

# Employees' Retirement System of the State of Hawaii

Actuarial Experience Study  
for the period ending June 30, 2021





June 14, 2022

Board of Trustees  
Employees' Retirement System of  
The State of Hawaii  
City Financial Tower  
201 Merchant St., Ste. 1400  
Honolulu, HI 96813-2980

**Subject: Results of 2022 Experience Study**

We are pleased to present our report on the results of the 2022 Experience Study for the Employees' Retirement System of the State of Hawaii (ERS). It includes our recommendations for new actuarial assumptions to be effective for the June 30, 2022 actuarial valuation, and it describes the actuarial impact produced by these recommendations as though they had been effective for the June 30, 2021 actuarial valuation.

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

We wish to thank the ERS staff for their assistance in providing data for this study.

Sincerely,  
Gabriel, Roeder, Smith & Company

A handwritten signature in black ink, appearing to read "Joe Newton". The signature is fluid and cursive, written over a white background.

Joseph P. Newton, FSA  
Pension Market Leader

A handwritten signature in black ink, appearing to read "Lewis Ward". The signature is fluid and cursive, written over a white background.

Lewis Ward  
Consultant

J:\3046\EXP\ExpStudy2021.docx

# Table of Contents

	<u>Page</u>
<b>Section I</b>	Executive Summary .....3
<b>Section II</b>	Introduction .....7
<b>Section III</b>	Analysis of Experience and Recommendations.....11
<b>Section IV</b>	Actuarial Impact of Recommendations .....31
<b>Section V</b>	Summary of Recommendations .....33
<b>Section VI</b>	Summary of Assumptions and Methods, Incorporating Recommended Assumptions.....35
<b>Section VII</b>	Summary of Data and Experience .....50

## **SECTION I**

---

### **EXECUTIVE SUMMARY**

## Executive Summary

In general, the current assumption set portrayed a reasonable estimate of the future liabilities of ERS, and we are recommending only minor changes. The two most significant recommendations (the increase in the salary increase assumptions and the updating of the mortality improvement scales) mainly offset each other. Our recommended changes to the current actuarial assumptions may be summarized as follows:

### *Economic Assumptions*

- We recommend no change to the current nominal investment return assumption of 7.00%. Based on the current capital market assumptions from ERS' investment consultant and the System's target asset allocation, a 7.00% investment return is very close to the median expected geometric return. We have verified this result against a blending of the current capital market assumptions from eleven shorter term and five longer term independent sources.
- We recommend changing the assumption that administrative expenses will be 0.35% of covered payroll to 0.40% of covered payroll.
- We recommend no change to the inflation assumption of 2.50%.
- For General Employees and Teachers, we recommend decreasing the 1.00% general productivity component of the general wage inflation assumption to 0.50%. This yields a nominal assumption of 3.00%. This assumption represents the average increase in wages in the general economy and is used to index salaries for each cohort of new entrants in projections. We recommend no change to the 1.00% assumption for Police and Fire employees.
- The assumed salary increase schedules include an ultimate component for general wage inflation that may add on additional increases for individual merit (which would include promotions) and then an additional component for step rates based on service. For all three groups, the salary increases over the past decade have been rather close to the current assumptions, but that was during a period when actual inflation was materially lower than the current 2.50% assumption. If inflation is closer to the 2.50% prospectively, it is reasonable to assume that the actual salary increases will be higher in the future, thus we are recommending a higher salary increase schedule.
  - For General Employees and Teachers, the data over the last ten years have been very similar, both in the step schedule and the overall increases. We are recommending one single assumption to be used for both groups, which is higher than the current assumption set.
  - For General Employees, the current assumption approximates the average annual salary increase received by the member over their career, from all sources, to be 4.41%. The proposed assumption set would increase that to 4.66%, an increase of about 0.25% per year.

- For Teachers, the current assumption approximates the average annual salary increase received by the member over their career, from all sources, to be 4.37%. The proposed assumption set would increase that to 4.66%, an increase of about 0.29% per year.
- For Police and Fire Employees, the current assumption approximates the average annual salary increase received by the member over their career, from all sources, to be 5.57%. The proposed assumption set would increase that to 5.78%, an increase of about 0.21% per year.

### *Mortality Assumptions*

- We recommend updating the base mortality tables with data through June 30, 2021. These are client-specific mortality tables developed using the actual mortality experience of non-disabled retirees in ERS. We also recommend no change to the assumption that mortality rates will continue to improve in the future using a fully generational approach, but recommend the improvement scale used to project future improvement be updated to the ultimate values of the most recently published Scale MP2021. We will apply further adjustments to this set of base tables based on occupation (General Employees, Teachers, and Public Safety).
- We recommend continuing with our current procedure for setting disabled post-retirement mortality rates which is disabled retirees mortality rates will be the rates used for the healthy retirees, adjusted with a 3-year set-forward to reflect impaired mortality (the mortality rates will change in conjunction with the change in healthy retiree mortality rates). We also apply a minimum mortality probability of 3.5% for males and 2.5% for females. Mortality rates will continue to improve in the future using a fully generational approach based on the ultimate values of Scale MP2021.
- We recommend continuing to use the pre-retirement mortality tables for active employees to use the recently published Pub-2010 mortality tables for active employees, by job classification. We also recommend assuming mortality rates will continue to improve in the future using a fully generational approach based on the ultimate values of Scale MP2021.

### *Other Demographic Assumptions*

- We recommend updating the termination patterns to reflect recent experience. In general, the new tables lower the rate of turnover.
- We recommend no change to the retirement patterns for General Employees or Teachers, and adding 2% to the annual probability of retirement for Police and Fire members before age 60.
- We recommend minor changes to the disability patterns for members consistent with experience and future expectations.
- For members that become disabled in the future, we will continue to assume 50% of them will choose the 100% joint and survivor annuity option.

- We recommend reductions to the assumed amount of sick leave converted to service at retirement for General Employees and Teachers, with no change for Police and Fire.

*Actuarial Methods and Policies*

- We recommend no change to the current process of estimating the valuation payroll for the upcoming fiscal year.
- We recommend no change to the use of a 4-year smoothing technique to determine the actuarial value of assets, used for determining the funding period.
- We recommend no change to the current funding method. The Entry Age Normal cost method (EAN) is the current funding method being used to allocate the actuarial costs of the System. The Entry Age Normal method will generally produce relatively level contribution amounts as a percentage of payroll from year to year, and allocates costs among various generations of taxpayers in a reasonable manner. It is by far the most commonly used actuarial cost method for large public retirement systems.
- **Impact of all recommended changes:**  
All values are illustrated based on the valuation as of June 30, 2021.

Item	Current Assumptions	Proposed Assumptions
(1)	(2)	(3)
<b>Total System</b>		
Unfunded Actuarial Accrued Liability (\$ in Millions)	\$14,229	\$14,080
Funded Ratio	58.3%	58.6%
<b>Police and Fire Only</b>		
Unfunded Actuarial Accrued Liability (\$ in Millions)	\$2,457	\$2,473
Total Normal Cost %	26.20%	27.55%
Funding Period based on current 41% employer contribution rate (years)	25	27
<b>All Other Employees</b>		
Unfunded Actuarial Accrued Liability (\$ in Millions)	\$11,772	\$11,607
Total Normal Cost %	12.43%	12.95%
Funding Period based on current 24% employer contribution rate (years)	23	24

## **SECTION II**

---

### **INTRODUCTION**

## Introduction

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

A single set of assumptions is typically not expected to be suitable forever. As the actual experience of the retirement system changes, the assumptions should be reviewed and adjusted accordingly.

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

Changes in certain assumptions and methods are suggested upon this comparison to remove any bias that may exist and to perhaps add in a slight margin for future adverse experience where appropriate. Next, the assumption set as a whole was analyzed for consistency and to ensure that the projection of liabilities was reasonable and consistent with historical trends.

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

## Summary of Process

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

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

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

For this purpose we have reviewed and analyzed ERS's data for the period ending June 30, 2021. We used multiple lengths of time for various assumptions. Sometimes using a 3-6 year period gives too much weight to such short-term effects. Alternatively, sometimes using a longer period would water down real changes that may be occurring, such as mortality improvement or a change in the ages at which members retire.

In an experience study, we first determine the number of deaths, retirements, etc. that occurred during the period. Then we determine the number expected to occur, based on the current actuarial assumptions. Finally we calculate the A/E ratio, where "A" is the actual number (of retirements, for example) and "E" is the expected number. If the current assumptions were "perfect", the A/E ratio would be 100%. When it varies much from this figure, it is a sign that new assumptions may be needed. Of course we not only look at the assumptions as a whole, but we also review how well they fit the actual results by sex, by age, and by service.

Finally, if the data leads the actuary to conclude that new tables are needed, the actuary "graduates" or smoothes the results, since the raw results can be quite uneven from age to age or from service to service.

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

## Organization of Report

Section I of this report summarizes our recommended changes. Section III contains our findings and a more detailed analysis of our recommendation for each actuarial assumption. The impact of adopting our recommendations on liabilities and contribution rates is shown in Section IV. Sections V and VI show a summary of the recommended assumptions for each System. Finally, Section VII presents detailed summaries of the data and comparisons of the A/E ratios.



## Section VII Exhibits

The exhibits in Section VII should generally be self-explanatory. For example, on page 93, we show the exhibit analyzing the police service-based termination rates (salary weighted). The second column shows the total salary of members who terminated during the study period. This excludes members who died, became disabled or retired. Column (3) shows the total exposures. This is the salary of members who could have terminated during any of the years. In this exhibit, the exposures exclude anyone eligible for retirement. A member is counted in each year they could have terminated, so the total shown is the total exposures for the study period. Column (4) shows the probability of termination based on the raw data. That is, it is the result of dividing the actual salary of terminations (col. 2) by the salary exposed (col. 3). Column (5) shows the current termination rate and column (6) shows the new recommended termination rate. Columns (7) and (8) show the expected salary of terminations based on the current and proposed termination assumptions. Columns (9) and (10) show the Actual-to-Expected ratios under the current and proposed termination assumptions.

## **SECTION III**

---

### **ANALYSIS OF EXPERIENCE AND RECOMMENDATIONS**

# Analysis of Experience and Recommendations

We will begin by discussing the economic assumptions: inflation, the investment return rate, the general wage increase assumption, and the salary increase assumption. Then we will discuss the demographic assumptions: mortality, disability, termination and retirement. Finally, we will discuss the actuarial methods used.

## ECONOMIC ASSUMPTIONS

Actuaries are guided by the Actuarial Standards of Practice (ASOP) adopted by the Actuarial Standards Board (ASB). One of these standards is ASOP No. 27, Selection of Economic Assumptions for Measuring Pension Obligations. This standard provides guidance to actuaries giving advice on selecting economic assumptions for measuring obligations under defined benefit plans.

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

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

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

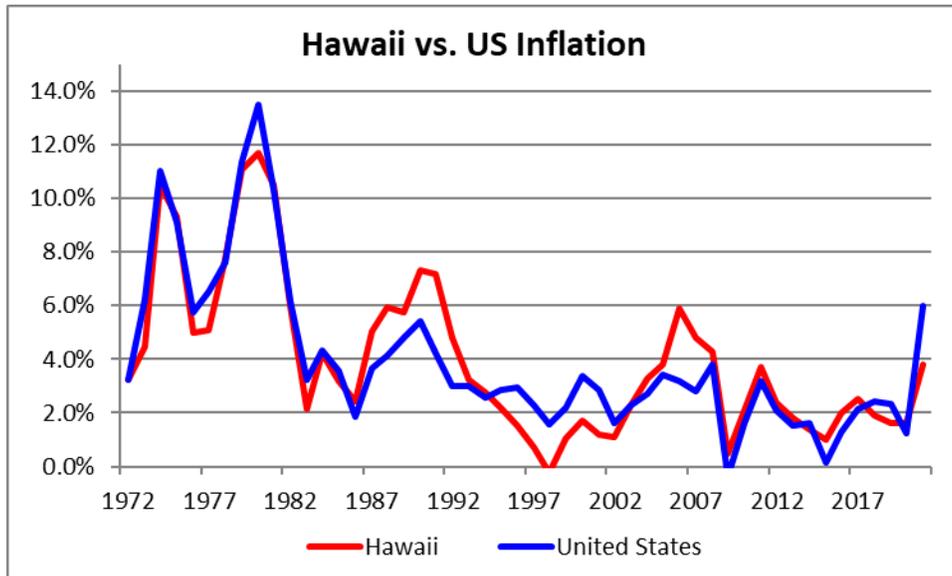
Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period. Nevertheless, the economic assumptions are much more subjective in nature than the demographic assumptions, which in itself can still create a difference in opinion among individuals in the actuarial profession and possibly stakeholders of the Retirement Systems.

## Inflation Assumption

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



However, because Hawaii’s economy is separated from the Mainland and may not trend at the same rate, there could be a need for separate inflation assumptions: one underlying the investment return and one underlying the wage increases. We compared the CPI-U over the last fifty years for Honolulu to All-US. The data showed that while for given periods of time of the economic cycle the two rates may differ, over the long term, the two rates trend very closely. The following graph shows the annual rates of inflation for both sets of data.

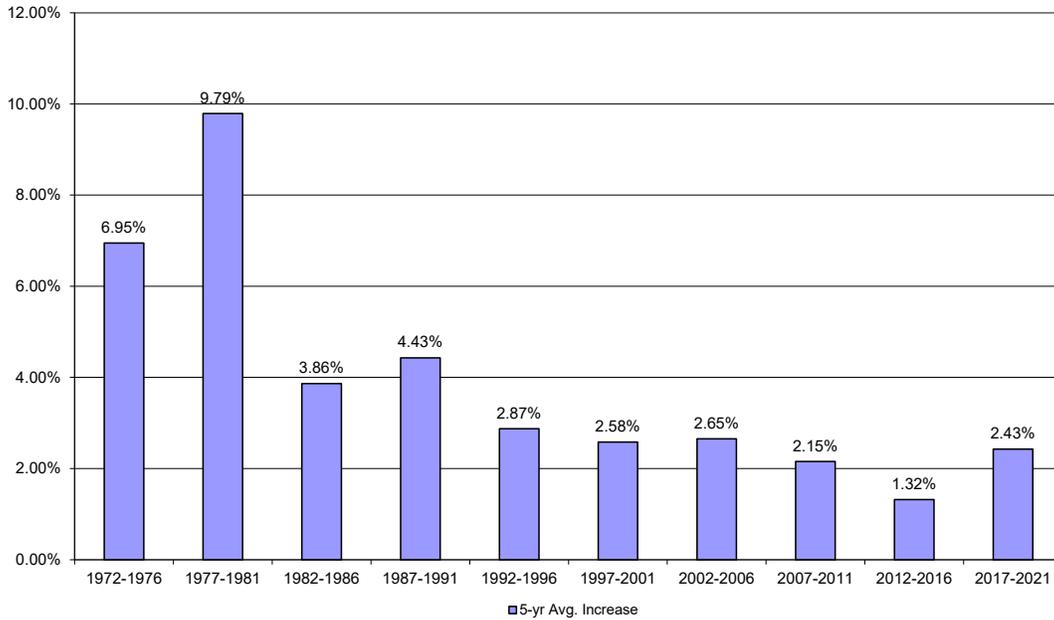


Over the long term, when the state economy booms relative to the Mainland, Hawaii’s inflation is usually higher and when it is depressed relative to the Mainland, the inflation is usually lower. However, the average Hawaii inflation over the past fifty years has been 3.93%, and the average all-US inflation has been 3.91%. We believe the two inflation measurements will track closely over time and we have developed and recommend one inflation assumption. In addition, if there are differences, the only real place it would impact the valuation results would be in the wage assumptions, in which the difference would naturally be incorporated in the net increases above general inflation.

Actual Change in CPI-U

The chart below shows the average annual inflation in each of the ten consecutive five-year periods over the last fifty years:

Average Annual Inflation  
CPI-U, Five Fiscal Year Averages



The following table shows the average inflation over various periods, ending June 30, 2021:

Periods Ending June 30, 2015	Average Annual Increase in CPI-U
Last five (5) years	2.43%
Last ten (10) years	1.87%
Last fifteen (15) years	1.97%
Last twenty (20) years	2.14%
Last twenty-five (25) years	2.23%
Last thirty (30) years	2.33%
Since 1913 (first available year)	3.12%

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

As you can see, inflation has been very close to the current 2.50% assumption over the past five years, but has been relatively low over the last thirty years.

**Expectations Implied in the Bond Market**

Another source of information about future inflation is the market for US Treasury bonds. As of December 31, 2021, the 20-Year Breakeven Inflation was 2.42% based on the difference between inflation indexed and non-indexed bonds. The difference in yield for 30-year bonds implies 2.32% inflation over the next 30 years. This analysis is known to be imperfect as it ignores the inflation risk premium that buyers of US Treasury bonds often demand as well as possible differences in liquidity between US Treasury bonds and TIPS, but has historically been a reasonable estimator of future inflation.

### Forecasts from Social Security Administration

In the Social Security Administration’s 2021 Trustees Report, the Office of the Chief Actuary is projecting a long-term average annual inflation rate of 2.4% under the intermediate cost assumption and the low cost and high cost scenarios are 1.8% and 3.0%, respectively.

### Survey of Professional Forecasters and Fed Policy

The Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. Their forecast for the fourth quarter of 2021 was for inflation over the next ten years (2022 to 2031) to average 2.55%. Additionally, the Fed has openly stated that they have a target 2.00% inflation rate.

### Comparison of Inflation Expectations from 2018 to 2021

Finally, the table below provides a comparison of the inflation expectations documented in the 2018 experience study report and the current inflation expectations.

Source	Inflation Expectations		
	2018	2021	Change
(1)	(2)	(3)	(4)
ERS’ Investment Consultant	2.25%	2.20%	-0.05%
Implied Inflation 20-Year Treasuries	1.78%	2.42%	+0.64%
SSA Trustees Report	2.60%	2.40%	-0.20%
Survey of Professional Forecasters	2.21%	2.55%	+0.34%

### Recommendation

The inflation assumption is not explicitly used in the valuation but instead is used as a building block into other economic assumptions. As shown, the current 2.50% was slightly higher than a majority of the reported sources in 2018, but much closer to the sources as of 2021. As such, we are not recommending a change at this time as 2.50% is still in the reasonable range.

