Employees' Retirement System of the State of Hawaii

Actuarial Experience Study
for the period ending June 30, 2018

July 30, 2019

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 2019 Experience Study

We are pleased to present our report on the results of the 2019 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, 2019 actuarial valuation, and it describes the actuarial impact produced by these recommendations as though they had been effective for the June 30, 2018 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

Joseph P. Newton, FSA
Pension Market Leader

Lewis Ward
Consultant

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SECTION I

EXECUTIVE SUMMARY

Executive Summary

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 fourteen shorter term and six longer term independent sources.

- We recommend no change to the assumption that administrative expenses will be 0.35% of covered payroll.

- We recommend no change to the inflation assumption of 2.50%.

- We recommend no change to the 1.00% general productivity component of the general wage inflation assumption. This yields a nominal assumption of 3.50%. 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.

- 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.

  o For General Employees, we recommend no change to either the current 1.00% above inflation assumption for the ultimate component or the step-rate component. The current assumption approximates the average annual salary increase received by the member over their career to be 4.43%.

  o For Teachers, we recommend no change to either the current 1.25% above inflation assumption for the ultimate component or the step-rate component. The current assumption approximates the average annual salary increase received by the member over their career to be 4.38%.

  o For Police and Fire Employees, we recommend no change to the 5.00% ultimate component. However, we recommend extending the current 2 year step schedule to 25 years based on the experience. The net change is an approximate 0.41% increase in the average annual salary increase received by the member over their career (5.16% to 5.57%).

Mortality Assumptions

- We recommend updating the base mortality tables with data through June 30, 2018. 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 and Scale BB. We will apply further adjustments to this set of base tables based on occupation (General Employees, Teachers, and Public Safety).

- We recommend no change to the procedure for current post-retirement mortality rates which is disabled retirees mortality rates will be the rates used for the healthy retirees, adjusted with a 5-year set-forward to reflect impaired morality (the mortality rates will change in conjunction with the change in healthy retiree mortality rates). We also apply a minimum morality 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 and Scale BB.

- We recommend updating 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 and Scale BB.

Other Demographic Assumptions

- We recommend no change to the termination patterns.

- We recommend minor adjustments to the retirement patterns for members consistent with experience and future expectations.

- We recommend minor increases 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 no change to the current assumption for the amount of sick leave converted to service at retirement.

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 based on the valuation as of June 30, 2018.

Item	Current Assumptions	Proposed Assumptions
(1)	(2)	(3)
Total System		
Unfunded Actuarial Accrued Liability ($ in Millions)	$13,405	$13,465
Funded Ratio	55.2%	55.1%
Police and Fire Only		
Unfunded Actuarial Accrued Liability ($ in Millions)	$2,313	$2,308
Total Normal Cost %	25.46%	26.34%
Funding Period based on current 41% employer contribution rate (years)	26	26
All Other Employees		
Unfunded Actuarial Accrued Liability ($ in Millions)	$11,092	$11,157
Total Normal Cost %	12.38%	12.45%
Funding Period based on current 24% employer contribution rate (years)	25	25

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 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, 2018. We used multiple lengths of time for various assumptions. Sometimes using a 3-5 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 <u>actual</u> number (of retirements, for example) and "E" is the <u>expected</u> 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 4.07%, and the average all-US inflation has been 4.03%. We believe the two inflation measurements will track closely over time and we have developed and recommend one inflation assumption.

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, 2018:

Periods Ending June 30, 2015	Average Annual Increase in CPI-U
Last five (5) years	1.54%
Last ten (10) years	1.42%
Last fifteen (15) years	2.13%
Last twenty (20) years	2.20%
Last twenty-five (25) years	2.25%
Last thirty (30) years	2.56%
Since 1913 (first available year)	3.14%

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

As you can see, inflation 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. For example, the June 30, 2018 yield for 20-year inflation indexed Treasury bonds was 0.84% plus actual inflation. The yield for 20-year non-indexed US Treasury bonds was 2.61%. Simplistically, this means that on that day the bond market was predicting that inflation over the next twenty years would average 1.76% [(1 + 2.61%) / (1 + 0.84%) - 1] per year. The difference in yield for 30-year bonds implies 1.83% inflation over the next 30 years.   This is consistent with most forecasts of inflation and overall economic growth being lower over the next decade. However, this analysis is known to be imperfect as it ignores the inflation risk premium that buyers of US Treasury bonds often demand as well as possible differences in liquidity between US Treasury bonds and TIPS.

Forecasts from Social Security Administration

In the Social Security Administration's 2018 Trustees Report, the Office of the Chief Actuary is projecting a long-term average annual inflation rate of 2.6% under the intermediate cost assumption. The Chief Actuary for the Social Security Administration kept this assumption unchanged from the prior year and the low cost and high cost scenarios are 2.0% and 3.2%, respectively.

<u>Survey of Professional Forecasters and Fed Policy</u>

The Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. Their forecast for the fourth quarter of 2018 was for inflation over the next ten years (2019 to 2028) to average 2.21%. Additionally, the Fed has openly stated that they have a target 2.00% inflation rate.

<u>Comparison of Inflation Expectations from 2015 to 2018</u>

Finally, the table below provides a comparison of the inflation expectations documented in the 2015 experience study report and the current inflation expectations.

	Inflation Expectations		
Source	**2015**	**2018**	**Change**
(1)	(2)	(3)	(4)
ERS' Investment Consultant	2.25%	2.25%	0.00%
Implied Inflation 20-Year Treasuries	1.96%	1.78%	-0.18%
SSA Trustees Report	2.70%	2.60%	-0.10%
Survey of Professional Forecasters	2.15%	2.21%	+0.06%

<u>Recommendation</u>

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% is slightly higher than a majority of the reported sources. However, we are not recommending a change at this time as 2.50% is still in the reasonable range. We will be monitoring this assumption and it is a potential area for change in the 2022 experience study if data points remain lower than the 2.50% assumption.

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. Based on plan administrative expenses reported in the 2018 CAFR bring equal to the 0.35%, we are recommend no change to this assumption.

Investment Return

ERS assumes an investment return rate of 7.00%, net of investment and administrative expenses. This was reduced from 7.50% in the last 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 2018.

7.00%

The returns in the chart above are market returns as reporting in the performance report as of June 30, 2018. While ERS did not exceed the currently expected 7.00% return assumption over a 10 year time horizon, they have if measured on a one, 5 year, or since 1990 basis.

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 2019.

Figure 4: Change in Distribution of Public Pension Investment Return Assumptions. FY 01 to FY 19

Source: Public Plans Database. Median investment return assumption: 7.25% nominal return.

As shown, there has been a strong trend in lowering this assumption and the median assumption is now 7.25%.

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 Total Return	Expected Portfolio Return
(1)	(2)	(3)	(4)
Traditional Growth	22.37%	8.95%	
Options Overlay + Min Vol	15.21%	7.35%	
Credit	1.90%	4.85%	
High Yield	1.27%	6.40%	
Loans	0.63%	6.55%	
Levered Core Real Estate	3.35%	6.40%	
Private Growth	18.27%	11.45%	
Syst. Trend Following	7.00%	6.70%	
ARP	8.00%	5.35%	
Long Duration	5.00%	4.35%	
TIPS	5.00%	3.60%	
Other RR Assets	5.00%	5.85%	
Principal Protection	7.00%	3.10%	
Gross Arithmetic Return			7.44%
Adjustment for Compounding			(0.49%)
Net Compound Return			6.95%

As you can see, the 2018 capital market assumptions developed by Meketa would result in a ten-year expected compound return of 6.95%, which is approximately equal to the current 7.00% return assumption. (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 profession 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 2019 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 14 investment consultants and each provided forward-looking return expectations for next 7 to 10 years. Additionally, six 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 5.35% to 7.84%, with an average of 6.67%. This compares to Maketa's 6.95%. 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 6.97% to 7.80%, with an average of 7.45% and a 56% 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 0.59%, and for the last 20 years, wage inflation has exceeded price inflation by about 0.94%. Since 1951, wage inflation has been about 1.01% larger than price inflation each year.

The current assumption is consistent with national long term trends and we recommend no change to the spread above inflation.

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 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, 2008 and ending June 30, 2018.

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

Average Salary Increase			
Year Ending June 30,	General Employees	Teachers	Public Safety
2009	8.04%	7.30%	7.66%
2010	-0.87%	-0.75%	5.59%
2011	0.94%	0.96%	7.90%
2012	0.36%	-1.73%	1.57%
2013	3.05%	4.59%	0.52%
2014	5.51%	4.77%	4.66%
2015	7.00%	4.64%	15.14%
2016	6.29%	5.33%	8.58%
2017	5.62%	4.60%	7.83%
2018	4.18%	5.41%	5.45%
Average	**3.97%**	**3.47%**	**6.42%**

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.

