

# State Universities Retirement System of Illinois

2021 Experience Review Covering the Period  
June 30, 2017, to June 30, 2020





June 1, 2021

Board of Trustees  
State Universities Retirement System of Illinois  
1901 Fox Drive  
Champaign, Illinois 61820

**Subject: Experience Review Covering the Period June 30, 2017, to June 30, 2020**

Dear Members of the Board:

At your request, we have performed a review of the actuarial assumptions used in the annual actuarial valuation of the State Universities Retirement System of Illinois ("SURS"). The primary purpose of the study is to determine the continued appropriateness of the current actuarial assumptions by comparing actual experience to expected experience. Our study was based on census information for the period from June 30, 2017, to June 30, 2020, as provided by SURS Staff.

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

- Price Inflation,
- Investment Return,
- Salary Increases,
- Wage Inflation (based on uncapped pay),
- Effective Rate of Interest,
- Mortality,
- Disability,
- Withdrawal, and
- Retirement.

The results of this analysis are set forth in Section II of this report. Section III contains the cost impact on the Statutory contribution and funded status of the plan as a result of the assumption modifications. Finally, Section IV contains a summary of all proposed rates.

Amy Williams and Brian B. Murphy are Members of the American Academy of Actuaries ("MAAA") and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions herein.

The signing actuaries are independent of the plan sponsor.

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

This report was prepared using our proprietary valuation model and related software which in our professional judgment has the capability to provide results that are consistent with the purposes of the valuation. We performed tests to ensure that the model reasonably represents that which is intended to be modeled.

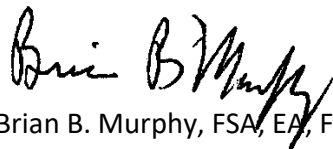
This report is based upon information, furnished to us by SURS, concerning retirement and ancillary benefits, active members, deferred vested members, retirees and beneficiaries, and financial data. If your understanding of this information is different, please let us know. This information was checked for internal consistency, but it was not audited.

The results of the experience study and recommended assumptions set forth in this report are based on the data and actuarial techniques and methods described above, and upon the provisions of SURS as of the most recent valuation date, June 30, 2020. To the best of our knowledge the information contained in this report is accurate and fairly presents the experience of members participating in the SURS defined benefit plans for the period June 30, 2017, through June 30, 2020. All calculations have been made in conformity with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board.

Respectfully submitted,



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AW/BBM:bd



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## **SECTION I**

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### **EXPERIENCE REVIEW SUMMARY**

# Experience Review Summary

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## Background

For any pension plan, actuarial assumptions are selected that are intended to provide reasonable estimates of future expected events, such as System investment returns, interest crediting, and patterns of retirement, turnover and mortality. These assumptions, along with an actuarial cost method, the employee census data and the plan's provisions are used to determine the actuarial liabilities and overall actuarially determined funding requirements for the plan. The true cost to the plan over time will be the actual benefit payments and expenses required by the plan's provisions for the participant group under the plan. To the extent the actual experience deviates from the assumptions, experience gains and losses will occur. These gains (losses) then serve to reduce (increase) future actuarially determined contributions and increase (reduce) the funded ratio. The actuarial assumptions should be individually reasonable and consistent in the aggregate. They should also be reviewed periodically to ensure that they remain appropriate. The actuarial cost method, for plan sponsors that use actuarially based funding policies, automatically adjusts contributions over time for differences between what is assumed and the actual experience under the plan.

## Actuarial Standards of Practice ("ASOPs")

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

- (1) ASOP No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*;
- (2) ASOP No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*;
- (3) ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*;
- (4) ASOP No. 44, *Selection and Use of Asset Valuation Methods for Pension Valuations*; and
- (5) ASOP No. 51, *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions*.

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

## Assumptions Reviewed

The actuarial assumptions are usually divided into two categories:

- (1) Economic assumptions, which include:
  - Assumed rate of price inflation (as measured by the change in the Consumer Price Index for all urban consumers)
    - Underlies all other economic assumptions
    - Basis for cost-of-living increases for members hired on or after January 1, 2011
  - Assumed long-term rate of return on investments (prescribed rate as defined in statute)
    - Rate at which projected benefits are reduced to present value
    - Basis for money purchase annuity factors



## Experience Review Summary

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- Assumed effective rate of interest (rate at which member contributions are accumulated to generate benefits under the Money Purchase Benefit formula – Rule 2)
- General wage increases
  - Reflects inflationary forces on increases in pay for all members

The economic assumptions are generally chosen on the basis of the actuary's expectations as to the effect of future economic conditions on the operation of the plan, with input from Staff, the Board and other investment advisors.

The economic assumptions will be reviewed later this spring. This study includes review of the demographic assumptions.

(2) Demographic assumptions, which include the following rates:

- Mortality,
- Retirement,
- Disablement, and
- Withdrawal (other termination of employment).

Demographic assumptions are generally based on the plan's own experience, taking into account emerging trends. Rates of salary increase due to promotion and longevity are also related to the plan's experience.

The accuracy and extent of the data is an important consideration in assessing demographic experience. The accuracy of the data for this study was generally good, but a very large amount of data is required to develop a credible mortality table. The approach we have taken to recommending a mortality assumption for the SURS actuarial valuation is based on the model described by the Society of Actuaries (SOA). In effect, we select a base mortality table from the Pub-2010 mortality tables and a mortality improvement scale. We then use what is termed "the limited fluctuation credibility procedure" to determine the appropriate scaling factor of the base mortality tables for each gender and each member classification.

(3) Other methods and assumptions including the following:

- a. Cost method,
- b. Amortization method,
- c. Asset smoothing method,
- d. Dependent assumptions,
- e. Assumptions on reciprocal service and service purchases,
- f. Assumptions on refund of contributions vs. deferred annuity,
- g. Pay increase and decrement timing assumptions, and
- h. Plan election assumptions (Traditional/Portable vs. Retirement Savings Plan).

### **Key Findings and Recommendations**

Gabriel, Roeder, Smith & Company ("GRS") has performed an experience study of the State Universities Retirement System of Illinois ("SURS") for the period from June 30, 2017, to June 30, 2020. The primary



# Experience Review Summary

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purpose of the study was to compare the SURS plan experience and future expectations for experience against the actuarial assumptions used in the actuarial valuation. Our study was based on the information used to perform the annual actuarial valuations for the period from June 30, 2017, to June 30, 2020.

Following is a summary of the key findings and recommendations:

- **Price inflation:** We recommend maintaining the rate of assumed inflation of 2.25 percent.
- **Investment return:** We recommend decreasing the investment return assumption from 6.75 percent to 6.50 percent. This reflects decreasing the assumed real rate of return from 4.50 percent to 4.25 percent and maintaining the underlying assumed price inflation of 2.25 percent. We will monitor the assumptions for continued reasonableness in the future.
- **General wage inflation assumption:** We recommend decreasing the general wage inflation assumption from 3.25 percent to 3.00 percent. This reflects decreasing the assumed rate for productivity increases from 1.00 to 0.75 percent and maintaining the underlying assumed price inflation of 2.25 percent.
- **Salary increase:** We recommend modifying the overall assumed salary increase rates. This reflects maintaining the price inflation assumption of 2.25 percent and modifying the assumed real rates of salary increase for certain years of service based on the observed experience and using different salary increase rates for people age 50 and older.
- **Effective rate of interest assumption:** We recommend the long-term assumption for the ERI for crediting the money purchase accounts be reduced, from 6.75 percent per year to 6.50 percent per year, consistent with the 25 basis point decrease in the investment return assumption.
- **Normal retirement rates:** We recommend separate rates for members in Academic positions than for members in Non-Academic positions. The overall rates for Academic members are lower and the overall rates for Non-Academic members are higher than under our current assumptions based on the observed experience.
- **Early retirement rates:** We recommend separate rates for members in Academic positions than for members in Non-Academic positions. The overall rates for Academic members are lower and the overall rates for Non-Academic members are higher than under our current assumptions based on the observed experience.
- **Turnover rates:** We recommend separate rates for members in Academic positions than for members in Non-Academic positions. In total, the proposed turnover rates produce fewer expected number of terminations than the current turnover rates for both Academic and Non-Academic members.
- **Mortality rates:** We recommend:
  - Using the Pub-2010 Mortality tables that are based on public sector pension plan experience;
  - Using the Pub-2010 Mortality tables for Teachers for the Academic non-disabled members and using the Pub-2010 Mortality tables for General Employees for the Non-Academic non-disabled members;
  - Using the Pub-2010 Disabled Mortality table for Non-Safety Employees for both Academic and Non-Academic disabled members;



# Experience Review Summary

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- Updating the projection scale from the MP-2017 to the MP-2020 scale;
- Maintaining the MP-2020 projection scale until the assumptions are studied with the next experience study; and
- Applying certain scaling factors to the base tables based on the actual experience and the credibility that can be applied to that experience.

The specific mortality table recommendations and a more detailed description of the new mortality tables can be found in Section II.

- **Disability rates:** We recommend separate rates for members in Academic positions than for members in Non-Academic positions and maintaining separate rates for males and females. We recommend decreasing the current disability rates for Academic members and increasing the current disability rates for Non-Academic members based on observed experience. We recommend including a small load on projected benefit payments to reflect the disability benefits expected to be paid to members who do not receive benefits on a long-term basis.
- **Money purchase conversion factor assumptions:** By statute, the money purchase conversion factors are to be updated when the investment return assumption and/or the mortality assumption are updated. Therefore, the recommended changes will result in updates to the money purchase conversion factors. We recommend a blended mortality assumption be used for purposes of the money purchase conversion factors that would apply to both Academic and Non-Academic members.
- **Cost Method:** The actuarial cost method is Projected Unit Credit, which is required to be used by State Statute.
- **Amortization Method:** The State Statute requires that the plan be funded at a level such that the funded ratio reaches 90% in the year 2045. There is no separate amortization of the unfunded accrued liability that leads to a 100% funding of the accrued liability. The statutory funding method generates a contribution requirement that is less than a reasonable actuarially determined contribution because the funding method targets 90% instead of 100%.
- **Asset Smoothing Method:** The asset smoothing method is also defined by State Statute. Gains and losses (the difference between the actual investment return and the expected investment return) are smoothed in over a five-year period at a rate of 20 percent per year. There is currently no asset corridor. An asset corridor limits the amount that the actuarial (smoothed) value of assets can deviate from the market value of assets. Because the statutory funding policy defers contributions, we recommend that an asset corridor of 80 percent to 120 percent of market value of assets be implemented. However, our understanding is that this change could require legislative action.
- **Plan Election:** We recommend changing the plan election assumptions to 75 percent elect Tier 2 and 25 percent elect to participate in the Retirement Savings Plan (RSP) for the Non-Academic members and changing to 55 percent elect Tier 2 and 45 percent elect to participate in the Retirement Savings Plan (RSP) for the Academic members.
- **Load for reciprocal benefits, service purchases and refunds of excess contributions:** We recommend maintaining the liability load of 10 percent on the liabilities for service retirees whose benefits have not been finalized and a “best formula” benefit has not been provided and a 5.00 percent load if a “best formula” benefit has been provided.

## Experience Review Summary

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- **Pay increases during the final rate of earnings period (used for 6% employer billing contributions):** We recommend maintaining the current assumption that pay increases will be lower 6.00 percent during the final average earnings period and therefore there will be no contributions received or liability losses generated by members receiving pay increases in excess of 6.00 percent during the final average earnings period.
- **Buyout election assumptions:** We recommend maintaining the buyout election assumption of 0% until the program ends or conditions change. This means that the savings from the buyout program will be recognized each year as they occur – a common approach for this type of program.

Section III contains the cost impact on the Statutory contribution and funded status of the plan as a result of the assumption modifications. The recommended demographic assumptions decrease the actuarial liability and alternate policy (normal cost plus amortization of the unfunded liability) contribution requirement and increase the funded ratio.

In order to maintain the fiscal health of SURS, and to comply with the Actuarial Standards of Practice (applicable to all actuaries who practice in the United States), it is important to select actuarial assumptions that reflect realistic estimates of future investment returns.

One factor to keep in mind is that Public Act 100-0023 requires any change in an actuarial assumption that increases or decreases the required State contribution to be implemented in equal annual amounts over a five-year period beginning in the state fiscal year in which the change first applies to the required state contribution. For changes that first applied in FY 2014, FY 2015, FY 2016 or FY 2017, the impact is calculated based on a five-year period and the applicable portion is recognized during the remaining fiscal years in that five-year period. Any contribution increases attributable to changes in actuarial assumptions first effective in the June 30, 2021, actuarial valuation will be recognized over five years beginning with the fiscal year 2023 Statutory contribution.

## **SECTION II**

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### **EXPERIENCE ANALYSIS**

# Economic Assumptions

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

These assumptions are based, at their core, on the assumed level of price inflation. Each economic assumption is then developed from expected spreads over price inflation. Since price inflation is relatively volatile and is subject to a number of influences not based on recent history, economic assumptions are less reliably based on recent past experience than are the demographic assumptions.

The key economic assumptions are:

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

## Actuarial Standard of Practice No. 27

ASOP No. 27 provides guidance related to selecting economic assumptions, including the investment return, discount rate, inflation, postemployment benefit increases, compensation increases and any other related economic assumptions, such as the Effective Rate of Interest (ERI) assumption.

In developing specific actuarial assumptions, ASOP No. 27 requires the actuary to follow a general process of:

- (1) Identifying the components of the assumption;
- (2) Evaluating relevant data;
- (3) Considering specific and general factors related to the measurement; and
- (4) Selecting a reasonable assumption.

In evaluating relevant data, the actuary should include appropriate recent and long-term historic data, but not give undue weight to recent experience.

Further, under ASOP No. 27, an assumption is considered reasonable if:

- It is appropriate for the purpose of the measurement;
- It reflects the actuary's professional judgment;
- It takes into account historical and current economic data that is relevant as of the measurement date;
- It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
- It has no significant bias (i.e., it is not significantly optimistic or pessimistic).

Also according to the ASOP No. 27, 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



## Economic Assumptions

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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.

### Inflation

By “inflation,” we mean price inflation, as measured by annual increases in the Consumer Price Index (CPI). This inflation assumption underlies all of the other economic assumptions we employ. It not only impacts investment return, but also salary increase rates and the general wage inflation assumption. The current annual inflation assumption is 2.25 percent.

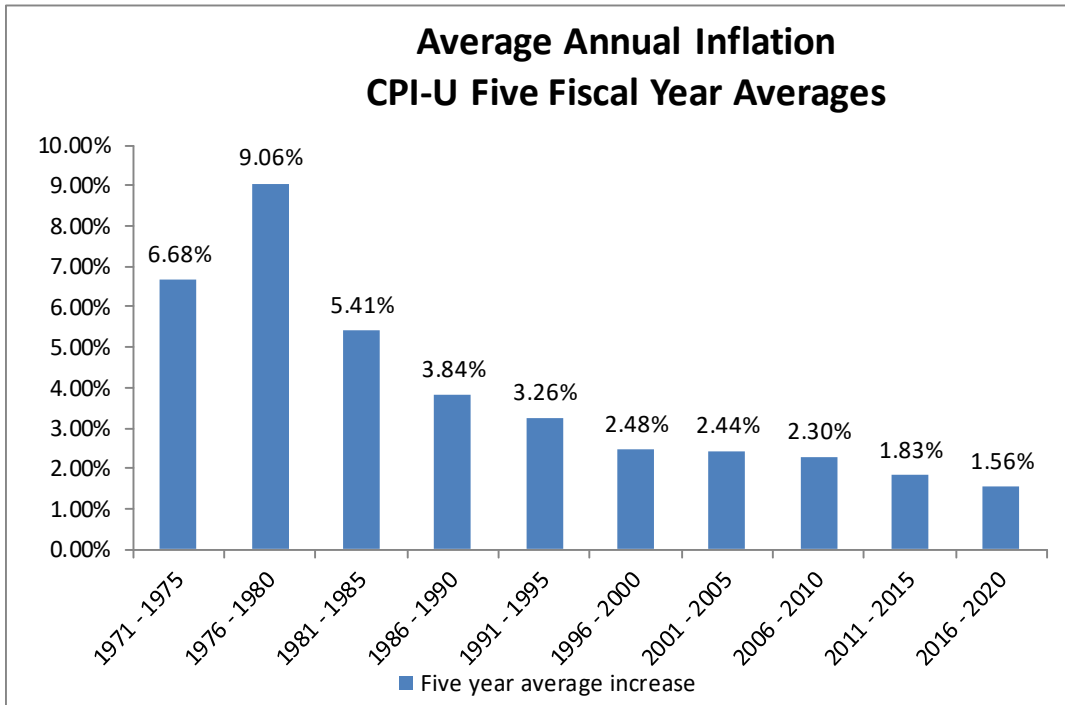
Over the five-year period from June 2015 through June 2020, the CPI-U has increased at an average rate of 1.56 percent. However, please remember that the assumed inflation rate is only weakly tied to past results.

The following table shows the average inflation over various periods, ending June 2020.

Fiscal Year	Annual Increase in CPI-U
2015-16	1.00%
2016-17	1.63%
2017-18	2.87%
2018-19	1.65%
2019-20	0.65%
3-Year Average	1.72%
5-Year Average	1.56%
10-Year Average	1.69%
20-Year Average	2.03%
25-Year Average	2.12%
30-Year Average	2.31%
40-Year Average	2.88%
50-Year Average	3.86%

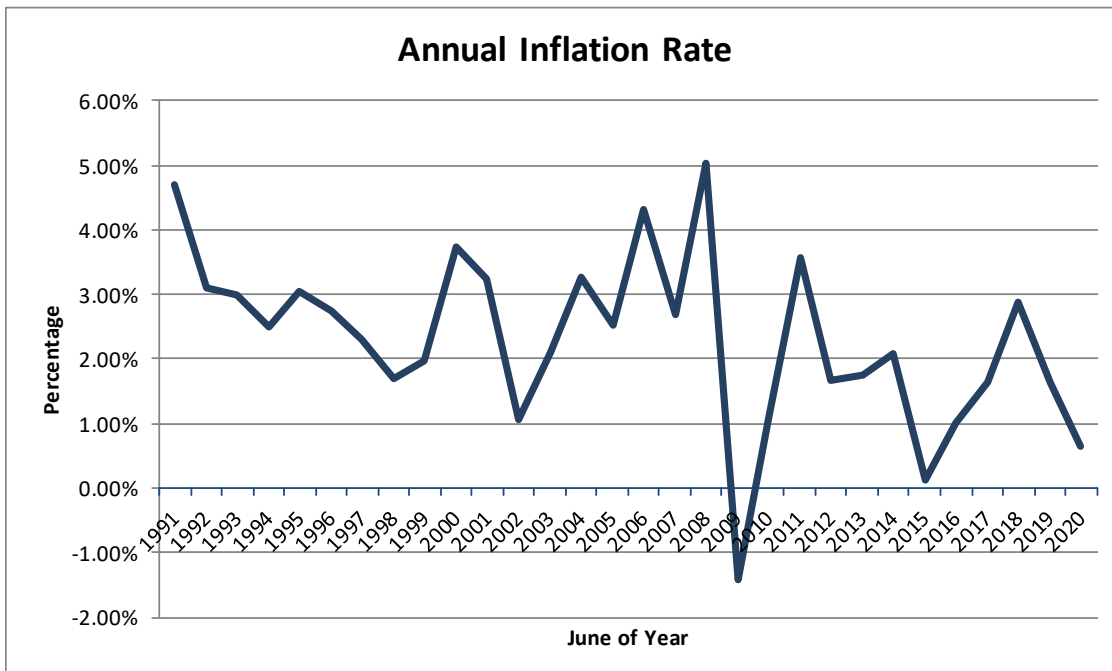
The graph on the next page shows the average annual inflation, as measured by the increase in CPI-U, in each of the 10 consecutive 5-year periods over the last 50 years.

## Economic Assumptions



As the above chart illustrates, the high inflation of the 1970s and 1980s is well in the past. The geometric average annual increase in price inflation was 2.31 percent per year over the last 30 years from June 1990 to June 2020, 2.03 percent over the last 20 years and 1.69 percent over the last 10 years.

The following graph illustrates the rate of inflation on a year by year basis over the last 30 years.



Since price inflation is relatively volatile and is subject to a number of influences not based on recent history, economic assumptions are less reliably based on recent past experience than are the demographic

## Economic Assumptions

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assumptions. Therefore, it is important not to give undue weight to recent experience. We must also consider future expectations as well.

Another source of information about future inflation is the market for US Treasury bonds. As of December 2020, the Treasury Breakeven Inflation (TBI) Curve was 1.90 percent for 10 years, 1.94 percent for 20 years, and 2.08 percent for 30 years. Simplistically, this implies that inflation over the next 30 years would average 2.08 percent.

However, this analysis is not perfect as it ignores (1) the inflation risk premium that buyers of US Treasury bonds often demand, as well as (2) possible differences in liquidity between US Treasury bonds and Treasury Inflation-Protected Securities (TIPS).

We also surveyed the inflation assumption used by well-known investment consulting firms across the country. In our sample of these firms, the inflation assumption ranged from 1.92 percent to 3.10 percent (with the next highest assumption being 2.40 percent), with an average of 2.19 percent.

Another point of reference is the Social Security Administration's (SSA) 2020 Trustees Report, in which the Office of the Chief Actuary is projecting a long-term average ultimate annual inflation rate of 1.8 percent in the high cost projection scenario, 2.4 percent under the intermediate cost projection scenario and 3.0 percent in the low cost projection scenario. The Social Security Trustees report uses the ultimate rates for their 75-year projections, much longer than the longest horizon we can discern from Treasuries and TIPS.

The following table presents a summary of inflation rate forecasts from various professional experts.

## Economic Assumptions

Forward-looking Annual Inflation Forecasts <sup>a</sup>	
<b>Congressional Budget Office<sup>b</sup></b>  5-Year Annual Average 10-Year Annual Average	  1.68% 1.94%
<b>Federal Reserve Bank of Philadelphia<sup>c</sup></b>  5-Year Annual Average 10-Year Annual Average	  2.00% 2.12%
<b>Federal Reserve Bank of Cleveland<sup>d</sup></b>  10-Year Expectation 20-Year Expectation 30-Year Expectation	  1.42% 1.69% 1.90%
<b>Federal Reserve Bank of St. Louis<sup>e</sup></b>  10-Year Breakeven Inflation 20-Year Breakeven Inflation 30-Year Breakeven Inflation	  1.81% 2.01% 2.00%
<b>U.S. Department of the Treasury<sup>f</sup></b>  10-Year Breakeven Inflation 20-Year Breakeven Inflation 30-Year Breakeven Inflation 50-Year Breakeven Inflation 100-Year Breakeven Inflation	  1.90% 1.94% 2.08% 2.13% 2.17%
<b>Social Security Trustees<sup>g</sup></b>  Ultimate Intermediate Assumption	  2.40%

<sup>a</sup>End of the Fourth Quarter, 2020. Version 2021-01-25 by Gabriel, Roeder, Smith & Company.

<sup>b</sup>*An Update to the Economic Outlook: 2020 to 2030*, Release Date: July 2020, Consumer Price Index (CPI-U), Percentage Change from Year to Year, 5-Year Annual Average (2020 - 2024), 10-Year Annual Average (2020 - 2029).

<sup>c</sup>*Fourth Quarter 2020 Survey of Professional Forecasters*, Release Date: November 16, 2020, Headline CPI, Annualized Percentage Points, 5-Year Annual Average (2020 - 2024), 10-Year Annual Average (2020 - 2029).

<sup>d</sup>Inflation Expectations, Model output date: December 1, 2020.

<sup>e</sup>The breakeven inflation rate represents a measure of expected inflation derived from X-Year Treasury Constant Maturity Securities and X-Year Treasury Inflation-Indexed Constant Maturity Securities. Observation date:

<sup>f</sup>*The Treasury Breakeven Inflation (TBI) Curve*, Monthly Average Rates, December, 2020.

<sup>g</sup>*The 2020 Annual Report of The Board of Trustees of The Federal Old-Age And Survivors Insurance and Federal Disability Insurance Trust Funds*, April 22, 2020, Long-range (75-year) assumptions, Intermediate, Consumer Price Index (CPI-W), for 2024 and later.



## Economic Assumptions

Following is a table with a summary of inflation rate forecasts from the various professional experts at different points in time. It is interesting to note the difference in the inflation forecasts from quarter to quarter during 2020.

Forward-Looking Price Inflation Forecasts			
Congressional Budget Office	6/30/2020	9/30/2020	12/31/2020
5-Year Annual Average	2.46%	1.68%	1.68%
10-Year Annual Average	2.38%	1.94%	1.94%
Federal Reserve Bank of Philadelphia			
5-Year Annual Average	2.00%	1.90%	2.00%
10-Year Annual Average	2.14%	2.03%	2.12%
Federal Reserve Bank of Cleveland			
10-Year Expectation	1.23%	1.35%	1.42%
20-Year Expectation	1.58%	1.64%	1.69%
30-Year Expectation	1.81%	1.86%	1.90%
Federal Reserve Bank of St. Louis			
10-Year Breakeven Inflation	1.18%	1.76%	1.81%
20-Year Breakeven Inflation	1.55%	1.80%	2.01%
30-Year Breakeven Inflation	1.55%	1.76%	2.00%
U.S. Department of the Treasury			
10-Year Breakeven Inflation	1.24%	1.62%	1.90%
20-Year Breakeven Inflation	1.41%	1.67%	1.94%
30-Year Breakeven Inflation	1.71%	1.87%	2.08%
50-Year Breakeven Inflation	1.84%	1.95%	2.13%
100-Year Breakeven Inflation	1.93%	2.01%	2.17%
Social Security Trustees			
Ultimate Intermediate Assumption	2.40%	2.40%	2.40%

Based on this information, our opinion is that it would be reasonable to maintain the current price inflation assumption of 2.25 percent. (The Federal Reserve's target and the Social Security Trustees' ultimate high cost assumptions are both between 1.75 percent and 2.00 percent.)

## Economic Assumptions

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### **Retiree Cost-of-Living Adjustment (COLA) and Increases in the Pay Cap for Pensionable Pay for Participants Hired on and After January 1, 2011**

Automatic annual increases in the retirement annuity differ for employees who first become a participant before or on or after January 1, 2011. Employees who first became a participant before January 1, 2011, receive an increase equal to 3 percent of the current retirement annuity amount. Employees who first become a participant on or after January 1, 2011, receive an increase equal to the lesser of 3 percent or one-half the annual change in the Consumer Price Index-U, whichever is less, based on the originally granted retirement annuity.

Based on maintaining the price inflation assumption of 2.25 percent, we recommend maintaining the retiree COLA assumption of 1.125 percent for employees who first become a participant on or after January 1, 2011.

For participants who first became members on and after January 1, 2011, and are Tier 2 members, pensionable salary, upon which benefits and member contributions are based, is limited to \$106,800 in 2011 and increased by the lesser of 3 percent and one-half of the annual unadjusted percentage increase in the Consumer Price Index-U (but not less than zero) as measured in the preceding 12-month period ending with the September preceding the November 1, which is the date that the new amount will be calculated and made available to the pension funds.

Based on the price inflation assumption of 2.25 percent, we recommend maintaining the assumption of 1.125 percent for future increases in the pay cap for pensionable pay.

# Economic Assumptions

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## Investment Return

For purposes of budgeting contributions as a level percentage of payroll, the assumed rate of investment return is used as the discount rate to determine the present value of the system's pension obligations. It is important to note that an actuarial investment return assumption based on expected future experience is a single estimate for all years and therefore implicitly assumes that returns above and below expectations will "average out" over time. In other words, the expected risk premium is reflected in the assumed rate of investment return in advance of being earned, while the investment risk is not reflected until actual experience emerges with each actuarial valuation.

The review of the investment return assumption in this report considers forward-looking measures of likely investment return outcomes for the asset classes in the two proposed SURS investment policies. We have compared this analysis with that of the System's Investment Staff and Investment Advisor, Meketa. We thank the System's Staff and Meketa for their cooperation. We have attempted to make our analysis as independent as possible and used our discussions with System Staff as confirmation of our understanding of the Board's investment objectives.

Our analysis is based on the 2021 GRS Capital Market Assumption Modeler (CMAM). Because GRS is a benefits consulting firm and does not develop or maintain our own capital market expectations, we request and monitor forward-looking expectations developed by a number of well-known major firms (investment consultants, asset managers and insurance companies). We update our CMAM on an annual basis. The capital market assumptions in the 2021 CMAM are from the following investment firms (in alphabetical order): Aon Hewitt, Blackrock, BNY Mellon, Callan, Cambridge, JPMorgan, Meketa, Mercer, NEPC, RVK, Verus, and Wilshire. We believe that the benefit of performing this analysis using multiple investment firms is to recognize the uncertain nature of the items affecting the selection of the investment return assumption. While there may be differences in asset classes, investment horizons, inflation assumptions, treatment of investment expenses, excess manager performance (i.e., alpha), etc., we have attempted to align the various assumption sets from the different investment firms to be as consistent as possible. In some cases, we have made minor adjustments or assumptions to align the various assumptions sets with our model.

Each investment firm provided capital market assumptions over an investment horizon of approximately 10 years. Although investment firms often refer to this period as "short-term" it is important to remember that 10 years is actually a very long time. In fact, the duration of the liabilities of the SURS plan is 13 years. Therefore, returns during the next ten years will affect the plan's funding materially. A subset of six investment firms provided capital market expectations over a longer horizon, varying between 20 and 30 years. For purposes of this report, the analysis is generally based on the 10-year expectations provided by the investment firms.

In general, our understanding is that the methodology for developing these capital market expectations is forward-looking, not purely backward-looking. Over the years, we have observed a general decreasing trend in capital market expectations. However, we have also observed that some of the investment firms' assumption sets are dependent on the market conditions at the time they are developed and consequently may be sensitive to short-term market fluctuations. Some expectations are contrarian – meaning that when the market is high, future expectations are lowered and when the market is low, future expectations are raised. The amount of these fluctuations as they appear in the year-to-year capital market assumptions varies between the various investment firms.



## Economic Assumptions

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Each year, the GRS CMAM reflects the most up-to-date information at the time the data was collected (typically reflecting the firms' expectations at the beginning of the calendar year). The results of the 2021 survey were generally lower capital market assumptions than 2020 for most asset classes, in some cases substantially lower. This is perhaps due in part to the decrease in bond yields in 2020 to record lows and the high stock market at the end of 2020 (resulting in the contrarian expectation of lower future stock market returns). Looking back to 2019, return expectations were somewhat higher than prior years for some survey participants, perhaps in part due to an increase in bond yields and a decrease in the stock market at the end of 2018. If we consider the three-year average of return expectations, the general decreasing trend is more apparent and the short-term fluctuations are diminished.

To the best of our ability, we have adapted the SURS's investment policy to fit with the investment firms' assumptions adjusting for these known differences in assumptions and methodology. The asset classes in the system's investment allocation often do not exactly align with the asset classes of all investment firms in the survey. This may require us to make approximations which can introduce some subjectivity into the process. In the following charts, to the extent possible all returns are net of passive investment expenses and have no assumption for excess manager performance (alpha) in excess of active management fees. The information in this report is not intended to be construed as investment advice.