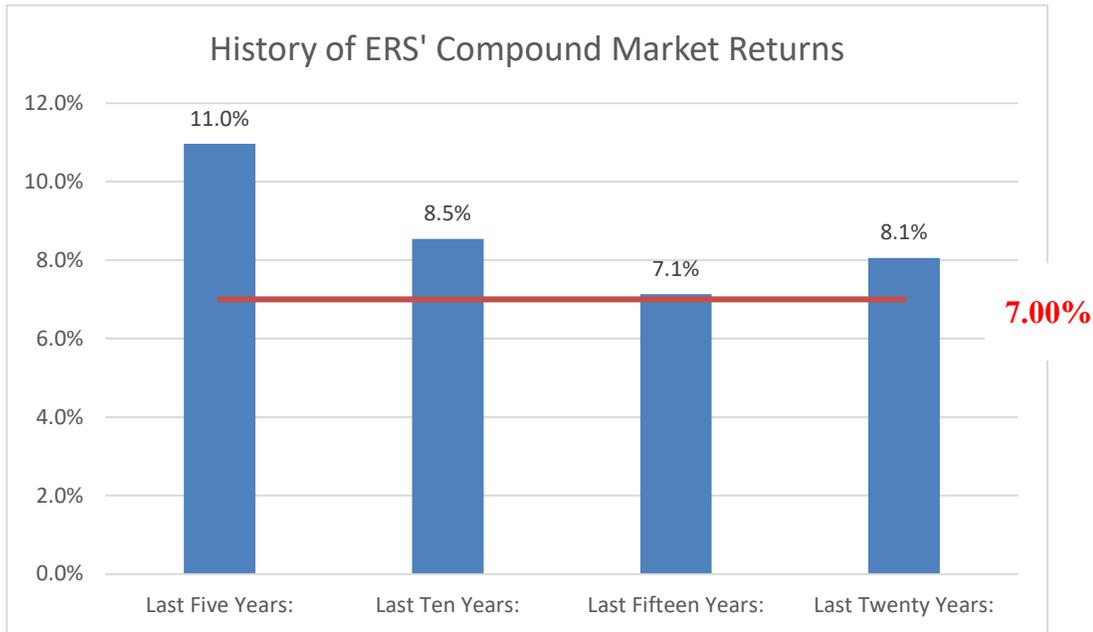
## **Investment and Administrative Expenses**

The trust fund pays expenses in addition to member benefits and refunds so we must make some assumption about these. For ERS, current practice has been to have an explicit administrative expense assumption that is a percentage of payroll and include it in the normal cost rate. The current assumption is 0.35% of payroll. Over the last six years the average was 0.37%. However, over the past three years, the administrative expenses have been 40 basis points or higher. We are recommending increasing the assumption to 40 basis points.

## Investment Return

ERS assumes an investment return rate of 7.00%, net of investment expenses. This was reduced from 7.50% in the 2015 experience study. This is the rate used in discounting future payments in calculating the actuarial present value of those payments. Even a small change to this assumption can produce significant changes to the liabilities and contribution rates.

The chart on the following page shows a history of ERS' market returns through FY 2021.

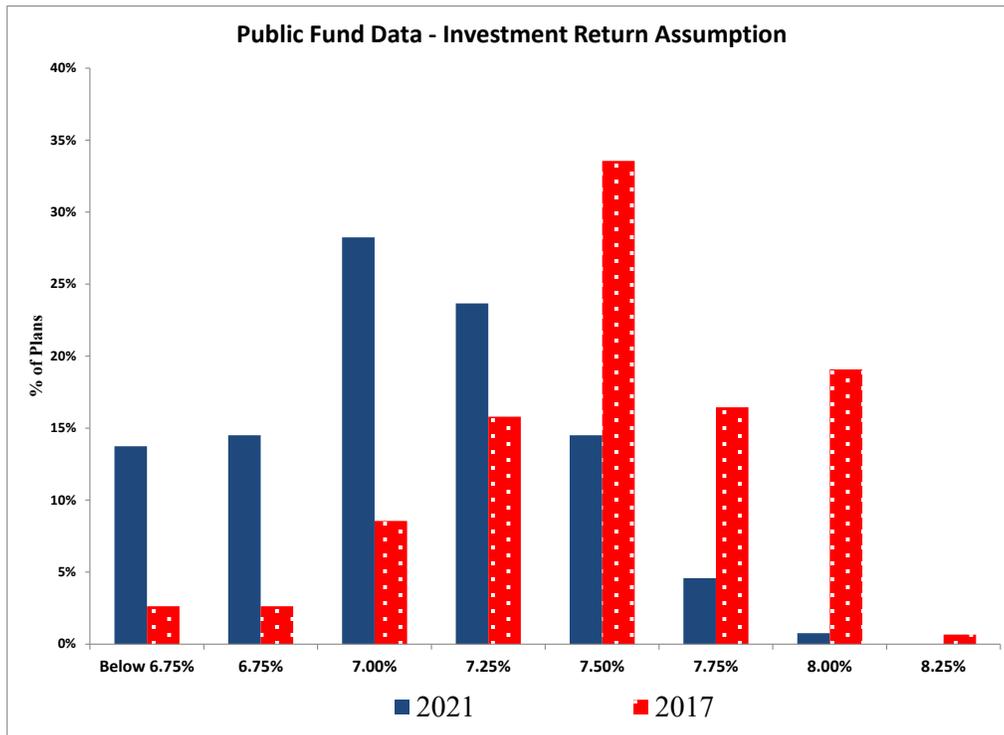


The returns in the chart above are market returns as reporting in the performance report as of June 30, 2021. As shown, ERS has exceeded the currently expected 7.00% return assumption over all timeframes.

However, past performance, even averaged over a twenty-year period, is not a reliable indicator of future performance for this assumption. The actual asset allocation of the trust fund will significantly impact the overall performance, so returns achieved under a different allocation are not meaningful. More importantly, the real rates of return for many asset classes, especially equities, vary so dramatically from year to year that even a twenty-year period is not long enough to provide reasonable guidance.

### Comparison to Peers

We do not recommend the selection of an investment return assumption based on prevalence information. However, it is still informative to identify where the investment return assumption for ERS is compared to its peers. The chart on the following page shows the distribution of the investment return assumptions in the Public Plans Data as of February 2022.



Source: Public Plans Database. Median investment return assumption: 7.00% nominal return.

As shown, there has been a strong trend in lowering this assumption and the median assumption is now 7.00%.

Forecasts Developed by ERS’ Investment Consultant

We believe a more appropriate approach to selecting an investment return assumption is to identify expected returns developed by mapping the investment policy to forward-looking capital market assumptions that are developed by investment consulting firms.

Because GRS is a benefits consulting firm and does not provide investment consulting advice, we do not develop or maintain our own forecasts of capital market expectations. Instead, we utilized the forward-looking return expectations developed by Meketa (ERS’ investment consultant). Meketa regularly updates their capital market expectations (i.e. estimates of expected returns, volatility, and correlations) as the economy and financial markets evolve.

We requested from Meketa the current return expectations and target portfolio of ERS. The following is a summary of the information they provided.

Strategic Class	Long-Term Target Asset Allocation	Expected 20-year Compound Return
(1)	(2)	(3)
Private Equity	13.50%	10.0%
Global Equity	20.00%	7.2%
Low Vol Equity	4.00%	6.5%
Global Options	4.00%	5.2%
Credit	6.00%	5.9%
Non-Core RE	4.50%	9.2%
Core RE	6.00%	6.1%
Timber/Ag/Infra	5.00%	7.9%
Long Treasuries	5.00%	2.8%
Intermediate Govt	4.00%	1.9%
TIPs	2.00%	2.4%
Systematic Trend Following	10.00%	4.8%
Global Macro	4.00%	5.0%
Alternative Risk Premia (ARP)	8.00%	5.0%
Reinsurance	4.00%	5.0%
Expected Portfolio Geometric Return		7.0%
Expected Portfolio Volatility		10.5%

As you can see, the 2022 capital market assumptions developed by Meketa would result in a twenty-year expected compound return of approximately 7.0%. (Meketa’s analysis above includes ERS’ 2.50% inflation assumption.)

#### Comparison of Meketa’s Return Expectations to Other Investment Consultants

As we previously mentioned, most investment consulting firms develop forecasts regarding future investment returns. Meketa’s return expectations are one opinion among many different opinions in the professional investment community. GRS is a benefits consulting firm and does not provide investment consulting advice, we do not develop or maintain our own forecasts of capital market expectations. Instead, we utilized 2022 forward-looking capital market return expectations developed by several investment consulting. The primary purpose of performing this analysis using multiple investment consulting firms is to quantify possible differences in forward looking return expectations within the professional investment community.

The survey included 11 investment consultants and each provided forward-looking return expectations for next 7 to 10 years. Additionally, five of these firms develop return expectations over a longer, 20- to 30-year period, although for some of the firms the expectations aren’t necessarily for the next 20-30 years, but more of a typical 20-30 year period.

The short term expectations range from 5.16% to 7.20%, with an average of 6.50%. This compares to Maketa's 7.0%. It is typical in this process for the expectations from the System's investment consultant to be slightly higher than our survey as the consultant will have a much more specific allocation and understanding of the strategies, while we have to make subjective mapping between asset classes in many cases and we try to be conservative in any subjective decisions between the classes.

The longer term expectations range from 6.91% to 7.95%, with an average of 7.77% and a 58% probability of achieving 7.00% over the next 20 years.

When developing the expected return for each assumption set we normalized the expected portfolio return for any difference between the investment consultant's price inflation assumption and the 2.50% price inflation assumption used in the actuarial valuation.

### Recommendation

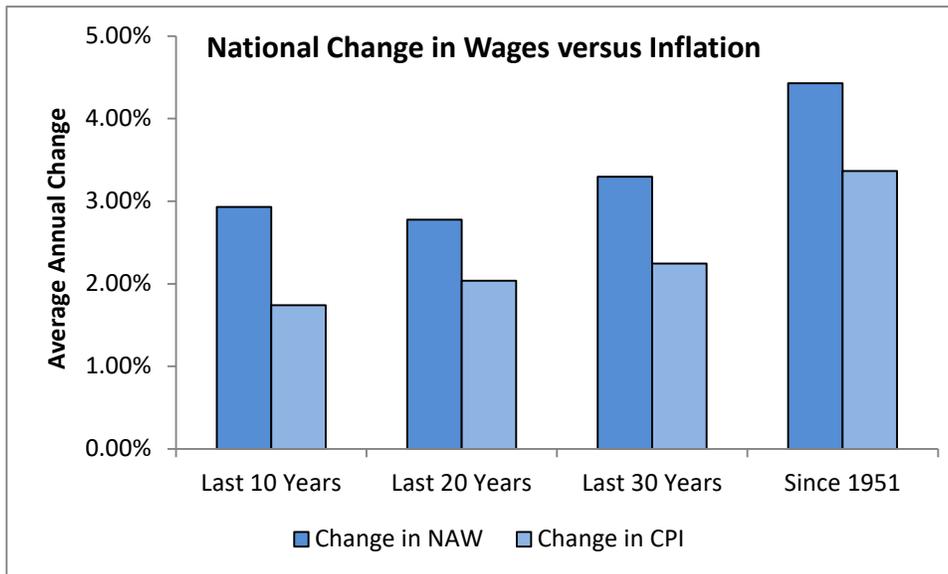
We believe the compilation of these sources of data support the current 7.00% long term investment return assumption.

We believe this recommendation satisfies the reasonable assumption requirement under ASOP No. 27. Also, this recommendation is consistent with the recommendations regarding the use of an investment return assumption that is estimated to be realizable at least 50% of the time from a report released by the Society of Actuaries Blue Ribbon Panel on public pension plan funding in February 2014.

### **General Wage Inflation**

The valuation currently assumes that General Wage Inflation (GWI) will be 1.00% above price inflation. The 1.00% represents the real wage growth over time in the general economy, or, is the assumption on how much the pay scales themselves will change year to year, not necessarily how much the pay increases received by individuals are. This assumption is used primarily to index each cohort of new entrants used in the projections to determine the funding period.

Historically, General Wage Inflation almost always exceeds price inflation. This is because wage inflation is in theory the result of (a) price inflation, and (b) productivity gains being passed through to wages. For the last 10 years, for the national economy as a whole, wage inflation has outpaced price inflation by about 1.19%, and for the last 20 years, wage inflation has exceeded price inflation by about 0.74%. Since 1951, wage inflation has been about 1.06% larger than price inflation each year.



However, as this assumption is mainly used in the valuation to index cohorts of new entrants in determining the funding period, it is important to look at ERS specific data as well. The following table provides various averages annual change for the three groups of employees over the last decade.

ERS Specific General Wage Statistics							
	Actual Inflation	Change in Average Base Salary	Net of Inflation	Change In New Entrant Base Salary	Net of Inflation	Current Assumption Net of Inflation	Proposed Assumption Net of Inflation
General Employees	1.87%	2.45%	0.58%	1.37%	-0.50%	1.00%	0.50%
Teachers	1.87%	2.60%	0.73%	2.06%	0.18%	1.00%	0.50%
Police and Fire	1.87%	3.50%	1.63%	3.24%	1.36%	1.00%	1.00%

As shown, the Police and Fire group, in total and for new hires, has exceeded the assumption on net of inflation terms for the past decade. However, this was when inflation was very low, so it is likely the 3.50% nominal assumption continues to be reasonable and we are recommending no change. For General Employees and Teachers, however, the averages have not kept up with the assumption, and we are recommending a decrease of 0.50% in both. Due to current salary pressure for new employees in the economy as a whole, it is likely that new entrant salaries will see increases, especially over the short term, so an assumption above inflation is reasonable.

### Salary increase rates

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

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

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

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

Salary increases for employees of state government tend to vary significantly from year to year. In particular, when the state’s tax revenues stall or increase slowly, salary increases often are small or nonexistent. Also, increases may be granted through biennial legislative sessions or through labor negotiations that do not occur every year. Therefore, a longer period for measuring salary increase rates usually provides a more accurate picture, by allowing us to smooth out short-term effects.

For this assumption, we looked at the base salaries provided for all members who were active in the start and the end of an experience year, for the ten-year study period, beginning July 1, 2011 and ending June 30, 2021.

The following table shows the average increase over the last 10 years.

Average Base Salary Increase			
Year Ending June 30,	General Employees	Teachers	Public Safety
2012	1.82%	1.38%	1.57%
2013	2.16%	1.80%	0.52%
2014	5.55%	4.90%	4.66%
2015	7.30%	4.81%	15.14%
2016	6.64%	5.40%	8.58%

2017	5.91%	4.76%	7.83%
2018	4.45%	5.50%	5.45%
2019	5.58%	5.67%	3.87%
2020	2.97%	7.50%	3.17%
2021	5.52%	3.74%	4.28%
<b>Average</b>	<b>4.78%</b>	<b>4.53%</b>	<b>5.43%</b>

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

Historically, the data also shows differences in salary increases for Teachers, Police & Fire, and General Employees. Therefore, the salary scales have been derived separately for these three groups. However, the data from the last decade shows minimal difference between the General Employee and Teacher groups, thus to emphasize simplifying the assumption set when appropriate and because it is difficult to argue one group should receive higher salary increases over time compared to the other, we have ultimately proposed the same assumption for both groups.

The current salary increase assumption varies based on years of service, with an ultimate salary increase assumption used for all employees who have attained 25 years of service. The table below shows the actual average long-service increases for each year of the study. Note that these actual average rates of increase include average actual inflation, not our inflation assumption.

Average “Long-Service” Increase				
Actual Experience				
Year Ending	Inflation	Police & Fire	Teachers	General Employees
2012	1.66%	1.11%	0.52%	0.91%
2013	1.75%	0.73%	0.49%	1.52%
2014	2.07%	4.59%	4.26%	4.80%
2015	0.12%	12.69%	4.24%	6.24%
2016	1.00%	8.19%	4.94%	5.38%
2017	1.63%	7.23%	3.94%	4.93%
2018	2.87%	4.31%	4.75%	3.84%
2019	1.65%	7.03%	4.72%	4.53%
2020	0.65%	-0.73%	4.40%	1.07%

2021	5.39%	3.21%	3.53%	5.30%
Average	1.87%	4.77%	3.61%	3.83%
Current Assumption	2.50%	5.00%	3.75%	3.50%
Proposed Assumption	2.50%	5.00%	3.75%	3.75%

As shown, the experience for all three groups has been reasonably close to the current assumption, perhaps slightly lower for a couple of the groups, but this has been during a time that actual inflation was lower than assumed, and includes a couple of the post-financial crisis years during which there were pay reductions and furloughs. The years from 2014 onward have outpaced the current assumption. Based on this data, it is difficult to argue the General Employee group should have a lower ultimate salary increase assumption than the Teacher group, so we are recommending increasing the 3.50% ultimate salary scale to 3.75% to match the Teacher group.

The ultimate salary increase assumption above incorporates general price inflation, a component for general productivity, and individual merit and promotion. There is also a service-based step-rate component. The following table shows the average increase over the ten-year period parsed out in five-year service bands for each group:

Average Pay Increase			
Service	Police & Fire	Teachers	General Employees
1 to 5 Years	5.86%	5.55%	6.02%
6 to 10 Years	5.25%	4.72%	4.75%
11 to 15 Years	6.01%	4.39%	4.39%
16 to 20 Years	5.83%	3.98%	4.17%
21 to 24 Years	5.03%	3.63%	4.04%
25 Years or More	4.77%	3.61%	3.83%

To determine the new salary scale, we first calculated the average increase over the ten-year period for members grouped by service. Members with 25 or more years of service were selected to be the longer-service employees to be used in determining the increases given overall, so the difference would be the step-related portion.

The following table illustrates the process for the Police and Fire group.

Police & Fire Step-rate/Promotional Experience			
Years of Service	Average Pay Increase	Less Actual Inflation and Productivity	Actual Step-Rate Component

		Components	
1-5	5.86%	- 4.77%	1.10%
6 -10	5.25%	- 4.77%	0.48%
11-15	6.01%	- 4.77%	1.24%
16-20	5.83%	- 4.77%	1.07%
21-24	5.03%	- 4.77%	0.26%
25+	4.77%	- 4.77%	0.00%

The next step is to smooth these actual step-rates in order to develop a schedule that will produce a salary history consistent with the experience. The following table gives the average increase over a member's entire career based on the combined salary increase assumption. In general, the new salary increase schedule projects higher salary increases than the current assumption by about 0.25% per year. The full schedule for each group is shown in Section VI of this report.

