |
| 48  | 161      | 5                      | 3.1%           | 8.5                 | 5.3%            | 8.5                  | 5.3%             |
| 49  | 137      | 6                      | 4.4%           | 6.9                 | 5.0%            | 6.9                  | 5.0%             |
| 50  | 149      | 7                      | 4.7%           | 7.5                 | 5.0%            | 7.5                  | 5.0%             |
| 51  | 142      | 4                      | 2.8%           | 7.1                 | 5.0%            | 7.1                  | 5.0%             |
| 52  | 181      | 10                     | 5.5%           | 9.1                 | 5.0%            | 9.1                  | 5.0%             |
| 53  | 155      | 5                      | 3.2%           | 7.8                 | 5.0%            | 7.8                  | 5.0%             |
| 54  | 163      | 8                      | 4.9%           | 8.2                 | 5.0%            | 8.2                  | 5.0%             |
|     | 3,881    | 278                    | 7.2%           | 275.7               | 7.1%            | 275.7                | 7.1%             |



Appendix G-22  
Rate of Termination of Employment  
OPERS - 9 Years

| Age | Exposure | Actual Terminations | Actual Rate | Current Expected | Current Rate | Proposed Expected | Proposed Rate |
|-----|----------|---------------------|-------------|------------------|--------------|-------------------|---------------|
| 25  | 1        | -                   | 0.0%        | 0.1              | 14.3%        | 0.1               | 14.3%         |
| 26  | -        | -                   | 0.0%        | -                | 13.1%        | -                 | 13.1%         |
| 27  | 7        | 1                   | 14.3%       | 0.8              | 11.9%        | 0.8               | 11.9%         |
| 28  | 27       | 5                   | 18.5%       | 3.0              | 11.3%        | 3.0               | 11.3%         |
| 29  | 37       | 4                   | 10.8%       | 4.0              | 10.9%        | 3.9               | 10.7%         |
| 30  | 62       | 6                   | 9.7%        | 6.5              | 10.5%        | 6.2               | 10.0%         |
| 31  | 90       | 6                   | 6.7%        | 9.0              | 10.0%        | 8.5               | 9.4%          |
| 32  | 154      | 10                  | 6.5%        | 14.6             | 9.5%         | 13.5              | 8.8%          |
| 33  | 150      | 13                  | 8.7%        | 13.5             | 9.0%         | 12.6              | 8.4%          |
| 34  | 161      | 10                  | 6.2%        | 14.1             | 8.8%         | 13.0              | 8.1%          |
| 35  | 131      | 12                  | 9.2%        | 11.1             | 8.5%         | 10.1              | 7.7%          |
| 36  | 165      | 9                   | 5.5%        | 13.6             | 8.3%         | 12.1              | 7.3%          |
| 37  | 140      | 2                   | 1.4%        | 11.2             | 8.0%         | 9.7               | 7.0%          |
| 38  | 140      | 7                   | 5.0%        | 10.9             | 7.8%         | 9.2               | 6.6%          |
| 39  | 157      | 12                  | 7.6%        | 11.8             | 7.5%         | 9.8               | 6.2%          |
| 40  | 133      | 5                   | 3.8%        | 9.6              | 7.3%         | 7.8               | 5.9%          |
| 41  | 131      | 6                   | 4.6%        | 9.2              | 7.0%         | 7.2               | 5.5%          |
| 42  | 115      | 5                   | 4.3%        | 7.8              | 6.8%         | 5.9               | 5.2%          |
| 43  | 140      | 8                   | 5.7%        | 9.1              | 6.5%         | 7.0               | 5.0%          |
| 44  | 118      | 6                   | 5.1%        | 7.4              | 6.3%         | 5.7               | 4.9%          |
| 45  | 144      | 11                  | 7.6%        | 8.6              | 6.0%         | 6.7               | 4.7%          |
| 46  | 166      | 7                   | 4.2%        | 9.5              | 5.8%         | 7.5               | 4.5%          |
| 47  | 146      | 11                  | 7.5%        | 8.0              | 5.5%         | 6.4               | 4.4%          |
| 48  | 150      | 7                   | 4.7%        | 7.9              | 5.3%         | 6.5               | 4.4%          |
| 49  | 162      | 7                   | 4.3%        | 8.1              | 5.0%         | 7.1               | 4.4%          |
| 50  | 157      | 10                  | 6.4%        | 7.9              | 5.0%         | 6.8               | 4.4%          |
| 51  | 147      | 6                   | 4.1%        | 7.4              | 5.0%         | 6.4               | 4.4%          |