# Economic Assumptions

## Real Return

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

For purposes of this analysis, we have reviewed the following investment allocation based on proposed portfolios C and D provided by Meketa in April 2021:

Target Asset Allocation		
Asset Class	Target Percentage	
	C	D
Global Equity	28%	34%
Core Private Real Estate	5%	6%
Infrastructure (Core Private)	2%	3%
Put Write	0%	0%
Investment Grade Corporate Bonds	0%	0%
Bank Loans	1%	1%
High Yield Bonds	1%	1%
Emerging Market Bonds (major)	1%	1%
Emerging Market Bonds (local)	1%	1%
Private Debt	6%	6%
Convertible Bonds	0%	1%
Private Equity	13%	13%
Value-Added Real Estate	2%	2%
Opportunistic Real Estate	2%	2%
Infrastructure (Non-Core Private)	2%	2%
TIPS	5%	5%
Intermediate Government Bonds	8%	8%
Long-term Government Bonds	7%	3%
CTA (Trend Following)	10%	9%
Alternative Risk Premia (ARP)	10%	6%
<b>Annual Volatility</b>	<b>10.00%</b>	<b>11.10%</b>
<b>Expected Geometric Return - 20 Year</b>	<b>6.60%</b>	<b>6.80%</b>
<b>Expected Geometric Return - 10 Year</b>	<b>6.00%</b>	<b>6.20%</b>

The arithmetic expected return developed from these asset allocations are shown in following tables. The CMAM begins with the nominal expected return from each Capital Market Assumption (CMA) set (column 2), takes out each CMA's price inflation assumption (column 3) to arrive at the real return (column 4). We then incorporate the current price inflation assumption of 2.25 percent (column 5) to get the adjusted nominal return (column 6). Investment expenses not already netted out of the return and/or administrative expenses paid out of trust assets which are not reflected in the employer contributions



## Economic Assumptions

(column 7) are netted out of the return. The final arithmetic expected return is shown in column 8. We believe that this is reasonable provided that the current price inflation assumption does not differ materially from the assumptions used by the investment firms. Note that the arithmetic return is in general higher than the median return due to the compounding effect of random returns. In general, the difference between the arithmetic and median return will be larger for larger standard deviation of returns. We have shown the standard deviation of returns as the investment risk in column 9.

ASOP No. 27, Section 3.6.2, states that “[d]ue to the uncertain nature of the items for which assumptions are selected, the actuary may consider several different assumptions reasonable for a given measurement. 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.” This range of different expectations from the CMAs is evident from the summaries we show from our CMAM.

Investment Consultant	Investment Consultant Expected Nominal Return	Investment Consultant Inflation Assumption	Expected Real Return (2)-(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)	Investment Expenses	Expected Nominal Return Net of Expenses (6)-(7)	Standard Deviation of Expected Return (1-Year)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Average Portfolio C	6.15%	2.19%	3.96%	2.25%	6.21%	0.00%	6.21%	11.29%
Average Portfolio D	6.45%	2.19%	4.27%	2.25%	6.52%	0.00%	6.52%	12.09%

The average expected nominal return from column 8 is 6.21 percent using portfolio C and 6.52 percent using portfolio D. This is the average arithmetic rate of return. Note that the arithmetic rate of return represents the average future expected return which is higher than the median future expected. Accumulating assets and cash flows at the average arithmetic rate of return is expected to produce the average asset amount over time. However, in any given year it is less than 50 percent likely that the arithmetic average rate of return will be achieved. Moreover, over a period of longer than one year, the realized rate of return is generally computed as a geometric average. Additional analysis is required to adjust to the median (or geometric average) return.

Next, we compare the probabilities of achieving returns over a 10-year horizon. We compute the 40<sup>th</sup>, 50<sup>th</sup>, and 60<sup>th</sup> percentiles of returns as well as the probability of achieving the current assumption of 6.75 percent, and alternate assumptions of 6.50 percent, 6.25 percent and 6.00 percent over a 10-year horizon. These estimates are based on the assumption that the distribution of returns for the next 10 years is the same each year.

Investment Consultant	Distribution of 10-Year Average Geometric Net Nominal Return			Probability of exceeding 6.75%	Probability of exceeding 6.50%	Probability of exceeding 6.25%	Probability of exceeding 6.00%
	40th	50th	60th	(5)	(6)	(7)	(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Average Portfolio C	4.72%	5.61%	6.51%	37.40%	40.07%	42.80%	45.57%
Average Portfolio D	4.88%	5.83%	6.80%	40.39%	42.95%	45.54%	48.17%

## Economic Assumptions

The 50<sup>th</sup> percentile return is also related to the geometric average return. The geometric average of a sequence of returns over a number of years is the compound average of those returns over the number of years compounded. As the number of years in the geometric average increase and if the distributions of returns each year are independent and identically distributed, then the geometric average will converge to the median return. The median return may be considered a reasonable rate of return for purposes of the valuation. The average of 50<sup>th</sup> percentile returns is 5.61 percent per year under portfolio C and 5.83 percent per year under portfolio D.

In summary, a preferred range for the assumed rate of return based on the current CMAM's 10-year investment horizon is between the median of 5.61 percent and the (arithmetic) nominal expected return of 6.21 percent for Portfolio C and between the median of 5.83 percent and the (arithmetic) nominal expected return of 6.52 percent for Portfolio D. Returns outside that range are not necessarily unreasonable, but a separate justification may be needed.

Following is a summary of the expected returns over 10 and 20-year time horizons for portfolios C and D from Meketa and a summary of the probability of exceeding different rates of return based on the results from the GRS CMAM.

		Meketa		GRS Capital Market Assumption Modeler				
		Geo. Return	Volatility	Probability of Exceeding				
				6.75%	6.50%	6.25%	6%	5.75%
<b>Portfolio C</b>	10 year	6.00%		37%	40%	43%	46%	48%
	20 Year	6.60%	10.0%	50%	53%	55%	58%	61%
<b>Portfolio D</b>	10 year	6.20%		40%	43%	46%	48%	51%
	20 Year	6.80%	11.10%	52%	54%	57%	59%	62%

A very important fact to consider when deciding what weight to put on shorter term results or longer term results is the amount of benefits that are projected to be paid in the next 10 years. As shown in the following table, about 50 percent of the present value of future benefits as of June 30, 2020, is attributable to benefits that are projected to be paid in the next 10 years. Therefore, it is extremely important to consider shorter-term expectations in addition to longer-term expectations in setting the economic assumptions.

(\$ In Millions)	
SURS Values as of June 30, 2020	
(1) Present Value of Future Benefits - PVB (6.50%)	\$54,387.94
(2) Market Value of Assets	\$19,617.02
(3) Present Value of Benefit Payments in Next 10 Years at 6.50% as % of Total PVB (3)/(1)	\$23,676.59 44%
(4) Present Value of Benefit Payments in Next 15 Years at 6.50% as % of Total PVB (4)/(1)	\$32,422.52 60%
(5) Present Value of Benefit Payments in Next 20 Years at 6.50% as % of Total PVB (5)/(1)	\$39,057.33 72%
(6) Present Value of Benefit Payments in Next 30 Years at 6.50% as % of Total PVB (6)/(1)	\$47,197.13 87%



# Economic Assumptions

## Recommendation

Based on our analysis of the expected investment return, the 10-year and 20-year return expectations from Meketa, our recommended assumption for inflation of 2.25 percent and the two proposed SURS target asset allocations (Portfolios C and D), we recommend reducing the investment return assumption of 6.75 percent to 6.50 percent for the actuarial valuation as of June 30, 2021. A lower assumption of 6.50 percent will result in a higher probability of the assumption being achieved in the future under either Portfolio C or D than the current 6.75 percent assumption.

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

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

## Additional Considerations

The prescribed interest rate used to develop the money purchase conversion factors is equal to the investment return assumption used in the annual actuarial valuation. The money purchase conversion factors, which apply to Rule 2 benefit calculations (for members hired before July 1, 2005), by statute, are to be updated each time there is a change in the investment return assumption or the post retirement mortality assumption. Therefore, the money purchase factors would need to be updated in the near future based on our recommendation to lower the investment return assumption and modify the mortality assumption.

Following is a table summarizing the recent changes in assumptions and the effective date of the money purchase factors:

Valuation Date	Updated Investment Return Assumption	Effective Date of Updated Money Purchase Factors
June 30, 2014 (investment return)/June 30, 2015 (mortality)	7.25%	January 4, 2016
June 30, 2018	6.75%	July 2, 2019

Illustrations of the impact on money purchase benefits of changing the money purchase conversion factors can be found later in this report under "Other Valuation Assumptions."





# Economic Assumptions

## Effective Rate of Interest (ERI)

The assumed effective rate of interest impacts the projected benefits calculated in the actuarial valuation for members who were hired before July 1, 2005, and are eligible for benefits calculated under the highest of three formulas – the general formula, the money purchase formula and the minimum benefit formula. The assumed effective rate of interest also impacts the projected member contributions under the Portable Plan for purposes of refunds and lump sum retirements.

In order to value all future liabilities in the plan during the annual actuarial valuation, the actuary makes an assumption about the future effective rate of interest to be used in crediting the money purchase accounts and for Portable Plan lump sum retirements and refunds.

The actual Rule 2 Money Purchase ERI, or Effective Rate of Interest, is set by the Comptroller’s office each year. Beginning with the Money Purchase ERI for fiscal year 2006, the State Comptroller determined the rate for purposes of crediting member contributions balances for the Rule 2 money purchase formula. The SURS Board of Trustees determined the ERI for years prior to fiscal year 2006 for all purposes, including money purchase, and continues to certify the ERI for purposes of calculating service purchases, refunds for excess contributions and for lump sum retirements and refunds under the Portable Plan.

The following table shows the ERI assumptions used in the actuarial valuation, the ERI assumption approved by the SURS Board and the actual ERI declared by the Comptroller’s office for the last 10 years:

Fiscal Years Ending June 30,	Assumed overall Rate of Return - Valuation	ERI assumption used in the actuarial valuation	ERI “Legacy” approved by the SURS Board of Trustees*	ERI declared by the Comptroller’s Office
2022			6.00%	5.50%
2021	<b>6.50%</b>	<b>6.50%</b>	6.50%	6.00%
2020	6.75%	6.75%	6.50%	6.50%
2019	6.75%	6.75%	6.50%	6.75%
2018	6.75%	6.75%	6.50%	6.50%
2017	7.25%	7.00%	7.00%	6.75%
2016	7.25%	7.00%	7.00%	7.00%
2015	7.25%	7.00%	7.00%	6.75%
2014	7.25%	7.00%	7.00%	6.75%
2013	7.75%	7.00%	7.50%	6.50%
2012	7.75%	7.75%	7.50%	6.75%
2011	7.75%	7.75%	7.50%	7.00%

\* For purposes of calculating service purchases, refunds for excess contributions and for lump sum retirements and refunds under the Portable Plan.

Recommended assumptions for the actuarial valuation as of June 30, 2021 are bolded and italicized.



## Economic Assumptions

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As an actuarial assumption change, this will only affect the actuarial valuation and the liability and funding results. This will not impact the actual benefits earned by the members. This change in actuarial assumption will reduce the liabilities of the plan, since the assumption of a lower long-term rate of interest in the money purchase account will produce a lower assumed money purchase balance and therefore a lower future retirement benefit. A change in the assumed ERI credited to member accounts does not affect the factors used to convert the money purchase account balance to an annuity. (These factors are impacted by the assumed long-term rate of investment return and the mortality assumption.)

The Office of the Comptroller reduced the ERI to 6.00 percent for fiscal year end 2021 and 5.50 percent for fiscal year end 2022.

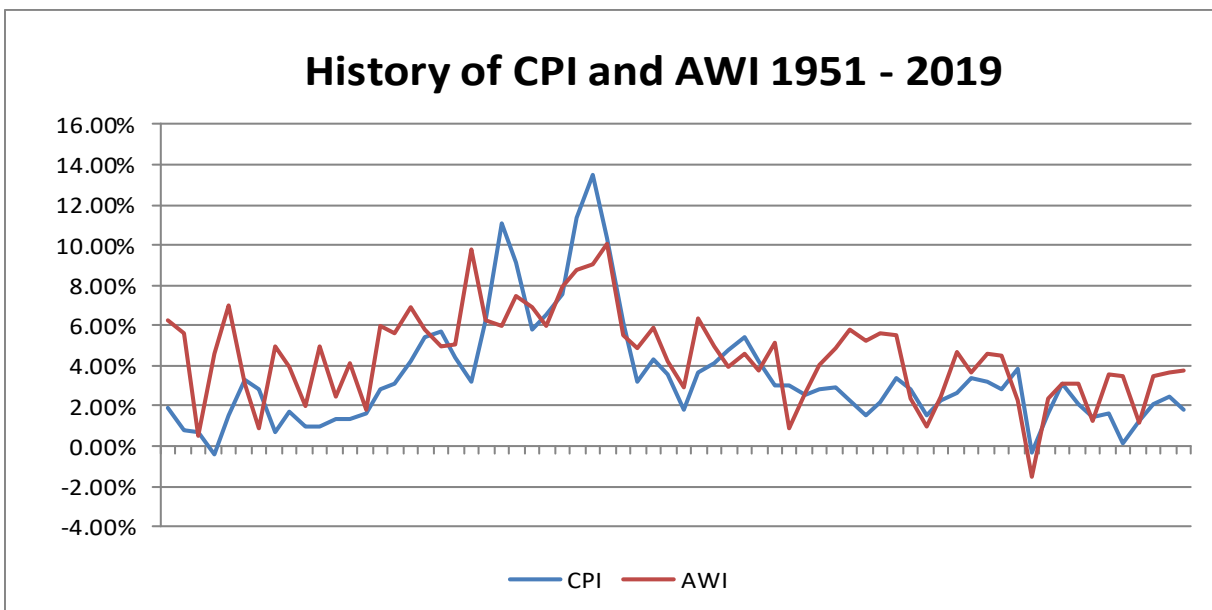
Based on lower expectations for investment return, we recommend lowering the assumed Effective Rate of Interest to the proposed investment return assumption of 6.50 percent for the purpose of estimating future benefits and liabilities in the actuarial valuation for the Rule 2 money purchase conversions and for Portable Plan lump sum refunds and retirement conversions. The ERI each year that will be used to actually credit member accounts will continue to be calculated by the Office of the Comptroller and by SURS. If the ERI continues to be lower than the investment return assumption used in the actuarial valuation, it would be reasonable to decrease this assumption in the future.

# Economic Assumptions

## General Wage Inflation

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

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



Over the last 65 years, AWI has exceeded CPI 44 times and the averages over that period are 4.5 percent for AWI and 3.5 percent for CPI. The last 25 years has had fewer cases of high inflation, but the distinction between prices and wages still appears. Over the last 25 years, the average increase in AWI is 3.4 percent and the average increase in CPI is 2.2 percent.

As with the investment return assumption, past experience does not necessarily dictate future expectations. Current expectations are mixed on whether price and wage inflation will remain low in the short term, particularly due to the after effects of recent federal government spending. For a long-term view, the 2020 Annual Report from the Trustees of the Social Security Administration (SSA) assumes an intermediate average ultimate CPI of 2.4 percent over the next 75 years and an ultimate intermediate growth assumption for average wages in covered employment of 3.5 percent. The SSA report provides

## Economic Assumptions

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alternate “High-cost” assumptions of 1.8 percent CPI/2.3 percent wages and “Low-cost” assumptions of 3.0 percent CPI/4.8 percent wages.

With ongoing pressure on the ability of states to sustain across the board increases in wages consistent with historical norms, we believe there is justification to decrease the assumption for productivity increases; in other words, to decrease the assumed gap between price increase and wage growth. We recommend decreasing the assumption for productivity increases from 1.00 percent to 0.75 percent. The 0.75 percent assumption is more consistent with the average salary increases (in excess of price inflation) that were received by SURS members with 35 or more years of service during the experience study period. Combining the recommendation of 0.75 percent for productivity increases with a 2.25 percent inflation assumption implies a wage growth assumption of 3.00 percent. These assumptions are summarized below:

	Current Assumption	Recommended Assumption
Price Inflation	2.25%	2.25%
Productivity Increases	1.00%	0.75%
Total Wage Inflation	3.25%	3.00%

# Economic Assumptions

## Salary Increase

The components that determine the total salary increase are wage inflation, merit and longevity increases and promotion increases. We recommend a change to the merit and longevity and promotion increase portion of the salary increase assumption to better reflect actual experience.

Following is a summary of the average actual salary increases during the first two years of service from the current experience study and the last three experience studies. GRS has worked with SURS staff and will continue to do so to refine the salary data that is provided for newer members. Although very short service members have a low liability, we will continue working to improve the valuation of liabilities for these members.

Years of Service	Average Total Salary Increase			
	2010	2014	2018	2021
1	77%	21%	5%	2%
2	33%	21%	17%	16%
Average Rate	53%	21%	11%	13%

The experience in Table I shows that actual salary increases were higher than the current assumptions during the experience study period on average for members with less than 20 years of service. However, average inflation over the experience study period was about 0.00 percent, which is lower than the current assumption of 2.25 percent. Therefore, our recommended rates of salary increases may be higher than the actual increases during the experience study period to take into account that we are assuming that future rates of inflation on average will be higher than 0.00 percent.

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

- Table I – Salary Experience by Service
- Graph I – Salary Experience by Service – blended rate for under and over age 50
- Graph II - Salary Experience by Service and Age Category

The following table compares the rates of increase for an active member’s remaining career assuming the member was hired at age 35 (and therefore the rates applicable to ages 50 and older begin at 15 years of service).

Service At Valuation	Service at End of Career	Average Annual Salary Increases		
		Actual Increase	Current Assumption	Proposed Assumption
0	20	5.59%	5.53%	5.82%
0	25	5.12%	5.12%	5.30%
0	30	4.82%	4.85%	4.95%
0	35	4.55%	4.65%	4.70%
10	20	4.12%	3.90%	4.02%
10	25	3.83%	3.77%	3.76%
10	30	3.70%	3.70%	3.64%
10	35	3.55%	3.65%	3.55%



# Salary Scale Assumption

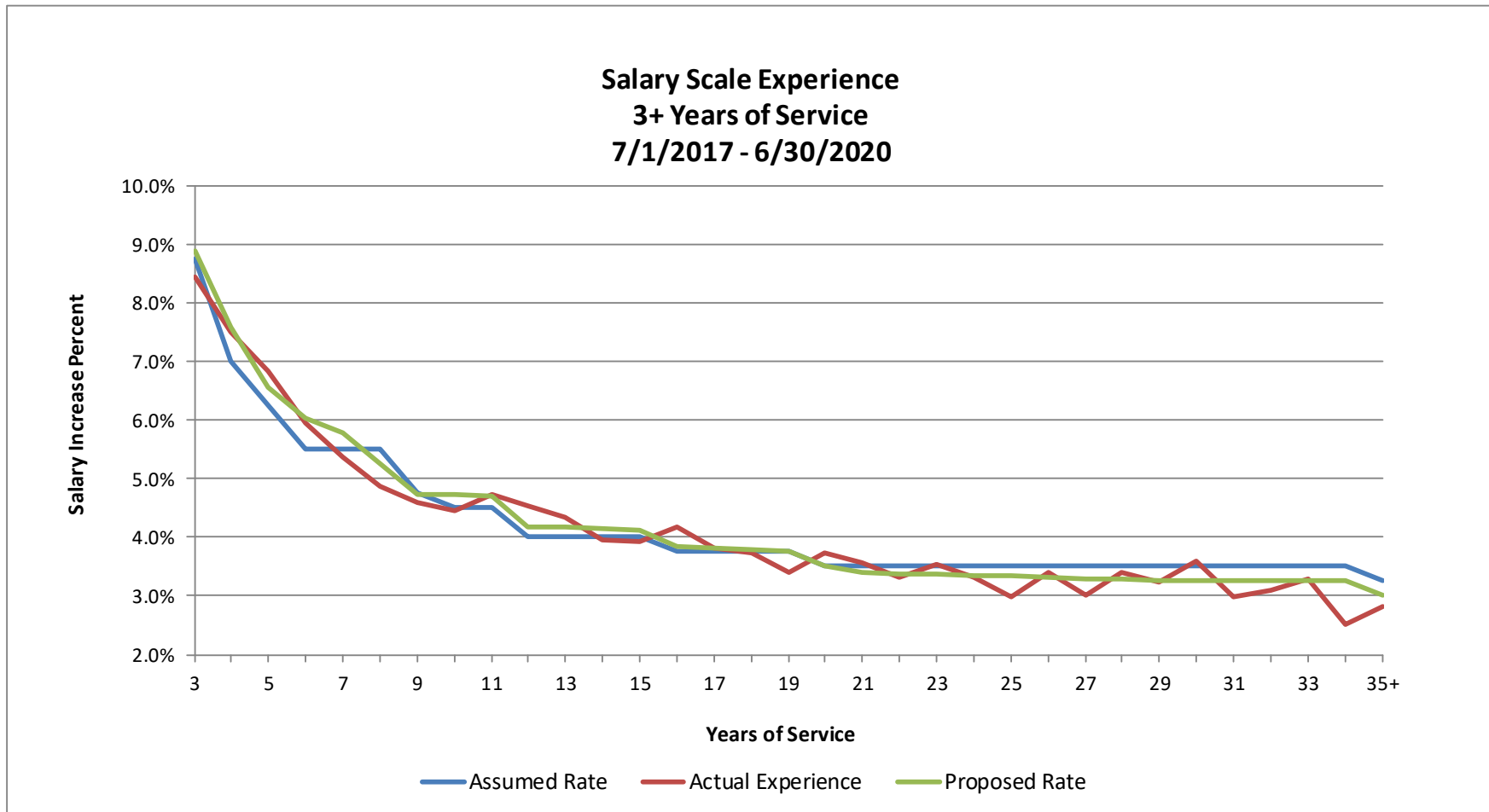
Table I

Service at End of Year	Under Age 50 Actual				Age 50 and Older Actual				Average Actual Total Increase	Expected Total Increase	Under Age 50 Proposed Total Increase	Age 50 and Older Proposed Total Increase	Average Proposed Total Increase
	Number	Prior Year	Current Year	Total Increase	Number	Prior Year	Current Year	Total Increase					
1	2,443	\$ 108,557,219	\$ 113,124,164	4.21%	425	\$ 21,644,865	\$ 19,962,080	-7.77%	2.22%	12.25%	12.75%	12.00%	12.63%
2	7,726	322,828,722	378,230,060	17.16%	1,468	64,531,357	72,552,293	12.43%	16.37%	12.25%	12.75%	12.00%	12.63%
3	7,540	357,779,003	388,346,632	8.54%	1,608	77,245,823	83,351,531	7.90%	8.43%	8.75%	9.00%	8.25%	8.87%
4	7,220	330,322,027	355,529,757	7.63%	2,367	90,572,300	96,939,362	7.03%	7.50%	7.00%	7.75%	7.00%	7.59%
5	6,684	306,205,055	328,035,756	7.13%	2,729	100,656,649	106,577,768	5.88%	6.82%	6.25%	6.75%	6.00%	6.56%
6	6,032	297,363,454	315,680,935	6.16%	2,838	115,430,073	121,659,563	5.40%	5.95%	5.50%	6.25%	5.50%	6.04%
7	5,344	278,100,670	293,556,323	5.56%	2,833	122,608,405	128,595,059	4.88%	5.35%	5.50%	6.00%	5.25%	5.77%
8	4,728	266,439,868	280,394,424	5.24%	2,717	128,177,898	133,385,587	4.06%	4.86%	5.50%	5.50%	4.75%	5.26%
9	3,904	228,457,248	239,728,956	4.93%	2,446	121,748,242	126,521,722	3.92%	4.58%	4.75%	5.00%	4.25%	4.74%
10	3,525	215,608,027	226,061,250	4.85%	2,409	125,790,034	130,562,844	3.79%	4.46%	4.50%	5.00%	4.25%	4.72%
11	3,526	221,218,309	232,547,067	5.12%	2,718	145,118,419	151,143,011	4.15%	4.74%	4.50%	5.00%	4.25%	4.70%
12	3,481	225,176,372	235,851,722	4.74%	2,916	164,757,600	171,755,425	4.25%	4.53%	4.00%	4.50%	3.75%	4.18%
13	3,233	213,107,565	223,611,640	4.93%	2,973	175,842,059	182,211,846	3.62%	4.34%	4.00%	4.50%	3.75%	4.16%
14	2,755	185,315,900	194,160,619	4.77%	2,891	178,000,330	183,541,850	3.11%	3.96%	4.00%	4.50%	3.75%	4.13%
15	2,350	162,852,439	170,052,265	4.42%	2,735	173,594,602	179,590,309	3.45%	3.92%	4.00%	4.50%	3.75%	4.11%
16	2,052	144,603,671	151,599,317	4.84%	2,630	177,319,697	183,774,170	3.64%	4.18%	3.75%	4.25%	3.50%	3.84%
17	1,929	139,074,051	144,994,623	4.26%	2,774	191,962,686	198,646,762	3.48%	3.81%	3.75%	4.25%	3.50%	3.82%
18	1,819	129,969,902	135,367,158	4.15%	2,902	205,246,207	212,379,747	3.48%	3.74%	3.75%	4.25%	3.50%	3.79%
19	1,597	112,473,261	116,731,065	3.79%	2,895	201,051,954	207,474,964	3.19%	3.41%	3.75%	4.25%	3.50%	3.77%
20	1,298	91,776,145	95,732,406	4.31%	2,642	183,426,802	189,747,971	3.45%	3.73%	3.50%	4.00%	3.25%	3.50%
21	995	71,431,746	74,103,615	3.74%	2,320	164,581,806	170,344,447	3.50%	3.57%	3.50%	3.75%	3.25%	3.40%
22	776	55,248,703	57,165,209	3.47%	2,083	154,423,733	159,484,584	3.28%	3.33%	3.50%	3.75%	3.25%	3.38%
23	653	48,225,377	50,067,971	3.82%	1,963	152,310,651	157,579,459	3.46%	3.55%	3.50%	3.75%	3.25%	3.37%
24	568	42,545,605	44,187,959	3.86%	1,956	159,921,457	164,981,194	3.16%	3.31%	3.50%	3.75%	3.25%	3.36%
25	449	34,416,724	35,588,388	3.40%	1,927	164,536,326	169,312,779	2.90%	2.99%	3.50%	3.75%	3.25%	3.34%
26	329	25,189,168	26,090,704	3.58%	1,818	155,871,576	161,117,826	3.37%	3.40%	3.50%	3.75%	3.25%	3.32%
27	220	15,664,238	16,180,656	3.30%	1,878	160,171,673	164,961,546	2.99%	3.02%	3.50%	3.75%	3.25%	3.29%
28	160	11,075,318	11,443,169	3.32%	1,806	158,852,691	164,236,797	3.39%	3.38%	3.50%	3.75%	3.25%	3.28%
29	92	5,839,832	6,062,940	3.82%	1,604	144,738,300	149,390,010	3.21%	3.24%	3.50%	3.75%	3.25%	3.27%
30	46	2,766,758	2,851,234	3.05%	1,157	109,805,683	113,761,905	3.60%	3.59%	3.50%	3.75%	3.25%	3.26%
31	12	666,249	679,038	1.92%	818	80,126,051	82,526,518	3.00%	2.99%	3.50%	3.75%	3.25%	3.25%
32	2	199,185	204,531	2.68%	642	65,822,682	67,866,864	3.11%	3.10%	3.50%	3.75%	3.25%	3.25%
33	1	68,071	68,170	0.15%	547	56,222,841	58,073,028	3.29%	3.29%	3.50%	3.75%	3.25%	3.25%
34	0	-	-	N/A	436	46,424,512	47,584,724	2.50%	2.50%	3.50%	3.75%	3.25%	3.25%
35+	0	-	-	N/A	1,163	141,918,525	145,906,002	2.81%	2.81%	3.25%	3.50%	3.00%	3.00%
<b>Total</b>	<b>83,489</b>	<b>\$4,650,565,882</b>	<b>\$4,944,029,723</b>	<b>6.31%</b>	<b>72,034</b>	<b>\$4,680,454,509</b>	<b>\$4,857,501,547</b>	<b>3.78%</b>	<b>5.04%</b>	<b>5.78%</b>	<b>6.23%</b>	<b>3.97%</b>	<b>5.10%</b>
<b>Total Years 1-5</b>	<b>31,613</b>	<b>1,425,692,026</b>	<b>1,563,266,369</b>	<b>9.65%</b>	<b>8,597</b>	<b>354,650,994</b>	<b>379,383,034</b>	<b>6.97%</b>	<b>9.12%</b>	<b>8.78%</b>	<b>9.36%</b>	<b>8.20%</b>	<b>9.13%</b>
<b>Total Years 6-10</b>	<b>23,533</b>	<b>1,285,969,267</b>	<b>1,355,421,888</b>	<b>5.40%</b>	<b>13,243</b>	<b>613,754,652</b>	<b>640,724,775</b>	<b>4.39%</b>	<b>5.08%</b>	<b>5.18%</b>	<b>5.61%</b>	<b>4.79%</b>	<b>5.34%</b>
<b>Total Years 11-15</b>	<b>15,345</b>	<b>1,007,670,585</b>	<b>1,056,223,313</b>	<b>4.82%</b>	<b>14,233</b>	<b>837,313,010</b>	<b>868,242,441</b>	<b>3.69%</b>	<b>4.31%</b>	<b>4.10%</b>	<b>4.61%</b>	<b>3.84%</b>	<b>4.26%</b>
<b>Total Years 16-20</b>	<b>8,695</b>	<b>617,897,030</b>	<b>644,424,569</b>	<b>4.29%</b>	<b>13,843</b>	<b>959,007,346</b>	<b>992,023,614</b>	<b>3.44%</b>	<b>3.78%</b>	<b>3.71%</b>	<b>4.21%</b>	<b>3.45%</b>	<b>3.75%</b>
<b>Total Years 21+</b>	<b>4,303</b>	<b>313,336,974</b>	<b>324,693,584</b>	<b>3.62%</b>	<b>22,118</b>	<b>1,915,728,507</b>	<b>1,977,127,683</b>	<b>3.21%</b>	<b>3.26%</b>	<b>3.48%</b>	<b>3.75%</b>	<b>3.23%</b>	<b>3.30%</b>



# Salary Scale Assumption

Graph I



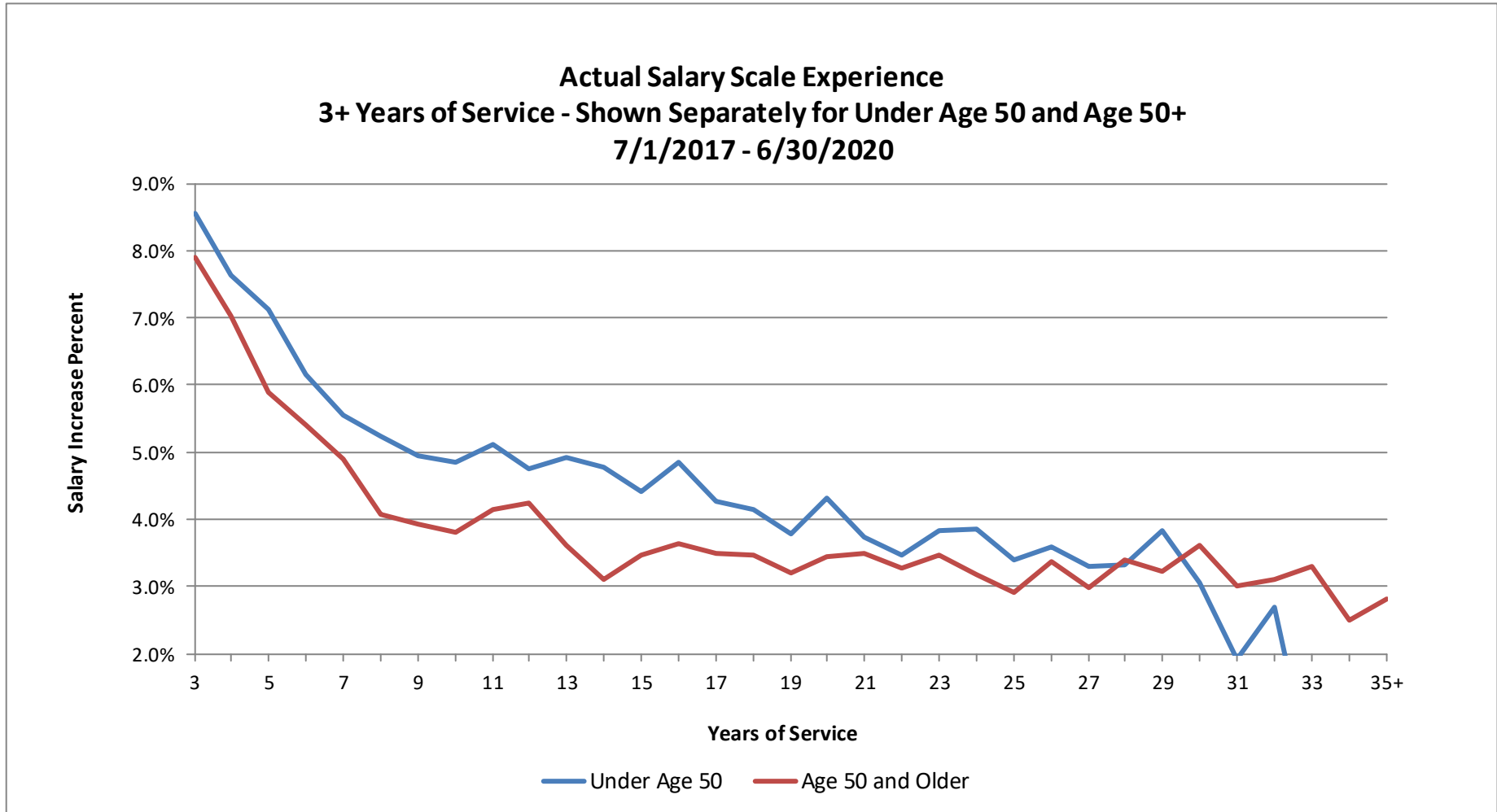
Actual inflation was about 50 basis points lower than assumed inflation of 2.25 percent during the experience study period.