Career Average Salary Increase Assumptions							
		Actual Increase		Current Assumption		Proposed Assumption	
	Actual Inflation	Average Increase	Net of Inflation	Gross Increase	Net of Inflation	Gross Increase	Net of Inflation
General Employees	1.87%	4.67%	2.80%	4.41%	1.91%	4.66%	2.16%
Teachers	1.87%	4.45%	2.58%	4.37%	1.87%	4.66%	2.16%
Police and Fire	1.87%	5.59%	3.72%	5.57%	3.07%	5.78%	3.28%

These changes will increase the normal cost and the liabilities, but will also increase the amount of contributions to be received over the funding period.

## DEMOGRAPHIC ASSUMPTIONS

### Analysis of Post-Retirement Mortality

The most critical demographic assumption used in pension valuations is post-retirement mortality. Rates of mortality affect our estimate of how long each individual is expected to live and consequently how long each individual is expected to receive a pension. Life expectancy in turn has a direct impact on pension plan liabilities.

Mortality rates have generally decreased over time in the U.S., meaning that life expectancies have generally increased over time. The assumption for future decreases in mortality is referred to as the mortality

improvement assumption. In general, the current rates of mortality and mortality improvement are two separate assumptions. Thus, we will discuss this in two parts, the recommended base mortality assumption, and the recommended mortality improvement assumption.

The relevant ASOP, ASOP 35, and published practice notes require pension actuaries to make and disclose an assumption as to expected mortality improvement after the valuation date. To meet this standard, the best practice actuarial model is to use mortality tables that explicitly incorporate projected mortality improvements over time. This type of table (or series of tables) is called “generational mortality.” Specifically, mortality rates are assumed to decline each year in the future so that life expectancies for each annual cohort of retirees will be slightly higher than the previous year’s. Therefore, the life expectancy at age 60 for someone reaching 60 now will not be as long as the life expectancy for someone reaching 60 in 2025, and their life expectancy will not be as long as someone reaching 60 in 2040, etc.

Because of this assumption of continuous improvement, life expectancies for today’s younger active members are expected to be longer than those of today’s retirees. By utilizing generational mortality, the improvement over time is built into the contributions for individual members while they are employed. Below is a table with the projected life expectancy (including future improvement) for a retired member who attains age 65 based on the current assumptions.

<b>Current Mortality Assumption – Projected Life Expectancy for an Age 65 Retiree in Years</b>					
<b>Group</b>	<b>Year of Retirement</b>				
	<b>2020</b>	<b>2025</b>	<b>2030</b>	<b>2035</b>	<b>2040</b>
General Employee – Male	23.3	23.8	24.2	24.7	25.2
General Employee – Female	26.5	26.8	27.2	27.5	27.9
Teachers – Male	24.0	24.5	25.0	25.4	25.9
Teachers – Female	27.8	28.2	28.5	28.8	29.1
Public Safety – Male	22.0	22.5	23.0	23.5	24.0
Public Safety – Female	26.5	26.8	27.2	27.5	27.9

The mortality table currently being used for non-disabled retirees and for beneficiaries receiving benefits is the Hawaiian Retired Public Employees mortality table as of 2019, which is an ERS specific table created in the 2019 Experience Study. The table has separate rates for males and females. Our strategy is to update this table with each experience study to ensure that our Base tables are as current as possible, while leaving the projected improvement unchanged to the extent possible. This strategy allows for making minor, frequent adjustments instead of large adjustment every decade or so and minimizes the volatility that can come from changing mortality assumptions.

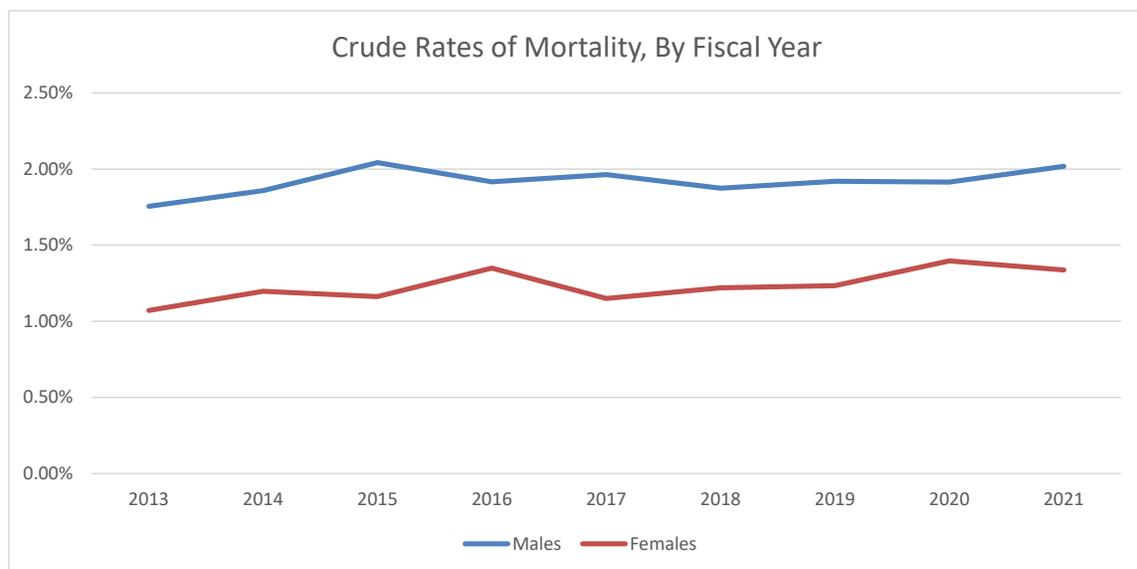
### **Approach and Data**

Based on experience observed in prior experience studies, we currently adjust the tables to reflect differences for the three groups of members (Teachers, Public Safety, and General Employees). This is a fairly common practice and is appropriate because individual employee groups may have measurably

different rates of mortality. The individual groups are variations of the core Base table, created by combing data from all of the groups, so the first step is the create the core Base table.

We have utilized nine years of experience to increase the credibility of the analysis and minimize any variance created by timing of data collection from year to year. During this time, mortality improvement may have occurred and thus a general procedure is to adjust the actual experience for mortality improvements during the study period to the central year, in this case 2016.

We did decide to include the data from fiscal years 2020 and 2021, even though the experience from those years do show slightly higher mortality experience than the previous years. That is one of the reasons we utilize several years of data, to dampen the potential impact from one year, and it is at least potentially likely mortality will be higher going forward because of either direct impact from post-COVID mobility or indirect impacts from the lockdowns. Also, Hawaii has not been impacted by pandemic to the same extent as other states. In fact, the increase in the crude rates in fiscal year 2020 and 2021 could just as easily be explained by the increase in the average age of the retiree. The following is the crude rate of mortality by year for males and females during the study period.



The analysis uses only the retirees, not the beneficiaries, joint annuitants, or survivors as the vast majority of the liability is based on this group of members and data from the beneficiaries can often have a survivorship bias which would skew the results. We will use a liability-weighted analysis by weighting members by the amount of their annuity. There are two reasons for using a liability-weighted approach. First, mortality experience across the U.S. has been shown to vary depending on income level. Liability-weighting takes into account differing benefit levels. Second, selecting an assumption based on headcount-weighting is consistent with estimating expected deaths, but selecting an assumption based on liability-weighting is consistent with minimizing the actuarial gains and losses associated with expected deaths. By weighting the data by annuity amounts, we are giving more weight to members who have larger annuities (and thus have larger liabilities).

### Credibility

When choosing an appropriate mortality assumption, actuaries typically use standard mortality tables, unlike when choosing other demographic assumptions. They may choose to adjust these standard

mortality tables, however, to reflect various characteristics of the covered group, and to provide for expectations of future mortality improvement (both up to and after the measurement date). If the plan population has sufficient credibility to justify its own mortality table, then the use of such a table also could be appropriate. Factors that may be considered in selecting and/or adjusting a mortality table include the demographics of the covered group, the size of the group, the statistical credibility of its experience, and the anticipated rate of future mortality improvement.

We first measured the credibility of the dataset to determine whether standard, unadjusted tables should be used or if statistical analysis of ERS specific data was warranted. The method for this approach can be found in the article *“Selecting Mortality Tables: A Credibility Approach”* October 2008. Statistical analysis suggests 1,082 deaths per gender is sufficient to be considered fully credible, as at that amount of experience we are 90% confident that the observed experience is within +/- 5% of the actual pattern. However, when weighting on benefit amounts, it should be even higher. The following table gives the number of deaths needed by gender to have a given level of confidence that the data is +/- X% of the actual pattern.

Standard Score	Confidence	99% – 101%	97% – 103%	95% – 105%	90% – 110%	80% – 120%
0.674	75%	4,543	505	182	45	11
1.282	80%	16,435	1,826	657	164	41
1.645	90%	27,060	3,007	1,082	271	68
1.96	95%	38,416	4,268	1,537	384	96
2.576	99%	66,358	7,373	2,654	664	166

ERS had 5,275 male and 4,723 female observed deaths during the period analyzed. As shown by the statistical credibility table, we are 97% confident that we are within 3% of the true mortality experience. The following provides the full details with p=95% and r=5%.

Group	All Retirees	
	Male	Female
Actual Deaths	5,275	4,723
Deaths needed for full credibility		
Based on Count	1,537	1,537
Based on Annuity Amount	3,001	3,125
Z Factor		
Based on Count	100.0%	100.0%
Based on Annuity Amount	100.0%	100.0%

In addition, to consider a national table, there would need to be one with expectations reasonably close to ERS experience to use as a baseline. The following table shows the life expectancy in years for female

retirees ages 60, 65, & 70 based on occupation compared to the life expectancies created by three versions of the recently published PUB (10) mortality tables.

Females - Life Expectancy in Years (2016 Central Age)					
Current Age	HI Teachers	HI General Employees	PUB(10) Teachers - Median	PUB(10) Teachers – Above Median	PUB(10) General – Above Median
60	30.5	29.5	28.6	28.8	27.2
65	26.0	25.0	24.0	24.2	22.9
70	21.5	20.7	19.6	19.7	18.7

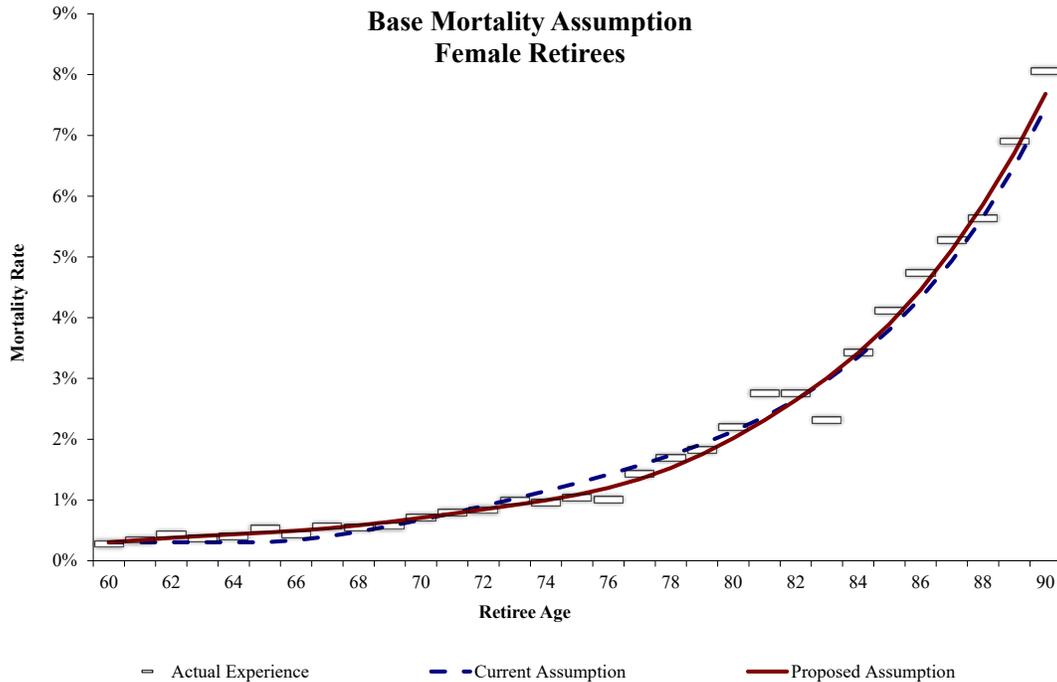
As shown, even compared to the above median versions of the PUB (10) tables, the life expectancy of ERS female retirees far exceeds the expectation from the industry table. It would take material adjustments to the industry tables to mimic ERS experience. Based on this information and the level of credibility discussed above, we conclude it is appropriate for ERS to use non-standard, System specific mortality tables.

### Recommended Base Mortality Assumption

To develop the recommended mortality assumptions, we grouped the data into five-year ages bands. Mortality rates for ages after 60 are based on the System’s experience, using a cubic spline method to provide a smooth fit to the experience. This produced an R<sup>2</sup> of .974 and .992 for males and females, respectively when compared to the raw underlying data. Mortality rates for ages under 60 and after age 100 are equal to a credibility adjusted version of the most recently published Pub-2010 mortality assumptions (adjusted forward to the central point of the experience period).

The final step in the creation of the base mortality assumption was to project the preliminary table from the center point of the analysis period (i.e., 2016) to the year 2022 using the recommended projection scale below. We will refer to this new table as the Hawaiian Retired Public Employees mortality table as of 2022.

The following is a chart that shows the actual mortality experience assumption for females.



For the new assumptions, the A/E ratios in total (across all ages) for males and females would have been about 101% at the core ages. A better way to examine the best table is to compare the life expectancies created at various ages. The following table provides the life expectancies calculated from the given age based on the actual data, the current assumption, and the recommended tables.

Static Life Expectancy, in years – Females with Base Year 2016			
Retiree Age	Actual in Data	Current Assumption	Proposed Table
60	30.0	30.0	30.0
65	25.5	25.4	25.5
70	21.1	20.9	21.1
75	16.9	16.8	17.0
80	13.0	12.9	13.0

Overall, this change has a minimal impact to the current valuation results. More detail is shown on the tables in Section VII.

**Summary of Experience and Adjustments for Occupation**

There are then age adjustments and multipliers applied to this base table based on the occupation. Higher multipliers mean higher rates of mortality and thus shorter life expectancies. The following table provides the multipliers for each gender and occupation combination. Please note that for Public Safety females, we have used the Base table unadjusted. This is because (1) there is not enough data to analysis the female Public Safety members on their own and (2) most of the female mortality liability in

the valuation of Public Safety is in the beneficiary liability, which will look more like the general population.

Mortality Adjustments – Setbacks/Multipliers			
	General Employee	Teacher	Public Safety
Male	0/102%	1/97%	-2/93%
Female	-1/98%	1/101%	0/100%

The setbacks were selected to produce the multiplier closest to 100% possible in each case. In addition, adjustments continued until the total of the individual groups approximately equaled the results based on the Base table alone. Thus, the process of creating more precise life expectancies by occupation should have no impact on the overall conservatism or aggressiveness of the assumption.

### Recommended Mortality Improvement Assumption

We use a fully generational approach to this assumption. Because of this strategy of building in continuous improvement, life expectancies for today’s younger active members are expected to be materially longer than those of today’s retirees, and this provides substantial stability and dependability on costs and liabilities. We currently use Scale BB, which was published in 2012 based on data from 1994 through 2009.

There is an annual report published by the Retirement Plans Experience Committee of the Society of Actuaries to provide commentary on national trends in mortality experience and provide updated projection scales. The initial report was in 2014, with annual updates every year since. In every update, rates of projection were materially decreased, meaning the original MP-2014 table was found to be too conservative. In addition, the amount of change from year to year has been significant. The amount of volatility produced by changing annually to each “most recent” table has been on the same order as the actual investment performance. Thus, we find that the use of the full version of these tables to produce an overly complex, volatile pattern of results that has actually had minimal, if any, predictive power.

After approximately 15 years, all of the versions prior to the 2020 version of the MP tables reflected the same improvement rate at each future calendar year (the ultimate mortality improvement rates). In order to balance the two objectives of reflecting the most recent data available, while maintaining stability of results from year to year, GRS has been recommending the use of the ultimate mortality improvement rates in the MP tables for all years, which is approximately 1% per year improvement across most ages.

In the 2020 report the ultimate mortality improvement rates were modified to be higher at some ages and more precise across different age groups based on historical trends. Specifically, the pattern is 1.35% rate for ages 62 and younger, decreasing linearly to 1.10% at age 80, further decreasing linearly to 0.40% at age 95, and then decreasing linearly to 0.00% at age 115 (and thereafter). In general, the net change in overall liabilities if a retirement system was using the ultimate rates of the MP-2019 table to the ultimate rates of the MP-2020 version is minimal. Basically, the rates at individual ages were changed but the overall pattern over a lifetime is not much different.

We find it would be reasonable to use either set of improvement scales, but give preference to the more recently published report all else being equal. Given the material increase in healthcare costs it has required over the last few decades to allow for the rates of improvement that have existed, and the general worsening in morbidity factors in the United States, we find it reasonable to assume the future

improvement would be approximate to or less than it has been historically across most ages. The 2020 report provides several pages of rationale and disclosure of the process used to generate the new long-term rates, including comparing to historical trends, and we find the analysis thorough and reasonable. Thus, we are recommending use of the ultimate rates in the MP-2021 scales, applied for all years. Compared to the current Scale BB projection scale used in the ERS valuations, the change to the ultimate values of the MP-2021 scales will project lower life expectancies into the future, thus will lower liabilities and costs.

The following is a table with the life expectancy for a retired member who attains age 65 based on the proposed assumption set, by calendar year. As shown, the life expectancy is expected to increase into the future.

<b>Proposed Mortality Assumption - Life Expectancy for an Age 65 Retiree in Years</b>					
<b>Group</b>	<b>Year of Retirement</b>				
	<b>2020</b>	<b>2025</b>	<b>2030</b>	<b>2035</b>	<b>2040</b>
General Employee – Male	22.5	22.8	23.2	23.5	23.9
General Employee - Female	26.1	26.4	26.7	27.0	27.3
Teachers - Male	23.7	24.1	24.4	24.8	25.1
Teachers - Female	27.6	27.9	28.2	28.5	28.8
Public Safety - Male	21.5	21.9	22.2	22.6	23.3
Public Safety - Female	26.8	27.1	27.4	27.7	28.0

### **Disabled mortality rates**

This is a minor assumption, and it has little impact on the liabilities of ERS. We are recommending keeping the prior procedure to assume members that live past normal retirement age will use the same table as healthy retirees, but reducing the set-forward from 5 years to 3 years, meaning a disabled member age 70 will use the same mortality rate as a healthy member age 73. For ages prior to normal retirement age, we will assume the same 3-year set-forward, but we are applying a minimum mortality rate of 3.5% for males and 2.5% for females to reflect impaired mortality during those ages. Because of the changes to the healthy retiree mortality, the rates for disabled lives will change as well.