| 52  | 146      | 6                   | 4.1%        | 7.3              | 5.0%         | 6.4               | 4.4%          |
| 53  | 177      | 9                   | 5.1%        | 8.9              | 5.0%         | 7.7               | 4.4%          |
| 54  | 132      | 3                   | 2.3%        | 6.6              | 5.0%         | 5.8               | 4.4%          |
|     | 3,586    | 204                 | 5.7%        | 247.5            | 6.9%         | 213.8             | 6.0%          |



Appendix G-23  
Rate of Termination of Employment  
OPERS - More Than 9 Years

| Age | Exposure | Actual Terminations | Actual Rate | Current Expected | Current Rate | Proposed Expected | Proposed Rate |
|-----|----------|---------------------|-------------|------------------|--------------|-------------------|---------------|
| 25  | 4        | 1                   | 25.0%       | 0.3              | 8.0%         | 0.3               | 7.0%          |
| 26  | 1        | -                   | 0.0%        | 0.1              | 8.0%         | 0.1               | 7.0%          |
| 27  | 2        | -                   | 0.0%        | 0.2              | 8.0%         | 0.1               | 7.0%          |
| 28  | 6        | -                   | 0.0%        | 0.5              | 8.0%         | 0.4               | 7.0%          |
| 29  | 25       | 3                   | 12.0%       | 2.0              | 8.0%         | 1.8               | 7.0%          |
| 30  | 46       | 1                   | 2.2%        | 3.7              | 8.0%         | 3.2               | 7.0%          |
| 31  | 96       | 9                   | 9.4%        | 7.7              | 8.0%         | 6.7               | 7.0%          |
| 32  | 161      | 8                   | 5.0%        | 12.9             | 8.0%         | 11.3              | 7.0%          |
| 33  | 265      | 15                  | 5.7%        | 20.1             | 7.6%         | 17.5              | 6.6%          |
| 34  | 366      | 21                  | 5.7%        | 26.4             | 7.2%         | 22.7              | 6.2%          |
| 35  | 483      | 23                  | 4.8%        | 32.8             | 6.8%         | 28.0              | 5.8%          |
| 36  | 615      | 34                  | 5.5%        | 39.4             | 6.4%         | 33.8              | 5.5%          |
| 37  | 767      | 44                  | 5.7%        | 46.0             | 6.0%         | 39.9              | 5.2%          |
| 38  | 846      | 47                  | 5.6%        | 47.4             | 5.6%         | 41.5              | 4.9%          |
| 39  | 920      | 40                  | 4.3%        | 47.8             | 5.2%         | 42.3              | 4.6%          |
| 40  | 1,039    | 36                  | 3.5%        | 49.9             | 4.8%         | 45.7              | 4.4%          |
| 41  | 1,112    | 38                  | 3.4%        | 48.9             | 4.4%         | 46.7              | 4.2%          |
| 42  | 1,221    | 43                  | 3.5%        | 48.8             | 4.0%         | 48.8              | 4.0%          |
| 43  | 1,401    | 46                  | 3.3%        | 50.4             | 3.6%         | 50.4              | 3.6%          |
| 44  | 1,693    | 64                  | 3.8%        | 54.2             | 3.2%         | 57.6              | 3.4%          |
| 45  | 1,857    | 53                  | 2.9%        | 59.4             | 3.2%         | 59.4              | 3.2%          |
| 46  | 2,069    | 63                  | 3.0%        | 66.2             | 3.2%         | 62.1              | 3.0%          |
| 47  | 2,193    | 52                  | 2.4%        | 70.2             | 3.2%         | 65.8              | 3.0%          |
| 48  | 2,350    | 57                  | 2.4%        | 75.2             | 3.2%         | 70.5              | 3.0%          |
| 49  | 2,423    | 89                  | 3.7%        | 77.5             | 3.2%         | 72.7              | 3.0%          |
| 50  | 2,317    | 54                  | 2.3%        | 74.1             | 3.2%         | 69.5              | 3.0%          |
| 51  | 2,193    | 57                  | 2.6%        | 70.2             | 3.2%         | 65.8              | 3.0%          |
| 52  | 1,963    | 57                  | 2.9%        | 62.8             | 3.2%         | 58.9              | 3.0%          |
| 53  | 1,832    | 55                  | 3.0%        | 58.6             | 3.2%         | 55.0              | 3.0%          |
| 54  | 1,792    | 51                  | 2.8%        | 57.3             | 3.2%         | 53.8              | 3.0%          |
|     | 32,058   | 1,061               | 3.3%        | 1,211.1          | 3.8%         | 1,132.2           | 3.5%          |



Appendix G-24  
Probability of Contributions Remaining with the System  
OPERS - Regular

| Age | Exposure | Actual<br>Remaining | Actual<br>Rate | Current<br>Expected | Current<br>Rate | Proposed<br>Expected | Proposed<br>Rate |
