**LOUISIANA STATE EMPLOYEES'
RETIREMENT SYSTEM**

ACTUARIAL EXPERIENCE STUDY
July 1, 2013 – June 30, 2018

FOSTER & FOSTER
ACTUARIES AND CONSULTANTS

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January 23, 2019

Board of Trustees
Louisiana State Employee's Retirement System
Post Office Box 44213
Baton Rouge, Louisiana   70804-9123

Dear Board Members:

The following report presents the results of our experience study of the actuarial assumptions of the Louisiana State Employee's Retirement System (LASERS) for the period July 1, 2013 through June 30, 2018. The report includes a review of demographic and economic experience, a comparison of this experience to current actuarial assumptions, our recommendations regarding changes in assumptions or methods to be effective for the June 30, 2019 actuarial valuation, and the estimated actuarial impact of these recommended changes, determined as the impact the changes would have had on the June 30, 2018 valuation.

In preparing this report, we compiled experience for the Plans using data furnished by the retirement system. While we have not audited the information provided, the supplied information was reviewed for consistency and reasonableness. We have no reason to doubt the substantial accuracy of the information and believe it has produced appropriate results.

Future actuarial measurements may differ significantly from current measurements due to such factors as: plan experience differing from that anticipated by the assumptions; changes in assumptions; changes in plan provisions or applicable law. Due to the limited scope of the assignment, we did not perform an analysis of the potential range of such future measurements.

The study was prepared in accordance with the applicable Actuarial Standards of Practice issued by the Actuarial Standards Board. Shelley is an Associate in the Society of Actuaries and Pat is a Fellow in the Society of Actuaries. Shelley and Pat are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

We would like to thank the executive director and staff for their assistance with this report. We look forward to presenting the conclusions and recommendations contained in this report to LASERS and are available to answer any questions concerning its contents.

Respectfully submitted,

FOSTER & FOSTER INC.

Shelley R. Johnson, ASA, MAAA   D. Patrick McDonald, FSA, EA, MAAA, FCA

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INTRODUCTION

The purpose of this study is to review the current economic and demographic assumptions used in the actuarial valuations of the System's Plans to determine which changes, if any, are necessary in order to achieve the objective of developing costs that are stable, predictable, and represent our best estimate of anticipated future experience.

The ultimate cost of any defined benefit pension plan is the sum of the benefits paid from the plan and the administrative expenses incurred, less any net investment gains received. Therefore, the actual cost of a plan will only be known after all benefits accrued by the members are paid to the members or their beneficiaries. Since members who retire, become disabled, terminate or die are continuously replaced by new employees, the exact cost to the System cannot be determined at any one point in time. To assure that adequate assets will accumulate to meet current and future benefit obligations, the actuary must make certain demographic and economic assumptions about future contingent events in order to determine the funding requirements necessary to meet the actual cost. Economic assumptions include salary growth and investment growth, both of which include inflation as a component. The demographic assumptions include rates of retirement, withdrawal, disability, and mortality.

Although the ultimate cost is independent of the actuarial assumptions used to determine funding requirements, the assumptions should reflect the actuary's best estimate of future plan experience. If the assumptions are inappropriate or do not reflect the long-term plan experience, the plan will incur experience gains (over-funding) or experience losses (under-funding) which will exceed or fall short of the actual long-term plan cost. If the contributions determined based upon these assumptions are paid as required, and if the assumptions are in accordance with the actual experience of the plan, then sufficient assets will accumulate to pay the actual cost.

LASERS typically conducts an experience study every five years. The current observation period (July 1, 2013 - June 30, 2018) includes the most recent experience available. The experience study reviews the economic and demographic assumptions currently being used for valuing the following system Plans. "Plan" or "Plans" for purposes of this study is a subgroup within the System characterized by the following employee classifications:

- Rank and File Employees
- Judges
- Hazardous Duty Plans

Note the Rank and File experience includes appellate law clerks for all but the retirement assumption analysis, where Appellate Law Clerk experience is included with Judges experience. Wildlife Plan experience for the termination assumption is evaluated separately from the other Hazardous Duty plans since terminations for this group of members continues to be substantially less than for other Hazardous Duty Plans.

This report presents details of the experience analysis by Plan, the proposed assumptions, and the expected impact of the proposed changes on funding requirements. The following assumptions were included as part of this study:

- Inflation, Investment Return and Discount Rate
- Salary and Real Wage Growth Rates
- Retirement Rates
- Withdrawal/Termination Rates
- Mortality Rates
- Disability Incidence Rates
- Other Assumptions

Please keep in mind that while the recommended assumption set represents our best estimate, other reasonable assumption sets could be supported. Even seemingly minor changes in the assumptions can materially change the liabilities, calculated contribution rates and funding periods.

ACTUARIAL STANDARDS OF PRACTICE

The Actuarial Standards Board has provided coordinated guidance through of a series of Actuarial Standards of Practice (ASOP) for measuring pension obligations and determining pension plan costs or contributions. The ASOPs that apply specifically to valuing pensions are as follows:

> ➤ ASOP No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*, which ties together the standards shown below, provides guidance on actuarial cost methods, and addresses overall considerations for measuring pension obligations and determining plan costs or contributions

> ➤ ASOP No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*

> ➤ ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*

The contents of this report are in compliance and consistent with the Actuarial Standards of Practice mentioned above. When applicable, further details of the ASOP associated with the reviewed actuarial assumption will be provided in the discussion of the Economic Assumptions and Demographic Assumptions sections of this report.

EXPERIENCE REVIEW SUMMARY

Below is a summary of our key findings and proposed changes. The remainder of the document outlines our analysis and documents our recommendations.

ECONOMIC ASSUMPTIONS

- **Inflation:** We recommend reducing the current 2.75% inflation assumption to 2.50%.

- **Investment Return and Discount Rate:** The Board has adopted a plan to reduce the discount rate in 0.05% increments from 7.75% to 7.50%. A 7.65% discount rate was utilized in the most recent valuation. We recommend at a minimum that the Board continue this plan. Based on the Board's target asset allocation and 2018 capital market assumptions provided by NEPC, LASERS' Investment Consultant, and LASERS Investment staff, which manages private equity investments, the target portfolio produces an expected return of 7.97%, when based on our recommended 2.50% inflation assumption. When modeling the LASERS 2018 target portfolio allocation using capital market assumptions provided in the Horizon Actuarial Services Survey, 2018 edition, which provides the average capital market assumptions of thirteen investment advisors, and utilizes a 2.44% inflation assumption, the 20-year expected return is 8.41%.

  Following the guidance provided in ASOPS 4 and 27, we recognize the gain-sharing provisions by using a discount rate that is net of expected investment returns to be allocated to the experience account to potentially fund future benefit increases. This margin was recently determined to be 40 basis points using a stochastic analysis. Subtracting 40 basis points for gain sharing from the NEPC/Investment Staff expected return and from the 2018 Horizon Actuarial Services expected return for LASERS portfolio results in discount rates of 7.57%, and 8.01%, respectively. We believe the Board's plan to continue to reduce the discount rate incrementally from the current 7.65% to 7.50% results in reasonable assumptions relative to current market expectations.

- **Salary Increases:** We recommend reducing the salary increase assumptions for Rank and File, Judges, and Hazardous Duty Plans. The experience analysis shows that salary increases during the current and prior study period are significantly less than anticipated by the current assumptions. This is partially attributable to employer budgetary constraints and may not be representative of long-term expected salary increases. However, the State Civil Service Department recently implemented a new compensation plan which will likely reduce salary increases for those whose salary is above the midpoint of their position's salary range. For Rank and File and the Hazardous Duty Plans, we recommend moderate reductions to the salary assumptions but, as a conservative measure, not to the level of recent experience. The reductions in the total salary increase assumptions are 0.25% greater than the reduction in the real wage increase because it includes the recommended reduction in the inflation assumption. We recommend no changes in the Judges total salary increase assumptions, which correspond to an increase in the real wage component since the inflation component is decreasing.

DEMOGRAPHIC ASSUMPTIONS

- **Mortality Rates:** We analyzed mortality experience separately for general and public safety employees and for active and inactive members. Based on this analysis, we recommend the following mortality tables:

- o   Active General Employees, Males – RP-2014 Blue Collar Employee Table * 0.978
- o   Active General Employees, Females – RP 2014 Blue Collar Employee Table * 1.144
- o   Active Public Safety, Males – RP-2014 Blue Collar Employee Table * 1.005
- o   Active Public Safety, Females – RP-2014 Blue Collar Employee Table * 1.129
- o   Inactive General Employees, Males – RP-2014 Blue Collar Healthy Annuitant Table * 1.280
- o   Inactive General Employees, Females – RP-2014 White Collar Healthy Annuitant table * 1.417
- o   Inactive Public Safely Employees, Males – RP-2014 Blue Collar Healthy Annuitant Table * 1.185
- o   Inactive Public Safely Employees, Females – RP-2014 Blue Collar Healthy Annuitant * 1.017
- o   Disability Retirees, Males – RP-2000 Disability Retiree Table * 1.009
- o   Disability Retirees, Females – RP-2000 Disability Retiree Table * 1.043

We recommend projecting future mortality improvement for all of the above tables, except for the disability tables, using the MP-2018 Mortality Improvement Scale, applied on a fully generational basis. We recommend using no mortality improvement for disability retirees.

- **Retirement Rates**: We recommend retaining the current structure of age-based tables for Rank and File and we recommend changing the structure for Judges and Hazardous Duty Plans to coincide better with the retirement eligibility requirements for these plans. We recommend changes to the retirement rates to better reflect experience since 2013.

- **Disability Rates**: We recommend updating the disability rates to reflect experience since 2013.

- **Withdrawal/Termination Rates**: We recommend changes to the age/service categories for Rank and File and the Hazardous Duty Plans, except for Wildlife, which is analyzed separately for this assumption. We recommend changes to the withdrawal rate assumptions for all plans to better reflect withdrawal experience since 2013.

- **Other Assumptions:** We recommend revising the percentages used to determine unisex mortality tables used for service purchase, service transfers, and option factor calculations from 50% male/50% female to 40% male/60% female based on the distribution of current membership. Based on experience during the study period, we recommend increasing the current assumed benefit increase resulting from converted sick and annual leave.

EXPECTED ACTUARIAL COST IMPACT

Adoption of the proposed assumption changes will alter future funding requirements. The total change in liability and funding requirements if they had been applied for the June 30, 2018 actuarial valuation would have been an overall <u>reduction</u> in aggregate funding requirements of 0.71% of payroll. If adopted, the new assumptions will be used in the June 30, 2019 actuarial valuation and will be reflected in employer rates beginning July 1, 2020.

The changes for each assumption change and in aggregate are summarized as follows:

Valuation Impact		
	Change in Accrued Liability	Change in Normal Cost
Salary growth rates	(125,339,521)	(15,348,167)
Retirement rates	(132,470,121)	(4,902,886)
Termination rates	63,677,464	(3,109,839)
Disability rates	(1,808,509)	3,608
Mortality rates	(24,050,670)	1,081,496
Other Assumptions	173,314,542	16,756,158
TOTAL	(46,676,815)	(5,519,630)
Aggregate Valuation Change *	(65,119,333)	(7,859,797)
Aggregate Amortization Payments	(5,392,011)	
Aggregate Projected Payroll	1,870,871,587	
Payroll Percentage	-0.29%	-0.42%
Aggregate Contribution Rate Change	-0.71%	

Estimated Employer Rate Impact			
	UAL Payment Change (%)	Normal Cost Change (%)	Total Change (%)
Rank and File	-0.29%	-0.81%	-1.09%
Judges (aggregate)	-0.29%	0.90%	+0.61%
Hazardous Duty Plans (aggregate)	-0.29%	+2.26%	+1.97%
Aggregate Employer Impact	-0.29%	-0.42%	-0.71%

*   The Aggregate Valuation Change does not equal the sum of the individual changes because the decrements do not operate in isolation of each other. Changes to one decrement will alter the effects of changes to another decrement.

ECONOMIC ASSUMPTIONS

OVERVIEW

ASOP No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations,* provides guidance to actuaries in selecting (including giving advice on selecting) economic assumptions – primarily inflation, investment return, discount rate, and salary scale – for measuring defined benefit pension plan obligations.

Throughout the remainder of this section, we have used the standards set forth in ASOP No. 27 as a guideline for reviewing and if applicable, selecting proposed changes to the following economic actuarial assumption:

- Inflation
- Investment Return and Discount Rate
- Salary Increases

Please keep in mind that ASOP No. 27 states that "the best an actuary can do is to use professional judgment to estimate possible future economic outcomes based on past experience and future expectations, and to select assumptions based upon that application of professional judgment."

INFLATION

Inflation refers to general economic inflation, defined as price changes over the whole of the economy. The assumed inflation rate is the basis for the other economic assumptions, such as assumed investment returns, the discount rate, and salary increase assumptions.

In order to assess the reasonableness of the inflation assumption, we review historical inflation, applicable inflation forecasts to the extent available, inflation assumptions used by the system's investment consultant and other investment consultants, and assumptions currently used by similar plans.

Following ASOP No. 27, which provides guidance on the selection of economic assumptions, such as inflation, our determination of an appropriate inflation assumption includes a review of recent and long-term historical inflation, without giving undue weight to recent experience. We note that, long-term historical experience, beyond 35 or so years, is less meaningful given that the Federal Reserve Board's monetary policy changed in the 1980's toward more vigilance in preventing high inflation.

Historical Inflation

Inflation has been relatively low over the past 20 years, particularly over the last five years. The table below shows the average historical change in the annual CPI-U, over various periods.

Periods Ending Dec. 2018	Average Annual Increase in CPI-U
Last 5 years	1.5%
Last 10 years	1.8%
Last 20 years	2.2%
Last 30 years	2.5%
Last 40 years	3.3%

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

The current assumption of 2.75% appears to be high based on recent increases and the average increase over the last 20-30 years.

<u>Yields on Government Securities of Various Maturities</u>

The spread between the nominal yield on treasury securities and the inflation indexed nominal yield on inflation protected treasury bills (TIPS) of the same maturity is referred to as the "breakeven rate of inflation" and represents the bond market's expectation of inflation over the period to maturity. Current estimate reported at Bloomberg.com on January 9, 2019 are as follows:

Years to Maturity	Bond Nominal Yield	TIPS Nominal Yield	Breakeven Rate of Inflation
10 Years	3.13%	0.75%	2.38%
30 Years	3.38%	1.00%	2.38%

The current assumption is about 35-40 points higher than the above market data.

<u>Forecasts of Inflation</u>

The Federal Reserve Bank of Philadelphia conducts a quarterly survey of the Society of Professional Forecasters and publishes a mid-term expectation. Their most recent forecast (fourth quarter of 2018) predicts average inflation over the next ten years (2018-2027) will be 2.21%. The Philadelphia Fed's Livingston Survey summarizes the forecasts of economists from industry, government, banking, and academia. The December 2018 report shows an average 10-year inflation expectation of 2.23%. The report does not provide a forecast beyond 10 years.

The Social Security Administration's 2018 Trustees Report includes the Office of the Chief Actuary's projection of ultimate long-term (75 year) average annual inflation. The intermediate cost assumption is 2.60%. The report provides a low-to-high range of 2.00% to 3.20%.

<u>Forecasts from Investment Consulting Firms</u>

NEPC, LASERS' investment consultant currently uses a long-term inflation assumption of 2.75% for US inflation and 3.25% for global inflation. Horizon Actuarial Services, LLC, compiles and summarizes expected returns and volatility by asset class for 34 different investment advisors. The results of the survey are provided in a report titled <u>Survey of Capital Market Assumptions: 2018 Edition</u>. The report defines the short-term horizon as 10 years and the long-term horizon as 20-years. All advisors provided short-term assumptions, while 13 provided both short-term and long-term assumptions. The average short-term (10-year) inflation assumption for all advisors is 2.24%, with a range of 2.0% to 2.8%. Of the 13 advisors providing both short-term and long-term assumptions, the short-term inflation assumption is 2.41% long-term inflation assumption is 2.47%, with a range from 2.2% to 2.8%.

<u>Recommendation</u>

The Federal Reserve forecaster survey responses would appear to support an inflation assumption near 2.25%. However, these are 10-year forecasts and longer-term forecasts (25-30 years) would likely result in higher expected future inflation. This is supported by the much higher inflation assumption used by the Social Security administration in their intermediate cost projection. The system's investment consultant's long-term expected inflation supports the current assumption of 2.75%. The average long-term inflation assumption of 13 advisors as reported in the 2018 Horizon Actuarial Services survey is 2.47%. Based on these determinations, we recommend reducing the long-term inflation assumption from 2.75% to 2.50%.

INVESTMENT RETURN & DISCOUNT RATE

The investment return and discount rate are among the most significant assumptions in the annual actuarial valuation process. Minor changes in the discount rate can have a major impact on valuation results. Investment earnings are used to fund plan benefits and a portion of investment experience gains are allocated to the experience account to fund future permanent benefit increases. The discount rate is used to discount the expected benefit payments for all active, inactive, and retired members of the System. Therefore, the discount rate is representative of expected investment earnings less earnings expected to be allocated to the experience account.

Investment and Administrative Expenses

Investment return assumptions are typically net of investment expenses. The capital market assumptions developed by investment consulting firms used to develop our recommendations are net of investment expenses, therefore no further adjustments for these expenses are necessary.

Prior to July 1, 2018, administrative expenses were precluded from being directly funded as a percentage of payroll, therefore the investment return assumption was reduced by 0.10%, in order to offset these expenses. The triggers provided by Act 94 of 2016 were met in the June 30, 2017 actuarial valuation, therefore, this adjustment is no longer necessary. Since investment returns are no longer assumed to cover administrative expenses, this change in method for recognizing administrative expenses will lessen the burden on the investment portfolio.

Gain-sharing

Actuarial Standard of Practice (ASOP) No. 27, paragraph 3.5.1 states that "the actuary may determine that it is appropriate to adjust the economic assumptions to provide for considerations such as … plan provisions that are difficult to measure." ASOP No. 4, Measuring Pension Obligations and Determining Pension Plan Costs or Contributions includes gain-sharing in its description of "provisions that are difficult to measure." Therefore, the ASOPs support the method of adjusting the investment return assumption to adjust for returns expected to be used for gain-sharing rather than used to fund regular plan benefits.

In order to determine an appropriate adjustment for gain-sharing, we use a forward-looking model based upon one-hundred 30-year projections of annual market returns (provided by NEPC). These projections were developed based upon LASERS' current target portfolio allocation, and NEPC's 2016 capital market assumptions. We then projected the actuarial (smoothed) returns and the resulting the annual investment gains and losses in each scenario and the assets to be allocated to the experience account, according to current statutory provisions. The model accounts for LASERS' projected increasing funded ratio over the 30-year period, and subsequent increasing permanent benefit increases (PBIs) and experience account caps (the cap increases as the funded ratio of the plan increases). In addition, the model recognizes the statutory indexed "threshold allocation", which requires a higher dollar amount of investment experience gains to be achieved, in proportion to increases in the actuarial value of assets, before any funds are allocated to the experience account. We assume that the full PBI will always be granted, when funds are sufficient to grant a full PBI and when the other requirements of current law are satisfied.