### **Active mortality rates**

A separate mortality table is used for active members. It is typical for active mortality to be much lower than the retiree mortality. We are recommending no change to the use of the Pub2010 mortality tables for active employees, grouped by occupation. This assumption has basically no impact.

### **Disability rates**

Disability is also a minor assumption, with little effect on the liabilities. However, the experience appears to be higher than expected from the current assumptions, especially for duty related disabilities. To determine the actual experience, we counted the actual number of new disability

records in the retiree data over the five-year period 2016-2021. This allows the experience to account for the normal delay in processing disability claims. Based on this information, we are recommending changing the percentages of the client table to match the experience of the groups.

	Ordinary Disability			Duty Related Disability		
	Expected	Actual	Proposed	Expected	Actual	Proposed
General Employees	351	273	293	94	140	141
Teachers	47	62	56	5	6	6
Police and Fire	7	2	5	12	16	15

For future members who become disabled, we currently assume 50% will choose a 100% Joint and Survivor option to reflect any subsidy that exists in the option factors. We recommend no change to this assumption.

### Retirement rates

For this assumption, an A/E ratio between 90% and 100% is desirable for conservatism. We currently use retirement rates that vary by group, age, and sex. The retirement tables also vary by contributory vs. noncontributory. The analysis was completed weighting by liability instead of counts as individuals with higher benefits are more likely to retire earlier. The analysis studied all of the groups separately. Data from the prior experience study was taken into consideration when changes were recommended to the assumptions.

The following sections give a brief description of the findings for unreduced retirement for each group for the “core ages” of 55-69. We are recommending no changes to the retirement patterns during these core unreduced eligibility ages. For General Employees with 25&out eligibilities before age 55, we are increasing that probability from 6% to 18%. Also, we are slightly modifying some of the

Hybrid (\$ in 000s of liability)					
Group	Actual Retirements	Old Assumptions		Proposed Assumptions	
		Expected Retirements	Actual/Expected	Expected Retirements	Actual/Expected
General Male	\$7,646	\$7,684	99.5%	\$7,684	99.5%
General Female	9,893	9,857	100.4%	9,861	100.3%
Teacher Male	2,112	2,168	97.4%	2,168	97.4%
Teacher Female	5,409	5,694	95.0%	5,694	95.0%

probabilities for reduced retirement. There were very minor changes made. Section VII has more detail on the experience.

Non-Contributory (\$ in 000s of liability)					
		Old Assumptions		Proposed Assumptions	
Group	Actual Retirements	Expected Retirements	Actual/Expected	Expected Retirements	Actual/Expected
General Male	\$4,038	\$4,362	92.6%	\$4,362	92.6%
General Female	3,651	4,015	90.9%	4,015	90.9%
Teacher Male	847	936	90.5%	936	90.5%
Teacher Female	1,970	2,134	92.3%	2,134	92.3%

*Police & Fire Employees:*

The actual number of retirements have been outpacing the expectations. We have added 2% to all ages prior to age 60. The following table gives more detail.

Police & Fire Employees – Males and Females (\$ in 000s of liability)					
		Old Assumptions		Proposed Assumptions	
Age Range	Actual Retirements	Expected Retirements	Actual/Expected	Expected Retirements	Actual/Expected
45-49	\$1,514	\$1,351	112.1%	\$1,552	97.6%
50-54	5,978	5,041	118.6%	5,671	105.4%
55-59	6,024	5,295	113.8%	5,802	103.8%
60-61	1,343	1,337	100.5%	1,337	100.5%
Sub-Total	\$14,860	\$13,024	114.1%	\$14,361	103.5%
62-64	842	915	92.1%	915	92.1%
Total (including ages 62-64)	\$15,702	\$13,939	112.6%	\$15,276	102.8%

**Termination rates**

Termination rates reflect members who leave for any reason other than death, disability or service retirement. They apply whether the termination is voluntary or involuntary, whether the member is vested or non-vested, and whether the member takes a refund or keeps his/her account balance on deposit and takes a deferred benefit. For this analysis, we utilized 10 years of data to capture a longer economic cycle and have based the analysis weighted by salary instead of count.

We found that while in general the current assumptions may a reasonable job of estimating the total number of terminations, they tend to overestimate turnover later in the career. We have created new patterns to give a better specific fit to the experience. For this assumption, the targeted A/E ratio is 100-105% to allow for rehiring at a later date after an initial termination. The following tables show selected information. Section VII gives more detail on the data.

Termination Experience, in \$000's of Salary					
		Old Assumptions		Proposed Assumptions	
	Actual Terminations	Expected Terminations	A/E	Expected Terminations	A/E
10 years of service or less					
Teachers	\$474,988	\$467,092	101%	\$464,846	102%
General Employees	876,358	925,776	95%	862,656	102%
Police & Fire	45,285	44,110	103%	44,798	101%
11 years of service or more					
Teachers	\$91,134	\$112,145	81%	\$89,315	102%
General Employees	180,683	247,155	73%	173,428	104%
Police & Fire	17,371	22,862	76%	17,120	101%

### Sick Leave

We currently assume that each member has their service increased at retirement for unused sick leave. The current assumption varies the percentage increase by employee group. Data shows the amount of sick leave is proportional to the amount of service at retirement. Data also shows the amount differs by General Employees, Teachers, and Police and Fire. We are recommending small reductions to the assumptions as the averages from this new three-year period are quite lower than previous data. The following is the experience from 2017-2021 based on actual retirements showing the average months of service.

	Credited Service at Retirement	Credited Sick Leave	% Increase	Current Assumption	Proposed Assumption
Teachers	304.0	11.6	3.80%	4.25%	3.75%
General Employees	284.7	9.1	3.21%	3.75%	3.25%
Police & Fire	335.9	16.8	5.01%	5.00%	5.00%

## **Other assumptions**

There are other assumptions made in the course of a valuation, such as the age difference between husbands and wives, the likelihood that a terminating employee will take a refund, timing of decrements, etc. We reviewed these, and decided to recommend no changes to these other assumptions.

## **Actuarial methods**

We have reviewed the actuarial cost method being used—the Entry Age Normal cost method (EAN)—and we continue to believe that this is the method of choice for this plan, since this method usually does the best job of keeping costs level as a percentage of payroll.

## **Actuarial Value of Assets**

Actuaries generally recommend using a smoothed actuarial value of assets (AVA), rather than market value (MVA), in order to dampen the fluctuations in measurements such as the required contribution amount and the funded status of the Plan. Currently, the actuarial value of assets is based on the market value of assets with four-year smoothing applied. We recommend no change to this method.

## **SECTION IV**

---

### **ACTUARIAL IMPACT OF RECOMMENDATIONS**

## Actuarial Impact of Recommendations

All values are based on the illustrated valuation as of June 30, 2021.

Item	Current Assumptions	Proposed Assumptions
(1)	(2)	(3)
<b>Total System</b>		
Unfunded Actuarial Accrued Liability (\$ in Millions)	\$14,229	\$14,080
Funded Ratio	58.3%	58.6%
<b>Police and Fire Only</b>		
Unfunded Actuarial Accrued Liability (\$ in Millions)	\$2,457	\$2,473
Total Normal Cost %	26.20%	27.55%
Funding Period based on current 41% employer contribution rate (years)	25	27
<b>All Other Employees</b>		
Unfunded Actuarial Accrued Liability (\$ in Millions)	\$11,772	\$11,607
Total Normal Cost %	12.43%	12.95%
Funding Period based on current 24% employer contribution rate (years)	23	24

Shown above is a table that compares key statistics from the June 30, 2021 actuarial valuation before and after taking into account the recommended new assumptions. The net result of making all the recommended changes makes a very small change in the picture of ERS's actuarial status.

The Board's decisions should be based on the appropriateness of each recommendation not on their effect on the funding period or the unfunded liability.

## **SECTION V**

---

### **SUMMARY OF RECOMMENDATIONS**

## Summary of Recommendations

Our recommendations may be summarized as follows:

### *Economic Assumptions*

1. We recommend no change to the current nominal investment return assumption of 7.00%.
2. We recommend increasing the explicit charge for administrative expenses from 0.35% of covered payroll to 0.40% of covered payroll.
3. We recommend no change to the 1.00% general productivity component of the general wage inflation assumption for Police and Fire employees, but decreasing the general productivity component to 0.50% for General Employees and Teachers.
4. For all groups, we are recommending small increases to the assumed salary increase for individuals.
5. We recommend updating the client-specific base mortality tables with data through 2021. We also recommend continuing to assuming mortality rates will improve in the future using a fully generational approach. We also recommend updating the scale used to project mortality improvement to the ultimate rates of the recently published MP-2021 scales.
6. We recommend no change to the process used to determine the post-retirement mortality tables for disabled retirees, except for a 3-year set forward instead of a 5-year set forward.
7. We recommend no change to the pre-retirement mortality tables for active employees.
8. We recommend minor adjustments to the retirement and disability patterns for members consistent with experience and future expectations.
9. We recommend a new termination patterns for all three groups with lower turnover for members after ten years of service.
10. We recommend a reduction in the assumed amount of sick leave converted to service at retirement.
11. We recommend no change to the assumption that 50% members that become disabled in the future will choose a 100% joint and survivor annuity option.
12. We recommend no change to the current process of estimating the valuation payroll for the upcoming fiscal year.
13. Recommend no change to the use of a 4-year smoothing technique to determine the actuarial value of assets, used for determining the funding period.
14. We recommend no change to the current funding method.

## **SECTION VI**

---

### **SUMMARY OF ASSUMPTIONS AND METHODS INCORPORATING THE RECOMMENDED ASSUMPTIONS**

# Summary of Assumptions and Methods

## Incorporating the Recommended Assumptions

The following assumptions were developed and recommended based on an experience study performed in 2022. All of the assumptions are based on a combination of anticipated future experience and market observations. We believe all of the assumptions are reasonable and appropriate for this measurement. Please see our report dated June 1, 2021 for more discussion about the selection of these assumptions.

### *I. Valuation Date*

The valuation date is June 30th of each plan year. This is the date as of which the actuarial present value of future benefits and the actuarial value of assets are determined.

### *II. Actuarial Cost Method*

The normal cost and actuarial accrued liability are determined using the Entry Age Actuarial Cost Method. The actuarial accrued liability is assigned to years prior to the valuation, and the normal cost is assigned to the year following the valuation. The remaining costs are assigned to future years. The normal cost and accrued liability are determined on an individual basis.

The normal cost is the level percentage of payroll contribution required to accumulate the needed funds to pay all expected benefits. This percentage of payroll is then applied to the total compensation for the prior year for all active members, and is then adjusted for the payroll growth assumption.

The actuarial accrued liability is the difference between the total present value of future benefits and the actuarial present value of future normal costs. The unfunded actuarial accrued liability (UAAL) is the excess of the actuarial accrued liability over the actuarial value of assets.

### *III. Funding of Unfunded Actuarial Accrued Liability*

Since the State statutes governing the System establish the employee and employer contribution rates, the actuarial valuation determines the number of years required to amortize (or fund) the UAAL. Because of the legislated increases in future employer contribution rates and the new tier of benefits for employees hired after June 30, 2012, an open group projection of liabilities and assets was used to determine the length of time until the UAAL is eliminated. The open group projection assumed that the number of active members would remain static (i.e. each active employee who leaves employment due to termination, retirement, death or disability, would be replaced by exactly one new employee).

Because of this methodology for determining the funding period, any change in the unfunded actuarial accrued liability due to (i) actuarial gains and losses, (ii) changes in actuarial assumptions, or (iii) amendments, affects the funding period.

Please see Section V of this table for a description of the new entrant profile used in the open group projection.

IV. Actuarial Value of Assets

The actuarial value of assets is based on the market value of assets with a four-year phase-in of actual investment return in excess of (less than) expected investment income. Offsetting unrecognized gains and losses are immediately recognized, with the shortest remaining bases recognized first and the net remaining bases continue to be recognized on their original timeframe. The expected actuarial value of assets is calculated net of investment expenses, and the expected investment return is equal to the assumed investment return rate multiplied by the prior year’s actuarial value of assets, adjusted for contributions, benefits paid, and refunds.

V. New Entrant Profile

For the purposes of determining the funding period, an open group projection is used which replaces on a one-to-one basis each active member who leaves employment with an average new hire. The average new hire is determined based on a new entrant profile, which is created from the valuation data by determining the entry age and entry pay for anyone with seven or less years of service as of the valuation date. Each group of new hires’ salaries is assumed to grow at the General Wage Inflation of 3.50% over the salaries of the previous year’s group.

The new entrant profile for members assumed to be hired during the year following the valuation date for the Police and Fire Employees and the All Other Employees are shown in the table below.

New Entrant Profile for Police & Fire Employees		
Entry Age	# of Employees	Average Salary
20-24	199	\$42,080
25-29	421	41,841
30-34	286	41,807
35-39	136	42,273
40-44	47	42,310
45-49	17	43,503
50-54	6	45,708
55-59	1	40,632
Total	1,113	41,993

It is assumed that 92.7% of new hires will be male.

New Entrant Profile for All Other Employees		
Entry Age	# of Employees	Average Salary
15-19	19	\$26,410
20-24	1,433	37,250
25-29	3,459	40,108
30-34	2,759	42,208
35-39	2,388	43,097
40-44	1,954	41,537
45-49	1,785	40,980
50-54	1,449	42,278
55-59	1,169	45,146
60-64	484	46,511
65-69	52	47,971
Total	16,951	41,610

It is assumed that 40.0% of new hires will be male.

VI. Actuarial Assumptions

A. Economic Assumptions

1. Investment return: 7.0% per year, compounded annually, composed of an assumed 2.50% inflation rate and a 4.50% net real rate of return.
2. General Wage Inflation: 3.50% per annum for Police & Fire, 3.00% per annum for the other groups.

3. Salary increase rates: As shown below

Years of Service	General Employees		Teachers	
	Service-related Component	Total Rate Including 2.50% Inflation Component and 1.25% Productivity Component	Service-related Component	Total Rate Including 2.50% Inflation Component and 1.25% Productivity Component
1	3.00%	6.75%	3.00%	6.75%
2	3.00%	6.75%	3.00%	6.75%
3	2.00%	5.75%	2.00%	5.75%
4	1.50%	5.25%	1.50%	5.25%
5	1.50%	5.25%	1.50%	5.25%
6	1.25%	5.00%	1.25%	5.00%
7	1.25%	5.00%	1.25%	5.00%
8	1.00%	4.75%	1.00%	4.75%
9	1.00%	4.75%	1.00%	4.75%
10	1.00%	4.75%	1.00%	4.75%
11	0.75%	4.50%	0.75%	4.50%
12	0.75%	4.50%	0.75%	4.50%
13	0.50%	4.25%	0.50%	4.25%
14	0.50%	4.25%	0.50%	4.25%
15	0.50%	4.25%	0.50%	4.25%
16	0.50%	4.25%	0.50%	4.25%
17	0.50%	4.25%	0.50%	4.25%
18	0.50%	4.25%	0.50%	4.25%
19	0.50%	4.25%	0.50%	4.25%
20	0.25%	4.00%	0.25%	4.00%
21	0.25%	4.00%	0.25%	4.00%
22	0.25%	4.00%	0.25%	4.00%
23	0.25%	4.00%	0.25%	4.00%
24	0.25%	4.00%	0.25%	4.00%
25 or more	0.00%	3.75%	0.00%	3.75%

3. Salary increase rates (continued):



Police & Firefighters

---

Years of Service	Service-related Component	Total Annual Rate of Increase Including 2.50% Inflation Component and 2.50% General Increase Rate
1	1.00%	6.00%
2	1.00%	6.00%
3	1.00%	6.00%
4	1.00%	6.00%
5	1.00%	6.00%
6	1.00%	6.00%
7	1.00%	6.00%
8	1.00%	6.00%
9	1.00%	6.00%
10	1.00%	6.00%
11	1.00%	6.00%
12	1.00%	6.00%
13	1.00%	6.00%
14	1.00%	6.00%
15	1.00%	6.00%
16	0.75%	5.75%
17	0.75%	5.75%
18	0.75%	5.75%
19	0.50%	5.50%
20	0.50%	5.50%
21	0.50%	5.50%
22	0.25%	5.25%
23	0.25%	5.25%
24	0.25%	5.25%
25 or more	0.00%	5.00%

Salary increases are assumed to occur once a year, on July 1. Therefore the pay used for the period between the valuation date and the first anniversary of the valuation date is equal to the reported pay for the prior year, annualized if necessary, and then increased by the salary increase assumption. To adjust the pays received as of March 31<sup>st</sup> to the June 30<sup>th</sup> valuation date, the reported pay for each member is increased by 1%.

B. Demographic Assumptions

1. Mortality rates:

Active Members: Multiples of the Pub-2010, Employee Tables for active employees based on the occupation of the member as follows:

Type	General Employees	Teachers	Police and Fire
	Male & Female	Male & Female	Male & Female
Ordinary	94%	92%	80%
% of Ordinary	41%	52%	24%
Choosing Annuity			
Duty Related	6%	8%	20%

Healthy Retirees: The 2022 Public Retirees of Hawaii mortality tables. The rates are projected on a fully generational basis by the long-term rates of scale UMP from the year 2022 and with multipliers and setbacks based on plan and group experience. The following are sample rates of the base table with the corresponding multipliers:

Healthy Annuitant Mortality Rates Before Projection (Multiplier Applied)

Age	General Employees		Teachers		Police and Fire	
	Male	Female	Male	Female	Male	Female
50	0.2094%	0.1276%	0.1698%	0.0951%	0.2421%	0.1130%
55	0.3215%	0.1687%	0.2883%	0.1596%	0.3473%	0.1633%
60	0.5570%	0.3095%	0.4672%	0.2467%	0.6179%	0.2799%
65	0.8041%	0.4488%	0.7256%	0.4063%	0.8426%	0.4283%
70	1.2621%	0.7066%	1.0762%	0.6015%	1.4172%	0.6565%
75	2.0700%	1.0964%	1.7879%	0.9358%	2.3227%	1.0121%
80	3.5996%	2.1275%	3.0429%	1.6565%	4.1824%	1.8863%
85	6.5891%	4.1569%	5.5564%	3.2698%	7.6513%	3.6977%
90	11.9340%	8.3647%	10.1056%	6.5007%	13.6689%	7.3991%
Multiplier	102%	98%	97%	101%	93%	100%
Setback	0	-1	1	1	-2	0

The following table provides the life expectancy for individuals retiring in future years based on the assumption with full generational projection:

Life Expectancy for an Age 65 Retiree in Years

Gender	Year of Retirement				
	2025	2030	2035	2040	2045
<u>General Retirees</u>					
Male	22.8	23.2	23.5	23.9	24.2
Female	26.3	26.6	26.9	27.2	27.5
<u>Teachers</u>					
Male	24.1	24.5	24.9	25.2	25.5
Female	28.0	28.3	28.6	28.9	29.2
<u>Police and Fire</u>					
Male	21.8	22.1	22.4	22.8	23.1
Female	27.1	27.4	27.7	28	28.3

Disabled retirees: Base Table for healthy retirees' occupation, set forward 3 years, generational projection using the UMP projection table from the year 2022. Minimum mortality rate of 3.5% for males and 2.5% for females.

