Employees Retirement System of Texas

Actuarial Experience Study
As of August 31, 2019

Presented to the ERS Board of Trustees on May 20, 2020

GRS

May 12, 2020

Board of Trustees
Employees Retirement System of Texas
200 East 18th Street
Austin, TX 78701

Subject: **Results of 2020 Actuarial Experience Study**

Members of the Board:

We are pleased to present our report on the results of the 2020 Actuarial Experience Study for the Employees Retirement System of Texas (ERS).   It includes our recommendations for new actuarial assumptions and methods to be effective for the August 31, 2020 actuarial valuation, and it describes the actuarial impact produced by these recommendations as though they had been effective for the August 31, 2019 actuarial valuation.

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

This study was conducted in accordance with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board. The signing actuaries are independent of the plan sponsor. Mr. Falls, Mr. Newton and Ms. Woolfrey are Enrolled Actuaries and Fellows of the Society of Actuaries, and all of the undersigned are Members of the American Academy of Actuaries, and meet the Qualification Standards of the American Academy of Actuaries. Finally, each of the undersigned are experienced in performing valuations for large public retirement systems. We wish to thank the ERS staff for their assistance in providing data for this study.

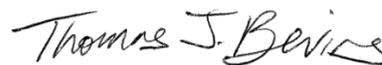Respectfully submitted,
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SECTION A

EXECUTIVE SUMMARY

Summary of Recommendations

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

Economic Assumptions

1. We recommend decreasing the nominal investment return assumption from 7.50% to 7.00%.

2. We recommend decreasing the inflation assumption from 2.50% to 2.30%.

3. For Regular State employees we recommend the merit component of the salary scale decrease by 0.30%, thus when combined with the lower inflation assumption, produces a total reduction to the salary scale of 0.50%. For LECO members, we are recommending a decrease of 0.55% to the current merit component, thus when combined with the lower inflation assumption, produces a total reduction to the salary scale of 0.75%.

4. We recommend a general wage inflation assumption of 0.40% above inflation, or 2.70%. This compares to the current assumption of 3.00%. This assumption is used primarily to index each cohort of new entrants used in the projections to determine the funding period.

5. We currently assume there will be no cost of living increases or supplemental payments provided to retirees. At this time, we recommend no change to this assumption.

Mortality Assumptions

6. We recommend no change to the post-retirement mortality tables and projection scale for non-disabled (healthy) retirees. We will update the base table to incorporate the assumed mortality improvements since the original base table was constructed, but there are no changes to the underlying mortality assumption.

7. We recommend updating post-retirement mortality tables for disabled retirees to the proposed tables for non-disabled retirees, but with a three-year set forward for males and females to reflect the potential impact of their impairment. Additionally, minimum mortality rates of 3.00% and 2.50% will be applied for males and females, respectively. We also recommend continuing to assume mortality rates will improve in the future using a fully generational approach with the most recently published projection scale U–MP.

8. We recommend updating pre-retirement mortality tables for active employees to the most recently published national tables for public sector employees, the Pub-2010 General Employees tables for non-LECO employees, and the Pub-2010 Public Safely tables for LECO employees. We also recommend continuing to assume mortality rates will improve in the future using a fully generational approach with the most recently published projection scale U–MP.

Other Demographic Assumptions

9. For LECO employees, we recommend an increase in assumed termination rates to better reflect actual plan experience.

10. For LECO employees hired on or after September 1, 2013 ("Tier 3"), we recommend changes to the adjustments made to historical retirement patterns (based primarily on Tier 1 experience) to reflect the potentially less valuable benefits these members will be eligible for once they become eligible to retire.

Actuarial Methods and Policies

11. We recommend no change to the current process of estimating the valuation payroll for the upcoming fiscal year.

12. We recommend no change to the actuarial cost method nor the asset smoothing method.

Cost Impact – Employees Retirement System of Texas (ERS)

As of August 31, 2019	Current Assumptions	Proposed Assumptions
Normal Cost Rate*	13.76%	14.24%
31 Year ASC - % of payroll	23.26%	25.33%
25 Year ASC - % of payroll	24.51%	26.79%
Unfunded UAAL (billions)	$11.70	$13.60
Funded Ratio	70.5%	67.3%

* Average normal cost rate for all groups, includes administrative expenses

Cost Impact – Law Enforcement and Custodial Officer Supplemental Retirement Fund (LECOSRF)

As of August 31, 2019	Current Assumptions	Proposed Assumptions
Normal Cost Rate*	2.08%	1.97%
31 Year ASC** - % of payroll	3.14%	3.24%
25 Year ASC** - % of payroll	3.37%	3.47%
Unfunded UAAL (millions)	$515	$584
Funded Ratio	65.3%	62.4%

* Average normal cost rate for all groups, includes administrative expenses
** In addition to expected court fees.

Cost Impact – Judicial Retirement System of Texas, Plan 2 (JRS2)

As of August 31, 2019	Current Assumptions	Proposed Assumptions
Normal Cost Rate*	23.14%	24.66%
31 Year ASC - % of payroll	27.84%	30.79%
25 Year ASC - % of payroll	28.35%	31.49%
Unfunded UAAL (millions)	$67	$90
Funded Ratio	87.5%	83.8%

* Average normal cost rate, includes administrative expenses

SECTION B

INTRODUCTION

Introduction

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

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

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

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

The following report provides our recommended changes to the current actuarial assumptions.

Summary of Process

In determining liabilities and contribution rates for retirement plans, actuaries must make assumptions about the future. Among the assumptions that must be made include:

- Retirement rates
- Mortality rates
- Turnover rates
- Disability rates
- Investment return rate
- Salary increase rates
- Inflation rate

For some of these assumptions, such as the mortality rates, past experience provides important evidence about the future. For others, such as the investment return assumption, the link between past and future results is much weaker. In either case, actuaries should review the plan's assumptions periodically and determine whether these assumptions are consistent with actual past experience and with anticipated future experience.

The last such actuarial experience investigation was performed following the August 31, 2016 actuarial valuation and the recommendations were adopted on August 23, 2017. For this experience study, we have reviewed ERS' experience for the five-year period from August 31, 2014 through August 31, 2019. However, for some analysis, such as salary, we utilized data from the previous experience study dating back to August 31, 2011.

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

In an experience study, we first determine the number of deaths, retirements, etc. that occurred during the period. Then we determine the number expected to occur, based on the current actuarial assumptions. The number of "expected" decrements is determined by multiplying the probability of the occurrence at the given age, by the "exposures" at that same age. For example, let's look at a rate of retirement of 15% at age 55. The number of exposures can only be those members who are age 55 and eligible for retirement at that time. Thus they are considered "exposed" to that assumption. Finally, we calculate the A/E ratio, where "A" is the actual number (of retirements, for example) and "E" is the expected number. If the current assumptions were "perfect", the A/E ratio would be 100%. When it varies much from this figure, it is a sign that new assumptions may be needed. (However, in some cases we prefer to set our assumptions to produce an A/E ratio a little above or below 100%, in order to introduce some conservatism.) Of course we not only look at the assumptions as a whole, but we also review how well they fit the actual results by gender, by age, and by service.

In many circumstances, we enhance this process by using an amount-weighted analysis. An amount-weighted analysis will generally use amounts such as benefits, pay, or liabilities to complete the analysis. From the perspective of the mortality assumption, there are two reasons for using an amount-weighted approach. First, mortality experience across the U.S. has been shown to vary depending on income level. Amount-weighting takes into account differing benefit levels. Second, selecting an assumption based on headcount-weighting is consistent with estimating expected deaths, but selecting an assumption based on amount-weighting is consistent with minimizing gains and losses associated with expected deaths. By weighting the data by annuity amounts, we are giving more weight to members who have larger annuities (and thus have larger liabilities). The same concepts apply when the amount-weighted approach is applied to other demographic assumptions such as termination and retirement.

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

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

Section E Exhibits

The exhibits in Section E should generally be self-explanatory. For example, on page E-13, we show an exhibit analyzing the termination rates for LECO members by years of service. The second column shows the total amount-weighted number of LECO members with 18 or fewer years of service who terminated during the study period. This excludes members who died, became disabled or retired. Column (3), labeled "Total Count" shows the total amount-weighted exposures of this group. This is the number of members who meet the criteria who could have terminated during any of the years. On this exhibit, the exposures exclude anyone eligible for unreduced retirement. A member is counted in each year they could have terminated, so the total shown is the total exposures for the five-year period. Column (4) shows the probability of termination based on the raw data.

That is, it is the result of dividing the actual number of terminations (col. 2) by the number exposed (col. 3). Column (5) shows the new recommended termination rate. Column (6) shows the expected amount-weighted number of terminations based on the proposed termination assumptions. Column (7) shows the Actual-to-Expected ratios under the proposed termination assumptions.

SECTION C

ANALYSIS OF EXPERIENCE AND RECOMMENDATIONS

Analysis of Experience and Recommendations

We will begin by discussing the economic assumptions: inflation, the investment return rate, the general wage increase assumption, the salary increase assumption for individuals, cost-of-living increases if applicable, and the payroll growth rate used for projecting total contributions. Then we will discuss the demographic assumptions: mortality, disability, termination and retirement. Finally we will discuss the actuarial methods used.

Inflation and Investment Return Assumptions

Actuarial Standards of Practice (ASOP) No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, provides guidance to actuaries on giving advice on selecting economic assumptions for measuring obligations for defined benefit plans. ASOP No. 27 was revised and adopted by the Actuarial Standards Board (ASB) in September 2013.

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

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

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

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

Inflation Assumption

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

The following chart shows the average annual inflation, as measured by the increase in the Consumer Price Index (CPI-U), in each of the seven consecutive five-year periods over the last 35 years.

Average Annual Inflation
CPI-U, Five-Year Averages
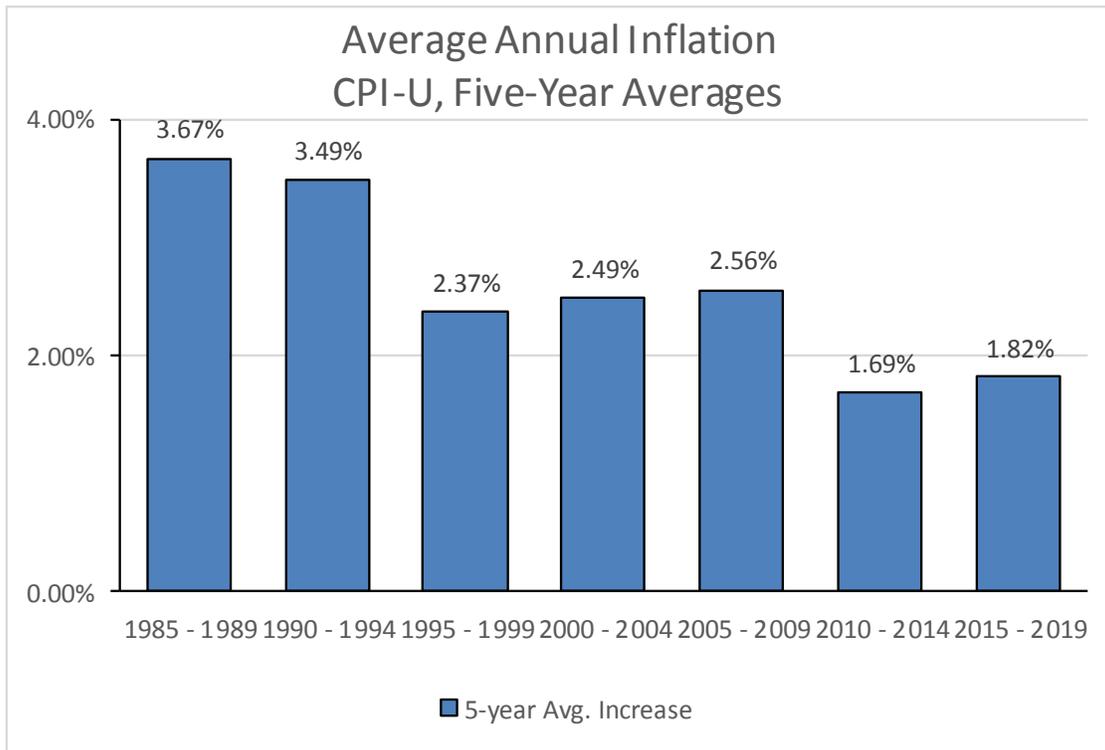
Source: Bureau of Labor Statistics, CPI-U, all items, not seasonally adjusted, Calendar Years

The table below shows the average inflation over various periods, ending December 2019.

Periods Ending Dec. 2016	Average Annual Increase in CPI-U
Last five (5) years	1.82%
Last ten (10) years	1.75%
Last fifteen (15) years	2.02%
Last twenty (20) years	2.14%
Last twenty-five (25) years	2.18%
Last thirty (30) years	2.40%
Since 1913 (first available year)	3.11%

Source: Bureau of Labor Statistics, CPI-U, all items, not seasonally adjusted

As you can see, inflation has been relatively low over the last twenty-five years, and historically so over the past 10 years.

Forecasts from NEPC (ERS Investment Consultant)

The 2020 Capital Market Assumptions for NEPC, ERS' Investment Consultant, are using 2.30% as the price inflation assumption for the next 10 years.

Forecasts from Other Investment Consulting Firms

We examined the 2019 capital market assumption sets for 14 investment consulting firms and the average assumption for inflation was 2.18%, with a range of 1.70% to 2.50%.

Expectations Implied in the Bond Market

Another source of information about future inflation is the market for US Treasury bonds. Simplistically, the difference in yield between non-indexed and indexed treasury bonds should be a reasonable estimate of what the bond market expects on a forward looking basis for inflation. As of the end of December, the difference for 20-year bonds implies that inflation over the next twenty years would average 1.85%. The difference in yield for 30-year bonds implies 1.80% inflation over the next 30 years.

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

Forecasts from Social Security Administration

In the Social Security Administration's 2019 Trustees Report, the Office of the Chief Actuary is projecting a long-term average annual inflation rate of 2.6% under the intermediate cost assumption. Similarly, the low cost scenario is 2.0% and the high cost scenario is 3.2%.

Survey of Professional Forecasters and Fed Policy

The Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. Their most recent forecast (fourth quarter of 2019) was for inflation over the next ten years (2019 to 2028) to average 2.20%.

Additionally, the Fed has openly stated that they have a target 2.00% inflation rate.

Recommendation

As a result, we find a reasonable range for this assumption to be 2.00% to 2.50% and are recommending lowering the assumption to 2.30%. This change will bring the assumption closer to recent inflation levels, more consistent with NEPC's assumption, and closer to the levels expected in the financial markets. As you will see, this change also affects all other economic assumptions.

Investment and Administrative Expenses

Since the trust fund pays expenses in addition to member benefits and refunds, we must make some assumption about these. Almost all actuaries treat investment expenses as an offset to the investment return assumption. That is, the investment return assumption represents expected return after payment of investment expenses.

In regards to investment expenses, investment consulting firms periodically issue reports that describe their capital market assumptions. The estimates for core investments (i.e., fixed income, equities, and real estate) are generally based on anticipated returns produced by passive index funds that are net of investment related fees. The investment return expectations for the alternative asset class such as private equity and hedge funds are also net of investment expenses. Therefore, we did not make any

adjustments to account for investment related expenses. Some of the retirement systems may also employ active management investment strategies that result in higher investment expenses compared to strategies that invest in passive index funds. We have assumed that active management strategies would result in the same returns, net of investment expenses, as passive management strategies.