|-----|----------|---------------------|----------------|---------------------|-----------------|----------------------|------------------|
| 30  | 20       | 13                  | 65.0%          | 16.0                | 80.0%           | 14.0                 | 70.0%            |
| 31  | 27       | 16                  | 59.3%          | 21.6                | 80.0%           | 18.9                 | 70.0%            |
| 32  | 32       | 15                  | 46.9%          | 25.6                | 80.0%           | 22.4                 | 70.0%            |
| 33  | 32       | 21                  | 65.6%          | 25.6                | 80.0%           | 22.4                 | 70.0%            |
| 34  | 35       | 17                  | 48.6%          | 28.0                | 80.0%           | 26.3                 | 75.0%            |
| 35  | 38       | 23                  | 60.5%          | 30.4                | 80.0%           | 28.5                 | 75.0%            |
| 36  | 45       | 27                  | 60.0%          | 38.3                | 85.0%           | 33.8                 | 75.0%            |
| 37  | 50       | 30                  | 60.0%          | 42.5                | 85.0%           | 37.5                 | 75.0%            |
| 38  | 62       | 46                  | 74.2%          | 52.7                | 85.0%           | 46.5                 | 75.0%            |
| 39  | 57       | 39                  | 68.4%          | 48.5                | 85.0%           | 45.6                 | 80.0%            |
| 40  | 47       | 28                  | 59.6%          | 40.0                | 85.0%           | 37.6                 | 80.0%            |
| 41  | 51       | 34                  | 66.7%          | 43.4                | 85.0%           | 40.8                 | 80.0%            |
| 42  | 55       | 33                  | 60.0%          | 46.8                | 85.0%           | 44.0                 | 80.0%            |
| 43  | 56       | 38                  | 67.9%          | 47.6                | 85.0%           | 44.8                 | 80.0%            |
| 44  | 77       | 56                  | 72.7%          | 65.5                | 85.0%           | 61.6                 | 80.0%            |
| 45  | 78       | 58                  | 74.4%          | 66.3                | 85.0%           | 62.4                 | 80.0%            |
| 46  | 75       | 49                  | 65.3%          | 63.8                | 85.0%           | 60.0                 | 80.0%            |
| 47  | 67       | 49                  | 73.1%          | 67.0                | 100.0%          | 57.0                 | 85.0%            |
| 48  | 64       | 52                  | 81.3%          | 64.0                | 100.0%          | 57.6                 | 90.0%            |
| 49  | 94       | 72                  | 76.6%          | 94.0                | 100.0%          | 89.3                 | 95.0%            |
| 50  | 68       | 57                  | 83.8%          | 68.0                | 100.0%          | 68.0                 | 100.0%           |
| 51  | 67       | 54                  | 80.6%          | 67.0                | 100.0%          | 67.0                 | 100.0%           |
| 52  | 73       | 54                  | 74.0%          | 73.0                | 100.0%          | 73.0                 | 100.0%           |
| 53  | 70       | 50                  | 71.4%          | 70.0                | 100.0%          | 70.0                 | 100.0%           |
| 54  | 64       | 50                  | 78.1%          | 64.0                | 100.0%          | 64.0                 | 100.0%           |
|     | 1,404    | 981                 | 69.9%          | 1,269.3             | 90.4%           | 1,192.9              | 85.0%            |



Appendix G-25  
Total Salary Scale  
OPERS

| Age | Initial<br>Salary<br>(Millions) | Subsequent<br>Salary<br>(Millions) | Actual<br>Rate | Current<br>Expected<br>(Millions) | Current<br>Rate | Proposed<br>Expected<br>(Millions) | Proposed<br>Rate |
|-----|---------------------------------|------------------------------------|----------------|-----------------------------------|-----------------|------------------------------------|------------------|
| 21  | 4.3                             | 4.9                                | 14.2%          | 4.7                               | 9.3%            | 4.7                                | 9.1%             |
| 22  | 7.4                             | 8.4                                | 13.0%          | 8.1                               | 9.0%            | 8.1                                | 8.7%             |
| 23  | 13.9                            | 15.6                               | 12.6%          | 15.1                              | 8.8%            | 15.0                               | 8.5%             |