The 30-year projection showed that a mean 39 basis points of investment earnings is expected to be allocated to the experience account. Eliminating the five highest and five lowest results resulted in a minimum of 15 and a maximum of 66 basis points allocated to the experience account.
Note the provisions described above for funding the experience account are prescribed in statue, but the availability of funds is only one of many requirements that must be met before a PBI can be granted. Once sufficient funds are available to fund a full PBI, the Board may request the PBI, a bill must be filed and approved by two-thirds of both the House and Senate. Even with this approval, the governor may veto the

bill. The PBI provisions have been modified by the legislature several times in recent years to allocate less earnings to the experience account, to reduce the amount of PBI allowed, and to strengthen the legislature's ability to not approve the increase. Also, the legislature has previously required that some of the money credited to the experience account be redirected to pay down the system's UAL rather than fund a PBI. Given these reasons, we believe that our model's assumption that the PBI will always be granted when funds are available is a conservative assumption.

We believe the current assumption is reasonable and recommend retaining this assumption.

Asset Allocation

The actual asset allocation of the trust significantly impacts the overall performance. LASERS investment consultant, NEPC, completed an asset allocation study in 2018. The Board adopted the following target asset allocation:

Asset Class	Target Asset Allocation
Large Cap U.S. Equity	13.00%
Small/Mid Cap U.S. Equity	10.00%
International Equity (Developed)	20.00%
Emerging Markets Equity	12.00%
Core U.S. Fixed Income	3.00%
Domestic High Yield Bonds	3.00%
Global Multi-Sector Fixed Income	7.00%
Emerging Market Debt	3.00%
Private Equity	15.00%
Absolute Returns	7.00%
Risk Parity	7.00%
	100.00%

Historical Returns

ASOP No. 27 states that the actuary should evaluate relevant data, such as recent and long-term historical economic data, without giving undue weight to recent experience. Historical experience is not a reliable indicator of future experience. Future performance by asset class may vary significantly from historical performance and the current (and target) asset allocation of the trust, which significantly impacts future performance, is likely different than prior allocations. LASERS' historical annualized returns determined based on the market value of assets and the actuarial value of assets are shown in the chart below. Note these returns are net of investment expenses, but not net of administrative expenses or allocations to the experience account, so are comparable to the expected investment return before adjusting for these other expenses.

		Market	Actuarial
5 Year	7/2014 – 6/2018	7.87%	8.90%
10 Year	7/2009 – 6/2018	6.58%	6.22%
15 Year	7/2004 – 6/2018	7.85%	7.68%
20 Year	7/1999 – 6/2018	6.37%	6.63%
30 Year	7/1989 – 6/2018	7.78%*	7.95%

*29 year market value return (30 year was not available)

LASERS' Investment Consultant's Expected Return

We generally look to the system's investment consultant as the starting point in determining our recommended long-term expected return assumption. We compare the investment consultant's capital market assumptions by asset class to those utilized by other investment advisors. NEPC and LASERS investment staff utilize a private equity return assumption of 13%. This compares to LASERS' historical 15- and 25-year returns for this asset category of 11.95% and 13.92%, respectively. Using LASERS' target portfolio allocation, NEPC's 30-year capital market assumptions for all but private equity and our recommended 2.50% inflation assumption, the long-term (30-year) expected return of the portfolio is 7.97%, with a resulting discount rate of 7.57% after deducting 40 basis points for gain-sharing.

Other Investment Consultants

We utilized the Horizon Actuarial Services, LLC, 2018 survey of other consulting firms (which includes NEPC) to assess how NEPC's return expectations compare to other consulting firms. The 2018 survey is based upon the capital market assumptions of 34 investment advisors participating in the survey. Of the participating advisors, 21 provided one set of assumptions for varying terms of 10 to 15 years. The remaining 13 advisors provided assumptions over both shorter-term (five to 10 years) and longer-term (20 years or more) horizons. The survey refers to the longer term returns as 20-year assumptions and states that the longer-term horizon is more appropriate for mature ongoing pension plans without solvency issues.

We mapped LASERS' target portfolio allocation to the average 20-year survey assumptions. Using the survey's average expected returns for all asset categories, and the associated standard deviation and covariance matrix, including the survey's average 20-year inflation assumption of 2.44%, the resulting expected long-term nominal return is 8.41%. Using our recommended inflation assumption of 2.50%, the resulting expected long-term nominal return is 8.47%. The returns in the survey are generally considered to be indexed and net of fees, so are comparable to the assumptions used to determine the expected return of 7.97% described above. Therefore, the 7.97% expected return assumption is less than assumptions used by other investment advisors for LASERS' specific portfolio allocation.

Recommended Discount Rate for Funding

The Board is currently following a plan to reduce the discount rate in 0.05% increments to 7.50%. Based on this plan, the discount rate used in the June 30, 2019 valuation would be 7.60% and the discount rate used for determining the projected contribution rate for fiscal year ending June 30, 2021 would be 7.55%. This plan was discussed at length in the June 2016 PRSAC committee meeting and was ultimately unanimously adopted by the committee. Therefore, our focus has been on the reasonableness of the current discount rate of 7.60% and the goal of 7.50% by June 30, 2021. These discount rates correspond to assumed rates of return of 8.00% for the June 30, 2019 valuation and 7.90% by June 30, 2021. Based on the above analysis, we believe the Board's assumptions are reasonable. Note, a more conservative long-term assumption could also be considered reasonable. We will continue to review capital market assumptions annually and continue discussions with the Board.

Recommended Discount Rate for GASB Reporting

GASB statements 67 and 68 generally require the discount rate to be determined based on the long-term expected rate of return. In discussions with LASERS' executive and investment staff, and external auditor, it was agreed that it was preferable to use the same discount rate for funding and GASB reporting, as long as the assumptions used are reasonable for each purpose, despite the inherent differences in the total return expectation of each. There is no reason to require that each be based on a single overall long-term expected rate of return. The LASERS Board agreed and has maintained the same discount rate for funding and GASB reporting.

ASOP 27 regarding the Selection of Economic Assumptions for Measuring Pension Obligations specifically addresses this in paragraph 3.6.2. which addresses the "Range of Reasonable Assumptions". The paragraph states "The actuary should recognize the uncertain nature of the items for which assumptions are selected and, as a result, may consider several different assumptions reasonable for a given measurement. The actuary should also recognize that different actuaries will apply different professional judgment and may choose different reasonable assumptions. As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice."

We continue to believe this is a reasonable approach. Given that staff and external auditors are comfortable with this approach, and actuarial standards of practice specifically allow it, we recommend continued use of the same discount rate as that used for funding purposes to be used for GASB reporting purposes. Specifically, we believe that a 7.65% discount rate with the goal of reducing the discount rate to 7.50% by June 30, 2021 to be reasonable for GASB reporting purposes. This is more conservative than the funding assumptions, but still reasonable in our opinion.

SALARY AND REAL WAGE GROWTH

The salary increase assumption is used to project a member's annual salary each year from the valuation date through the assumed retirement age. This assumption plays an important role in measuring individual pension costs and obligations. The sum of inflation and the real wage growth components comprise the recommended salary increase assumption. The real rate of wage increase includes increases due to promotion and longevity, often called merit increases, which are generally service related.

We previously addressed the inflation assumption, which we recommend reducing to 2.50%. We address the real wage growth assumption below.

Experience and Recommended Assumptions

To assess the current assumed annual increases and provide a basis for updated assumptions, we reviewed the actual salary experience over the study period. Not surprisingly, we found that salary increases during the study period were lower than current assumptions would have predicted. This is at least partially due to budget restrictions experienced by state agencies in recent years. It is important to keep in mind that salary increase assumptions are used to project a member's salary from the valuation date until the assumed retirement age. For newly hired members, this projection could be for 40 or more years. Therefore, the recent past should not be considered in isolation. In addition to recent experience, we reviewed the experience from the two prior experience studies and long-term wage growth assumptions utilized by the social security administration.

The State Civil Service Department recently implemented a new compensation plan. The employee's salary adjustment will be based on the relationship of the current salary to the midpoint of the pay range for that job. Previously, all employees were eligible for a 4% pay increase. With the new structure, members at the midpoint of the salary range will be limited to a 3% increase and members above the midpoint will be limited to a 2% increase.

In the pages at the end of this section, we have included service-based tables and graphs for each LASERS employer category that compares the actual experience to the current assumptions. The rates illustrated are unisex and represent the actual, expected, and proposed salary increase for a given duration of service. Historically, members received higher average salary increases toward the beginning of their careers and lower average salary increases later in their careers. Salary increase assumptions are typically represented as a flat salary scale assumption or as a service-based assumption. A flat salary scale assumption assumes that a member will get the same rate of salary increase for all years, whereas a service-based table assumes different rates based on the member's longevity with the Plan. LASERS' experience continues to support the use of a service-based table for all employer categories.

Rank and File – Current salary assumptions decrease from 12.75% in the first year of service to 3.75% by 21 years and all remaining years of service. Actual salary increases were less than expected for all durations of service except the first year. As shown in the following pages, the expected aggregate salary increase was 5.65% but actual salaries increased in aggregate by 4.66%. With an average annual inflation of 1.54% over this period, the aggregate real wage increase was 3.12%, which compares to an assumed real wage increase of 2.90%. We propose a revised salary scale that varies by years of service from 13.0% to 3.2% and has an aggregate expected salary increase of 5.04%. This reduces overall salary increase expectations by 0.61% which includes the 0.25% reduction in the inflation assumptions and an additional 0.36% reduction in the real wage increase. This is lower than the current aggregate real increased experienced in prior years to account for the compensation program recently implemented by civil service, which is expected to result in lower future increases in aggregate that was provided by the prior structure.

<u>Judges</u> – Current salary assumptions decrease from 5.25% in the first year of service to 2.75% for all remaining years of service. The aggregate actual salary increase over the experience period was 2.68%, which compares to an expected aggregate salary increase of 3.06%. We propose maintaining the current assumptions. Since the recommended inflation assumptions is decreasing by 0.25%, this corresponds to an increase in the real wage increase component of 0.25%.

<u>Corrections/Hazardous Duty</u> – Current salary assumptions decrease from 14.25% in the first year of service to 3.35% by 30 years and all future years of service. In total, actual salary increases were less than expected for almost all durations of service. The actual average aggregate increase was 5.27%, which compares to an expected average annual increase of 6.94%. With an average annual inflation of 1.54% over this period, the aggregate real wage increase was 3.73%. We propose a reduced salary assumption scale that varies by years of service from 14.0% to 3.75% and has an aggregate expected salary increase of 6.05%. This reduces overall salary increase expectations by 0.89% which includes the 0.25% reduction in the inflation assumptions and an additional 0.64% reduction in the real wage increase.

Actual Aggregate Salary Increase Experience							
	Actual Inflation	Rank and File		Judges		Corr/Haz	
		Real	Total	Real	Total	Real	Total
2005-2008	4.00%	2.41%	6.41%	-0.49%	3.51%	3.76%	7.76%
2008-2013	1.31%	3.40%	4.71%	1.96%	3.27%	2.04%	3.35%
2013-2018	1.54%	3.12%	4.66%	1.14%	2.68%	3.73%	5.27%

Salary Increase Assumptions – Current and Proposed							
	Assumed Inflation	Rank and File		Judges		Corr/Haz	
		Real	Total	Real	Total	Real	Total
Current Aggregate Assumed Annual Increase	2.75%	2.90%	5.65%	0.31%	3.06%	4.19%	6.94%
Proposed Aggregate Assumed Annual Increase	2.50%	2.54%	5.04%	0.54%	3.04%	3.55%	6.05%

<u>Social Security Administration</u>

The Social Security Administration's (SSA) 2018 Trustees Report includes the Office of the Chief Actuary's projection of real wage inflation, which are used in their 75-year projections. These assumptions are based on data derived predominantly from the private sector so should not be considered in isolation. However, given the volatility of LASERS actual salary increase experience in recent years relative to historical increases, this provides a basis to help determine the reasonableness of the recommended long-term real increases shown above.

The annual increase in the National Average Wage Index under the intermediate cost assumption (best estimate) was 3.8%, with a range from 2.58% to 5.02%. After netting the SSA's inflation assumption of 2.60%, the SSA's best estimate of the current long-term real wage inflation is 1.20%, with a range of 0.58% to 1.82% per year. Our recommended real wage increase of 2.54% for Rank and File, 0.54% for Judges, and 3.55% for Corrections/Hazardous Duty appears high but is heavily weighted by the increase in the first year of service. After the first year, the aggregate real wage increase is 1.64%, 0.25%, and 2.33%, for Rank and File, Judges and Corrections/Hazardous Duty, respectively, which are more comparable to the to the SSA real wage growth range.

Impact on Valuation Results

The table below shows the impact of the proposed changes to the accrued liability and normal cost by Plan. Note the change in accrued liability and normal cost are determined based on the recent June 30, 2018 actuarial valuation updated to reflect a 7.65% interest rate, retaining prior decrements for all other assumptions.

	Change in Accrued Liability	Change in Normal Cost
Rank and File	(91,721,785)	(12,969,788)
Judges	-	-
Hazardous Duty Plans	(33,617,736)	(2,378,379)
TOTAL	(125,339,521)	(15,348,167)

The proposed salary increase rates for each Plan by duration of service are provided on the following tables. Following the tables are graphs which provide a visual representation of the actual and proposed salary increase rates compared to the current assumptions.

Rank and File - Salary Increase Experience						
Service	Eligible Members	Prior Year Salaries	Actual Salaries	Expected Salaries	Actual Increase	Expected Increase	Proposed Increase
< 1	21,075	665,456	753,133	750,381	13.18%	12.76%	13.00%
1	7,914	291,297	310,167	313,874	6.48%	7.75%	7.10%
2	6,339	248,709	262,798	265,493	5.66%	6.75%	6.35%
3	5,675	233,563	245,862	248,162	5.27%	6.25%	5.60%
4	5,844	246,609	258,754	260,791	4.92%	5.75%	5.35%
5	6,344	267,884	280,413	282,621	4.68%	5.50%	5.10%
6	6,268	269,192	280,502	283,463	4.20%	5.30%	4.80%
7	6,535	287,308	297,688	302,108	3.61%	5.15%	4.50%
8	6,146	273,905	284,256	287,742	3.78%	5.05%	4.20%
9	5,714	261,476	270,819	274,427	3.57%	4.95%	4.10%
10	5,216	242,208	250,932	253,961	3.60%	4.85%	3.80%
11	5,114	242,145	250,704	253,653	3.53%	4.75%	3.80%
12	4,891	233,698	241,918	244,572	3.52%	4.65%	3.80%
13	4,864	235,417	242,727	246,133	3.11%	4.55%	3.50%
14	4,734	232,483	240,094	242,832	3.27%	4.45%	3.40%
15	4,427	220,486	227,322	230,079	3.10%	4.35%	3.40%
16	4,229	212,784	219,458	221,828	3.14%	4.25%	3.40%
17	4,115	211,705	218,114	220,492	3.03%	4.15%	3.40%
18	3,755	196,018	201,776	203,957	2.94%	4.05%	3.30%
19	3,405	181,509	186,524	188,679	2.76%	3.95%	3.20%
20	3,248	176,674	181,536	183,476	2.75%	3.85%	3.20%
21	3,248	180,585	185,892	187,357	2.94%	3.75%	3.20%
22	3,227	181,692	186,905	188,506	2.87%	3.75%	3.20%
23	2,470	146,277	150,312	151,762	2.76%	3.75%	3.20%
24	2,123	129,134	132,585	133,975	2.67%	3.75%	3.20%
25	1,858	114,866	117,567	119,173	2.35%	3.75%	3.20%
26	1,468	92,880	95,332	96,362	2.64%	3.75%	3.20%
27	1,283	80,373	82,675	83,387	2.86%	3.75%	3.20%
28	555	38,018	39,254	39,444	3.25%	3.75%	3.20%
29	404	28,687	29,505	29,763	2.85%	3.75%	3.20%
30+	1,860	130,757	133,885	135,661	2.39%	3.75%	3.20%
Total	144,348	6,553,795	6,859,409	6,924,114	4.66%	5.65%	5.04%
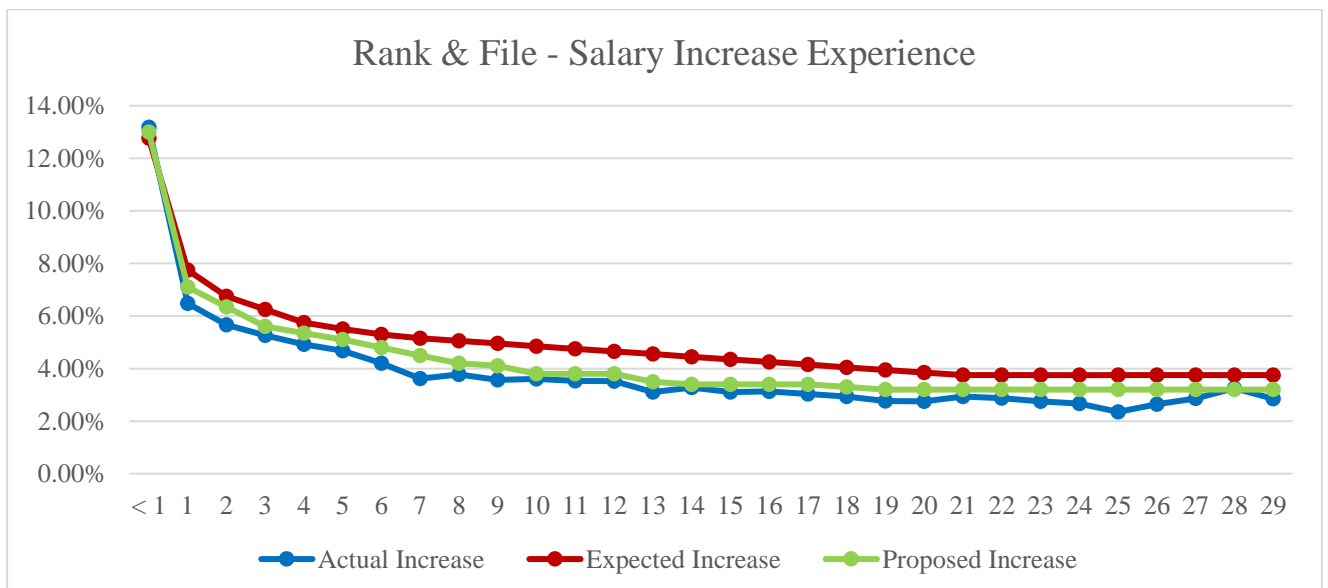
Rank & File - Salary Increase Experience