On the other hand, there is a divergence of practice on the handling of administrative expenses. Some actuaries make an assumption that administrative expenses will be some fixed or increasing dollar amount. Others assume that the administrative expenses will be some percentage of the plan's actuarial liabilities or normal cost. And others treat administrative expenses like investment expenses, as an offset to the investment return assumption. For ERS, the practice has been to explicitly add a load onto the normal cost. This is also our preferred approach and we recommend continuing this practice. Using an explicit load onto the normal cost maximizes transparency, aligns better with the standards of the Governmental Accounting Standards Board, and maintains a parallel between the investment returns used by the investment consultant and the actuary.

The following table provides the actual administrative expenses as a percentage of covered payroll for the last five years for the three pre-funded plans, along with our recommended assumptions.

Administrative Expense as a Percentage of Covered Payroll								
	FY19	FY18	FY17	FY16	FY15	Average	Current Assumption	Recommended Assumption
ERS	0.40%	0.35%	0.34%	0.31%	0.35%	0.35%	0.33%	0.33%
LECOSRF	0.13%	0.11%	0.10%	0.08%	0.09%	0.10%	0.08%	0.08%
JRS2	0.45%	0.37%	0.38%	0.28%	0.36%	0.37%	0.33%	0.33%

Investment Return Rate

The investment return assumption is one of the principal assumptions used in any actuarial valuation of a retirement plan. It is used to discount future expected benefit payments to the valuation date in order to determine the liabilities of the plans. Even a small change to this assumption can produce significant changes to the liabilities and contribution rates. Currently, it is assumed that future investment returns will average 7.50% per year, net of investment expenses.

The chart below shows the historical annualized history of ERS market returns through FY 2019.

Annualized Return

Years ending August 31, 2019

Years	Return
25	7.3%
20	5.8%
15	6.8%
10	8.1%
5	6.0%
1	3.0%
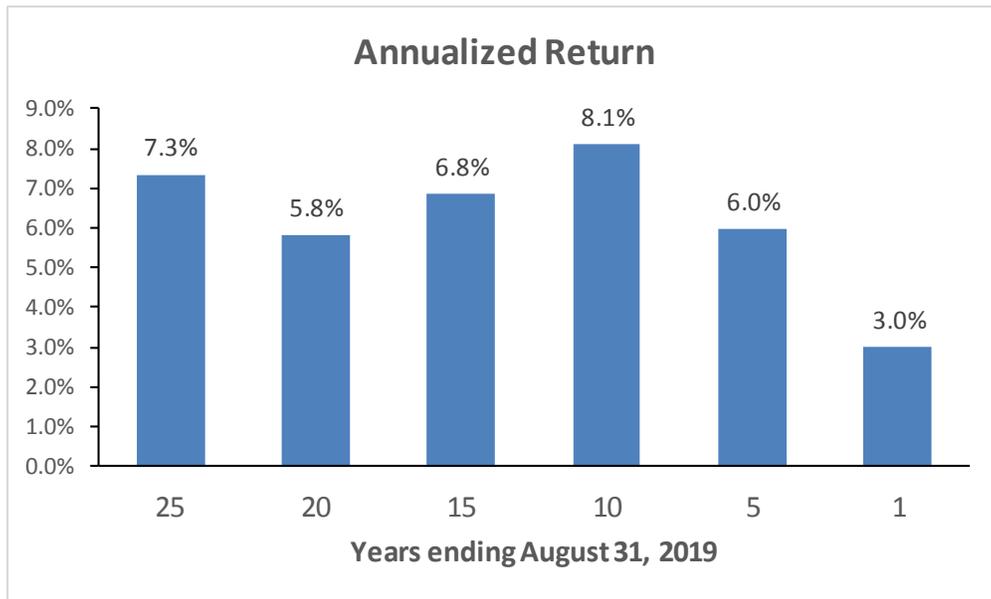
The returns in the chart above are market returns, net of investment expenses, as reported in the actuarial valuations. ERS did exceed the expected 7.50% return assumption in 17 of the last 25 years, but the average annualized market return during this period was 7.3%. Over the same period inflation averaged 2.2%, producing an average realized real return of 5.1%.

However, for this assumption, past performance, even averaged over a twenty-five year period, is not a reliable indicator of future performance. The actual asset allocation of the trust fund will significantly impact the overall performance, so returns achieved under a different allocation are not meaningful.

More importantly, the real rates of return for many asset classes, especially equities, vary so dramatically from year to year that even a twenty-five year period is not long enough to provide reasonable guidance. There are strong reasons to believe the next twenty-five years will be different than the last twenty-five, in large part because current bond yields are significantly lower than they were 25 years ago.

Assumption Comparison to Peers

We do not recommend the selection of an investment return assumption based on prevalence information. However, it is still informative to identify where the investment return assumption for ERS is compared to its peers. The chart below shows the distribution of the investment return assumptions, as reported by NASRA in February, 2020.

Public Fund Survey, NASRA Feb-20
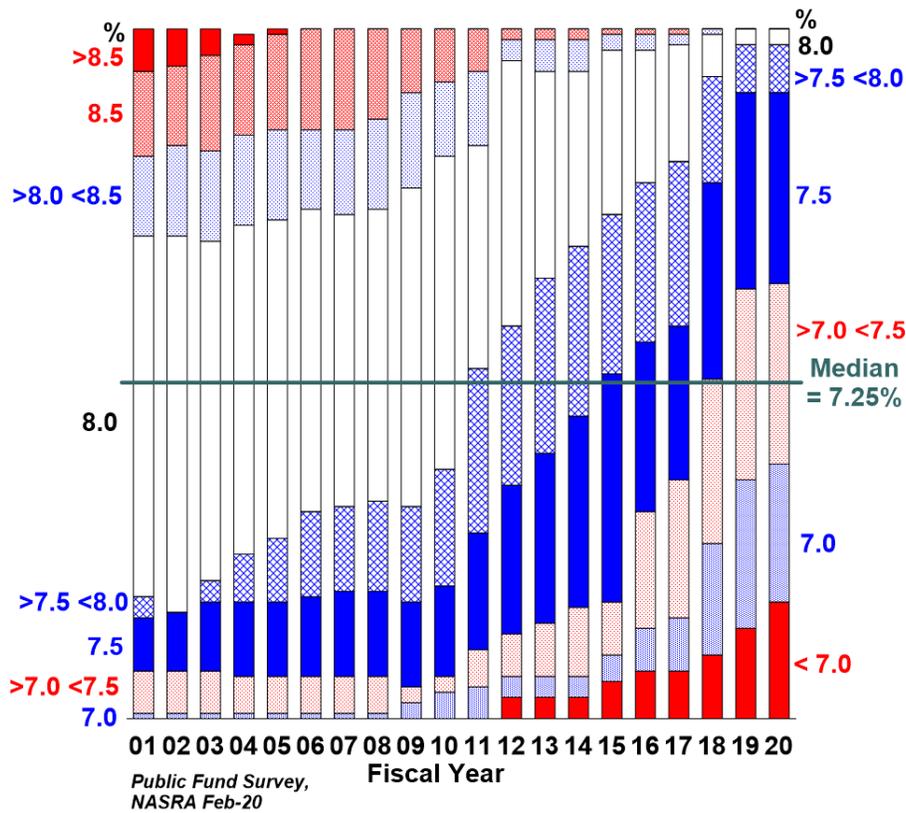
The median rate of return is 7.25%. However, this chart does not tell the entire story. Several of the data points, including the one for ERS, have not been examined in a few years, meaning even the current survey data is a little stale.

Asset Allocation

We believe the most appropriate approach to selecting an investment return assumption is to identify expected returns given the funds' asset allocation mapped to forward-looking capital market assumptions. Based on ERS' Investment Policy Statement, most recently adopted on May 22, 2019, below is a summary of the target asset for ERS:

CURRENT LONG-TERM ASSET ALLOCATION TARGET	
ASSET CLASS	Current
Public Equity	37%
Private Equity	13%
Global Credit	11%
Public Real Estate	3%
Private Real Estate	9%
Private Infrastructure	7%
Opportunistic Credit	3%
Fixed Income - Rates	11%
Hedge Funds/Absolute Return	5%
Cash	1%
Total	100%

In order to develop an appropriate estimate for an investment return assumption, we have utilized the forward-looking return expectations developed by several investment consulting firms and industry surveys.

Our survey includes 14 sets of expectations. Based on the average of these sets of expectations, and the proposed 2.30% inflation assumption, the expected compound return over the short term (generally, 7 to 10 year horizon) is 6.57%, with a range of outcomes from 5.2% to 7.8%, and the expected compound return over the long term (generally, 20 to 30 year horizon) is 7.37%, with a range of outcomes from 7.0% to 7.6%. Thus, much of the investment community is anticipating lower returns over the next decade compared to longer time frames.

Recommendation

Based on this analysis, we are recommending the Board reduce the investment return assumption to 7.00%. This would be comprised of a 4.70% net real return and a 2.30% inflation assumption.

Even though we are comfortable with a 7.00% assumption for a longer term, if the Board is uncomfortable with what is likely a less than 50% probability of achieving the 7.00% over the next decade, it should consider adopting a lower assumption.

Cost-of-Living Increase Assumption

ERS does not provide automatic post-retirement cost of living adjustments (COLAs) to retired members. It has been past practice for the legislature to periodically grant ad hoc COLAs, when it is determined that the system can afford to absorb the cost. As we have seen over the last decade, the COLAs are certainly not automatic. We recommend continuing to assume no future COLAs in the annual valuations.

Retired members of the Elected Class in ERS receive post-retirement increases that are tied to the State base salary of a district court judge. JRS1 retirees who retire on or after September 1, 2019 will be based on 120% of the State base salary, consistent with a judge of a court of the same classification as the court on which the retiree last served before retirement. The annuities of past retirees who may have retired under a different salary schedule will continue to be based on the prescribed state base salary schedule consistent with a judge of a court of the same classification as the court on which the retiree last served before retirement, with future adjustments upon changes in the state base salary. These expected pay increases are discussed in the salary increase section, below.

General Wage Inflation

A General Wage Inflation (GWI) assumption represents the real wage growth over time in the general economy, or, is the assumption on how much the pay scales themselves will change year to year, not necessarily how much the pay increases received by individuals are, or even necessarily how the payroll in total may change, which can be impacted by population changes, etc. This assumption should be applicable to a local economy, not necessarily one group inside a retirement system. This assumption is used primarily to index the pay of each group of new entrants used in the open group projections. In an open group projection, projected terminations from the current active population are replaced with projected new entrants.

Historically, General Wage Inflation has almost always exceeded price inflation. This is because wage inflation is in theory the result of (a) price inflation, and (b) productivity gains being passed through to wages. Since 1951, for the national economy as a whole, wage inflation has been about 1.00% larger than price inflation each year. For the last 10 years, for the national economy as a whole, wage inflation has been 2.35%, outpacing price inflation by about 0.60%. However, that spread will likely be viewed as overstated due to the historically low inflation during the past decade.

Over the past 20 years, the average salary for an ERS member has increased 2.4% per year, and 2.0% per year over the past 10 years. Over the same periods, the national average wage changed by 3.0% and 2.4%, respectively. Over the past 10 years, the average salary for an ERS member with less than 5 years of service has changed by 2.1%. This is the closest apples-to-apples comparison for this assumption as it shows how the pay scales themselves are changing, not how the population inside is changing.

We are recommending a 0.40% real productivity growth assumption, or a nominal 2.70% GWI assumption.

Salary increase rates

In order to project future benefits, the actuary must project future salary increases. Salaries may increase for a variety of reasons:

- Across-the-board increases for all employees;
- Across-the-board increases for a given group of employees;
- Increases to a minimum salary schedule;
- Additional pay for additional duties;
- Step or service-related increases;
- Increases for acquisition of advanced degrees or specialized training;
- Promotions;
- Overtime;
- Bonuses, if available; or
- Merit increases, if available.

Our salary increase assumption is meant to reflect all of these kinds of increases to the extent that they are included in the pay used to determine contributions or plan benefits.

The actuary should not look at the overall increases in payroll in setting this assumption, because payroll can grow at a rate different from the average pay increase for individual members. There are two reasons for this. First, when older, longer-service employees terminate, retire or die, they are generally replaced with new employees who have a lower salary. Because of this, in most populations that are not growing in size, the growth in total payroll is smaller than the average pay increase for members. Second, payroll can change due to an increase or decrease in the size of the group. Therefore, to analyze salary increases, we examine the actual increase in salary for each year and for each member who is active in two consecutive fiscal years.

We looked at the salaries provided for all members who were active in the start and the end of an experience year, for an eight year study period. The following table shows the average increase over the last eight years.

Average Salary Increase		
Year Ending August 31,	Regular State Employees	LECOs
2012	2.71%	1.50%
2013	3.13%	1.61%
2014	5.39%	6.97%
2015	4.95%	4.11%
2016	6.07%	9.52%
2017	4.53%	2.21%
2018	3.68%	2.40%
2019	4.32%	2.08%
Average	**4.34%**	**3.76%**

Most actuaries recommend salary increase assumptions that include an element that depends on the member's age or service, especially for large, state-wide retirement systems. They assume larger pay increases for younger or shorter-service employees. This is done in order to reflect pay increases that accompany changes in job responsibility, promotions, demonstrated merit, etc. The experience shows salaries continue to be more closely correlated to service (rather than age), as promotions and productivity increases tend to be greater in the first few years of a career, even if the new employee is older than the average new hire. For this reason, for LECOs, we will continue to use salary scales based on service. For ERS, the step-related portion is a two-dimensional table based on both age and service.

The individual salary increase assumption will typically decline until one final ultimate salary increase assumption that will be used for all employees who have attained a specified amount of service. This ultimate salary increase assumption is currently about 3.80% for General State Employees with 30 or more years of service and 4.50% for LECOs with 18 or more years of service. The table below shows the actual average long-service increases for each year of the study. Note that these actual average rates of increase include average actual inflation, not our inflation assumption.

Average "Long-Service" Increase			
Actual Experience			
Year Ending	Inflation	Regular State Employees	LECOs
2012	1.69%	1.99%	0.74%
2013	1.52%	1.98%	0.95%
2014	1.70%	3.55%	6.38%
2015	0.20%	3.93%	4.01%
2016	1.06%	5.00%	7.27%
2017	1.94%	2.07%	1.00%
2018	2.70%	2.24%	1.36%
2019	1.75%	2.55%	1.10%
Average	**1.57%**	**2.91%**	**2.82%**

The following table shows the average increase over the five-year period parsed out in service groups:

Average Salary Increase with Service Groupings		
Service	Regular State Employees	LECOs
1 to 5 Years	6.0%	5.8%
6 to 10 Years	4.4%	3.2%
11 to 15 Years	3.8%	2.8%
16 to 20 Years	3.4%	2.8%
21 to 25 Years	3.2%	3.0%
26 to 30 Years	3.1%	3.2%

The table shows that regular State employees with less than 6 years of service had an average increase of 6.0%, which is 1.6% higher than that of members with 6 to 10 years of service and 2.8% higher than that of members with more than 20 years of service. Similarly, LECOs with less than 6 years of service had an average increase of 5.8%, which is 2.6% higher than that of members with 6 to 10 years of service and 2.8% higher than that of members with more than 20 years of service. Therefore, we continue to recommend the adoption of assumed salary increase rates which vary by service.

The following describes the building block methodology used to construct the current and proposed salary assumptions. The salary scale is composed of three pieces: price inflation, a productivity/merit component, and a service based step-rate or promotional piece. Our recommended price inflation assumption is 2.30%, as discussed earlier. The productivity/merit component would include the general productivity included in the GWI and any additional salary increase of the longer-service employees that is above the GWI (which could come from individual merit and promotions). The service-based or step-rate component is the expected salary increase of the shorter-service members that is above this level. All three pieces are assessed independently and then added together to develop the ultimate salary schedule.