| 24  | 22.6                            | 25.1                               | 11.2%          | 24.5                              | 8.6%            | 24.5                               | 8.4%             |
| 25  | 31.1                            | 33.9                               | 9.0%           | 33.7                              | 8.4%            | 33.6                               | 8.2%             |
| 26  | 39.6                            | 43.0                               | 8.5%           | 42.9                              | 8.2%            | 42.8                               | 8.0%             |
| 27  | 45.9                            | 49.5                               | 7.9%           | 49.5                              | 8.0%            | 49.4                               | 7.7%             |
| 28  | 50.2                            | 53.2                               | 6.1%           | 54.0                              | 7.7%            | 53.9                               | 7.5%             |
| 29  | 52.0                            | 54.9                               | 5.7%           | 55.8                              | 7.4%            | 55.7                               | 7.1%             |
| 30  | 53.0                            | 56.2                               | 6.1%           | 56.7                              | 7.1%            | 56.6                               | 6.9%             |
| 31  | 55.9                            | 59.5                               | 6.5%           | 59.7                              | 6.9%            | 59.6                               | 6.6%             |
| 32  | 61.8                            | 65.0                               | 5.0%           | 66.0                              | 6.7%            | 65.8                               | 6.5%             |
| 33  | 64.5                            | 68.3                               | 5.8%           | 68.7                              | 6.5%            | 68.5                               | 6.2%             |
| 34  | 68.7                            | 71.9                               | 4.7%           | 73.0                              | 6.2%            | 72.8                               | 6.0%             |
| 35  | 70.9                            | 74.3                               | 4.8%           | 75.3                              | 6.2%            | 75.1                               | 5.9%             |
| 36  | 76.1                            | 79.8                               | 4.9%           | 80.7                              | 6.1%            | 80.5                               | 5.9%             |
| 37  | 81.7                            | 85.6                               | 4.8%           | 86.6                              | 6.1%            | 86.4                               | 5.8%             |
| 38  | 86.8                            | 90.9                               | 4.6%           | 92.1                              | 6.0%            | 91.8                               | 5.7%             |
| 39  | 87.7                            | 91.7                               | 4.5%           | 93.0                              | 6.0%            | 92.8                               | 5.7%             |
| 40  | 90.6                            | 94.4                               | 4.2%           | 96.0                              | 5.9%            | 95.7                               | 5.7%             |
| 41  | 88.9                            | 92.9                               | 4.5%           | 94.2                              | 5.9%            | 94.0                               | 5.7%             |
| 42  | 93.9                            | 97.9                               | 4.2%           | 99.3                              | 5.8%            | 99.1                               | 5.5%             |
| 43  | 101.3                           | 105.0                              | 3.7%           | 107.1                             | 5.7%            | 106.8                              | 5.5%             |
| 44  | 116.1                           | 120.5                              | 3.8%           | 122.6                             | 5.6%            | 122.3                              | 5.4%             |
| 45  | 128.3                           | 133.3                              | 3.9%           | 135.5                             | 5.6%            | 135.1                              | 5.3%             |
| 46  | 140.6                           | 145.4                              | 3.4%           | 148.3                             | 5.5%            | 148.0                              | 5.3%             |
| 47  | 147.0                           | 152.1                              | 3.4%           | 155.0                             | 5.4%            | 154.6                              | 5.2%             |