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.

The current salary increase assumption varies based on years of service, with an ultimate salary increase assumption used for all employees who have attained a specified amount of service (3.50% for General Employees with 25 or more years of service, 3.75% for Teachers with 25 or more years of service, and 5.00% for Police and Fire employees with 3 or more years of service). The table below shows the actual average long-service increases for each year of the study. Note that these actual average rates of increase include average actual inflation, not our inflation assumption.

Average "Long-Service" Increase				
Actual Experience				
Year Ending	Inflation	Police & Fire	Teachers	General Employees
2009	-1.43%	7.65%	6.28%	6.14%
2010	1.05%	5.52%	-1.32%	-1.26%
2011	3.56%	7.90%	0.63%	0.49%
2012	1.66%	1.50%	-3.26%	-1.23%
2013	1.75%	0.43%	4.82%	3.24%
2014	2.07%	4.61%	4.25%	5.15%
2015	0.12%	15.07%	4.00%	5.98%
2016	1.00%	8.47%	5.04%	5.35%
2017	1.63%	7.79%	3.86%	4.79%
2018	2.87%	5.41%	4.82%	3.67%
Average	1.42%	6.36%	2.87%	3.20%
Current Assumption	2.50%	5.00%	3.75%	3.50%

As shown, the experience for Teachers and General Employees has been slightly less than the current assumption, but this has been during a time that actual inflation was lower than assumed, and includes the post-financial crisis years during which there where pay reductions and furloughs. The years from

2013 onward have outpaced the current assumption. For Police and Fire Employees the salary increases have been much more than assumed, but much of that appears to be step related and thus we are recommending extending the current 2 year step period to 25 years, consistent with the trend in the data. The following describes the building block methodology used to construct the proposed salary assumptions for Police and Fire Employees.

The following table shows the average increase over the ten-year period parsed out in five-year service groups for Police and Fire Employees:

Police and Fire Experience	
Service	Average Pay Increase
1 to 5 Years	6.75%
6 to 10 Years	6.33%
11 to 15 Years	7.07%
16 to 20 Years	6.81%
21 to 24 Years	6.09%
25 Years or More	5.71%

The table shows that members with less than 6 years of service had an average increase of 6.75%, which is 0.66% higher than that of members with 21 to 24 years of service and 1.04% higher than that of members with more than 25 years of service.

The salary scale is composed of three pieces: general price inflation, a component for general productivity, individual merit and promotion, and a service based step-rate piece. The individual merit/promotional component would include the general productivity included in the GWI and any additional salary increase of the longer-service employees that is above the GWI. The service-based or step-rate component is the expected salary increase of the shorter-service members that is above this level. All three pieces are determined independently and then added together to develop the ultimate salary schedule.

To determine the new salary scale, we first calculated the average increase over the 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 individual productivity component. They were grouped together because their salary increase after this point did not vary significantly with additional service.

Using this group, we backed out actual inflation during the study period (1.42%) to get the real rates of increase. The average increase for the longer-service employees over the ten-year period was 5.71%; therefore, the actual individual productivity component for the period was 4.29% (5.71% less the actual inflation rate of 1.48%). This compares to the current assumption of 2.50%.

However, we are not recommending a change to this ultimate assumption at this time. We feel the recent experience is unsustainable long term and maybe inflated due to the very large increases granted coming out of the financial crisis.   We also think the spread is overstated as pay increases are typically negotiated based on future expectations of inflation, or perhaps even perceived inflation, and

not actual recent experience. Instead, we are recommending keeping the long term assumption at 5.00% and extending the step rate portion from 2 years to 25 years.

The following table shows the actual increases for members with less than 25 years of service and how we calculated the actual step-rates from the experience. Notice how the step rates decrease as the service increases.

Teachers Step-rate/Promotional Experience			
Years of Service	Average Pay Increase	Less Actual Inflation and Productivity Components	Actual Step-Rate Component
1-5	6.75%	- 5.71%	1.04%
6 -10	6.33%	- 5.71%	0.62%
11-15	7.07%	- 5.71%	1.36%
16-20	6.81%	- 5.71%	1.10%
21-24	6.09%	- 5.71%	0.38%
25+	5.71%	- 5.71%	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.

To obtain the recommended rates, we add the smoothed step-rate component, the 2.50% inflation component, and the 2.50% productivity and merit component. These rates include an increase of 7.00% for new members after their first year of service and grade down to an annual 5.00% increase for members with 25 or more years of service. The average salary increase under the schedule is 5.57%, an increase of 0.41% per year over the course of a member's career when compared to the current assumption. While this is a material increase, the data clearly shows the increase could have been significantly larger. We will be monitoring this assumption closely for possible additional changes in a future experience study.   The full schedule is shown in Section VI of this report.

For General Employees and Teachers, we are recommending no change to the current salary scale assumptions.

DEMOGRAPHIC ASSUMPTIONS

Analysis of Post-Retirement Mortality

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

The issue of future mortality improvement is one that the governing bodies of our profession have increasingly become more focused on studying and ensuring that the actuarial profession remains on the forefront of this issue. This has resulted in recent changes to the relevant Actuarial Standard of Practice, ASOP 35, Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations, and published practice notes. This ASOP now requires pension actuaries to make and disclose an assumption as to the expected mortality improvement after the valuation date.

The expectation of continued increases in longevity is supported by national trends. The following graph provides the expected remaining lifetime in years for a 65-year old retiree measured beginning in 1960. Notice the recent uptrend in female longevity after almost two decades of relatively minimal improvement. This significant change in pattern has led most of the actuarial profession to agree that future improvements will likely continue.

Life Expectancy in Years, Current Age 65

National Vital Statistics Reports, Vol 58, No 21, June 2010

National Vital Statistics Reports, Vol 60, No 4, January 2011

Based on this, ERS currently uses a fully generational approach for mortality assumptions. By doing this, future mortality rates will be projected to continually decrease each year. 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 2020, and their life expectancy will not be as long as someone reaching 60 in 2040, etc. For illustrative purposes, the following table provides the life expectancy for individuals retiring in future years, based on the updated Hawaiian Retired Public Employees mortality table as of 2019.

Proposed Life Expectancy for an Age 65 Retiree (in Years)					
Gender	Year of Retirement				
	2020	2025	2030	2035	2040
Male	23.2	23.7	24.2	24.7	25.1
Female	26.9	27.3	27.6	28.0	28.3

Because of this assumption of continuous improvement, life expectancies for today's younger active members are expected to be materially longer than those of today's retirees. The improvement over time is built into the projections for individual members.

ERS Specific Analysis

Based on experience observed in prior experience studies, we currently have separate mortality tables 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.

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.   Based on a practice note issued by the American Academy of Actuaries in the Fall of 2011, a dataset needs 96 expected deaths for each gender to be within +/- 20% of the actual pattern with 95% confidence. We believe +/- 20% is a rather large range to be considered fully credible. Other sources state higher requirements, such as 1,000 deaths per gender. 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

Using this information, 1,082 deaths are needed by gender to have 90% confidence that the data is within +/- 5% of the actual pattern. ERS had 2,900 male deaths during the 5-year period and 2,565 female deaths, clearly indicating they are a highly credible group.

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

Our current strategy is to update the base tables with each experience study to keep the data as recent as possible, and to allow for small, more frequent adjustments in comparison to a long period of no adjustments followed by a large one-time adjustment.

The updated base mortality assumptions are based on ERS's experience for the five-year period ending June 30, 2018. We intentionally used a five-year period for developing a morality assumption because this is the most recent experience and reflects the most recent improvements in longevity. Using a larger experience period would temper real changes that have occurred in the mortality assumption due to real changes, or improvements, observed in this assumption.

To develop the recommended mortality assumptions, mortality rates for ages after 60 are based on the System's experience, using a polynomial model to provide a smooth fit to the experience. Mortality rates for ages under age 60 were smoothed into most recently published Pub2010 combined healthy annuitant mortality assumptions (adjusted back to the central point of the experience period). Finally, the mortality rates after age 100 were also set to the rates in the Pub2010 tables.

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., 2015) to the year 2019 using the recommended projection scale below.

There are then 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 same multiplier as the General Employee females. 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.

	General Employee	Teacher	Public Safety
Male	100%	91%	117%
Female	108%	90%	108%

Recommended Mortality Improvement Assumption

Mortality is currently projected to improve into the future using Scale BB published by the Society of Actuaries. Scale BB is a reasonable projection scale and the most conservative one currently published. We recommend no change to the projection scales used in the valuation.