To determine the new salary scale, we first calculated the average increase over the eight-year period for members grouped by service. Members with 30 or more years of service were selected to be the longer-service employees to be used in determining the productivity/merit component. They were grouped together because, after that point, the salary increase did not vary significantly with additional service.

Using this group, we backed out actual inflation during the study period (1.57%) to get the real rates of increase. The average increase for the longer-service regular State employees over the eight-year period was 2.91%; therefore, the actual productivity/merit component for the period was 1.34% (2.91% less the actual inflation rate of 1.57%). The average increase for the longer-service LECOs over the eight-year period was 2.82%; therefore, the actual productivity/merit component for the period was 1.25%. The current assumption set has a productivity/merit component of 1.30% for regular State employees and 2.00% for LECOs. Although the experience for the regular State employee productivity/merit component was about in line with the assumption, it was during a period of prolonged low inflation which can cause this to be higher than it otherwise would be. We recommend bringing the productivity/merit component down for regular State employees to 1.00%. For LECOs the productivity experience was substantially lower than the current assumption. We recommend bringing this assumption down from 2.00% to 1.45%, which includes some margin for conservatism as compared to the experience during the period.

For regular State employees, this reduces the entire schedule by 0.50%, (0.20% change in the underlying inflation assumption and a decrease in the individual merit component by an additional 0.30%). For LECOs, this reduces the entire schedule by 0.75%, (0.20% change in the underlying inflation assumption and a decrease in the individual merit component by an additional 0.55%).

Next, we reviewed the step-rate component of the salary scale for the LECOs. The following table shows the actual increases for members with less than 19 years of service and the resulting actual step-rates from the experience. Notice how the step rates decrease as the service increases.

LECOS Step-rate/Promotional Experience			
Years of Service	Average Pay Increase	Less Actual Inflation and Productivity Components	Actual Step-Rate Component
1	10.42%	- 2.82%	7.60%
2	5.75%	- 2.82%	2.93%
3	4.17%	- 2.82%	1.35%
4	4.54%	- 2.82%	1.72%
5	4.49%	- 2.82%	1.67%
6	2.80%	- 2.82%	-0.02%
7	3.23%	- 2.82%	0.41%
8	3.91%	- 2.82%	1.09%
9	3.16%	- 2.82%	0.34%
10	2.78%	- 2.82%	-0.04%
11-18	2.85%	- 2.82%	0.03%
19+	2.82%	- 2.82%	0.00%

After reviewing this experience, we determined that there was not sufficient reason to make changes to the service-based portion of the LECO salary scale beyond the previously proposed changes to the underlying inflation and individual merit.

We completed a similar analysis for the general State employees and the experience and the data for the step portion of the salary experience was very close to the current expectations. As a result, we are not recommending a change to this portion of the salary increase assumption for the general State employees at this time.

Judicial Salaries

Judicial pay increases impact the retirement plans in multiple ways. First, an individual salary increase assumption (similar to the discussion above) must be developed to project the salaries throughout the careers of the active judges that are participating in the Judicial Retirement System of Texas, Plan 1 (JRS1) and the Judicial Retirement System of Texas, Plan 2 (JRS2). Additionally, the post-retirement benefits for Elected Class and JRS1 members are indexed to the increases in the State base salary of a district court judge.

Judicial pay increases are difficult to analyze because they change very infrequently. For example, the judicial salary schedule has only changed twice in the last 22 years but the increases were sizable. It should be noted that the schedule did change every couple of years prior to that time and the increases were much more modest.

However, House Bill 2384, enacted in 2019 by the Texas State Legislature, restructured the compensation and retirement benefits for State judges. This restructuring also impacted the compensation used to determine benefits upon retirement for Elected Class members. HB 2384 sets forth specific service-based salary increases as a percentage of the State base salary for each judicial office type, as shown below:

Annual Salary Increases for Merit, Promotion and Longevity Male and Female District Attorneys in the Elected Class			
Age	Years of Eligibility Service as a District Attorney		
	Less than 4	4 or more, but less than 8	8 or more
All	State base salary of a district judge	110% of base salary	120% of base salary

Over the last 25 years, the State base salary of a district court judge increased by an average of 2.01%. Over the same period, CPI increased at approximately 2.18% per year.

Since the pay increases for a District court judge have only been slightly higher than inflation over the last 25 years, prior to the enactment of HB 2384, we assumed pay increase for the State base salary of a district court judge (and the resulting post-retirement increases for Elected Class and JRS1 members) be 2.75% (or, 0.25% more than the assumed inflation of 2.50%). Additionally, due to the small potential for "promotion" of active judges participating in JRS1 and JRS2 to appellate and/or chief justice positions, we assumed that the pay of active judges participating in JRS1 and JRS2 increased at 3.00% per year.

Since HB 2384 was effective September 1, 2019 and relevant to the August 31, 2019 actuarial valuations, we have already incorporated a revised assumption such that judges (and district attorney) follow the salary structure prescribed by HB 2384 based on their actual pay and service, plus an inflation component that we recommend decreases from 2.50% to 2.30%.

Payroll Growth Rate

The salary increase rates discussed above are assumptions applied to individuals. They are used in projecting future benefits. The GWI assumption above reflects how wages will change in the general economy. The GWI assumption is used in projections and to compare the reasonableness of the assumption set to national trends. There also may be an overall payroll growth assumption, currently 3.00%, in projecting aggregate payroll growth for a specific retirement system, and more specifically, perhaps a separate group inside a retirement system. For example, all plans under ERS should have the same GWI assumption, but it could be reasonable for ERS, LECOSRF, and JRS2 to have different payroll growth assumptions based on their individual demographics.

Typically, the payroll growth rate is used in determining the contributions needed to amortize the unfunded actuarial accrued liability. The amortization payments are calculated to be a level percentage of payroll, so as payroll increases over time, these contributions also increase. Thus, the amortization percentage is dependent on the rate at which payroll is assumed to increase. However, for a plan with different benefit groups using a fixed rate funding strategy, the open group projection is used to determine the funding period instead of an algebraic formula, and thus the payroll growth assumption is not directly used.

The best way to estimate this assumption is to produce an open group projection using all of the census data, the demographic assumptions, and the other wage assumptions, in order to project total payroll over the amortization period.

We have performed open group projections, based on the proposed salary scales, demographic assumptions, and increasing the payroll for each cohort of new entrants by the 2.70% GWI assumption. These projections show that payroll will grow over the next couple of decades reasonably close to the 2.70% GWI assumption. Therefore, we are recommending a payroll growth assumption of 2.70%.

Demographic Assumptions

Actuaries are guided by the Actuarial Standards of Practice (ASOP) adopted by the Actuarial Standards Board (ASB). One of these standards is ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*. This standard provides guidance to actuaries giving advice on selecting noneconomic assumptions for measuring obligations under defined benefit plans. We believe the recommended assumptions in this report were developed in compliance with this standard.

Post-Retirement Mortality Rates

ERS' actuarial liabilities and contribution rates depend in part on how long retirees live. If members live longer than expected, benefits will be paid for a longer period of time and the liability and ultimate contribution rates will be larger than expected.

The mortality table currently being used for non-disabled retirees and for beneficiaries receiving benefits is the 2017 State Retirees of Texas (SRT) mortality tables for males and females. The 2017 SRT tables were developed based on actual experience of ERS members from September 1, 2011 through August 31, 2016. Generational mortality improvements in accordance with the ultimate rates of Scale MP are projected from the year 2017.

In determining whether the current table continues to be appropriate, we have weighted the analysis by the amount of the member's monthly annuity. This is consistent with the previous analysis and the development of all national tables, as data shows a clear correlation between income and longevity. By weighting the data by annuity amounts, we are giving more weight to members who have larger annuities (and thus have larger liabilities).

We begin by determining the expected number of deaths in each year at each age for males and females. Then we compare the actual number to the expected number. The ratio of the actual deaths to the expected deaths (the A/E ratio) tells us whether the assumptions are reasonable. When using a generational approach for mortality improvement, an A/E of 100% is targeted. However, we will also focus on the pattern across all ages and life expectancy created at individual ages when determining whether the assumption is appropriate. We will discuss this in two parts, the recommended base mortality assumption, and the recommended mortality improvement assumption.

Recommended Base Mortality Assumption

Experience used to examine the fit of the current assumption was for non-disabled retirees for the seven-year period ending August 31, 2019. Retiree data was not available by regular State employees and LECOs, separately, but those eligible for a LECOSRF benefit (20 years CPO/CO service) could be identified within the overall data. Based on non-LECOSRF mortality experience, overall actual to expected ratios were 101.7% and 93.6% for males and females, respectively. When compared to the current assumptions, LECOSRF

male mortality experience produced an actual to expected ratio of 104.5%. There was very minimal LECOSRF female mortality experience.

We find this experience to be reasonably in line with the current assumption. We recommend no change to this assumption, although for disclosure purposes, we recommend updating the base table to the projected 2020 rates.

Recommended Mortality Improvement Assumption

The current mortality assumption includes a fully generational approach to projecting mortality improvement. Because of this strategy of building in continuous mortality improvement, life expectancies for today's younger active members are expected to be materially longer than those of today's retirees, and this has a significant impact on actuarial liabilities contribution requirements.

In 2015 through 2019, the RPEC issued updates to the mortality improvement assumption called Scale MP-2015, Scale MP-2016, etc. MP-2015 reflected an additional two years of mortality experience and MP-2016 reflected an additional three years of mortality experience, and so forth. In each of the updates, rates of projection were materially decreased, meaning the original MP-2014 table was found to be too conservative. In addition, it has been stated that new projection scales are going to be published each year.

After approximately 15 years, all of the MP tables (MP-2014 through MP-2019) reflect the same improvement rate at each future calendar year (the ultimate mortality improvement rates). In order to balance the two objectives of reflecting the most recent data available, while maintaining stability of results from year to year, GRS recommended the use of the ultimate mortality improvement rates in the MP tables for all years in the prior study. This recommendation is still consistent with the most recently available information and we recommend no change to this assumption.

Disabled Mortality Rates

Because the rate of disability incidence is so low for the ERS plans and the disabled mortality rates apply to a very small subsection of plan participants, this is a minor assumption that has little impact on the liabilities of ERS. We recommend using the 2020 SRT tables, set forward three years for males and females, with a minimum mortality rate of 3.0% and 2.5% for males and females, respectively. Additionally, we recommend continuing to apply future mortality improvements using the ultimate mortality improvement rates in the MP tables.

Active Mortality Rates

Active mortality is also a minor assumption. Incidence of active deaths is very low in comparison to terminations and retirements. For active mortality rates, we recommend using the Pub-2010 General Employees mortality tables for healthy non-LECO employees and the Pub-2010 Public Safety mortality tables for LECO employees. For all employees, we recommend future mortality improvements modeled using the ultimate mortality improvement rates in the MP tables.

Disability Rates

Disability experience during the five-year period ending August 31, 2019, was very similar to the experience during the prior study period (344 disabilities vs 353). We recommend no change to this assumption at this time.

Retirement Rates

The valuation currently uses retirement rates that vary by age, service, and benefit group. There are also provisions to allow members to retire earlier than the data would expect to reflect sick/annual leave service conversions, service purchases and portability. The current assumptions for Tier 2 and 3 are estimates as very few members in those groups are yet eligible to retire. During our analysis we observed that Tier 1 retirement rates tracked very well and recommend no changes to the base rates. There were slightly fewer retirements than expected, with a 95% actual to expected ratio for regular State employees and a 94% actual to expected for LECOs.

Tier 2 members are assumed to retire at similar rates to Tier 1.

For Tier 3, we currently make more substantial modifications to the base Tier 1 table to reflect the following:

- Less retirements during periods of early retirement reductions - the more substantial the reduction in benefit, the more substantial the reduction in expected rates of retirement;
- Increased retirement at first eligibility for unreduced benefits to reflect "pent-up demand" to retire due to later unreduced retirement eligibility than Tier 1; and
- An overall tendency for the retirement behavior for all benefit groups to ultimately converge at older ages when all groups are eligible for unreduced benefits and the demand for retirement becomes more related to ability to continue to work.

For Tier 3 regular State employees, we recommend no changes to the current modifications. For Tier 3 LECOs who reach 20 years of CPO/CO service prior to age 57, we currently assume members will retire at a rate of 100% at age 57. We recommend reducing this rate to 80%. For Tier 3 LECOs who will reach 20 years of CPO/CO service after age 62, we currently modify the Tier 1 rate at age 62 by adding 20% plus 6% times the number of years the age at 1st eligibility was before age 62. We recommend removing the 20% add-on component of the adjustment.

Termination Rates

Termination rates reflect members who leave for any reason other than death, disability or service retirement. They apply whether the termination is voluntary or involuntary, and whether the member takes a refund or keeps his/her account balance on deposit in ERS. The current termination rates are separated by regular State employees or LECOs, with regular State employees having different rates depending on whether their entry age is before or after age 35. This results in three distinct tables of termination rates. Each of these three termination rate tables is based on service.

In analyzing this assumption, we have weighted the experience by the present value of benefits (PVB), meaning instead of counting members and the number of members that terminate, we have summed the PVB and the portion of the PVB that terminates. Setting this assumption by counts can result in an assumption which will accurately predict the number of terminations, but result in gains or losses on

liabilities each year. For example, a higher paid member has more liability than a lower paid member, and thus the termination pattern for the higher paid member will have more impact on the future liabilities of the plan. Also, higher paid members may be hired in to positions that have lower turnover versus lower paid members.

GRS recommends no change to the basic structure of the three tables. The current assumptions produce an A/E ratio for LECOs of 133%, an A/E ratio of 107% for regular State employees with Entry Age At or Younger Than 35 and an A/E ratio for regular employees with Entry Age Older Than 35 of 107%. For this assumption, A/E ratios over 100% are conservative.

Because LECOs were terminating at significantly higher rates than expected, GRS recommends increasing the current LECO rates by 115%. The recommended change brings the A/E ratio closer to 100% (116%), but leaves some conservatism and recognizes that a five-year study period may not be sufficient for full credibility.

The results are shown below ($ in 100,000s):

Termination Rates – LECOs					
		Current Assumptions		Recommended Assumptions	
Service Years	Actual terms	Expected Terms	A/E ratio	Expected Terms	A/E ratio
0	1,592	1,088	146%	1,251	127%
1-4	7,012	5,284	133%	6,077	115%
5-9	3,432	2,824	122%	3,247	106%
≥ 10	2,865	2,019	142%	2,322	123%
Totals	14,901	11,215	133%	12,897	116%

Termination Rates – Regular Employees / Entry Age At or Younger Than 35					
		Current Assumptions		Recommended Assumptions	
Service Years	Actual terms	Expected Terms	A/E ratio	Expected Terms	A/E ratio
0	1,877	1,326	142%	1,326	142%
1-4	7,383	6,997	106%	6,997	106%
5-9	4,418	4,469	99%	4,469	99%
≥ 10	7,164	6,710	107%	6,710	107%
Totals	20,842	19,502	107%	19,502	107%

Termination Rates – Regular Employees / Entry Age Older Than 35					
		Current Assumptions		Recommended Assumptions	
Service Years	Actual terms	Expected Terms	A/E ratio	Expected Terms	A/E ratio
0	1,465	1,041	141%	1,041	141%
1-4	5,777	5,707	101%	5,707	101%
5-9	3,501	3,477	101%	3,477	101%
≥ 10	2,556	2,256	113%	2,256	113%
Totals	13,299	12,481	107%	12,481	107%

Service Conversions at Retirement

We are not recommending any changes to service purchase conversion assumptions at this time.

Other Assumptions and Refunds

There are other assumptions made in the course of a valuation, such as the percentage of members who are married, the age difference between husbands and wives, the likelihood that a terminating employee will take a refund, etc. We are not recommending any changes to these minor assumptions at this time.