Judges - Salary Increase Experience							
Service	Eligible Members	Prior Year Salaries	Actual Salaries	Expected Salaries	Actual Increase	Expected Increase	Proposed Increase
< 1	173	23,467	24,732	24,700	5.39%	5.25%	5.25%
1	79	11,087	11,435	11,392	3.14%	2.75%	2.75%
2	37	4,933	5,066	5,069	2.70%	2.76%	2.75%
3	76	10,207	10,513	10,492	3.00%	2.79%	2.75%
4	66	8,891	9,054	9,139	1.83%	2.79%	2.75%
5	61	8,273	8,508	8,502	2.84%	2.77%	2.75%
6	54	7,445	7,632	7,653	2.51%	2.79%	2.75%
7	57	7,893	8,106	8,114	2.70%	2.80%	2.75%
8	29	3,862	3,967	3,969	2.72%	2.77%	2.75%
9	45	5,908	6,061	6,071	2.59%	2.76%	2.75%
10	45	6,003	6,124	6,170	2.02%	2.78%	2.75%
11	49	6,750	6,914	6,937	2.43%	2.77%	2.75%
12	53	7,172	7,336	7,372	2.29%	2.79%	2.75%
13	47	6,422	6,573	6,601	2.35%	2.79%	2.75%
14	43	5,842	6,023	6,004	3.10%	2.77%	2.75%
15	50	6,946	7,156	7,138	3.02%	2.76%	2.75%
16	54	7,541	7,723	7,750	2.41%	2.77%	2.75%
17	59	8,469	8,633	8,702	1.94%	2.75%	2.75%
18	52	7,595	7,740	7,804	1.91%	2.75%	2.75%
19	53	7,665	7,837	7,875	2.24%	2.74%	2.75%
20	50	7,336	7,328	7,537	-0.11%	2.74%	2.75%
21	51	7,291	7,403	7,491	1.54%	2.74%	2.75%
22	41	5,939	6,059	6,102	2.02%	2.74%	2.75%
23	37	5,297	5,394	5,443	1.83%	2.76%	2.75%
24	28	4,010	4,086	4,121	1.90%	2.77%	2.75%
25	21	3,045	3,111	3,129	2.17%	2.76%	2.75%
26	12	1,683	1,737	1,729	3.21%	2.73%	2.75%
27	11	1,548	1,599	1,590	3.29%	2.71%	2.75%
28	4	574	582	590	1.39%	2.79%	2.75%
29	2	283	291	291	2.83%	2.83%	2.75%
30+	12	1,705	1,748	1,752	2.52%	2.76%	2.75%
Total	1,451	201,082	206,471	207,229	2.68%	3.06%	3.04%

Judges - Salary Increase Experience

Corrections/Hazardous Duty - Salary Increase Experience							
Service	Eligible Members	Prior Year Salaries	Actual Salaries	Expected Salaries	Actual Increase	Expected Increase	Proposed Increase
< 1	3,754	111,997	127,646	127,916	13.97%	14.21%	14.00%
1	1,219	41,922	44,942	45,309	7.20%	8.08%	8.00%
2	917	32,597	34,078	34,789	4.54%	6.72%	6.50%
3	769	27,990	29,334	29,841	4.80%	6.61%	6.25%
4	743	27,390	28,717	29,065	4.84%	6.12%	6.00%
5	776	29,237	30,786	30,999	5.30%	6.03%	5.75%
6	771	29,944	31,731	31,736	5.97%	5.98%	5.75%
7	786	31,803	32,976	33,688	3.69%	5.93%	5.00%
8	734	30,766	32,004	32,569	4.02%	5.86%	5.00%
9	687	29,718	30,920	31,445	4.04%	5.81%	5.00%
10	646	28,776	29,911	30,441	3.94%	5.79%	5.00%
11	684	30,998	32,231	32,771	3.98%	5.72%	5.00%
12	721	33,761	35,168	35,672	4.17%	5.66%	5.00%
13	767	37,043	38,319	39,129	3.44%	5.63%	4.50%
14	796	39,689	40,949	41,901	3.17%	5.57%	4.00%
15	749	38,167	39,479	40,272	3.44%	5.52%	3.75%
16	695	36,510	37,696	38,510	3.25%	5.48%	3.75%
17	626	33,760	34,743	35,587	2.91%	5.41%	3.75%
18	487	26,913	27,681	28,353	2.85%	5.35%	3.75%
19	416	23,668	24,276	24,927	2.57%	5.32%	3.75%
20	377	22,156	22,854	23,327	3.15%	5.29%	3.75%
21	384	23,387	24,093	24,614	3.02%	5.25%	3.75%
22	404	25,184	25,902	26,506	2.85%	5.25%	3.75%
23	203	13,287	13,668	13,974	2.87%	5.17%	3.75%
24	145	9,763	10,064	10,263	3.08%	5.12%	3.75%
25	123	8,442	8,666	8,877	2.65%	5.15%	3.75%
26	86	5,790	6,023	6,091	4.02%	5.20%	3.75%
27	48	3,579	3,576	3,734	-0.08%	4.33%	3.75%
28	29	2,101	2,145	2,192	2.09%	4.33%	3.75%
29	19	1,435	1,476	1,496	2.86%	4.25%	3.75%
30+	42	3,354	3,431	3,467	2.30%	3.37%	3.75%
Total	19,603	841,127	885,485	899,461	5.27%	6.94%	6.05%

Corrections/Hazardous Duty - Salary Increase Experience
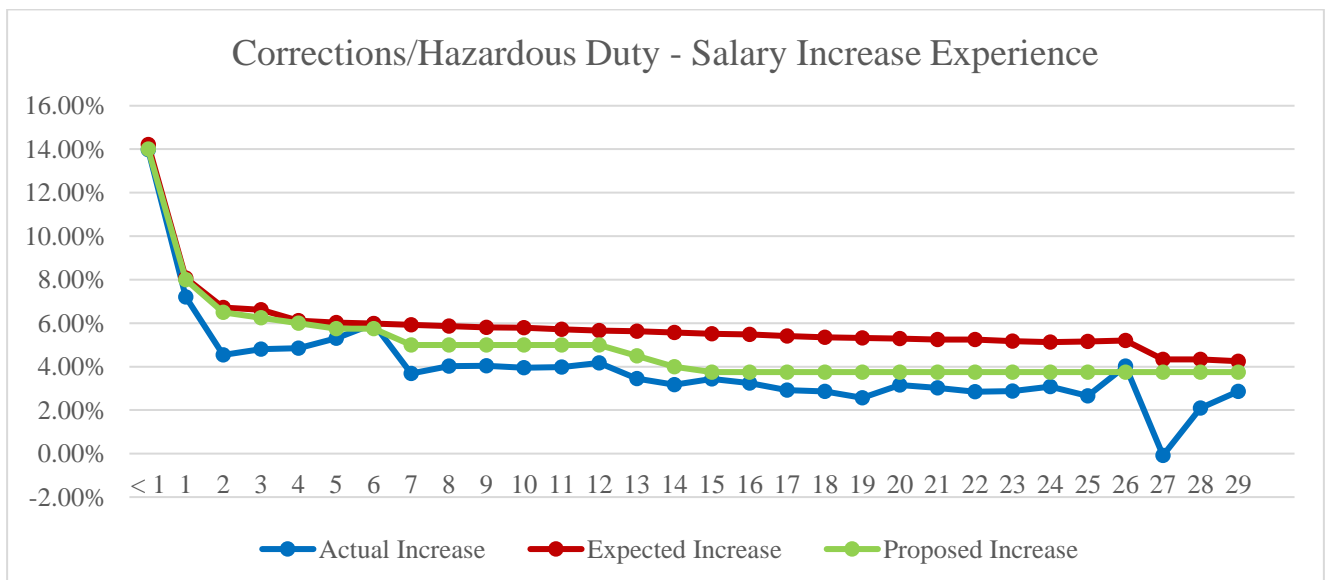
DEMOGRAPHIC ASSUMPTIONS

OVERVIEW

ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*, provides guidance to actuaries in selecting (including giving advice on selecting) demographic and other noneconomic assumptions for measuring obligations under defined benefit pension plans.

Over the following pages, the following demographic assumptions will be reviewed:

- Retirement Rates
- Withdrawal/Termination Rates
- Mortality Rates
- Disability Incidence Rates

Generally, demographic assumptions are based on actual plan experience with additional considerations for current trends. ASOP No. 35 states "the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment." ASOP No. 35 also states that "a reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses…the actuary should not give undue weight to past experience when selecting demographic assumptions."

Demographic assumptions generally remain consistent over time, absent significant changes in plan provisions or economic conditions. Therefore, the best true indicator of future experience is often past experience. For each assumption, the study compares actual experience for that time period to assumptions used in the valuations.

Note that actuarial assumptions reflect average experience over long periods of time. A change in actuarial assumptions generally results when experience over a period of years indicates a consistent pattern. Proposed changes to the demographic assumptions are made to better reflect actual plan experience over the studied time period. The proposed changes also meet the objective of developing costs that are stable, predictable, and represent our best estimate of anticipated future experience.

RETIREMENT RATES

Retirement rates represent the probability that a member will retire or enter DROP at a given age and/or service, if they have attained the eligibility requirements. Higher rates of retirement at earlier ages generally result in higher costs to the plan but may be offset by the impacts of actuarially equivalent early retirement reductions.

For all plans except Corrections Secondary, members are eligible for an actuarially reduced benefit with 20 years of service. The current normal retirement eligibility requirements are as follows:

Regular Members:
- Member hired prior to 7/1/2006
  - Age 55 and 25 years of service, or
  - Age 60 and 10 years of service, or
  - 30 years of service
- Member hired on or after 7/1/2006
  - Age 60 and 5 years of service

Judicial Members:
- Members hired prior to 1/1/2011
  - Age 65 and 10 years of service as a judge or court officer, or
  - Age 55 and 12 years of service as a judge or court officer, or
  - Any age and 18 years of service as a judge or court officer, or
  - Age 55 and 12 years of service as a judge or court officer, or
  - Age 50 and 20 years of service, with 12 years of service as a judge or court officer, or
  - Age 70 and any years of service as a judge or court officer
- Members hired on or after 1/1/2011
  - Age 60 and 5 years of service

Corrections/Hazardous Duty:
The majority of members in the various Hazardous Duty-type plans are in the Corrections Secondary Plan or the Hazardous Duty Plan
- Corrections Secondary
  - Age 60 and 10 years of service, or
  - 25 years of service
- Hazardous Duty
  - Age 55 and 12 years of service, or
  - 25 years of service

Experience and Proposed Assumptions

The charts and graphs at the end of this section illustrate the actual retirement experience over the last five years. The rates illustrated are unisex and represent the probability of retirement, given the member had met the eligibility requirements. If the member did not meet the eligibility requirements at a given age, the member's exposure was excluded for that age. Note, we combined the experience by service category for some age groups in order to maintain consistent assumptions across service categories where retirement patterns seemed likely to be consistent. This results in aggregate proposed rates that differ from the aggregate experience but results in overall more stable and reasonable assumptions.

Rank and File: Current assumptions are age-based tables with separate tables for less than 10 years of service, 10-19 years of service, 20-24 years of service, 25-29 years of service, and 30 or more years of service. We recommend retaining the current age/service structure. In general, retirement rates for members less than age 60 were greater than expected while retirement rates for members greater than age 60 were less than expected. We recommend changes to the retirement/DROP rates to more closely mirror recent experience.

Judges: Current assumptions are age-based tables with separate tables for less than 15 years of service, 15-19 years of service, and 20 or more years of service. We recommend revising the service categories to be less than 12 years of service, 12 to 17, and 18 or more years of service, to be more reflective of the retirement eligibility requirements for judges. In aggregate, retirement rates were greater than expected. Our recommended retirement rates were developed to be reflective of current experience in each proposed service category.

Corrections/Hazardous Duty: Current assumptions are age-based tables with separate tables for members with less than 25 years of service and greater than 25 years of service. We recommend revising the service categories to be less than 10 years of service and 10 or more years of service to be more reflective of the retirement eligibility requirements for the hazardous duty plans. In aggregate, retirement rates were less than expected. Generally, retirement rates were greater than expected for members less than age 50 and less than expected for members greater than age 50. Our recommended retirement rates were developed to closely mirror current experience.

Impact on Valuation Results

The table below shows the impact of the proposed changes to the accrued liability and normal cost by Plan. Note the change in accrued liability and normal cost are determined based on the recent June 30, 2018 actuarial valuation updated to reflect a 7.65% interest rate, retaining prior decrements for all other assumptions.

	Change in Accrued Liability	Change in Normal Cost
Rank and File	(124,261,993)	(4,891,223)
Judges	12,565,452	400,512
Hazardous Duty Plans	(20,773,580)	(412,175)
TOTAL	(132,470,121)	(4,902,886)

The actual, expected, and proposed retirement rates for each Plan by age and duration of service are provided on the following tables. Following the tables are graphs which provide a visual representation of the actual and proposed retirement rates compared to the current assumptions.

	Rank and File – Retirement Rates								
	<10 Years of Service			10-19 Years of Service			20-24 Years of Service		
Age	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate
38	N/A	0.0%	0.0%	6.8%	0.0%	5.0%	0.0%	2.0%	5.0%
39	N/A	0.0%	0.0%	1.8%	0.0%	5.0%	2.0%	2.0%	5.0%
40	N/A	0.0%	0.0%	2.5%	0.0%	5.0%	7.1%	2.0%	5.0%
41	N/A	0.0%	0.0%	4.3%	0.0%	5.0%	5.9%	2.0%	5.0%
42	N/A	0.0%	0.0%	1.5%	0.0%	5.0%	1.7%	2.0%	5.0%
43	N/A	0.0%	0.0%	6.3%	0.0%	5.0%	3.7%	2.0%	5.0%
44	N/A	0.0%	0.0%	6.3%	0.0%	5.0%	4.4%	2.0%	5.0%
45	N/A	0.0%	0.0%	2.9%	0.0%	5.0%	4.6%	2.0%	5.0%
46	N/A	0.0%	0.0%	4.1%	0.0%	5.0%	4.0%	2.0%	5.0%
47	N/A	0.0%	0.0%	6.9%	0.0%	5.0%	3.8%	2.0%	5.0%
48	N/A	0.0%	0.0%	3.9%	0.0%	8.0%	3.7%	2.0%	8.0%
49	N/A	0.0%	0.0%	5.5%	0.0%	8.0%	4.2%	2.0%	8.0%
50	N/A	0.0%	0.0%	3.9%	0.0%	10.0%	5.7%	3.0%	10.0%
51	N/A	0.0%	0.0%	4.3%	0.0%	10.0%	4.9%	3.0%	10.0%
52	N/A	0.0%	0.0%	5.7%	0.0%	10.0%	6.2%	3.0%	10.0%
53	N/A	0.0%	0.0%	6.0%	0.0%	10.0%	6.0%	3.0%	10.0%
54	N/A	0.0%	0.0%	6.6%	0.0%	25.0%	11.3%	6.0%	25.0%
55	N/A	0.0%	0.0%	9.7%	0.0%	18.0%	19.9%	8.0%	18.0%
56	N/A	0.0%	0.0%	6.2%	0.0%	18.0%	19.8%	8.0%	18.0%
57	N/A	0.0%	0.0%	10.5%	0.0%	18.0%	16.6%	8.0%	18.0%
58	N/A	0.0%	0.0%	4.6%	0.0%	18.0%	17.9%	8.0%	18.0%
59	17.0%	0.0%	0.0%	35.6%	0.0%	18.0%	37.0%	25.0%	18.0%
60	19.2%	10.0%	35.0%	37.6%	33.0%	35.0%	62.9%	55.0%	35.0%
61	16.8%	25.0%	18.0%	16.7%	18.0%	18.0%	22.6%	21.0%	18.0%
62	19.6%	25.0%	17.0%	14.3%	16.0%	17.0%	17.0%	20.0%	17.0%
63	14.4%	25.0%	15.0%	13.5%	16.0%	15.0%	15.3%	15.0%	15.0%
64	16.9%	25.0%	17.0%	16.3%	17.0%	17.0%	14.1%	15.0%	17.0%
65	21.2%	25.0%	20.0%	20.7%	24.0%	20.0%	21.6%	25.0%	20.0%
66	26.9%	25.0%	18.0%	19.2%	16.0%	18.0%	15.6%	25.0%	18.0%
67	24.8%	25.0%	18.0%	13.6%	23.0%	18.0%	21.4%	30.0%	18.0%
68	22.0%	25.0%	18.0%	23.8%	23.0%	18.0%	15.8%	10.0%	18.0%
69	21.6%	25.0%	18.0%	16.0%	23.0%	18.0%	8.6%	25.0%	18.0%
70	34.2%	75.0%	18.0%	22.8%	23.0%	18.0%	16.4%	25.0%	18.0%
71	8.3%	75.0%	18.0%	19.8%	23.0%	18.0%	30.4%	25.0%	18.0%
72	20.0%	75.0%	18.0%	12.9%	23.0%	18.0%	17.0%	25.0%	18.0%
73	8.3%	75.0%	18.0%	22.7%	23.0%	18.0%	46.7%	25.0%	18.0%
74	0.0%	75.0%	18.0%	25.0%	23.0%	18.0%	0.0%	25.0%	18.0%
75+	0.0%	100.0%	100.0%	18.2%	100.0%	100.0%	18.2%	100.0%	100.0%
Total	18.8%	21.3%	19.4%	17.3%	13.3%	17.6%	12.6%	8.3%	13.0%