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, with a 5-year set-forward, meaning a disabled member age 70 will use the same mortality rate as a healthy member age 75. For ages prior to normal retirement age, we will assume the same 5-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 updating this assumption to the new Pub2010 mortality tables for active employees, grouped by occupation, and applying a multiplier based on ERS experience, including the proportion of members with duty related or non-duty related deaths and the prevalence of beneficiaries. 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. To determine the actual experience, we counted the actual number of new disability records in the retiree data over the five year period 2013-2017. 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	161	184	184	35	71	47
Teachers	34	43	38	3	4	4
Police and Fire	4	4	4	4	6	6

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 weighted by liability instead of count 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. There were very minor changes made. Section VII has more detail on the experience.

Hybrid ($ in 000s of liability)					
		Old Assumptions		Proposed Assumptions	
Group	Actual Retirements	Expected Retirements	Actual/ Expected	Expected Retirements	Actual/ Expected
General Male	$3,474	$3,417	101.7%	$3,500	99.3%
General Female	4,269	4,506	94.7%	4,506	94.7%
Teacher Male	1,022	1,032	99.0%	1,032	99.0%
Teacher Female	2,303	2,619	87.9%	2,619	87.9%
Non-Contributory ($ in 000s of liability)					
		Old Assumptions		Proposed Assumptions	
Group	Actual Retirements	Expected Retirements	Actual/ Expected	Expected Retirements	Actual/ Expected
General Male	$1,700	$1,860	91.4%	$1,860	91.4%
General Female	1,827	1,931	94.6%	1,931	94.6%
Teacher Male	405	453	89.2%	453	89.2%
Teacher Female	952	1,019	93.4%	1,019	93.4%
Contributory ($ in 000s of liability)					
		Old Assumptions		Proposed Assumptions	
Group	Actual Retirements	Expected Retirements	Actual/ Expected	Expected Retirements	Actual/ Expected
General Male	$770	$750	102.6%	$750	102.6%
General Female	846	908	93.3%	908	93.3%
Teacher Male	203	175	115.4%	175	115.4%
Teacher Female	652	606	107.6%	606	107.6%

Police & Fire Employees:

The retirement rates were very slightly increased prior to age 55 to closer match experience, as shown below. The following table gives more detail.

		Old Assumptions		Proposed Assumptions	
Age Range	Actual Retirements	Expected Retirements	Actual/ Expected	Expected Retirements	Actual/ Expected
45-49	828	739	111.9%	799	103.6%
50-54	2,503	2,316	108.1%	2,470	101.3%
55-59	2,504	2,494	100.4%	2,494	100.4%
60-61	691	672	102.8%	672	102.8%
Sub-Total	6,525	6,221	104.9%	6,435	101.4%
62-64	386	382	100.9%	382	100.9%
Total (including ages 62-64)	6,911	6,604	104.7%	6,817	101.4%

Police & Fire Employees – Males and Females ($ in 000s of liability)

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 in general the current assumptions do a reasonable job of estimating the number of terminations. In the previous study we found very little difference in patterns between males and females and that a service only pattern was preferred to the more complicated service and age based schedule previously being used. Thus, we created unisex tables solely based on service.

The following tables show selected information. Section VII gives more detail on the data.

	Actual Terminations	Old Assumptions		Proposed Assumptions	
		Expected Terminations	A/E	Expected Terminations	A/E
Teachers	524,374	529,361	99%	529,361	99%
General Employees	995,417	889,051	112%	889,051	112%
Police & Fire	53,707	48,680	110%	48,680	110%

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 no changes to the assumptions at this time. The following is the experience from 2013-2018 based on actual retirements showing the average months of service.

	Credited Service at Retirement	Credited Sick Leave	% Increase	Current Assumption
Teachers	299.4	12.3	4.11%	4.25%
General Employees	276.8	9.5	3.43%	3.75%
Police & Fire	333.3	17.2	5.16%	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, 2018.

Item	Current Assumptions	Proposed Assumptions
(1)	(2)	(3)
Total System		
Unfunded Actuarial Accrued Liability ($ in Millions)	$13,405	$13,465
Funded Ratio	55.2%	55.1%
Police and Fire Only		
Unfunded Actuarial Accrued Liability ($ in Millions)	$2,313	$2,308
Total Normal Cost %	25.46%	26.34%
Funding Period based on current 41% employer contribution rate (years)	26	26
All Other Employees		
Unfunded Actuarial Accrued Liability ($ in Millions)	$11,092	$11,157
Total Normal Cost %	12.38%	12.45%
Funding Period based on current 24% employer contribution rate (years)	25	25

Shown above is a table that compares key statistics from the June 30, 2018 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 no change to the explicit charge for administrative expenses of 0.35% of covered payroll.

3. We recommend no change to the 1.00% general productivity component of the general wage inflation assumption.

4. For General Employees and Teachers, we are recommending no change to the current expectations for salary increases for individuals.

5. For Police and Fire Employees, we are recommending no change to the 2.50% above inflation assumption for the ultimate component of the salary scales used for individuals. However, we are recommending extending the step rate portion from only 2 years to 25 years and increasing the steps themselves.

6. We recommend updating the client-specific base mortality tables with data through 2018. We also recommend continuing to assuming mortality rates will improve in the future using a fully generational approach and Scale BB.

7. We recommend no change to the process used to determine the post-retirement mortality tables for disabled retirees.

8. We recommend updating the pre-retirement mortality tables for active employees to use multiples of the recently published Pub-2010 mortality tables for active employees.

9. We recommend minor adjustments to the retirement and disability patterns for members consistent with experience and future expectations.

10. We recommend no change to the rates of termination, the assumption that 50% members that become disabled in the future will choose a 100% joint and survivor annuity option, or the current assumption for the amount of sick leave converted to service at retirement.

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

12. 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..

13. 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 2016. 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, 2016 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.

3. Salary increase rates: As shown below

Years of Service	General Employees		Teachers	
	Service-related Component	Total Rate Including 2.50% Inflation Component and 1.00% Productivity Component	Service-related Component	Total Rate Including 2.50% Inflation Component and 1.25% Productivity Component
1	3.00%	6.50%	2.00%	5.75%
2	3.00%	6.50%	1.75%	5.50%
3	2.00%	5.50%	1.75%	5.50%
4	1.50%	5.00%	1.50%	5.25%
5	1.50%	5.00%	1.00%	4.75%
6	1.25%	4.75%	1.00%	4.75%
7	1.25%	4.75%	0.75%	4.50%
8	1.00%	4.50%	0.75%	4.50%
9	1.00%	4.50%	0.50%	4.25%
10	1.00%	4.50%	0.50%	4.25%
11	0.75%	4.25%	0.50%	4.25%
12	0.75%	4.25%	0.50%	4.25%
13	0.50%	4.00%	0.25%	4.00%
14	0.50%	4.00%	0.25%	4.00%
15	0.50%	4.00%	0.25%	4.00%
16	0.50%	4.00%	0.25%	4.00%
17	0.50%	4.00%	0.25%	4.00%
18	0.50%	4.00%	0.25%	4.00%
19	0.50%	4.00%	0.25%	4.00%
20	0.25%	3.75%	0.25%	4.00%
21	0.25%	3.75%	0.25%	4.00%
22	0.25%	3.75%	0.25%	4.00%
23	0.25%	3.75%	0.25%	4.00%
24	0.25%	3.75%	0.25%	4.00%
25 or more	0.00%	3.50%	0.00%	3.75%

3. Salary increase rates (continued):

Years of Service	Police & Firefighters	
	Service-related Component	Total Annual Rate of Increase Including 2.50% Inflation Component and 2.5% General Increase Rate
1	2.00%	7.00%
2	2.00%	7.00%
3	1.00%	6.00%
4	1.00%	6.00%
5	1.00%	6.00%
6	0.75%	5.75%
7	0.75%	5.75%
8	0.75%	5.75%
9	0.50%	5.50%
10	0.50%	5.50%
11	0.50%	5.50%
12	0.50%	5.50%
13	0.25%	5.25%
14	0.25%	5.25%
15	0.25%	5.25%
16	0.25%	5.25%
17	0.25%	5.25%
18	0.25%	5.25%
19	0.25%	5.25%
20	0.25%	5.25%
21	0.25%	5.25%
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 31st to the June 30th 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 Male & Female	Teachers Male & Female	Police and Fire Male & Female
Ordinary	94%	92%	83%
% of Ordinary Choosing Annuity	41%	52%	24%
Duty Related	6%	8%	17%

Healthy Retirees: The 2019 Public Retirees of Hawaii mortality table, generational projection using the BB projection table from the year 2019 and with multipliers based on plan and group experience. The following are sample rates of the base table as of 2019 with the corresponding multipliers:

Healthy Annuitant Mortality Rates Before Projection (Multiplier Applied)