Actuarial Methods

Actuarial Cost Method

We recommend continuing to use the Individual Entry Age Normal (IEAN) actuarial cost method. IEAN will generally produce level contribution amounts for each member as a percentage of salary from year to year, and allocates costs among various generations of taxpayers in a reasonable manner. It is by far the most commonly used actuarial cost method for large public retirement systems and the method used for accounting disclosures under GASB Statement No. 67.

For a plan that receives it contribution as a fixed percent of payroll, the IEAN method does, however, eliminate the ability to perform a simple and algebraic calculation of the funding period and contribution requirements. Thus, the funding period will continue to be determined based on an open group projection. In the open group projection, the demographic assumptions are applied to the current active members (many of which are members hired before September 1, 2013) and any members that are assumed to leave employment are replaced one-for-one with new members. Over time this results in the change of the membership to mostly members hired after September 1, 2013 (with the less expensive benefit structure) and incorporates the fact that the normal cost rate will trend down over time. The projection is built to assume no gains or losses on the actuarial accrued liability or the actuarial value of assets.

Asset Valuation (Smoothing) Method

The purpose of asset smoothing is to reduce short-term volatility in actuarial valuation results which are intended for long-term decision making and funding. Periods of poor returns are often followed by some amount of recovery or vice versa, and a market value (unsmoothed) approach, may result in overreaction to short-term market volatility.

We are recommending no change to the asset valuation method. The current method keeps track of individual gains or losses each year and ensures that they are recognized within the 5-year period. If an offsetting gain or loss occurs in a future valuation, the current method would use the offsetting gain or loss to recognize the individual gains or losses more quickly.   This method has the benefit of ensuring that any individual gain or loss is recognized in a reasonable timeframe, while eliminating the artificial volatility that is introduced from the more traditional individual gain loss method.

SECTION D

SUMMARY OF ASSUMPTIONS AND METHODS

Summary of Assumptions and Methods
Incorporating the Recommended Assumptions

The assumptions and methods applied in this actuarial valuation may be adopted by the Board of Trustees on May 20, 2020 based on the experience investigation that covered the five-year period from September 1, 2014 through August 31, 2019.

I.   *Valuation Date*

The valuation date is August 31 of each plan year. This is the date as of which the actuarial present value of future benefits and the actuarial value of assets are determined.

II.   *Actuarial Cost Method*

The actuarial valuation is used to determine the adequacy of the State contribution rate (established by Legislative appropriation) and employer contribution rate (established by statute) and to describe the current financial condition of ERS.

The actuarial valuation uses the Entry Age Normal actuarial cost method. Under this method, the first step is to determine the contribution rate (level as a percentage of pay) required to provide the benefits to each member, or the normal cost rate. The normal cost rate consists of two pieces: (i) the member's contribution rate, and (ii) the remaining portion of the normal cost rate which is the employer's normal cost rate. The total normal cost rate is based on the benefits payable to each individual active member.

The Unfunded Actuarial Accrued Liability (UAAL) is the liability for future benefits which is in excess of (i) the actuarial value of assets, and (ii) the present value of future normal costs. The employer contribution provided in excess of the employer normal cost is applied to amortize the UAAL.

The funding period is calculated as the number of years required to fully amortize the UAAL, and is calculated with the use of an open group projection that takes into account: (a) future market earnings, net of investment-related expenses, will equal 7.25% per year, (b) there will be no changes in assumptions, (c) the number of active members will remain unchanged, (d) active members who leave employment will be replaced by new entrants each year, and (e) State and employer contributions will remain the same percentage of payroll as described in Appendix I of the valuation report.

The Entry Age actuarial cost method is an "immediate gain" method (i.e., experience gains and losses are separately identified as part of the UAAL). However, they are amortized over the same period applied to all other components of the UAAL.

III.   *Actuarial Value of Assets*

The actuarial value of assets is based on the market value of assets with a five-year phase-in of actual investment return in excess of (less than) expected investment income. Offsetting unrecognized gains and losses are immediately recognized, with the shortest remaining bases recognized first and the net remaining bases continue to be recognized on their original timeframe. Expected investment income is determined using the assumed investment return rate and the market value of assets (adjusted for receipts and disbursements during the year). The returns are computed net of investment-related expenses.

IV.   *Actuarial Assumptions*

Investment Return: 7.00% per year, net of investment-related expenses (composed of an assumed 2.30% inflation rate and a 4.70% real rate of return)

Administrative Expenses: 0.33% of valuation payroll per year (for ERS and JRS2)
0.08% of valuation payroll per year (for LECOSRF)

Salary Increases: Inflationary pay increases are assumed to occur at the beginning of the year and the remaining pay increases associated with merit, promotion and longevity are assumed to occur at the middle of the valuation year and vary by employee group. The components of the annual increases are:

Employee Group	Inflation ***	Real Wage Growth (Productivity)	Merit, Promotion and Longevity
Elected Class: Legislators	0%	0%	0%
Elected Class: District Attorneys	2.30%	0%	See salary structure below
Elected Class: Other than Legislators and District Attorneys	2.30%	0%	0%
Employee Class	2.30%	included in Merit, Promotion and Longevity Increases	See sample rates
State Base Salary of a District Judge*	2.30%	0%	0%
Inactive members who transfer to TRS**	2.30%	0%	2.50%

*   Retirees from the Elected Class are assumed to receive post-retirement increases in accordance with changes in the State base salary of a district judge.

**   Assumed in estimating benefits of former members who transfer to the Teacher Retirement System of Texas (TRS).

*** Total liabilities for this valuation reflect the most significant across-the-board pay increases appropriated by the State legislature for the current biennium compared to the assumed rate of inflation.

<u>Sample Rates</u>:

	Annual Salary Increases for Merit, Promotion and Longevity Male and Female Regular State Employees						
	Years of Eligibility Service						
Age	0	1	2 - 4	5 - 9	10 - 14	15 - 19	20+
20	6.50 %	4.95 %	4.45 %	4.00 %			
25	6.10	4.95	4.45	3.20	2.20 %		
30	5.60	4.95	4.45	2.70	2.20	1.70 %	
35	5.10	4.45	3.70	2.70	2.20	1.70	1.60 %
40	4.60	4.45	3.70	2.70	2.20	1.60	1.50
45	4.10	3.95	3.45	2.70	2.10	1.60	1.40
50	3.60	3.40	2.90	2.40	1.90	1.40	1.30
55	3.10	2.90	2.50	2.10	1.60	1.30	1.20
60+	2.60	2.40	2.00	1.70	1.30	1.10	1.00

	Annual Salary Increases for Merit, Promotion and Longevity Male and Female LECO Members					
	Years of Eligibility Service					
Age	0	1	2 -4	5 - 8	9 - 17	18+
All	6.45 %	4.45 %	2.95 %	1.95 %	1.70 %	1.45 %

District attorneys in the Elected Class are assumed to follow the judicial salary schedule of a district judge as prescribed in Section 659.012 of the Texas Government Code. The salary structure is illustrated below:

	Annual Salary Increases for Merit, Promotion and Longevity Male and Female District Attorneys in the Elected Class		
	Years of Eligibility Service as a District Attorney		
Age	Less than 4	4 or more, but less than 8	8 or more
All	State base salary of a district judge	110% of base salary	120% of base salary

New Entrant Wage Growth: 2.70% per year, compounded annually (for increasing new hire salary in open group projection).

New Entrant Profile: The average new hire is determined based on a new entrant profile, which is created from the valuation data by determining the entry age and entry pay for anyone with greater than or equal to three but less than eight years of service as of the valuation date. Each group of

new hires' salaries is assumed to grow at the New Entrant Wage Growth of 2.70% over the salaries of the previous year's group.

Post-Retirement Increases for Elected Class Members: If benefits are based on the State base salary of a district judge, the benefits are assumed to increase 2.30% per year during retirement (each September 1), compounded annually, consistent with the assumed Salary Increase for a district judge. Increases are assumed to also occur during deferral periods (if any). Otherwise, no increases are assumed.

Age and Service Assumptions and Methods:

Eligibility Service:
> Eligibility Service is considered to be all service eligible for vesting purposes, which includes service earned as a Regular State Employee, a LECO member, a member of the Elected Class, as State Judge, and service earned in the Teacher Retirement System of Texas ("TRS").

Benefit Service:
> Current Benefit Service in years and months as of the valuation date was provided by ERS. This service plus Future Earned Service, Service Credit at Retirement, and Eligibility Service at Retirement were used to project benefit amounts.

Future Earned Service:
> Active members were assumed to earn one additional year of service credit in each future year employed based on their current class of membership (but not beyond the amount of credit needed to provide a 100% of average monthly compensation standard service retirement annuity).

Service Credit at Retirement:
> For regular state employees, service credit when eligible for service retirement is assumed to be increased by:
> - 1.0 years if age plus service, prior to adjustment, is greater than or equal to 80;
> - 0.5 years if age plus service, prior to adjustment, is less than 80; and
> (but not beyond the amount of credit needed to provide a 100% of average monthly compensation standard service retirement annuity).
>
> For LECO members, service credit when eligible for service retirement is assumed to be increased by:
> - 1.0 years if CPO/CO service, prior to adjustment, is at least 20 years; and
> - 0.5 years if CPO/CO service, prior to adjustment, is less than 20 years.
> (but not beyond the amount of credit needed to provide a 100% of average monthly compensation standard service retirement annuity).
>
> For the Elected Class members, there is no assumed increase in service credit when eligible for service retirement.

Entry Age:
> Entry age is calculated as the age at the valuation date minus Eligibility Service (excluding TRS service).

Decrement Timing: All decrements – mortality, service retirement, disability retirement, and termination of employment for reasons other than death or retirement – are assumed to occur at the middle of the valuation year.

Mortality Decrements:

Service Retirees, Beneficiaries, and Inactive Members

      2020 State Retirees of Texas (SRT) mortality table. Generational mortality improvements in accordance with the ultimate rates from the scale most recently published by Retirement Plans Experience Committee of the Society of Actuaries ("Scale U-MP") and projected from the year 2020. Rates for male LECO members are set forward one year. Sample rates for the base mortality table included below.

Annual Mortality Rates per 100 Individuals		
Age	Males	Females
40	0.0585	0.0369
45	0.1028	0.0667
50	0.1771	0.1179
55	0.3052	0.2086
60	0.5260	0.3691
65	0.9066	0.6530
70	1.5627	1.1554
75	2.6933	2.0443
80	4.6421	3.6170
85	8.0010	6.3997
90	13.8587	11.3793

Active Members

      Pub-2010 General Employees Active Member Mortality table for non-LECO members. Pub-2010 Public Safety Active Member Mortality table for LECO members. Generational mortality improvements in accordance with the Ultimate MP scales are projected from the year 2010.

Disability Retirees

      2020 State Retirees of Texas (SRT) mortality table, set forward three years for males and females. Minimum rates at all ages of 3.0% and 2.5% for males and females, respectively. Generational mortality improvements in accordance with the Ultimate MP scales are projected from the year 2020.

Occupational Death

      1.0% of male and female active member deaths are assumed to be occupational.

Service Retirement Decrements: Graded tables based on ERS experience.

<u>Active Regular State Employees</u>

Service retirement rates are determined by the first set of eligibility requirements satisfied:

- Eligibility A: Age plus eligibility service is greater than or equal to 80 ("Rule of 80")
- Eligibility B: Retirement eligibility other than Rule of 80

Adjustments to the base rates are made to account for age at first eligibility or reduced retirement benefits, based on date of hire (described below sample table).

Base rates for eligible members:

	Annual Service Retirement Rates Regular State Employees (Males & Females)	
	Eligibility A	Eligibility B
Age	Rule of 80	Other Age/Service
<50	0.50	
50	0.40	
51	0.35	
52	0.30	
53	0.28	
54	0.27	
55	0.26	
56	0.25	
57	0.24	
58	0.23	
59	0.22	
60	0.21	0.18
61	0.20	0.12
62	0.33	0.20
63	0.27	0.18
64	0.27	0.18
65 - 74	0.27	0.27
75	1.00	1.00

Adjustments for members hired before September 1, 2009:
- Eligibility A: Add 0.30 at age of 1st eligibility

Adjustments for members hired on or after September 1, 2009, but before September 1, 2013:
- Eligibility A: Add 0.30 at age 60

Adjustments for members hired on or after September 1, 2013:
- Eligibility A: If age of 1st eligibility is before age 62, then
  - rates prior to age 62 are multiplied by 75% for each year prior to age 62
  - the rate at age 62 is the base table rate plus 0.20 plus 0.06 times the number of years the age at 1st eligibility was before age 62

<u>Active LECO Members</u>

Service retirement rates are determined by the first set of eligibility requirements satisfied:
- Eligibility A: 20 years of CPO/CO service
- Eligibility B: Age 55 and 10 years of CPO/CO service
- Eligibility C: Any eligibility pertaining to regular State employees (see rates and adjustments for regular State employees)

Adjustments to the base rates are made to account for age at first eligibility or reduced retirement benefits, based on date of hire (described below sample table).

Base rates for eligible members:

Annual Service Retirement Rates LECO Members (Males & Females)			
Eligibility A		Eligibility B	
Age	20 yrs CPO/CO	Age	Age 55 & 10 yrs CPO/CO
<48	0.03		
48	0.04	55	0.20
49	0.05	56	0.18
50	0.60	57	0.16
51 - 61	0.33	58 - 61	0.14
62 - 74	0.50	62 - 74	0.27
75	1.00	75	1.00

Adjustments for members hired before September 1, 2013:
- Eligibility A and B: Rate set to zero if member has 18 or 19 years of CPO/CO service. Rate is doubled if member has 20 years of CPO/CO service.

Adjustments for members hired on or after September 1, 2013:
- Eligibility A: If age of 1st eligibility is before age 57, then
  - rates prior to age 57 are multiplied by 75% for each year prior to age 57
  - the rate at age 57 is 100%
- Eligibility B: If member will attain 20 years of CPO/CO service at or before age 62, rates are zero prior to age 62 and 80% when member attains 20 years of CPO/CO service.
- Eligibility B: If member will attain 20 years of CPO/CO service after age 62, then
  - rates prior to age 62 are multiplied by 75% for each year prior to age 62
  - the rate at age 62 is the base table rate plus 0.06 times the number of years the age at 1st eligibility was before age 62

Active Elected Class Members

Annual Service Retirement Rates Elected Class Members	
Age	Male and Female
50 - 61	0.10
62 - 74	0.20
75+	1.00

Active State Judge

Annual Service Retirement Rates State Judges		
	Male and Female	
Age	Unreduced	Reduced
50 - 64	0.20	0.10
65 - 69	0.20	N/A
70 - 74	0.25	N/A
75+	1.00	N/A

Disability Retirement Decrements: Graded Tables Based on ERS Experience

<u>Active Regular State Employees</u>
- The rates do not apply before someone is eligible for the benefit.
- 10 years of service is required for non-occupational disability retirement.
- Non-occupational disability rates are assumed to be zero once the sum of the member's age and eligibility service is greater than or equal to 80.

<u>Active Elected Class Members and State Judges</u>
- The rates do not apply before someone is eligible for the benefit.
- No occupational disabilities are assumed for the elected class or judges.
- Eight years of service is required for non-occupational disability retirement.
- Non-occupational disability rates are assumed to be zero once the member has attained service retirement eligibility.