	Rank and File – Retirement Rates					
	25-29 Years of Service			30+ Years of Service		
Age	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate
38	0.0%	3.0%	5.0%	N/A	0.0%	0.0%
39	50.0%	3.0%	5.0%	N/A	0.0%	0.0%
40	0.0%	3.0%	5.0%	N/A	0.0%	0.0%
41	N/A	3.0%	5.0%	N/A	0.0%	0.0%
42	25.0%	3.0%	5.0%	N/A	0.0%	0.0%
43	0.0%	3.0%	5.0%	N/A	0.0%	0.0%
44	2.6%	3.0%	5.0%	N/A	0.0%	0.0%
45	12.0%	3.0%	5.0%	N/A	3.0%	0.0%
46	4.2%	3.0%	5.0%	N/A	3.0%	0.0%
47	6.0%	3.0%	5.0%	N/A	50.0%	0.0%
48	11.6%	6.0%	8.0%	100.0%	50.0%	20.0%
49	14.5%	7.0%	8.0%	26.3%	50.0%	20.0%
50	13.8%	7.0%	10.0%	21.7%	43.0%	20.0%
51	15.3%	7.0%	10.0%	16.4%	40.0%	20.0%
52	18.4%	8.0%	10.0%	20.5%	47.0%	20.0%
53	16.4%	12.0%	10.0%	20.0%	44.0%	20.0%
54	40.8%	28.0%	25.0%	27.8%	47.0%	25.0%
55	68.3%	55.0%	60.0%	23.0%	30.0%	60.0%
56	22.0%	32.0%	20.0%	17.4%	25.0%	20.0%
57	19.6%	30.0%	20.0%	17.8%	22.0%	20.0%
58	15.5%	28.0%	20.0%	23.9%	20.0%	20.0%
59	16.6%	35.0%	20.0%	15.2%	18.0%	20.0%
60	21.7%	30.0%	35.0%	15.4%	24.0%	35.0%
61	17.6%	18.0%	18.0%	27.0%	22.0%	18.0%
62	13.9%	18.0%	17.0%	23.8%	25.0%	17.0%
63	13.2%	25.0%	15.0%	23.0%	25.0%	15.0%
64	22.6%	18.0%	17.0%	20.8%	25.0%	17.0%
65	17.6%	25.0%	20.0%	21.7%	25.0%	20.0%
66	17.1%	20.0%	18.0%	15.1%	30.0%	18.0%
67	20.3%	18.0%	18.0%	23.4%	35.0%	18.0%
68	19.3%	18.0%	18.0%	19.1%	20.0%	18.0%
69	23.8%	40.0%	18.0%	30.0%	20.0%	18.0%
70	17.6%	35.0%	18.0%	21.4%	25.0%	18.0%
71	4.2%	35.0%	18.0%	31.6%	25.0%	18.0%
72	11.1%	35.0%	18.0%	33.3%	25.0%	18.0%
73	27.8%	35.0%	18.0%	N/A	25.0%	18.0%
74	20.0%	35.0%	18.0%	N/A	25.0%	18.0%
75+	14.3%	100.0%	100.0%	N/A	100.0%	100.0%
Total	21.7%	17.3%	16.8%	21.3%	29.3%	23.6%
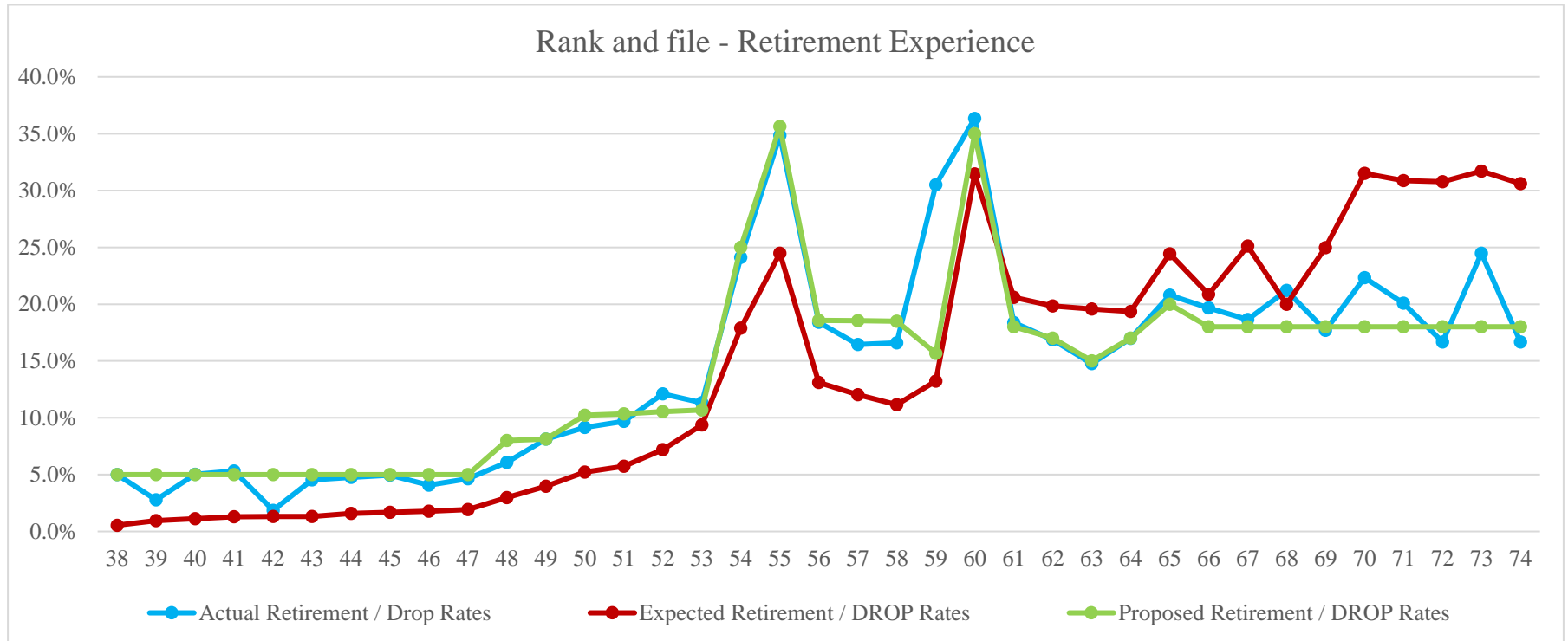
Rank and file - Retirement Experience

	Judges – Retirement Rates								
	<12 Years of Service			12-17 Years of Service			18+ Years of Service		
Age	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate
38	N/A	0.0%	0.0%	N/A	0.0%	0.0%	N/A	0.0%	6.8%
39	N/A	0.0%	0.0%	N/A	0.0%	0.0%	N/A	0.0%	6.8%
40	N/A	0.0%	0.0%	N/A	0.0%	0.0%	0.0%	0.0%	6.8%
41	N/A	0.0%	0.0%	N/A	0.0%	0.0%	0.0%	0.0%	6.8%
42	N/A	0.0%	0.0%	N/A	0.0%	0.0%	0.0%	0.0%	6.8%
43	N/A	0.0%	0.0%	N/A	0.0%	0.0%	0.0%	0.0%	6.8%
44	N/A	0.0%	0.0%	N/A	0.0%	0.0%	0.0%	0.0%	6.8%
45	N/A	0.0%	0.0%	N/A	0.0%	0.0%	10.0%	0.0%	6.8%
46	N/A	0.0%	0.0%	N/A	10.0%	0.0%	8.3%	15.0%	6.8%
47	N/A	0.0%	0.0%	N/A	10.0%	0.0%	0.0%	12.0%	6.8%
48	N/A	0.0%	0.0%	N/A	10.0%	0.0%	4.5%	10.0%	6.8%
49	N/A	0.0%	0.0%	N/A	10.0%	0.0%	13.0%	10.7%	6.8%
50	N/A	0.0%	0.0%	N/A	10.0%	0.0%	8.0%	11.6%	6.8%
51	N/A	0.0%	0.0%	N/A	5.0%	0.0%	12.0%	6.6%	6.8%
52	N/A	0.0%	0.0%	N/A	5.0%	0.0%	3.7%	6.7%	6.8%
53	N/A	0.0%	0.0%	N/A	5.0%	0.0%	7.5%	6.9%	6.8%
54	N/A	0.0%	0.0%	N/A	10.0%	0.0%	5.9%	10.8%	6.8%
55	N/A	5.0%	0.0%	20.8%	13.8%	20.8%	14.6%	12.4%	11.5%
56	N/A	5.0%	0.0%	4.2%	7.7%	9.0%	7.5%	6.8%	11.5%
57	N/A	10.0%	0.0%	0.0%	6.0%	9.0%	5.6%	5.1%	11.5%
58	N/A	5.0%	0.0%	0.0%	3.5%	9.0%	13.9%	5.2%	11.5%
59	N/A	5.0%	0.0%	13.5%	3.9%	9.0%	15.8%	6.4%	11.5%
60	0.0%	10.0%	10.8%	14.8%	5.6%	9.0%	23.8%	6.1%	23.8%
61	33.3%	10.0%	10.8%	22.7%	5.6%	9.0%	18.4%	9.3%	17.3%
62	0.0%	20.0%	10.8%	13.3%	9.2%	9.0%	15.6%	9.8%	17.3%
63	14.3%	20.0%	10.8%	11.1%	10.0%	9.0%	16.1%	5.1%	17.3%
64	0.0%	15.0%	10.8%	0.0%	12.5%	9.0%	20.0%	6.6%	17.3%
65	0.0%	50.0%	10.8%	18.2%	28.0%	18.2%	15.8%	6.4%	17.3%
66	0.0%	10.0%	10.8%	0.0%	10.0%	10.5%	0.0%	10.4%	12.2%
67	0.0%	10.0%	10.8%	9.1%	10.0%	10.5%	4.8%	10.0%	12.2%
68	10.0%	10.0%	10.8%	0.0%	10.0%	10.5%	19.2%	10.0%	12.2%
69	16.7%	10.0%	10.8%	12.5%	10.0%	10.5%	15.0%	10.0%	12.2%
70	0.0%	10.0%	10.8%	0.0%	10.0%	10.5%	16.7%	10.0%	12.2%
71	33.3%	5.0%	10.8%	28.6%	14.9%	10.5%	20.0%	40.0%	12.2%
72	100.0%	5.0%	10.8%	0.0%	22.5%	10.5%	62.5%	40.0%	54.5%
73	N/A	5.0%	10.8%	0.0%	22.5%	10.5%	50.0%	40.0%	54.5%
74	N/A	5.0%	10.8%	100.0%	39.5%	10.5%	0.0%	40.0%	54.5%
75+	N/A	5.0%	100.0%	100.0%	100.0%	100.0%	0.0%	100.0%	100.0%
Total	10.8%	15.6%	10.8%	10.9%	9.3%	10.9%	12.4%	9.3%	12.7%

Judges - Retirement Experience

	Corrections/Hazardous Duty– Retirement Rates					
	< 10 Years of Service			10+ Years of Service		
Age	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate
38	0.0%	0.0%	0.0%	0.0%	20.0%	11.0%
39	0.0%	0.0%	0.0%	10.0%	20.0%	11.0%
40	0.0%	0.0%	0.0%	10.5%	20.0%	11.0%
41	0.0%	0.0%	0.0%	16.0%	20.0%	11.0%
42	0.0%	0.0%	0.0%	8.7%	20.2%	11.0%
43	0.0%	0.0%	0.0%	20.8%	20.1%	23.5%
44	0.0%	0.0%	0.0%	28.9%	20.5%	23.5%
45	0.0%	0.0%	0.0%	30.0%	21.0%	23.5%
46	0.0%	0.0%	0.0%	26.7%	21.0%	23.5%
47	0.0%	0.0%	0.0%	28.8%	21.2%	23.5%
48	0.0%	0.0%	0.0%	30.2%	21.4%	23.5%
49	0.0%	0.0%	0.0%	19.9%	21.3%	23.5%
50	0.0%	0.0%	0.0%	22.3%	31.7%	23.5%
51	0.0%	0.0%	0.0%	19.6%	14.3%	23.5%
52	0.0%	0.0%	0.0%	20.7%	28.2%	23.5%
53	0.0%	0.0%	0.0%	21.0%	27.8%	23.5%
54	0.0%	0.0%	0.0%	25.4%	31.4%	23.5%
55	0.0%	0.0%	0.0%	23.3%	31.1%	23.5%
56	0.0%	0.0%	0.0%	24.1%	31.5%	23.5%
57	0.0%	0.0%	0.0%	17.4%	31.5%	23.5%
58	0.0%	0.0%	0.0%	28.9%	30.9%	28.9%
59	0.0%	29.8%	0.0%	28.9%	30.5%	28.9%
60	41.7%	44.9%	50.0%	36.9%	45.2%	36.9%
61	62.5%	39.9%	50.0%	24.0%	41.6%	24.0%
62	33.3%	39.9%	32.5%	15.6%	41.5%	19.6%
63	10.0%	39.8%	32.5%	18.1%	41.4%	19.6%
64	20.0%	39.8%	32.5%	19.6%	40.9%	19.6%
65	33.3%	34.7%	32.5%	25.5%	37.0%	19.6%
66	50.0%	34.8%	32.5%	22.2%	36.4%	19.6%
67	0.0%	35.0%	32.5%	9.5%	36.1%	19.6%
68	0.0% A	0.0%	32.5%	28.6%	36.9%	19.6%
69	66.7%	34.7%	32.5%	28.6%	35.8%	19.6%
70	100.0%	49.5%	32.5%	20.0%	49.6%	19.6%
71	0.0%	0.0%	32.5%	16.7%	49.7%	19.6%
72	0.0%	0.0%	32.5%	0.0%	49.6%	19.6%
73	100.0%	49.0%	32.5%	0.0%	49.0%	19.6%
74	0.0%	49.0%	32.5%	100.0%	49.0%	19.6%
75+	0.0%	100.0% %	100.0%	0.0%	100.0% !	100.0%
Total	38.3%	40.5%	38.3%	23.8%	29.0%	23.8%

Corrections/Hazardous Duty - Retirement Experience
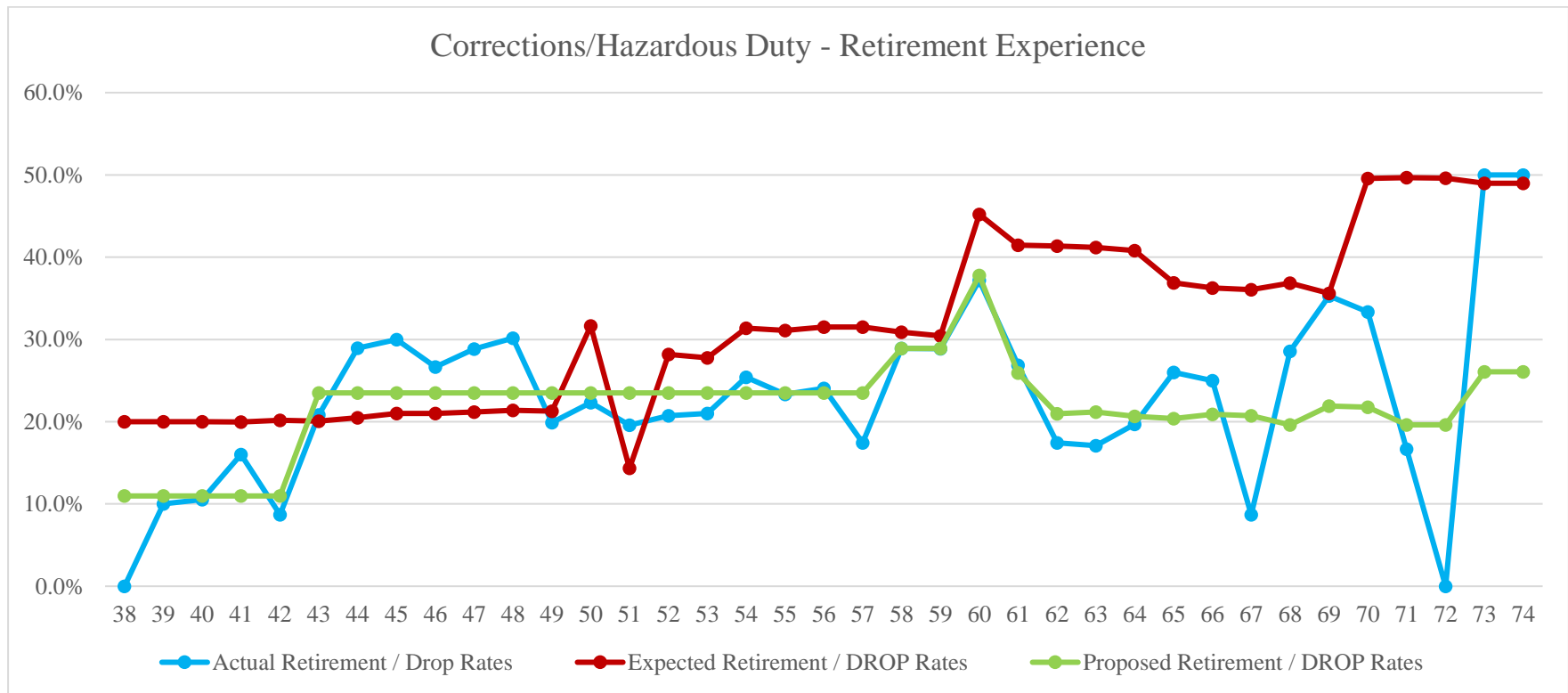
WITHDRAWAL/TERMINATION RATES

The withdrawal rate, or sometimes referred to as the termination rate, is the probability that a member will separate employment from a cause other than disability, death, or retirement.

Experience and Proposed Assumptions

All active members during the observation period were included in the exposure unless the member had met the retirement eligibility requirements. If a member was eligible for retirement at a given age, the member's exposure was excluded for that age.

Rank and File – Current assumptions vary based on the age of the member and nine distinct levels of service based on prior experience: less than one year, one year, two to three years, four to five, six, seven, either, nine, and ten or more years of service. To better match recent experience, we are recommending restructuring the service categories to the following: less than one year, one year, two to three years, four to six years, seven to nine years, and ten or more years.

Actual withdrawal experience was higher than expected for every service category, therefore we are recommending increasing the assumed withdrawal rates for nearly all ages in each service category. The aggregate withdrawal rate for all age and service levels was 13.3% compared to an expected rate of 10.9%. In the two to three years, and four to six-year categories, we are recommending rates that aggregate to less than the actual withdrawal rates since the experience period in the prior study showed slightly lower withdrawal rates than for the most recent period The ten or more years of service category, which is the largest service category with nearly one-third of the exposure, experienced an aggregate withdrawal rate of 5.4% compared to an expected withdrawal rate of 4.3%. The increase was observed for almost all ages; therefore, we are recommending increasing rates for all ages in this service category. .

Judges – Current assumptions vary by years of service and are based on prior experience. With only nine withdrawals in five years, there is minimal experience on which to base our recommendations. We assumed an aggregate withdrawal rate of 1.7%. The plan experienced an aggregate withdrawal rate of 1.2% over the experience period. Therefore, we recommend reducing the withdrawal assumption to 1.2% for all durations of service.

Corrections/Hazardous Duty – The Corrections/Hazardous Duty analysis excluded Wildlife experience, which was analyzed separately since this group continues to exhibit a pattern of withdrawals that differs from the remaining Hazardous Duty plans. Current assumptions for each vary based on the age of the member and two distinct levels of service based on prior experience: less than ten years and greater than or equal to ten years. To better match recent experience, we are recommending expanding the service categories to the following: less than one year, one year, two years, three to four years, five to seven years, eight to nine years, and ten or more years.

The total aggregate actual withdrawal rate of 17.2% exceeded the expected withdrawal rate of 16.7%. For members with less than one year of service the actual withdrawal rate of 44.7% significantly exceeded the expected withdrawal rate of 23.6%. For members with one year of service, the actual withdrawal rate of 26.5% exceeded the expected withdrawal rate of 23.2%. The aggregate actual withdrawal rate for all categories with two or more years was less than expected. Our proposed rates within each service category were chosen to provide a close fit to actual experience within each proposed new category. Our proposed aggregate withdrawal rate of 17.2% equals the aggregate actual withdrawal rate.

Wildlife – Current assumptions vary by years of service and are based on prior experience. With only eight withdrawals in five years, there is minimal experience on which to base our recommendations. However, we observed a clear difference in withdrawal pattern for members with less than six years of service versus those with six or more years of service. For members with less than six years, the aggregate withdrawal rate of 7.6% exceeded the expected withdrawal rate of 6.0%. We recommend a 7.6% withdrawal assumption for all ages for members with less than six years of service. For six or more years, the actual withdrawal rate of 0.5% was less than the expected aggregate withdrawal rate of 3.0%. We recommend a 0.5% withdrawal assumption for all ages for members with six or more years of service.