The actual experience and proposed rates in the graph represent blended rates for under age 50 and age 50+. The average proposed rates are not too different from the current rates.



# Salary Scale Assumption

Graph II





## Demographic Assumptions

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

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

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

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

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

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

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

### **Analysis Approach**

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

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



## Demographic Assumptions

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

This analysis is based on the actuarial valuation data for the three-year period from June 30, 2017, to June 30, 2020.

In addition to analyzing experience based on headcounts, we also analyzed experience on a liability-weighted basis (and a benefits weighted basis for postretirement non-disabled mortality). Analyzing experience on a liability-weighted basis gives additional credibility to decrements that occur to members with a higher liability (due to higher pays, more service or younger ages). The liability amounts shown in the experience tables are total liability amounts divided by \$100,000.

We reviewed experience separately based on employment classifications (Academic and Non-Academic). Following is a summary of the membership as of June 30, 2020 based on these classifications.

	Full-Time Active Member Counts			FY 2020 Payroll (\$ in Millions)		
	SURS	RSP	Total	SURS	RSP	Total
Academic	20,586	5,558	26,144	\$1,389	\$553	\$1,942
Non-Academic	39,003	7,168	46,171	2,113	499	2,613
Total	59,589	12,726	72,315	3,502	1,052	4,554

	Retiree and Beneficiary Counts		FY 2020 Annualized Benefits (\$ in Millions)	
	SURS		SURS	
Academic	30,968		\$1,443	
Non-Academic	38,204		1,224	
Total	69,172		2,667	



# Tier 1 Retirement Assumption

## Retirement

The Plan provisions establish the minimum eligibility requirements for retirement. Participants of the plan who became members before January 1, 2011<sup>1</sup>, are eligible for immediate normal retirement benefits at the earlier of 30 years of service at any age, age 60 with eight years of service, or age 62 with five years of service. (Police officers and firefighters are eligible at age 50 with 25 years of service or age 55 with 20 years of service.) Participants of the plan who became members before January 1, 2011<sup>1</sup>, are eligible for early (reduced) retirement benefits on or after the attainment of age 55 with eight years of service.

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

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

The table below shows the number of actual retirements during each year of the experience study period compared with the number expected under the current assumptions. There were fewer retirements during FY 2020 than during the other two years of the experience study period.

Fiscal Year End	Normal Retirement			Early Retirement		
	Actual	Current Assumption	Actual/Expected	Actual	Current Assumption	Actual/Expected
2018	1,892	1,799	1.1	268	324	0.8
2019	2,041	1,770	1.2	271	309	0.9
2020	1,698	1,723	1.0	212	284	0.7
<b>Total</b>	<b>5,632</b>	<b>5,292</b>	<b>1.1</b>	<b>751</b>	<b>917</b>	<b>0.8</b>

<sup>1</sup> Participants who become members of the plan on or after January 1, 2011, are eligible for retirement at age 67 with 10 years of service. Police officers and firefighters who become members of the plan on or after January 1, 2011, are also eligible for unreduced retirement at age 60 with 20 years of service. Assumed retirement rates for these members will differ from current members.

# Tier 1 Retirement Assumption

## Normal Retirement Experience

Current and past experience has shown that retirement rates under this plan are correlated with age. Currently, the Plan uses age-based rates with higher rates at key ages, with 100 percent retirement at age 80. In addition, the experience showed differences in retirement patterns between members classified as Academic and not classified as Academic in the census data. Based on the retirement experience, we recommend the following changes to the Tier 1 retirement rates:

- Applying separate rates to members classified as Academic and not classified as Academic
- Decrease most rates for ages younger than 60
- Increase most rates for ages 60 and older
- Decrease rates for members with 40 or more years of service and younger than age 80
  - If the member has 40 or more years of service and is younger than age 80 change the rate from 50 percent to 1.5 times the rate applicable to members with less than 40 years of service.

The recommended changes to the retirement rates reflect the actual experience on a liability weighted basis over the past three years from the current experience study and different patterns for members classified as Academic and not classified as Academic.

Applying the proposed Tier 1 retirement rates to historical data generates the following liability weighted retirements by age at retirement:

Nearest Age	Liability Weighted Retirements					
	Actual	Academic		Actual	Non-Academic	
		Current Assumption	Proposed Assumption		Current Assumption	Proposed Assumption
Under 50	0	0	0	216	173	191
50-54	316	332	304	2,018	2,487	2,020
55-59	1,060	1,510	1,131	2,767	3,036	2,678
60-64	4,705	4,210	4,681	4,948	3,649	4,887
65-69	4,047	3,839	4,067	3,259	2,242	3,419
70-74	1,676	2,145	1,628	767	705	781
75-79	468	880	535	171	186	191
80+	333	1,200	1,200	40	326	326
<b>Total</b>	<b>12,605</b>	<b>14,116</b>	<b>13,546</b>	<b>14,186</b>	<b>12,804</b>	<b>14,493</b>
<b>Under 80</b>	<b>12,272</b>	<b>12,916</b>	<b>12,346</b>	<b>14,146</b>	<b>12,478</b>	<b>14,167</b>

## Early Retirement Experience

Fewer Academic participants retired under Tier 1 early retirement eligibility than expected under the current assumptions and more non-Academic participants retired under Tier 1 early retirement eligibility than expected under the current assumptions. We recommend changes in rates for most Tier 1 early retirement eligibility ages (55-59) to reflect these differences.

## Tier 1 Retirement Assumption

Liability Weighted Retirements						
Nearest Age	Academic			Non-Academic		
	Actual	Current Assumption	Proposed Assumption	Actual	Current Assumption	Proposed Assumption
55	247	439	251	556	446	510
56	190	348	253	354	329	329
57	252	250	250	327	234	321
58	250	306	244	304	293	322
59	245	336	244	411	321	408
<b>Total</b>	<b>1,184</b>	<b>1,679</b>	<b>1,242</b>	<b>1,951</b>	<b>1,623</b>	<b>1,890</b>

### *Retirement Experience and Recommendations*

The tables and graphs on the following pages show experience for Tier 1 normal and early retirement.

- Table and Graph II(a)(i) – Normal Retirement Experience – Academic
- Table and Graph II(a)(ii) – Normal Retirement Experience – Non-Academic
- Table and Graph II(b)(i) – Early Retirement Experience – Academic
- Table and Graph II(b)(ii) – Early Retirement Experience – Non-Academic
- Table II(c)(i) – Summary of Tier 1 Retirement Rates
- Table II(c)(ii) – Summary of Tier 2 Retirement Rates

There is currently no retirement experience for Tier 2 members. However, we need to make assumptions on the retirement patterns for members under Tier 2. The table on page 41 shows the current and recommended retirement rates applicable to members in Tier 2. The retirement rates are based on the Tier 1 rates and reflect that a higher number of members are expected to retire at first eligibility (because first eligibility for retirement under Tier 2 is about seven years later than under Tier 1).

# Tier 1 Retirement Assumption

Table II(a)(i)

## Academic

Nearest Age @ Retirement	Actual Experience				Current Assumptions - Liability Weighted				Proposed Assumptions - Liability Weighted					
	Population Weighted		Liability Weighted		Rates Weighted by		Expected	Blended	Under 40 Years	Actual /	Expected	Blended	Under 40 Years	Actual /
	Exposures	Retirements	Exposures	Retirements	Population	Liabilities	Retirements	Assumed Rate	Proposed Rate	Expected	Retirements	Proposed Rate	Proposed Rate	Expected
Under 50	0	1	0	0			0		50.0%		0		55.0%	
50	4	2	38	21	50.0%	54.2%	19	50.1%	50.0%	1.1	21	55.3%	55.0%	1.0
51	9	3	86	30	33.3%	34.7%	34	39.7%	40.0%	0.9	34	39.7%	40.0%	0.9
52	15	7	165	74	46.7%	44.9%	66	40.0%	40.0%	1.1	66	40.0%	40.0%	1.1
53	18	7	213	68	38.9%	32.1%	74	34.8%	35.0%	0.9	64	30.1%	30.0%	1.1
54	34	14	397	123	41.2%	31.0%	139	35.0%	35.0%	0.9	119	30.0%	30.0%	1.0
55	39	9	493	72	23.1%	14.6%	172	34.9%	35.0%	0.4	99	20.1%	20.0%	0.7
56	68	13	939	147	19.1%	15.7%	282	30.0%	30.0%	0.5	188	20.0%	20.0%	0.8
57	92	20	1,147	262	21.7%	22.9%	287	25.0%	25.0%	0.9	229	20.0%	20.0%	1.1
58	111	24	1,316	256	21.6%	19.5%	329	25.0%	25.0%	0.8	263	20.0%	20.0%	1.0
59	131	29	1,759	322	22.1%	18.3%	440	25.0%	25.0%	0.7	352	20.0%	20.0%	0.9
60	1,457	154	8,018	1,004	10.6%	12.5%	882	11.0%	11.0%	1.1	1,042	13.0%	13.0%	1.0
61	1,384	162	7,287	934	11.7%	12.8%	802	11.0%	11.0%	1.2	947	13.0%	13.0%	1.0
62	1,443	158	7,175	751	10.9%	10.5%	869	12.1%	12.0%	0.9	934	13.0%	13.0%	0.8
63	1,371	171	6,847	917	12.5%	13.4%	838	12.2%	12.0%	1.1	893	13.0%	13.0%	1.0
64	1,335	181	6,619	1,100	13.6%	16.6%	819	12.4%	12.0%	1.3	865	13.1%	13.0%	1.3
65	1,361	191	6,205	1,011	14.0%	16.3%	966	15.6%	15.0%	1.0	1,064	17.1%	17.0%	1.0
66	1,253	205	5,614	980	16.4%	17.5%	894	15.9%	15.0%	1.1	968	17.2%	17.0%	1.0
67	1,078	161	4,708	787	14.9%	16.7%	804	17.1%	15.0%	1.0	825	17.5%	17.0%	1.0
68	906	133	3,775	633	14.7%	16.8%	636	16.8%	15.0%	1.0	660	17.5%	17.0%	1.0
69	795	139	3,129	635	17.5%	20.3%	539	17.2%	15.0%	1.2	550	17.6%	17.0%	1.2
70	670	121	2,651	460	18.1%	17.3%	505	19.1%	15.0%	0.9	478	18.0%	17.0%	1.0
71	582	97	2,294	429	16.7%	18.7%	495	21.6%	15.0%	0.9	376	16.4%	15.0%	1.1
72	451	82	1,790	328	18.2%	18.3%	418	23.4%	15.0%	0.8	300	16.8%	15.0%	1.1
73	344	58	1,544	281	16.9%	18.2%	420	27.2%	15.0%	0.7	272	17.6%	15.0%	1.0
74	255	40	1,154	178	15.7%	15.4%	307	26.6%	15.0%	0.6	202	17.5%	15.0%	0.9
75	219	33	970	149	15.1%	15.3%	273	28.2%	15.0%	0.5	173	17.8%	15.0%	0.9
76	176	32	740	179	18.2%	24.2%	208	28.1%	15.0%	0.9	132	17.8%	15.0%	1.4
77	134	20	473	64	14.9%	13.4%	154	32.5%	15.0%	0.4	89	18.8%	15.0%	0.7
78	104	19	401	56	18.3%	13.9%	128	31.9%	15.0%	0.4	75	18.7%	15.0%	0.7
79	69	9	350	21	13.0%	6.0%	117	33.4%	15.0%	0.2	66	18.8%	15.0%	0.3
80+	209	41	1,200	333	19.6%	27.8%	1,200	100.0%	100.0%	0.3	1,200	100.0%	100.0%	0.3
<b>Totals:</b>	<b>16,117</b>	<b>2,336</b>	<b>79,497</b>	<b>12,605</b>	<b>13.0%</b>	<b>15.9%</b>	<b>14,116</b>	<b>17.8%</b>		<b>0.9</b>	<b>13,546</b>	<b>17.0%</b>	<b>17.0%</b>	<b>0.9</b>
<b>Excluding 80+:</b>	<b>15,908</b>	<b>2,295</b>	<b>78,297</b>	<b>12,272</b>	<b>19.6%</b>	<b>15.7%</b>	<b>12,916</b>	<b>16.5%</b>		<b>1.0</b>	<b>12,346</b>	<b>15.8%</b>	<b>15.8%</b>	<b>1.0</b>

Rates are for Tier 1 members only. Expected retirements for a member who has 40 or more years of service:

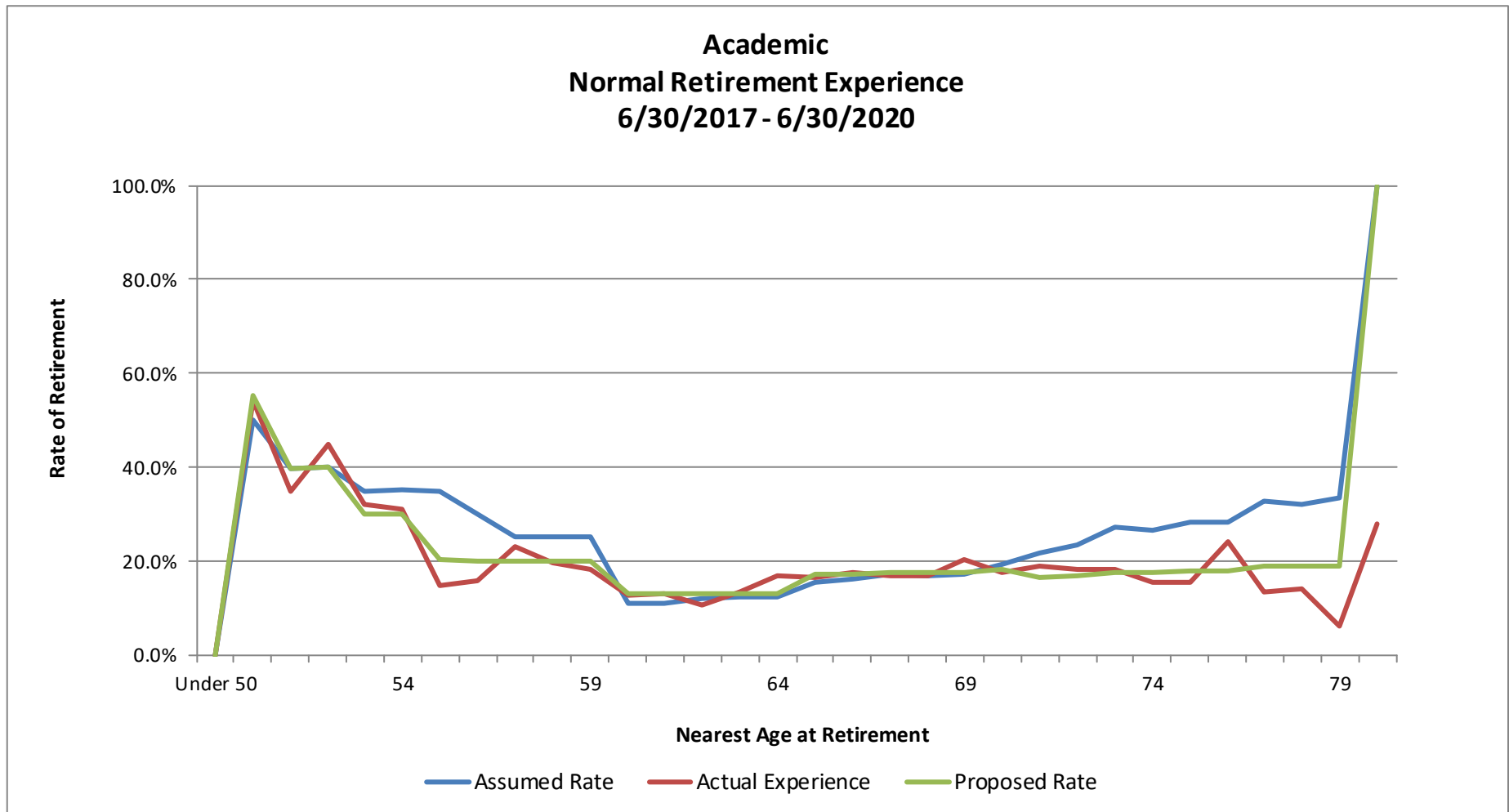
- 50 percent under the current assumptions (younger than age 80)
- 1.5 times the rate for under 40 years of service under the proposed assumptions (younger than age 80)

There is not current retirement experience for Tier 2 members who have different eligibility conditions. Separate retirement rates apply for Tier 2 members.



# Tier 1 Retirement Assumption

Graph II(a)(i)



Rates are for Tier 1 members only. Expected retirements for a member who has 40 or more years of service:

- 50 percent under the current assumptions (younger than age 80)
- 1.5 times the rate for under 40 years of service under the proposed assumptions (younger than age 80)

There is not current retirement experience for Tier 2 members who have different eligibility conditions. Separate retirement rates apply for Tier 2 members.



# Tier 1 Early Retirement Assumption

Table II(a)(ii)

## Non-Academic

Nearest Age @ Retirement	Actual Experience				Current Assumptions - Liability Weighted				Proposed Assumptions - Liability Weighted					
	Population Weighted		Liability Weighted		Rates Weighted by		Expected	Blended	Under 40 Years	Actual /	Expected	Blended	Under 40 Years	Actual /
	Exposures	Retirements	Exposures	Retirements	Population	Liabilities								
Under 50	46	27	347	216	1	62.3%	173	49.9%	50.0%	1.2	191	55.1%	55.0%	1.1
50	75	29	654	259	38.7%	39.6%	327	50.0%	50.0%	0.8	262	40.0%	40.0%	1.0
51	106	36	911	278	34.0%	30.5%	364	40.0%	40.0%	0.8	273	30.0%	30.0%	1.0
52	149	42	1,280	314	28.2%	24.6%	512	40.0%	40.0%	0.6	384	30.0%	30.0%	0.8
53	198	61	1,659	508	30.8%	30.6%	581	35.0%	35.0%	0.9	498	30.0%	30.0%	1.0
54	230	79	2,010	659	34.3%	32.8%	703	35.0%	35.0%	0.9	603	30.0%	30.0%	1.1
55	264	79	2,285	623	29.9%	27.3%	800	35.0%	35.0%	0.8	571	25.0%	25.0%	1.1
56	271	83	2,326	673	30.6%	29.0%	698	30.0%	30.0%	1.0	582	25.0%	25.0%	1.2
57	248	66	2,083	516	26.6%	24.8%	521	25.0%	25.0%	1.0	521	25.0%	25.0%	1.0
58	235	59	1,971	438	25.1%	22.2%	501	25.4%	25.0%	0.9	497	25.2%	25.0%	0.9
59	247	62	1,996	516	25.1%	25.8%	516	25.9%	25.0%	1.0	507	25.4%	25.0%	1.0
60	2,065	313	7,366	1,400	15.2%	19.0%	845	11.5%	11.0%	1.7	1,482	20.1%	20.0%	0.9
61	1,911	236	6,731	1,016	12.3%	15.1%	769	11.4%	11.0%	1.3	1,015	15.1%	15.0%	1.0
62	1,798	248	5,942	895	13.8%	15.1%	749	12.6%	12.0%	1.2	898	15.1%	15.0%	1.0
63	1,626	231	5,355	954	14.2%	17.8%	707	13.2%	12.0%	1.3	816	15.2%	15.0%	1.2
64	1,424	195	4,445	683	13.7%	15.4%	579	13.0%	12.0%	1.2	676	15.2%	15.0%	1.0
65	1,343	279	3,991	1,049	20.8%	26.3%	647	16.2%	15.0%	1.6	1,015	25.4%	25.0%	1.0
66	1,091	249	3,205	757	22.8%	23.6%	520	16.2%	15.0%	1.5	815	25.4%	25.0%	0.9
67	851	174	2,671	706	20.4%	26.4%	461	17.3%	15.0%	1.5	689	25.8%	25.0%	1.0
68	651	130	1,981	502	20.0%	25.4%	352	17.8%	15.0%	1.4	515	26.0%	25.0%	1.0
69	530	96	1,483	244	18.1%	16.5%	262	17.7%	15.0%	0.9	385	26.0%	25.0%	0.6
70	440	76	1,221	256	17.3%	21.0%	241	19.7%	15.0%	1.1	261	21.4%	20.0%	1.0
71	360	58	929	176	16.1%	18.9%	178	19.2%	15.0%	1.0	197	21.2%	20.0%	0.9
72	276	47	709	147	17.0%	20.8%	134	18.9%	15.0%	1.1	150	21.2%	20.0%	1.0
73	193	31	493	148	16.1%	30.0%	91	18.5%	15.0%	1.6	104	21.1%	20.0%	1.4
74	138	19	329	40	13.8%	12.1%	61	18.6%	15.0%	0.7	69	21.0%	20.0%	0.6
75	135	25	324	74	18.5%	22.9%	50	15.4%	15.0%	1.5	65	20.0%	20.0%	1.1
76	91	12	202	34	13.2%	16.7%	37	18.3%	15.0%	0.9	42	20.8%	20.0%	0.8
77	65	16	137	35	24.6%	25.6%	26	19.0%	15.0%	1.3	29	21.2%	20.0%	1.2
78	31	7	113	18	22.6%	16.2%	35	31.0%	15.0%	0.5	28	24.8%	20.0%	0.7
79	31	5	103	10	16.1%	9.8%	38	36.9%	15.0%	0.3	27	26.2%	20.0%	0.4
80+	114	21	326	40	18.4%	12.3%	326	99.9%	100.0%	0.1	326	99.9%	100.0%	0.1
<b>Totals:</b>	<b>17,233</b>	<b>3,091</b>	<b>65,577</b>	<b>14,186</b>	<b>16.1%</b>	<b>21.6%</b>	<b>12,804</b>	<b>19.5%</b>		<b>1.1</b>	<b>14,493</b>	<b>22.1%</b>	<b>17.0%</b>	<b>1.0</b>
<b>Excluding 80+:</b>	<b>17,119</b>	<b>3,070</b>	<b>65,250</b>	<b>14,146</b>	<b>18.4%</b>	<b>21.7%</b>	<b>12,478</b>	<b>19.1%</b>		<b>1.1</b>	<b>14,167</b>	<b>21.7%</b>	<b>15.8%</b>	<b>1.0</b>

Rates are for Tier 1 members only. Expected retirements for a member who has 40 or more years of service:

- 50 percent under the current assumptions (younger than age 80)
- 1.5 times the rate for under 40 years of service under the proposed assumptions (younger than age 80)

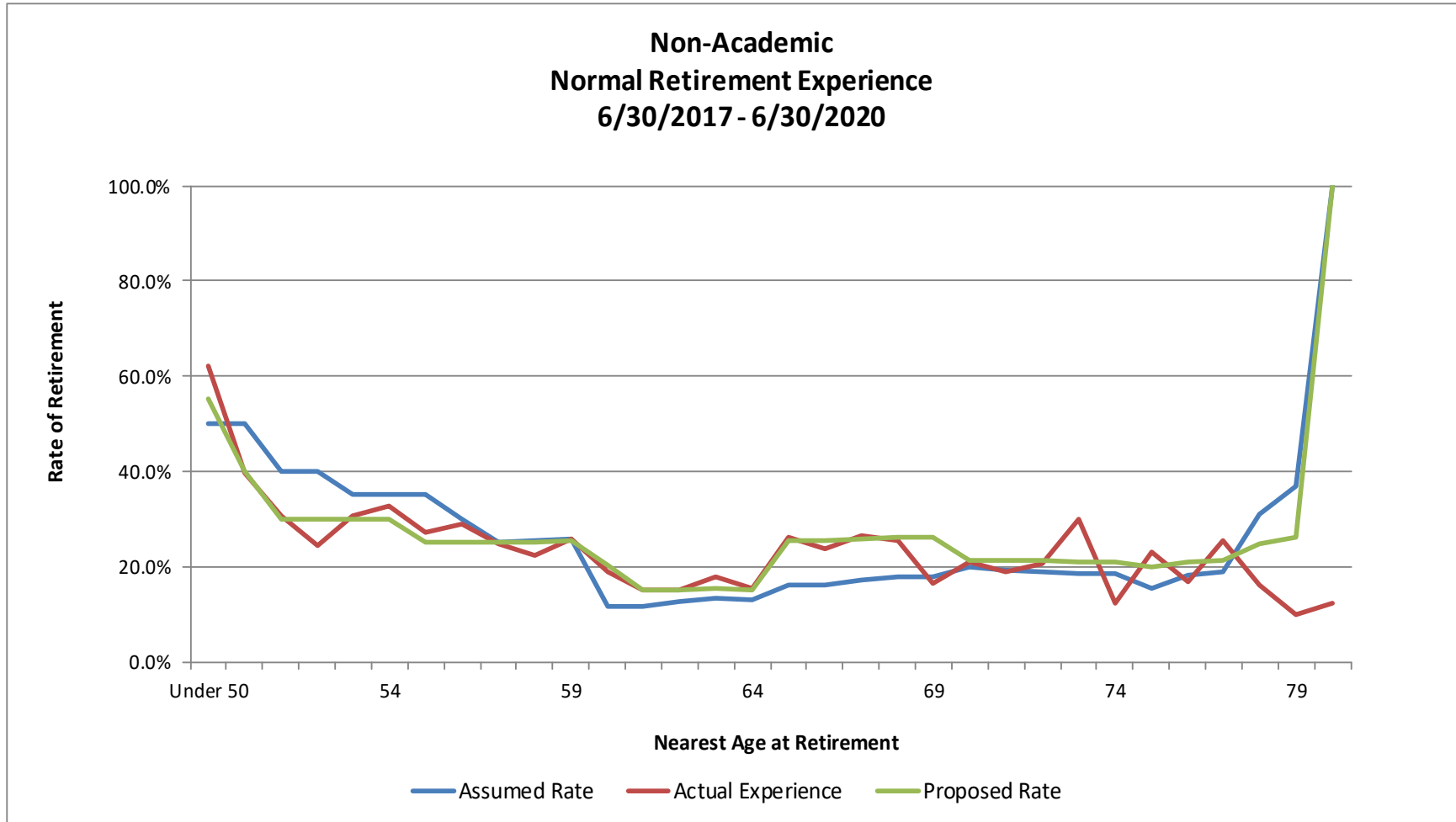
There is not current retirement experience for Tier 2 members who have different eligibility conditions. Separate retirement rates apply for Tier 2 members.





# Tier 1 Early Retirement Assumption

Graph II(a)(ii)



Rates are for Tier 1 members only. Expected retirements for a member who has 40 or more years of service:

- 50 percent under the current assumptions (younger than age 80)
- 1.5 times the rate for under 40 years of service under the proposed assumptions (younger than age 80)

There is not current retirement experience for Tier 2 members who have different eligibility conditions. Separate retirement rates apply for Tier 2 members.