2. Disability rates – The assumed total disability rates at select ages are multiples of the client specific table that follows:

Age	Male & Female
25	0.000%
30	0.001%
35	0.008%
40	0.026%
45	0.064%
50	0.146%
55	0.198%
60	0.217%

Note: The disability rates project the percentage of employees at each age that is assumed to become disabled before retiring. Multiples of the rates above are assumed to be ordinary disability or accidental disability, and varies by employee group as follows:

Type	<u>General Employees</u>	<u>Teachers</u>	<u>Police and Fire</u>
	Male & Female	Male & Female	Male & Female
Ordinary	200%	100%	50%
Accidental	60%	8%	120%

3. Termination Rates - Same male and female rates, based solely on the member's service. Rates reflect terminations for causes other than death, disability or retirement. Employees eligible for retirement are assumed to have no probability of termination. Sample rates are shown below:

Years of Service	Expected Terminations per 1000 Lives (Male & Female)		
	General Employees	Teachers	Police & Fire
0	177.2	0.0	140.0
1	142.2	197.9	52.4
2	114.2	165.2	41.3
3	92.0	134.8	34.8
4	74.8	108.2	30.2
5	61.7	86.3	26.6
6	51.9	69.4	23.7
7	44.7	57.3	21.3
8	39.6	49.4	19.1
9	35.8	44.5	17.2
10	32.8	41.0	15.6
11	30.3	35.8	10.6
12	27.9	32.4	10.0
13	22.6	29.1	9.4
14	19.8	26.1	8.8
15	17.7	23.2	8.2
16	16.1	20.6	7.6
17	14.8	18.1	7.0
18	13.7	15.8	6.4
19	12.8	13.6	5.8
20	11.9	11.7	5.2
21	11.1	10.0	4.6
22	10.2	8.4	4.0
23	9.3	7.0	3.4
24	8.3	5.8	2.8
25	7.1	4.8	0.0
26	6.0	4.0	0.0
27	4.7	3.3	0.0
28	3.5	2.8	0.0
29	2.4	2.6	0.0
30 and more	0.0	0.0	0.0

4. Retirement rates - Separate male and female rates, based on age. Sample rates are shown below:

Contributory Members

Expected Retirements per 100 Lives

Age	General Employees				Teachers				Police/Fire
	Unreduced Retirement		Reduced Retirement		Unreduced Retirement		Reduced Retirement		Unreduced Retirement
	Male	Female	Male	Female	Male	Female	Male	Female	Male & Female
45	0	0	0	0	0	0	0	0	15.5
46	0	0	0	0	0	0	0	0	15.5
47	0	0	0	0	0	0	0	0	15.5
48	0	0	0	0	0	0	0	0	15.5
49	0	0	0	0	0	0	0	0	15.5
50	0	0	0	0	0	0	1	0	18.0
51	0	0	2	1	0	0	1	1	18.0
52	0	0	2	1	0	0	1	1	18.0
53	0	0	2	1	0	0	2	2	18.0
54	0	0	3	2	0	0	3	3	18.0
55	25	20			20	18			22.0
56	25	20			15	16			22.0
57	16	13			15	16			22.0
58	16	13			15	16			24.0
59	13	13			15	16			27.0
60	13	15			14	18			30.0
61	13	15			14	18			30.0
62	28	25			14	25			30.0
63	20	20			14	20			30.0
64	20	20			14	15			30.0
65	20	20			20	25			100.0
66	18	20			15	25			
67	18	20			15	20			
68	18	20			15	20			
69	18	20			15	20			
70	20	20			15	20			
71	20	20			15	20			
72	20	20			15	20			
73	20	20			15	20			
74	20	20			15	20			
75	100	100			100	100			

## Noncontributory Members

Age	Expected Retirements per 100 Lives									
	General Employees						Teacher			
	Unreduced		25 & Out		Reduced		Unreduced		Reduced Retirement	
Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
55	20	11	15	11	1	1	10	13	1	2
56	18	11	23	11	1	1	10	7	1	2
57	13	11	18	11	1	1	10	8	1	2
58	10	11	15	11	2	2	10	10	2	2
59	10	11	15	11	2	2	10	20	3	3
60	10	14	15	14	4	4	10	11	5	5
61	11	18	16	18	4	4	10	16	7	5
62	20	20	25	20			16	25		
63	20	20	25	20			12	20		
64	12	20	17	20			10	15		
65	14	20	19	20			20	25		
66	20	20	25	20			15	25		
67	20	20	25	20			15	25		
68	20	20	25	20			15	25		
69	20	20	25	20			15	25		
70	20	20	25	20			15	25		
71	20	20	25	20			15	25		
72	20	20	25	20			15	25		
73	20	20	25	20			15	25		
74	20	20	25	20			15	25		
75	100	100	100	100			100	100		

Note: Retirement rates for the 25&out group prior to age 55 are 15% for male and 11% for female.

## Hybrid Members

Age	Expected Retirements per 100 Lives							
	General Employees				Teachers			
	Unreduced		Reduced		Unreduced		Reduced	
Male	Female	Male	Female	Male	Female	Male	Female	
55	18	18	1	1	20	16	2	2
56	12	13	1	1	13	10	2	2
57	12	13	1	1	13	10	2	2
58	16	13	2	2	13	12	2	2
59	16	13	2	2	13	12	3	3
60	14	13	4	4	14	14	3	5
61	14	15	4	4	14	18	3	10
62	21	20			22	30		
63	18	20			14	20		
64	18	20			14	20		
65	21	20			20	25		
66	18	18			15	25		
67	18	18			15	25		
68	18	18			15	25		
69	18	18			15	25		
70	20	20			15	25		
71	20	20			15	25		
72	20	20			15	25		
73	20	20			15	25		
74	20	20			15	25		
75	100	100			100	100		

Note: For the 25&out group with membership dates before July 1, 2012, the retirement rates prior to age 55 are 6% for both male and female.

For members hired after June 30, 2012 the retirement rates for members once they reach unreduced retirement eligibility are increased 10% (multiplicative) for each year the member is beyond the age the member would have been eligible under the Hybrid provisions for members hired prior to June 30, 2012.

C. Other Assumptions

1. Projected payroll for contributions: The aggregate projected payroll for the fiscal year following the valuation date is calculated taking the lesser of the actual payroll paid during the previous fiscal year and the current annualized pay on the valuation date and increasing this number by the payroll growth rate.
2. Age difference: Male members are assumed to be four years older than their spouses, and female members are assumed to be four years younger than their spouses.
3. Marriage Assumption: While not implicitly used in the valuation, 100% of active members are assumed to be married when setting other benefit election and eligibility assumptions.
4. Percent electing annuity on death for contributory participants (when eligible): All of the spouses of married participants who die after becoming eligible for a retirement benefit are assumed to elect an annuity or a refund, whichever is more valuable at time of participant's death.
5. Payment Option: Future healthy retirees are assumed to choose the life only payment option. 50% of future disabled retirees are assumed to choose the 100% Joint and Survivor option.
6. Percent electing deferred termination benefit: vested terminating members are assumed to elect a refund or a deferred benefit, whichever is more valuable at the time of termination.
7. Assumed age for commencement of deferred benefits: Members electing to receive a deferred benefit are assumed to commence receipt when eligible for early retirement.
8. Administrative expenses: Administrative expenses are assumed to be 0.35% of active member payroll.
9. Reemployment, purchase of service, transfers: No recognition is made of (i) future member reimbursements upon reemployment, (ii) future purchase of additional service, or (iii) special transfer provisions.
10. Sick Leave: It is assumed that all members will have their benefit service increased by sick leave and the following loads will be applied by group:

General Employees	3.25%
Teachers	3.75%
Police and Fire	5.00%

11. COLA delay: It is assumed that the first COLA will be received 9 months after retirement. Teachers are assumed to receive COLA 12 months after retirement,
12. There will be no recoveries once disabled.
13. No surviving spouse will remarry and there will be no children's benefit.
14. Pay increase timing: Beginning of (fiscal) year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.
15. Decrement timing: Retirements and terminations of Teachers are assumed to occur at the beginning of the year. All other decrements are assumed to occur mid-year.
16. Eligibility testing: Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
17. Decrement relativity: Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.
18. Incidence of Contributions: Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made.
19. Benefit Service: All members are assumed to accrue 1 year of service each year. Exact fractional service is used to determine the amount of benefit payable.
20. Police officers, firefighters, investigators of the Department of the Prosecuting Attorney and the Attorney General, narcotic enforcement investigators, and public safety investigators hired prior to June 30, 2012 are not assumed to retire at age 55 unless they have 10 years of service.

## VI. Participant Data

Participant data was supplied in electronic files for (i) active members, (ii) inactive vested members, who are entitled to a future deferred benefit, (iii) members and beneficiaries receiving benefits.

Salary supplied for the current year was based on the actual pensionable earnings for the 12-month period ending the March preceding the valuation date. This pay was increased by 1% to reflect the three month difference from March to June. For members with less than one year of service, the base pay rate provided in the data was used.

## **SECTION VII**

---

### **SUMMARY OF DATA AND EXPERIENCE**

**GENERAL EMPLOYEES - CONTRIBUTORY**  
**MALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Liabilities		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	155,712	533,268	0.292	0.250	0.250	133,317	133,317	117%	117%
56	160,662	471,007	0.341	0.250	0.250	117,752	117,752	136%	136%
57	77,341	403,797	0.192	0.160	0.160	64,607	64,607	120%	120%
58	37,000	440,676	0.084	0.160	0.160	70,508	70,508	52%	52%
59	72,920	484,503	0.151	0.130	0.130	62,985	62,985	116%	116%
60	78,702	511,422	0.154	0.130	0.130	66,485	66,485	118%	118%
61	88,587	529,706	0.167	0.130	0.130	68,862	68,862	129%	129%
62	109,926	617,756	0.178	0.280	0.280	172,972	172,972	64%	64%
63	80,044	596,352	0.134	0.200	0.200	119,270	119,270	67%	67%
64	136,622	606,142	0.225	0.200	0.200	121,228	121,228	113%	113%
65	66,472	527,030	0.126	0.200	0.200	105,406	105,406	63%	63%
66	148,461	493,509	0.301	0.180	0.180	88,832	88,832	167%	167%
67	64,337	345,597	0.186	0.180	0.180	62,207	62,207	103%	103%
68	67,845	302,710	0.224	0.180	0.180	54,488	54,488	125%	125%
69	62,450	253,940	0.246	0.180	0.180	45,709	45,709	137%	137%
Subtotal	1,407,081	7,117,413	0.198			1,354,629	1,354,629	104%	104%
70-74	186,747	698,579	0.267	0.200	0.200	139,716	139,716	134%	134%
Subtotal	1,593,828	7,815,992	0.204			1,494,344	1,494,344	107%	107%
75 & Over	62,893	371,557	0.169	1.000	1.000	371,557	371,557	17%	17%
Total	1,656,721	8,187,548	0.202			1,865,901	1,865,901	89%	89%



**GENERAL EMPLOYEES - CONTRIBUTORY**  
**FEMALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6) (8)	Current (2) / (7)	Proposed (2) / (8) (10)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	38,239	192,464	0.199	0.200	0.200	38,493	38,493	99%	99%
56	34,897	277,473	0.126	0.200	0.200	55,495	55,495	63%	63%
57	57,140	408,755	0.140	0.130	0.130	53,138	53,138	108%	108%
58	38,161	530,356	0.072	0.130	0.130	68,946	68,946	55%	55%
59	85,453	663,399	0.129	0.130	0.130	86,242	86,242	99%	99%
60	84,058	706,229	0.119	0.150	0.150	105,934	105,934	79%	79%
61	104,301	831,236	0.125	0.150	0.150	124,685	124,685	84%	84%
62	166,588	828,204	0.201	0.250	0.250	207,051	207,051	80%	80%
63	101,106	761,357	0.133	0.200	0.200	152,271	152,271	66%	66%
64	119,139	740,270	0.161	0.200	0.200	148,054	148,054	80%	80%
65	143,589	652,765	0.220	0.200	0.200	130,553	130,553	110%	110%
66	181,579	617,224	0.294	0.200	0.200	123,445	123,445	147%	147%
67	105,148	437,207	0.240	0.200	0.200	87,441	87,441	120%	120%
68	84,837	374,293	0.227	0.200	0.200	74,859	74,859	113%	113%
69	42,555	299,006	0.142	0.200	0.200	59,801	59,801	71%	71%
Subtotal	1,386,791	8,320,237	0.167			1,516,409	1,516,409	91%	91%
70-74	120,818	956,633	0.126	0.200	0.200	191,327	191,327	63%	63%
Subtotal	1,507,609	9,276,870	0.163			1,707,735	1,707,735	88%	88%
75 & Over	93,051	425,573	0.219	1.000	1.000	425,573	425,573	22%	22%
Total	1,600,660	9,702,443	0.165			2,133,308	2,133,308	75%	75%



**GENERAL EMPLOYEES - CONTRIBUTORY  
MALE EARLY RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 45	-	-	N/A	0.000	0.000	-	-	N/A	N/A
45	-	-	N/A	0.000	0.000	-	-	N/A	N/A
46	-	3,876	0.000	0.000	0.000	-	-	N/A	N/A
47	-	4,223	0.000	0.000	0.000	-	-	N/A	N/A
48	-	8,376	0.000	0.000	0.000	-	-	N/A	N/A
49	-	9,713	0.000	0.000	0.000	-	-	N/A	N/A
50	-	4,970	0.000	0.020	0.020	99	99	0%	0%
51	-	57,689	0.000	0.020	0.020	1,154	1,154	0%	0%
52	-	113,343	0.000	0.020	0.020	2,267	2,267	0%	0%
53	4,915	170,941	0.029	0.030	0.030	5,128	5,128	96%	96%
54	4,071	317,480	0.013	0.030	0.030	9,524	9,524	43%	43%
Total	8,985	690,611	0.013			18,173	18,173	49%	49%

**GENERAL EMPLOYEES - CONTRIBUTORY  
FEMALE EARLY RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age (1)	Actual Liabilities (2)	Total Liabilities (3)	Actual Rate (4)	Assumed Rate		Expected Retirement		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
Under 45	-	-	N/A	0.000	0.000	-	-	N/A	N/A
45	-	-	N/A	0.000	0.000	-	-	N/A	N/A
46	-	-	N/A	0.000	0.000	-	-	N/A	N/A
47	-	-	N/A	0.000	0.000	-	-	N/A	N/A
48	-	-	N/A	0.000	0.000	-	-	N/A	N/A
49	-	-	N/A	0.000	0.000	-	-	N/A	N/A
50	-	7,245	0.000	0.000	0.000	-	-	N/A	N/A
51	-	30,118	0.000	0.010	0.010	301	301	0%	0%
52	10,935	48,057	0.228	0.010	0.010	481	481	2275%	2275%
53	-	37,370	0.000	0.010	0.010	374	374	0%	0%
54	15,756	88,997	0.177	0.020	0.020	1,780	1,780	885%	885%
<b>Total</b>	<b>26,691</b>	<b>211,786</b>	<b>0.126</b>			<b>2,935</b>	<b>2,935</b>	<b>909%</b>	<b>909%</b>

**GENERAL EMPLOYEES - NONCONTRIBUTORY  
MALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 55	44,693	611,338	0.073	0.150	0.150	91,701	91,701	49%	49%
55	118,100	1,151,532	0.103	0.200	0.200	230,306	230,306	51%	51%
56	203,618	1,385,314	0.147	0.180	0.180	249,357	249,357	82%	82%
57	121,264	1,327,030	0.091	0.130	0.130	172,514	172,514	70%	70%
58	131,746	1,459,246	0.090	0.100	0.100	145,925	145,925	90%	90%
59	180,154	1,508,502	0.119	0.100	0.100	150,850	150,850	119%	119%
60	148,843	1,533,863	0.097	0.100	0.100	153,386	153,386	97%	97%
61	189,582	1,594,574	0.119	0.110	0.110	175,403	175,403	108%	108%
62	698,763	3,469,105	0.201	0.200	0.200	693,821	693,821	101%	101%
63	516,815	2,936,949	0.176	0.200	0.200	587,390	587,390	88%	88%
64	316,783	2,391,342	0.132	0.120	0.120	286,961	286,961	110%	110%
65	290,360	2,143,340	0.135	0.140	0.140	300,068	300,068	97%	97%
66	355,252	1,917,518	0.185	0.200	0.200	383,504	383,504	93%	93%
67	262,770	1,534,975	0.171	0.200	0.200	306,995	306,995	86%	86%
68	270,123	1,219,637	0.221	0.200	0.200	243,927	243,927	111%	111%
69	189,353	949,588	0.199	0.200	0.200	189,918	189,918	100%	100%
Subtotal	4,038,219	27,133,855	0.149			4,362,025	4,362,025	93%	93%
70-74	438,184	2,366,447	0.185	0.200	0.200	473,289	473,289	93%	93%
Subtotal	4,476,403	29,500,301	0.152			4,835,314	4,835,314	93%	93%
75 & Over	150,770	885,805	0.170	1.000	1.000	885,805	885,805	17%	17%
Total	4,627,173	30,386,106	0.152			5,721,119	5,721,119	81%	81%