Impact on Valuation Results

The table below shows the impact of the proposed changes to the accrued liability and normal cost by Plan. Note the change in accrued liability and normal cost are determined based on the recent June 30, 2018 actuarial valuation updated to reflect a 7.65% interest rate, retaining prior decrements for all other assumptions.

	Change in Accrued Liability	Change in Normal Cost
Rank and File	17,409,993	(11,337,534)
Judges	(11,758)	20,945
Hazardous Duty Plans	46,279,229	8,206,750
TOTAL	63,677,464	(3,109,839)

The actual, expected, and proposed withdrawal rates for each Plan by age and duration of service are provided on the following tables. Following the tables are graphs which provide a visual representation of the actual and proposed withdrawal rates compared to the current assumptions.
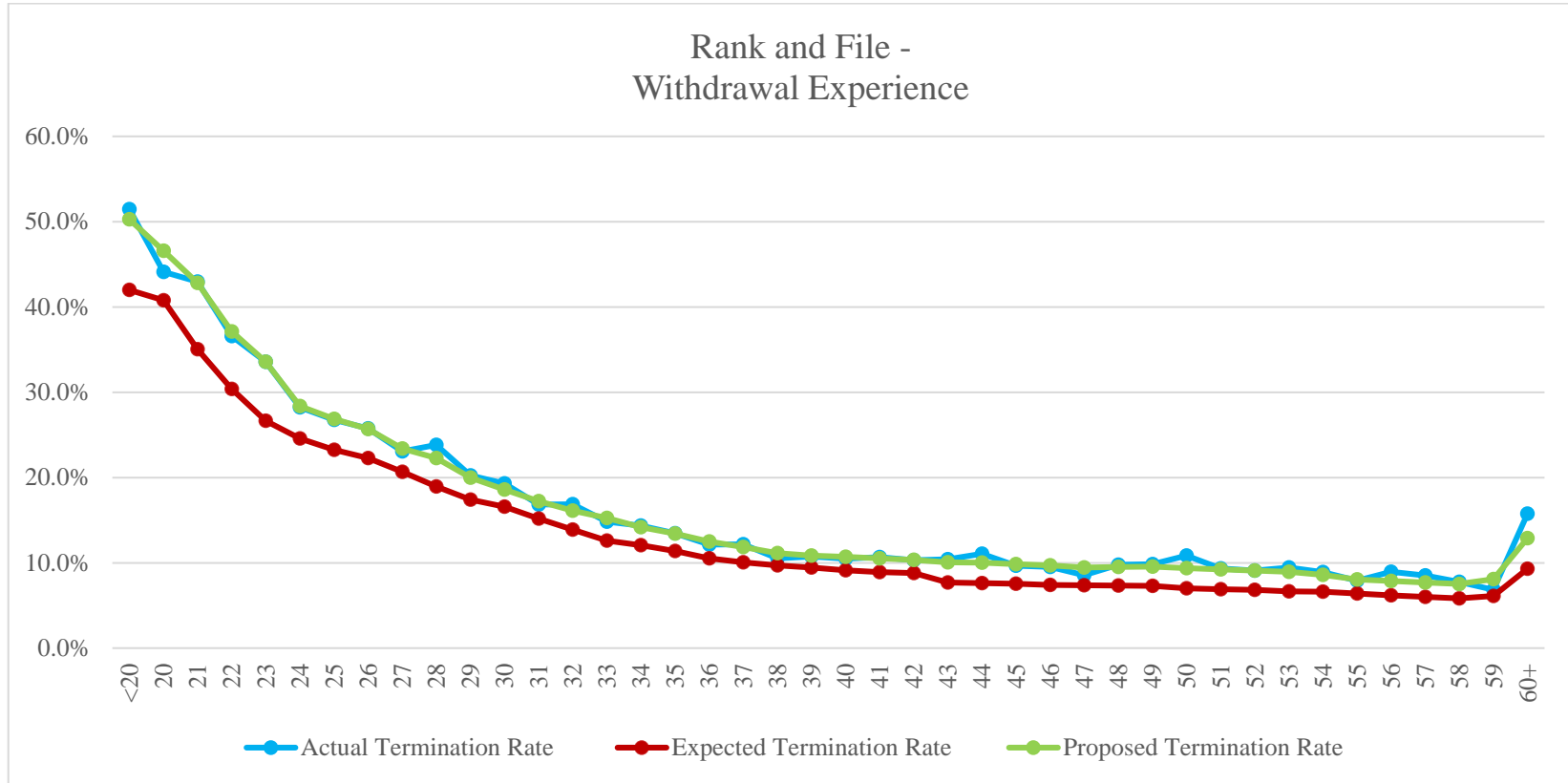
	Rank and File – Withdrawal/Termination Rates											
	< 1 Years of Service			1 Years of Service			2,3 Years of Service			4, 5, 6 Years of Service		
Age	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate
<20	51.2%	42.6%	50.0%	55.6%	30.0%	55.0%	N/A	0.0%	33.0%	N/A	13.0%	23.0%
20	46.6%	45.0%	50.0%	37.8%	30.2%	38.0%	33.3%	22.0%	33.0%	N/A	13.0%	23.0%
21	50.3%	40.0%	50.0%	32.0%	30.2%	32.0%	32.8%	22.0%	33.0%	N/A	13.0%	23.0%
22	43.8%	35.0%	44.0%	28.8%	25.3%	30.0%	23.3%	22.1%	24.0%	0.0%	13.0%	23.0%
23	37.7%	29.0%	38.0%	30.7%	25.1%	30.0%	24.7%	22.2%	24.0%	18.5%	13.0%	23.0%
24	31.8%	29.0%	32.5%	27.6%	21.1%	27.0%	19.1%	21.0%	20.0%	27.5%	12.0%	23.0%
25	32.6%	29.0%	32.5%	25.6%	20.7%	27.0%	21.8%	20.1%	20.0%	14.8%	11.6%	16.0%
26	33.4%	29.0%	32.5%	27.8%	20.5%	27.0%	18.5%	20.0%	20.0%	16.8%	11.4%	16.0%
27	28.4%	29.0%	29.0%	26.0%	20.1%	27.0%	20.2%	19.1%	20.0%	16.1%	11.1%	16.0%
28	31.5%	29.0%	29.0%	28.5%	19.8%	27.0%	21.7%	18.0%	20.0%	16.6%	11.0%	16.0%
29	29.3%	28.9%	29.0%	23.6%	19.5%	23.0%	16.4%	17.0%	18.0%	18.3%	10.8%	16.0%
30	27.3%	29.0%	29.0%	23.7%	19.2%	23.0%	20.9%	17.0%	18.0%	13.8%	10.6%	13.3%
31	29.6%	28.9%	29.0%	20.9%	18.9%	23.0%	17.0%	16.0%	18.0%	12.5%	10.4%	13.3%
32	29.5%	28.9%	29.0%	26.1%	18.6%	23.0%	17.1%	15.0%	18.0%	14.8%	10.3%	13.3%
33	29.2%	28.9%	29.0%	22.7%	18.3%	23.0%	16.7%	13.0%	18.0%	11.8%	10.2%	13.3%
34	29.0%	28.9%	29.0%	20.1%	18.0%	22.0%	18.7%	13.0%	18.0%	15.0%	10.0%	13.3%
35	27.4%	29.0%	29.0%	25.1%	17.7%	22.0%	19.5%	13.0%	18.0%	12.7%	9.9%	13.3%
36	26.1%	28.4%	29.0%	19.5%	17.4%	22.0%	18.7%	13.0%	18.0%	13.1%	9.8%	13.3%
37	31.0%	27.9%	29.0%	23.9%	17.1%	22.0%	13.8%	12.0%	15.0%	15.1%	9.7%	13.3%
38	27.1%	27.4%	29.0%	19.6%	16.8%	18.0%	16.3%	12.0%	15.0%	11.4%	9.5%	13.0%
39	28.9%	27.0%	28.0%	18.5%	16.5%	18.0%	15.3%	12.0%	15.0%	14.6%	9.4%	13.0%
40	29.0%	26.4%	28.0%	17.6%	16.2%	18.0%	14.9%	11.0%	15.0%	12.4%	9.2%	13.0%
41	25.9%	25.9%	28.0%	23.0%	15.9%	18.0%	16.2%	11.0%	15.0%	13.9%	9.1%	13.0%
42	28.5%	25.4%	28.0%	17.7%	15.6%	18.0%	13.3%	11.0%	14.0%	12.6%	9.0%	12.5%
43	23.8%	24.9%	25.0%	21.5%	15.3%	18.0%	13.4%	8.0%	14.0%	10.8%	8.2%	12.5%
44	27.1%	24.5%	25.0%	19.5%	15.0%	18.0%	15.8%	8.0%	14.0%	14.2%	8.0%	12.5%
45	22.3%	23.9%	25.0%	21.1%	14.7%	18.0%	13.4%	8.0%	14.0%	11.8%	7.9%	12.5%
46	26.9%	23.5%	25.0%	18.4%	14.4%	18.0%	14.0%	8.0%	14.0%	13.3%	7.7%	12.5%
47	20.9%	22.9%	25.0%	14.4%	14.1%	18.0%	12.5%	8.0%	12.5%	10.4%	7.6%	11.5%
48	27.3%	22.4%	25.0%	15.0%	13.8%	18.0%	12.3%	8.0%	12.5%	10.2%	7.5%	11.5%
49	24.6%	21.9%	25.0%	20.6%	13.5%	18.0%	11.7%	8.0%	12.5%	12.8%	7.3%	11.5%
50	26.6%	21.4%	25.0%	20.4%	13.2%	18.0%	10.6%	8.0%	12.5%	13.3%	7.2%	11.5%
51	23.8%	20.9%	25.0%	15.7%	12.9%	18.0%	15.3%	8.0%	12.5%	13.0%	7.1%	11.5%
52	24.2%	20.4%	25.0%	15.9%	12.6%	18.0%	12.2%	8.0%	11.5%	11.0%	7.0%	11.5%
53	25.1%	19.9%	25.0%	18.6%	12.3%	18.0%	10.1%	8.0%	11.5%	11.9%	6.9%	11.5%
54	24.3%	19.4%	25.0%	17.6%	12.0%	18.0%	11.9%	8.0%	11.5%	8.9%	6.7%	8.5%
55	19.9%	18.9%	20.0%	14.2%	11.7%	18.0%	12.0%	8.0%	11.5%	8.1%	6.6%	8.5%
56	27.4%	18.4%	20.0%	21.0%	11.4%	18.0%	12.2%	8.0%	11.5%	8.4%	6.5%	8.5%
57	18.5%	17.9%	20.0%	18.0%	11.1%	18.0%	12.5%	8.0%	11.5%	11.3%	6.4%	8.5%
58	17.3%	17.4%	20.0%	11.8%	10.8%	18.0%	11.1%	8.0%	11.5%	11.6%	6.3%	8.5%
59	14.9%	16.9%	20.0%	16.8%	10.5%	18.0%	8.4%	8.0%	11.5%	5.5%	6.1%	8.5%
60+	24.6%	16.4%	20.0%	18.6%	10.2%	18.0%	13.6%	8.0%	11.5%	5.8%	6.4%	8.5%
Total	29.7%	27.4%	29.7%	22.5%	17.5%	22.2%	16.3%	12.9%	16.1%	13.0%	8.9%	12.6%

Rank and File – Withdrawal/Termination Rates								
	7,8,9 Years of Service			10+ Years of Service			Total (Aggregate)		
Age	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate
<20	N/A	8.0%	10.5%	N/A	5.0%	8.0%	51.4%	42.0%	50.3%
20	N/A	8.0%	10.5%	N/A	5.0%	8.0%	44.1%	40.8%	46.6%
21	N/A	8.0%	10.5%	N/A	5.0%	8.0%	43.0%	35.0%	42.8%
22	N/A	8.0%	10.5%	N/A	5.0%	8.0%	36.6%	30.4%	37.1%
23	N/A	8.0%	10.5%	N/A	5.0%	8.0%	33.6%	26.7%	33.6%
24	N/A	8.0%	10.5%	N/A	5.0%	8.0%	28.2%	24.6%	28.4%
25	0.0%	8.0%	10.5%	N/A	5.0%	8.0%	26.8%	23.3%	26.9%
26	3.3%	7.9%	10.5%	N/A	5.0%	8.0%	25.8%	22.3%	25.7%
27	10.4%	7.5%	10.5%	N/A	5.0%	8.0%	23.1%	20.7%	23.4%
28	11.0%	7.3%	10.5%	0.0%	5.0%	8.0%	23.8%	18.9%	22.3%
29	9.3%	7.2%	10.5%	3.0%	5.0%	8.0%	20.2%	17.4%	20.0%
30	11.8%	7.4%	10.5%	7.6%	5.0%	8.0%	19.3%	16.6%	18.6%
31	8.4%	7.3%	8.0%	11.6%	5.0%	8.0%	16.8%	15.2%	17.2%
32	8.7%	7.2%	8.0%	7.4%	5.0%	8.0%	16.9%	13.9%	16.1%
33	8.9%	7.0%	8.0%	7.0%	5.0%	8.0%	14.8%	12.6%	15.3%
34	7.7%	7.0%	8.0%	5.5%	5.0%	5.5%	14.3%	12.1%	14.2%
35	6.9%	7.0%	8.0%	5.6%	5.0%	5.5%	13.5%	11.4%	13.4%
36	6.2%	7.0%	8.0%	6.8%	5.0%	5.5%	12.1%	10.5%	12.5%
37	8.7%	7.0%	8.0%	4.7%	5.0%	5.5%	12.2%	10.1%	11.8%
38	7.0%	7.0%	8.0%	4.7%	5.0%	5.5%	10.5%	9.7%	11.1%
39	5.8%	7.0%	8.0%	5.2%	5.0%	5.5%	10.7%	9.4%	10.8%
40	8.2%	7.0%	8.0%	5.0%	5.0%	5.5%	10.5%	9.1%	10.7%
41	8.5%	7.0%	8.0%	4.7%	5.0%	5.5%	10.7%	8.9%	10.5%
42	7.7%	7.0%	8.0%	5.6%	5.0%	5.5%	10.3%	8.8%	10.3%
43	9.9%	6.0%	8.0%	6.0%	4.0%	5.5%	10.4%	7.7%	10.0%
44	9.8%	6.1%	8.0%	5.7%	4.0%	5.5%	11.1%	7.6%	10.0%
45	8.6%	6.0%	8.0%	4.7%	4.0%	5.0%	9.6%	7.5%	9.8%
46	5.7%	5.9%	7.5%	4.6%	4.0%	5.0%	9.5%	7.4%	9.7%
47	6.3%	6.0%	7.5%	5.0%	4.0%	5.0%	8.5%	7.4%	9.5%
48	7.3%	6.1%	7.5%	6.0%	4.0%	5.0%	9.8%	7.3%	9.5%
49	7.8%	6.0%	7.5%	4.9%	4.0%	5.0%	9.8%	7.3%	9.6%
50	9.8%	5.9%	7.5%	6.7%	4.0%	5.0%	10.9%	7.0%	9.4%
51	6.7%	5.9%	7.0%	4.7%	4.0%	5.0%	9.3%	6.9%	9.2%
52	5.7%	6.0%	7.0%	5.9%	4.0%	5.0%	9.1%	6.8%	9.1%
53	7.4%	6.0%	7.0%	5.9%	4.0%	5.0%	9.4%	6.6%	8.9%
54	7.5%	6.0%	7.0%	5.5%	4.0%	5.0%	8.9%	6.6%	8.6%
55	8.0%	5.9%	7.0%	4.8%	4.0%	5.0%	7.9%	6.4%	8.0%
56	8.1%	5.9%	7.0%	5.6%	4.0%	5.0%	8.9%	6.2%	7.9%
57	7.8%	6.0%	7.0%	5.5%	4.0%	5.0%	8.5%	6.0%	7.7%
58	5.7%	6.0%	7.0%	5.8%	4.0%	5.0%	7.8%	5.8%	7.5%
59	7.7%	6.0%	7.0%	4.3%	4.0%	5.0%	6.8%	6.1%	8.1%
60+	12.6%	6.3%	7.0%	0.0%	4.0%	5.0%	15.7%	9.3%	12.9%
Total	7.9%	6.5%	7.8%	5.4%	4.3%	5.3%	13.3%	10.9%	13.1%

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Rank and File -
Withdrawal Experience