| 48  | 151.8                           | 156.4                              | 3.0%           | 159.9                             | 5.3%            | 159.5                              | 5.0%             |
| 49  | 152.3                           | 156.8                              | 3.0%           | 160.3                             | 5.3%            | 159.9                              | 5.1%             |
| 50  | 155.1                           | 159.9                              | 3.1%           | 163.2                             | 5.2%            | 162.8                              | 5.0%             |
| 51  | 158.5                           | 163.5                              | 3.2%           | 166.7                             | 5.2%            | 166.3                              | 4.9%             |
| 52  | 158.4                           | 162.4                              | 2.6%           | 166.4                             | 5.1%            | 166.0                              | 4.8%             |
| 53  | 158.1                           | 162.6                              | 2.9%           | 166.2                             | 5.1%            | 165.8                              | 4.8%             |
| 54  | 154.0                           | 158.8                              | 3.1%           | 161.9                             | 5.1%            | 161.5                              | 4.8%             |
| 55  | 153.9                           | 158.6                              | 3.0%           | 161.8                             | 5.1%            | 161.4                              | 4.8%             |
| 56  | 148.2                           | 152.6                              | 3.0%           | 155.8                             | 5.1%            | 155.4                              | 4.8%             |
| 57  | 140.0                           | 144.0                              | 2.8%           | 147.2                             | 5.1%            | 146.8                              | 4.8%             |
| 58  | 132.8                           | 136.1                              | 2.5%           | 139.6                             | 5.1%            | 139.2                              | 4.8%             |
| 59  | 123.0                           | 126.7                              | 3.0%           | 129.3                             | 5.1%            | 129.0                              | 4.8%             |
| 60  | 121.7                           | 124.7                              | 2.4%           | 127.9                             | 5.1%            | 127.6                              | 4.8%             |
| 61  | 105.8                           | 108.7                              | 2.7%           | 111.2                             | 5.1%            | 111.0                              | 4.8%             |
| 62  | 79.9                            | 81.1                               | 1.5%           | 84.0                              | 5.1%            | 83.8                               | 4.8%             |
| 63  | 63.0                            | 64.3                               | 2.0%           | 66.2                              | 5.1%            | 66.1                               | 4.8%             |
| 64  | 51.1                            | 52.3                               | 2.4%           | 53.7                              | 5.1%            | 53.5                               | 4.8%             |
| 65  | 38.6                            | 39.4                               | 2.1%           | 40.6                              | 5.1%            | 40.5                               | 4.8%             |
| 66  | 26.7                            | 27.1                               | 1.5%           | 28.1                              | 5.1%            | 28.0                               | 4.8%             |
| 67  | 20.6                            | 21.9                               | 6.2%           | 21.7                              | 5.1%            | 21.6                               | 4.8%             |
| 68  | 17.8                            | 18.3                               | 3.0%           | 18.7                              | 5.1%            | 18.7                               | 4.8%             |
| 69  | 13.9                            | 14.1                               | 0.9%           | 14.6                              | 5.1%            | 14.6                               | 4.8%             |
| 70  | 9.4                             | 9.5                                | 1.1%           | 9.9                               | 5.1%            | 9.9                                | 4.8%             |
|     | 4,215.4                         | 4,372.9                            | 3.7%           | 4,452.8                           | 5.6%            | 4,442.2                            | 5.4%             |