**GENERAL EMPLOYEES - NONCONTRIBUTORY  
FEMALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 55	-	70,466	0.000	0.110	0.110	7,751	7,751	0%	0%
55	43,596	643,192	0.068	0.110	0.110	70,751	70,751	62%	62%
56	137,982	821,710	0.168	0.110	0.110	90,388	90,388	153%	153%
57	61,838	834,409	0.074	0.110	0.110	91,785	91,785	67%	67%
58	127,141	964,964	0.132	0.110	0.110	106,146	106,146	120%	120%
59	120,979	1,072,455	0.113	0.110	0.110	117,970	117,970	103%	103%
60	161,469	1,138,651	0.142	0.140	0.140	159,411	159,411	101%	101%
61	176,149	1,225,923	0.144	0.180	0.180	220,666	220,666	80%	80%
62	546,696	3,393,433	0.161	0.200	0.200	678,687	678,687	81%	81%
63	588,383	2,925,713	0.201	0.200	0.200	585,143	585,143	101%	101%
64	398,184	2,394,390	0.166	0.200	0.200	478,878	478,878	83%	83%
65	333,960	2,044,061	0.163	0.200	0.200	408,812	408,812	82%	82%
66	365,746	1,759,672	0.208	0.200	0.200	351,934	351,934	104%	104%
67	297,381	1,345,486	0.221	0.200	0.200	269,097	269,097	111%	111%
68	187,552	1,050,522	0.179	0.200	0.200	210,104	210,104	89%	89%
69	104,233	838,274	0.124	0.200	0.200	167,655	167,655	62%	62%
Subtotal	3,651,289	22,523,321	0.162			4,015,179	4,015,179	91%	91%
70-74	533,415	2,466,939	0.216	0.250	0.200	493,388	493,388	108%	108%
Subtotal	4,184,704	24,990,260	0.167			4,508,567	4,508,567	93%	93%
75 & Over	153,422	815,527	0.188	1.000	1.000	815,527	815,527	19%	19%
Total	4,338,125	25,805,787	0.168			5,324,094	5,324,094	81%	81%



**GENERAL EMPLOYEES - NONCONTRIBUTORY  
MALE EARLY RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 55	-	-	N\A	0.000	0.000	-	-	N\A	N\A
55	15,109	1,262,329	0.012	0.010	0.010	12,623	12,623	120%	120%
56	23,073	1,248,352	0.018	0.010	0.010	12,484	12,484	185%	185%
57	16,829	1,415,645	0.012	0.010	0.010	14,156	14,156	119%	119%
58	33,837	1,429,913	0.024	0.010	0.020	14,299	28,598	237%	118%
59	36,072	1,576,522	0.023	0.020	0.020	31,530	31,530	114%	114%
60	47,249	1,460,563	0.032	0.030	0.040	43,817	58,423	108%	81%
61	34,838	1,391,883	0.025	0.040	0.040	55,675	55,675	63%	63%
Total	207,007	9,785,207	0.021			184,585	213,490	112%	97%

**GENERAL EMPLOYEES - NONCONTRIBUTORY  
FEMALE EARLY RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 55	-	-	N\A	N\A	0.000	-	-	N\A	N\A
55	5,442	920,405	0.006	0.010	0.010	9,204	9,204	59%	59%
56	11,898	1,063,186	0.011	0.010	0.010	10,632	10,632	112%	112%
57	24,941	1,206,833	0.021	0.010	0.010	12,068	12,068	207%	207%
58	39,773	1,324,165	0.030	0.010	0.020	13,242	26,483	300%	150%
59	33,955	1,365,909	0.025	0.020	0.020	27,318	27,318	124%	124%
60	52,066	1,529,005	0.034	0.030	0.040	45,870	61,160	114%	85%
61	73,226	1,690,472	0.043	0.040	0.040	67,619	67,619	108%	108%
<b>Total</b>	<b>241,301</b>	<b>9,099,976</b>	<b>0.027</b>			<b>185,953</b>	<b>214,485</b>	<b>130%</b>	<b>113%</b>

**GENERAL EMPLOYEES - HYBRID**  
**MALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) *	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 55	52,402	325,764	0.161	0.060	0.180	19,546	58,638	268%	89%
55	290,562	1,611,589	0.180	0.180	0.180	290,086	290,086	100%	100%
56	362,463	1,803,113	0.201	0.120	0.120	216,374	216,374	168%	168%
57	271,119	1,890,291	0.143	0.120	0.120	226,835	226,835	120%	120%
58	284,800	2,024,985	0.141	0.160	0.160	323,998	323,998	88%	88%
59	331,744	2,281,987	0.145	0.160	0.160	365,118	365,118	91%	91%
60	491,404	2,394,384	0.205	0.140	0.140	335,214	335,214	147%	147%
61	341,399	2,193,631	0.156	0.140	0.140	307,108	307,108	111%	111%
62	971,406	5,975,868	0.163	0.210	0.210	1,254,932	1,254,932	77%	77%
63	1,006,236	5,419,898	0.186	0.180	0.180	975,582	975,582	103%	103%
64	605,793	4,510,369	0.134	0.180	0.180	811,866	811,866	75%	75%
65	652,005	4,074,867	0.160	0.210	0.210	855,722	855,722	76%	76%
66	656,658	3,338,632	0.197	0.180	0.180	600,954	600,954	109%	109%
67	660,465	2,649,674	0.249	0.180	0.180	476,941	476,941	138%	138%
68	390,036	1,965,633	0.198	0.180	0.180	353,814	353,814	110%	110%
69	277,538	1,497,665	0.185	0.180	0.180	269,580	269,580	103%	103%
Subtotal	7,646,030	43,958,349	0.174			7,683,669	7,722,761	100%	99%
70-74	702,446	3,673,415	0.191	0.200	0.200	734,683	734,683	96%	96%
Subtotal	8,348,476	47,631,764	0.175			8,418,352	8,457,444	99%	99%
75 & Over	185,386	1,102,434	0.168	1.000	1.000	1,102,428	1,102,434	17%	17%
Total	8,533,862	48,734,198	0.175			9,520,780	9,559,878	90%	89%



**GENERAL EMPLOYEES - HYBRID**  
**FEMALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 45	11,769	32,053	0.367	0.060	0.180	1,923	5,770	612%	204%
55	262,996	2,219,286	0.119	0.180	0.180	399,472	399,472	66%	66%
56	365,378	2,483,993	0.147	0.130	0.130	322,919	322,919	113%	113%
57	314,403	2,794,592	0.113	0.130	0.130	363,297	363,297	87%	87%
58	353,461	2,978,574	0.119	0.130	0.130	387,215	387,215	91%	91%
59	416,717	3,051,112	0.137	0.130	0.130	396,645	396,645	105%	105%
60	507,058	3,187,161	0.159	0.130	0.130	414,331	414,331	122%	122%
61	482,189	3,119,625	0.155	0.150	0.150	467,944	467,944	103%	103%
62	1,507,963	8,072,227	0.187	0.200	0.200	1,614,445	1,614,445	93%	93%
63	1,409,070	6,849,427	0.206	0.200	0.200	1,369,885	1,369,885	103%	103%
64	956,562	5,702,910	0.168	0.200	0.200	1,140,582	1,140,582	84%	84%
65	868,434	4,906,900	0.177	0.200	0.200	981,380	981,380	88%	88%
66	954,117	3,963,236	0.241	0.180	0.180	713,382	713,382	134%	134%
67	692,136	3,066,320	0.226	0.180	0.180	551,938	551,938	125%	125%
68	505,555	2,360,981	0.214	0.180	0.180	424,977	424,977	119%	119%
69	285,140	1,706,578	0.167	0.180	0.180	307,184	307,184	93%	93%
Subtotal	9,892,948	56,494,975	0.175			9,857,518	9,861,364	100%	100%
70-74	785,914	3,794,756	0.207	0.200	0.200	759,299	758,951	104%	104%
Subtotal	10,678,863	60,289,731	0.177			10,616,817	10,620,316	101%	101%
75 & Over	172,114	740,834	0.232	1.000	1.000	740,834	740,834	23%	23%
Total	10,850,976	61,030,566	0.178			11,357,652	11,361,150	96%	96%



**GENERAL EMPLOYEES - HYBRID  
MALE EARLY RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	33,908	1,974,930	0.017	0.010	0.010	19,749	19,749	172%	172%
56	69,039	2,040,032	0.034	0.010	0.010	20,400	20,400	338%	338%
57	29,020	2,059,028	0.014	0.010	0.010	20,590	20,590	141%	141%
58	48,434	2,167,074	0.022	0.010	0.020	21,671	43,341	224%	112%
59	60,994	2,129,749	0.029	0.020	0.020	42,595	42,595	143%	143%
60	91,660	2,045,959	0.045	0.020	0.040	40,919	81,838	224%	112%
61	63,649	1,931,900	0.033	0.030	0.040	57,957	77,276	110%	82%
62	-	-	N/A	0.000	0.000	-	-	0%	0%
63	-	-	N/A	0.000	0.000	-	-	0%	0%
64	-	-	N/A	0.000	0.000	-	-	0%	0%
<b>Total</b>	<b>396,704</b>	<b>14,348,672</b>	<b>0.028</b>			<b>223,882</b>	<b>305,791</b>	<b>177%</b>	<b>130%</b>

**GENERAL EMPLOYEES - HYBRID  
FEMALE EARLY RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	42,240	2,468,472	0.017	0.010	0.010	24,685	24,685	171%	171%
56	34,137	2,544,930	0.013	0.010	0.010	25,449	25,449	134%	134%
57	30,743	2,542,799	0.012	0.010	0.010	25,428	25,428	121%	121%
58	61,255	2,609,507	0.023	0.020	0.020	52,190	52,190	117%	117%
59	69,806	2,748,696	0.025	0.020	0.020	54,974	54,974	127%	127%
60	132,761	2,903,009	0.046	0.040	0.040	116,120	116,120	114%	114%
61	117,425	2,844,883	0.041	0.040	0.040	113,795	113,795	103%	103%
62	-	-	N/A	0.000	0.000	-	-	0%	0%
63	-	-	N/A	0.000	0.000	-	-	0%	0%
64	-	-	N/A	0.000	0.000	-	-	0%	0%
<b>Total</b>	<b>488,368</b>	<b>18,662,296</b>	<b>0.026</b>			<b>412,642</b>	<b>412,642</b>	<b>118%</b>	<b>118%</b>

**TEACHERS - CONTRIBUTORY**  
**MALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age (1)	Actual Liabilities (2)	Total Liabilities (3)	Actual Rate (4)	Assumed Rate		Expected Retirement		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
55	-	42,311	0.000	0.200	0.200	8,462	8,462	0%	0%
56	6,708	80,237	0.084	0.150	0.150	12,035	12,035	56%	56%
57	14,724	99,307	0.148	0.150	0.150	14,896	14,896	99%	99%
58	19,127	125,779	0.152	0.150	0.150	18,867	18,867	101%	101%
59	-	161,214	0.000	0.150	0.150	24,182	24,182	0%	0%
60	15,158	168,604	0.090	0.140	0.140	23,605	23,605	64%	64%
61	15,689	168,939	0.093	0.140	0.140	23,651	23,651	66%	66%
62	41,207	181,824	0.227	0.140	0.140	25,455	25,455	162%	162%
63	35,982	176,799	0.204	0.140	0.140	24,752	24,752	145%	145%
64	28,180	137,220	0.205	0.140	0.140	19,211	19,211	147%	147%
65	30,846	108,573	0.284	0.200	0.200	21,715	21,715	142%	142%
66	26,263	131,596	0.200	0.150	0.150	19,739	19,739	133%	133%
67	63,268	137,958	0.459	0.150	0.150	20,694	20,694	306%	306%
68	47,887	94,900	0.505	0.150	0.150	14,235	14,235	336%	336%
69	6,570	68,382	0.096	0.150	0.150	10,257	10,257	64%	64%
Subtotal	351,607	1,883,644	0.187			281,757	281,757	125%	125%
70-74	117,925	433,645	0.272	0.150	0.150	65,047	65,047	181%	181%
Subtotal	469,533	2,317,289	0.203			346,804	346,804	135%	135%
75 & Over	9,788	277,487	0.035	1.000	1.000	277,487	277,487	4%	4%
Total	479,320	2,594,776	0.185			624,291	624,291	77%	77%



**TEACHERS - CONTRIBUTORY**  
**FEMALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age (1)	Actual Liabilities (2)	Total Liabilities (3)	Actual Rate (4)	Assumed Rate		Expected Retirement		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
55	18,220	82,053	0.222	0.180	0.180	14,770	14,770	123%	123%
56	17,595	148,388	0.119	0.160	0.160	23,742	23,742	74%	74%
57	58,990	209,675	0.281	0.160	0.160	33,548	33,548	176%	176%
58	16,989	230,163	0.074	0.160	0.160	36,826	36,826	46%	46%
59	41,199	335,112	0.123	0.160	0.160	53,618	53,618	77%	77%
60	90,122	416,242	0.217	0.180	0.180	74,924	74,924	120%	120%
61	70,332	433,101	0.162	0.180	0.180	77,958	77,958	90%	90%
62	120,030	505,529	0.237	0.250	0.250	126,382	126,382	95%	95%
63	149,391	544,409	0.274	0.200	0.200	108,882	108,882	137%	137%
64	67,234	479,909	0.140	0.150	0.150	71,986	71,986	93%	93%
65	140,709	460,364	0.306	0.250	0.250	115,091	115,091	122%	122%
66	116,444	353,316	0.330	0.250	0.250	88,329	88,329	132%	132%
67	96,559	255,264	0.378	0.200	0.200	51,053	51,053	189%	189%
68	35,915	188,196	0.191	0.200	0.200	37,639	37,639	95%	95%
69	31,281	146,291	0.214	0.200	0.200	29,258	29,258	107%	107%
Subtotal	1,071,009	4,788,011	0.224			944,006	944,006	113%	113%
70-74	146,854	600,403	0.245	0.200	0.200	120,081	120,081	122%	122%
Subtotal	1,217,862	5,388,414	0.226			1,064,086	1,064,086	114%	114%
75 & Over	42,628	140,883	0.303	1.000	1.000	140,883	140,883	30%	30%
Total	1,260,491	5,529,297	0.228			1,204,969	1,204,969	105%	105%



**TEACHERS - NONCONTRIBUTORY**  
**MALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	15,136	211,873	0.071	0.100	0.100	21,187	21,187	71%	71%
56	31,962	266,089	0.120	0.100	0.100	26,609	26,609	120%	120%
57	26,672	243,350	0.110	0.100	0.100	24,335	24,335	110%	110%
58	50,847	328,157	0.155	0.100	0.100	32,816	32,816	155%	155%
59	32,797	294,093	0.112	0.100	0.100	29,409	29,409	112%	112%
60	42,381	282,142	0.150	0.100	0.100	28,214	28,214	150%	150%
61	25,985	307,998	0.084	0.100	0.100	30,800	30,800	84%	84%
62	120,458	797,986	0.151	0.160	0.160	127,678	127,678	94%	94%
63	61,331	717,888	0.085	0.120	0.120	86,147	86,147	71%	71%
64	56,934	647,047	0.088	0.100	0.100	64,705	64,705	88%	88%
65	86,426	638,154	0.135	0.200	0.200	127,631	127,631	68%	68%
66	92,922	618,700	0.150	0.150	0.150	92,805	92,805	100%	100%
67	49,676	589,904	0.084	0.150	0.150	88,486	88,486	56%	56%
68	71,508	536,651	0.133	0.150	0.150	80,498	80,498	89%	89%
69	82,112	496,643	0.165	0.150	0.150	74,496	74,496	110%	110%
Subtotal	847,144	6,976,674	0.121			935,815	935,815	91%	91%
70-74	279,136	1,407,832	0.198	0.150	0.150	211,175	211,175	132%	132%
Subtotal	1,126,280	8,384,506	0.134			1,146,989	1,146,989	98%	98%
75 & Over	67,890	632,008	0.107	1.000	1.000	632,008	632,008	11%	11%
Total	1,194,170	9,016,514	0.132			1,778,997	1,778,997	67%	67%



**TEACHERS - NONCONTRIBUTORY**  
**FEMALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	72,522	590,358	0.123	0.130	0.130	76,747	76,747	94%	94%
56	86,140	662,792	0.130	0.070	0.070	46,395	46,395	186%	186%
57	65,345	653,481	0.100	0.080	0.080	52,278	52,278	125%	125%
58	40,275	574,346	0.070	0.100	0.100	57,435	57,435	70%	70%
59	107,043	546,553	0.196	0.200	0.200	109,311	109,311	98%	98%
60	59,082	450,935	0.131	0.110	0.110	49,603	49,603	119%	119%
61	104,166	491,042	0.212	0.160	0.160	78,567	78,567	133%	133%
62	308,307	1,381,626	0.223	0.250	0.250	345,406	345,406	89%	89%
63	171,168	1,108,406	0.154	0.200	0.200	221,681	221,681	77%	77%
64	135,845	1,029,002	0.132	0.150	0.150	154,350	154,350	88%	88%
65	185,463	1,031,333	0.180	0.250	0.250	257,833	257,833	72%	72%
66	238,715	903,591	0.264	0.250	0.250	225,898	225,898	106%	106%
67	140,810	717,176	0.196	0.250	0.250	179,294	179,294	79%	79%
68	140,541	610,757	0.230	0.250	0.250	152,689	152,689	92%	92%
69	114,902	506,362	0.227	0.250	0.250	126,591	126,591	91%	91%
Subtotal	1,970,324	11,257,758	0.175			2,134,078	2,134,078	92%	92%
70-74	199,725	1,187,336	0.168	0.250	0.250	296,834	296,834	67%	67%
Subtotal	2,170,049	12,445,093	0.174			2,430,911	2,430,911	89%	89%
75 & Over	82,042	377,955	0.217	1.000	1.000	377,955	377,955	22%	22%
Total	2,252,091	12,823,048	0.176			2,808,867	2,808,867	80%	80%