# Tier 1 Early Retirement Assumption

Academic

Table II(b)(i)

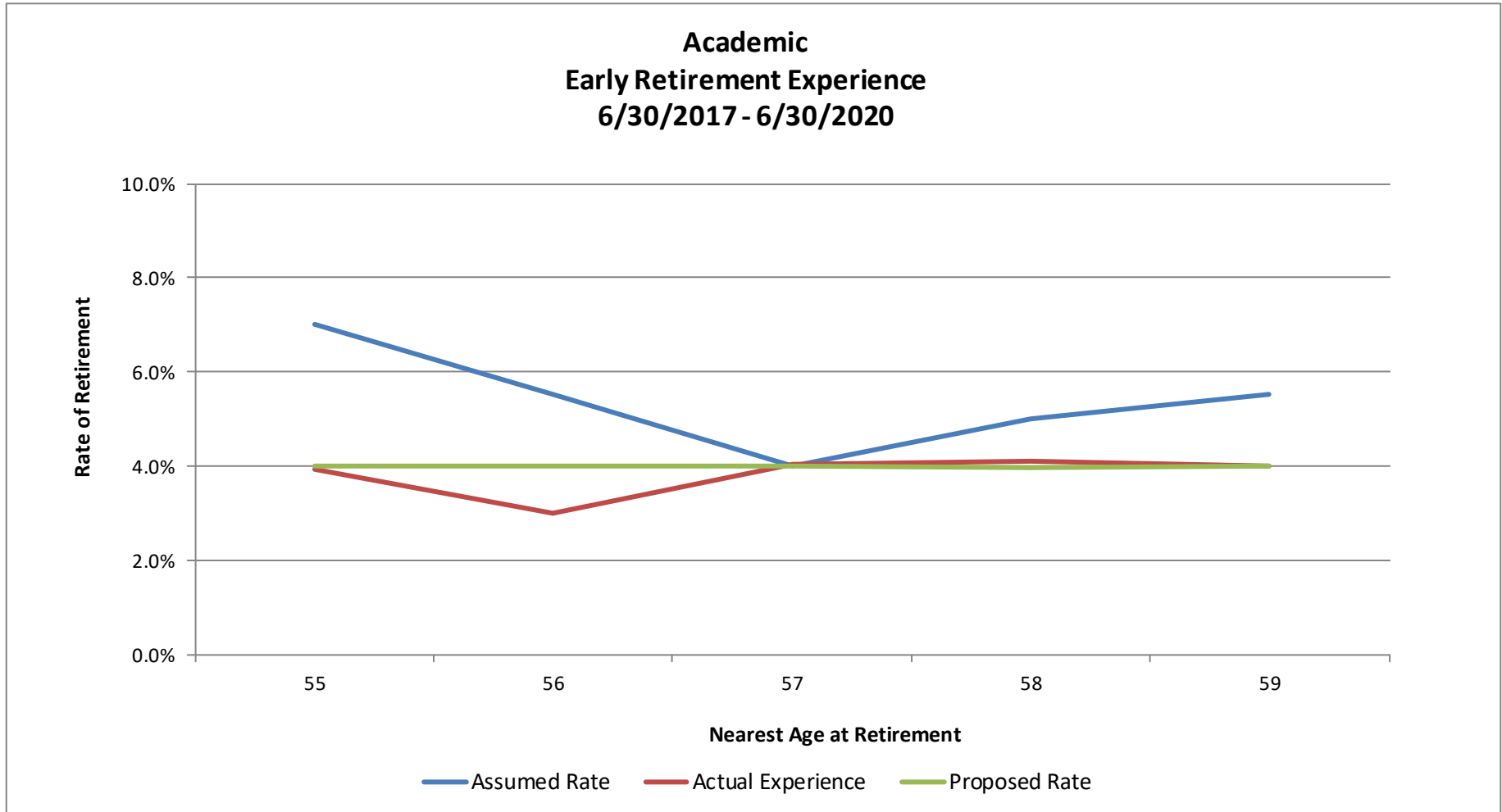
Nearest Age @ Retirement	Actual Experience				Current Assumptions - LW			Proposed Assumptions - LW		
	Population Weighted		Liability Weighted (LW)		Expected Retirements	Assumed Rate	Actual / Expected	Expected Retirements	Proposed Rate	Actual / Expected
	Exposures	Retirements	Exposures	Retirements						
55	1,475	52	6,278	247	439	7.0%	0.6	251	4.0%	1.0
56	1,452	41	6,319	190	348	5.5%	0.5	253	4.0%	0.8
57	1,384	42	6,252	252	250	4.0%	1.0	250	4.0%	1.0
58	1,352	45	6,112	250	306	5.0%	0.8	244	4.0%	1.0
59	1,359	57	6,105	245	336	5.5%	0.7	244	4.0%	1.0
<b>Totals:</b>	<b>7,022</b>	<b>237</b>	<b>31,066</b>	<b>1,184</b>	<b>1,679</b>	<b>5.4%</b>	<b>0.7</b>	<b>1,242</b>	<b>4.0%</b>	<b>1.0</b>

*Rates are for Tier 1 members only. There is not current retirement experience for Tier 2 members who have different eligibility conditions. Separate retirement rates apply for Tier 2 members. Current assumptions and proposed assumptions are based on liability weighting.*



# Tier 1 Early Retirement Assumption

Graph II(b)(i)



*Current assumptions and proposed assumptions are based on liability weighting.*

## Tier 1 Early Retirement Assumption

Non-Academic

Table II(b)(ii)

Nearest Age @ Retirement	Actual Experience						Current Assumptions - LW			Proposed Assumptions - LW		
	Population Weighted		Liability Weighted (LW)		Rates Weighted by		Expected Retirements	Assumed Rate	Actual / Expected	Expected Retirements	Proposed Rate	Actual / Expected
	Exposures	Retirements	Exposures	Retirements	Population	Liabilities						
55	2,065	139	6,374	556	6.7%	8.7%	446	7.0%	1.2	510	8.0%	1.1
56	1,994	104	5,981	354	5.2%	5.9%	329	5.5%	1.1	329	5.5%	1.1
57	1,928	83	5,845	327	4.3%	5.6%	234	4.0%	1.4	321	5.5%	1.0
58	1,926	85	5,861	304	4.4%	5.2%	293	5.0%	1.0	322	5.5%	0.9
59	1,905	102	5,835	411	5.4%	7.0%	321	5.5%	1.3	408	7.0%	1.0
<b>Totals:</b>	<b>9,818</b>	<b>513</b>	<b>29,896</b>	<b>1,951</b>	<b>5.2%</b>	<b>6.5%</b>	<b>1,623</b>	<b>5.4%</b>	<b>1.2</b>	<b>1,890</b>	<b>6.3%</b>	<b>1.0</b>

*Rates are for Tier 1 members only. There is not current retirement experience for Tier 2 members who have different eligibility conditions.*

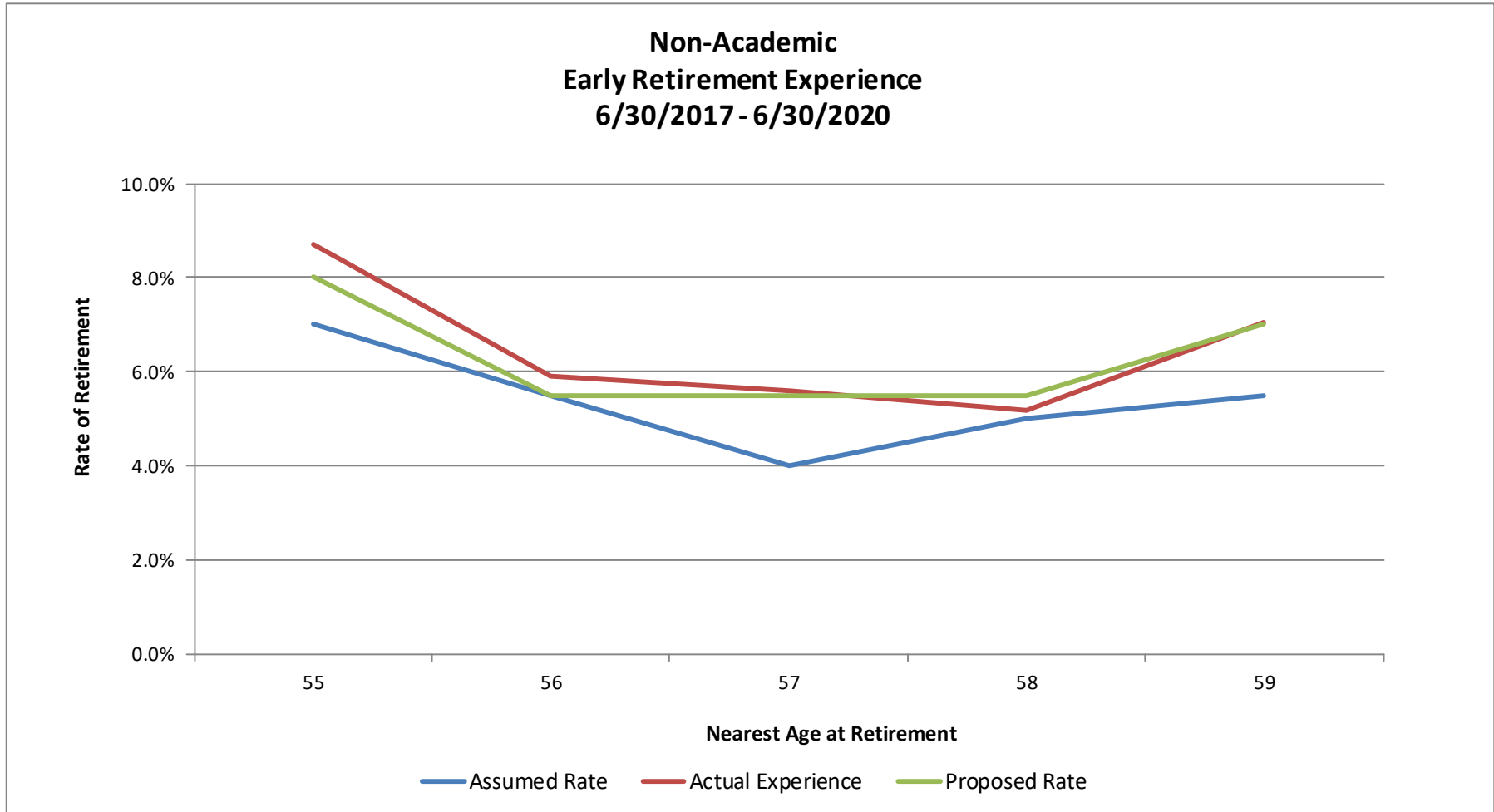
*Separate retirement rates apply for Tier 2 members.*

*Current assumptions and proposed assumptions are based on liability weighting.*



# Tier 1 Early Retirement Assumption

Graph II(b)(ii)



*Current assumptions and proposed assumptions are based on liability weighting.*



## Tier 1 Retirement Assumption Summary

Table II(c)(i)

Nearest Age @ Retirement	Tier 1 - Normal (Unreduced) Retirement						Tier 1 - Early (Reduced) Retirement		
	Current Rates		Proposed Rates				Current Rates	Proposed Rates	
	Under 40 Years	40+ Years	Academic		Non-Academic			Academic	Non-Academic
	Under 40 Years	40+ Years	Under 40 Years	40+ Years	Under 40 Years	40+ Years			
Under 50	50.0%	50.0%	55.0%		55.0%				
50	50.0%	50.0%	55.0%		40.0%				
51	40.0%	50.0%	40.0%		30.0%				
52	40.0%	50.0%	40.0%		30.0%				
53	35.0%	50.0%	30.0%		30.0%				
54	35.0%	50.0%	30.0%		30.0%				
55	35.0%	50.0%	20.0%	30.0%	25.0%	37.5%	7.0%	4.0%	8.0%
56	30.0%	50.0%	20.0%	30.0%	25.0%	37.5%	5.5%	4.0%	5.5%
57	25.0%	50.0%	20.0%	30.0%	25.0%	37.5%	4.0%	4.0%	5.5%
58	25.0%	50.0%	20.0%	30.0%	25.0%	37.5%	5.0%	4.0%	5.5%
59	25.0%	50.0%	20.0%	30.0%	25.0%	37.5%	5.5%	4.0%	7.0%
60	11.0%	50.0%	13.0%	19.5%	20.0%	30.0%			
61	11.0%	50.0%	13.0%	19.5%	15.0%	22.5%			
62	12.0%	50.0%	13.0%	19.5%	15.0%	22.5%			
63	12.0%	50.0%	13.0%	19.5%	15.0%	22.5%			
64	12.0%	50.0%	13.0%	19.5%	15.0%	22.5%			
65	15.0%	50.0%	17.0%	25.5%	25.0%	37.5%			
66	15.0%	50.0%	17.0%	25.5%	25.0%	37.5%			
67	15.0%	50.0%	17.0%	25.5%	25.0%	37.5%			
68	15.0%	50.0%	17.0%	25.5%	25.0%	37.5%			
69	15.0%	50.0%	17.0%	25.5%	25.0%	37.5%			
70	15.0%	50.0%	17.0%	25.5%	20.0%	30.0%			
71-79	15.0%	50.0%	15.0%	22.5%	20.0%	30.0%			
80+	100.0%	50.0%	100.0%	100.0%	100.0%	100.0%			

*Non-Academic rates are used for members who are Police and Firefighters.*



## Tier 2 Retirement Assumption

Table II(c)(ii)

Nearest Age @ Retirement	Tier 2 - Normal Retirement				Tier 2 - Early Retirement			
	Current Rate	Proposed Rate		Current Rate	Proposed Rate	Current Rate	Proposed Rate	
	Non Police	Academic	Non-Academic	Police	Police	All	Academic	Non- Academic
60				60.0%	60.0%			
61				25.0%	25.0%			
62				25.0%	25.0%	25.0%	25.0%	35.0%
63				25.0%	25.0%	10.0%	10.0%	15.0%
64				25.0%	25.0%	10.0%	10.0%	15.0%
65				15.0%	15.0%	10.0%	10.0%	15.0%
66				15.0%	15.0%	10.0%	10.0%	15.0%
67	35.0%	35.0%	35.0%	15.0%	15.0%			
68	15.0%	17.0%	25.0%	15.0%	25.0%			
69	15.0%	17.0%	25.0%	15.0%	25.0%			
70	15.0%	17.0%	20.0%	15.0%	20.0%			
71	15.0%	15.0%	20.0%	15.0%	20.0%			
72	15.0%	15.0%	20.0%	15.0%	20.0%			
73	15.0%	15.0%	20.0%	15.0%	20.0%			
74	15.0%	15.0%	20.0%	15.0%	20.0%			
75	15.0%	15.0%	20.0%	15.0%	20.0%			
76	15.0%	15.0%	20.0%	15.0%	20.0%			
77	15.0%	15.0%	20.0%	15.0%	20.0%			
78	15.0%	15.0%	20.0%	15.0%	20.0%			
79	15.0%	15.0%	20.0%	15.0%	20.0%			
80+	100.0%	100.0%	100.0%	100.0%	100.0%			

Retirement rates for a member who has 40 or more years of service:

- 50 percent under the current assumptions (younger than age 80)
- 1.5 times the rate for under 40 years of service under the proposed assumptions (younger than age 80)



# Turnover Assumption

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## Turnover

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

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

Typically, we would consider a status change from active to inactive a termination in developing turnover rates. However, because some of these participants return to active status and accrue additional benefits, we have considered this in our analysis of turnover experience. The “Net Turnover” column shows the number of employees, by years of service, who went from inactive to active status between the experience study period of June 30, 2017, and June 30, 2020. While these participants are not necessarily the same exact participants who went to inactive status during the experience study period, we believe that using this data helps us develop proposed net effective turnover rates.

There were more terminations than expected under the current assumptions. Based on our analysis, we recommend maintaining service-based rates and making the following changes to the turnover rates:

- Slight decrease in rates at most ages; and
- Maintain a pattern of decreasing termination rates by years of service.

In addition, we recommend continuing to assume that members who are eligible for a deferred benefit elect the option that is more valuable – return of contributions or a deferred benefit. This will provide a level of conservatism in the actuarial valuation.

The tables and graphs on the following pages show termination experience by service, including the impact of members returning from inactive to active status.

- Table III(a) and Graph III(a) – Termination Experience by Service – Academic
- Table III(b) and Graph III(b) – Termination Experience by Service – Non-Academic



# Turnover Assumption

Table III(a)

**Academic**

Service BOY	Actual Experience				Actual Experience			Current Assumptions			Proposed Assumptions		
	Population Weighted				Liability Weighted			Liability Weighted			Liability Weighted		
	Exposures	Turnover	Net Turnover <sup>1</sup>	Actual Rate	Exposures	Net Turnover <sup>1</sup>	Actual Rate	Expected Turnover	Assumed Rate	Actual / Expected <sup>1</sup>	Expected Turnover	Proposed Rate	Actual / Expected <sup>2</sup>
0	427	178	37	8.67%	30	2	6.05%	6	20.00%	0.3	5	15.00%	0.4
1	2,318	650	535	23.08%	147	19	13.15%	29	20.00%	0.7	22	15.00%	0.9
2	2,322	273	91	3.92%	291	28	9.76%	44	15.00%	0.6	35	12.00%	0.8
3	3,485	611	422	12.11%	534	54	10.19%	75	14.00%	0.7	59	11.00%	0.9
4	3,778	596	458	12.12%	766	71	9.30%	100	13.00%	0.7	77	10.00%	0.9
5	3,413	478	367	10.75%	1,006	76	7.57%	121	12.00%	0.6	91	9.00%	0.8
6	3,010	363	278	9.24%	1,214	84	6.88%	121	10.00%	0.7	97	8.00%	0.9
7	2,713	261	200	7.37%	1,578	81	5.12%	142	9.00%	0.6	110	7.00%	0.7
8	2,464	200	147	5.97%	1,933	89	4.62%	155	8.00%	0.6	116	6.00%	0.8
9	2,255	201	158	7.01%	2,392	104	4.33%	167	7.00%	0.6	120	5.00%	0.9
10	2,195	161	117	5.33%	2,803	95	3.38%	168	6.00%	0.6	112	4.00%	0.8
11	2,064	149	116	5.62%	3,208	127	3.94%	160	5.00%	0.8	128	4.00%	1.0
12	1,899	111	86	4.53%	3,340	93	2.80%	150	4.50%	0.6	100	3.00%	0.9
13	1,767	96	68	3.85%	3,680	75	2.05%	147	4.00%	0.5	110	3.00%	0.7
14	1,662	80	61	3.67%	4,050	97	2.39%	162	4.00%	0.6	121	3.00%	0.8
15	1,568	62	43	2.74%	4,480	101	2.24%	179	4.00%	0.6	112	2.50%	0.9
16	1,515	45	32	2.11%	4,799	75	1.57%	168	3.50%	0.4	120	2.50%	0.6
17	1,358	44	32	2.36%	4,792	62	1.29%	168	3.50%	0.4	120	2.50%	0.5
18	1,201	28	24	2.00%	4,440	48	1.08%	155	3.50%	0.3	111	2.50%	0.4
19	1,042	22	16	1.54%	4,261	44	1.02%	128	3.00%	0.3	107	2.50%	0.4
20	906	40	33	3.64%	4,058	82	2.03%	122	3.00%	0.7	81	2.00%	1.0
21	772	20	16	2.07%	4,028	60	1.50%	121	3.00%	0.5	81	2.00%	0.7
22	694	18	13	1.87%	3,918	59	1.50%	98	2.50%	0.6	78	2.00%	0.8
23	622	16	12	1.93%	4,011	55	1.37%	100	2.50%	0.6	80	2.00%	0.7
24	603	16	11	1.82%	4,250	48	1.14%	106	2.50%	0.5	85	2.00%	0.6
25	552	16	12	2.17%	4,200	62	1.49%	84	2.00%	0.7	63	1.50%	1.0
26	494	9	8	1.62%	4,053	36	0.89%	81	2.00%	0.4	61	1.50%	0.6
27	428	5	5	1.17%	3,921	26	0.67%	78	2.00%	0.3	59	1.50%	0.4
28	330	9	9	2.73%	3,486	47	1.35%	70	2.00%	0.7	52	1.50%	0.9
29	60	3	2	3.33%	628	24	3.84%	13	2.00%	1.9	9	1.50%	2.7
<b>Totals:</b>	<b>47,917</b>	<b>4,761</b>	<b>3,409</b>	<b>7.11%</b>	<b>86,298</b>	<b>1,926</b>	<b>2.23%</b>	<b>3,418</b>	<b>7.13%</b>	<b>0.6</b>	<b>2,522</b>	<b>2.92%</b>	<b>0.8</b>

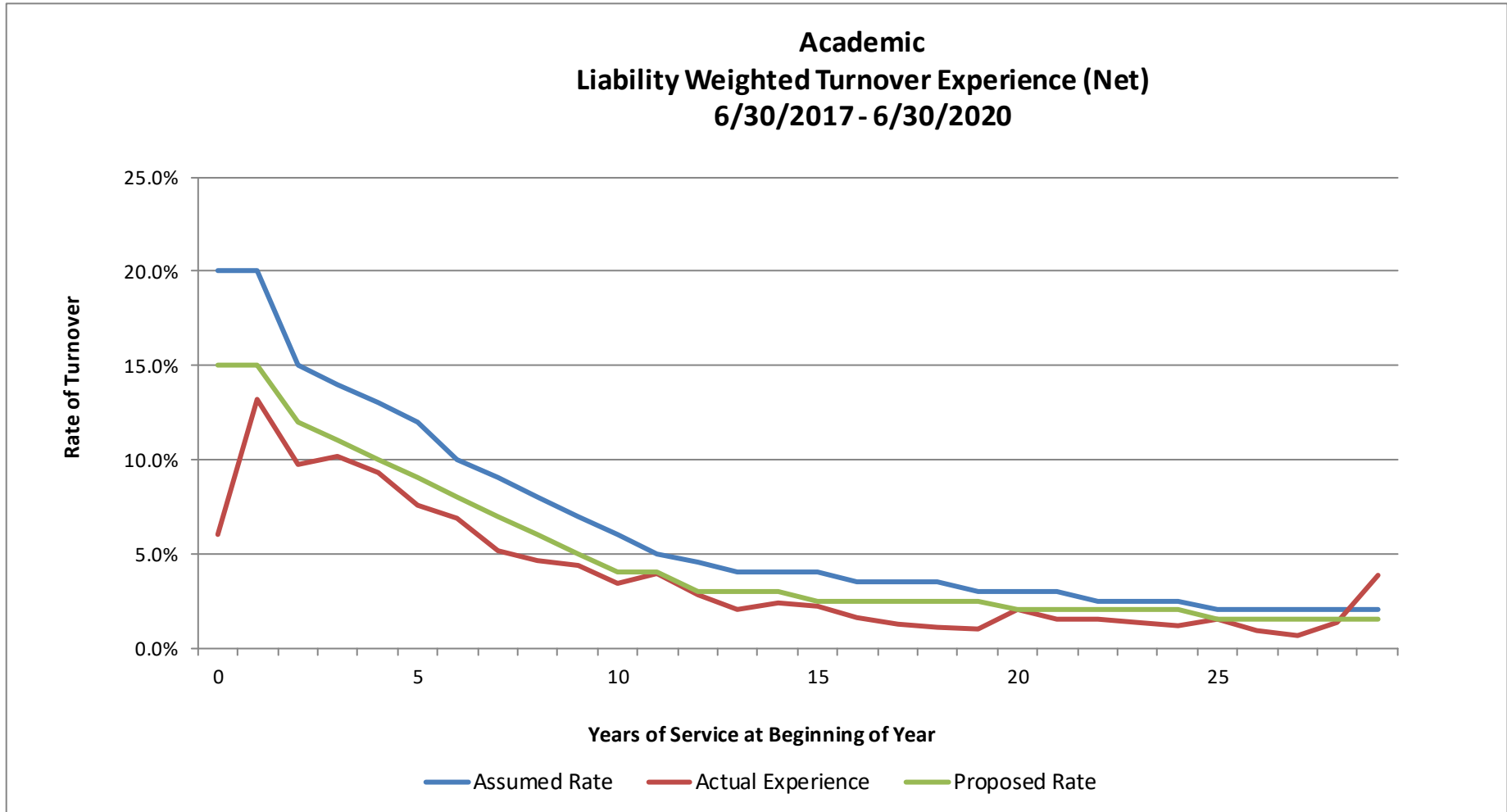
<sup>1</sup> Reflects actual turnover net of inactive members who returned to active service.

<sup>2</sup> Actual to expected ratio based on net turnover.



# Turnover Assumption

Graph III(a)



# Turnover Assumption

Table III(b)

**Non-Academic**

Service BOY	Actual Experience				Actual Experience			Current Assumptions			Proposed Assumptions		
	Population Weighted				Liability Weighted			Liability Weighted			Liability Weighted		
	Exposures	Turnover	Net Turnover <sup>1</sup>	Actual Rate	Exposures	Net Turnover <sup>1</sup>	Actual Rate	Expected Turnover	Assumed Rate	Actual / Expected <sup>1</sup>	Expected Turnover	Proposed Rate	Actual / Expected <sup>2</sup>
0	3,511	914	567	16.15%	232	13	5.78%	46	20.00%	0.3	35	15.00%	0.4
1	9,706	2,127	1,932	19.91%	578	63	10.94%	116	20.00%	0.5	87	15.00%	0.7
2	8,791	1,531	1,363	15.50%	873	119	13.59%	131	15.00%	0.9	131	15.00%	0.9
3	7,915	1,375	1,246	15.74%	1,262	177	14.04%	177	14.00%	1.0	177	14.00%	1.0
4	6,918	1,057	969	14.01%	1,605	181	11.30%	209	13.00%	0.9	193	12.00%	0.9
5	6,314	778	694	10.99%	2,072	188	9.07%	249	12.00%	0.8	207	10.00%	0.9
6	5,617	521	454	8.08%	2,410	176	7.31%	241	10.00%	0.7	217	9.00%	0.8
7	4,793	407	361	7.53%	2,682	169	6.31%	241	9.00%	0.7	215	8.00%	0.8
8	3,620	281	237	6.55%	2,692	174	6.48%	215	8.00%	0.8	188	7.00%	0.9
9	3,144	222	175	5.57%	3,087	159	5.15%	216	7.00%	0.7	185	6.00%	0.9
10	3,298	205	174	5.28%	3,844	183	4.76%	231	6.00%	0.8	192	5.00%	1.0
11	3,430	165	137	3.99%	4,513	166	3.69%	226	5.00%	0.7	226	5.00%	0.7
12	3,318	138	114	3.44%	5,120	165	3.22%	230	4.50%	0.7	179	3.50%	0.9
13	2,880	114	89	3.09%	5,125	148	2.88%	205	4.00%	0.7	179	3.50%	0.8
14	2,487	102	77	3.10%	5,029	137	2.72%	201	4.00%	0.7	176	3.50%	0.8
15	2,164	74	59	2.73%	4,920	127	2.57%	197	4.00%	0.6	148	3.00%	0.9
16	2,212	67	48	2.17%	5,599	119	2.13%	196	3.50%	0.6	168	3.00%	0.7
17	2,354	74	57	2.42%	6,495	154	2.37%	227	3.50%	0.7	195	3.00%	0.8
18	2,199	55	41	1.86%	6,505	122	1.88%	228	3.50%	0.5	195	3.00%	0.6
19	1,948	45	32	1.64%	6,089	100	1.65%	183	3.00%	0.5	183	3.00%	0.5
20	1,596	38	25	1.57%	5,456	93	1.71%	164	3.00%	0.6	109	2.00%	0.9
21	1,358	41	33	2.43%	4,998	121	2.42%	150	3.00%	0.8	100	2.00%	1.2
22	1,220	23	16	1.31%	5,017	76	1.52%	125	2.50%	0.6	100	2.00%	0.8
23	1,196	23	21	1.76%	5,458	79	1.44%	136	2.50%	0.6	109	2.00%	0.7
24	1,075	13	7	0.65%	5,414	56	1.03%	135	2.50%	0.4	108	2.00%	0.5
25	928	14	13	1.40%	4,953	54	1.09%	99	2.00%	0.5	74	1.50%	0.7
26	789	10	7	0.89%	4,476	57	1.27%	90	2.00%	0.6	67	1.50%	0.9
27	806	11	9	1.12%	5,007	49	0.98%	100	2.00%	0.5	75	1.50%	0.7
28	792	19	18	2.27%	5,453	115	2.11%	109	2.00%	1.1	82	1.50%	1.4
29	221	8	7	3.17%	1,574	38	2.40%	31	2.00%	1.2	24	1.50%	1.6
<b>Totals:</b>	<b>96,600</b>	<b>10,452</b>	<b>8,982</b>	<b>9.30%</b>	<b>118,539</b>	<b>3,579</b>	<b>3.02%</b>	<b>5,104</b>	<b>5.28%</b>	<b>0.7</b>	<b>4,324</b>	<b>3.65%</b>	<b>0.8</b>

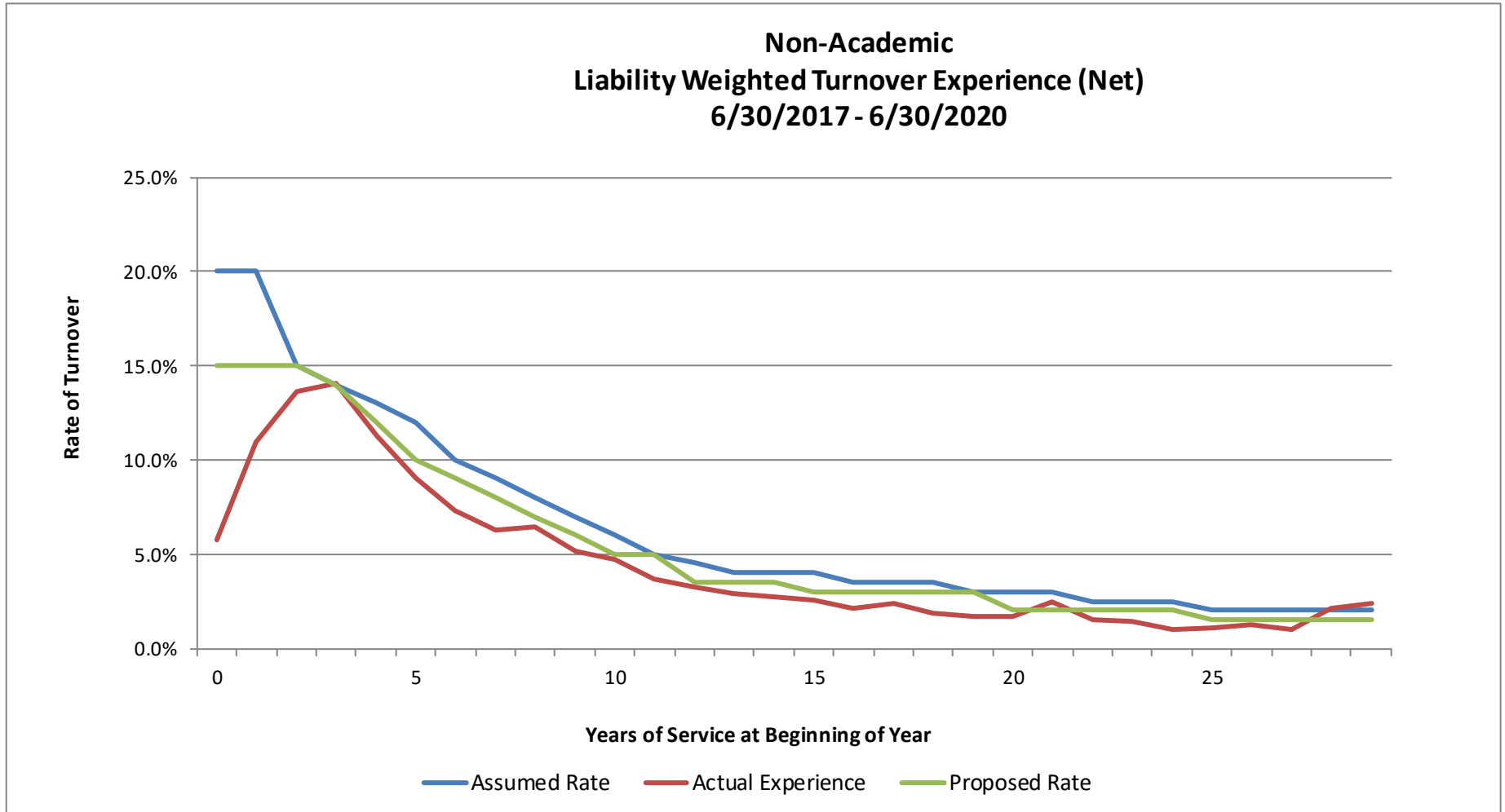
<sup>1</sup> Reflects actual turnover net of inactive members who returned to active service.

<sup>2</sup> Actual to expected ratio based on net turnover.



# Turnover Assumption

Graph III(b)



# Disability Assumption

## Disability

Disability experience during the last three years was considered in the analysis shown on the following pages. The “Exposure” column shows the number of employees in five-year age bands throughout the experience period.

We reviewed historical disability experience over the past eight years and found that a high percentage of members receiving disability benefits cease receiving disability benefits and either return to active status or are classified as inactive status. Therefore, in addition to reviewing the number of new disabilities each year from active status, we reviewed the number of “net disabilities” each year. “Net disabilities” are disabilities that are expected to be long-term and exclude the incidences of disability where the benefits ceased. In addition, there are members who start receiving disability benefits who were classified as either active members or inactive members in the previous actuarial valuation. Therefore, we considered this in recommending disability rates. Approximately 50 percent of disabled members (on average) do not maintain their disabled status and return to active or inactive status. Therefore, we recommend maintaining proposed rates that are 60 percent of the recommended rates we would have proposed based on actual disability experience (without consideration of disabilities that cease). The rate of 60 percent is slightly higher than the actual rate of 53 percent to account for the short-term cost for the disabled members who subsequently change from disabled status after receiving disability benefits.

	2013	2014	2015	2016	2017	2018	2019	2020	Total		
									8-Year	13-17	18-20
New Disabilities from Active Status	126	95	114	137	96	102	73	69	812	568	244
Return to Active Status	39	32	28	17	45	35	34	24	254	161	93
Change to Terminated Status	51	53	35	43	33	25	30	21	291	215	76
Net Disabilities	36	10	51	77	18	42	9	24	267	192	75
Net Disabilities as % of New Disabilities from Active	29%	11%	45%	56%	19%	41%	12%	35%	33%	34%	31%
New Disabilities from Inactive Status	47	41	42	47	39	56	34	47	353	216	137
Net Disabilities from Active and Inactive Status	83	51	93	124	57	98	43	71	620	408	212
Net Disabilities as % of New Disabilities from Active and Inactive	48%	38%	60%	67%	42%	62%	40%	61%	53%	52%	56%

Annualized disability benefits for new disability recipients from active status as of June 30, 2020, were approximately \$1.8 million. The recommended disability rates and methodology would account for the 60 percent of payments that are expected to be long term. We recommend adding a small load to the projected benefit payments to account for the short-term cost of the projected disability benefits that are expected to cease. The projected additional amount is \$0.7 million for the year ending June 30, 2021.

## Disability Assumption

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The tables and graphs on the following pages show experience for disability.

- Table and Graph IV(a) – Male Disability Experience – Academic
- Table and Graph IV(b) – Female Disability Experience – Academic
- Table and Graph IV(c) – Male Disability Experience – Non-Academic
- Table and Graph IV(d) – Female Disability Experience – Non-Academic

The disability experience reflected on the following pages does not include disability experience for the RSP. The RSP disability assumption was separately studied and a separate report was issued.