Age	General Employees Male	General Employees Female	Teachers Male	Teachers Female	Police and Fire Male	Police and Fire Female
50	0.2901%	0.2376%	0.2640%	0.1980%	0.3394%	0.2376%
55	0.4195%	0.3042%	0.3817%	0.2535%	0.4908%	0.3042%
60	0.5773%	0.3175%	0.5253%	0.2646%	0.6754%	0.3175%
65	0.8603%	0.3175%	0.7829%	0.2646%	1.0066%	0.3175%
70	1.2866%	0.7022%	1.1708%	0.5852%	1.5053%	0.7022%
75	2.0370%	1.3340%	1.8537%	1.1117%	2.3833%	1.3340%
80	3.4486%	2.2177%	3.1382%	1.8481%	4.0349%	2.2177%
85	6.2716%	3.9579%	5.7072%	3.2982%	7.3378%	3.9579%
90	11.8489%	7.7873%	10.7825%	6.4895%	13.8632%	7.7873%
Multiplier	100%	108%	91%	90%	117%	108%
Setback	0	0	0	0	0	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	2025	2030	2035	2040	2045
		Year of Retirement			
		General Retirees			
Male	23.8	24.2	24.7	25.2	25.6
Female	26.8	27.2	27.5	27.9	28.2
		Teachers			
Male	24.5	25.0	25.4	25.9	26.3
Female	28.2	28.5	28.8	29.1	29.5
		Police and Fire			
Male	22.5	23.0	23.5	24.0	24.5
Female	26.8	27.2	27.5	27.9	28.2

Disabled retirees: Base Table for healthy retirees occupation, set forward 5 years, generational projection using the BB projection table from the year 2019. 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	General Employees Male & Female	Teachers Male & Female	Police and Fire Male & Female
Ordinary	240%	85%	70%
Accidental	40%	7%	100%

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	185.9	243.6	110.0
1	152.5	200.8	95.0
2	124.6	164.7	37.0
3	101.6	134.4	30.1
4	82.9	109.4	26.1
5	67.9	89.0	23.3
6	56.1	72.5	21.0
7	47.0	59.5	19.2
8	40.1	49.4	17.7
9	35.1	41.7	16.4
10	31.5	36.0	15.2
11	29.1	31.9	14.1
12	27.6	29.0	13.2
13	26.6	27.0	12.3
14	25.9	25.7	11.5
15	25.5	24.8	10.8
16	25.1	24.0	10.1
17	24.5	23.2	9.5
18	23.9	22.4	8.9
19	23.0	21.4	8.3
20	22.0	20.2	7.7
21	20.8	18.7	7.2
22	19.5	17.1	6.8
23	18.3	15.4	6.3
24	17.4	13.6	5.8
25	16.8	12.1	0.0
26	16.8	10.9	0.0
27	16.8	10.4	0.0
28	16.8	10.7	0.0
29	16.8	10.0	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

	General Employees				Teachers				Police/Fire
	Unreduced Retirement		Reduced Retirement		Unreduced Retirement		Reduced Retirement		Unreduced Retirement
									Male &
Age	Male	Female	Male	Female	Male	Female	Male	Female	Female
45	0	0	0	0	0	0	0	0	13.5
46	0	0	0	0	0	0	0	0	13.5
47	0	0	0	0	0	0	0	0	13.5
48	0	0	0	0	0	0	0	0	13.5
49	0	0	0	0	0	0	0	0	13.5
50	0	0	0	0	0	0	1	0	16.0
51	0	0	2	1	0	0	1	1	16.0
52	0	0	2	1	0	0	1	1	16.0
53	0	0	2	1	0	0	2	2	16.0
54	0	0	3	2	0	0	3	3	16.0
55	25	20	3	2	20	18			20.0
56	25	20			15	16			20.0
57	16	13			15	16			20.0
58	16	13			15	16			22.0
59	13	13			15	16			25.0
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

| | General Employees | | | | Teachers | | | | Reduced Retirement | |
| | Unreduced | | 25 & Out | | Reduced | | Unreduced | | | |
Age	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	1	1	10	10	2	2
59	10	11	15	11	2	2	10	20	3	3
60	10	14	15	14	3	3	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		

Expected Retirements per 100 Lives

Note: Retirement rates for the 25&out group age 50-54 are 15% for male and 11% for female.

Hybrid Members

	Expected Retirements per 100 Lives							
	General Employees				Teachers			
	Unreduced		Reduced		Unreduced		Reduced	
Age	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	1	2	13	12	2	2
59	16	13	2	2	13	12	3	3
60	14	13	2	4	14	14	3	5
61	14	15	3	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: Retirement rates for the 25&out group age 50-54 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 by increasing the actual payroll paid during the previous fiscal year by the payroll growth rate and multiplying by the ratio of current active members to the average number of active members during the previous fiscal year.

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	3.75%
Teachers	4.25%
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	124,358	347,932	0.357	0.250	0.250	86,983	86,983	143%	143%
56	95,739	271,777	0.352	0.250	0.250	67,944	67,944	141%	141%
57	51,568	240,737	0.214	0.160	0.160	38,518	38,518	134%	134%
58	11,956	261,049	0.046	0.160	0.160	41,768	41,768	29%	29%
59	22,937	278,475	0.082	0.130	0.130	36,202	36,202	63%	63%
60	48,288	305,357	0.158	0.130	0.130	39,696	39,696	122%	122%
61	23,825	308,881	0.077	0.130	0.130	40,154	40,154	59%	59%
62	68,579	390,386	0.176	0.280	0.280	109,308	109,308	63%	63%
63	50,756	360,357	0.141	0.200	0.200	72,071	72,071	70%	70%
64	119,980	334,469	0.359	0.200	0.200	66,894	66,894	179%	179%
65	27,136	216,468	0.125	0.200	0.200	43,294	43,294	63%	63%
66	27,345	179,071	0.153	0.180	0.180	32,233	32,233	85%	85%
67	34,885	162,464	0.215	0.180	0.180	29,244	29,244	119%	119%
68	33,262	135,792	0.245	0.180	0.180	24,443	24,443	136%	136%
69	29,210	119,616	0.244	0.180	0.180	21,531	21,531	136%	136%
Subtotal	769,824	3,912,830	0.197			750,282	750,282	103%	103%
70-74	80,760	351,048	0.230	0.200	0.200	70,210	70,210	115%	115%
Subtotal	850,584	4,263,878	0.199			820,492	820,492	104%	104%
75 & Over	21,196	199,445	0.106	1.000	1.000	199,445	199,445	11%	11%
Total	871,780	4,463,323	0.195			1,019,937	1,019,937	85%	85%

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

				Assumed Rate		Expected Retirement		Actual/Expected	
Age	Actual Liabilities	Total Liabilities	Actual Rate	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	38,239	165,681	0.231	0.200	0.200	33,136	33,136	115%	115%
56	34,897	244,733	0.143	0.200	0.200	48,947	48,947	71%	71%
57	57,140	330,573	0.173	0.130	0.130	42,975	42,975	133%	133%
58	23,962	384,736	0.062	0.130	0.130	50,016	50,016	48%	48%
59	69,704	478,320	0.146	0.130	0.130	62,182	62,182	112%	112%
60	70,364	421,883	0.167	0.150	0.150	63,283	63,283	111%	111%
61	61,272	504,990	0.121	0.150	0.150	75,749	75,749	81%	81%
62	88,890	453,065	0.196	0.250	0.250	113,266	113,266	78%	78%
63	62,205	493,282	0.126	0.200	0.200	98,656	98,656	63%	63%
64	88,180	397,687	0.222	0.200	0.200	79,537	79,537	111%	111%
65	67,929	349,047	0.195	0.200	0.200	69,809	69,809	97%	97%
66	75,002	281,802	0.266	0.200	0.200	56,360	56,360	133%	133%
67	53,995	213,959	0.252	0.200	0.200	42,792	42,792	126%	126%
68	35,651	180,317	0.198	0.200	0.200	36,063	36,063	99%	99%
69	19,008	174,123	0.109	0.200	0.200	34,825	34,825	55%	55%
Subtotal	846,437	5,074,199	0.167			907,595	907,595	93%	93%
70-74	38,809	454,273	0.085	0.200	0.200	90,855	90,855	43%	43%
Subtotal	885,246	5,528,472	0.160			998,450	998,450	89%	89%
75 & Over	8,274	159,843	0.052	1.000	1.000	159,843	159,843	5%	5%
Total	893,520	5,688,315	0.157			1,158,293	1,158,293	77%	77%

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	0.000	0.000	-	-	N/A	N/A
51	-	23,792	0.000	0.020	0.020	476	476	0%	0%
52	-	88,185	0.000	0.020	0.020	1,764	1,764	0%	0%
53	4,915	126,676	0.039	0.020	0.020	2,534	2,534	194%	194%
54	4,071	250,297	0.016	0.030	0.030	7,509	7,509	54%	54%
Total	8,985	520,107	0.017			12,282	12,282	73%	73%