	Corrections/Hazardous Duty – Withdrawal/Termination Rates											
	< 1 Years of Service			1 Years of Service			2 Years of Service			3, 4 Years of Service		
Age	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate
<20	58.5%	50.0%	58.0%	50.0%	50.0%	50.0%	N/A	0.0%	30.0%	N/A	13.0%	37.0%
20	59.4%	46.0%	58.0%	34.9%	46.0%	39.0%	0.0%	46.0%	30.0%	N/A	13.0%	37.0%
21	57.1%	42.0%	58.0%	47.0%	42.0%	39.0%	22.2%	42.0%	30.0%	33.3%	13.0%	37.0%
22	58.0%	38.0%	58.0%	33.7%	37.9%	39.0%	33.3%	38.0%	30.0%	40.9%	13.0%	37.0%
23	49.6%	34.9%	48.0%	36.2%	34.9%	36.0%	32.8%	35.0%	30.0%	24.2%	35.0%	24.0%
24	45.7%	31.9%	48.0%	25.4%	31.7%	30.5%	28.1%	32.0%	30.0%	17.7%	32.0%	24.0%
25	48.8%	29.0%	48.0%	28.8%	28.9%	30.5%	31.4%	28.8%	30.0%	30.0%	29.0%	24.0%
26	44.5%	27.0%	46.7%	31.6%	26.9%	30.5%	15.2%	26.7%	24.0%	22.1%	27.0%	20.5%
27	46.7%	25.1%	46.7%	34.3%	24.9%	30.5%	24.7%	24.8%	24.0%	19.1%	24.9%	20.5%
28	49.0%	23.1%	46.7%	31.4%	22.9%	30.5%	28.1%	23.0%	24.0%	20.2%	22.8%	20.5%
29	46.7%	21.1%	46.7%	31.9%	21.0%	30.5%	18.5%	20.9%	24.0%	12.4%	20.9%	20.0%
30	42.5%	20.1%	43.5%	25.0%	20.0%	25.5%	22.9%	20.0%	24.0%	16.3%	19.8%	20.0%
31	42.2%	20.2%	43.5%	21.3%	20.0%	25.5%	33.3%	20.0%	24.0%	18.0%	19.7%	20.0%
32	40.2%	20.5%	43.5%	28.4%	20.0%	25.5%	15.5%	19.8%	20.0%	25.6%	19.9%	20.0%
33	47.7%	20.2%	43.5%	29.4%	20.0%	25.5%	9.5%	20.0%	20.0%	19.6%	19.7%	20.0%
34	43.0%	20.1%	43.5%	15.1%	20.0%	25.5%	17.4%	19.8%	20.0%	20.7%	19.8%	20.0%
35	45.9%	20.1%	43.5%	21.6%	20.0%	25.5%	27.5%	20.0%	20.0%	25.9%	19.8%	20.0%
36	40.3%	18.1%	41.0%	28.6%	18.0%	25.5%	11.9%	18.0%	20.0%	18.2%	17.8%	15.5%
37	38.2%	18.1%	41.0%	34.0%	18.0%	25.5%	31.6%	17.8%	20.0%	13.8%	18.0%	15.5%
38	40.0%	18.1%	41.0%	27.5%	18.0%	25.5%	23.3%	17.8%	20.0%	14.3%	18.0%	15.5%
39	41.7%	18.0%	41.0%	19.1%	18.0%	21.0%	13.0%	18.0%	20.0%	19.1%	17.6%	15.5%
40	45.9%	18.1%	41.0%	18.9%	18.0%	21.0%	22.9%	18.0%	20.0%	7.5%	17.5%	15.5%
41	41.7%	18.2%	41.0%	22.2%	18.0%	21.0%	15.2%	18.0%	20.0%	12.8%	17.8%	15.5%
42	27.3%	18.0%	32.0%	24.3%	17.8%	21.0%	25.9%	18.0%	20.0%	20.5%	18.0%	15.5%
43	26.9%	18.1%	32.0%	18.9%	18.0%	17.0%	24.0%	18.0%	20.0%	18.6%	18.0%	15.5%
44	37.0%	18.2%	32.0%	9.1%	17.9%	17.0%	22.6%	18.0%	20.0%	10.3%	18.0%	15.5%
45	31.4%	17.4%	32.0%	25.0%	17.0%	17.0%	9.5%	16.8%	12.0%	10.8%	16.7%	15.5%
46	37.2%	17.1%	32.0%	27.9%	16.9%	17.0%	12.0%	17.0%	12.0%	25.0%	16.8%	15.5%
47	29.4%	17.1%	32.0%	11.1%	16.9%	17.0%	10.3%	17.0%	12.0%	2.2%	16.8%	10.0%
48	36.5%	17.1%	32.0%	18.9%	17.0%	17.0%	18.2%	16.7%	12.0%	10.0%	17.0%	10.0%
49	25.0%	17.0%	27.5%	18.2%	16.8%	17.0%	13.6%	17.0%	12.0%	8.3%	17.0%	10.0%
50	23.4%	13.0%	27.5%	25.0%	13.0%	17.0%	12.5%	12.8%	12.0%	9.6%	12.8%	10.0%
51	20.0%	13.3%	27.5%	10.0%	13.0%	17.0%	9.5%	13.0%	12.0%	3.1%	13.0%	10.0%
52	43.2%	13.2%	27.5%	14.7%	12.9%	17.0%	13.3%	13.0%	12.0%	11.4%	12.9%	10.0%
53	14.3%	13.2%	27.5%	28.6%	12.9%	17.0%	4.2%	13.0%	9.0%	11.4%	12.9%	10.0%
54	46.2%	13.0%	27.5%	8.3%	12.9%	17.0%	0.0%	12.9%	9.0%	17.6%	12.7%	10.0%
55	21.7%	12.9%	27.5%	22.2%	12.9%	17.0%	12.5%	12.9%	9.0%	4.2%	12.9%	10.0%
56	13.8%	12.9%	19.0%	21.1%	12.9%	17.0%	11.1%	12.9%	9.0%	21.7%	12.9%	10.0%
57	20.0%	13.0%	19.0%	26.1%	12.9%	17.0%	7.1%	12.9%	9.0%	10.5%	12.9%	10.0%
58	25.0%	12.9%	19.0%	0.0%	12.9%	17.0%	28.6%	12.9%	9.0%	10.5%	12.9%	10.0%
59	16.7%	12.9%	19.0%	0.0%	12.9%	17.0%	0.0%	12.9%	9.0%	6.3%	12.9%	10.0%
60+	42.2%	13.1%	19.0%	20.5%	12.9%	17.0%	22.6%	13.0%	9.0%	16.0%	13.0%	10.0%
Total	44.7%	26.3%	44.4%	26.5%	23.2%	26.5%	20.7%	21.5%	20.7%	17.0%	19.7%	17.0%

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	Corrections/Hazardous Duty – Withdrawal/Termination Rates											
	5, 6, 7 Years of Service			8, 9 Years of Service			10+ Years of Service			Total (Aggregate)		
Age	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate
<20	N/A	8.0%	15.5%	N/A	5.0%	6.4%	N/A	5.0%	2.8%	57.9%	50.0%	57.5%
20	N/A	8.0%	15.5%	N/A	5.0%	6.4%	N/A	5.0%	2.8%	53.5%	46.0%	53.7%
21	N/A	8.0%	15.5%	N/A	5.0%	6.4%	N/A	5.0%	2.8%	51.8%	42.0%	51.4%
22	N/A	8.0%	15.5%	N/A	5.0%	6.4%	N/A	5.0%	2.8%	47.5%	37.9%	48.5%
23	0.0%	8.0%	15.5%	N/A	5.0%	6.4%	N/A	5.0%	2.8%	42.3%	34.9%	41.0%
24	13.3%	8.0%	15.5%	N/A	5.0%	6.4%	N/A	5.0%	2.8%	34.2%	31.9%	37.7%
25	18.8%	28.5%	15.5%	N/A	5.0%	6.4%	N/A	5.0%	2.8%	37.3%	28.9%	36.3%
26	12.0%	26.4%	15.5%	0.0%	5.0%	6.4%	N/A	5.0%	2.8%	30.8%	26.9%	32.9%
27	18.8%	24.8%	15.5%	0.0%	5.0%	6.4%	N/A	5.0%	2.8%	31.5%	24.9%	30.5%
28	13.2%	22.8%	13.5%	14.8%	23.0%	6.4%	0.0%	10.0%	2.8%	29.9%	22.9%	28.2%
29	10.9%	20.6%	13.5%	10.0%	21.0%	6.4%	0.0%	10.0%	2.8%	24.8%	20.8%	26.7%
30	16.8%	19.8%	13.5%	0.0%	20.0%	6.4%	4.3%	10.0%	2.8%	23.2%	19.5%	23.9%
31	6.3%	19.9%	10.0%	9.4%	19.2%	6.4%	1.7%	10.0%	2.8%	19.7%	18.8%	20.4%
32	6.6%	19.5%	10.0%	5.5%	19.6%	6.4%	4.9%	9.9%	2.8%	18.3%	18.5%	18.6%
33	6.8%	19.5%	10.0%	6.7%	19.8%	6.4%	1.8%	7.9%	2.8%	16.6%	17.6%	17.2%
34	6.5%	19.8%	10.0%	4.9%	19.2%	6.4%	3.1%	7.9%	2.8%	13.7%	16.6%	15.6%
35	9.9%	19.7%	10.0%	8.5%	19.6%	6.4%	3.8%	7.9%	2.8%	17.4%	15.9%	15.7%
36	19.5%	17.7%	10.0%	6.3%	17.7%	6.4%	3.9%	6.0%	2.8%	14.8%	13.3%	13.3%
37	8.5%	17.7%	10.0%	4.7%	17.8%	6.4%	3.0%	6.0%	2.8%	13.1%	12.7%	12.4%
38	12.5%	17.4%	10.0%	2.2%	17.7%	6.4%	2.5%	6.0%	2.8%	12.2%	12.1%	12.2%
39	10.7%	18.0%	10.0%	2.6%	17.7%	6.4%	3.8%	6.0%	2.8%	10.7%	11.6%	10.5%
40	6.9%	18.0%	9.0%	4.5%	17.7%	6.4%	1.3%	5.0%	2.8%	9.7%	11.1%	10.8%
41	9.8%	17.8%	9.0%	8.1%	17.6%	6.4%	1.5%	5.0%	2.8%	9.5%	10.8%	10.4%
42	6.0%	17.6%	9.0%	2.2%	18.0%	6.4%	3.3%	5.0%	2.8%	8.9%	10.5%	8.9%
43	5.7%	17.5%	9.0%	8.7%	17.7%	6.4%	1.1%	5.0%	2.8%	7.2%	10.4%	8.4%
44	9.7%	17.5%	9.0%	10.5%	17.3%	6.4%	3.3%	6.0%	2.8%	8.8%	10.8%	8.4%
45	9.3%	16.8%	9.0%	7.5%	16.8%	6.4%	3.0%	6.0%	2.8%	8.1%	10.5%	7.9%
46	6.9%	16.9%	9.0%	4.7%	16.7%	6.4%	3.2%	6.0%	2.8%	9.5%	10.4%	7.8%
47	12.8%	16.7%	9.0%	13.3%	17.0%	6.4%	3.5%	6.0%	2.8%	7.6%	10.3%	7.7%
48	12.5%	16.6%	9.0%	14.8%	17.0%	6.4%	2.2%	6.0%	2.8%	9.6%	10.8%	8.3%
49	10.0%	17.0%	9.0%	0.0%	16.6%	6.4%	1.6%	6.9%	2.8%	6.5%	11.7%	7.7%
50	12.7%	13.0%	9.0%	0.0%	13.0%	6.4%	5.1%	6.9%	2.8%	9.8%	10.4%	9.0%
51	9.5%	13.0%	9.0%	11.6%	13.0%	6.4%	3.3%	7.0%	2.8%	7.8%	10.5%	9.0%
52	13.2%	12.9%	9.0%	8.6%	12.9%	6.4%	3.5%	7.0%	2.8%	10.9%	10.1%	8.4%
53	11.4%	12.9%	9.0%	6.3%	12.9%	6.4%	4.0%	7.0%	2.8%	7.8%	9.9%	7.4%
54	2.6%	12.9%	9.0%	2.9%	12.9%	6.4%	2.2%	10.0%	2.8%	7.3%	11.4%	7.5%
55	7.5%	12.9%	9.0%	8.3%	12.9%	6.4%	3.1%	10.0%	2.8%	7.2%	11.4%	7.5%
56	11.1%	12.7%	9.0%	8.3%	12.9%	6.4%	3.5%	10.0%	2.8%	8.9%	11.5%	7.4%
57	10.0%	12.8%	9.0%	3.6%	12.9%	6.4%	2.1%	9.9%	2.8%	7.2%	11.4%	7.0%
58	9.7%	12.9%	9.0%	0.0%	12.9%	6.4%	0.8%	9.9%	2.8%	5.8%	11.4%	6.8%
59	3.4%	12.9%	9.0%	7.1%	12.9%	6.4%	1.6%	9.9%	2.8%	3.9%	11.7%	7.7%
60+	10.4%	13.0%	9.0%	12.1%	13.0%	6.4%	20.0%	10.0%	2.8%	17.6%	13.0%	10.7%
Total	10.3%	18.0%	10.3%	6.4%	17.2%	6.4%	2.8%	6.6%	2.8%	17.2%	16.7%	17.2%
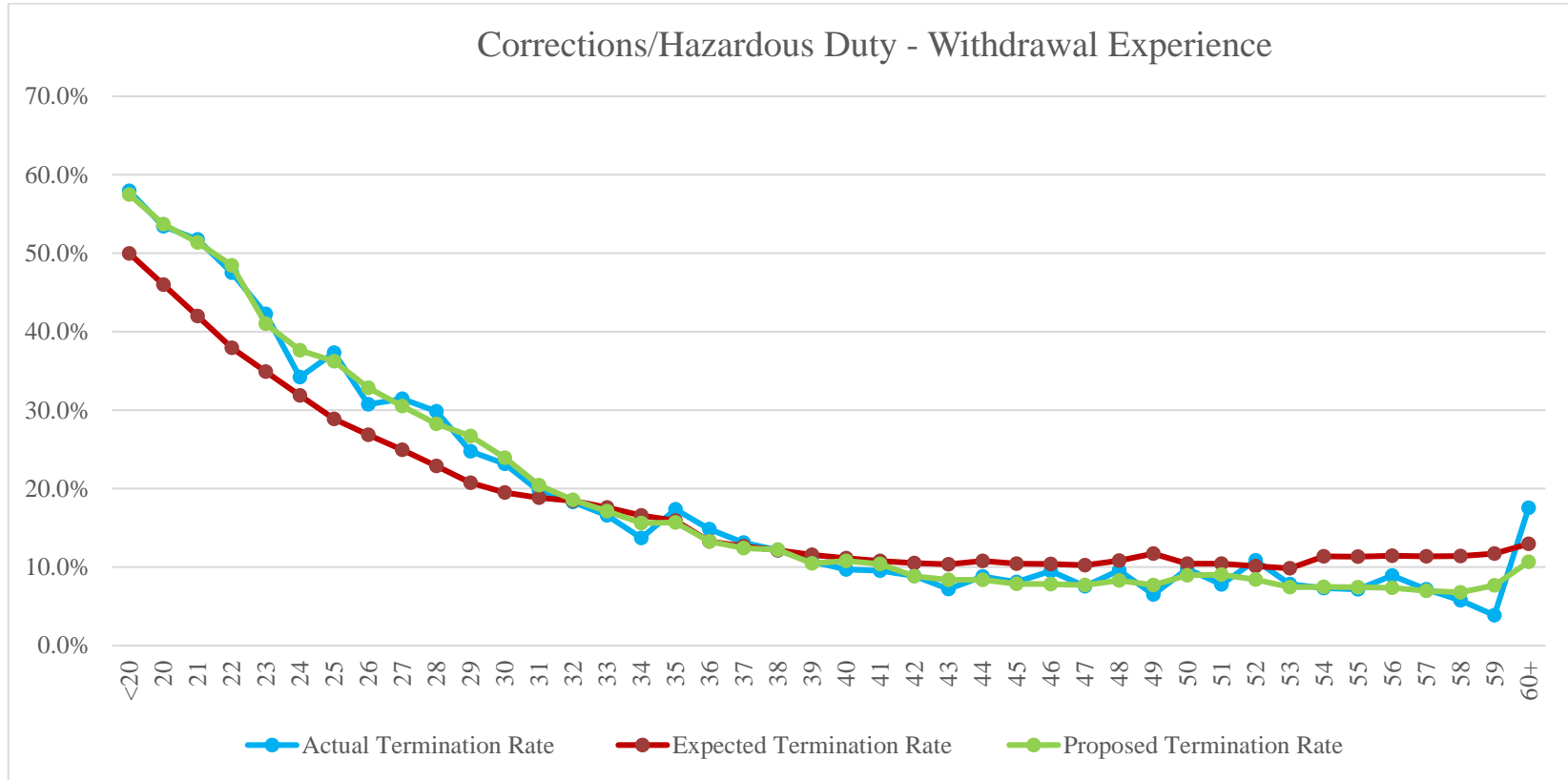
Corrections/Hazardous Duty - Withdrawal Experience

Wildlife – Withdrawal/Termination Rates					
	< 6 Years of Service			>= 6 Years of Service	
Age	Actual Rate	Expected Rate	Proposed Rate	Actual Rate	Expected Rate	Proposed Rate
---	---	---	---	---	---	---
<26	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
26	25.0%	3.0%	7.6%	0.0%	3.0%	0.5%
27	20.0%	3.0%	7.6%	0.0%	3.0%	0.5%
28	10.0%	3.0%	7.6%	0.0%	3.0%	0.5%
29	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
30	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
31	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
32	20.0%	3.0%	7.6%	0.0%	3.0%	0.5%
33	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
34	25.0%	3.0%	7.6%	0.0%	3.0%	0.5%
35	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
36	0.0%	3.0%	7.6%	2.8%	3.0%	0.5%
37	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
38	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
39	0.0%	3.0%	7.6%	2.7%	3.0%	0.5%
40	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
41	0.0%	3.0%	7.6%	2.5%	3.0%	0.5%
42	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
43	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
44	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
45	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
46	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
47	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
48	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
49	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
50	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
51	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
52	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
53	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
54	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
55	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
56	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
57	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
58	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
59	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
60+	0.0%	3.0%	7.6%	0.0%	3.0%	0.5%
Total	7.6%	3.0%	7.6%	0.5%	3.0%	0.5%

MORTALITY RATES

LASERS normal cost and actuarial accrued liabilities depend in part on how long retirees will live. If retirees live longer than anticipated by the assumptions, benefits will be paid longer than expected and experience losses will develop. If retirees do not live as long as anticipated by the assumptions, experience gains will develop.   Mortality rates represent the probability of death at a given age. The choice of mortality rates impacts active member and retiree costs and liabilities and has the greatest impact on the liabilities for retirees.

The actuarial profession has increasingly become more focused on the issue of future mortality improvement. Mortality rates have declined over time as advances in medical care have evolved. The extent of future mortality improvement will impact the magnitude of pension costs and liabilities for future benefit commitments. ASOP No. 35 discusses the importance of actuaries considering mortality improvements when measuring pension obligations. Specifically, an actuary should make and disclose a specific recommendation with respect to future mortality improvement after the measurement date. Mortality improvement can be accounted for with static or generational mortality tables. A static table includes a projection of the base mortality rates to a specific date or equivalently for a specific number of years. The same mortality rates at any given age apply to everyone. A generational table anticipates future improvements in mortality by using a different static mortality table for each year of birth, with the tables for later years of birth assuming lower mortality than the tables of earlier years of birth.

Our analysis employs a credibility procedure which uses a statistical approach to combine actual mortality experience with standard mortality tables to improve the estimate of future mortality.

Standard Mortality Tables

In October 2014, the Society of Actuaries (SOA) released the RP-2014 Mortality Tables, which are based on private pension plan experience but are widely used by public pension plans, as they contained the most recent standard mortality tables available. In January 2015, the SOA initiated a study of public pension plans mortality experience. LASERS participated in this study by providing data. The SOA released an Exposure Draft in August 2018, which provided gender-specific mortality tables for Employees (General Employees, Public Safety, Teachers), Retiree Tables (General Employees, Public Safety, Teachers), Disabled Retiree Tables (Non-Safety and Safety), and Contingent Survivor Tables (all employer categories combined). These tables are collectively named the Pub-2010 Mortality Tables.

In preparing this study, we compared LASERS actual plan experience to the RP-2014 Mortality Tables for White Collar, Blue Collar, the Total Data Set for employees and annuitants, as applicable, and to the applicable Pub-2010 Mortality Tables. Each of these tables was projected to 2015 (the central year of the experience study) using improvement scale MP-2018.

In order for a plan to develop a mortality table based solely on its own experience it must have hundreds of thousands of lives and thousands of deaths at each age and sex. However, many plans provide enough fully credible experience to develop a custom mortality table by multiplying the mortality rates in a published table by the ratio of actual to expected deaths. We employed this methodology by first identifying a standard table with mortality rates that are similar to those shown by the actual plan membership. Since the rate at each age in the custom mortality table will be a multiple of the rate at that age from the standard table, close attention was given to the shape of the standard table in making the selection.