Sample rates for eligible regular State employees, elected class members, and judges:

Annual Disability Rates per 100 Participants		
	Regular State Employes and Elected Class	
Age	Males	Females
30	0.0275	0.0135
35	0.0650	0.0442
40	0.0749	0.0896
45	0.1027	0.1455
50	0.1484	0.2072
55	0.2477	0.3488
60	0.3740	0.5583

99% of the disability rates stated above are assumed to be attributable to non-occupational disabilities and 1% are assumed to be attributable to occupational disabilities. No occupational disabilities are assumed for the elected class and judges.

Active LECO Members

- The rates do not apply before a member is eligible for the benefit.
- Service greater than zero is required for occupational disability retirement.
- 10 years of service is required for non-occupational disability retirement.
- Non-occupational disability rates are assumed to be zero once the sum of the member's age and eligibility service is greater than or equal to 80, or the member has attained age 55 with 10 or more years of CPO/CO service.

Sample rates for members:

Annual Disability Rates per 100 Participants LECO Members	
Age	Males and Females
30	0.0092
35	0.0314
40	0.0586
45	0.0980
50	0.1774
55	0.2460
60	0.3150

95% of the disability rates stated above are assumed to be attributable to non-occupational disabilities, 4.5% are assumed to be attributable to non-total occupational disabilities, and 0.5% are assumed to be attributable to total occupational disabilities.

Termination Decrements for Reasons Other Than Death or Retirement: Graded Tables Based on ERS Experience.

Rates of termination are zero for members eligible for service retirement. To account for active regular State employees and LECO members that accumulate additional eligibility service at retirement through converting sick/annual leave or other types of service purchases, termination rates are also set to zero in the year prior to first retirement eligibility.

Rates for members not eligible for service retirement:

Active Regular State Employees

Annual Rates of Termination per 100 Participants Regular State Employees		
	Male and Female	
Eligibility Service	Entry age 35 or younger	Entry age over 35
0	25.25	19.63
1	21.24	16.07
2	17.88	13.26
3	15.07	11.08
4	12.76	9.42
5	10.86	8.16
6	9.33	7.21
7	8.09	6.49
8	7.10	5.94
9	6.31	5.50
10	5.67	5.11
11	5.15	4.75
12	4.71	4.39
13	4.32	4.03
14	3.97	3.66
15	3.64	3.29
16	3.30	2.95
17	2.97	2.69
18	2.62	2.53
19	2.27	1.00
20	1.92	1.00
21	1.59	1.00
22	1.29	1.00
23	1.05	1.00
24	0.89	1.00
25+	0.85	1.00

Active LECO Members

Annual Rates of Termination per 100 Participants LECO Members	
Eligibility Service	Male and Female
0	26.45
1	22.10
2	17.66
3	14.35
4	11.91
5	10.13
6	8.82
7	7.83
8	7.03
9	6.35
10	5.70
11	5.08
12	4.49
13	3.94
14	3.53
15	3.34
16	2.88
17	1.15
18	1.15
19+	0.00

Elected Class Members: 4 per 100 participants for members not eligible for service retirement

State Judges: 4 per 100 participants for members not eligible for service retirement

Withdrawal of Employee Contributions: Members that terminate with a vested benefit are assumed to choose the most valuable option available to them at the time of termination: withdrawal of contributions or deferred annuity.

Percentage of Members Electing Various Benefit Options:

Sex / Benefit	Standard Life Annuity	Option 1	Option 4
Male Member			
Disability	50%	50%	0%
Service Retirement			
Non-LECO	100%	0%	0%
LECO	60%	40%	0%
Death Benefit Plan	0%	85%	15%
Female Member			
Disability	75%	25%	0%
Service Retirement	100%	0%	0%
Death Benefit Plan	0%	70%	30%

The value of the Standard Service Retirement Life Annuity reflects the return of excess contributions payable as a lump sum death benefit in cases the annuity benefits paid are less than the member account balance at the time of retirement.

Beneficiary Characteristics: Male member is assumed to be two years older than female beneficiary; and female member is assumed to be two years younger than male beneficiary.

Transfers from ERS to TRS:

Contributing ERS members:

> It is assumed that 10% of regular State employees and LECO members who cease contributing to ERS and do not withdraw employee contributions will transfer ERS service credit to TRS at retirement.

Noncontributing ERS Members:

> Records of ERS and TRS are matched by ERS staff to determine former ERS members who are currently contributing under TRS.

TRS Retirement Age:

> Former ERS members who are, or are assumed to become, contributing TRS members are assumed to continue to earn service credit under TRS until first eligible for unreduced service retirement benefits, retire at that time, and transfer ERS service credit to TRS.

Census Data and Assets

- The valuation was based on members of ERS as of August 31, 2019 and does not take into account future members.
- All census data was supplied by ERS and was subject to reasonable consistency checks.
- There were data elements that were modified for some members as part of the valuation in order to make the data complete. However, the number of missing data items was immaterial.
- Asset data was supplied by ERS.

Other Actuarial Valuation Procedures

- No provision was made in this actuarial valuation for the limitations of Internal Revenue Code Sections 415 or 401(a)17.
- Valuation payroll (earnings applied to the current valuation year) is the expected payroll for the fiscal year following the valuation date. It is based on reported payroll determined from August member contributions increased to reflect the across-the-board salary increases appropriated by the State legislature, effective on or after September 1, and projected according to the actuarial assumptions for the upcoming fiscal year.
- No liability was included for benefits which are funded by special State appropriations.
- State appropriations for membership fees are currently immaterial in relation to the overall payroll contributions and have been ignored.

SECTION E

SUMMARY OF DATA AND EXPERIENCE

Retirement Experience for the Five-Year Period Ending August 31, 2019
Regular State Employees - Males and Females
First retirement eligibility: Rule of 80*

Age	Actual Retirement	Total Count	Actual Rate	Proposed Rate	Expected Retirement (3) * (5)	Actual/ Expected (2) / (6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Under 50	101	552	18%	50%	276	37%
50	301	1,023	29%	40%	409	74%
51	427	1,663	26%	35%	582	73%
52	682	2,321	29%	30%	696	98%
53	789	2,834	28%	28%	794	99%
54	838	3,137	27%	27%	847	99%
55	804	3,333	24%	26%	867	93%
56	854	3,542	24%	25%	886	96%
57	864	3,655	24%	24%	877	99%
58	804	3,650	22%	23%	840	96%
59	753	3,063	25%	22%	674	112%
60	538	2,425	22%	21%	509	106%
61	370	1,925	19%	20%	385	96%
62	429	1,581	27%	33%	522	82%
63	300	1,091	27%	27%	295	102%
64	189	758	25%	27%	205	92%
65	141	543	26%	27%	147	96%
66	122	360	34%	27%	97	126%
67	68	213	32%	27%	58	117%
68	42	131	32%	27%	35	120%
69	14	81	17%	27%	22	64%
70	25	64	39%	27%	17	147%
71	21	60	35%	27%	16	131%
72	8	63	13%	27%	17	47%
73	8	57	14%	27%	15	53%
74	3	52	6%	27%	14	21%
Total	9,495	38,177	25%		10,102	94%

*Includes all Regular State Employees who reached eligibility for Rule of 80 prior to other retirement eligibilities. Members may be beyond their initial retirement eligibility at the time of inclusion in the retirement experience. For example, the age 60 experience may include someone who is age 60 with 22 years of service. This person was first eligible for retirement at age 59 with 21 years of service, a "Rule of" retirement.

Retirement Experience for the Five-Year Period Ending August 31, 2019
Regular State Employees - Males and Females
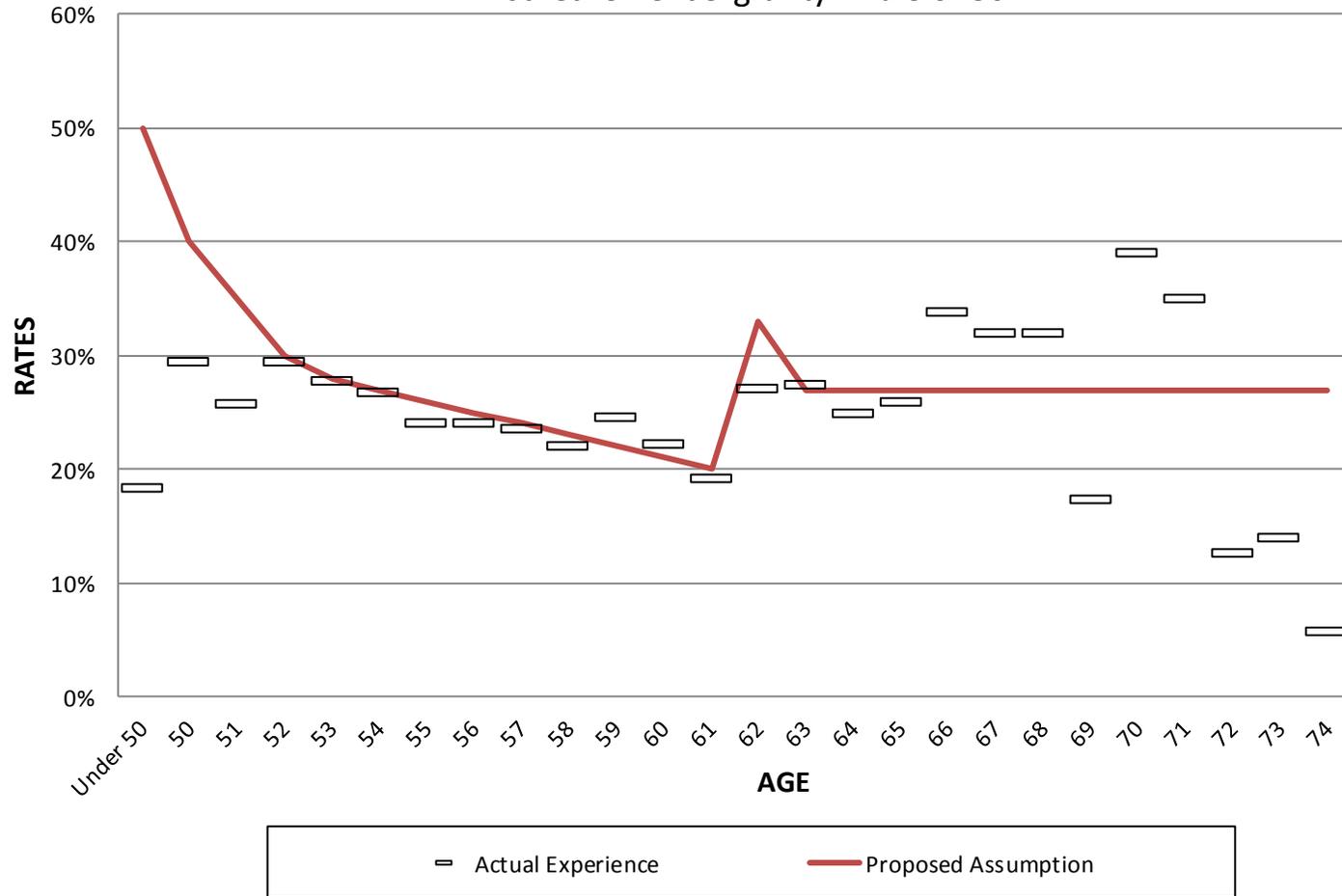### First retirement eligibility: Rule of 80

Retirement Experience for the Five-Year Period Ending August 31, 2019

Regular State Employees - Males and Females

First retirement eligibility other than Rule of 80*

Age	Actual Retirement	Total Count	Actual Rate	Proposed Rate	Expected Retirement (3) * (5)	Actual/ Expected (2) / (6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
60	864	5,352	16%	18%	963	90%
61	645	5,178	12%	12%	621	104%
62	935	4,935	19%	20%	987	95%
63	757	4,160	18%	18%	749	101%
64	606	3,604	17%	18%	649	93%
65	854	3,149	27%	27%	850	100%
66	715	2,452	29%	27%	662	108%
67	469	1,753	27%	27%	473	99%
68	321	1,381	23%	27%	373	86%
69	263	1,056	25%	27%	285	92%
70	222	804	28%	27%	217	102%
71	142	572	25%	27%	154	92%
72	108	431	25%	27%	116	93%
73	68	307	22%	27%	83	82%
74	53	230	23%	27%	62	85%
75 & over	179	696	26%	100%	696	26%
Total	7,201	36,060	20%		7,940	91%

*Includes all Regular State Employees who reached eligibility for retirement prior to reaching Rule of 80. Members may be beyond their initial retirement eligibility at the time of inclusion in the retirement experience. For example, the age 61 experience may include someone who is age 61 with 12 years of service. This person was first eligible for retirement at age 60 with 11 years of service, an age and service combination not meeting Rule of 80.
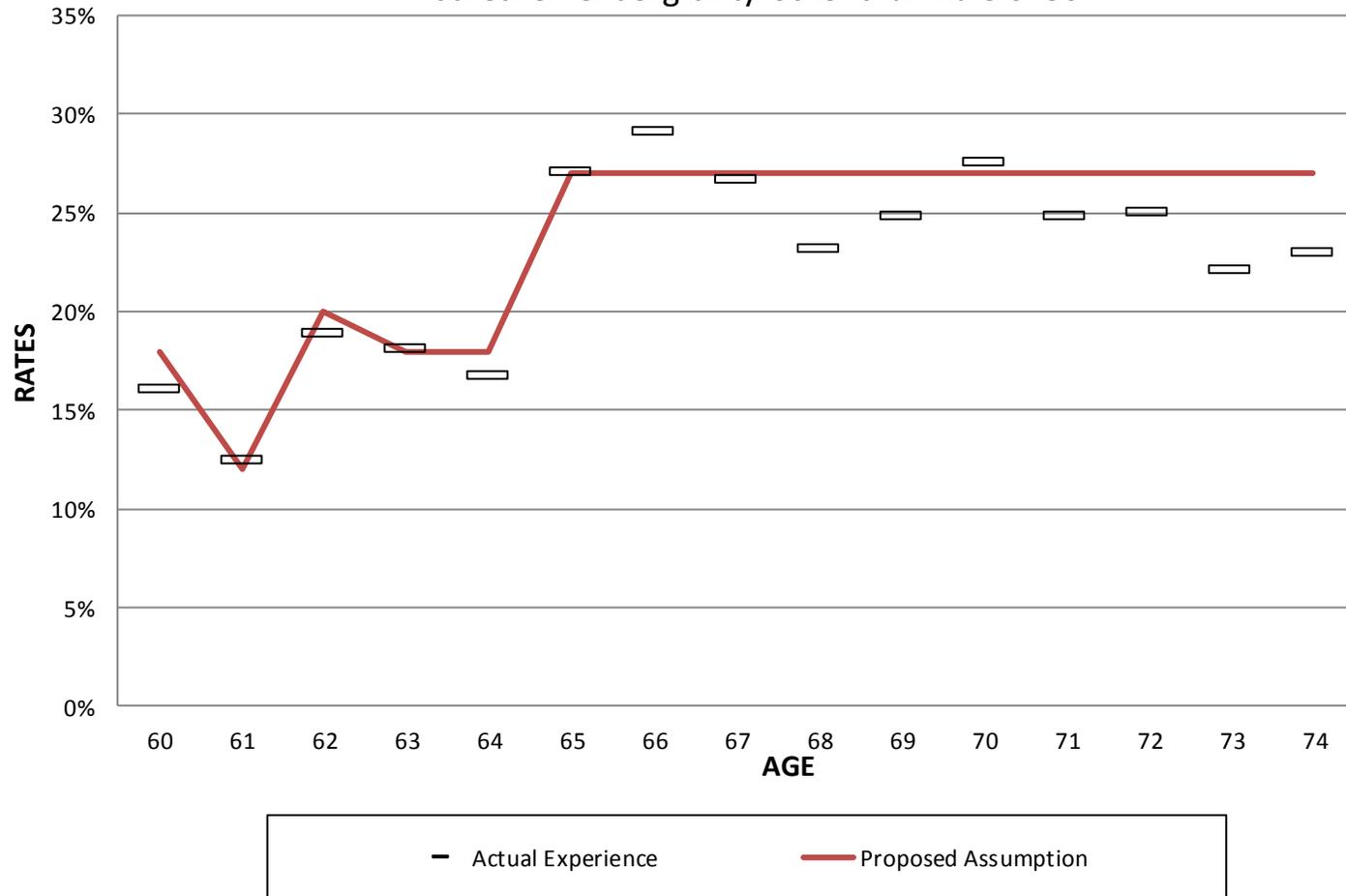
Retirement Experience for the Five-Year Period Ending August 31, 2019