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

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate Current	Assumed Rate Proposed	Expected Retirement Current (3) * (5)	Expected Retirement Proposed (3) * (6)	Actual/Expected Current (2) / (7)	Actual/Expected 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	-	-	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	-	25,644	0.000	0.010	0.010	256	256	0%	0%
52	5,729	19,164	0.299	0.010	0.010	192	192	2990%	2990%
53	-	14,049	0.000	0.010	0.010	140	140	0%	0%
54	10,812	60,342	0.179	0.020	0.020	1,207	1,207	896%	896%
Total	16,541	126,443	0.131			1,795	1,795	921%	921%

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)
55	54,739	398,870	0.137	0.200	0.200	79,774	79,774	69%	69%
56	77,328	508,785	0.152	0.180	0.180	91,581	91,581	84%	84%
57	46,327	471,909	0.098	0.130	0.130	61,348	61,348	76%	76%
58	33,616	514,053	0.065	0.100	0.100	51,405	51,405	65%	65%
59	52,816	555,402	0.095	0.100	0.100	55,540	55,540	95%	95%
60	69,426	640,195	0.108	0.100	0.100	64,020	64,020	108%	108%
61	53,793	633,809	0.085	0.110	0.110	69,719	69,719	77%	77%
62	317,275	1,621,107	0.196	0.200	0.200	324,221	324,221	98%	98%
63	235,072	1,416,783	0.166	0.200	0.200	283,357	283,357	83%	83%
64	160,801	1,190,311	0.135	0.120	0.120	142,837	142,837	113%	113%
65	122,511	1,023,187	0.120	0.140	0.140	143,246	143,246	86%	86%
66	156,055	881,315	0.177	0.200	0.200	176,263	176,263	89%	89%
67	129,243	666,340	0.194	0.200	0.200	133,268	133,268	97%	97%
68	114,495	494,508	0.232	0.200	0.200	98,902	98,902	116%	116%
69	76,467	423,255	0.181	0.200	0.200	84,651	84,651	90%	90%
Subtotal	1,699,963	11,439,828	0.149			1,860,132	1,860,132	91%	91%
70-74	220,125	1,154,669	0.191	0.200	0.200	230,934	230,934	95%	95%
Subtotal	1,920,087	12,594,497	0.152			2,091,066	2,091,066	92%	92%
75 & Over	49,554	363,156	0.136	1.000	1.000	363,156	363,156	14%	14%
Total	1,969,641	12,957,653	0.152			2,454,222	2,454,222	80%	80%

Note: The proposed male retirement rates of the 25& out group from age 50 to 54 are 15%.

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)
55	10,379	250,507	0.041	0.110	0.110	27,556	27,556	38%	38%
56	73,316	402,265	0.182	0.110	0.110	44,249	44,249	166%	166%
57	32,233	416,742	0.077	0.110	0.110	45,842	45,842	70%	70%
58	58,521	479,392	0.122	0.110	0.110	52,733	52,733	111%	111%
59	46,238	454,614	0.102	0.110	0.110	50,008	50,008	92%	92%
60	85,506	464,728	0.184	0.140	0.140	65,062	65,062	131%	131%
61	72,572	534,930	0.136	0.180	0.180	96,287	96,287	75%	75%
62	303,255	1,712,545	0.177	0.200	0.200	342,509	342,509	89%	89%
63	323,869	1,481,204	0.219	0.200	0.200	296,241	296,241	109%	109%
64	226,675	1,169,321	0.194	0.200	0.200	233,864	233,864	97%	97%
65	131,975	946,158	0.139	0.200	0.200	189,232	189,232	70%	70%
66	191,456	850,930	0.225	0.200	0.200	170,186	170,186	112%	112%
67	148,931	642,083	0.232	0.200	0.200	128,417	128,417	116%	116%
68	73,666	525,068	0.140	0.200	0.200	105,014	105,014	70%	70%
69	48,326	420,026	0.115	0.200	0.200	84,005	84,005	58%	58%
Subtotal	1,826,920	10,750,515	0.170			1,931,204	1,931,204	95%	95%
70-74	210,394	1,097,050	0.192	0.250	0.200	219,410	219,410	96%	96%
Subtotal	2,037,313	11,847,566	0.172			2,150,614	2,150,614	95%	95%
75 & Over	74,255	342,079	0.217	1.000	1.000	342,079	342,079	22%	22%
Total	2,111,569	12,189,645	0.173			2,492,693	2,492,693	85%	85%

Note: The proposed female retirement rates of the 25& out group from age 50 to 54 are 11%.

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	9,541	670,729	0.014	0.010	0.010	6,707	6,707	142%	142%
56	6,649	660,814	0.010	0.010	0.010	6,608	6,608	101%	101%
57	5,734	703,723	0.008	0.010	0.010	7,037	7,037	81%	81%
58	10,666	715,610	0.015	0.010	0.010	7,156	7,156	149%	149%
59	10,391	775,203	0.013	0.020	0.020	15,504	15,504	67%	67%
60	20,083	706,243	0.028	0.030	0.030	21,187	21,187	95%	95%
61	19,195	693,529	0.028	0.040	0.040	27,741	27,741	69%	69%
Total	82,259	4,925,850	0.017			91,941	91,941	89%	89%

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	2,731	439,069	0.006	0.010	0.010	4,391	4,391	62%	62%
56	5,121	538,223	0.010	0.010	0.010	5,382	5,382	95%	95%
57	11,191	653,754	0.017	0.010	0.010	6,538	6,538	171%	171%
58	15,085	747,736	0.020	0.010	0.010	7,477	7,477	202%	202%
59	11,344	719,714	0.016	0.020	0.020	14,394	14,394	79%	79%
60	25,600	798,618	0.032	0.030	0.030	23,959	23,959	107%	107%
61	42,933	858,564	0.050	0.040	0.040	34,343	34,343	125%	125%
Total	114,005	4,755,677	0.024			96,483	96,483	118%	118%

GENERAL EMPLOYEES - NONCONTRIBUTORY 25 OUT
MALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED

Age	Actual Retirement	Total Count	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	94,186	655,343	0.144	0.100	0.150	65,534	98,301	144%	96%
55	12,977	86,548	0.150	0.200	0.150	17,310	12,982	75%	100%
56	21,744	75,645	0.287	0.180	0.230	13,616	17,398	160%	125%
57	3,696	35,486	0.104	0.130	0.180	4,613	6,388	80%	58%
58	3,461	30,858	0.112	0.100	0.150	3,086	4,629	112%	75%
59	1,513	41,256	0.037	0.100	0.150	4,126	6,188	37%	24%
60	15,045	47,940	0.314	0.100	0.150	4,794	7,191	314%	209%
61	3,584	31,313	0.114	0.110	0.160	3,444	5,010	104%	72%
62	8,823	45,453	0.194	0.200	0.250	9,091	11,363	97%	78%
63	8,898	33,403	0.266	0.200	0.250	6,681	8,351	133%	107%
64	-	17,218	0.000	0.120	0.170	2,066	2,927	0%	0%
65	-	17,635	0.000	0.140	0.190	2,469	3,351	0%	0%
66	3,812	6,785	0.562	0.200	0.250	1,357	1,696	281%	225%
67	866	6,518	0.133	0.200	0.250	1,304	1,629	66%	53%
68	-	5,760	0.000	0.200	0.250	1,152	1,440	0%	0%
69	-	5,804	0.000	0.200	0.250	1,161	1,451	0%	0%
Subtotal	84,419	1,142,964	0.074			141,803	190,296	126%	94%
70-74	2,350	6,042	0.389	0.200	0.250	1,208	1,511	194%	156%
Subtotal	86,769	1,149,006	0.076			143,011	191,806	127%	94%
75 & Over	-	-	N\A	1.000	1.000	-	-	N/A	N/A
Total	86,769	1,149,006	0.076			143,011	191,806	127%	94%

GENERAL EMPLOYEES - NONCONTRIBUTORY 25 OUT
FEMALE NORMAL RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED

				Assumed Rate		Expected Retirement		Actual/Expected	
Age	Actual Retirement	Total Count	Actual Rate	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	-	38,557	0.000	0.110	0.110	4,241	4,241	0%	0%
55	-	8,173	0.000	0.110	0.110	899	899	0%	0%
56	-	-	N\A	0.110	0.110	-	-	N/A	N/A
57	-	-	N\A	0.110	0.110	-	-	N/A	N/A
58	-	-	N\A	0.110	0.110	-	-	N/A	N/A
59	-	-	N\A	0.110	0.110	-	-	N/A	N/A
60	-	4,005	0.000	0.140	0.140	561	561	0%	0%
61	4,393	4,393	1.000	0.180	0.180	791	791	556%	556%
62	-	755	0.000	0.200	0.200	151	151	0%	0%
63	-	798	0.000	0.200	0.200	160	160	0%	0%
64	867	867	1.000	0.200	0.200	173	173	500%	500%
65	-	-	N\A	0.200	0.200	-	-	N/A	N/A
66	-	-	N\A	0.200	0.200	-	-	N/A	N/A
67	-	-	N\A	0.200	0.200	-	-	N/A	N/A
68	-	-	N\A	0.200	0.200	-	-	N/A	N/A
69	-	-	N\A	0.200	0.200	-	-	N/A	N/A
Subtotal	5,260	57,548	0.091			6,976	6,976	75%	75%
70-74	-	-	N\A	0.200	0.200	-	-	N/A	N/A
Subtotal	5,260	57,548	0.091			6,976	6,976	75%	75%
75 & Over	-	-	N\A	1.000	1.000	-	-	N/A	N/A
Total	5,260	57,548	0.091			6,976	6,976	75%	75%