## Disability Assumption

Table IV(a)

### Academic – Male

Age @ Disablement	Actual Experience						Current Assumptions - LW			Proposed Assumptions - LW				
	Population Weighted			Liability Weighted (LW)			Net Rates Weighted by		Expected Disabilities	Assumed Rate	Actual (Net)/ Expected	Expected Disabilities	Proposed Rate	Actual (Net)/ Expected
	Exposures	Disabilities	Net Disabilities	Exposures	Disabilities	Net Disabilities	Population	Liabilities						
Under 20	1	0	0	0	0	0	0.0000%	0.0000%	0	0.0247%	0.0	0	0.0074%	0.0
20-25	28	0	0	1	0	0	0.0000%	0.0000%	0	0.0264%	0.0	0	0.0079%	0.0
25-29	402	0	0	33	0	0	0.0000%	0.0000%	0	0.0295%	0.0	0	0.0088%	0.0
30-34	1,524	0	0	340	0	0	0.0000%	0.0000%	0	0.0355%	0.0	0	0.0106%	0.0
35-39	2,919	0	0	1,568	0	0	0.0000%	0.0000%	1	0.0447%	0.0	0	0.0134%	0.0
40-44	3,485	1	1	4,181	1	0	0.0172%	0.0109%	3	0.0672%	0.2	1	0.0202%	0.5
45-49	3,838	0	0	7,940	0	0	0.0000%	0.0000%	8	0.1014%	0.0	2	0.0304%	0.0
50-54	4,044	1	1	12,951	0	0	0.0148%	0.0011%	18	0.1373%	0.0	5	0.0412%	0.0
55-59	4,394	2	1	20,662	11	7	0.0273%	0.0328%	32	0.1552%	0.2	10	0.0466%	0.7
60-64	4,105	1	1	21,545	3	2	0.0146%	0.0074%	33	0.1552%	0.0	10	0.0466%	0.2
65+	4,920	0	0	23,797	0	0	0.0000%	0.0000%	37	0.1552%	0.0	11	0.0466%	0.0
<b>Totals:</b>	<b>29,660</b>	<b>5</b>	<b>3</b>	<b>93,018</b>	<b>15</b>	<b>9</b>	<b>0.0101%</b>	<b>0.0096%</b>	<b>132</b>	<b>0.1418%</b>	<b>0.1</b>	<b>40</b>	<b>0.0425%</b>	<b>0.2</b>
<b>Under 40</b>	<b>4,874</b>	<b>0</b>	<b>0</b>	<b>1,942</b>	<b>0</b>	<b>0</b>	<b>0.0000%</b>	<b>0.0000%</b>	<b>1</b>	<b>0.0429%</b>	<b>0.0</b>	<b>0</b>	<b>0.0129%</b>	<b>0.0</b>
<b>40-59</b>	<b>15,761</b>	<b>4</b>	<b>2</b>	<b>45,734</b>	<b>12</b>	<b>7</b>	<b>0.0152%</b>	<b>0.0161%</b>	<b>61</b>	<b>0.1327%</b>	<b>0.1</b>	<b>18</b>	<b>0.0398%</b>	<b>0.4</b>
<b>60+</b>	<b>9,025</b>	<b>1</b>	<b>1</b>	<b>45,342</b>	<b>3</b>	<b>2</b>	<b>0.0066%</b>	<b>0.0035%</b>	<b>70</b>	<b>0.1552%</b>	<b>0.0</b>	<b>21</b>	<b>0.0466%</b>	<b>0.1</b>

Disability rates vary by age. Average rates for the five-year age bands are shown in the table above.

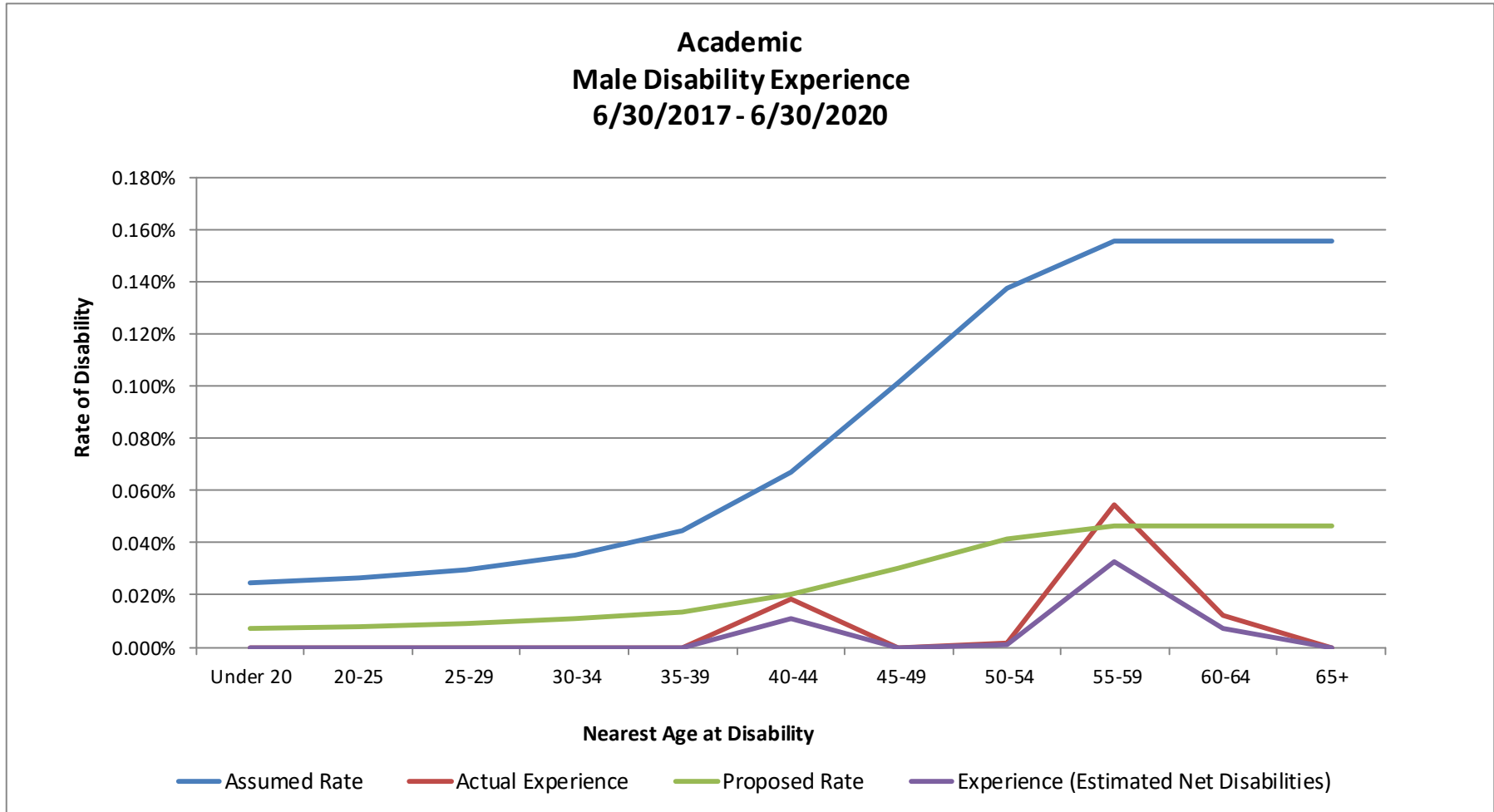
Current assumptions and proposed assumptions are based on liability weighting.

Actual to expected ratios for the proposed rates are based on estimated net disabilities (60 percent of actual disabilities).



# Disability Assumption

Graph IV(a)



Experience (Estimated Net Disabilities) is equal to 60 percent of actual disabilities.



# Disability Assumption

Table IV(b)

## Academic - Female

Age @ Disablement	Actual Experience						Current Assumptions - LW			Proposed Assumptions - LW				
	Population Weighted			Liability Weighted (LW)			Net Rates Weighted by		Expected	Assumed	Actual (Net)/	Expected	Proposed	Actual (Net)/
	Exposures	Disabilities	Net Disabilities	Exposures	Disabilities	Net Disabilities	Population	Liabilities	Disabilities	Rate	Expected	Disabilities	Rate	Expected
Under 20	0	0	0	0	0	0			0		0.0	0		0.0
20-25	28	0	0	1	0	0	0.0000%	0.0000%	0	0.0394%	0.0	0	0.0197%	0.0
25-29	544	0	0	45	0	0	0.0000%	0.0000%	0	0.0483%	0.0	0	0.0242%	0.0
30-34	2,065	0	0	455	0	0	0.0000%	0.0000%	0	0.0652%	0.0	0	0.0326%	0.0
35-39	3,826	1	1	2,081	1	1	0.0157%	0.0361%	2	0.0843%	0.4	1	0.0422%	0.9
40-44	4,460	3	2	4,894	5	3	0.0404%	0.0595%	5	0.1044%	0.6	3	0.0522%	1.1
45-49	4,687	0	0	8,396	0	0	0.0000%	0.0000%	10	0.1245%	0.0	5	0.0622%	0.0
50-54	4,684	2	1	12,150	1	1	0.0256%	0.0060%	18	0.1451%	0.0	9	0.0725%	0.1
55-59	4,769	4	2	16,597	24	14	0.0503%	0.0866%	26	0.1565%	0.6	13	0.0783%	1.1
60-64	4,048	1	1	14,759	4	2	0.0148%	0.0144%	23	0.1565%	0.1	12	0.0783%	0.2
65+	4,092	0	0	12,136	0	0	0.0000%	0.0000%	19	0.1565%	0.0	9	0.0783%	0.0
<b>Totals:</b>	<b>33,203</b>	<b>11</b>	<b>7</b>	<b>71,514</b>	<b>35</b>	<b>21</b>	<b>0.0199%</b>	<b>0.0292%</b>	<b>103</b>	<b>0.1445%</b>	<b>0.2</b>	<b>52</b>	<b>0.0722%</b>	<b>0.4</b>
<b>Under 40</b>	<b>6,463</b>	<b>1</b>	<b>1</b>	<b>2,582</b>	<b>1</b>	<b>1</b>	<b>0.0093%</b>	<b>0.0291%</b>	<b>2</b>	<b>0.0803%</b>	<b>0.4</b>	<b>1</b>	<b>0.0402%</b>	<b>0.7</b>
<b>40-59</b>	<b>18,600</b>	<b>9</b>	<b>5</b>	<b>42,037</b>	<b>30</b>	<b>18</b>	<b>0.0290%</b>	<b>0.0429%</b>	<b>59</b>	<b>0.1407%</b>	<b>0.3</b>	<b>30</b>	<b>0.0704%</b>	<b>0.6</b>
<b>60+</b>	<b>8,140</b>	<b>1</b>	<b>1</b>	<b>26,896</b>	<b>4</b>	<b>2</b>	<b>0.0074%</b>	<b>0.0079%</b>	<b>42</b>	<b>0.1565%</b>	<b>0.1</b>	<b>21</b>	<b>0.0783%</b>	<b>0.1</b>

*Disability rates vary by age. Average rates for the five-year age bands are shown in the table above.*

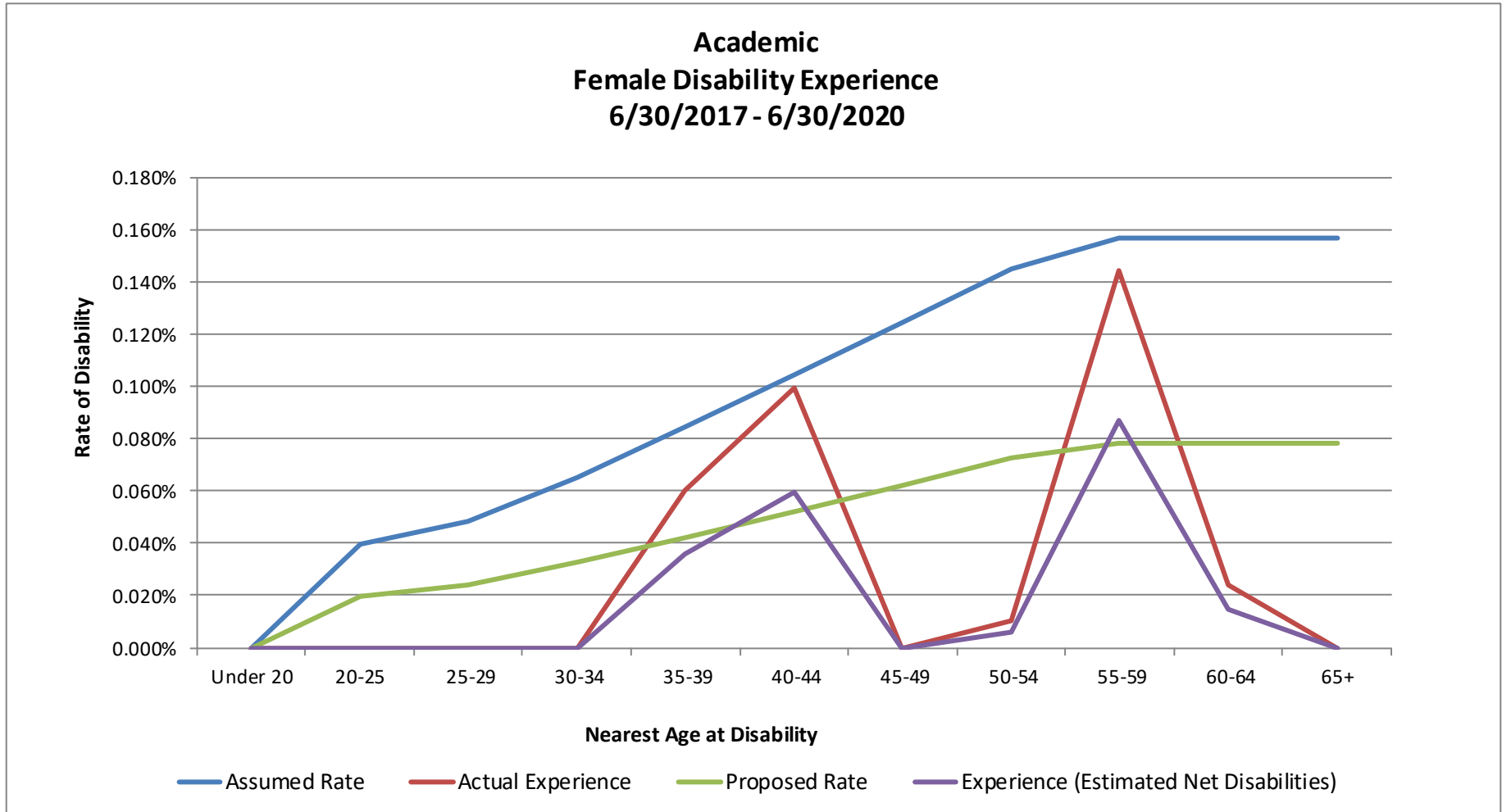
*Current assumptions and proposed assumptions are based on liability weighting.*

*Actual to expected ratios for the proposed rates are based on estimated net disabilities (60 percent of actual disabilities).*



# Disability Assumption

Graph IV(b)



Experience (Estimated Net Disabilities) is equal to 60 percent of actual disabilities.

## Disability Assumption

Table IV(c)

### Non-Academic - Male

Age @ Disablement	Actual Experience						Current Assumptions - LW			Proposed Assumptions - LW				
	Population Weighted			Liability Weighted (LW)			Net Rates Weighted by		Expected Disabilities	Assumed Rate	Actual (Net)/ Expected	Expected Disabilities	Proposed Rate	Actual (Net)/ Expected
	Exposures	Disabilities	Net Disabilities	Exposures	Disabilities	Net Disabilities	Population	Liabilities						
Under 20	1	0	0	0	0	0	0.0000%	0.0000%	0	0.0247%	0.0	0	0.0272%	0.0
20-25	418	0	0	17	0	0	0.0000%	0.0000%	0	0.0267%	0.0	0	0.0293%	0.0
25-29	2,579	2	1	272	0	0	0.0465%	0.0573%	0	0.0293%	2.0	0	0.0323%	1.8
30-34	4,917	0	0	1,488	0	0	0.0000%	0.0000%	1	0.0352%	0.0	1	0.0387%	0.0
35-39	5,079	4	2	3,661	2	1	0.0473%	0.0316%	2	0.0442%	0.7	2	0.0486%	0.7
40-44	5,030	6	4	6,561	6	3	0.0716%	0.0524%	4	0.0661%	0.8	5	0.0727%	0.7
45-49	5,392	12	7	11,347	25	15	0.1335%	0.1338%	11	0.1012%	1.3	13	0.1113%	1.2
50-54	5,619	15	9	16,225	39	23	0.1602%	0.1429%	22	0.1369%	1.0	24	0.1506%	0.9
55-59	5,555	19	11	17,449	51	31	0.2052%	0.1757%	27	0.1552%	1.1	30	0.1707%	1.0
60-64	4,045	17	10	12,301	35	21	0.2522%	0.1700%	19	0.1552%	1.1	21	0.1707%	1.0
65+	2,851	4	2	7,476	7	4	0.0842%	0.0549%	12	0.1552%	0.4	13	0.1707%	0.3
<b>Totals:</b>	<b>41,486</b>	<b>79</b>	<b>47</b>	<b>76,797</b>	<b>165</b>	<b>99</b>	<b>0.1143%</b>	<b>0.1286%</b>	<b>98</b>	<b>0.1276%</b>	<b>1.0</b>	<b>108</b>	<b>0.1404%</b>	<b>0.9</b>
<b>Under 40</b>	<b>12,994</b>	<b>6</b>	<b>4</b>	<b>5,439</b>	<b>2</b>	<b>1</b>	<b>0.0277%</b>	<b>0.0241%</b>	<b>2</b>	<b>0.0409%</b>	<b>0.6</b>	<b>2</b>	<b>0.0450%</b>	<b>0.5</b>
<b>40-59</b>	<b>21,596</b>	<b>52</b>	<b>31</b>	<b>51,582</b>	<b>121</b>	<b>72</b>	<b>0.1445%</b>	<b>0.1405%</b>	<b>65</b>	<b>0.1262%</b>	<b>1.1</b>	<b>72</b>	<b>0.1388%</b>	<b>1.0</b>
<b>60+</b>	<b>6,896</b>	<b>21</b>	<b>13</b>	<b>19,777</b>	<b>42</b>	<b>25</b>	<b>0.1827%</b>	<b>0.1265%</b>	<b>31</b>	<b>0.1552%</b>	<b>0.8</b>	<b>34</b>	<b>0.1707%</b>	<b>0.7</b>

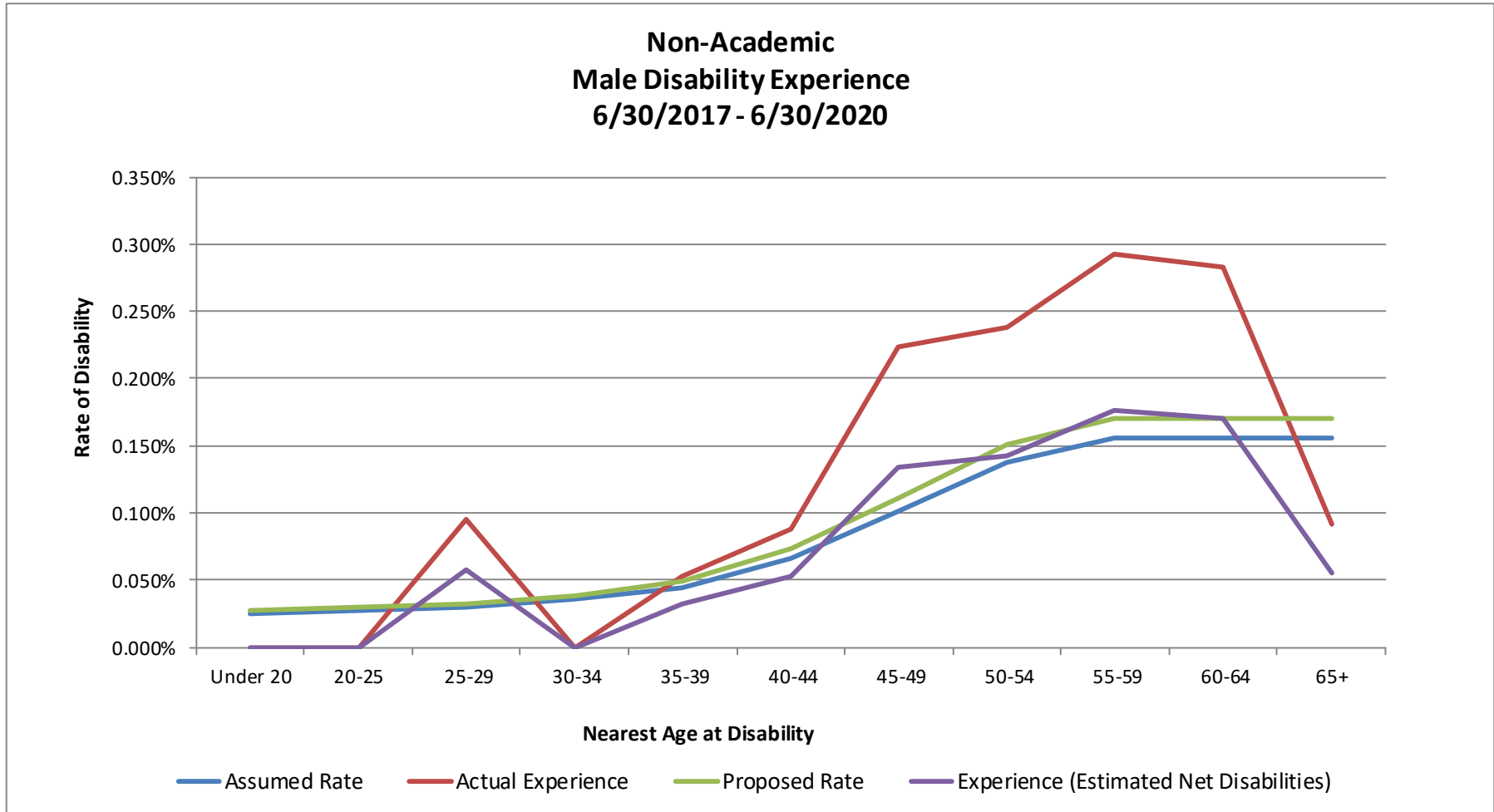
*Disability rates vary by age. Average rates for the five-year age bands are shown in the table above.*

*Current assumptions and proposed assumptions are based on liability weighting.*

*Actual to expected ratios for the proposed rates are based on estimated net disabilities (60 percent of actual disabilities).*

# Disability Assumption

Graph IV(c)



Experience (Estimated Net Disabilities) is equal to 60 percent of actual disabilities.

## Disability Assumption

Table IV(d)

### Non-Academic - Female

Age @ Disablement	Actual Experience						Current Assumptions - LW			Proposed Assumptions - LW				
	Population Weighted			Liability Weighted (LW)			Net Rates Weighted by		Expected	Assumed	Actual (Net)/	Expected	Proposed	Actual (Net)/
	Exposures	Disabilities	Net Disabilities	Exposures	Disabilities	Net Disabilities	Population	Liabilities	Disabilities	Rate	Expected	Disabilities	Rate	Expected
Under 20	2	0	0	0	0	0	0.0000%	0.0000%	0	0.0328%	0.0	0	0.0377%	0.0
20-25	514	1	1	19	0	0	0.1167%	0.3353%	0	0.0392%	8.5	0	0.0451%	7.4
25-29	4,272	0	0	417	0	0	0.0000%	0.0000%	0	0.0476%	0.0	0	0.0548%	0.0
30-34	7,015	5	3	1,869	2	1	0.0428%	0.0773%	1	0.0643%	1.2	1	0.0739%	1.0
35-39	7,857	7	4	5,116	5	3	0.0535%	0.0636%	4	0.0839%	0.8	5	0.0965%	0.7
40-44	7,757	16	10	8,666	14	8	0.1238%	0.0947%	9	0.1038%	0.9	10	0.1194%	0.8
45-49	8,137	21	13	14,389	43	26	0.1548%	0.1778%	18	0.1248%	1.4	21	0.1435%	1.2
50-54	9,230	29	17	22,304	46	28	0.1885%	0.1240%	32	0.1447%	0.9	37	0.1664%	0.7
55-59	9,313	28	17	24,676	64	38	0.1804%	0.1552%	39	0.1565%	1.0	44	0.1800%	0.9
60-64	7,001	25	15	18,394	73	44	0.2143%	0.2377%	29	0.1565%	1.5	33	0.1800%	1.3
65+	4,174	17	10	10,660	24	14	0.2444%	0.1351%	17	0.1565%	0.9	19	0.1800%	0.8
<b>Totals:</b>	<b>65,272</b>	<b>149</b>	<b>89</b>	<b>106,512</b>	<b>271</b>	<b>163</b>	<b>0.1370%</b>	<b>0.1527%</b>	<b>149</b>	<b>0.1399%</b>	<b>1.1</b>	<b>171</b>	<b>0.1609%</b>	<b>0.9</b>
<b>Under 40</b>	<b>19,660</b>	<b>13</b>	<b>8</b>	<b>7,421</b>	<b>8</b>	<b>5</b>	<b>0.0397%</b>	<b>0.0642%</b>	<b>6</b>	<b>0.0768%</b>	<b>0.8</b>	<b>7</b>	<b>0.0883%</b>	<b>0.7</b>
<b>40-59</b>	<b>34,437</b>	<b>94</b>	<b>56</b>	<b>70,037</b>	<b>166</b>	<b>100</b>	<b>0.1638%</b>	<b>0.1424%</b>	<b>98</b>	<b>0.1397%</b>	<b>1.0</b>	<b>113</b>	<b>0.1607%</b>	<b>0.9</b>
<b>60+</b>	<b>11,175</b>	<b>42</b>	<b>25</b>	<b>29,054</b>	<b>97</b>	<b>58</b>	<b>0.2255%</b>	<b>0.2001%</b>	<b>45</b>	<b>0.1565%</b>	<b>1.3</b>	<b>52</b>	<b>0.1800%</b>	<b>1.1</b>

*Disability rates vary by age. Average rates for the five-year age bands are shown in the table above.*

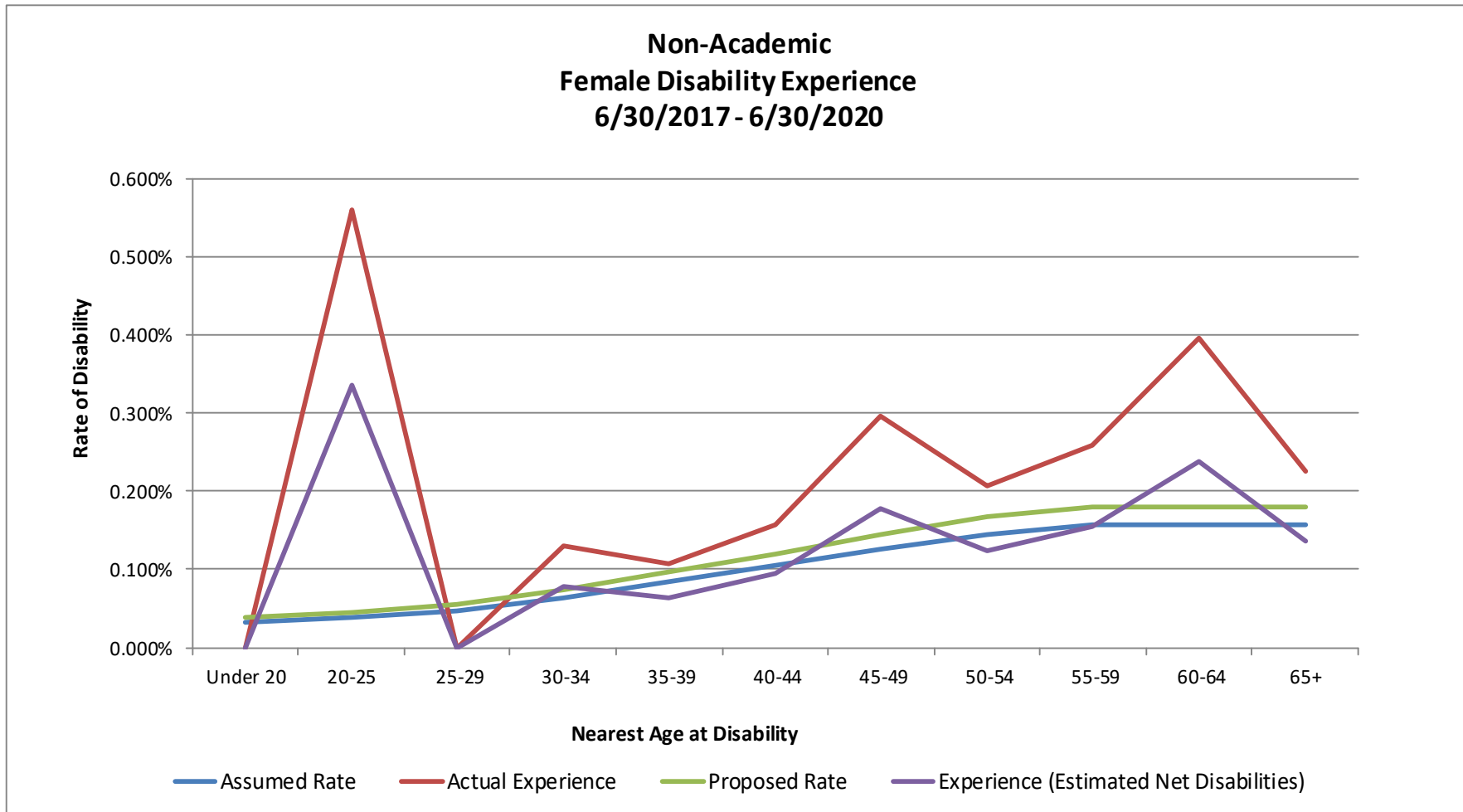
*Current assumptions and proposed assumptions are based on liability weighting.*

*Actual to expected ratios for the proposed rates are based on estimated net disabilities (60 percent of actual disabilities).*



# Disability Assumption

Graph IV(d)



Experience (Estimated Net Disabilities) is equal to 60 percent of actual disabilities.

# Mortality Assumptions

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## Mortality

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

### *Actuarial Standards of Practice*

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

### *The Pub-2010 Mortality Tables*

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

## Partial Credibility

We use what is termed “the limited fluctuation credibility procedure” to determine the appropriate scaling factor of the base mortality tables for each gender and each member classification. We used a benefits weighted basis for post-retirement non-disabled mortality and used a headcount basis for pre-retirement and post-retirement disabled mortality. In each case, the partial credibility factor (or “Z-factor”) is computed based on the experience of the specific group being studied. This Z-factor is a measure of the credibility of the pertinent group.

The Best Fit is the ratio of actual to expected deaths using the base table. The final scale is then determined as the weighted average of the Best Fit and 100% based on the Z-factor. For example, the Z-factor for Academic Male Active Members is 17%, suggesting that the data for this group is 17% credible (there were not enough deaths among active members to be completely credible). The Best Fit for this group would be to scale the base tables by 107%. The final scale of 101% is the credibility-weighted average ( $101\% = 17\% \times 107\% + 83\% \times 100\%$ ). Factors for other groups are determined similarly. For retired males, there were enough deaths (on a benefits basis) to warrant full credibility on a lives basis. Therefore, the Best Fit is used as the final scale.