**TEACHERS - HYBRID**  
**MALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	109,264	512,078	0.213	0.200	0.200	102,416	102,416	107%	107%
56	81,699	603,775	0.135	0.130	0.130	78,491	78,491	104%	104%
57	102,916	724,678	0.142	0.130	0.130	94,208	94,208	109%	109%
58	96,166	782,481	0.123	0.130	0.130	101,723	101,723	95%	95%
59	133,118	748,275	0.178	0.130	0.130	97,276	97,276	137%	137%
60	90,144	660,354	0.137	0.140	0.140	92,450	92,450	98%	98%
61	79,712	626,470	0.127	0.140	0.140	87,706	87,706	91%	91%
62	251,501	1,609,298	0.156	0.220	0.220	354,045	354,045	71%	71%
63	208,671	1,501,364	0.139	0.140	0.140	210,191	210,191	99%	99%
64	132,835	1,352,952	0.098	0.140	0.140	189,413	189,413	70%	70%
65	205,567	1,267,782	0.162	0.200	0.200	253,556	253,556	81%	81%
66	276,207	1,106,898	0.250	0.150	0.150	166,035	166,035	166%	166%
67	83,082	821,067	0.101	0.150	0.150	123,160	123,160	67%	67%
68	146,192	788,160	0.185	0.150	0.150	118,224	118,224	124%	124%
69	114,772	661,280	0.174	0.150	0.150	99,192	99,192	116%	116%
Subtotal	2,111,847	13,766,911	0.153			2,168,085	2,168,085	97%	97%
70-74	374,344	2,013,151	0.186	0.150	0.150	301,973	301,973	124%	124%
Subtotal	2,486,191	15,780,062	0.158			2,470,058	2,470,058	101%	101%
75 & Over	189,502	929,423	0.204	1.000	1.000	929,423	929,423	20%	20%
Total	2,675,692	16,709,485	0.160			3,399,481	3,399,481	79%	79%



**TEACHERS - HYBRID**  
**FEMALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	284,376	1,658,591	0.171	0.160	0.160	265,375	265,375	107%	107%
56	240,225	1,828,434	0.131	0.100	0.100	182,843	182,843	131%	131%
57	210,853	1,812,407	0.116	0.100	0.100	181,241	181,241	116%	116%
58	246,760	1,772,845	0.139	0.120	0.120	212,741	212,741	116%	116%
59	250,481	1,673,045	0.150	0.120	0.120	200,765	200,765	125%	125%
60	249,173	1,526,190	0.163	0.140	0.140	213,667	213,667	117%	117%
61	254,625	1,493,737	0.170	0.180	0.180	268,873	268,873	95%	95%
62	795,787	3,721,651	0.214	0.300	0.300	1,116,495	1,116,495	71%	71%
63	613,495	3,168,041	0.194	0.200	0.200	633,608	633,608	97%	97%
64	470,240	2,630,793	0.179	0.200	0.200	526,159	526,159	89%	89%
65	482,084	2,327,833	0.207	0.250	0.250	581,958	581,958	83%	83%
66	574,243	1,966,935	0.292	0.250	0.250	491,734	491,734	117%	117%
67	345,543	1,351,769	0.256	0.250	0.250	337,942	337,942	102%	102%
68	271,279	1,120,356	0.242	0.250	0.250	280,089	280,089	97%	97%
69	120,021	801,927	0.150	0.250	0.250	200,482	200,482	60%	60%
Subtotal	5,409,183	28,854,555	0.187			5,693,972	5,693,972	95%	95%
70-74	429,789	1,958,587	0.219	0.250	0.250	489,647	489,647	88%	88%
Subtotal	5,838,972	30,813,142	0.189			6,183,619	6,183,619	94%	94%
75 & Over	83,474	421,121	0.198	1.000	1.000	421,121	421,121	20%	20%
Total	5,922,446	31,234,263	0.190			6,604,739	6,604,739	90%	90%



**TEACHERS - HYBRID**  
**MALE EARLY RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	9,925	628,820	0.016	0.020	0.020	12,576	12,576	79%	79%
56	10,971	610,313	0.018	0.020	0.020	12,206	12,206	90%	90%
57	10,105	528,873	0.019	0.020	0.020	10,577	10,577	96%	96%
58	-	523,364	0.000	0.020	0.020	10,467	10,467	0%	0%
59	5,378	504,559	0.011	0.030	0.030	15,137	15,137	36%	36%
60	16,899	541,661	0.031	0.030	0.030	16,250	16,250	104%	104%
61	14,412	519,403	0.028	0.030	0.030	15,582	15,582	92%	92%
62	-	-	N/A	0.000	0.000	-	-	0%	0%
63	-	-	N/A	0.000	0.000	-	-	0%	0%
64	-	-	N/A	0.000	0.000	-	-	0%	0%
<b>Total</b>	<b>67,689</b>	<b>3,856,993</b>	<b>0.018</b>			<b>92,796</b>	<b>92,796</b>	<b>73%</b>	<b>73%</b>

**TEACHERS - HYBRID**  
**FEMALE EARLY RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	28,352	1,426,853	0.020	0.020	0.020	28,537	28,537	99%	99%
56	19,136	1,267,590	0.015	0.020	0.020	25,352	25,352	75%	75%
57	25,510	1,241,823	0.021	0.020	0.020	24,836	24,836	103%	103%
58	21,292	1,235,006	0.017	0.020	0.020	24,700	24,700	86%	86%
59	73,094	1,213,239	0.060	0.030	0.030	36,397	36,397	201%	201%
60	70,302	1,226,330	0.057	0.050	0.050	61,317	61,317	115%	115%
61	83,881	1,266,579	0.066	0.100	0.100	126,658	126,658	66%	66%
62	-	-	N/A	0.000	0.000	-	-	0%	0%
63	-	-	N/A	0.000	0.000	-	-	0%	0%
64	-	-	N/A	0.000	0.000	-	-	0%	0%
<b>Total</b>	<b>321,567</b>	<b>8,877,421</b>	<b>0.036</b>			<b>327,797</b>	<b>327,797</b>	<b>98%</b>	<b>98%</b>

**POLICE & FIRE EMPLOYEES**  
**RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED**

Age (1)	Actual Liabilities (2)	Total Liabilities (3)	Actual Rate (4)	Assumed Rate		Expected Retirement		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
45	43,026	143,354	0.300	0.135	0.155	19,353	22,220	222%	60%
46	67,874	729,882	0.093	0.135	0.155	98,534	113,132	69%	93%
47	223,758	1,549,912	0.144	0.135	0.155	209,238	240,236	107%	99%
48	488,224	3,195,448	0.153	0.135	0.155	431,385	495,294	113%	102%
49	691,455	4,391,499	0.157	0.135	0.155	592,852	680,682	117%	83%
50	832,069	5,583,974	0.149	0.160	0.180	893,436	1,005,115	93%	95%
51	1,069,684	6,287,504	0.170	0.160	0.180	1,006,001	1,131,751	106%	104%
52	1,244,332	6,668,303	0.187	0.160	0.180	1,066,928	1,200,294	117%	108%
53	1,277,132	6,557,622	0.195	0.160	0.180	1,049,220	1,180,372	122%	135%
54	1,554,329	6,405,839	0.243	0.160	0.180	1,024,934	1,153,051	152%	102%
55	1,749,246	7,790,102	0.225	0.200	0.220	1,558,020	1,713,823	112%	118%
56	1,581,557	6,102,887	0.259	0.200	0.220	1,220,577	1,342,635	130%	100%
57	1,013,882	4,599,119	0.220	0.200	0.220	919,824	1,011,806	110%	98%
58	876,842	3,716,821	0.236	0.220	0.240	817,701	892,037	107%	95%
59	802,917	3,117,085	0.258	0.250	0.270	779,271	841,613	103%	87%
60	633,044	2,434,369	0.260	0.300	0.300	730,311	730,311	87%	117%
61	710,213	2,022,105	0.351	0.300	0.300	606,632	606,632	117%	70%
Subtotal	14,859,584	71,295,827	0.208			13,024,218	14,361,005	114%	103%
62-64	842,199	3,049,023	0.276	0.300	0.300	914,707	914,707	92%	92%
Subtotal	15,701,783	74,344,850	0.211			13,938,924	15,275,712	113%	103%
65 & Over	331,477	1,233,938	0.269	1.000	1.000	1,233,938	1,233,938	27%	27%
Total	16,033,260	75,578,787	0.212			15,172,862	16,509,649	106%	97%



**SALARY SCALE ASSUMPTION  
GENERAL EMPLOYEES**

Average Long Service			
Year	Increase	CPI	Productivity
2012	0.91%	1.66%	-0.75%
2013	1.52%	1.75%	-0.24%
2014	4.80%	2.07%	2.73%
2015	6.24%	0.12%	6.12%
2016	5.38%	1.00%	4.39%
2017	4.93%	1.63%	3.29%
2018	3.84%	2.87%	0.97%
2019	4.53%	1.65%	2.88%
2020	1.07%	0.65%	0.43%
2021	5.30%	5.39%	-0.10%
Average	3.83%	1.87%	1.96%
Proposed	3.75%	2.50%	1.25%

**SALARY SCALE ASSUMPTION  
GENERAL EMPLOYEES**

Years of Service	Average Pay Increase	Less Actual Inflation and Productivity Components	Actual Step-Rate/Promotional Component	Proposed Step-Rate/Promotional Component
1	6.59%	-3.83%	2.76%	3.00%
2	6.72%	-3.83%	2.88%	3.00%
3	6.03%	-3.83%	2.20%	2.00%
4	5.50%	-3.83%	1.66%	1.50%
5	5.24%	-3.83%	1.40%	1.50%
6	4.98%	-3.83%	1.14%	1.25%
7	4.93%	-3.83%	1.10%	1.25%
8	4.76%	-3.83%	0.93%	1.00%
9	4.57%	-3.83%	0.73%	1.00%
10	4.51%	-3.83%	0.68%	1.00%
11	4.70%	-3.83%	0.86%	0.75%
12	4.32%	-3.83%	0.49%	0.75%
13	4.44%	-3.83%	0.60%	0.50%
14	4.33%	-3.83%	0.50%	0.50%
15	4.15%	-3.83%	0.31%	0.50%
16	4.41%	-3.83%	0.57%	0.50%
17	4.15%	-3.83%	0.31%	0.50%
18	4.17%	-3.83%	0.33%	0.50%
19	4.15%	-3.83%	0.31%	0.50%
20	4.00%	-3.83%	0.16%	0.25%
21	3.77%	-3.83%	-0.06%	0.25%
22	4.27%	-3.83%	0.44%	0.25%
23	4.05%	-3.83%	0.22%	0.25%
24	4.27%	-3.83%	0.44%	0.25%
25	3.83%	-3.83%	0.00%	0.00%

**SALARY SCALE ASSUMPTION  
TEACHERS**

Year	Average Long Service		
	Increase	CPI	Productivity
2012	0.52%	1.66%	-1.15%
2013	0.49%	1.75%	-1.26%
2014	4.26%	2.07%	2.18%
2015	4.24%	0.12%	4.12%
2016	4.94%	1.00%	3.94%
2017	3.94%	1.63%	2.31%
2018	4.75%	2.87%	1.88%
2019	4.72%	1.65%	3.07%
2020	4.40%	0.65%	3.75%
2021	3.53%	5.39%	-1.86%
Average	3.61%	1.87%	1.74%
Proposed	3.75%	2.50%	1.25%

**SALARY SCALE ASSUMPTION  
TEACHERS**

Years of Service	Average Pay Increase	Less Actual Inflation and Productivity Components	Actual Step-Rate/Promotional Component	Proposed Step-Rate/Promotional Component
1	6.63%	-3.61%	3.02%	3.00%
2	5.49%	-3.61%	1.87%	3.00%
3	5.27%	-3.61%	1.65%	2.00%
4	5.09%	-3.61%	1.47%	1.50%
5	5.30%	-3.61%	1.68%	1.50%
6	4.65%	-3.61%	1.04%	1.25%
7	5.11%	-3.61%	1.50%	1.25%
8	4.59%	-3.61%	0.98%	1.00%
9	4.67%	-3.61%	1.06%	1.00%
10	4.57%	-3.61%	0.96%	1.00%
11	4.48%	-3.61%	0.86%	0.75%
12	4.47%	-3.61%	0.85%	0.75%
13	4.25%	-3.61%	0.63%	0.50%
14	4.57%	-3.61%	0.95%	0.50%
15	4.21%	-3.61%	0.59%	0.50%
16	3.94%	-3.61%	0.33%	0.50%
17	4.22%	-3.61%	0.60%	0.50%
18	3.79%	-3.61%	0.17%	0.50%
19	4.04%	-3.61%	0.42%	0.50%
20	3.92%	-3.61%	0.31%	0.25%
21	3.83%	-3.61%	0.22%	0.25%
22	3.43%	-3.61%	-0.18%	0.25%
23	3.96%	-3.61%	0.34%	0.25%
24	3.34%	-3.61%	-0.27%	0.25%
25	3.61%	-3.61%	0.00%	0.00%

**SALARY SCALE ASSUMPTION  
POLICE & FIRE EMPLOYEES**

Year	Average Long Service		
	Increase	CPI	Productivity
2012	1.11%	0.00%	1.66%
2013	0.73%	0.00%	1.75%
2014	4.59%	0.00%	2.07%
2015	12.69%	0.00%	0.12%
2016	8.19%	0.00%	1.00%
2017	7.23%	0.00%	1.63%
2018	4.31%	0.00%	2.87%
2019	7.03%	0.00%	1.65%
2020	-0.73%	0.00%	0.65%
2021	3.21%	0.00%	5.39%
Average	4.77%	1.87%	2.89%
Proposed	5.00%	2.50%	2.50%

**SALARY SCALE ASSUMPTION  
POLICE & FIRE EMPLOYEES**

Years of Service	Average Pay Increase	Less Actual Inflation and Productivity Components	Actual Step-Rate/Promotional Component	Proposed Step-Rate/Promotional Component
1	6.41%	4.77%	1.65%	1.00%
2	7.98%	4.77%	3.21%	1.00%
3	4.55%	4.77%	-0.21%	1.00%
4	4.12%	4.77%	-0.65%	1.00%
5	6.25%	4.77%	1.48%	1.00%
6	4.92%	4.77%	0.15%	1.00%
7	4.89%	4.77%	0.12%	1.00%
8	6.03%	4.77%	1.26%	1.00%
9	5.00%	4.77%	0.24%	1.00%
10	5.41%	4.77%	0.65%	1.00%
11	6.60%	4.77%	1.83%	1.00%
12	5.25%	4.77%	0.49%	1.00%
13	5.63%	4.77%	0.86%	1.00%
14	7.30%	4.77%	2.54%	1.00%
15	5.27%	4.77%	0.50%	1.00%
16	5.76%	4.77%	0.99%	0.75%
17	6.60%	4.77%	1.83%	0.75%
18	5.33%	4.77%	0.56%	0.75%
19	5.50%	4.77%	0.73%	0.50%
20	5.99%	4.77%	1.22%	0.50%
21	4.88%	4.77%	0.11%	0.50%
22	5.14%	4.77%	0.38%	0.25%
23	6.31%	4.77%	1.54%	0.25%
24	4.05%	4.77%	-0.72%	0.25%
25	4.77%	4.77%	0.00%	0.00%

**GENERAL EMPLOYEES**  
**POST-RETIREMENT MORTALITY - HEALTHY MALE**  
**Weighted by Annual Benefits in \$000s**

Age (1)	Actual Deaths (2)	Total Benefits (3)	Actual Rate (4)	Assumed Rate		Expected Benefits		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
55-59	\$ 59	\$ 12,902	0.0046	0.0049	0.0041	\$ 63	\$ 53	94%	110%
60-64	353	43,506	0.0081	0.0068	0.0074	294	320	120%	110%
65-69	700	76,015	0.0092	0.0104	0.0100	790	759	89%	92%
70-74	1,157	65,735	0.0176	0.0161	0.0167	1,058	1,099	109%	105%
75-79	1,119	39,887	0.0281	0.0260	0.0273	1,039	1,088	108%	103%
80-84	1,173	23,898	0.0491	0.0455	0.0488	1,089	1,165	108%	101%
85-89	1,014	11,994	0.0846	0.0842	0.0879	1,010	1,054	100%	96%
90-94	557	3,811	0.1461	0.1565	0.1549	596	590	93%	94%
95-99	163	672	0.2427	0.2600	0.2549	175	171	93%	95%
Totals	\$ 6,295	\$ 278,420	0.0226	0.0220	0.0226	\$ 6,114	\$ 6,301	103%	100%



**GENERAL EMPLOYEES**  
**POST-RETIREMENT MORTALITY - HEALTHY FEMALE**  
**Weighted by Annual Benefits in \$000s**

Age (1)	Actual Benefits (2)	Total Benefits (3)	Actual Rate (4)	Assumed Rate		Expected Benefits		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
55-59	\$ 68	\$ 11,123	0.0061	0.0032	0.0023	\$ 36	\$ 29	189%	236%
60-64	191	50,106	0.0038	0.0033	0.0040	165	207	116%	93%
65-69	560	89,033	0.0063	0.0043	0.0057	403	518	139%	108%
70-74	738	69,054	0.0107	0.0097	0.0090	659	616	112%	120%
75-79	598	38,866	0.0154	0.0170	0.0150	649	579	92%	103%
80-84	633	22,156	0.0286	0.0286	0.0296	630	648	100%	98%
85-89	645	12,752	0.0506	0.0533	0.0576	669	720	97%	90%
90-94	507	4,933	0.1027	0.1064	0.1165	498	542	102%	93%
95-99	160	887	0.1803	0.2098	0.1948	169	163	94%	98%
Totals	\$ 4,100	\$ 298,911	0.0137	0.0130	0.0135	\$ 3,878	\$ 4,023	106%	102%



**TEACHERS**  
**POST-RETIREMENT MORTALITY - HEALTHY MALE**  
**Weighted by Annual Benefits in \$000s**

Age (1)	Actual Deaths (2)	Total Benefits (3)	Actual Rate (4)	Assumed Rate		Expected Benefits		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
55-59	\$ 2	\$ 2,171	0.0010	0.0044	0.0036	\$ 10	\$ 8	22%	27%
60-64	54	9,799	0.0055	0.0061	0.0064	60	63	89%	85%
65-69	250	25,373	0.0099	0.0095	0.0088	240	223	104%	112%
70-74	343	30,089	0.0114	0.0147	0.0144	441	432	78%	79%
75-79	426	21,103	0.0202	0.0237	0.0233	500	492	85%	86%
80-84	591	13,970	0.0423	0.0414	0.0411	579	574	102%	103%
85-89	568	6,792	0.0837	0.0766	0.0741	521	503	109%	113%
90-94	273	1,733	0.1576	0.1424	0.1314	247	228	111%	120%
95-99	49	191	0.2585	0.2366	0.2217	45	42	109%	117%
<b>Totals</b>	<b>\$ 2,557</b>	<b>\$ 111,221</b>	<b>0.0230</b>	<b>0.0238</b>	<b>0.0231</b>	<b>\$ 2,643</b>	<b>\$ 2,565</b>	<b>97%</b>	<b>100%</b>