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) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	114,873	648,863	0.177	0.160	0.180	103,818	116,795	111%	98%
56	116,968	760,421	0.154	0.100	0.120	76,042	91,251	154%	128%
57	98,497	825,598	0.119	0.100	0.120	82,560	99,072	119%	99%
58	148,269	939,158	0.158	0.140	0.160	131,482	150,265	113%	99%
59	129,549	976,222	0.133	0.140	0.160	136,671	156,196	95%	83%
60	212,748	1,085,282	0.196	0.140	0.140	151,939	151,939	140%	140%
61	213,295	1,083,998	0.197	0.140	0.140	151,760	151,760	141%	141%
62	497,170	2,975,975	0.167	0.210	0.210	624,955	624,955	80%	80%
63	473,356	2,547,219	0.186	0.180	0.180	458,499	458,499	103%	103%
64	303,994	2,150,663	0.141	0.180	0.180	387,119	387,119	79%	79%
65	317,379	1,868,518	0.170	0.210	0.210	392,389	392,389	81%	81%
66	260,878	1,418,020	0.184	0.180	0.180	255,244	255,244	102%	102%
67	302,204	1,138,894	0.265	0.180	0.180	205,001	205,001	147%	147%
68	175,404	811,583	0.216	0.180	0.180	146,085	146,085	120%	120%
69	109,767	628,355	0.175	0.180	0.180	113,104	113,104	97%	97%
Subtotal	3,474,351	19,858,770	0.175			3,416,668	3,499,673	102%	99%
70-74	324,442	1,527,864	0.212	0.200	0.200	305,625	305,573	106%	106%
Subtotal	3,798,794	21,386,633	0.178			3,722,293	3,805,246	102%	100%
75 & Over	55,914	385,169	0.145	1.000	1.000	385,162	385,169	15%	15%
Total	3,854,708	21,771,802	0.177			4,107,456	4,190,415	94%	92%

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)
55	121,022	950,130	0.127	0.180	0.180	171,023	171,023	71%	71%
56	183,848	1,160,458	0.158	0.130	0.130	150,859	150,859	122%	122%
57	109,007	1,253,465	0.087	0.130	0.130	162,950	162,950	67%	67%
58	99,536	1,282,659	0.078	0.130	0.130	166,746	166,746	60%	60%
59	180,671	1,281,485	0.141	0.130	0.130	166,593	166,593	108%	108%
60	185,066	1,434,402	0.129	0.130	0.130	186,472	186,472	99%	99%
61	206,460	1,428,034	0.145	0.150	0.150	214,205	214,205	96%	96%
62	723,842	3,978,233	0.182	0.200	0.200	795,647	795,647	91%	91%
63	664,307	3,146,009	0.211	0.200	0.200	629,202	629,202	106%	106%
64	425,185	2,674,386	0.159	0.200	0.200	534,877	534,877	79%	79%
65	398,729	2,305,310	0.173	0.200	0.200	461,062	461,062	86%	86%
66	414,537	1,779,926	0.233	0.180	0.180	320,387	320,387	129%	129%
67	279,909	1,318,268	0.212	0.180	0.180	237,288	237,288	118%	118%
68	179,120	996,791	0.180	0.180	0.180	179,422	179,422	100%	100%
69	97,609	719,016	0.136	0.180	0.180	129,423	129,423	75%	75%
Subtotal	4,268,848	25,708,572	0.166			4,506,157	4,506,157	95%	95%
70-74	301,068	1,344,819	0.224	0.200	0.200	268,964	268,964	112%	112%
Subtotal	4,569,916	27,053,390	0.169			4,775,121	4,775,121	96%	96%
75 & Over	77,491	326,593	0.237	1.000	1.000	326,593	326,593	24%	24%
Total	4,647,407	27,379,983	0.170			5,101,714	5,101,714	91%	91%

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

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate Current	Assumed Rate Proposed	Expected Retirement Current (3) * (5)	Expected Retirement Proposed (3) * (6)	Actual/Expected Current (2) / (7)	Actual/Expected Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	8,818	1,056,970	0.008	0.010	0.010	10,570	10,570	83%	83%
56	26,440	1,124,465	0.024	0.010	0.010	11,245	11,245	235%	235%
57	8,678	1,019,946	0.009	0.010	0.010	10,199	10,199	85%	85%
58	20,488	1,013,576	0.020	0.010	0.010	10,136	10,136	202%	202%
59	29,838	1,013,343	0.029	0.020	0.020	20,267	20,267	147%	147%
60	47,543	1,050,053	0.045	0.020	0.020	21,001	21,001	226%	226%
61	22,856	964,597	0.024	0.030	0.030	28,938	28,938	79%	79%
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%
Total	164,660	7,242,950	0.023			112,355	112,355	147%	147%

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	19,375	1,259,376	0.015	0.010	0.010	12,594	12,594	154%	154%
56	12,833	1,360,103	0.009	0.010	0.010	13,601	13,601	94%	94%
57	14,698	1,347,537	0.011	0.010	0.010	13,475	13,475	109%	109%
58	14,841	1,390,491	0.011	0.020	0.020	27,810	27,810	53%	53%
59	25,782	1,406,148	0.018	0.020	0.020	28,123	28,123	92%	92%
60	49,037	1,428,813	0.034	0.040	0.040	57,153	57,153	86%	86%
61	47,863	1,466,567	0.033	0.040	0.040	58,663	58,663	82%	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%
Total	184,430	9,659,035	0.019			211,418	211,418	87%	87%

TEACHERS - CONTRIBUTORY

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	-	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	83,269	0.177	0.150	0.150	12,490	12,490	118%	118%
58	7,864	73,149	0.108	0.150	0.150	10,972	10,972	72%	72%
59	-	85,550	0.000	0.150	0.150	12,833	12,833	0%	0%
60	-	97,941	0.000	0.140	0.140	13,712	13,712	0%	0%
61	15,689	91,201	0.172	0.140	0.140	12,768	12,768	123%	123%
62	15,951	80,842	0.197	0.140	0.140	11,318	11,318	141%	141%
63	23,797	87,781	0.271	0.140	0.140	12,289	12,289	194%	194%
64	10,000	74,557	0.134	0.140	0.140	10,438	10,438	96%	96%
65	20,803	67,967	0.306	0.200	0.200	13,593	13,593	153%	153%
66	15,262	78,838	0.194	0.150	0.150	11,826	11,826	129%	129%
67	40,552	88,028	0.461	0.150	0.150	13,204	13,204	307%	307%
68	24,577	71,590	0.343	0.150	0.150	10,739	10,739	229%	229%
69	6,570	58,360	0.113	0.150	0.150	8,754	8,754	75%	75%
Subtotal	202,496	1,161,621	0.174			175,434	175,434	115%	115%
70-74	70,483	290,925	0.242	0.150	0.150	43,639	43,639	162%	162%
Subtotal	272,979	1,452,545	0.188			219,072	219,072	125%	125%
75 & Over	-	98,191	0.000	1.000	1.000	98,191	98,191	0%	0%
Total	272,979	1,550,736	0.176			317,263	317,263	86%	86%

GRS Retirement Consulting

TEACHERS - 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)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(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	50,424	189,932	0.265	0.160	0.160	30,389	30,389	166%	166%
58	16,989	185,945	0.091	0.160	0.160	29,751	29,751	57%	57%
59	28,568	239,086	0.119	0.160	0.160	38,254	38,254	75%	75%
60	61,036	276,285	0.221	0.180	0.180	49,731	49,731	123%	123%
61	56,299	307,645	0.183	0.180	0.180	55,376	55,376	102%	102%
62	76,509	353,164	0.217	0.250	0.250	88,291	88,291	87%	87%
63	121,854	401,105	0.304	0.200	0.200	80,221	80,221	152%	152%
64	50,156	303,144	0.165	0.150	0.150	45,472	45,472	110%	110%
65	82,604	218,742	0.378	0.250	0.250	54,685	54,685	151%	151%
66	26,521	131,541	0.202	0.250	0.250	32,885	32,885	81%	81%
67	38,013	118,420	0.321	0.200	0.200	23,684	23,684	161%	161%
68	-	107,842	0.000	0.200	0.200	21,568	21,568	0%	0%
69	7,093	85,557	0.083	0.200	0.200	17,111	17,111	41%	41%
Subtotal	651,879	3,148,847	0.207			605,931	605,931	108%	108%
70-74	76,327	295,146	0.259	0.200	0.200	59,029	59,029	129%	129%
Subtotal	728,207	3,443,994	0.211			664,960	664,960	110%	110%
75 & Over	17,672	57,092	0.310	1.000	1.000	57,092	57,092	31%	31%
Total	745,878	3,501,085	0.213			722,052	722,052	103%	103%