## Mortality Assumptions

	Benefits or Liability Needed For Full Credibility	Observed Deaths	Z-Factor	Best Fit	Final Scale Factor
<b>Academic</b>					
Healthy Male Retirees	\$1,172	\$821	84%	99%	99%
Healthy Female Retirees	\$899	\$250	53%	110%	105%
<b>Non-Academic</b>					
Healthy Male Retirees	\$707	\$376	73%	99%	99%
Healthy Female Retirees	\$444	\$313	84%	108%	107%
Disabled Male Retirees	\$9,711	\$262	16%	172%	112%
Disabled Female Retirees	\$6,935	\$282	20%	152%	110%
<b>Academic</b>					
Male Active Members	\$10,594	\$316	17%	107%	101%
Female Active Members	\$8,534	\$81	10%	68%	97%
<b>Non-Academic</b>					
Male Active Members	\$7,534	\$317	21%	169%	114%
Female Active Members	\$5,508	\$196	19%	124%	105%

*Disabled and active member experience is based on liability amounts and healthy retiree experience is based on benefit amounts (total benefit amounts and liability amounts divided by 100,000). Disabled member experience is for six years (the current and previous experience study). The other experience is for the three years of the experience study.*

### Recommendations

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

Following is a summary of the current mortality assumptions:

Applicable Group	Base Table Mortality Table	Male Scaling Factor	Female Scaling Factor
Pre-retirement	RP-2014 White Collar Employee, sex distinct	93%	100%
Post-retirement (non-disabled)	RP-2014 White Collar Healthy Annuitant, sex distinct	96%	93%
Post-retirement (disabled)	RP-2014 Disabled Annuitant, sex distinct	112%	123%

*Future mortality improvements are reflected by projecting the base mortality tables back from the year 2014 to the year 2006 using the MP-2014 projection scale and projecting from 2006 using the MP-2017 projection scale.*





## Mortality Assumptions

Following is summary of the recommended mortality assumptions for members classified as an employee type of academic:

Academic Applicable Group	Base Table Mortality Table	Male Scaling Factor	Female Scaling Factor
Pre-retirement	Pub-2010 Employee Mortality Table (for Teachers)	101%	97%
Post-retirement (non-disabled)	Pub-2010 Healthy Retiree Mortality Table (for Teachers)	99%	105%
Post-retirement (disabled)	Pub-2010 Disabled Retiree Mortality Table (for Non-Safety Employees)	112%	110%

Following is summary of the recommended mortality assumptions for members classified as an employee type of non-academic:

Non-Academic Applicable Group	Base Table Mortality Table	Male Scaling Factor	Female Scaling Factor
Pre-retirement	Pub-2010 Employee Mortality Table (for General Employees)	114%	105%
Post-retirement (non-disabled)	Pub-2010 Healthy Retiree Mortality Table (for General Employees)	99%	107%
Post-retirement (disabled)	Pub-2010 Disabled Retiree Mortality Table (for Non-Safety Employees)	112%	110%

*Future mortality improvements are reflected by projecting the base mortality tables from 2010 using the MP-2020 projection scale.*

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

- Table and Graph V(a)(i) – Post-Retirement Mortality Experience – Academic
- Table and Graph V(a)(ii) – Post-Retirement Mortality Experience – Non-Academic
- Table and Graph V(b)(i) – Pre-Retirement Mortality Experience - Academic
- Table and Graph V(b)(ii) – Pre-Retirement Mortality Experience – Non-Academic
- Table and Graph V(c) – Disabled Mortality Experience – Combined Academic and Non-Academic

# Mortality Assumptions

## Academic – Post-Retirement Mortality (non-disabled)

Table V(a)(i)

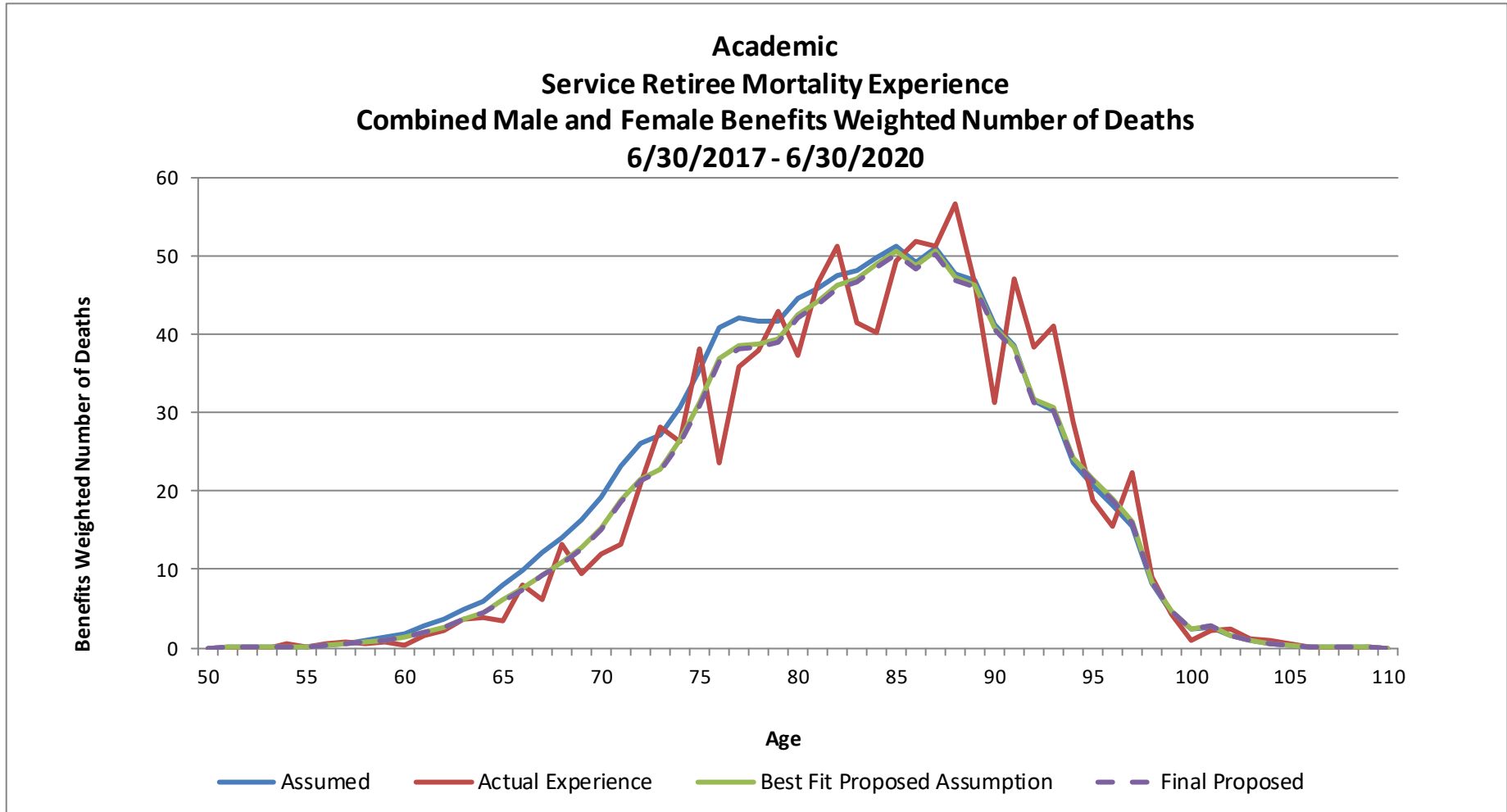
Male Service Retiree Mortality Experience															
Age	Actual Experience					Current Assumptions - BW			Best Fit Proposed Assumptions - BW			Final Proposed Assumptions - BW			
	Population Weighted		Benefits Weighted (BW)		Actual Rates Weighted by		Expected	Assumed	Actual /	Expected	Proposed	Actual /	Expected	Proposed	Actual /
	Exposures	Deaths	Exposures	Deaths	Population	Benefits	Deaths	Rate	Expected	Deaths	Rate	Expected	Deaths	Rate	Expected
Under 50	27	0	16	0	0.000%	0.000%	0	0.330%	0.00	0	0.161%	0.00	0	0.161%	0.00
50-54	1,060	2	433	1	0.189%	0.195%	2	0.451%	0.43	1	0.292%	0.67	1	0.292%	0.67
55-59	3,663	17	1,713	6	0.464%	0.375%	11	0.635%	0.59	8	0.468%	0.80	8	0.468%	0.80
60-64	7,623	60	3,942	25	0.787%	0.644%	37	0.951%	0.68	29	0.747%	0.86	29	0.747%	0.86
65-69	9,728	114	5,674	67	1.172%	1.174%	88	1.546%	0.76	74	1.297%	0.90	74	1.297%	0.90
70-74	8,388	202	5,769	129	2.408%	2.234%	152	2.635%	0.85	139	2.403%	0.93	139	2.403%	0.93
75-79	5,691	260	3,986	178	4.569%	4.462%	189	4.753%	0.94	182	4.570%	0.98	182	4.570%	0.98
80-84	3,474	328	2,351	212	9.442%	9.038%	205	8.739%	1.03	201	8.550%	1.06	201	8.550%	1.06
85-89	1,372	223	852	148	16.254%	17.372%	130	15.229%	1.14	128	15.010%	1.16	128	15.010%	1.16
90-94	373	85	226	51	22.788%	22.674%	53	23.288%	0.97	53	23.620%	0.96	53	23.620%	0.96
95-99	27	7	13	2	25.926%	19.974%	4	32.621%	0.61	4	33.122%	0.60	4	33.122%	0.60
100+	1	1	1	1	100.000%	100.000%	0	40.152%	2.49	0	40.962%	2.44	0	40.962%	2.44
<b>Totals:</b>	<b>41,427</b>	<b>1,299</b>	<b>24,975</b>	<b>821</b>	<b>3.136%</b>	<b>3.287%</b>	<b>872</b>	<b>3.491%</b>	<b>0.94</b>	<b>820</b>	<b>3.283%</b>	<b>1.00</b>	<b>820</b>	<b>3.283%</b>	<b>1.00</b>
Female Service Retiree Mortality Experience															
Under 50	44	1	28	1	2.273%	1.868%	0	0.235%	7.96	0	0.159%	11.73	0	0.152%	12.29
50-54	1,245	6	417	2	0.482%	0.451%	1	0.335%	1.34	1	0.280%	1.61	1	0.267%	1.69
55-59	4,714	19	1,576	5	0.403%	0.322%	8	0.514%	0.63	6	0.392%	0.82	6	0.374%	0.86
60-64	8,774	42	2,974	15	0.479%	0.500%	23	0.773%	0.65	17	0.573%	0.87	16	0.547%	0.91
65-69	8,459	94	3,118	34	1.111%	1.094%	38	1.230%	0.89	31	1.005%	1.09	30	0.960%	1.14
70-74	5,697	109	2,373	50	1.913%	2.087%	50	2.093%	1.00	46	1.946%	1.07	44	1.858%	1.12
75-79	3,051	98	1,225	39	3.212%	3.166%	46	3.760%	0.84	46	3.794%	0.83	44	3.621%	0.87
80-84	1,571	110	585	43	7.002%	7.296%	40	6.891%	1.06	42	7.184%	1.02	40	6.858%	1.06
85-89	785	107	284	38	13.631%	13.441%	35	12.414%	1.08	38	13.283%	1.01	36	12.680%	1.06
90-94	238	58	75	19	24.370%	25.065%	15	19.415%	1.29	16	21.712%	1.15	15	20.725%	1.21
95-99	44	17	13	5	38.636%	39.247%	4	29.404%	1.33	4	33.740%	1.16	4	32.206%	1.22
100+	4	2	1	0	50.000%	40.317%	0	40.567%	0.99	0	47.796%	0.84	0	45.625%	0.88
<b>Totals:</b>	<b>34,626</b>	<b>663</b>	<b>12,668</b>	<b>250</b>	<b>1.915%</b>	<b>1.970%</b>	<b>261</b>	<b>2.058%</b>	<b>0.96</b>	<b>249</b>	<b>1.966%</b>	<b>1.00</b>	<b>238</b>	<b>1.876%</b>	<b>1.05</b>
<b>Grand Totals:</b>	<b>76,053</b>	<b>1,962</b>	<b>25,308</b>	<b>499</b>	<b>2.580%</b>	<b>1.970%</b>	<b>521</b>	<b>2.060%</b>	<b>0.96</b>	<b>498</b>	<b>1.968%</b>	<b>1.00</b>	<b>475</b>	<b>1.878%</b>	<b>1.05</b>

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



# Mortality Assumptions

Graph V(a)(i)



# Mortality Assumptions

## Non-Academic – Post-Retirement Mortality (non-disabled)

Table V(a)(ii)

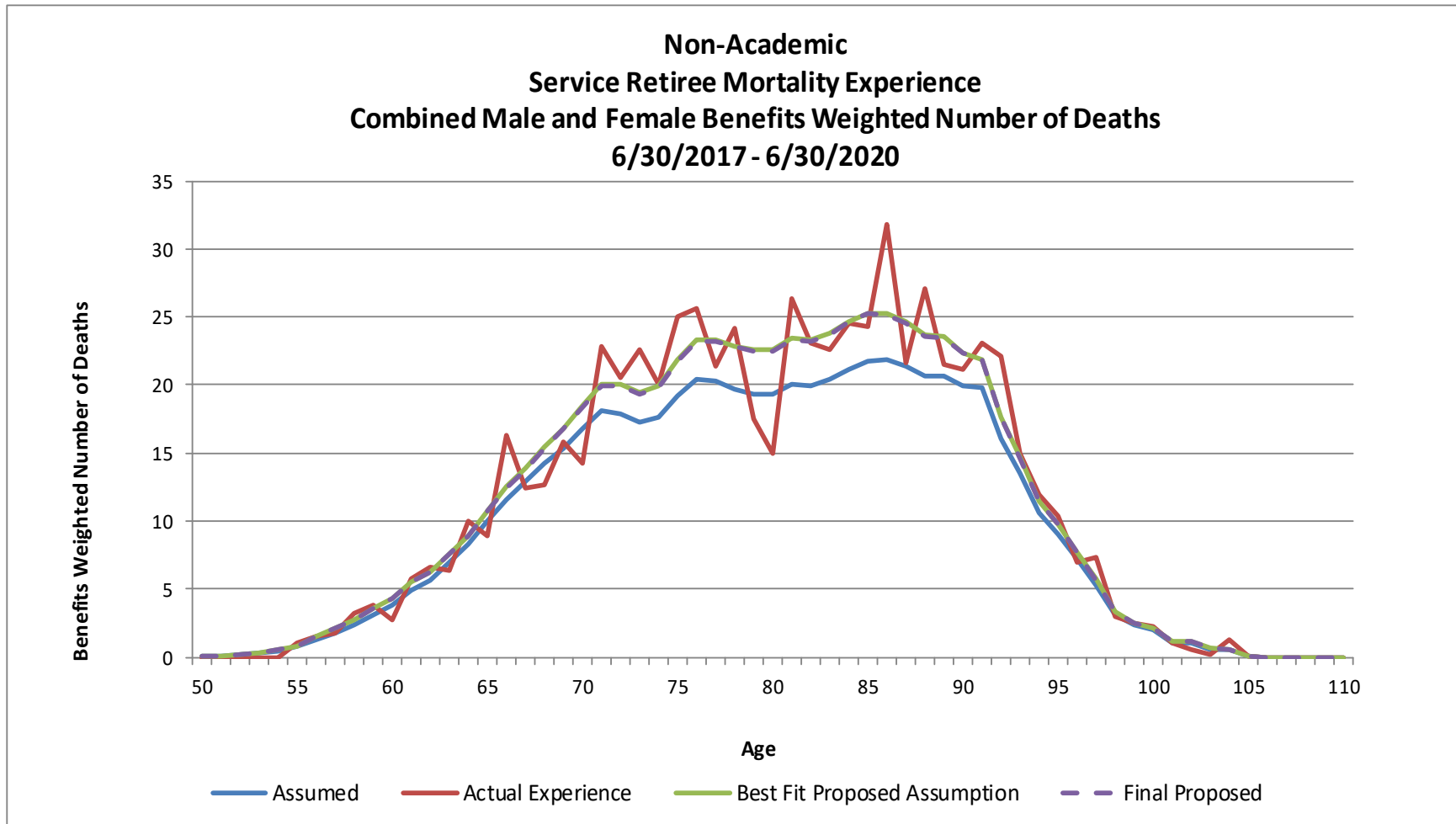
Male Service Retiree Mortality Experience															
Age	Actual Experience				Current Assumptions - BW				Best Fit Proposed Assumptions - BW			Final Proposed Assumptions - BW			
	Population Weighted		Benefits Weighted		Actual Rates Weighted by		Expected	Assumed	Actual /	Expected	Proposed	Actual /	Expected	Expected	Proposed
	Exposures	Deaths	Exposures	Deaths	Population	Benefits	Deaths	Rate	Expected	Deaths	Rate	Expected	Deaths	Rate	Expected
Under 50	256	0	143	0	0.000%	0.000%	0	0.330%	0.00	1	0.353%	0.00	1	0.353%	0.00
50-54	2,237	14	1,002	8	0.626%	0.766%	4	0.445%	1.72	5	0.522%	1.47	5	0.522%	1.47
55-59	5,028	45	2,188	15	0.895%	0.707%	14	0.626%	1.13	16	0.750%	0.94	16	0.750%	0.94
60-64	7,876	90	3,264	33	1.143%	1.012%	31	0.935%	1.08	36	1.091%	0.93	36	1.091%	0.93
65-69	7,279	140	2,991	56	1.923%	1.870%	45	1.511%	1.24	52	1.742%	1.07	52	1.742%	1.07
70-74	4,718	157	2,018	59	3.328%	2.947%	53	2.624%	1.12	62	3.061%	0.96	62	3.061%	0.96
75-79	3,074	180	1,239	65	5.856%	5.249%	59	4.748%	1.11	69	5.572%	0.94	69	5.572%	0.94
80-84	1,860	218	725	75	11.720%	10.398%	63	8.697%	1.20	71	9.850%	1.06	71	9.850%	1.06
85-89	778	143	306	50	18.380%	16.320%	46	15.141%	1.08	49	16.070%	1.02	49	16.070%	1.02
90-94	152	41	55	13	26.974%	23.382%	13	23.103%	1.01	13	23.786%	0.98	13	23.786%	0.98
95-99	16	5	5	1	31.250%	27.659%	2	31.819%	0.87	2	32.291%	0.86	2	32.291%	0.86
100+	0	0	0	0			0			0			0		
<b>Totals:</b>	<b>33,274</b>	<b>1,033</b>	<b>13,936</b>	<b>376</b>	<b>3.105%</b>	<b>2.700%</b>	<b>330</b>	<b>2.368%</b>	<b>1.14</b>	<b>376</b>	<b>2.699%</b>	<b>1.00</b>	<b>376</b>	<b>2.699%</b>	<b>1.00</b>
Female Service Retiree Mortality Experience															
Under 50	487	0	225	0	0.000%	0.000%	1	0.230%	0.00	1	0.280%	0.00	1	0.278%	0.00
50-54	4,004	11	1,446	4	0.275%	0.256%	5	0.331%	0.77	5	0.376%	0.68	5	0.373%	0.69
55-59	9,836	56	3,163	16	0.569%	0.504%	16	0.504%	1.00	16	0.511%	0.98	16	0.507%	0.99
60-64	14,469	100	4,337	33	0.691%	0.763%	33	0.770%	0.99	34	0.778%	0.98	33	0.770%	0.99
65-69	12,490	155	3,498	44	1.241%	1.263%	42	1.212%	1.04	46	1.306%	0.97	45	1.294%	0.98
70-74	8,467	209	2,218	54	2.468%	2.440%	46	2.072%	1.18	52	2.354%	1.04	52	2.332%	1.05
75-79	5,047	210	1,114	47	4.161%	4.179%	42	3.769%	1.11	49	4.376%	0.95	48	4.335%	0.96
80-84	2,842	242	617	51	8.515%	8.247%	43	7.007%	1.18	51	8.246%	1.00	50	8.170%	1.01
85-89	1,532	231	272	43	15.078%	15.904%	33	12.277%	1.30	39	14.282%	1.11	38	14.150%	1.12
90-94	483	112	72	17	23.188%	23.698%	14	19.545%	1.21	16	22.007%	1.08	16	21.804%	1.09
95-99	66	19	12	4	28.788%	31.834%	4	29.376%	1.08	4	33.095%	0.96	4	32.789%	0.97
100+	1	1	0	0	100.000%	100.000%	0	35.821%	2.79	0	40.987%	2.44	0	40.607%	2.46
<b>Totals:</b>	<b>59,724</b>	<b>1,346</b>	<b>16,974</b>	<b>313</b>	<b>2.254%</b>	<b>1.843%</b>	<b>279</b>	<b>1.646%</b>	<b>1.12</b>	<b>312</b>	<b>1.840%</b>	<b>1.00</b>	<b>309</b>	<b>1.823%</b>	<b>1.01</b>
<b>Grand Totals:</b>	<b>92,998</b>	<b>2,379</b>	<b>33,724</b>	<b>626</b>	<b>2.558%</b>	<b>1.855%</b>	<b>558</b>	<b>1.655%</b>	<b>1.12</b>	<b>624</b>	<b>1.850%</b>	<b>1.00</b>	<b>618</b>	<b>1.833%</b>	<b>1.01</b>

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



# Mortality Assumptions

Graph V(a)(ii)



# Mortality Assumptions

## Academic – Pre-Retirement Mortality

Table V(b)(i)

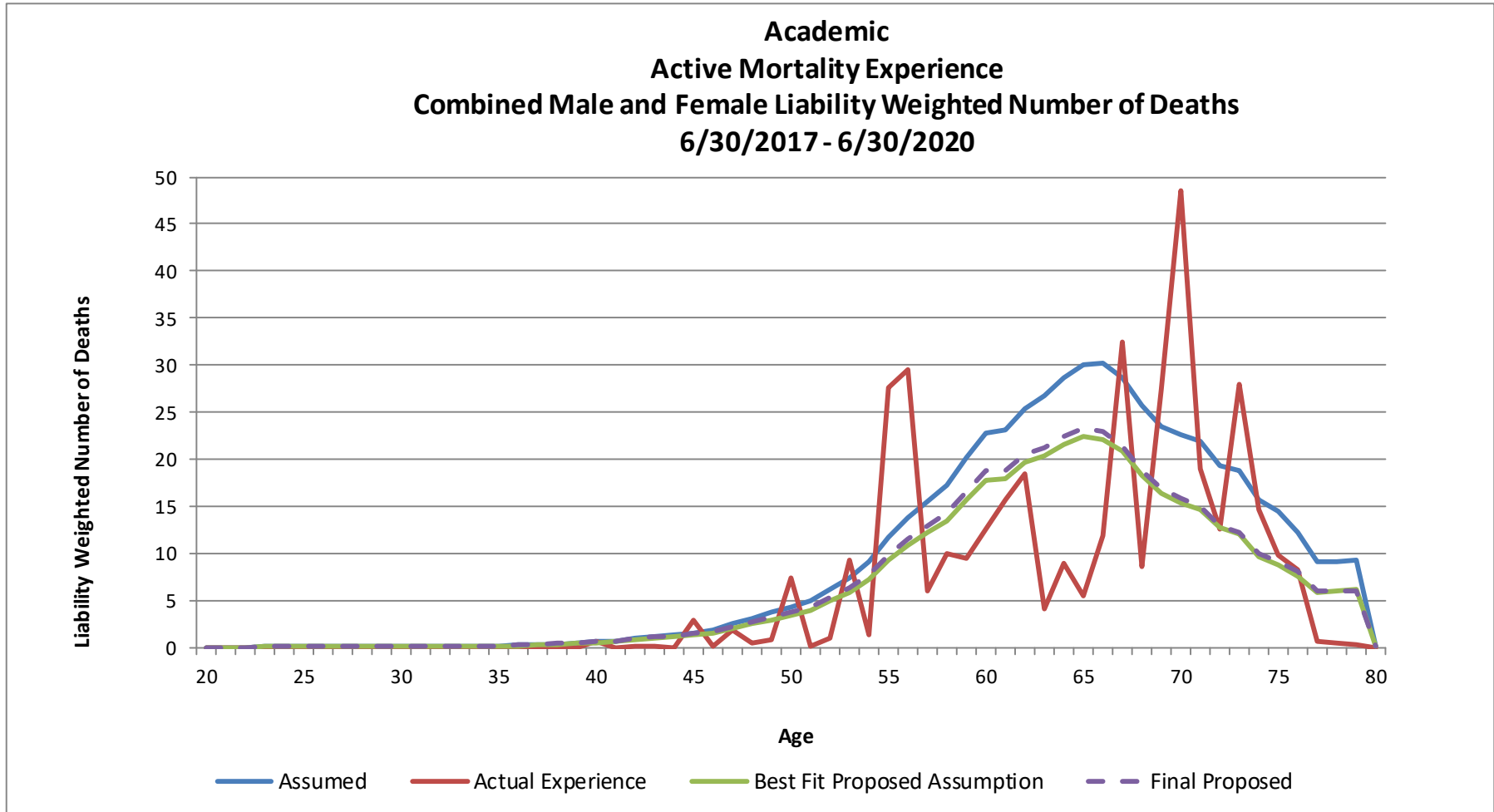
Male Active Mortality Experience															
Age	Actual Experience				Current Assumptions - LW			Best Fit Proposed Assumptions - LW			Final Proposed Assumptions - LW				
	Population Weighted		Liability Weighted (LW)		Actual Rates Weighted by		Expected Deaths	Assumed Rate	Actual / Expected	Expected Deaths	Proposed Rate	Actual / Expected	Expected Deaths	Proposed Rate	Actual / Expected
	Exposures	Deaths	Exposures	Deaths	Population	Liability									
Under 30	521	0	38	0	0.000%	0.000%	0	0.031%	0.00	0	0.026%	0.00	0	0.025%	0.00
30-39	4,610	0	1,921	0	0.000%	0.000%	1	0.041%	0.00	1	0.048%	0.00	1	0.045%	0.00
40-49	7,409	7	12,129	6	0.094%	0.049%	9	0.072%	0.67	10	0.079%	0.62	9	0.075%	0.65
50-59	8,498	19	33,619	65	0.224%	0.192%	66	0.196%	0.98	64	0.191%	1.01	61	0.180%	1.07
60-69	7,157	26	36,614	117	0.363%	0.321%	193	0.526%	0.61	160	0.436%	0.74	151	0.412%	0.78
70-79	1,897	20	8,731	127	1.054%	1.451%	124	1.419%	1.02	82	0.944%	1.54	78	0.891%	1.63
<b>Totals:</b>	<b>30,092</b>	<b>72</b>	<b>93,052</b>	<b>315</b>	<b>0.239%</b>	<b>0.338%</b>	<b>392</b>	<b>0.421%</b>	<b>0.80</b>	<b>317</b>	<b>0.340%</b>	<b>0.99</b>	<b>299</b>	<b>0.321%</b>	<b>1.05</b>
<b>Less than 60:</b>	<b>21,038</b>	<b>26</b>	<b>47,707</b>	<b>71</b>	<b>0.124%</b>	<b>0.148%</b>	<b>75</b>	<b>0.158%</b>	<b>0.94</b>	<b>75</b>	<b>0.157%</b>	<b>0.94</b>	<b>71</b>	<b>0.148%</b>	<b>1.00</b>
Female Active Mortality Experience															
Age	Population Weighted		Liability Weighted		Actual Rates Weighted by		Expected Deaths	Assumed Rate	Actual / Expected	Expected Deaths	Proposed Rate	Actual / Expected	Expected Deaths	Proposed Rate	Actual / Expected
	Exposures	Deaths	Exposures	Deaths	Population	Liability									
Under 30	668	0	50	0	0.000%	0.000%	0	0.018%	0.00	0	0.010%	0.00	0	0.014%	0.00
30-39	6,095	0	2,549	0	0.000%	0.000%	1	0.031%	0.00	1	0.020%	0.00	1	0.028%	0.00
40-49	9,258	3	13,299	1	0.032%	0.007%	8	0.061%	0.11	5	0.034%	0.20	6	0.049%	0.14
50-59	9,534	12	28,753	37	0.126%	0.128%	44	0.153%	0.84	22	0.077%	1.66	32	0.110%	1.17
60-69	6,840	13	23,226	28	0.190%	0.119%	72	0.309%	0.39	38	0.162%	0.74	54	0.232%	0.52
70-79	1,336	4	3,672	15	0.299%	0.417%	28	0.760%	0.55	16	0.440%	0.95	23	0.628%	0.66
<b>Totals:</b>	<b>33,731</b>	<b>32</b>	<b>71,549</b>	<b>81</b>	<b>0.095%</b>	<b>0.113%</b>	<b>153</b>	<b>0.213%</b>	<b>0.53</b>	<b>81</b>	<b>0.113%</b>	<b>1.00</b>	<b>116</b>	<b>0.162%</b>	<b>0.70</b>
<b>Less than 60:</b>	<b>25,555</b>	<b>15</b>	<b>44,651</b>	<b>38</b>	<b>0.059%</b>	<b>0.085%</b>	<b>53</b>	<b>0.118%</b>	<b>0.72</b>	<b>27</b>	<b>0.061%</b>	<b>1.39</b>	<b>39</b>	<b>0.087%</b>	<b>0.97</b>
<b>Grand Totals:</b>	<b>63,823</b>	<b>104</b>	<b>164,601</b>	<b>396</b>	<b>0.163%</b>	<b>0.240%</b>	<b>544</b>	<b>0.331%</b>	<b>0.73</b>	<b>398</b>	<b>0.242%</b>	<b>0.99</b>	<b>415</b>	<b>0.252%</b>	<b>0.95</b>
<b>Less than 60:</b>	<b>46,593</b>	<b>41</b>	<b>92,358</b>	<b>108</b>	<b>0.088%</b>	<b>0.117%</b>	<b>128</b>	<b>0.139%</b>	<b>0.85</b>	<b>102</b>	<b>0.110%</b>	<b>1.06</b>	<b>109</b>	<b>0.118%</b>	<b>0.99</b>

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



# Mortality Assumptions

Graph V(b)(i)



# Mortality Assumptions

## Non-Academic – Pre-Retirement Mortality

Table V(b)(ii)

Male Active Mortality Experience															
Age	Actual Experience				Current Assumptions - LW			Best Fit Proposed Assumptions - LW			Final Proposed Assumptions - LW				
	Population Weighted		Liability Weighted (LW)		Actual Rates Weighted by		Expected Deaths	Assumed Rate	Actual / Expected	Expected Deaths	Proposed Rate	Actual / Expected	Expected Deaths	Proposed Rate	Actual / Expected
	Exposures	Deaths	Exposures	Deaths	Population	Liability									
Under 30	3,767	2	324	0	0.053%	0.065%	0	0.031%	2.07	0	0.068%	0.95	0	0.046%	1.40
30-39	10,922	8	5,212	4	0.073%	0.070%	2	0.040%	1.73	6	0.114%	0.61	4	0.077%	0.91
40-49	10,902	14	17,950	23	0.128%	0.129%	13	0.071%	1.81	32	0.178%	0.72	22	0.120%	1.07
50-59	11,476	38	33,712	100	0.331%	0.296%	62	0.184%	1.60	123	0.363%	0.81	83	0.245%	1.21
60-69	6,171	42	17,744	107	0.681%	0.602%	86	0.486%	1.24	128	0.719%	0.84	86	0.485%	1.24
70-79	854	12	2,047	84	1.405%	4.085%	28	1.380%	2.96	29	1.422%	2.87	20	0.959%	4.26
<b>Totals:</b>	<b>44,092</b>	<b>116</b>	<b>76,990</b>	<b>317</b>	<b>0.263%</b>	<b>0.412%</b>	<b>192</b>	<b>0.249%</b>	<b>1.65</b>	<b>317</b>	<b>0.412%</b>	<b>1.00</b>	<b>214</b>	<b>0.278%</b>	<b>1.48</b>
<b>Less than 60:</b>	<b>37,067</b>	<b>62</b>	<b>57,199</b>	<b>127</b>	<b>0.167%</b>	<b>0.222%</b>	<b>77</b>	<b>0.135%</b>	<b>1.64</b>	<b>161</b>	<b>0.281%</b>	<b>0.79</b>	<b>108</b>	<b>0.189%</b>	<b>1.17</b>
Female Active Mortality Experience															
Age	Population Weighted		Liability Weighted		Actual Rates Weighted by		Expected Deaths	Assumed Rate	Actual / Expected	Expected Deaths	Proposed Rate	Actual / Expected	Expected Deaths	Proposed Rate	Actual / Expected
	Exposures	Deaths	Exposures	Deaths	Population	Liability									
Under 30	6,157	1	499	0	0.016%	0.005%	0	0.017%	0.31	0	0.018%	0.29	0	0.015%	0.34
30-39	16,272	3	7,077	3	0.018%	0.049%	2	0.030%	1.66	3	0.040%	1.24	2	0.034%	1.46
40-49	16,728	14	23,126	18	0.084%	0.076%	14	0.061%	1.25	16	0.071%	1.07	14	0.060%	1.27
50-59	19,139	26	47,039	62	0.136%	0.133%	70	0.148%	0.90	74	0.157%	0.84	63	0.133%	1.00
60-69	10,211	31	26,514	83	0.304%	0.313%	79	0.299%	1.05	84	0.317%	0.99	71	0.268%	1.17
70-79	1,111	7	2,554	29	0.630%	1.154%	19	0.726%	1.59	18	0.707%	1.63	15	0.598%	1.93
<b>Totals:</b>	<b>69,618</b>	<b>82</b>	<b>106,809</b>	<b>196</b>	<b>0.118%</b>	<b>0.184%</b>	<b>184</b>	<b>0.172%</b>	<b>1.07</b>	<b>195</b>	<b>0.183%</b>	<b>1.00</b>	<b>165</b>	<b>0.155%</b>	<b>1.19</b>
<b>Less than 60:</b>	<b>58,296</b>	<b>44</b>	<b>77,742</b>	<b>84</b>	<b>0.075%</b>	<b>0.108%</b>	<b>86</b>	<b>0.111%</b>	<b>0.97</b>	<b>93</b>	<b>0.120%</b>	<b>0.90</b>	<b>79</b>	<b>0.102%</b>	<b>1.06</b>
<b>Grand Totals:</b>	<b>113,710</b>	<b>198</b>	<b>183,799</b>	<b>513</b>	<b>0.174%</b>	<b>0.279%</b>	<b>375</b>	<b>0.204%</b>	<b>1.37</b>	<b>513</b>	<b>0.279%</b>	<b>1.00</b>	<b>379</b>	<b>0.206%</b>	<b>1.35</b>
<b>Less than 60:</b>	<b>95,363</b>	<b>106</b>	<b>134,940</b>	<b>210</b>	<b>0.111%</b>	<b>0.156%</b>	<b>163</b>	<b>0.121%</b>	<b>1.29</b>	<b>254</b>	<b>0.188%</b>	<b>0.83</b>	<b>187</b>	<b>0.139%</b>	<b>1.12</b>