Regular State Employees - Males and Females
First retirement eligibility other than Rule of 80

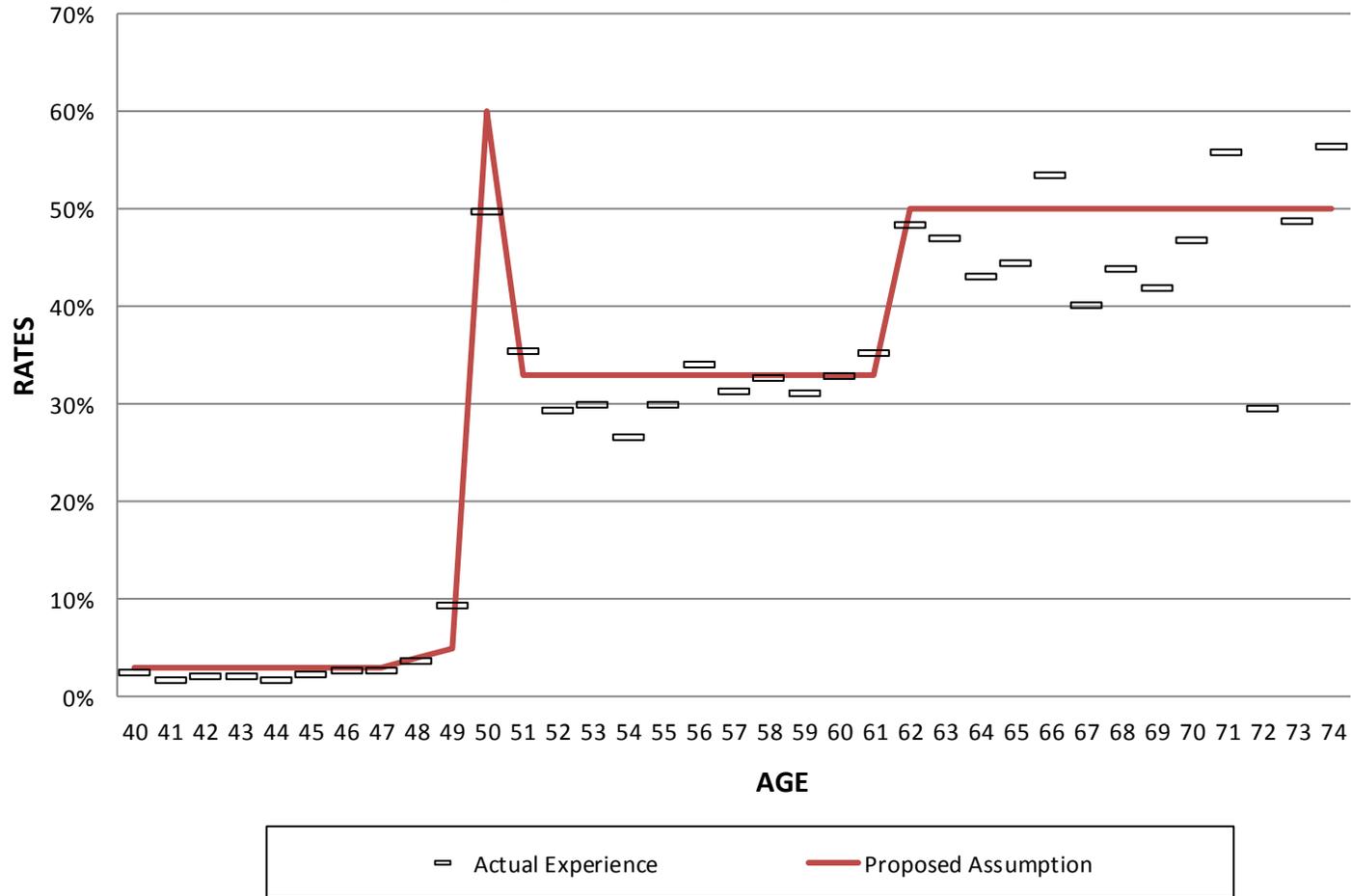# Retirement Experience for the Five-Year Period Ending August 31, 2019

LECO Members - Males and Females

First retirement eligibility: 20 years of CPO/CO service*

Age	Actual Retirement	Total Count	Actual Rate	Proposed Rate	Expected Retirement (3) * (5)	Actual/ Expected (2) / (6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
40	105	4,230	2%	3%	127	82%
41	101	6,619	2%	3%	199	51%
42	231	11,240	2%	3%	337	69%
43	298	15,420	2%	3%	463	64%
44	346	21,624	2%	3%	649	53%
45	593	27,003	2%	3%	810	73%
46	832	32,097	3%	3%	963	86%
47	972	36,492	3%	3%	1,095	89%
48	1,443	41,155	4%	4%	1,646	88%
49	4,228	45,308	9%	5%	2,265	187%
50	23,731	47,740	50%	60%	28,644	83%
51	10,429	29,565	35%	33%	9,756	107%
52	6,843	23,448	29%	33%	7,738	88%
53	5,913	19,809	30%	33%	6,537	90%
54	4,777	17,987	27%	33%	5,936	80%
55	4,690	15,712	30%	33%	5,185	90%
56	4,813	14,144	34%	33%	4,668	103%
57	3,840	12,292	31%	33%	4,056	95%
58	3,549	10,887	33%	33%	3,593	99%
59	3,009	9,727	31%	33%	3,210	94%
60	2,809	8,570	33%	33%	2,828	99%
61	2,732	7,774	35%	33%	2,565	106%
62	3,463	7,184	48%	50%	3,592	96%
63	2,178	4,642	47%	50%	2,321	94%
64	1,538	3,578	43%	50%	1,789	86%
65	1,295	2,920	44%	50%	1,460	89%
66	1,090	2,039	53%	50%	1,019	107%
67	577	1,440	40%	50%	720	80%
68	537	1,227	44%	50%	614	87%
69	303	723	42%	50%	361	84%
70	214	458	47%	50%	229	94%
71	112	201	56%	50%	101	111%
72	48	161	30%	50%	81	59%
73	105	215	49%	50%	108	97%
74	85	151	56%	50%	76	112%
Total	97,827	483,779	20%		105,741	93%

*Includes all LECOs who reached eligibility for retirement under the 20 years of CPO/CO service provisions prior to other retirement eligibilities. Members may be beyond their initial retirement eligibility at the time of inclusion in the retirement experience. For example, the age 60 experience may include someone who is age 60 with 28 years of CPO/CO service. This person was first eligible for retirement at age 52 with 20 years of service, a service-based retirement.

Retirement Experience for the Five-Year Period Ending August 31, 2019
LECO Members- Males and Females
First Eligibility: 20 or more years of CPO/CO service

Retirement Experience for the Five-Year Period Ending August 31, 2019

LECO Members - Males and Females

First retirement eligibility: Age 55 & 10 years of CPO/CO service*

Age	Actual Retirement	Total Count	Actual Rate	Proposed Rate	Expected Retirement (3) * (5)	Actual/ Expected (2) / (6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
55	3,755	20,995	18%	20%	4,199	89%
56	2,723	18,526	15%	18%	3,335	82%
57	2,069	16,006	13%	16%	2,561	81%
58	1,991	15,246	13%	14%	2,134	93%
59	1,782	13,989	13%	14%	1,958	91%
60	2,258	17,477	13%	14%	2,447	92%
61	1,752	15,150	12%	14%	2,121	83%
62	3,495	14,032	25%	27%	3,789	92%
63	2,699	11,059	24%	27%	2,986	90%
64	1,624	8,557	19%	27%	2,310	70%
65	1,854	7,105	26%	27%	1,918	97%
66	1,748	5,455	32%	27%	1,473	119%
67	1,220	4,083	30%	27%	1,102	111%
68	956	3,076	31%	27%	831	115%
69	607	2,115	29%	27%	571	106%
70	341	1,570	22%	27%	424	80%
71	406	1,344	30%	27%	363	112%
72	174	844	21%	27%	228	76%
73	416	749	55%	27%	202	206%
74	187	511	37%	27%	138	135%
Total	32,055	177,889	18%		35,090	91%

*Includes all LECOs who reached eligibility for retirement under the 55 and 10 years of CPO/CO service provisions prior to other retirement eligibilities. Members may be beyond their initial retirement eligibility at the time of inclusion in the retirement experience. For example, the age 60 experience may include someone who is age 60 with 14 years of CPO/CO service. This person was first eligible for retirement at age 56 with 10 years of service, an age-based retirement.

Retirement Experience for the Five-Year Period Ending August 31, 2019

LECO Members- Males and Females

First eligibility: Age 55 & 10 years of CPO/CO service

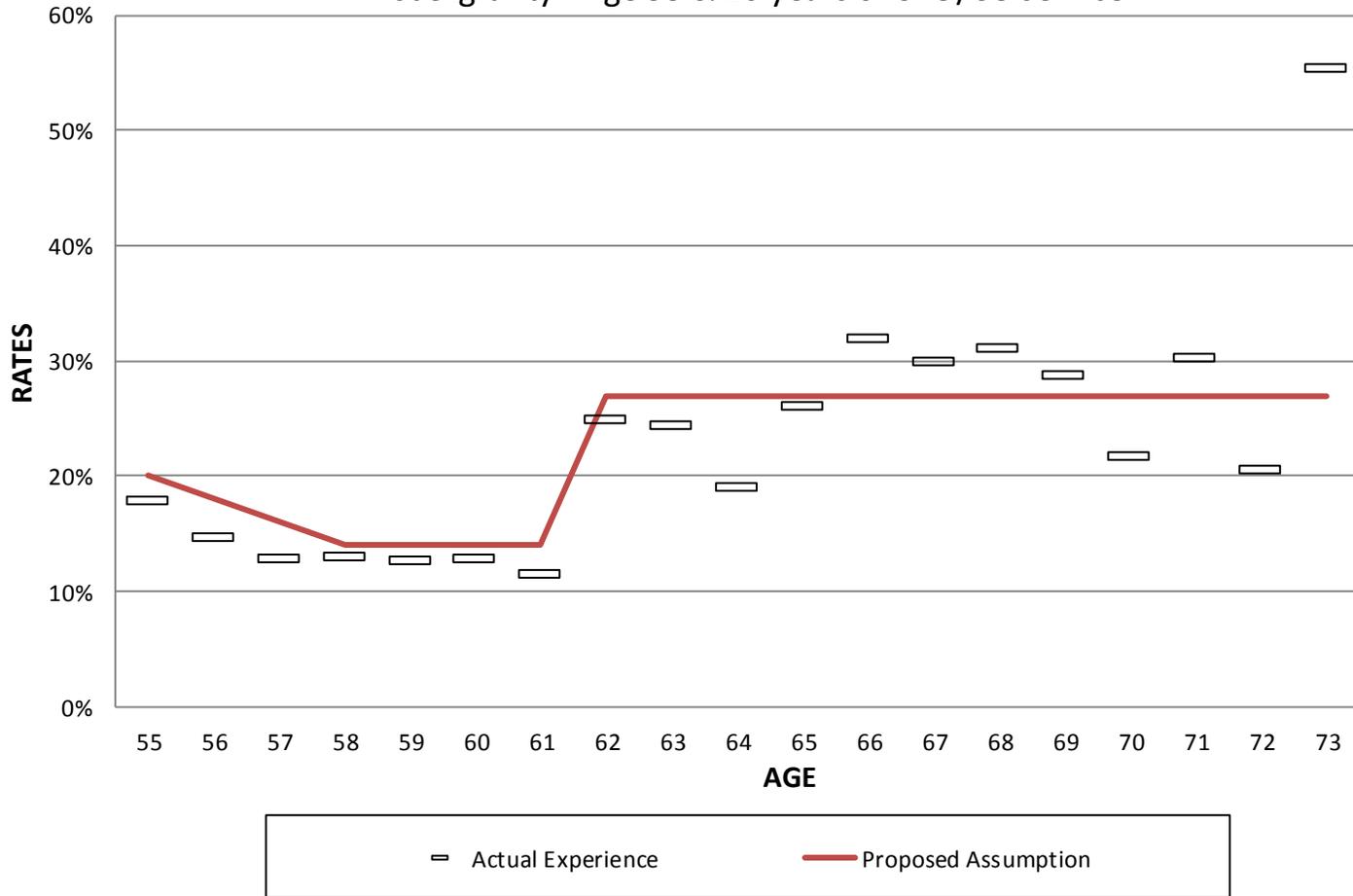Legend: Actual Experience / Proposed Assumption

Withdrawal Experience for the Five-Year Period Ending August 31, 2019*

Regular State Employees - Males and Females

Entry age of 35 or younger

Years of Service (1)	Actual Withdrawal (2)	Total Count (3)	Actual Rate (4)	Proposed Rate (5)	Expected Withdrawal (3) * (5) (6)	Actual/ Expected (2) / (6) (7)
1	1,877	5,271	0.3561	0.2525	1331	141%
2	2,621	10,800	0.2427	0.2124	2294	114%
3	1,966	10,799	0.1821	0.1788	1930	102%
4	1,556	10,429	0.1492	0.1507	1572	99%
5	1,240	9,572	0.1295	0.1276	1221	102%
6	1,001	9,337	0.1072	0.1086	1014	99%
7	913	9,888	0.0923	0.0933	923	99%
8	862	10,684	0.0807	0.0809	865	100%
9	784	11,961	0.0655	0.0710	849	92%
10	858	13,105	0.0655	0.0631	827	104%
11	855	13,130	0.0651	0.0567	744	115%
12	677	11,642	0.0582	0.0515	599	113%
13	579	11,210	0.0517	0.0471	528	110%
14	602	11,405	0.0527	0.0432	493	122%
15	494	12,254	0.0403	0.0397	487	101%
16	454	13,700	0.0332	0.0364	498	91%
17	418	16,301	0.0256	0.0330	539	77%
18	450	17,591	0.0256	0.0297	522	86%
19	524	18,341	0.0286	0.0262	480	109%
20	439	18,036	0.0243	0.0227	409	107%
21	313	18,818	0.0166	0.0192	361	87%
22	287	18,808	0.0153	0.0159	299	96%
23	252	17,984	0.0140	0.0129	232	108%
24	287	16,189	0.0177	0.0105	170	169%
25	166	14,185	0.0117	0.0089	127	131%
26	129	11,553	0.0112	0.0085	99	130%
27	122	8,263	0.0148	0.0085	71	172%
28	64	4,570	0.0139	0.0085	39	163%
29	29	2,046	0.0143	0.0085	17	172%
30	23	461	0.0501	0.0085	4	577%
Total	20,842	358,330	0.0582		19,544	107%

*Withdrawal indicates any termination of active employment for reasons other than death, disability or retirement.