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	4,705	88,571	0.053	0.100	0.100	8,857	8,857	53%	53%
56	10,382	98,506	0.105	0.100	0.100	9,851	9,851	105%	105%
57	16,281	81,044	0.201	0.100	0.100	8,104	8,104	201%	201%
58	22,068	130,023	0.170	0.100	0.100	13,002	13,002	170%	170%
59	23,195	128,555	0.180	0.100	0.100	12,855	12,855	180%	180%
60	15,493	122,617	0.126	0.100	0.100	12,262	12,262	126%	126%
61	20,052	107,759	0.186	0.100	0.100	10,776	10,776	186%	186%
62	50,342	368,088	0.137	0.160	0.160	58,894	58,894	85%	85%
63	25,627	410,825	0.062	0.120	0.120	49,299	49,299	52%	52%
64	38,582	363,473	0.106	0.100	0.100	36,347	36,347	106%	106%
65	33,290	310,292	0.107	0.200	0.200	62,058	62,058	54%	54%
66	46,887	243,412	0.193	0.150	0.150	36,512	36,512	128%	128%
67	24,587	283,708	0.087	0.150	0.150	42,556	42,556	58%	58%
68	24,689	289,981	0.085	0.150	0.150	43,497	43,497	57%	57%
69	48,309	323,737	0.149	0.150	0.150	48,561	48,561	99%	99%
Subtotal	404,489	3,350,592	0.121			453,432	453,432	89%	89%
70-74	149,838	671,532	0.223	0.150	0.150	100,730	100,730	149%	149%
Subtotal	554,327	4,022,123	0.138			554,162	554,162	100%	100%
75 & Over	25,216	245,512	0.103	1.000	1.000	245,512	245,512	10%	10%
Total	579,543	4,267,635	0.136			799,673	799,673	72%	72%

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	18,884	158,907	0.119	0.130	0.130	20,658	20,658	91%	91%
56	24,509	196,184	0.125	0.070	0.070	13,733	13,733	178%	178%
57	28,548	191,129	0.149	0.080	0.080	15,290	15,290	187%	187%
58	24,852	190,388	0.131	0.100	0.100	19,039	19,039	131%	131%
59	31,099	178,115	0.175	0.200	0.200	35,623	35,623	87%	87%
60	8,077	175,304	0.046	0.110	0.110	19,283	19,283	42%	42%
61	62,070	222,232	0.279	0.160	0.160	35,557	35,557	175%	175%
62	162,503	719,412	0.226	0.250	0.250	179,853	179,853	90%	90%
63	79,865	549,062	0.145	0.200	0.200	109,812	109,812	73%	73%
64	71,154	533,835	0.133	0.150	0.150	80,075	80,075	89%	89%
65	96,468	522,211	0.185	0.250	0.250	130,553	130,553	74%	74%
66	119,511	494,290	0.242	0.250	0.250	123,573	123,573	97%	97%
67	93,226	382,517	0.244	0.250	0.250	95,629	95,629	97%	97%
68	50,936	296,761	0.172	0.250	0.250	74,190	74,190	69%	69%
69	79,976	264,034	0.303	0.250	0.250	66,009	66,009	121%	121%
Subtotal	951,680	5,074,382	0.188			1,018,877	1,018,877	93%	93%
70-74	107,470	521,718	0.206	25.000	0.250	130,429	130,429	82%	82%
Subtotal	1,059,150	5,596,100	0.189			1,149,307	1,149,307	92%	92%
75 & Over	22,529	149,822	0.150	1.000	1.000	149,822	149,822	15%	15%
Total	1,081,679	5,745,922	0.188			1,299,129	1,299,129	83%	83%

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	46,973	298,627	0.157	0.200	0.200	59,725	59,725	79%	79%
56	46,971	348,714	0.135	0.130	0.130	45,333	45,333	104%	104%
57	78,331	307,192	0.255	0.130	0.130	39,935	39,935	196%	196%
58	41,321	278,728	0.148	0.130	0.130	36,235	36,235	114%	114%
59	38,721	267,419	0.145	0.130	0.130	34,764	34,764	111%	111%
60	37,865	364,970	0.104	0.140	0.140	51,096	51,096	74%	74%
61	50,858	310,150	0.164	0.140	0.140	43,421	43,421	117%	117%
62	151,641	841,217	0.180	0.220	0.220	185,068	185,068	82%	82%
63	82,103	719,705	0.114	0.140	0.140	100,759	100,759	81%	81%
64	69,591	613,203	0.113	0.140	0.140	85,848	85,848	81%	81%
65	87,450	561,974	0.156	0.200	0.200	112,588	112,395	78%	78%
66	119,117	509,681	0.234	0.150	0.150	76,452	76,452	156%	156%
67	50,993	391,936	0.130	0.150	0.150	58,790	58,790	87%	87%
68	70,353	367,032	0.192	0.150	0.150	55,055	55,055	128%	128%
69	50,069	314,496	0.159	0.150	0.150	47,174	47,174	106%	106%
Subtotal	1,022,358	6,495,044	0.157			1,032,244	1,032,050	99%	99%
70-74	149,199	1,021,008	0.146	0.150	0.150	153,151	153,151	97%	97%
Subtotal	1,171,557	7,516,052	0.156			1,185,395	1,185,202	99%	99%
75 & Over	80,014	348,384	0.230	1.000	1.000	348,384	348,384	23%	23%
Total	1,251,571	7,864,436	0.159			1,533,779	1,533,586	82%	82%

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) * | Proposed (3) * | Current | Proposed |
(1)	(2)	(3)	(4)	(5)	(6)	(5) (7)	(6) (8)	(2) / (7) (9)	(2) / (8) (10)
55	82,334	666,699	0.123	0.160	0.160	106,672	106,672	77%	77%
56	78,671	696,631	0.113	0.100	0.100	69,663	69,663	113%	113%
57	103,169	602,809	0.171	0.100	0.100	60,281	60,281	171%	171%
58	52,399	577,904	0.091	0.120	0.120	69,348	69,348	76%	76%
59	107,064	612,393	0.175	0.120	0.120	73,487	73,487	146%	146%
60	110,283	660,462	0.167	0.140	0.140	92,465	92,465	119%	119%
61	109,118	726,190	0.150	0.180	0.180	130,714	130,714	83%	83%
62	417,262	1,959,167	0.213	0.300	0.300	587,750	587,750	71%	71%
63	293,226	1,615,757	0.181	0.200	0.200	323,151	323,151	91%	91%
64	185,381	1,220,782	0.152	0.200	0.200	244,156	244,156	76%	76%
65	218,748	1,049,844	0.208	0.250	0.250	262,461	262,461	83%	83%
66	258,751	847,919	0.305	0.250	0.250	211,980	211,980	122%	122%
67	115,197	609,679	0.189	0.250	0.250	152,420	152,420	76%	76%
68	131,322	567,748	0.231	0.250	0.250	141,937	141,937	93%	93%
69	39,875	369,243	0.108	0.250	0.250	92,311	92,311	43%	43%
Subtotal	2,302,799	12,783,228	0.180			2,618,797	2,618,797	88%	88%
70-74	176,269	733,548	0.240	25.000	0.250	183,387	183,387	96%	96%
Subtotal	2,479,068	13,516,776	0.183			2,802,184	2,802,184	88%	88%
75 & Over	26,898	135,846	0.198	1.000	1.000	135,846	135,846	20%	20%
Total	2,505,965	13,652,622	0.184			2,938,029	2,938,029	85%	85%

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	6,995	315,784	0.022	0.020	0.020	6,316	6,316	111%	111%
56	3,075	274,297	0.011	0.020	0.020	5,486	5,486	56%	56%
57	3,803	257,882	0.015	0.020	0.020	5,158	5,158	74%	74%
58	-	219,105	0.000	0.020	0.020	4,382	4,382	0%	0%
59	-	230,013	0.000	0.030	0.030	6,900	6,900	0%	0%
60	16,899	271,722	0.062	0.030	0.030	8,152	8,152	207%	207%
61	6,865	309,101	0.022	0.030	0.030	9,273	9,273	74%	74%
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%
Total	37,637	1,877,904	0.020			45,666	45,666	82%	82%