Once the appropriate standard table was selected, we determined the multiple using the limited fluctuation approach to credibility, as described in the Society of Actuaries Credibility Educational Resource for

Pension Actuaries, issued in August 2017. Using this approach, 1082 deaths are needed to provide full credibility based on a 90% confidence level and a 5% margin of error. If the experience data is fully credible, then the rates from the standard table are multiplied by the ratio of the actual to expected deaths from the standard table. Where there are fewer than the 1,082 deaths needed for full credibility, the limited fluctuations approach allows some of the plan's actual experience to be used to adjust the standard table.

Experience and Recommended Assumptions

The RP-2000 Combined Healthy Mortality Tables adjusted to reflect mortality improvement through 2015 using Scale AA is the current mortality assumption for active members and regular retirees for all Plans.

Experience was reviewed separately for General Employees and Public Safety Employees for active members, regular retirees, and disabled retirees. We recommend updating the mortality assumptions as described below.

General Active Mortality:

Mortality rates for active members are much less significant to the valuation than retiree mortality rates since mortality rates are significantly lower for active members than for retirees. The low number of active member deaths results in an insufficient number of deaths needed to provide fully credible experience on which to develop the system's mortality rates. With only 145 male deaths over the study period and 165 female deaths, we found that male experience was 36.6% credible and female experience was 39.1% credible.

In selecting a standard table, we considered the RP-2014 White Collar, Blue Collar and Total Dataset Employee tables and the Pub-2010 General Employee tables for males and females. We found that the RP-2014 Blue Collar mortality tables provided a closer match to the experience of current active members for both males and females. For all tables considered we used the limited fluctuation approach to credibility analysis described above to determine the appropriate adjustment factor for each table. We then chose the table with the best fit to actual experience. Based on this analysis, we recommend using RP-2014 Blue Collar Employee tables for males and females, with the rates adjusted by factors of 0.978 for males and by 1.144 for females.

Public Safety Active:

The low number of active public safety member deaths results in an insufficient number of deaths needed to provide fully credible experience on which to develop the appropriate mortality rates. With only 24 male deaths over the study period and 15 female deaths, we found that male experience was only 14.9% credible and female experience was 11.8% credible.

In selecting a standard table, we considered the RP-2014 White Collar, Blue Collar and Total Dataset Employee tables and the Pub-2010 Public Safety Employee tables for males and females. We found that the RP-2014 Blue Collar mortality tables provided a closer match to the experience of current active members for both males and females. For all tables considered we used the limited fluctuation approach described above to determine the appropriate adjustment factor for each table. We then chose the table with the best fit to actual experience. Based on this analysis, we recommend using RP-2014 Blue Collar Employee tables for males and females, with the rates at each age adjusted by factors of 1.005 for males and by 1.129 for females. Note, although the experience on which to base this assumption was very limited, the result is remarkably close to the resulting table and factors for general active members.

General Retirees:

Mortality rates for retirees are much more significant to the valuation since mortality rates are significantly higher for retirees. The actual number of deaths for males and females were higher than expected based on current mortality tables. For males there were 2,582 deaths compared to 2,065 expected deaths and for females there were 3,092 deaths compared to 2,837 expected deaths.

Using the credibility approach described above, we found that LASERS general retiree mortality experience was 100% credible for both males and females. However, the number of deaths by age category was not fully credible so the limited fluctuation approach requires the use of a standard table with a multiple to adjust the table to reflect plan specific experience. In selecting a standard table, we considered the RP-2014 White Collar, Blue Collar and Total Dataset Healthy Annuitant tables, and the Pub-2010 General Healthy Retiree tables for males and females.

For males, we found that the RP-2014 Blue Collar Annuitant and Pub 2010 General Healthy Retiree tables provided a closer match to the total A/E ratio, but after adjusting all four standard tables with the multiple determined using the credibility method, the RP-2014 Blue Collar Healthy Annuitant table provided the closest overall fit to actual plan experience. Therefore, we recommend the RP-2014 Blue Collar Healthy Annuitant Male table for non-disabled male retirees and inactive members with the rates at each age adjusted by a factor of 1.280.

For females, we found that RP-2014 Blue Collar and Total Dataset Annuitant tables provided a closer match to the total A/E ratio, but after adjusting all four standard tables with the credibility factor, the RP-2014 White Collar table provided a significantly better fit to plan experience. Therefore, we recommend the RP-2014 White Collar Healthy Annuitant Female table for non-disabled female retirees and inactive members with the rates at each age adjusted by a factor of 1.417.

Public Safety Retirees:

Using the credibility approach described above, we found that LASERS Public Safety Retiree mortality experience was 40.2% credible for males and 15.5% credible for females. In selecting a standard table, we considered the RP-2014 White Collar, Blue Collar and Total Dataset Healthy Annuitant tables, and the Pub-2010 Public Safety Healthy Retiree tables for males and females.

We found that the RP-2014 Blue Collar Annuitant tables provided a closer match to the total A/E ratio for males and females. After adjusting all four standard tables with the multiple determined using the credibility method, we found that the RP-2014 Blue Collar Healthy Annuitant table continued to provide the best fit to actual experience for males and females. Therefore, we recommend the RP-2014 Blue Collar Healthy Annuitant tables for non-disabled public safety retirees and inactive members with the rates at each age adjusted by a factor of 1.185 for males and 1.017 for females.

Disability Retiree Mortality (General and Public Safety):

Mortality rates for disability retirees are generally higher than for regular retirees. For Disabled Retirees, the RP-2000 Disabled Retiree Mortality Table with no projection for mortality improvement is currently used for all plans. We reviewed the disability experience separately for General and Public Safety retirees. The Public Safety Disability mortality experience included only 24 deaths over the study period, which resulted in a non-credible experience base. However, even with such a limited experience base, we observed that the mortality experience was significantly higher than what would have been anticipated using the Public Plan Disability mortality tables and the experience was much closer than that of the

General Disability mortality experience. Therefore, we studied the combined General and Public Safety experience.

Using the credibility approach identified above, with 250 male deaths and 307 female deaths, the experience was 48.1% credible for males and 53.3% credible for females. In selecting a standard table, we found that the current table provided a far superior fit than the RP-2014 Disability mortality table or the Public Plan Disability mortality table. Based on our analysis using the limited fluctuation approach, we recommend retaining the current base table but adjusting the male rates by a factor of 1.009 and the female rates by a factor of 1.043.

Future Mortality Improvement:

Currently, the RP-2000 tables are adjusted to include projections for mortality improvement to 2015 using Scale AA. We recommend using the generational approach described above to project future mortality improvement.

The mortality experienced by the LASERS Plans for the 2013 to 2018 plan years does not reflect the trend of mortality improvement seen among the general population. However, we do not believe it is reasonable to expect no future mortality improvement. We considered recommending the MP-2018 mortality improvement scale with adjustments to reduce expected future mortality improvements, but we recognize that, since mortality rates in Louisiana are higher than observed on average nationally, it could be argued that there is more room to improve to the national average experience. However, we have opted to recommend using the full MP-2018 mortality improvement scale to project future improvement. As future experience develops, we may find it necessary to recommend a modified version of the standard improvement table in future studies.

For disabled retirees, we are recommending no future mortality improvement since there does not appear to have been any improvement since the RP-2000 tables were developed.

Impact on Valuation Results

The table below shows the impact of the proposed changes to the accrued liability and normal cost by Plan. Note the change in accrued liability and normal cost are determined based on the recent June 30, 2018 actuarial valuation updated to reflect a 7.65% interest rate, retaining prior decrements for all other assumptions.
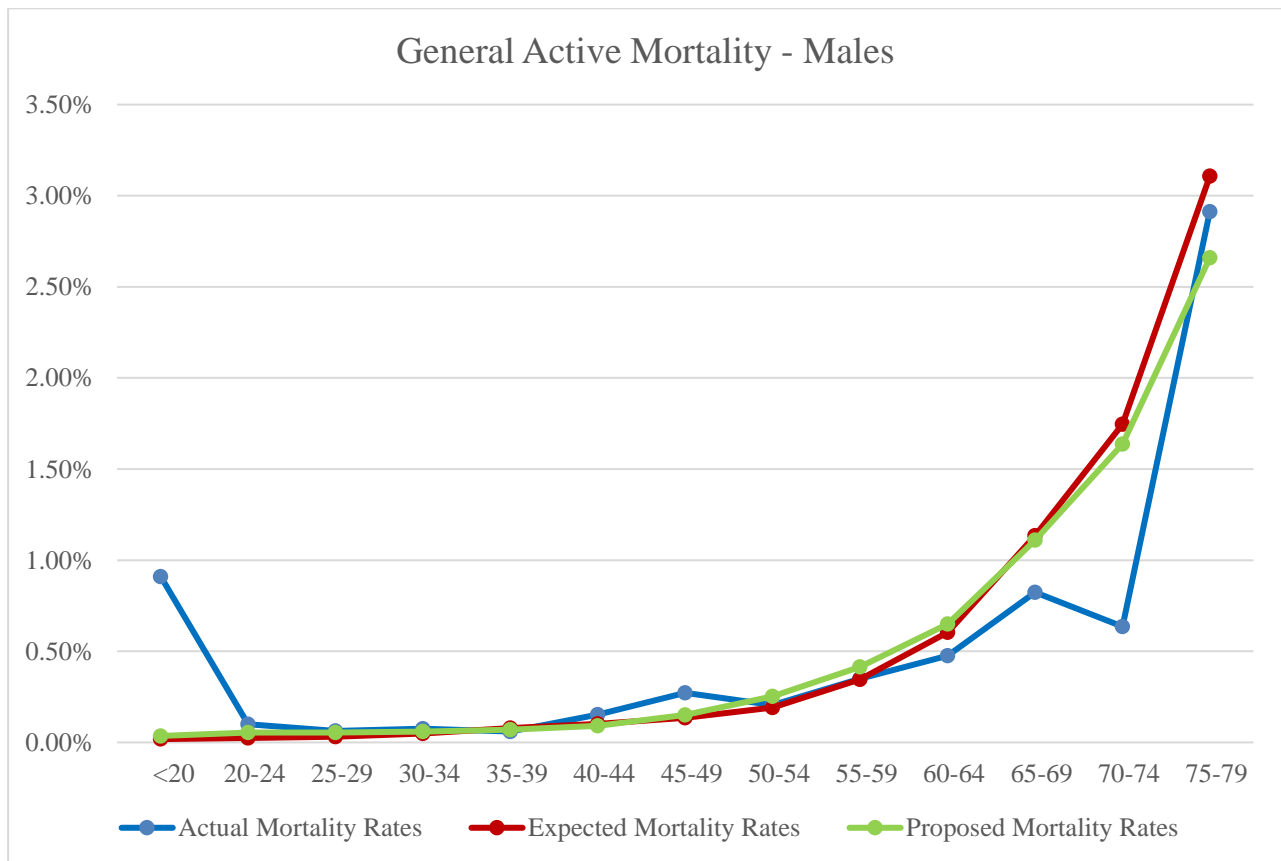
	Change in Accrued Liability	Change in Normal Cost
Rank and File	7,117,508	1,009,731
Judges	1,555,176	63,799
Corrections/Haz	(3,894,884)	7,966
Retirees/Inactive Members	(28,828,470)	0
TOTAL	(24,050,670)	1,081,496

The actual, expected, and proposed mortality rates for General and Public Safety for each active members and healthy retirees and combined General and Public Safety Disability mortality are provided on the following tables. Following the tables are graphs which provide a visual representation of the actual and proposed mortality rates compared to the current assumptions.

Age	Exposed Members	Actual Deaths	Expected Deaths	Actual Death Rate	Current Expected Mortality Rates	Proposed Expected Mortality Rates
<20	110	1	0	0.91%	0.02%	0.04%
20-24	2,002	2	0	0.10%	0.02%	0.05%
25-29	4,823	3	2	0.06%	0.03%	0.05%
30-34	6,628	5	3	0.08%	0.05%	0.06%
35-39	6,708	4	5	0.06%	0.08%	0.07%
40-44	7,220	11	7	0.15%	0.10%	0.09%
45-49	8,847	24	12	0.27%	0.13%	0.15%
50-54	9,771	20	19	0.20%	0.19%	0.25%
55-59	8,573	30	30	0.35%	0.35%	0.41%
60-64	4,631	22	28	0.48%	0.60%	0.65%
65-69	1,822	15	21	0.82%	1.13%	1.11%
70-74	472	3	8	0.64%	1.75%	1.64%
75-79	103	3	0	2.91%	3.11%	2.66%
Total	61,734	145	135	0.23%	0.22%	0.25%

General Active Member Mortality - Males

General Active Mortality - Males

					Current Expected Mortality Rates	Proposed Expected Mortality Rates
Age	Exposed Members	Actual Deaths	Expected Deaths	Actual Death Rate		
<20	63	0	0	0.00%	0.02%	0.02%
20-24	2,165	0	0	0.00%	0.01%	0.02%
25-29	7,909	2	1	0.03%	0.02%	0.02%
30-34	1,1847	4	3	0.03%	0.03%	0.03%
35-39	13,706	8	6	0.06%	0.04%	0.04%
40-44	14,288	17	9	0.12%	0.07%	0.06%
45-49	16,488	24	16	0.15%	0.10%	0.10%
50-54	18,274	30	29	0.16%	0.16%	0.16%
55-59	14,248	48	43	0.34%	0.30%	0.24%
60-64	6,586	15	35	0.23%	0.53%	0.32%
65-69	2,293	13	22	0.57%	0.96%	0.50%
70-74	583	3	9	0.51%	1.53%	0.79%
75-79	101	1	0	0.99%	2.58%	1.34%
Total	108,575	165	175	0.15%	0.16%	0.13%

The table is titled "General Active Member Mortality - Females"

General Active Mortality - Females

Public Safety Active Member Mortality - Males						
Age	Exposed Members	Actual Deaths	Expected Deaths	Actual Death Rate	Current Expected Mortality Rates	Proposed Expected Mortality Rates
<20	93	0	0	0.00%	0.02%	0.03%
20-24	1,117	2	0	0.18%	0.02%	0.05%
25-29	1,611	0	1	0.00%	0.03%	0.05%
30-34	1,797	1	1	0.06%	0.05%	0.06%
35-39	1,872	2	1	0.11%	0.08%	0.07%
40-44	2,363	6	2	0.25%	0.10%	0.09%
45-49	2,365	2	3	0.08%	0.13%	0.15%
50-54	1,668	1	3	0.06%	0.18%	0.24%
55-59	1,053	4	3	0.38%	0.33%	0.40%
60-64	509	5	3	0.98%	0.57%	0.63%
65-69	163	1	2	0.61%	1.09%	1.08%
70-74	34	0	1	0.00%	1.68%	1.60%
75-79	1	0	0	0.00%	3.00%	3.01%
Total	14,647	24	20	0.16%	0.14%	0.16%

Public Safety Active Mortality - Males

					Current Expected Mortality Rates	Proposed Expected Mortality Rates
Age	Exposed Members	Actual Deaths	Expected Deaths	Actual Death Rate		
<20	33	0	0	0.00%	0.00%	0.00%
20-24	738	0	0	0.00%	0.01%	0.02%
25-29	1096	0	0	0.00%	0.02%	0.02%
30-34	1223	2	0	0.16%	0.03%	0.03%
35-39	1320	1	1	0.08%	0.04%	0.04%
40-44	1159	1	1	0.09%	0.06%	0.06%
45-49	1335	6	1	0.45%	0.10%	0.10%
50-54	1233	1	2	0.08%	0.15%	0.15%
55-59	755	3	2	0.40%	0.29%	0.22%
60-64	289	1	1	0.35%	0.49%	0.29%
65-69	70	0	1	0.00%	0.89%	0.44%
70-74	13	0	0	0.00%	1.46%	0.78%
75-79	1	0	0	0.00%	2.40%	1.32%
Total	9,265	15	9	0.16%	0.10%	0.09%

Table title: Public Safety Active Member Mortality - Females

Public Safety Active Mortality - Females

					Current Expected Mortality Rates	Proposed Expected Mortality Rates
Age	Exposed Members	Actual Deaths	Expected Deaths	Actual Death Rate		
50-54	2,275	14	5	0.62%	0.21%	0.63%
55-59	6,282	52	24	0.83%	0.38%	0.90%
60-64	12,106	152	88	1.26%	0.73%	1.29%
65-69	14,370	249	189	1.73%	1.32%	1.94%
70-74	11,166	356	243	3.19%	2.18%	3.00%
75-79	8,737	461	339	5.28%	3.88%	4.88%
80-84	6,260	507	439	8.10%	7.02%	8.01%
85-89	3,505	456	426	13.01%	12.17%	13.33%
90-94	1,169	241	230	20.62%	19.72%	21.55%
95-99	259	81	72	31.27%	27.98%	31.47%
100+	27	13	10	48.15%	36.00%	43.41%
Total	66,156	2,582	2,065	3.90%	3.12%	3.90%

General Retiree/Inactive Mortality - Males

General Retiree/Inactive Mortality - Males

					Current Expected Mortality Rates	Proposed Expected Mortality Rates
				General Retiree/Inactive Mortality - Females		
Age	Exposed Members	Actual Deaths	Expected Deaths	Actual Death Rate		
50-54	5,398	12	10	0.22%	0.18%	0.34%
55-59	15,879	65	53	0.41%	0.33%	0.45%
60-64	27,035	191	172	0.71%	0.64%	0.71%
65-69	26,543	306	297	1.15%	1.12%	1.11%
70-74	18,099	319	339	1.76%	1.87%	1.80%
75-79	12,939	417	394	3.22%	3.04%	3.06%
80-84	8,894	477	450	5.36%	5.05%	5.39%
85-89	6,108	630	544	10.31%	8.91%	9.73%
90-94	2,820	450	413	15.96%	14.65%	17.23%
95-99	722	193	146	26.73%	20.17%	27.65%
100+	81	32	20	39.51%	24.62%	41.44%
Total	124,518	3,092	2,837	2.48%	2.28%	2.48%

General Retiree/Inactive Mortality - Females

					Current Expected Mortality Rates	Proposed Expected Mortality Rates
Age	Exposed Members	Actual Deaths	Expected Deaths	Actual Death Rate		
50-54	1,015	2	2	0.20%	0.21%	0.58%
55-59	1,683	9	6	0.53%	0.37%	0.83%
60-64	2,321	33	17	1.42%	0.72%	1.19%
65-69	2,145	49	28	2.28%	1.29%	1.77%
70-74	958	30	20	3.13%	2.10%	2.70%
75-79	342	20	13	5.85%	3.78%	4.43%
80-84	139	15	9	10.79%	6.75%	7.18%
85-89	32	11	4	34.38%	12.13%	12.29%
90-94	9	6	2	66.67%	19.00%	19.22%
95-99	0	0	0	N/A	N/A	N/A
100+	0	0	0	N/A	N/A	N/A
Total	8,644	175	101	2.02%	1.17%	1.64%