Withdrawal Experience for the Five-Year Period Ending August 31, 2019

Regular State Employees - Males and Females

Entry age of 35 or younger

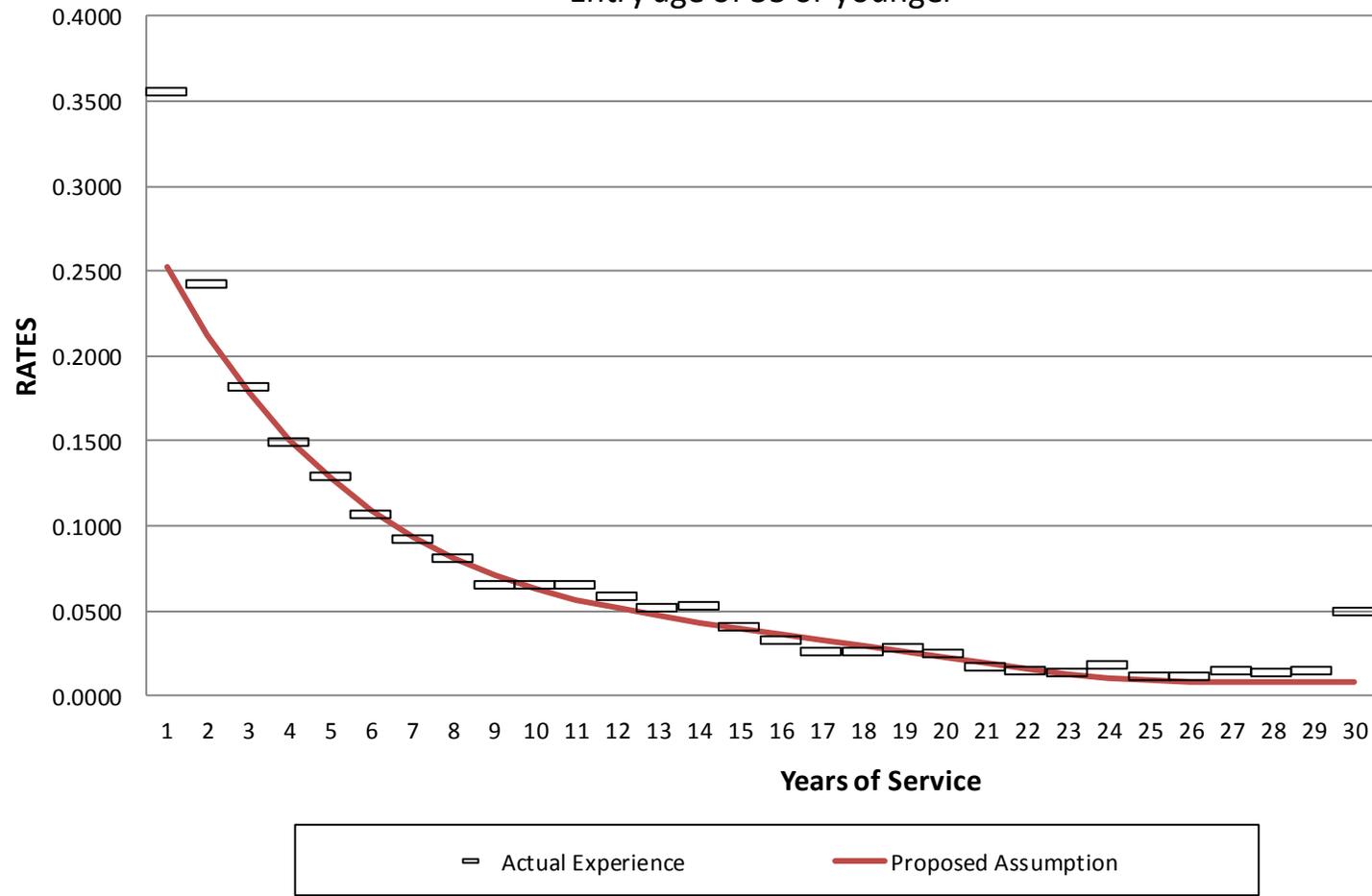## Withdrawal Experience for the Five-Year Period Ending August 31, 2019*

Regular State Employees - Males and Females
Entry age over 35

Years of Service	Actual Withdrawal	Total Count	Actual Rate	Proposed Rate	Expected Withdrawal (3) * (5)	Actual/ Expected (2) / (6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	1,465	5,304	0.2763	0.1963	1041	141%
2	2,008	11,462	0.1752	0.1607	1842	109%
3	1,552	11,696	0.1327	0.1326	1551	100%
4	1,252	11,591	0.1080	0.1108	1285	97%
5	965	10,820	0.0892	0.0942	1019	95%
6	844	10,648	0.0793	0.0816	868	97%
7	781	10,597	0.0737	0.0721	764	102%
8	685	10,447	0.0655	0.0649	678	101%
9	622	10,366	0.0600	0.0594	616	101%
10	569	9,916	0.0573	0.0550	545	104%
11	548	9,129	0.0601	0.0511	466	118%
12	424	7,595	0.0558	0.0475	361	117%
13	319	6,674	0.0479	0.0439	293	109%
14	289	6,192	0.0467	0.0403	249	116%
15	257	6,056	0.0424	0.0366	221	116%
16	176	5,817	0.0303	0.0329	191	92%
17	188	5,882	0.0320	0.0295	174	108%
18	129	5,245	0.0246	0.0269	141	92%
19	115	4,548	0.0253	0.0253	115	100%
20	54	2,858	0.0190	0.0100	29	187%
21	57	920	0.0622	0.0100	9	635%
Total	13,301	163,762	0.0812		12,458	107%

*Withdrawal indicates any termination of active employment for reasons other than death, disability or retirement.

Withdrawal Experience for the Five-Year Period Ending August 31, 2019

Regular State Employees - Males and Females

Entry age over 35

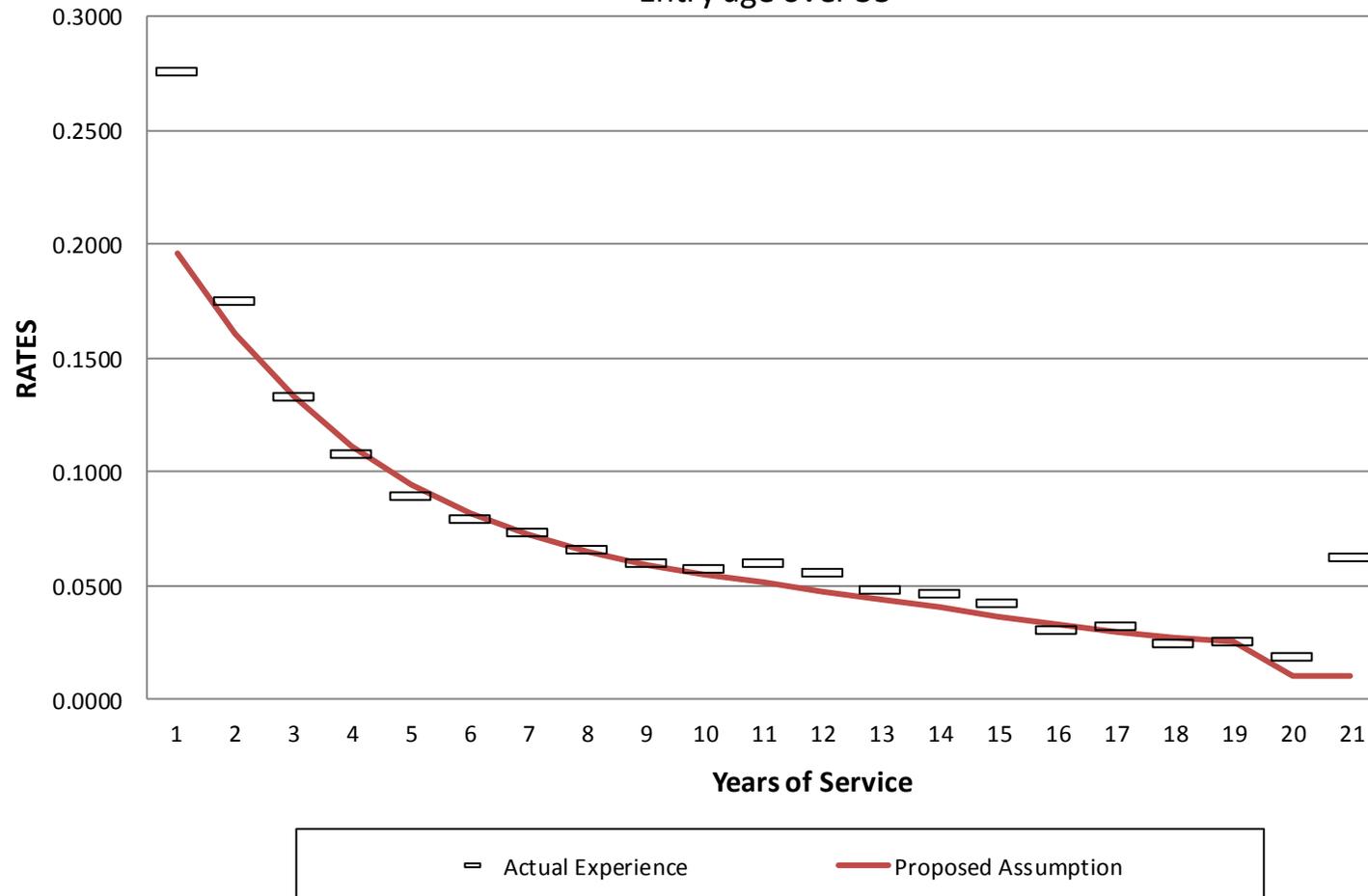## Withdrawal Experience for the Five-Year Period Ending August 31, 2019*

LECO Members- Males and Females

Years of Service	Actual Withdrawal	Total Count	Actual Rate	Proposed Rate	Expected Withdrawal (3) * (5)	Actual/ Expected (2) / (6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	1,592	4,732	0.3364	0.2644	1251	127%
2	2,755	10,159	0.2712	0.2211	2246	123%
3	1,919	9,554	0.2009	0.1766	1687	114%
4	1,336	8,653	0.1544	0.1435	1242	108%
5	1,002	7,570	0.1324	0.1191	902	111%
6	849	7,724	0.1099	0.1014	783	108%
7	780	8,024	0.0972	0.0881	707	110%
8	667	8,406	0.0793	0.0783	658	101%
9	595	8,318	0.0715	0.0702	584	102%
10	541	8,114	0.0667	0.0635	515	105%
11	488	7,924	0.0616	0.0570	452	108%
12	447	7,145	0.0626	0.0509	363	123%
13	359	7,043	0.0510	0.0449	316	114%
14	352	7,286	0.0483	0.0395	288	122%
15	296	7,351	0.0403	0.0354	260	114%
16	246	7,498	0.0328	0.0333	250	98%
17	230	8,195	0.0281	0.0288	236	97%
18	247	8,227	0.0300	0.0115	94	263%
19	200	5,549	0.0360	0.0114	63	317%
Total	14,901	147,472	0.1010		12,897	116%

*Withdrawal indicates any termination of active employment for reasons other than death, disability or retirement.

Withdrawal Experience for the Five-Year Period Ending August 31, 2019
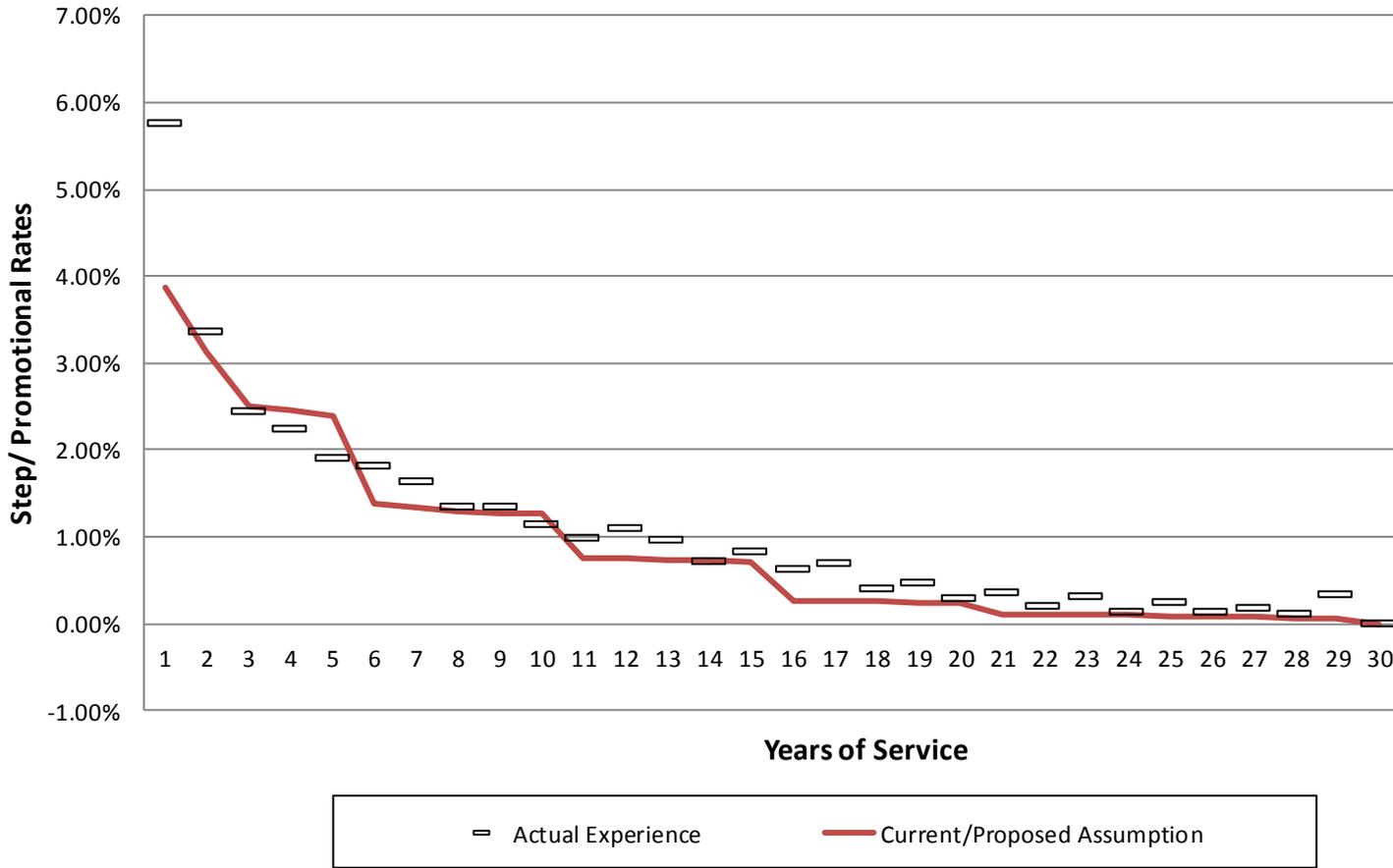## LECO Members- Males and Females