**TEACHERS**  
**POST-RETIREMENT MORTALITY - HEALTHY FEMALE**  
**Weighted by Annual Benefits in \$000s**

Age (1)	Actual Benefits (2)	Total Benefits (3)	Actual Rate (4)	Assumed Rate		Expected Benefits		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
55-59	\$ -	\$ 4,602	0.0000	0.0027	0.0019	\$ 12	\$ 10	0%	0%
60-64	100	27,019	0.0037	0.0027	0.0035	74	99	136%	102%
65-69	315	75,574	0.0042	0.0036	0.0050	293	388	108%	81%
70-74	536	81,175	0.0066	0.0081	0.0078	651	631	82%	85%
75-79	579	48,883	0.0118	0.0141	0.0121	680	590	85%	98%
80-84	613	25,072	0.0244	0.0238	0.0233	589	571	104%	107%
85-89	561	10,780	0.0520	0.0444	0.0449	462	467	121%	120%
90-94	295	2,905	0.1014	0.0887	0.0891	240	241	123%	122%
95-99	116	581	0.1997	0.1748	0.1748	93	93	125%	125%
<b>Totals</b>	<b>\$ 3,114</b>	<b>\$ 276,590</b>	<b>0.0113</b>	<b>0.0112</b>	<b>0.0112</b>	<b>\$ 3,094</b>	<b>\$ 3,089</b>	<b>101%</b>	<b>101%</b>



**POLICE & FIRE EMPLOYEES**  
**POST-RETIREMENT MORTALITY - HEALTHY MALE**  
**Weighted by Annual Benefits in \$000s**

Age (1)	Actual Benefits (2)	Total Benefits (3)	Actual Rate (4)	Assumed Rate		Expected Benefits		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
55-59	\$ 162	\$ 40,659	0.0040	0.0057	0.0049	\$ 231	\$ 198	70%	82%
60-64	330	48,903	0.0067	0.0079	0.0075	386	369	85%	89%
65-69	479	44,577	0.0107	0.0122	0.0111	542	497	88%	96%
70-74	558	29,754	0.0188	0.0188	0.0184	561	549	100%	102%
75-79	463	14,063	0.0329	0.0305	0.0313	429	439	108%	105%
80-84	283	4,976	0.0569	0.0533	0.0566	265	282	107%	101%
85-89	148	1,298	0.1143	0.0985	0.1015	128	132	116%	113%
90-94	62	332	0.1876	0.1831	0.1760	61	58	102%	107%
95-99	11	31	0.3545	0.3042	0.2722	9	8	117%	130%
Totals	\$ 2,497	\$ 184,593	0.0135	0.0141	0.0137	\$ 2,612	\$ 2,532	96%	99%



**POLICE & FIRE EMPLOYEES**  
**POST-RETIREMENT MORTALITY - HEALTHY FEMALE**  
**Weighted by Annual Benefits in \$000s**

Age (1)	Actual Benefits (2)	Total Benefits (3)	Actual Rate (4)	Assumed Rate		Expected Benefits		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
55-59	\$ -	\$ 3,116	0.0000	0.0032	0.0020	\$ 10	\$ 7	0%	0%
60-64	9	2,345	0.0037	0.0033	0.0038	8	9	112%	101%
65-69	10	1,160	0.0084	0.0043	0.0053	5	6	197%	159%
70-74	2	478	0.0050	0.0097	0.0085	4	4	53%	61%
75-79	2	99	0.0162	0.0170	0.0134	2	1	98%	123%
80-84	5	64	0.0742	0.0286	0.0264	2	2	261%	284%
85-89	0	32	0.0000	0.0533	0.0512	2	2	0%	0%
90-94	0	6	0.0000	0.1064	0.1021	1	1	0%	0%
95-99	0	0	N\A	0.2098	0.1880	0	0	0%	0%
<b>Totals</b>	<b>\$ 27</b>	<b>\$ 7,300</b>	<b>0.0037</b>	<b>0.0045</b>	<b>0.0042</b>	<b>\$ 33</b>	<b>\$ 31</b>	<b>83%</b>	<b>89%</b>



**ALL EMPLOYEES**  
**POST-RETIREMENT MORTALITY - HEALTHY MALE**  
**Weighted by Annual Benefits in \$000s**

Age (1)	Actual Benefits (2)	Total Benefits (3)	Actual Rate (4)	Assumed Rate		Expected Benefits		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
55-59	\$ 223	\$ 55,731	0.0040	0.0049	0.0041	\$ 270	\$ 226	82%	99%
60-64	737	102,208	0.0072	0.0068	0.0072	690	737	107%	100%
65-69	1,429	145,965	0.0098	0.0104	0.0098	1,517	1,429	94%	100%
70-74	2,059	125,579	0.0164	0.0161	0.0164	2,022	2,059	102%	100%
75-79	2,008	75,052	0.0268	0.0260	0.0268	1,955	2,008	103%	100%
80-84	2,048	42,844	0.0478	0.0455	0.0478	1,951	2,048	105%	100%
85-89	1,731	20,084	0.0862	0.0842	0.0862	1,691	1,731	102%	100%
90-94	892	5,876	0.1518	0.1565	0.1518	920	892	97%	100%
95-99	224	894	0.2499	0.2600	0.2499	233	224	96%	100%
Totals	\$ 11,349	\$ 574,234	0.0198	0.0196	0.0198	\$ 11,250	\$ 11,352	101%	100%



**ALL EMPLOYEES**  
**POST-RETIREMENT MORTALITY - HEALTHY FEMALE**  
**Weighted by Annual Benefits in \$000s**

Age (1)	Actual Benefits (2)	Total Benefits (3)	Actual Rate (4)	Assumed Rate		Expected Benefits		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
55-59	\$ 68	\$ 18,842	0.0036	0.0030	0.0020	\$ 56	\$ 43	121%	157%
60-64	301	79,471	0.0038	0.0030	0.0038	242	311	124%	97%
65-69	885	165,767	0.0053	0.0040	0.0053	703	908	126%	97%
70-74	1,277	150,707	0.0085	0.0090	0.0085	1,338	1,262	95%	101%
75-79	1,181	87,850	0.0134	0.0157	0.0134	1,358	1,178	87%	100%
80-84	1,250	47,292	0.0264	0.0265	0.0264	1,240	1,228	101%	102%
85-89	1,206	23,564	0.0512	0.0494	0.0512	1,135	1,172	106%	103%
90-94	801	7,844	0.1021	0.0986	0.1021	728	756	110%	106%
95-99	276	1,468	0.1880	0.1942	0.1880	260	255	106%	108%
Totals	\$ 7,245	\$ 582,805	0.0124	0.0121	0.0122	\$ 7,059	\$ 7,112	103%	102%



**ALL EMPLOYEES**  
**POST-RETIREMENT MORTALITY - DISABLED MALE**  
**Weighted by Annual Benefits in \$000s**

Age (1)	Actual Benefits (2)	Total Benefits (3)	Actual Rate (4)	Assumed Rate		Expected Benefits		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
45-49	\$ 8	\$ 362	0.0209	0.0350	0.0350	\$ 13	\$ 13	60%	60%
50-54	21	905	0.0236	0.0350	0.0350	32	32	67%	67%
55-59	55	2,325	0.0236	0.0350	0.0350	81	81	68%	68%
60-64	130	3,361	0.0385	0.0350	0.0350	118	118	110%	110%
65-69	122	2,974	0.0412	0.0350	0.0350	104	104	118%	118%
70-74	79	1,731	0.0455	0.0350	0.0350	61	61	130%	130%
75-79	51	745	0.0679	0.0455	0.0378	34	28	149%	180%
80-84	21	242	0.0866	0.0845	0.0687	20	17	102%	126%
85-89	9	104	0.0882	0.1589	0.1226	17	13	56%	72%
90-94	10	49	0.2043	0.2640	0.2099	13	10	77%	97%
95-99	2	9	0.1710	0.3642	0.3141	3	3	47%	54%
Totals	\$ 507	\$ 12,807	0.0396	0.0387	0.0374	\$ 495	\$ 479	102%	106%



**ALL EMPLOYEES**  
**POST-RETIREMENT MORTALITY - DISABLED FEMALE**  
**Weighted by Annual Benefits in \$000s**

Age (1)	Actual Benefits (2)	Total Benefits (3)	Actual Rate (4)	Assumed Rate		Expected Benefits		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
45-49	\$ 6	\$ 191	0.0288	0.0250	0.0250	\$ 5	\$ 5	115%	115%
50-54	25	590	0.0419	0.0250	0.0250	15	15	168%	168%
55-59	24	1,140	0.0212	0.0250	0.0250	29	29	85%	85%
60-64	74	2,274	0.0324	0.0250	0.0250	57	57	130%	130%
65-69	84	2,435	0.0346	0.0250	0.0250	61	61	138%	138%
70-74	50	1,375	0.0365	0.0250	0.0250	34	34	146%	146%
75-79	23	592	0.0391	0.0265	0.0250	16	15	145%	155%
80-84	9	197	0.0476	0.0494	0.0393	10	8	98%	122%
85-89	9	147	0.0605	0.0995	0.0775	15	11	61%	78%
90-94	5	68	0.0770	0.1972	0.1570	12	10	42%	53%
95-99	1	6	0.2635	0.3258	0.2135	2	1	84%	126%
Totals	\$ 311	\$ 9,015	0.0345	0.0282	0.0272	\$ 254	\$ 245	122%	127%



**GENERAL EMPLOYEES**  
**SERVICE BASED WITHDRAWAL EXPERIENCE - SALARY WEIGHTED in \$000s**

Service (1)	Actual (2)	Total (3)	Actual Rate (4)	Assumed Rate		Expected		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5) (7)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
1	191,653	1,054,753	0.1817	0.1859	0.1772	196,079	186,865	98%	103%
2	178,293	1,234,766	0.1444	0.1525	0.1422	188,302	175,614	95%	102%
3	127,829	1,112,754	0.1149	0.1246	0.1142	138,649	127,027	92%	101%
4	99,169	1,055,311	0.0940	0.1016	0.0920	107,220	97,058	92%	102%
5	74,132	980,454	0.0756	0.0829	0.0748	81,280	73,292	91%	101%
6	63,340	936,919	0.0676	0.0679	0.0617	63,617	57,764	100%	110%
7	46,620	891,971	0.0523	0.0561	0.0519	50,040	46,280	93%	101%
8	39,126	844,700	0.0463	0.0470	0.0447	39,701	37,789	99%	104%
9	29,839	822,670	0.0363	0.0401	0.0396	32,989	32,541	90%	92%
10	26,357	794,888	0.0332	0.0351	0.0358	27,901	28,427	94%	93%
11	31,120	798,638	0.0390	0.0315	0.0328	25,157	26,229	124%	119%
12	24,923	788,777	0.0316	0.0291	0.0303	22,953	23,937	109%	104%
13	20,396	752,906	0.0271	0.0276	0.0279	20,780	21,006	98%	97%
14	15,847	702,748	0.0226	0.0266	0.0226	18,693	15,871	85%	100%
15	13,298	656,407	0.0203	0.0259	0.0198	17,001	13,028	78%	102%
16	11,743	604,918	0.0194	0.0255	0.0177	15,425	10,721	76%	110%
17	10,267	573,056	0.0179	0.0251	0.0161	14,384	9,210	71%	111%
18	6,495	554,210	0.0117	0.0245	0.0148	13,578	8,184	48%	79%
19	7,572	546,682	0.0139	0.0239	0.0137	13,066	7,492	58%	101%
20	6,080	462,330	0.0132	0.0230	0.0128	10,634	5,913	57%	103%
21	6,283	444,198	0.0141	0.0220	0.0119	9,772	5,306	64%	118%
22	4,226	439,972	0.0096	0.0208	0.0111	9,151	4,888	46%	86%
23	4,890	437,193	0.0112	0.0195	0.0102	8,525	4,474	57%	109%
24	4,492	437,883	0.0103	0.0183	0.0093	8,013	4,068	56%	110%
25	3,598	429,221	0.0084	0.0174	0.0083	7,468	3,546	48%	101%
26	2,757	436,233	0.0063	0.0168	0.0071	7,329	3,118	38%	88%
27	2,786	425,994	0.0065	0.0168	0.0060	7,157	2,540	39%	110%
28	1,724	394,563	0.0044	0.0168	0.0047	6,629	1,869	26%	92%
29	1,418	362,106	0.0039	0.0168	0.0035	6,083	1,274	23%	111%
30	771	318,776	0.0024	0.0168	0.0024	5,355	754	14%	102%
Totals	1,057,041	20,295,997				1,172,931	1,036,084	90%	102%



**TEACHERS**  
**SERVICE BASED WITHDRAWAL EXPERIENCE - SALARY WEIGHTED in \$000s**

Service (1)	Actual (2)	Total (3)	Actual Rate (4)	Assumed Rate		Expected		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
1	133,656	672,150	0.1988	0.2008	0.1979	134,968	133,008	99%	100%
2	90,384	508,930	0.1776	0.1647	0.1652	83,821	84,057	108%	108%
3	61,861	465,156	0.1330	0.1344	0.1348	62,517	62,714	99%	99%
4	44,632	434,273	0.1028	0.1094	0.1082	47,510	47,009	94%	95%
5	38,256	411,324	0.0930	0.0890	0.0863	36,608	35,502	105%	108%
6	29,928	399,249	0.0750	0.0725	0.0694	28,946	27,698	103%	108%
7	22,678	394,978	0.0574	0.0595	0.0573	23,501	22,628	96%	100%
8	18,598	390,123	0.0477	0.0494	0.0494	19,272	19,272	97%	97%
9	17,921	389,174	0.0460	0.0417	0.0445	16,229	17,330	110%	103%
10	16,073	381,160	0.0422	0.0360	0.0410	13,722	15,628	117%	103%
11	14,988	379,453	0.0395	0.0319	0.0358	12,105	13,570	124%	110%
12	11,208	377,043	0.0297	0.0290	0.0324	10,934	12,198	103%	92%
13	11,704	366,452	0.0319	0.0270	0.0291	9,894	10,674	118%	110%
14	8,280	348,526	0.0238	0.0257	0.0261	8,957	9,093	92%	91%
15	8,649	337,559	0.0256	0.0248	0.0232	8,371	7,842	103%	110%
16	6,573	325,058	0.0202	0.0240	0.0206	7,801	6,683	84%	98%
17	4,726	310,371	0.0152	0.0232	0.0181	7,201	5,609	66%	84%
18	5,190	305,103	0.0170	0.0224	0.0158	6,834	4,811	76%	108%
19	4,120	297,708	0.0138	0.0214	0.0136	6,371	4,063	65%	101%
20	3,491	263,884	0.0132	0.0202	0.0117	5,330	3,091	65%	113%
21	3,055	254,984	0.0120	0.0187	0.0100	4,768	2,540	64%	120%
22	1,957	247,944	0.0079	0.0171	0.0084	4,240	2,081	46%	94%
23	1,446	246,256	0.0059	0.0154	0.0070	3,792	1,726	38%	84%
24	1,302	243,140	0.0054	0.0136	0.0058	3,307	1,412	39%	92%
25	1,711	233,103	0.0073	0.0121	0.0048	2,821	1,117	61%	153%
26	920	216,885	0.0042	0.0109	0.0040	2,364	859	39%	107%
27	532	200,748	0.0026	0.0104	0.0033	2,088	665	25%	80%
28	661	178,291	0.0037	0.0107	0.0028	1,908	508	35%	130%
29	402	161,504	0.0025	0.0100	0.0026	1,615	415	25%	97%
30	219	144,327	0.0015	0.0100	0.0025	1,443	357	15%	61%
Totals	565,122	9,884,857				579,237	554,161	98%	102%



**POLICE & FIRE EMPLOYEES**  
**SERVICE BASED WITHDRAWAL EXPERIENCE - SALARY WEIGHTED in \$000s**

Service (1)	Actual (2)	Total (3)	Actual Rate (4)	Assumed Rate		Expected		Actual/Expected	
				Current (5)	Proposed (6)	Current (3) * (5)	Proposed (3) * (6) (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
1	11,390	78,330	0.1454	0.1100	0.1400	8,616	10,966	132%	104%
2	5,679	110,525	0.0514	0.0950	0.0524	10,500	5,792	54%	98%
3	4,729	113,967	0.0415	0.0370	0.0413	4,217	4,708	112%	100%
4	4,043	119,988	0.0337	0.0301	0.0348	3,612	4,178	112%	97%
5	4,644	127,494	0.0364	0.0261	0.0302	3,328	3,853	140%	121%
6	3,908	136,991	0.0285	0.0233	0.0266	3,192	3,651	122%	107%
7	2,992	138,260	0.0216	0.0210	0.0237	2,903	3,281	103%	91%
8	2,969	142,604	0.0208	0.0192	0.0213	2,738	3,033	108%	98%
9	2,656	144,918	0.0183	0.0177	0.0191	2,565	2,772	104%	96%
10	2,275	148,727	0.0153	0.0164	0.0172	2,439	2,565	93%	89%
11	2,777	147,625	0.0188	0.0152	0.0156	2,244	2,297	124%	121%
12	1,674	157,992	0.0106	0.0141	0.0106	2,228	1,675	75%	100%
13	1,323	161,146	0.0082	0.0132	0.0100	2,127	1,611	62%	82%
14	1,520	165,729	0.0092	0.0123	0.0094	2,038	1,558	75%	98%
15	1,973	162,545	0.0121	0.0115	0.0088	1,869	1,430	106%	138%
16	1,535	164,309	0.0093	0.0108	0.0082	1,775	1,347	87%	114%
17	1,033	160,425	0.0064	0.0101	0.0076	1,620	1,219	64%	85%
18	592	163,427	0.0036	0.0095	0.0070	1,553	1,144	38%	52%
19	1,321	168,461	0.0078	0.0089	0.0064	1,499	1,078	88%	122%
20	782	171,531	0.0046	0.0083	0.0058	1,424	995	55%	79%
21	1,137	172,079	0.0066	0.0077	0.0052	1,325	895	86%	127%
22	814	158,698	0.0051	0.0072	0.0046	1,143	730	71%	112%
23	365	156,120	0.0023	0.0068	0.0040	1,062	624	34%	58%
24	524	151,794	0.0035	0.0063	0.0034	956	516	55%	102%
Totals	62,656	3,523,685				66,972	61,918	94%	101%