Public Safety Retiree Mortality - Males

Public Safety Retiree/Inactive Mortality - Males

					Current Expected Mortality Rates	Proposed Expected Mortality Rates
Age	Exposed Members	Actual Deaths	Expected Deaths	Actual Death Rate		
50-54	315	1	1	0.32%	0.17%	0.35%
55-59	601	3	2	0.50%	0.33%	0.48%
60-64	710	6	4	0.85%	0.63%	0.69%
65-69	577	5	6	0.87%	1.11%	1.05%
70-74	269	6	5	2.23%	1.83%	1.66%
75-79	110	3	3	2.73%	2.98%	2.77%
80-84	22	1	1	4.55%	4.73%	4.44%
85-89	5	1	0	20.00%	7.80%	7.12%
90-94	0	0	0	N/A	14.00%	14.06%
95-99	0	0	0	N/A	N/A	N/A
100+	0	0	0	N/A	N/A	N/A
Total	2,609	26	23	1.00%	0.88%	0.91%

Table title: Public Safety Retiree Mortality - Females

Public Safety Retiree/Inactive Mortality - Females

Disabled Retiree Mortality - Males						
Age	Exposed Members	Actual Deaths	Expected Deaths	Actual Death Rate	Current Expected Mortality Rates	Proposed Expected Mortality Rates
<20	0	0	0			
20-24	0	0	0			
25-29	0	0	0			
30-34	2	0	0	0.00%	2.00%	2.02%
35-39	17	1	0	5.88%	2.18%	2.20%
40-44	59	0	1	0.00%	2.29%	2.31%
45-49	164	6	4	3.66%	2.60%	2.62%
50-54	403	19	13	4.71%	3.18%	3.21%
55-59	701	27	27	3.85%	3.84%	3.87%
60-64	928	41	42	4.42%	4.51%	4.55%
65-69	798	38	43	4.76%	5.44%	5.49%
70-74	527	28	37	5.31%	6.94%	7.01%
75-79	395	41	36	10.38%	9.13%	9.21%
80-84	200	29	24	14.50%	12.00%	12.11%
85-89	75	12	12	16.00%	15.55%	15.69%
90-94	29	8	6	27.59%	20.52%	20.71%
95-99	0	0	0		29.94%	30.22%
Total	4,298	250	245	5.82%	5.70%	5.76%

Disability Retiree Mortality - Males

Disabled Retiree Mortality - Females						
Age	Exposed Members	Actual Deaths	Expected Deaths	Actual Death Rate	Current Expected Mortality Rates	Proposed Expected Mortality Rates
<20	0	0	0			
20-24	0	0	0			
25-29	0	0	0			
30-34	1	0	0	0.00%	1.00%	1.04%
35-39	26	0	0	0.00%	0.73%	0.76%
40-44	65	3	0	4.62%	0.75%	0.79%
45-49	272	4	3	1.47%	0.94%	0.98%
50-54	668	13	9	1.95%	1.38%	1.43%
55-59	1,256	35	24	2.79%	1.89%	1.97%
60-64	1,676	44	40	2.63%	2.41%	2.51%
65-69	1,358	44	43	3.24%	3.14%	3.28%
70-74	1,090	47	46	4.31%	4.26%	4.44%
75-79	777	47	46	6.05%	5.92%	6.17%
80-84	430	35	35	8.14%	8.12%	8.47%
85-89	201	24	23	11.94%	11.28%	11.77%
90-94	76	9	12	11.84%	15.47%	16.14%
95-99	15	2	3	13.33%	20.87%	21.76%
Total	7,911	307	284	3.88%	3.59%	3.75%

Disability Retiree Mortality - Females
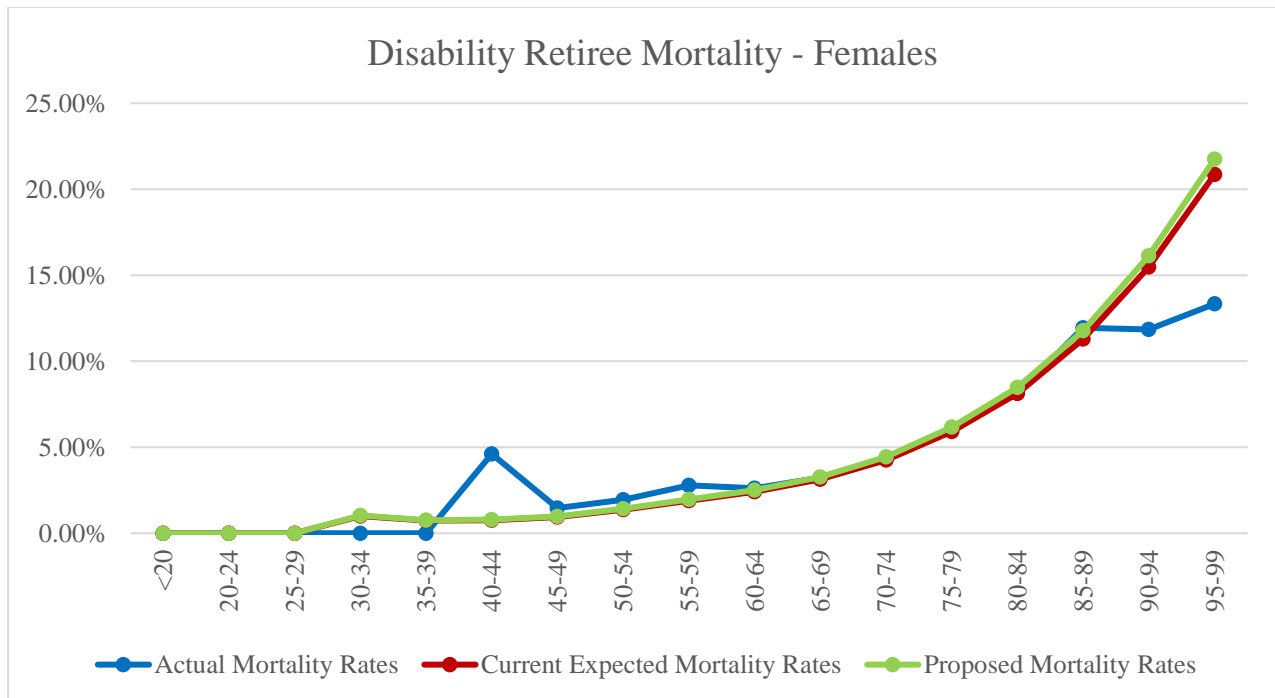
DISABILITY INCIDENCE RATES

The disability incidence assumption is the probability that a member will become disabled while actively participating in the plan. A review of past experience compared to the current assumption will provide the basis for examining the assumption.

Current Assumptions

Rank and File, Judges, and Corrections/Hazardous Duty currently each have distinct tables of disability assumptions that vary by member age.

Experience and Proposed Assumptions

The rates illustrated are unisex and represent the probability of disability, given the member had met the eligibility requirements. If the member did not meet the eligibility requirements at a given age, the member's exposure was excluded for that age. As shown on the tables following the end of this section, the overall disability experience varies by Plan.

Rank and File – The rate of disability incidence was less than expected for almost all ages. The actual aggregate rate of disabilities was 0.09% compared to an expected aggregate rate of 0.16%. In the prior experience study, the aggregate disability rate was 0.17%. Therefore, we are recommending decreasing the disability assumptions at almost all ages, but not quite to the level of actual experience for the most recent period.

Judges – This group experienced no disabilities during the study period. The expected aggregate rate of disabilities was 0.02%, which equaled the actual experience during the prior period. We propose maintaining the prior assumption of 0.02% from ages 45 to 69 and 0% for all other ages.

Corrections/Hazardous Duty – The Corrections/Hazardous Duty plans experienced a higher incidence of disabilities than previously expected. The aggregate rate of disability retirements was 0.23% compared to the expected aggregate rate of 0.19%. We recommend increasing the disability rates at most ages, with decreases for a few ages where actual experience was less than expected. All proposed rates are between the prior expected rates and actual experience.

Impact on Valuation Results

The table below shows the impact of the proposed changes to the accrued liability and normal cost by Plan. Note the change in accrued liability and normal cost are determined based on the recent June 30, 2018 actuarial valuation updated to reflect a 7.65% interest rate, retaining prior decrements for all other assumptions.
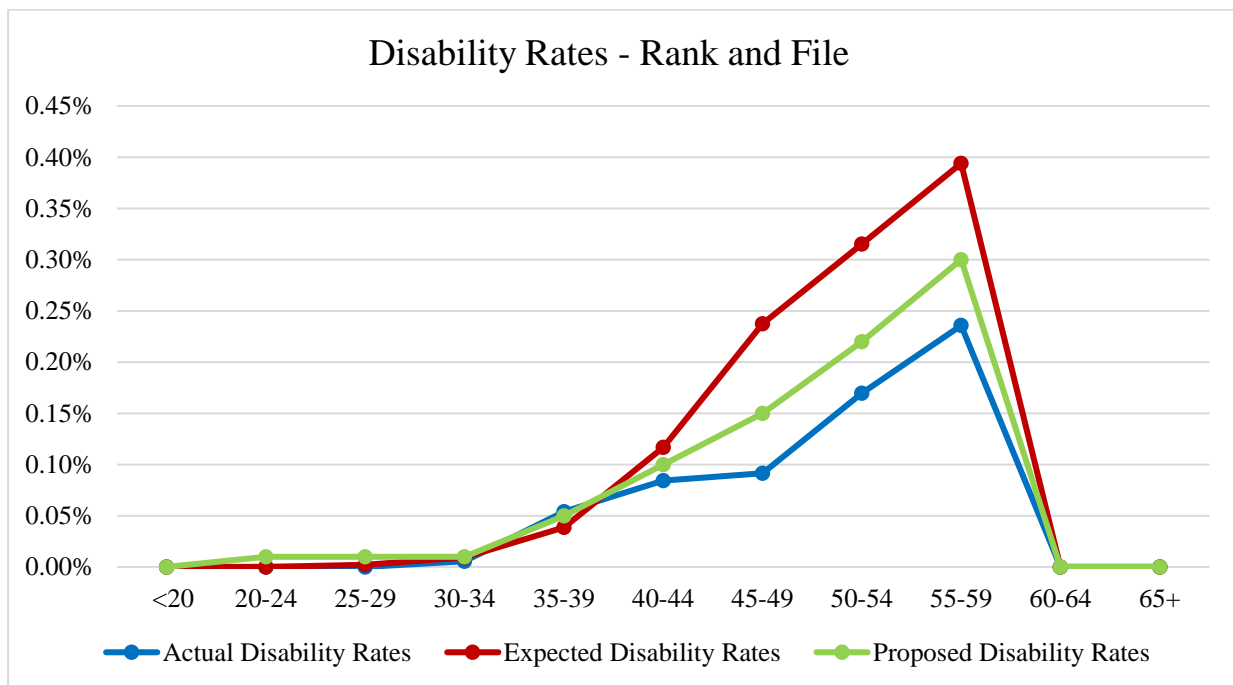
	Change in Accrued Liability	Change in Normal Cost
Rank and File	(292,505)	12,910
Judges	239	(97)
Corrections/Hazardous Duty	(1,516,243)	(9,205)
TOTAL	(1,808,509)	3,608

The actual, expected, and proposed rates of disability are provided on the following tables. Following the tables are graphs which provide a visual representation of the actual and proposed disability rates compared to the current assumptions.

| Rank and File – Disability Rates						
Age	Eligible Members	Actual Disabilities	Expected Disabilities	Actual Disability Rates	Expected Disability Rates	Proposed Disability Rates
<20	173	0	0	0.00%	0.00%	0.00%
20-24	4,167	0	0	0.00%	0.00%	0.01%
25-29	12,732	0	0	0.00%	0.00%	0.01%
30-34	18,469	1	2	0.01%	0.01%	0.01%
35-39	20,384	11	8	0.05%	0.04%	0.05%
40-44	21,390	18	25	0.08%	0.12%	0.10%
45-49	25,123	23	60	0.09%	0.24%	0.15%
50-54	27,723	47	87	0.17%	0.32%	0.22%
55-59	22,486	53	89	0.24%	0.39%	0.30%
60-64	10,903	0	0	0.00%	0.00%	0.00%
65+	5,148	0	0	0.00%	0.00%	0.00%
Total	168,698	153	270	0.09%	0.16%	0.12%

Disability Rates - Rank and File

Age	Eligible Members	Actual Disabilities	Expected Disabilities	Actual Disability Rates	Expected Disability Rates	Proposed Disability Rates
		Corrections/Hazardous Duty – Disability Rates				
<20	126	0	0	0.00%	0.00%	0.00%
20-24	1,855	0	0	0.00%	0.00%	0.01%
25-29	2,707	0	0	0.00%	0.00%	0.01%
30-34	3,020	2	0	0.07%	0.00%	0.05%
35-39	3,192	3	6	0.09%	0.18%	0.13%
40-44	3,522	3	8	0.09%	0.23%	0.17%
45-49	3,700	12	9	0.32%	0.24%	0.28%
50-54	2,900	18	11	0.62%	0.38%	0.55%
55-59	1,808	16	12	0.88%	0.68%	0.80%
60-64	798	0	0	0.00%	0.00%	0.00%
65+	283	0	0	0.00%	0.00%	0.00%
Total	23,911	54	46	0.23%	0.19%	0.22%

Corrections/Hazardous Duty - Disability Rates
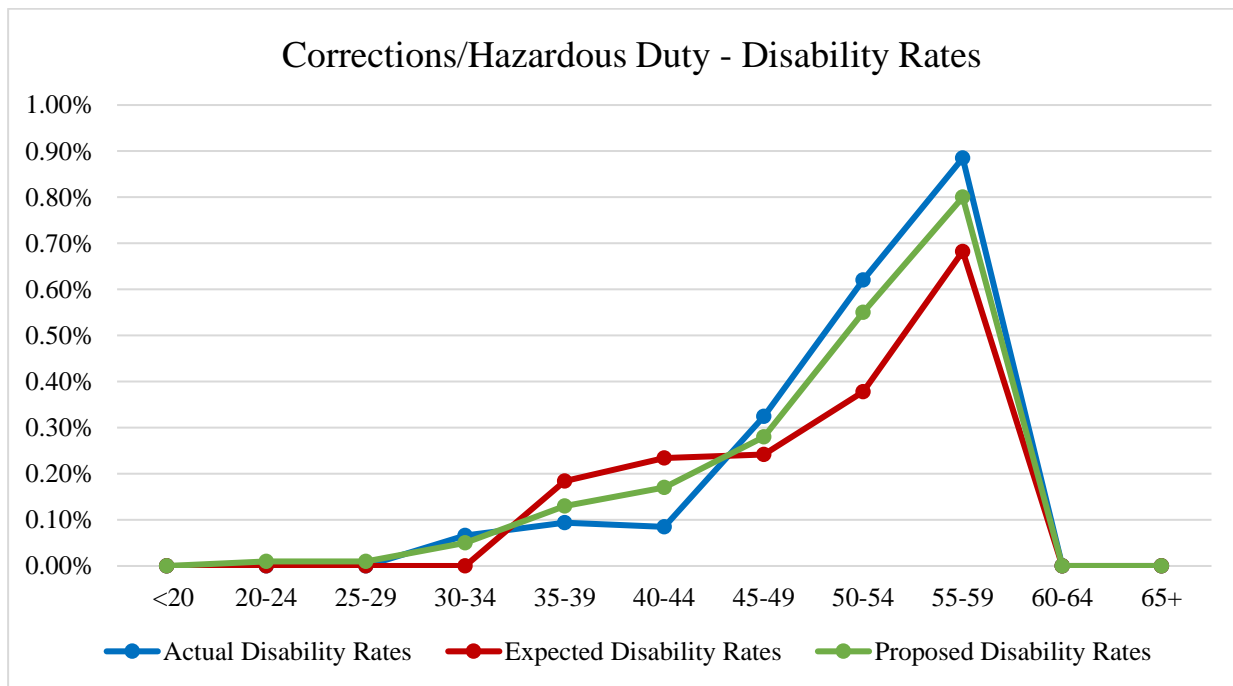
OTHER ASSUMPTIONS

Deferred vested: Currently, the valuation assumes 80% of participants that leave the system as vested members will receive a deferred benefit upon attaining the retirement eligibility requirements. We believe this assumption reasonable and recommend no changes

Dependent/minor children: Current dependent/minor children statistics are based on population reports published by the United States Census Bureau. We recommend no changes to these assumptions.

Spouse's age: Male spouses are assumed to be 3 years older. Correspondingly, female spouses are assumed to be three years younger. We recommend no changes to this assumption.

Marital status: The current valuation assumes that 75% of active members are married. This statistic is used to determine the probability that spousal benefits will be payable in the event of an active member's death. We are not provided the marital status on the census data, but as this is common assumption for public plans, and we believe it to be reasonable, so we recommend no changes to this assumption.

Unisex rates: For valuation purposes, we use sex distinct mortality rates. However, for service purchases, service transfers, and option factors it is appropriate to use unisex rates. We currently assume that the membership is 50% female and 50% male to determine unisex rates. We recommend revising these assumptions to be 40% male and 60% female to be more representative of current LASERS membership.

Option factors: The current option factors are based on the mortality table and the 7.50% discount rate to which the Board is incrementally moving. We recommend revising the factors to be based on the proposed base mortality tables for retirees using a single table determined as 90% general and 10% public safety and we recommend retaining the 7.50% discount rate. We recommend using a static projection of mortality improvement to the middle of the next five-year experience study period (i.e., 2020) rather than using a fully generational projection (which could produce different rates each year).

Unused annual leave service credit adjustments: Retirements during the five-year observation period were reviewed to determine the amount of leave credit converted to service credit or lump sum at retirement. Since leave credit is accrued throughout the duration of the member's career, the average converted credit is expressed as a percentage increase of the accrued benefit as shown below. Proposed rates for members retiring after DROP are the same as those proposed for regular retirement.

Since leave credit is accrued throughout the duration of the member's career, we recognize the anticipated average service credit to be converted as a percentage increase of the accrued benefit. Based on recent plan experience, we recommend revising this assumption as follows.

	Prior Rates		Recommended Rates	
	Regular Retirement	Disability	Regular Retirement	Disability
Regular Members	3.5%	1.5%	5.0%	1.5%
Judges	1.0%	1.0%	0.5%	1.0%
Corrections	5.0%	3.0%	9.0%	3.0%
Wildlife	6.0%	3.0%	9.0%	3.0%
Rehired Retirees	N/A	N/A	7.5%	N/A

Impact on Valuation Results

The table below shows the impact of the proposed changes to the accrued liability and normal cost by Plan. Note the change in accrued liability and normal cost are determined based on the recent June 30, 2018 actuarial valuation updated to reflect a 7.65% interest rate, retaining prior decrements for all other assumptions.

	Change in Accrued Liability	Change in Normal Cost
Rank and File	155,411,040	16,376,182
Judges	(710,646)	(35,554)
Hazardous Duty Plans	18,614,148	415,530
TOTAL	173,314,542	16,756,158