RATES vs Years of Service

Legend:
- Actual Experience
- Proposed Assumption
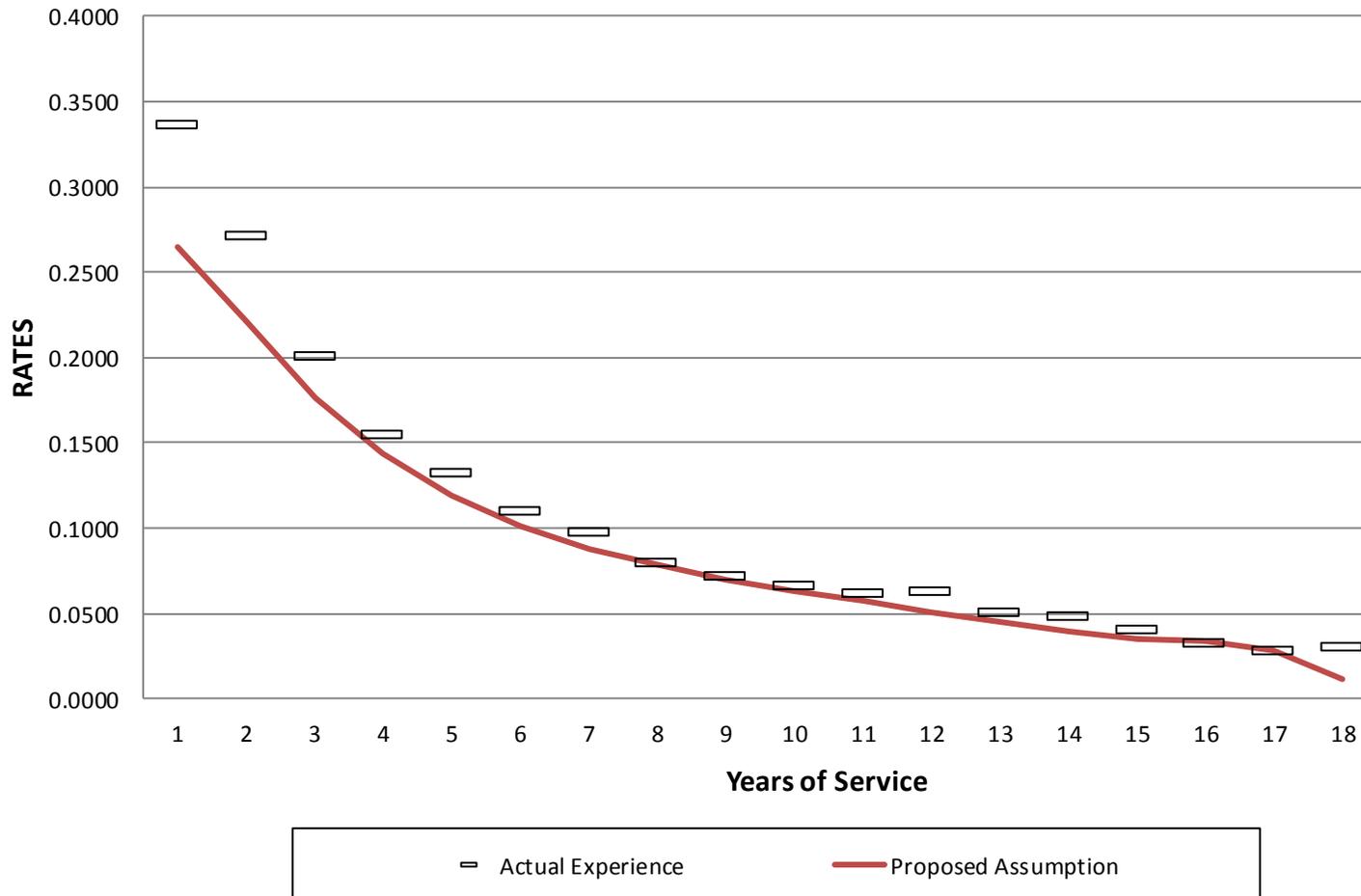
Service-Based Salary Rates
Regular State Employees - Males and Females

	Current Salary Scale		2011 - 2019 Actual Experience			Proposed Salary Scale	
Years of Service	Total	Step Rate/ Promotional	Total	Above Inflation	Step Rate/ Promotional	Total	Step Rate/ Promotional
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	7.86%	3.86%	8.66%	7.09%	5.75%	7.36%	3.86%
2	7.13%	3.13%	6.25%	4.68%	3.34%	6.63%	3.13%
3	6.51%	2.51%	5.34%	3.77%	2.43%	6.01%	2.51%
4	6.45%	2.45%	5.14%	3.58%	2.24%	5.95%	2.45%
5	6.39%	2.39%	4.80%	3.24%	1.89%	5.89%	2.39%
6	5.37%	1.37%	4.72%	3.15%	1.81%	4.87%	1.37%
7	5.33%	1.33%	4.54%	2.97%	1.63%	4.83%	1.33%
8	5.30%	1.30%	4.25%	2.68%	1.34%	4.80%	1.30%
9	5.27%	1.27%	4.23%	2.67%	1.33%	4.77%	1.27%
10	5.26%	1.26%	4.04%	2.47%	1.13%	4.76%	1.26%
11	4.75%	0.75%	3.88%	2.32%	0.97%	4.25%	0.75%
12	4.74%	0.74%	4.00%	2.43%	1.09%	4.24%	0.74%
13	4.74%	0.74%	3.86%	2.29%	0.95%	4.24%	0.74%
14	4.73%	0.73%	3.61%	2.04%	0.70%	4.23%	0.73%
15	4.72%	0.72%	3.73%	2.17%	0.83%	4.22%	0.72%
16	4.26%	0.26%	3.53%	1.96%	0.62%	3.76%	0.26%
17	4.26%	0.26%	3.59%	2.02%	0.68%	3.76%	0.26%
18	4.25%	0.25%	3.31%	1.74%	0.40%	3.75%	0.25%
19	4.25%	0.25%	3.38%	1.81%	0.47%	3.75%	0.25%
20	4.24%	0.24%	3.20%	1.63%	0.29%	3.74%	0.24%
21	4.11%	0.11%	3.27%	1.70%	0.36%	3.61%	0.11%
22	4.10%	0.10%	3.10%	1.53%	0.19%	3.60%	0.10%
23	4.09%	0.09%	3.21%	1.65%	0.31%	3.59%	0.09%
24	4.09%	0.09%	3.03%	1.46%	0.12%	3.59%	0.09%
25	4.09%	0.09%	3.14%	1.57%	0.23%	3.59%	0.09%
26	4.08%	0.08%	3.03%	1.47%	0.13%	3.58%	0.08%
27	4.07%	0.07%	3.08%	1.51%	0.17%	3.57%	0.07%
28	4.06%	0.06%	3.01%	1.44%	0.10%	3.56%	0.06%
29	4.05%	0.05%	3.23%	1.66%	0.32%	3.55%	0.05%
30	3.99%	-0.01%	2.91%	1.34%	0.00%	3.49%	-0.01%

Current Inflation Assumption	2.50%	Proposed Inflation Assumption	2.30%
Current Productivity Component	1.50%	Proposed Productivity Component	1.20%
Actual CPI-U Inflation for Period	1.57%		
Apparent Productivity Component	1.34%		

Regular State Employees - Males and Females
Service-Based Salary Rates

Service-Based Salary Rates

LECO Members - Males and Females

Years of Service	Current Salary Scale		2011 - 2019 Actual Experience			Proposed Salary Scale	
	Total	Step Rate/ Promotional	Total	Above Inflation	Step Rate/ Promotional	Total	Step Rate/ Promotional
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	9.50%	5.00%	10.42%	8.85%	7.60%	8.75%	5.00%
2	7.50%	3.00%	5.75%	4.19%	2.93%	6.75%	3.00%
3	6.00%	1.50%	4.17%	2.60%	1.35%	5.25%	1.50%
4	6.00%	1.50%	4.54%	2.98%	1.72%	5.25%	1.50%
5	6.00%	1.50%	4.49%	2.92%	1.67%	5.25%	1.50%
6	5.00%	0.50%	2.80%	1.23%	-0.03%	4.25%	0.50%
7	5.00%	0.50%	3.23%	1.66%	0.41%	4.25%	0.50%
8	5.00%	0.50%	3.91%	2.34%	1.08%	4.25%	0.50%
9	5.00%	0.50%	3.16%	1.59%	0.34%	4.25%	0.50%
10	4.75%	0.25%	2.78%	1.21%	-0.05%	4.00%	0.25%
11	4.75%	0.25%	2.78%	1.21%	-0.04%	4.00%	0.25%
12	4.75%	0.25%	3.01%	1.44%	0.19%	4.00%	0.25%
13	4.75%	0.25%	3.29%	1.72%	0.47%	4.00%	0.25%
14	4.75%	0.25%	2.69%	1.12%	-0.14%	4.00%	0.25%
15	4.75%	0.25%	2.42%	0.86%	-0.40%	4.00%	0.25%
16	4.75%	0.25%	2.80%	1.23%	-0.03%	4.00%	0.25%
17	4.75%	0.25%	3.18%	1.62%	0.36%	4.00%	0.25%
18	4.75%	0.25%	2.63%	1.07%	-0.19%	4.00%	0.25%
19+	4.50%	0.00%	2.82%	1.25%	0.00%	3.75%	0.00%

Current Inflation Assumption	2.50%	Proposed Inflation Assumption	2.30%
Current Productivity Component	2.00%	Proposed Productivity Component	1.45%
Actual CPI-U Inflation for Period	1.57%		
Apparent Productivity Component	1.25%		

LECO Members - Males and Females
Service-Based Salary Rates
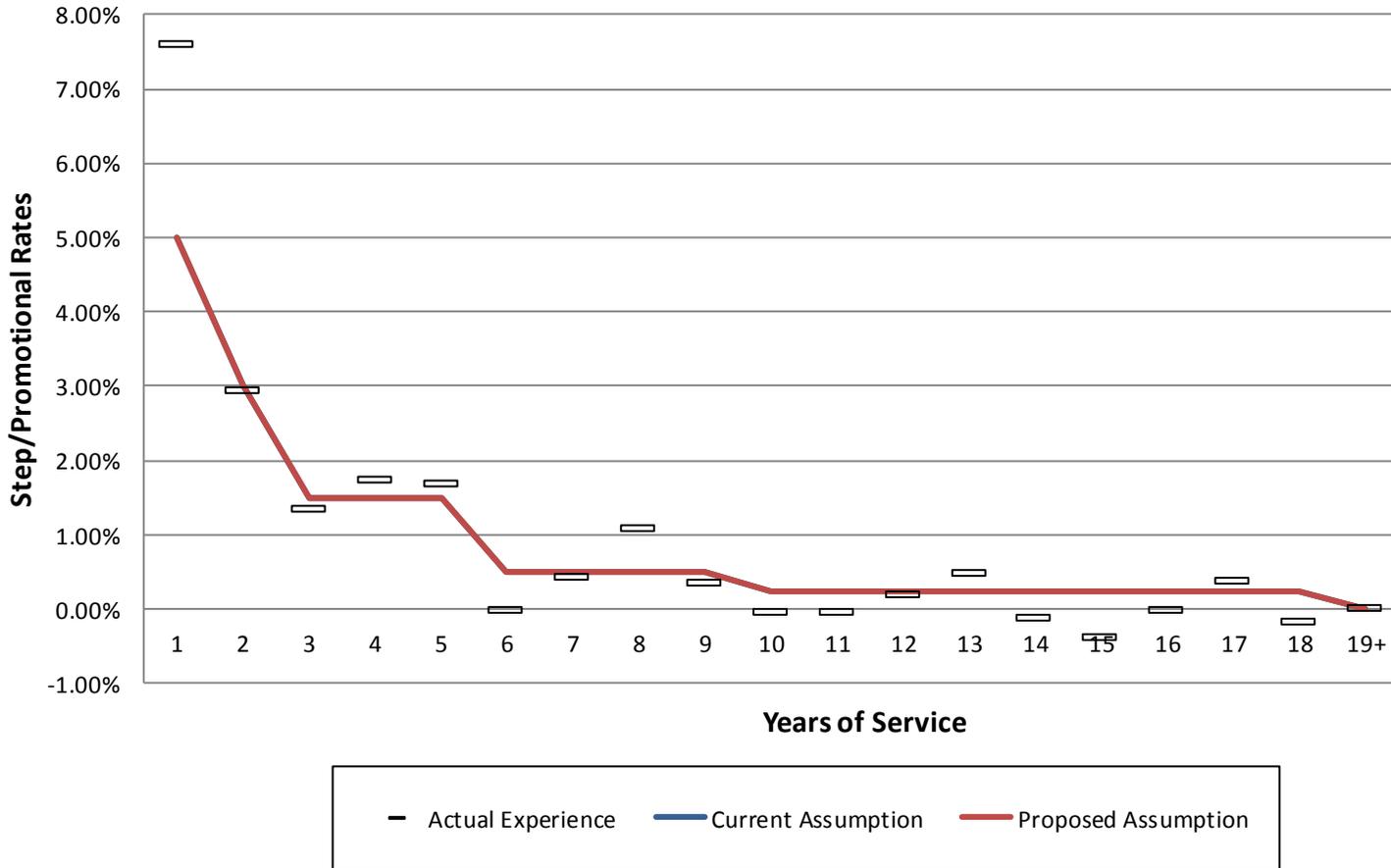
Post-Retirement Mortality Experience
Non-LECO Healthy Males

Age	Actual Deaths*	Total Exposures*	Actual Rate	Assumed Rate		Expected Deaths*		Actual / Expected	
				Current	Proposed	Current	Proposed	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
50-54	$ 74	$ 22,939	0.32%	0.23%	0.23%	$ 59	$ 60	124.0%	123.3%
55-59	288	59,904	0.48%	0.40%	0.40%	259	254	111.5%	113.5%
60-64	701	96,091	0.73%	0.69%	0.69%	761	703	92.2%	99.7%
65-69	1,551	123,729	1.25%	1.19%	1.19%	1,671	1,528	92.8%	101.5%
70-74	1,910	94,867	2.01%	2.04%	2.04%	2,020	1,978	94.5%	96.6%
75-79	2,159	61,403	3.52%	3.52%	3.52%	2,227	2,221	96.9%	97.2%
80-84	2,832	42,533	6.66%	6.07%	6.07%	2,667	2,634	106.2%	107.5%
85-89	2,552	22,699	11.24%	10.47%	10.47%	2,334	2,397	109.3%	106.4%
90-94	1,739	9,022	19.28%	18.07%	18.07%	1,517	1,605	114.7%	108.4%
95-99	474	1,933	24.54%	31.22%	31.22%	520	578	91.2%	82.0%
100-104	75	172	43.26%	50.55%	50.55%	70	82	106.6%	91.2%
105-109	7	19	34.22%	50.34%	50.34%	9	10	76.6%	67.1%
Total	$ 14,360	$ 535,311				$ 14,113	$ 14,049	101.8%	102.2%

* $ in ten-thousands of benefit

Post-Retirement Mortality Experience

Non-LECO Healthy Females

| Age | Actual Deaths* | Total Exposures* | Actual Rate | Assumed Rate | | Expected Deaths* | | Actual / Expected | |
| | | | | Current | Proposed | Current | Proposed | Current (2) / (7) | Proposed (2) / (8) |
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
50-54	$ 41	$ 25,873	0.16%	0.16%	0.16%	$ 48	$ 46	87.0%	90.0%
55-59	283	83,280	0.34%	0.28%	0.28%	280	247	101.0%	114.6%
60-64	723	133,982	0.54%	0.49%	0.49%	826	690	87.6%	104.8%
65-69	987	128,840	0.77%	0.86%	0.86%	1,297	1,143	76.1%	86.3%
70-74	1,167	77,819	1.50%	1.53%	1.53%	1,275	1,203	91.5%	97.0%
75-79	1,103	41,608	2.65%	2.70%	2.70%	1,191	1,142	92.6%	96.6%
80-84	1,161	23,345	4.97%	4.78%	4.78%	1,180	1,137	98.4%	102.2%
85-89	1,195	13,537	8.83%	8.46%	8.46%	1,215	1,163	98.3%	102.7%
90-94	1,004	6,186	16.23%	14.99%	14.99%	931	919	107.8%	109.3%
95-99	382	1,460	26.17%	26.59%	26.59%	352	373	108.5%	102.5%
100-104	73	235	31.03%	47.26%	47.26%	89	103	82.3%	70.9%
105-109	3	6	50.11%	50.34%	50.34%	3	3	105.3%	98.2%
Total	$ 8,123	$ 536,170				$ 8,687	$ 8,169	93.5%	99.4%

* $ in ten-thousands of benefit