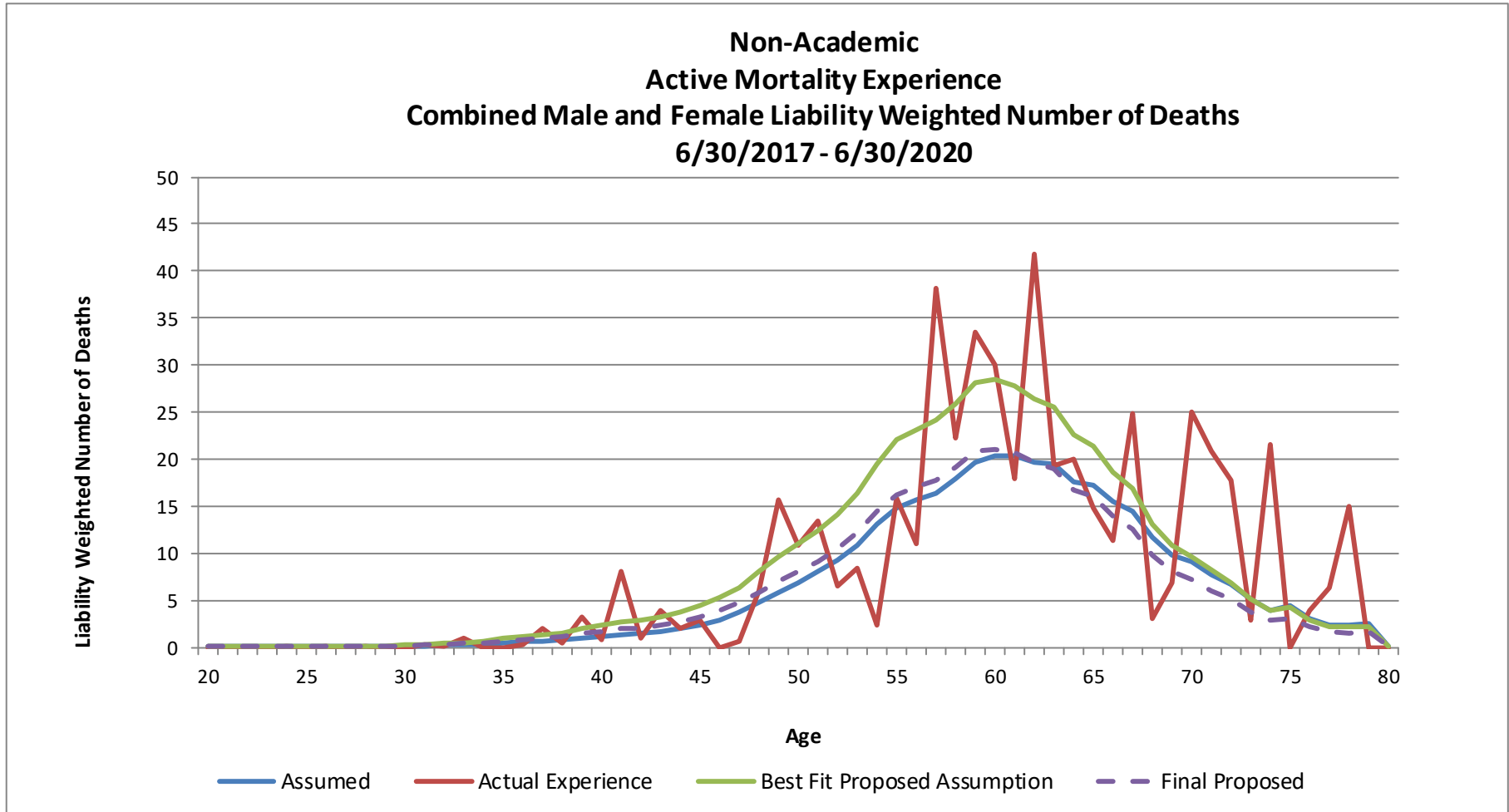
Expected deaths under the current and proposed assumptions are on a liability weighted basis.





# Mortality Assumptions

Graph V(b)(ii)



# Mortality Assumptions

**Combined Academic and Non-Academic – Post-Retirement Mortality disabled)**

**Table V(c)**

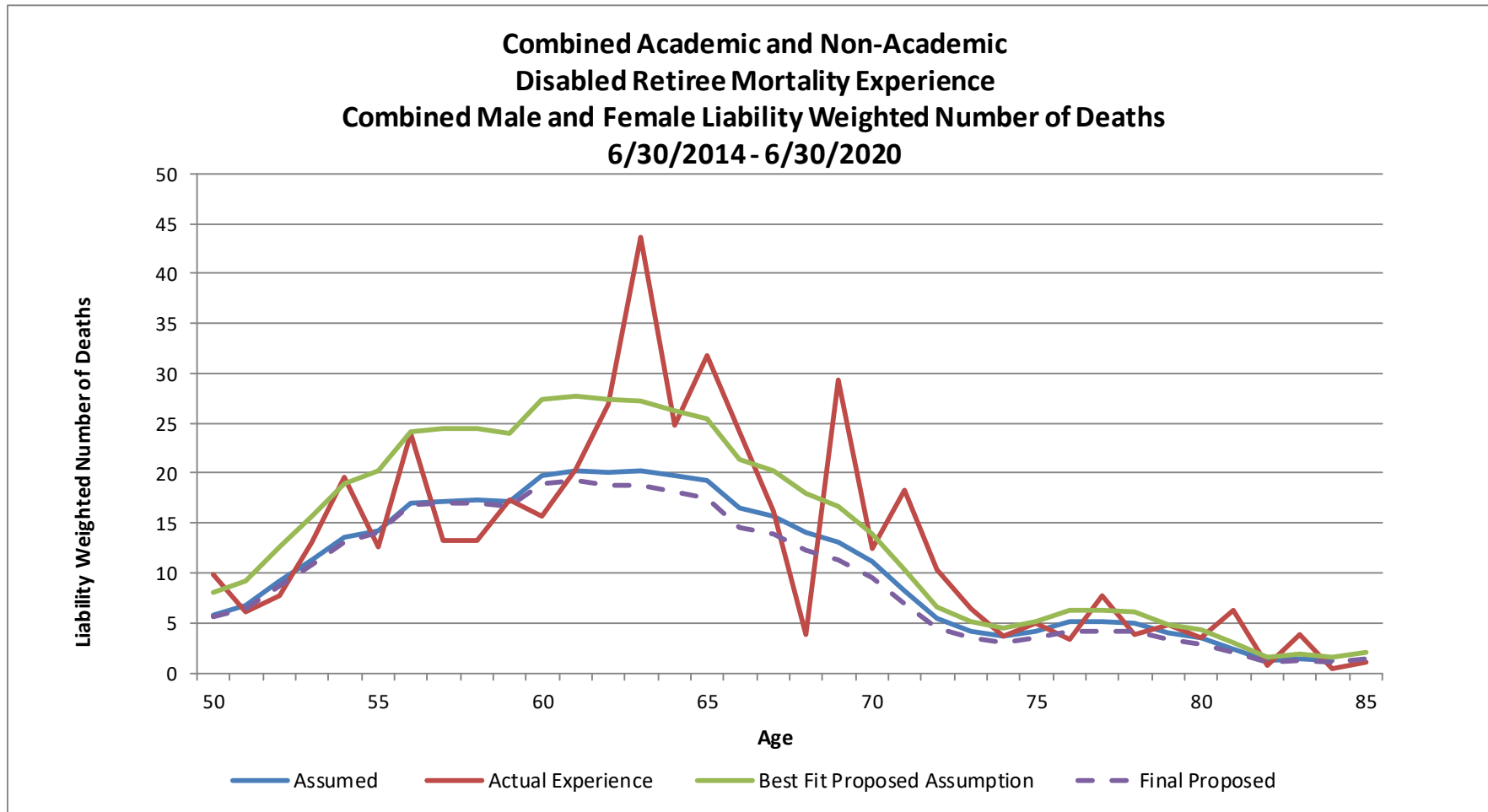
Male Disabled Retiree Mortality Experience																
Age	Actual Experience					Current Assumptions - LW				Best Fit Proposed Assumptions - LW			Final Proposed Assumptions - LW			
	Population Weighted		Liability Weighted (LW)		Actual Rates Weighted by		Expected	Assumed	Actual /	Expected	Proposed	Actual /	Expected	Expected	Proposed	Actual /
	Exposures	Deaths	Exposures	Deaths	Population	Liability	Deaths	Rate	Expected	Deaths	Rate	Expected	Deaths	Rate	Expected	
25-29	3	0	8	0	0.349%	0.000%	0	0.391%	0.00	0	0.670%	0.00	0	0.436%	0.00	
30-34	16	1	51	5	0.822%	9.814%	0	0.831%	11.80	0	0.937%	10.47	0	0.610%	16.08	
35-39	33	0	105	0	1.333%	0.000%	1	1.340%	0.00	1	1.210%	0.00	1	0.788%	0.00	
40-44	85	1	271	2	1.745%	0.645%	5	1.743%	0.37	4	1.515%	0.43	3	0.986%	0.65	
45-49	133	6	411	21	2.059%	5.223%	8	2.060%	2.53	9	2.080%	2.51	6	1.354%	3.86	
50-54	258	5	835	19	2.446%	2.327%	20	2.448%	0.95	26	3.065%	0.76	17	1.996%	1.17	
55-59	390	12	1,174	24	2.818%	2.006%	33	2.812%	0.71	47	3.968%	0.51	30	2.584%	0.78	
60-64	568	29	1,593	85	2.808%	5.339%	45	2.816%	1.90	64	4.027%	1.33	42	2.622%	2.04	
65-69	356	22	899	51	4.475%	5.724%	41	4.592%	1.25	57	6.382%	0.90	37	4.156%	1.38	
70-74	158	16	266	27	6.123%	10.084%	18	6.852%	1.47	24	9.195%	1.10	16	5.988%	1.68	
75-79	94	11	195	17	8.019%	8.706%	15	7.690%	1.13	20	10.104%	0.86	13	6.580%	1.32	
80-84	33	7	39	8	12.232%	19.542%	6	14.538%	1.34	8	19.173%	1.02	5	12.485%	1.57	
Other	25	2	21	3	3.451%	12.919%	1	5.108%	2.53	1	6.732%	1.92	1	4.383%	2.95	
<b>Totals:</b>	<b>2,152</b>	<b>112</b>	<b>5,867</b>	<b>262</b>	<b>3.536%</b>	<b>4.463%</b>	<b>195</b>	<b>3.317%</b>	<b>1.35</b>	<b>261</b>	<b>4.453%</b>	<b>1.00</b>	<b>170</b>	<b>2.899%</b>	<b>1.54</b>	
Female Disabled Retiree Mortality Experience																
25-29	4	0	10	0	0.228%	0.000%	0	0.231%	0.00	0	0.436%	0.00	0	0.316%	0.00	
30-34	31	0	109	0	0.457%	0.000%	1	0.468%	0.00	1	0.681%	0.00	1	0.493%	0.00	
35-39	85	3	313	11	0.741%	3.506%	2	0.746%	4.70	3	0.916%	3.83	2	0.663%	5.29	
40-44	150	4	523	8	1.032%	1.622%	5	1.026%	1.58	6	1.219%	1.33	5	0.882%	1.84	
45-49	298	8	940	24	1.273%	2.600%	12	1.276%	2.04	16	1.738%	1.50	12	1.258%	2.07	
50-54	498	13	1,610	37	1.633%	2.284%	26	1.624%	1.41	39	2.408%	0.95	28	1.743%	1.31	
55-59	864	21	2,408	57	2.069%	2.368%	50	2.066%	1.15	71	2.941%	0.81	51	2.128%	1.11	
60-64	1073	36	2,606	78	2.079%	2.999%	55	2.121%	1.41	72	2.761%	1.09	52	1.998%	1.50	
65-69	572	18	1,059	34	3.385%	3.242%	37	3.537%	0.92	44	4.179%	0.78	32	3.024%	1.07	
70-74	209	12	270	17	4.825%	6.215%	14	5.323%	1.17	16	5.896%	1.05	12	4.267%	1.46	
75-79	128	7	119	6	6.717%	5.113%	8	6.823%	0.75	9	7.422%	0.69	6	5.371%	0.95	
80-84	63	7	37	5	9.744%	12.678%	4	11.073%	1.14	5	12.269%	1.03	3	8.879%	1.43	
Other	44	12	19	5	3.965%	24.992%	1	4.986%	5.01	1	6.077%	4.11	1	4.398%	5.68	
<b>Totals:</b>	<b>4,019</b>	<b>141</b>	<b>10,024</b>	<b>282</b>	<b>2.497%</b>	<b>2.818%</b>	<b>216</b>	<b>2.159%</b>	<b>1.31</b>	<b>283</b>	<b>2.819%</b>	<b>1.00</b>	<b>205</b>	<b>2.040%</b>	<b>1.38</b>	
<b>Grand Totals:</b>	<b>6,171</b>	<b>253</b>	<b>15,892</b>	<b>544</b>	<b>2.860%</b>	<b>3.425%</b>	<b>411</b>	<b>2.586%</b>	<b>1.32</b>	<b>544</b>	<b>3.422%</b>	<b>1.00</b>	<b>375</b>	<b>2.358%</b>	<b>1.45</b>	

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



# Mortality Assumptions

Graph V(c)



## Other Valuation Assumptions

### Plan Election Percentage

Historically, members have been able to elect to participate in one of the two defined benefit plans, the Traditional Plan and the Portable Plan, or a defined contribution plan, the Retirement Savings Plan (RSP), which prior to September 1, 2020 was called the Self-Managed Plan (SMP).

Below is a summary of the election percentage for the RSP over the current and prior experience study period for all new members. The RSP election rate has been increasing since the implementation of Tier 2. In addition, the RSP election rate by payroll is higher than the RSP election rate by member count. This means that higher paid members are electing RSP in higher rates than lower paid members.

Fiscal Year End	RSP		RSP % of			
	Election	Total	Total	RSP Payroll	Total Payroll	RSP % of Total
2011	576	4,999	12%	\$26,313,040	\$158,945,724	17%
2012	905	5,980	15%	49,647,414	219,476,815	23%
2013	1,182	6,490	18%	63,653,331	226,530,240	28%
2014	1,206	6,062	20%	61,439,095	198,297,074	31%
<b>2011-2014</b>	<b>3,869</b>	<b>23,531</b>	<b>16%</b>	<b>201,052,880</b>	<b>803,249,854</b>	<b>25%</b>
2015	1,104	6,112	18%	63,337,720	213,701,866	30%
2016	906	5,019	18%	52,500,782	180,444,525	29%
2017	907	4,894	19%	50,705,974	176,714,628	29%
<b>2015-2017</b>	<b>2,917</b>	<b>16,025</b>	<b>18%</b>	<b>166,544,476</b>	<b>570,861,019</b>	<b>29%</b>
2018	1,082	5,563	19%	58,726,642	200,290,628	29%
2019	1,206	6,483	19%	65,619,059	237,130,015	28%
2020	1,279	6,440	20%	83,833,790	263,480,540	32%
<b>2018-2020</b>	<b>3,567</b>	<b>18,486</b>	<b>19%</b>	<b>208,179,491</b>	<b>700,901,183</b>	<b>30%</b>
<b>2015-2020</b>	<b>6,484</b>	<b>34,511</b>	<b>19%</b>	<b>374,723,967</b>	<b>1,271,762,203</b>	<b>29%</b>
<b>Total</b>	<b>10,353</b>	<b>58,042</b>	<b>18%</b>	<b>575,776,847</b>	<b>2,075,012,056</b>	<b>28%</b>

Below is a summary of the election percentage for the RSP over the experience study period for new members with salaries greater than or equal to \$100,000.

Fiscal Year End	RSP		RSP % of	
	Election	Total	Total	
2011	49	146	34%	
2012	90	204	44%	
2013	112	188	60%	
2014	125	177	71%	
<b>2011-2014</b>	<b>376</b>	<b>715</b>	<b>53%</b>	
2015	126	204	62%	
2016	112	186	60%	
2017	103	184	56%	
<b>2015-2017</b>	<b>341</b>	<b>574</b>	<b>59%</b>	
2018	112	189	59%	
2019	132	233	57%	
2020	207	295	70%	
<b>2018-2020</b>	<b>451</b>	<b>717</b>	<b>63%</b>	
<b>2015-2020</b>	<b>792</b>	<b>1,291</b>	<b>61%</b>	
<b>Total</b>	<b>1,168</b>	<b>2,006</b>	<b>58%</b>	

## Other Valuation Assumptions

Below is a summary of the election percentage for the RSP over the experience study period for new Tier 2 members shown separately for Academic and Non-Academic member classifications.

Fiscal Year End	RSP Election	RSP % of			RSP % of	
		Total	Total	RSP Payroll	Total Payroll	Total
<b>Academic</b>						
2018	293	1,010	29%	\$23,262,613	\$53,407,543	44%
2019	348	1,151	30%	27,129,037	62,541,124	43%
2020	350	1,133	31%	29,262,190	62,737,682	47%
<b>2018-2020</b>	<b>991</b>	<b>3,294</b>	<b>30%</b>	<b>\$79,653,840</b>	<b>\$178,686,350</b>	<b>45%</b>
<b>Non-Academic</b>						
2018	722	4,029	18%	\$32,695,185	\$129,188,942	25%
2019	791	4,715	17%	35,930,155	153,238,612	23%
2020	879	4,800	18%	52,056,369	182,377,957	29%
<b>2018-2020</b>	<b>2,392</b>	<b>13,544</b>	<b>18%</b>	<b>\$120,681,709</b>	<b>\$464,805,511</b>	<b>26%</b>
<b>Total</b>	<b>3,383</b>	<b>16,838</b>	<b>20%</b>	<b>\$200,335,549</b>	<b>\$643,491,860</b>	<b>31%</b>

Totals for 2018-2020 differ from prior page due to only including Tier 2 members. Certain members who are new actives may be eligible to participate in Tier 1.

We recommend using the following assumptions for plan elections, which are different for Academic and Non-Academic member classifications.

Plan Election Assumptions for Future New Hires			
	Current	Proposed	
		Academic	Non-Academic
Retirement Savings Plan (RSP)	30%	45%	25%
Tier 2 Plan	70%	55%	75%

## Other Valuation Assumptions

### Money Purchase Factors

The money purchase factors, which apply by statute to Rule 2 benefit calculations, are to be updated each time there is a change in the investment return assumption or the post-retirement mortality assumption. The current money purchase factors are based on an investment return assumption of 6.75 percent and a mortality assumption based on the RP-2014 White Collar Annuitant mortality tables.

Based on the recommendations in this experience study, GRS is recommending a change in the investment return assumption and the post-retirement mortality assumption to be first effective with the next valuation as of June 30, 2021. In the past when the factors have changed, the Board has adopted an effective date for implementation of the new money purchase factors. These factors will apply only to members hired before July 1, 2005, who are eligible for the money purchase benefit formula.

Following is the language from the Illinois Pension Code regarding actuarial assumptions used for benefit administration, including the calculation of money purchase factors.

(40 ILCS 5/15-124) (from Ch. 108 1/2, par. 15-124)

Sec. 15-124. Actuarial tables.

"Actuarial tables": Such tabular listings of assumed rates of decrement such as death, disability, retirement and withdrawal from service, according to age and sex, including mathematical functions derived from the rates of probability, combined with an interest discount factor, as are adopted by the board based upon the experience of the system.

For actuarial valuation purposes, GRS is recommending separate mortality rates for members for Academic and non-Academic employment types. However, for purposes of money purchase factors and other administrative purposes, we would recommend a combined mortality assumption that applies to all SURS members. The table below summarizes the separate assumptions recommended for actuarial valuation purposes and the combined mortality assumption recommended for administrative purposes. The money purchase factors are based on a unisex blend of 45% of the male rates and 55% of the female rates. There are other reasonable methods that could be used for a single mortality assumption for the money purchase factors other than the assumption shown in the table below, such as calculating separate money purchase factors based on Academic mortality and Non-Academic mortality and then blending the separate sets of money purchase factors.

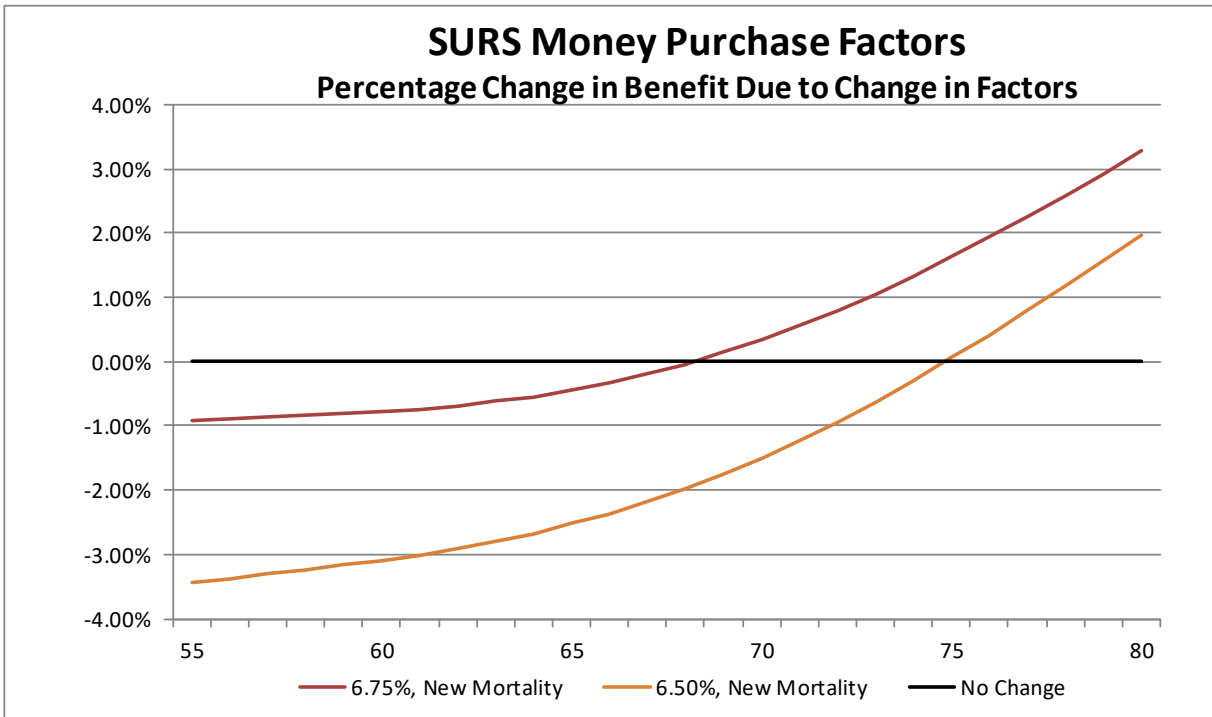
Post-retirement (non-disabled) for Applicable Group	Base Table Mortality Table	Male Scaling Factor	Female Scaling Factor
Academic	Pub-2010 Healthy Retiree Mortality Table (for Teachers)	99%	105%
Non-Academic	Pub-2010 Healthy Retiree Mortality Table (for General Employees)	99%	107%
Combined Academic and Non-Academic	Pub-2010 Healthy Retiree Mortality Table (for Teachers)	106%	121%

*Future mortality improvements are reflected by projecting the base mortality tables from 2010 using the MP-2020 projection scale.*

## Other Valuation Assumptions

Following is a graph illustrating the impact of the change in a member's benefit as a result to the change in the money purchase factors based on the proposed assumptions.

The money purchase benefit is calculated such that the money purchase balance is sufficient to pay benefits for the assumed lifetime of the retiree based on assumed future investment earnings.



Following is a table summarizing the money purchase benefit under the current factors and the factors using the proposed assumptions. In addition, the table shows the benefit under each set of factors if the member continued working for one additional year and retired with a higher money purchase balance. Although a member may have a lower benefit under the updated money purchase factors, a member would still accrue a higher benefit by working one additional year compared to retiring immediately before the change in the money purchase factors.

Immediate Monthly Benefit			Monthly Benefit 1 Year Later			Inc in Monthly Benefit 1 Year	
Age	Current	Proposed	Age	Current	Proposed	Current to Current	Current to Proposed
55	\$1,250	\$1,211	56	\$1,426	\$1,382	\$176	\$132
60	\$1,324	\$1,288	61	\$1,516	\$1,475	\$191	\$151
65	\$1,430	\$1,399	66	\$1,644	\$1,611	\$214	\$181
70	\$1,586	\$1,568	71	\$1,835	\$1,820	\$249	\$234
75	\$1,824	\$1,834	76	\$2,130	\$2,149	\$305	\$325

In addition, a member eligible for the money purchase formula will receive the greater of the money purchase formula benefit and the general formula benefit. Therefore, not all money purchase eligible members will be affected and the impact for a member may be less than the example shown above.

## Other Valuation Assumptions

The proposed annuity factors are based on member ages in the year 2024. Because the proposed mortality assumption is a generational mortality table, each cohort of retirees based on birth year would have a slightly different factor. In order to have one set of factors that will apply until the next experience study, we have calculated factors based on the mid-point of the expected timeframe in which the factors are expected to be effective.

Following is an age and service schedule for active members from the actuarial valuation as of June 30, 2020, who are eligible for benefits under the money purchase formula. Approximately 10,000 to 11,000 members are eligible to retire immediately under early or normal retirement eligibility conditions and the money purchase formula.

Service - Academic							
Age	< 10	10-14	15-19	20-24	25-29	30+	Total
<50	130	173	853	283	28	0	1,467
50-54	89	108	555	453	230	16	1,451
55-59	79	84	525	489	412	97	1,686
60-64	86	76	428	383	365	197	1,535
65-69	49	76	288	228	252	195	1,088
70-74	26	39	140	93	87	95	480
75+	2	13	53	39	44	51	202
<b>Total</b>	<b>461</b>	<b>569</b>	<b>2,842</b>	<b>1,968</b>	<b>1,418</b>	<b>651</b>	<b>7,909</b>
Service - Non-Academic							
Age	< 10	10-14	15-19	20-24	25-29	30+	Total
<50	82	105	1,507	906	221	6	2,827
50-54	55	60	696	704	516	168	2,199
55-59	48	43	707	654	474	296	2,222
60-64	43	44	571	514	334	260	1,766
65-69	14	24	256	241	160	111	806
70-74	1	12	78	70	76	37	274
75+	0	0	27	34	18	26	105
<b>Total</b>	<b>243</b>	<b>288</b>	<b>3,842</b>	<b>3,123</b>	<b>1,799</b>	<b>904</b>	<b>10,199</b>
Service - Total							
Age	< 10	10-14	15-19	20-24	25-29	30+	Total
<50	212	278	2,360	1,189	249	6	4,294
50-54	144	168	1,251	1,157	746	184	3,650
55-59	127	127	1,232	1,143	886	393	3,908
60-64	129	120	999	897	699	457	3,301
65-69	63	100	544	469	412	306	1,894
70-74	27	51	218	163	163	132	754
75+	2	13	80	73	62	77	307
<b>Total</b>	<b>704</b>	<b>857</b>	<b>6,684</b>	<b>5,091</b>	<b>3,217</b>	<b>1,555</b>	<b>18,108</b>



## Other Valuation Assumptions

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### Load on Liabilities for Service Retirees with Non-finalized Benefits

Prior to 2013, there had been liability losses for recent retired members due to finalized benefits that were higher than the preliminary estimates. Therefore, an additional 10 percent load on the estimated benefits had been assumed. Beginning with the 2013 actuarial valuation, SURS provided additional data for members whose benefits had not been finalized to help improve the liability measurement. A “best formula” benefit was provided which was higher than the benefits which had originally been provided. In the 2014 valuation, the losses generated for these members were significantly reduced.

Beginning with the June 30, 2015, actuarial valuation, the assumption was changed to the following:

- (1) A load of 10 percent on liabilities is assumed for service retirees whose benefits have not been finalized as of the valuation date and a “best formula” benefit **was not** provided in the data by Staff
  - (a) The assumption accounts for finalized benefits are on average about 10 percent higher than 100 percent of the preliminary estimated benefit
- (2) A load of 5 percent on liabilities is assumed for service retirees whose benefits have not been finalized as of the valuation date and a “best formula” benefit **was** provided in the data by Staff
  - (a) The assumption accounts for finalized benefits are on average about 5 percent higher than the “best formula” benefit

On the following page is a comparison of the ratio of the finalized benefits to the estimated benefits based on the current assumptions and data from the 2019 and 2020 valuations. The ratio is calculated in accordance with the following example:

- (1) Best formula monthly benefit provided for 2019 actuarial valuation: \$4,000
- (2) Projected benefit in 2020:  $\$4,000 * 1.03$  (COLA increase)  $* 1.05$  (5% load) = \$4,326
- (3) Finalized benefit provided for the 2020 actuarial valuation: \$4,200
- (4) Ratio of the finalized benefit to the estimated benefit:  $\$4,200 / \$4,326 - 1 = -3\%$

Following is the ratio of the total estimated to finalized benefits as of June 30, 2020 based on the current assumptions:

Total Finalized Benefits	\$3,774,529
Total Estimated Benefits	3,800,593
Ratio (Finalized to Estimated)	-0.7%

The current assumptions resulted in estimated benefits that were slightly higher than the finalized benefits and is a slightly conservative assumption. We recommend no changes to the current assumptions.



## Other Valuation Assumptions

### Ratio of Finalized Benefits to Estimated Benefits (Based on Current Assumptions)

	General Formula	Money Purchase	Police/ Fire	Total	% of Total 2020	% of Total 2019	% of Total 2018
< -50%	4	2	-	-	0%	0%	0%
-50% - -41%	1	1	-	2	0%	0%	0%
-40% - -31%	2	1	-	3	0%	0%	0%
-30% - -21%	8	2	-	10	1%	1%	1%
-20% - -11%	47	66	-	113	9%	7%	7%
-10% - -1%	354	475	5	834	65%	62%	62%
0% - 9%	194	55	1	250	19%	22%	21%
10% - 19%	18	5	2	25	2%	4%	3%
20% - 29%	7	5	-	12	1%	2%	1%
30% - 39%	2	3	-	5	0%	0%	0%
40% - 49%	-	1	-	1	0%	0%	0%
>= 50%	28	4	-	32	2%	2%	4%
<b>Totals</b>	<b>665</b>	<b>620</b>	<b>8</b>	<b>1,287</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

## Other Valuation Assumptions

### Ratio of Finalized Benefits to Estimated Benefits (Based on Current Assumptions)

	General Formula	Money Purchase	Police/ Fire	Total	% of Total	% of Grand Total	General Formula	Money Purchase	Police/ Fire
-10%	16	9	0	25	2%	2%	2%	1%	0%
-9%	14	19	0	33	3%	3%	2%	3%	0%
-8%	17	25	0	42	4%	3%	3%	4%	0%
-7%	11	9	0	20	2%	2%	2%	1%	0%
-6%	30	33	0	63	6%	5%	5%	5%	0%
-5%	109	200	0	309	28%	24%	16%	32%	0%
-4%	37	94	1	132	12%	10%	6%	15%	13%
-3%	50	60	2	112	10%	9%	8%	10%	25%
-2%	44	18	0	62	6%	5%	7%	3%	0%
-1%	26	8	2	36	3%	3%	4%	1%	25%
0%	27	12	0	39	4%	3%	4%	2%	0%
1%	31	16	0	47	4%	4%	5%	3%	0%
2%	27	8	1	36	3%	3%	4%	1%	13%
3%	31	8	0	39	4%	3%	5%	1%	0%
4%	14	4	0	18	2%	1%	2%	1%	0%
5%	21	1	0	22	2%	2%	3%	0%	0%
6%	12	3	0	15	1%	1%	2%	0%	0%
7%	10	2	0	12	1%	1%	2%	0%	0%
8%	11	1	0	12	1%	1%	2%	0%	0%
9%	10	0	0	10	1%	1%	2%	0%	0%
10%	7	2	0	9	1%	1%	1%	0%	0%
<b>Totals</b>	<b>555</b>	<b>532</b>	<b>6</b>	<b>1,093</b>	<b>100%</b>	<b>85%</b>	<b>83%</b>	<b>86%</b>	<b>75%</b>

## Other Valuation Assumptions

### Increase in Pensionable Earnings Greater than 6% during the Final Average Compensation Period (6% Employer Billing Contributions)

Under Section 15-155(g) of the Illinois Compiled Statutes, a participant's employer is required to fund the value of increases in pensionable earnings greater than 6% that would be used in the determination of the final rate of earnings. No additional assumption is currently being made for earnings used in the calculation of the final rate of earnings.

Following is a history of the contributions received from employers due to this provision and the amount as a percentage of projected payroll (from the actuarial valuation used to determine the applicable fiscal year statutory contribution):

\$ in Millions				
Fiscal Year	Number of Participants	Amount from Employers	Projected Payroll	Amount as % of Payroll
2014	226	\$1.9	\$4,274.0	0.04%
2015	357	2.5	4,435.6	0.06%
2016	336	2.2	4,499.7	0.05%
2017	379	3.1	4,610.0	0.07%
2018	290	2.4	4,587.7	0.05%
2019	318	2.4	4,593.5	0.05%
2020	241	2.3	4,551.0	0.05%
Average	307	2.4	4,507.4	0.05%

Based on SURS experience, the proposed salary increase assumption is 5.00 percent (4.25 percent for age 50 and older) grading down to an ultimate assumed rate of increase of 3.50 percent (3.00 percent for age 50 and older) for members with 10 or more years of service. Therefore, the actuarial valuation does not assume that members will receive pay increases in excess of 6.00 percent during the period used for the final rate of earnings. To the extent that members do receive increases in excess of 6.00 percent during the period used for the final rate of earnings, there will be a liability loss that will be partially offset by the employer contributions required by statute.

Due to the relatively small amount of contributions that are received to this provision, we recommend that no assumption be made for either the contributions received or the liability losses generated by members receiving pay increases in excess of 6.00 percent during the final average earnings period. In addition, we expect that the pay cap under Tier 2 will result in a decrease in the 6% employer billing contributions as a percentage of payroll in the future.

# Other Valuation Assumptions

## Buyout Election Assumptions

Under Public Act (PA) 100-0587, the State Universities Retirement System of Illinois (“SURS”) shall offer an accelerated pension benefit payment to eligible members beginning on the implementation date and until June 30, 2021. (Public Act 101-0010 extended the buyout period from June 30, 2021 through June 30, 2024 for both accelerated pension benefit options.) Assumptions are made and used in the actuarial valuations for these provisions.

There are two accelerated pension benefit payment options that are being offered: (1) for vested inactive members, a payment equal to 60% of the present value of the member’s pension benefit in lieu of receiving any pension benefit; and (2) for active Tier 1 members eligible for retirement, a payment equal to 70% of the difference between (i) the present value of the automatic annual increases (AAI) to a Tier 1 member's retirement annuity under the current AAI provisions and (ii) the present value of the automatic annual increases to the Tier 1 member's retirement annuity under revised AAI provisions.

The accelerated pension benefit payments are to be paid from the State Pension Obligation Acceleration Bond Fund after SURS submits vouchers for the payments to the State Comptroller. The funds do not come from SURS assets.

GRS issued a letter dated August 8, 2018 with the rationale for using buyout election assumptions of 0% in the actuarial valuation as of June 30, 2018. An assumption of 0% was also used in the actuarial valuation as of June 30, 2019. Through September 30, 2019 no members had elected either buyout.

Following are the buyout statistics for the automatic annual increase (AAI) buyout and the vested inactive member buyout (VIB) from June 10, 2019 (when the buyout was first offered) through May 31, 2020 as provided by the Retirement System and supported the rationale for using the 0% assumption in the actuarial valuation as of June 30, 2020.

	6/10/2019 through 5/31/2020	
	<u>AAI</u>	<u>VIB</u>
Number Eligible for the buyout*	2,454	23,669
Buyout applications received	80	59
Buyout election forms sent	22	31
Buyout election forms approved	14	19
Application %	3.3%	0.2%
Approved %	0.6%	0.1%
Approved buyout amount**	\$1,369,244	\$2,951,402

\* Number eligible for the VIB buyout is the number of vested Tier 1 inactive members included in the actuarial valuation as of June 30, 2019 who are in the Traditional or Portable Plan.

\*\*Includes amounts attributable to benefits that would have been payable from the Excess Benefit Arrangement (EBA).

The current buyout election assumption of 0% is a reasonable and modestly conservative assumption. Increasing this assumption would reduce the Statutory contribution below the amount that can be justified by actual experience. Doing so based upon so little data would risk underfunding the System if



## Other Valuation Assumptions

the increase turned out to be too aggressive. Therefore, we recommend maintaining the buyout election assumption of 0% until the program ends or conditions change . This means that the savings from the buyout program will be recognized each year as they occur – a common approach for this type of program.

### Assumed Marital Status during Active Employment

An assumption is made in the actuarial valuation on the percentage of active members who are married for purposes of estimating pre-retirement survivor benefits and estimating the percentage of Traditional Plan members who will have a postretirement beneficiary.

Following is a table with statistics on marital status for active SURS members as provided by SURS staff. Based on the information provided, we are recommending changes to the current assumptions.

Age	Male				Female			
	% No Information	% Married	Current Assumption	Proposed Assumption	% No Information	% Married	Current Assumption	Proposed Assumption
20-24	56%	5%	25%	10%	61%	15%	40%	25%
25-29	60%	22%	48%	35%	53%	37%	58%	45%
30-34	47%	47%	70%	60%	42%	57%	75%	65%
35-39	36%	63%	76%	70%	32%	64%	78%	70%
40-44	27%	70%	80%	75%	26%	69%	80%	75%
45-49	23%	75%	83%	80%	21%	70%	80%	75%
50-54	19%	78%	85%	80%	20%	73%	80%	75%
55-59	17%	80%	85%	80%	17%	72%	75%	75%
60-64	18%	80%	85%	80%	17%	69%	70%	70%
65-69	16%	81%	85%	80%	17%	62%	70%	70%
70-74	17%	82%	85%	80%	20%	65%	70%	70%
75-79	17%	79%	85%	80%	29%	54%	70%	70%
80-84	34%	85%	85%	80%	20%	46%	70%	70%
85-89	9%	80%	85%	80%	0%	25%	70%	70%

## **SECTION III**

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### **COST IMPACT OF RECOMMENDED CHANGES**

## Cost Impact of Recommended Changes

The impact of adopting the recommended assumptions is summarized in the table below and on the following pages. The recommended assumptions decrease the actuarial liability and alternate policy\* contribution requirements and increase the funded ratio.

	Dollars in Millions			% Increase (Decrease)
	Actuarial Valuation as of 6/30/20	Proposed Assumptions	Total Change	
<b>Actuarial Accrued Liability</b>				
<b>1. Active Members</b>	\$ 11,755.1	\$ 12,147.5	\$ 392.5	3.34%
<b>2. Benefit Recipients</b>				
a. Retirement	\$ 30,762.3	\$ 30,772.3	\$ 10.0	0.03%
b. Survivor	1,829.5	1,813.4	(16.10)	-0.88%
c. Disability	270.2	285.6	15.4	5.70%
Total - Benefit Recipients	\$ 32,862.0	\$ 32,871.3	\$ 9.3	0.03%
<b>3. Other Inactive</b>	\$ 2,963.4	\$ 2,970.6	\$ 7.2	0.24%
<b>4. Grand Total</b>	\$ 47,580.5	\$ 47,989.4	\$ 409.0	0.86%
		<b>Actuarial Results</b>		
<b>Actuarial Value of Assets</b>	\$ 20,091.7	\$ 20,091.7	\$ 0.0	0.00%
<b>Unfunded Actuarial Accrued</b>	\$ 27,488.8	\$ 27,897.8	\$ 409.0	1.49%
<b>Funded Ratio</b>	42.23%	41.87%	-0.36%	-0.36%
<b>Alternate Policy Contribution*</b>	\$ 2,499.4	\$ 2,508.9	\$ 9.5	0.38%

\*Based on normal cost plus 30-year closed period amortization (24 years remaining)





## Cost Impact of Recommended Changes – Projected Statutory Contributions

Comparison of Results from 2020 Actuarial Valuation With Results Using Recommended Assumptions Incl. 5-Year Phase-In of Change in Contribution Rate (\$ in Millions)

Fiscal Year	SURS Contribution (Excluding RSP)				RSP				Combined SURS and RSP (Includes State and Employer Contribution)					
	Baseline		Impact With Phase-In*		Baseline		Impact With Phase-In*		Baseline		Impact With Phase-In*		Difference	
	Dollar	% of Pay	Dollar	% of Pay	Dollar	% of Pay	Dollar	% of Pay	Dollar	% of Pay	Dollar	% of Pay	Dollar	% of Pay
2021	\$1,954.566	40.55%	\$1,953.431	40.38%	\$81.230	1.69%	\$82.365	1.70%	\$2,035.796	42.24%	\$2,035.796	42.08%	\$0.000	-0.16%
2022	2,055.984	42.02%	2,058.558	41.80%	86.033	1.76%	88.290	1.79%	2,142.017	43.78%	2,146.848	43.59%	4.831	-0.19%
2023	2,126.724	42.69%	2,124.282	42.25%	88.716	1.78%	91.925	1.83%	2,215.440	44.47%	2,216.208	44.08%	0.768	-0.39%
2024	2,205.973	43.42%	2,199.643	42.79%	92.662	1.82%	96.903	1.89%	2,298.635	45.24%	2,296.545	44.68%	-2.090	-0.56%
2025	2,258.319	43.56%	2,247.325	42.75%	96.653	1.86%	101.839	1.94%	2,354.972	45.42%	2,349.164	44.69%	-5.808	-0.74%
2026	2,316.262	43.76%	2,300.421	42.78%	100.662	1.90%	106.733	1.98%	2,416.924	45.66%	2,407.154	44.77%	-9.770	-0.90%
2027	2,365.616	43.76%	2,354.377	42.78%	104.706	1.94%	111.676	2.03%	2,470.322	45.69%	2,466.053	44.81%	-4.269	-0.88%

The financial impact is illustrated based on the June 30, 2020 actuarial valuation which determines the fiscal year 2022 statutory contribution. The assumption changes are expected to first be effective with the June 30, 2021 actuarial valuation and will therefore first affect the fiscal year 2023 statutory contribution. \*Under the statutory funding policy, the contribution rate impact from assumption changes is to be recognized over a five-year period.

Following is a comparison of the projected contributions shown above under assuming that 1) the recommended assumptions first affect the fiscal year 2022 contribution and the assumed investment return is realized in fiscal year 2021 and 2) the recommended assumptions first affect the fiscal year 2023 contribution and the fiscal year 2021 return is 20%.

Fiscal Year	\$ in Millions					
	Combined SURS and RSP (Includes State and Employer Contribution)					
	Impact With Assumed Return		Impact With Estimated FY 2021 Return*		Difference	
	Dollar	% of Pay	Dollar	% of Pay	Dollar	% of Pay
2021	\$2,035.796	42.08%	\$2,035.796	42.08%	\$0.000	0.00%
2022	2,146.848	43.59%	2,142.017	43.49%	-4.831	-0.10%
2023	2,216.208	44.08%	2,182.740	43.41%	-33.467	-0.67%
2024	2,296.545	44.68%	2,223.917	43.27%	-72.629	-1.41%
2025	2,349.164	44.69%	2,235.965	42.53%	-113.199	-2.15%
2026	2,407.154	44.77%	2,247.573	41.80%	-159.581	-2.97%
2027	2,466.053	44.81%	2,249.326	40.88%	-216.727	-3.94%



## **SECTION IV**

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### **RECOMMENDED ACTUARIAL ASSUMPTIONS**

## Recommended Actuarial Assumptions

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**Rate of Investment Return.** For all purposes under SURS the rate of investment return is assumed to be 6.50% per annum beginning with the **June 30, 2021**, actuarial valuation. This assumption is net of investment expenses.

**Price Inflation (Increase in Consumer Price Index “CPI”).** The assumed rate is 2.25% per annum.

**Effective Rate of Interest.** The assumed rate credited to member accounts is 6.50% per annum, beginning with the June 30, 2021, actuarial valuation.

**Cost of living adjustment “COLA.”** The assumed rate is 3.00% per annum for members hired before January 1, 2011, based on the benefit provision of 3.00% annual compound increases. The assumed rate is 1.125% for members hired on or after January 1, 2011, based on the benefit provision of increases equal to ½ of the increase in CPI with a maximum increase of 3.00%.

**Annual Compensation Increases.** Each member’s compensation is assumed to increase by 3.00% each year, 2.25% reflecting salary inflation and 0.75% reflecting standard of living increases. That rate is increased for members with less than 35 years of service to reflect merit, longevity and promotion increases. The rates are based on service at the beginning of the year and are as follows:

Service Year	Total Increase	
	Under Age 50	50 and Older
0	12.75%	12.00%
1	12.75%	12.00%
2	9.00%	8.25%
3	7.75%	7.00%
4	6.75%	6.00%
5	6.25%	5.50%
6	6.00%	5.25%
7	5.50%	4.75%
8-10	5.00%	4.25%
11-14	4.50%	3.75%
15-18	4.25%	3.50%
19	4.00%	3.25%
20-33	3.75%	3.25%
34+	3.50%	3.00%

**General Wage Inflation.** The assumed rate of general wage inflation is 3.00%.



## Recommended Actuarial Assumptions

**Mortality.** The mortality assumptions are as follows:

Members classified as an employee type of academic:

Academic Applicable Group	Base Table Mortality Table	Male Scaling Factor	Female Scaling Factor
Preretirement	Pub-2010 Employee Mortality Table (for Teachers)	101%	97%
Postretirement (non-disabled)	Pub-2010 Healthy Retiree Mortality Table (for Teachers)	99%	105%
Postretirement (disabled)	Pub-2010 Disabled Retiree Mortality Table (for Non-Safety Employees)	112%	110%

Members classified as an employee type of non-academic:

Non-Academic Applicable Group	Base Table Mortality Table	Male Scaling Factor	Female Scaling Factor
Preretirement	Pub-2010 Employee Mortality Table (for General Employees)	114%	105%
Postretirement (non-disabled)	Pub-2010 Healthy Retiree Mortality Table (for General Employees)	99%	107%
Postretirement (disabled)	Pub-2010 Disabled Retiree Mortality Table (for Non-Safety Employees)	112%	110%

*Future mortality improvements are reflected by projecting the base mortality tables from 2010 using the MP-2020 projection scale.*

Following are the future life expectancies for postretirement (non-disabled) mortality:

Age	Future Life Expectancy (years) in 2020				Future Life Expectancy (years) in 2030			
	Academic		Non Academic		Academic		Non Academic	
	Male	Female	Male	Female	Male	Female	Male	Female
35	53.35	55.10	50.92	53.26	54.11	55.79	51.84	54.07
40	48.10	49.84	45.66	47.96	48.85	50.54	46.57	48.77
45	42.87	44.60	40.42	42.68	43.62	45.29	41.31	43.48
50	37.66	39.37	35.31	37.51	38.41	40.07	36.18	38.30
55	32.54	34.24	30.42	32.56	33.28	34.93	31.27	33.34
60	27.59	29.31	25.71	27.75	28.30	29.97	26.51	28.47
65	22.84	24.52	21.24	23.08	23.49	25.11	21.95	23.73
70	18.33	19.85	17.01	18.60	18.89	20.39	17.60	19.17
75	14.14	15.44	13.10	14.42	14.61	15.92	13.59	14.91



## Recommended Actuarial Assumptions

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### **Disability.**

The following percentages that vary by employee type are applied to the base disability rates below:

A table of base disability incidence rates follow:

Age	Academic		Non- Academic	
	Male	Female	Male	Female
20	0.007410%	0.016400%	0.027170%	0.037720%
21	0.007590%	0.017350%	0.027830%	0.039905%
22	0.007770%	0.018300%	0.028490%	0.042090%
23	0.007950%	0.019250%	0.029150%	0.044275%
24	0.008130%	0.020200%	0.029810%	0.046460%
25	0.008310%	0.021150%	0.030470%	0.048645%
26	0.008490%	0.022100%	0.031130%	0.050830%
27	0.008670%	0.023050%	0.031790%	0.053015%
28	0.008850%	0.024050%	0.032450%	0.055315%
29	0.009000%	0.025000%	0.033000%	0.057500%
30	0.009450%	0.027050%	0.034650%	0.062215%
31	0.009900%	0.029100%	0.036300%	0.066930%
32	0.010350%	0.031150%	0.037950%	0.071645%
33	0.010770%	0.033200%	0.039490%	0.076360%
34	0.011220%	0.035250%	0.041140%	0.081075%
35	0.011850%	0.037250%	0.043450%	0.085675%
36	0.012450%	0.039300%	0.045650%	0.090390%
37	0.013080%	0.041350%	0.047960%	0.095105%
38	0.013710%	0.043400%	0.050270%	0.099820%
39	0.014310%	0.045450%	0.052470%	0.104535%
40	0.016080%	0.047500%	0.058960%	0.109250%
41	0.017850%	0.049550%	0.065450%	0.113965%
42	0.019620%	0.051600%	0.071940%	0.118680%
43	0.021390%	0.053650%	0.078430%	0.123395%
44	0.023160%	0.055700%	0.084920%	0.128110%
45	0.025350%	0.057750%	0.092950%	0.132825%
46	0.027570%	0.059800%	0.101090%	0.137540%
47	0.029790%	0.061850%	0.109230%	0.142255%
48	0.031980%	0.063900%	0.117260%	0.146970%
49	0.034200%	0.065950%	0.125400%	0.151685%
50	0.036420%	0.068000%	0.133540%	0.156400%
51	0.038610%	0.070050%	0.141570%	0.161115%
52	0.040830%	0.072100%	0.149710%	0.165830%
53	0.043050%	0.074150%	0.157850%	0.170545%
54	0.045240%	0.076200%	0.165880%	0.175260%
55 & Older	0.046560%	0.078250%	0.170720%	0.179975%

Disability rates apply during the retirement eligibility period.



## Recommended Actuarial Assumptions

**Retirement.** Upon eligibility, active members are assumed to retire as follows:

Tier 1						
Age	Normal (Unreduced) Retirement				Early (Reduced) Retirement	
	Academic		Non-Academic		Academic	Non-Academic
	Under 40 Years	40+ Years	Under 40 Years	40+ Years		
Under 50	55.0%		55.0%			
50	55.0%		40.0%			
51	40.0%		30.0%			
52	40.0%		30.0%			
53	30.0%		30.0%			
54	30.0%		30.0%			
55	20.0%	30.0%	25.0%	37.5%	7.0%	4.0%
56	20.0%	30.0%	25.0%	37.5%	5.5%	4.0%
57	20.0%	30.0%	25.0%	37.5%	4.0%	4.0%
58	20.0%	30.0%	25.0%	37.5%	5.0%	4.0%
59	20.0%	30.0%	25.0%	37.5%	5.5%	4.0%
60	13.0%	19.5%	20.0%	30.0%		
61	13.0%	19.5%	15.0%	22.5%		
62	13.0%	19.5%	15.0%	22.5%		
63	13.0%	19.5%	15.0%	22.5%		
64	13.0%	19.5%	15.0%	22.5%		
65	17.0%	25.5%	25.0%	37.5%		
66	17.0%	25.5%	25.0%	37.5%		
67	17.0%	25.5%	25.0%	37.5%		
68	17.0%	25.5%	25.0%	37.5%		
69	17.0%	25.5%	25.0%	37.5%		
70	17.0%	25.5%	20.0%	30.0%		
71-79	15.0%	22.5%	20.0%	30.0%		
80+	100.0%	100.0%	100.0%	100.0%		

## Recommended Actuarial Assumptions

Tier 2					
Age	Normal (Unreduced) Retirement			Early (Reduced) Retirement	
	Academic	Non-Academic	Police	Academic	Non-Academic
60			60.0%		
61			25.0%		
62			25.0%	25.0%	35.0%
63			25.0%	10.0%	15.0%
64			25.0%	10.0%	15.0%
65			15.0%	10.0%	15.0%
66			15.0%	10.0%	15.0%
67	35.0%	35.0%	15.0%		
68	17.0%	25.0%	25.0%		
69	17.0%	25.0%	25.0%		
70	17.0%	20.0%	20.0%		
71-79	15.0%	20.0%	20.0%		
80+	100.0%	100.0%	100.0%		

Members who retire are assumed to elect the most valuable option on a present value basis – refund of contributions (or portable lump sum retirement, if applicable) or a retirement annuity.

For purposes of the projections in the actuarial valuation, members of the Self-Managed Plan are assumed to retire in accordance with the Tier 1 and Tier 2 retirement rates (based on hire date).

## Recommended Actuarial Assumptions

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**General Turnover.** A table of termination rates based on experience in the 2015-2017 period. The assumption is a table of turnover rates by years of service. A sample of these rates follows:

<u>Years of Service</u>	<u>Academic</u>	<u>Non-Academic</u>
0	15.00%	15.00%
1	15.00%	15.00%
2	12.00%	15.00%
3	11.00%	14.00%
4	10.00%	12.00%
5	9.00%	10.00%
6	8.00%	9.00%
7	7.00%	8.00%
8	6.00%	7.00%
9	5.00%	6.00%
10	4.00%	5.00%
11	4.00%	5.00%
12	3.00%	3.50%
13	3.00%	3.50%
14	3.00%	3.50%
15	2.50%	3.00%
16	2.50%	3.00%
17	2.50%	3.00%
18	2.50%	3.00%
19	2.50%	3.00%
20	2.00%	2.00%
21	2.00%	2.00%
22	2.00%	2.00%
23	2.00%	2.00%
24	2.00%	2.00%
25	1.50%	1.50%
26	1.50%	1.50%
27	1.50%	1.50%
28	1.50%	1.50%
29	1.50%	1.50%

A termination rate of 100 percent is assumed at three years of service for members classified as part time for valuation purposes.

Members who terminate with at least five years of service (10 years of service for Tier 2 members) are assumed to elect the most valuable option on a present value basis – refund of contributions or a deferred benefit.

Termination rate for 29 years of service used for Tier 2 members until retirement eligibility is met.





## Recommended Actuarial Assumptions

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**Operational Expenses.** The amount of operational expenses incurred in the latest fiscal year are supplied by SURS staff and incorporated in the Normal Cost. Estimated administrative expenses for FY 2022 and after are assumed to increase by 3.25%.

**Marital Status.** Members are assumed to be married in the following proportions:

<u>Age</u>	<u>Males</u>	<u>Females</u>
20-24	10 %	25 %
25-29	35	45
30-34	60	65
35-39	70	70
40-44	75	75
45-49	80	75
50-54	80	75
55-59	80	75
60-64	80	70
65-69	80	70
70-74	80	70
75-79	80	70
80-84	80	70
85-89	80	70

**Spouse Age.** The female spouse is assumed to be three years younger than the male spouse.

**Benefit Commencement Age.** Inactive members eligible for a deferred benefit are assumed to commence benefits at their earliest normal retirement age. For Tier 1 members this is age 62 with at least five years of service, age 60 with at least eight years of service, or immediately if at least 30 years of service. For Tier 2 members, this is age 67 with 10 or more years of service.

**Load on Final Average Salary.** No load is assumed to account for higher than assumed pay increases in final years of employment before retirement.

**Load on Liabilities for Service Retirees With Non-finalized Benefits.** A load of 10% on liabilities for service retirees whose benefits have not been finalized as of the valuation date is assumed to account for finalized benefits that on average are 10% higher than 100% of the preliminary estimated benefit. A load of 5% is used if a “best formula” benefit was provided in the data by Staff.

**Valuation of Inactives.** An annuity benefit is estimated based on information provided by staff for Tier 1 inactive members with five or more years of service and Tier 2 members with 10 or more years of service.

**Assumption for Missing Data.** Members with an unknown gender are assumed to be female. Active and inactive members with an unknown date of birth are assumed to be 37 years old at the valuation date. An assumed spouse date of birth is calculated for current service retirees in the traditional plan for



## Recommended Actuarial Assumptions

purposes of calculating future survivor benefits. The female spouse is assumed to be three years younger than the male spouse. 70% of current total male retirees and 80% of current total female retirees in the traditional plan who have not elected a survivor refund are assumed to have a spouse at the valuation date.

**Reciprocal Service.** Reciprocal service is included for current inactive members for purposes of determining vesting eligibility and eligibility age to commence benefits.

The recently updated actuarial assumptions (including retirement and termination rates) were based on SURS service only. Therefore, reciprocal service was not included for current active members.

**Projection Assumptions.** The number of total active members throughout the projection period will remain the same as the total number of active members in the defined benefit plans and the RSP in the current actuarial valuation.

Future new hires are assumed to elect to participate in the offered plans as follows:

- Academic
  - 45% elect to participate in the Retirement Savings Plan
  - 55% elect to participate in the Tier 2 Plan
- Non-Academic
  - 25% elect to participate in the Retirement Savings Plan
  - 75% elect to participate in the Tier 2 Plan

New entrants have an average age of 37.0 and average capped pay of \$41,212 and average uncapped pay of \$43,205 (2020 dollars). These values are based on the average age and average pay of current members. The range profile is based on the age at hire and assumed pay at hire (using the actuarial assumptions, inflated to 2020 dollars) of current active members with service between one and four years.

### Academic

Summary of New Entrants - Academic									
Age	Average Pay			Average Pay			Total Number	Average Pay	
	Number Males	Tier 2		Number Females	Tier 2			Capped Total	Uncapped Total
		Capped Male	Uncapped Male		Capped Female	Uncapped Female			
<20	1	\$29,276	\$29,276	2	\$33,375	\$33,375	3	\$32,009	\$32,009
20 - 24	72	29,557	29,557	98	28,077	28,077	170	28,704	28,704
25 - 29	313	45,176	47,538	442	41,755	43,069	755	43,173	44,922
30 - 34	433	57,019	65,176	582	49,852	55,006	1,015	52,909	59,344
35 - 39	439	52,977	59,825	491	45,871	49,328	930	49,226	54,283
40 - 44	283	46,109	54,565	336	39,665	43,324	619	42,611	48,463
45 - 49	206	43,319	49,894	247	37,329	40,809	453	40,053	44,941
50 - 54	156	46,748	54,919	165	38,800	44,513	321	42,662	49,570
55 - 59	130	38,886	43,767	152	27,691	29,407	282	32,852	36,027
60 - 64	100	30,372	35,663	92	27,067	29,392	192	28,788	32,658
65 - 69	9	12,864	12,864	3	31,104	31,104	12	17,424	17,424
Total	2,142	2,142	2,142	2,142	2,142	2,142	2,142	2,142	2,142

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## Recommended Actuarial Assumptions

### Non-Academic

Summary of New Entrants - Non-Academic									
Age	Number Males	Average Pay		Number Females	Average Pay		Total Number	Average Pay	
		Tier 2			Tier 2			Tier 2	
		Capped Male	Uncapped Male		Capped Female	Uncapped Female		Capped Total	Uncapped Total
<20	57	\$18,729	\$18,729	65	\$18,810	\$18,810	122	\$18,772	\$18,772
20 - 24	660	31,096	31,096	1,167	29,441	29,441	1,827	30,039	30,039
25 - 29	1,237	40,746	40,856	1,867	38,687	38,801	3,104	39,508	39,620
30 - 34	962	45,877	47,327	1,431	41,511	42,012	2,393	43,266	44,148
35 - 39	623	48,034	49,453	1,060	40,561	41,136	1,683	43,327	44,215
40 - 44	464	49,161	51,286	826	41,597	42,475	1,290	44,317	45,644
45 - 49	405	48,295	51,908	725	39,368	40,671	1,130	42,567	44,698
50 - 54	337	48,089	50,753	593	37,676	38,998	930	41,449	43,258
55 - 59	261	48,832	56,226	470	36,566	38,951	731	40,945	45,119
60 - 64	139	43,076	46,697	167	39,544	44,047	306	41,149	45,251
65 - 69	4	63,646	0	8	28,387	0	12	40,140	50,732
Total	5,149	43,429	45,045	8,379	38,127	38,827	13,528	40,145	41,194

**RSP Contribution Assumptions** The projected SMP contributions are equal to 7.6% of SMP payroll, plus estimated SMP expenses minus SMP employer forfeitures. Estimated SMP expenses for FY 2021 are \$1,032,960 and actual FY 2019 SMP employer forfeitures used to reduce the certified contributions for FY 2022 are \$5,671,844 (as provided by SURS). Estimated SMP expenses for FY 2022 and after are assumed to increase by 3.25%. Estimated SMP employer forfeitures used to reduce the certified contributions for FY 2023 and after are assumed to be 7.5% of the gross SMP employer contribution.

**Pensionable Earnings Greater than 6%.** The participant's employer is required to pay the present value of the increase in benefits resulting from the portion of the increase in excess of 6.00% for earnings used in the calculation of the final average salary. The projections include a component paid for by employers for earnings increases greater than 6.00% in the calculation of the final average salary.

**Governor's Pay.** The governor's pay is \$181,700 as of June 30, 2020, and is expected to increase each year by the assumed rate of increase in the Tier 2 pay cap (1/2 the increase in CPI or 1.125%).

**Buyout Election Assumption.** 0% of eligible Tier 1 active members are assumed to elect to receive a reduced and delayed AAI benefit at retirement and an accelerated pension benefit option in accordance with Public Acts 100-0587 and 101-0010. 0% of eligible inactive members are assumed to elect to receive an accelerated pension benefit option in lieu of an annuity at retirement in accordance with Public Acts 100-0587 and 101-0010.

## Recommended Actuarial Assumptions

### Statistics from June 10, 2019 through May 31, 2020 as Provided by SURS Staff

	<u>AAI</u>	<u>VIB</u>
Number Eligible for the buyout*	2,454	23,669
Buyout applications received	80	59
Buyout election forms sent	22	31
Buyout election forms approved	14	19
Application %	3.3%	0.2%
Approved %	0.6%	0.1%
Approved buyout amount	\$1,369,244	\$2,951,402

\* Number eligible for the VIB buyout is the number of vested Tier 1 inactive members included in the actuarial valuation as of June 30, 2019 who are in the Traditional or Portable Plan. Vested active Tier 1 members would also be eligible for the buyout upon termination.

**Treatment of Benefits in Excess of the Internal Revenue Code Section 415 Limits.** The benefit amounts in excess of the IRC Section 415 limits for current retirees are paid through the Excess Benefit Arrangement (EBA) and are not reported in the actuarial valuation data. Therefore, the liabilities and the required contributions for these EBA benefits are not reflected in the actuarial valuation results. The amount of the estimated EBA payments for the upcoming fiscal year are provided by SURS Staff and included in the Statutory contribution requirement. Following are the estimates used in the previous and current valuations:

Valuation Year	Applicable Fiscal Year	Estimated EBA Payments
2018	2020	\$17.065 million
2019	2021	\$18.000 million
2020	2022	\$21.500 million

**Estimated Federal/Trust Fund Employer Contributions.** Following are the estimated employer contributions provided by SURS that reduce the estimated State contributions.

Valuation Year	Applicable Fiscal Year	Estimated Federal/Trust Fund Payments
2018	2020	\$52.0 million
2019	2021	\$52.5 million
2020	2022	\$57.0 million