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	13,943	734,959	0.019	0.020	0.020	14,699	14,699	95%	95%
56	6,968	643,320	0.011	0.020	0.020	12,866	12,866	54%	54%
57	20,391	640,494	0.032	0.020	0.020	12,810	12,810	159%	159%
58	10,260	596,081	0.017	0.020	0.020	11,922	11,922	86%	86%
59	48,681	632,299	0.077	0.030	0.030	18,969	18,969	257%	257%
60	32,002	638,597	0.050	0.050	0.050	31,930	31,930	100%	100%
61	36,971	706,845	0.052	0.100	0.100	70,685	70,685	52%	52%
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%
Total	169,215	4,592,596	0.037			173,880	173,880	97%	97%

POLICE & FIRE EMPLOYEES
RETIREMENT EXPERIENCE - AGE BASED LIABILITY WEIGHTED

Age	Actual Liabilities	Total Liabilities	Actual Rate	Assumed Rate Current	Assumed Rate Proposed	Expected Retirement Current (3) * (5)	Expected Retirement Proposed (3) * (6)	Actual/Expected Current (2) / (7)	Actual/Expected Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
45	43,026	130,143	0.331	0.125	0.135	16,268	17,569	264%	68%
46	50,999	552,604	0.092	0.125	0.135	69,075	74,602	74%	110%
47	163,456	1,102,889	0.148	0.125	0.135	137,861	148,890	119%	121%
48	300,766	1,845,486	0.163	0.125	0.135	230,686	249,141	130%	87%
49	269,333	2,284,245	0.118	0.125	0.135	285,531	308,373	94%	82%
50	366,809	2,810,429	0.131	0.150	0.160	421,564	449,669	87%	102%
51	511,983	3,128,932	0.164	0.150	0.160	469,340	500,629	109%	77%
52	414,585	3,353,282	0.124	0.150	0.160	502,992	536,525	82%	111%
53	582,657	3,280,679	0.178	0.150	0.160	492,102	524,909	118%	137%
54	626,633	2,863,722	0.219	0.150	0.160	429,558	458,196	146%	119%
55	781,612	3,293,364	0.237	0.200	0.200	658,673	658,673	119%	104%
56	567,504	2,724,120	0.208	0.200	0.200	544,824	544,824	104%	102%
57	489,634	2,389,682	0.205	0.200	0.200	477,936	477,936	102%	81%
58	327,952	1,838,174	0.178	0.220	0.220	404,398	404,398	81%	83%
59	337,450	1,632,291	0.207	0.250	0.250	408,073	408,073	83%	89%
60	332,459	1,248,891	0.266	0.300	0.300	374,667	374,667	89%	120%
61	358,439	991,769	0.361	0.300	0.300	297,531	297,531	120%	99%
Subtotal	6,525,297	35,470,702	0.184			6,221,080	6,434,604	105%	101%
62-64	385,772	1,274,820	0.303	0.300	0.300	382,446	382,446	101%	101%
Subtotal	6,911,069	36,745,521	0.188			6,603,526	6,817,050	105%	101%
65 & Over	142,275	601,122	0.237	1.000	1.000	601,122	601,122	24%	24%
Total	7,053,344	37,346,643	0.189			7,204,648	7,418,172	98%	95%

GRS Retirement Consulting

SALARY SCALE ASSUMPTION
GENERAL EMPLOYEES

Year	Average Long Service Increase	CPI	Productivity
2009	6.15%	-1.43%	7.58%
2010	-1.28%	1.05%	-2.33%
2011	0.46%	3.56%	-3.09%
2012	-1.20%	1.66%	-2.86%
2013	3.35%	1.75%	1.59%
2014	5.17%	2.07%	3.10%
2015	5.90%	0.12%	5.78%
2016	5.34%	1.00%	4.34%
2017	4.72%	1.63%	3.09%
Average	3.24%	1.42%	1.77%
Proposed	3.50%	2.50%	1.00%

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	5.97%	-3.20%	2.78%	3.00%
2	6.24%	-3.20%	3.05%	3.00%
3	5.46%	-3.20%	2.26%	2.00%
4	4.80%	-3.20%	1.61%	1.50%
5	4.63%	-3.20%	1.43%	1.50%
6	4.34%	-3.20%	1.14%	1.25%
7	4.23%	-3.20%	1.04%	1.25%
8	4.24%	-3.20%	1.04%	1.00%
9	4.17%	-3.20%	0.98%	1.00%
10	4.00%	-3.20%	0.81%	1.00%
11	4.03%	-3.20%	0.83%	0.75%
12	3.75%	-3.20%	0.56%	0.75%
13	3.63%	-3.20%	0.43%	0.50%
14	3.71%	-3.20%	0.52%	0.50%
15	3.62%	-3.20%	0.43%	0.50%
16	3.56%	-3.20%	0.37%	0.50%
17	3.75%	-3.20%	0.55%	0.50%
18	3.64%	-3.20%	0.44%	0.50%
19	3.63%	-3.20%	0.43%	0.50%
20	3.47%	-3.20%	0.27%	0.25%
21	3.38%	-3.20%	0.18%	0.25%
22	3.35%	-3.20%	0.15%	0.25%
23	3.51%	-3.20%	0.32%	0.25%
24	3.23%	-3.20%	0.03%	0.25%
25	3.20%	-3.20%	0.00%	0.00%

SALARY SCALE ASSUMPTION
TEACHERS

Year	Average Long Service Increase	CPI	Productivity
2009	6.28%	-1.43%	7.71%
2010	-1.32%	1.05%	-2.38%
2011	0.63%	3.56%	-2.93%
2012	-3.26%	1.66%	-4.92%
2013	4.82%	1.75%	3.07%
2014	4.25%	2.07%	2.18%
2015	4.00%	0.12%	3.87%
2016	5.04%	1.00%	4.05%
2017	3.86%	1.63%	2.23%
Average	2.87%	1.42%	1.45%
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	4.80%	-2.87%	1.94%	2.00%
2	5.03%	-2.87%	2.16%	1.75%
3	4.57%	-2.87%	1.70%	1.75%
4	4.38%	-2.87%	1.51%	1.50%
5	3.92%	-2.87%	1.05%	1.00%
6	4.17%	-2.87%	1.30%	1.00%
7	3.32%	-2.87%	0.45%	0.75%
8	4.03%	-2.87%	1.16%	0.75%
9	3.70%	-2.87%	0.83%	0.50%
10	3.80%	-2.87%	0.93%	0.50%
11	3.60%	-2.87%	0.73%	0.50%
12	3.58%	-2.87%	0.71%	0.50%
13	3.50%	-2.87%	0.63%	0.25%
14	3.31%	-2.87%	0.44%	0.25%
15	3.58%	-2.87%	0.71%	0.25%
16	3.39%	-2.87%	0.52%	0.25%
17	3.23%	-2.87%	0.36%	0.25%
18	3.26%	-2.87%	0.39%	0.25%
19	2.97%	-2.87%	0.10%	0.25%
20	3.19%	-2.87%	0.32%	0.25%
21	2.94%	-2.87%	0.07%	0.25%
22	2.95%	-2.87%	0.08%	0.25%
23	2.92%	-2.87%	0.05%	0.25%
24	3.16%	-2.87%	0.29%	0.25%
25	2.87%	-2.87%	0.00%	0.00%

SALARY SCALE ASSUMPTION
POLICE & FIRE EMPLOYEES

Year	Average Long Service Increase	CPI	Productivity
2009	7.13%	1.43%	8.56%
2010	4.53%	1.05%	3.47%
2011	7.11%	3.56%	3.55%
2012	1.11%	1.66%	-0.56%
2013	0.73%	1.75%	-1.03%
2014	4.59%	2.07%	2.52%
2015	12.69%	0.12%	12.57%
2016	8.19%	1.00%	7.20%
2017	7.23%	1.63%	5.60%
Average	5.31%	1.42%	4.29%
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	7.16%	-5.71%	1.45%	2.00%
2	8.61%	-5.71%	2.90%	2.00%
3	5.31%	-5.71%	-0.40%	1.00%
4	5.34%	-5.71%	-0.37%	1.00%
5	7.30%	-5.71%	1.59%	1.00%
6	5.89%	-5.71%	0.19%	0.75%
7	5.55%	-5.71%	-0.16%	0.75%
8	7.91%	-5.71%	2.20%	0.75%
9	5.85%	-5.71%	0.14%	0.50%
10	6.43%	-5.71%	0.72%	0.50%
11	7.82%	-5.71%	2.11%	0.50%
12	6.21%	-5.71%	0.50%	0.50%
13	6.82%	-5.71%	1.11%	0.25%
14	8.30%	-5.71%	2.59%	0.25%
15	6.22%	-5.71%	0.51%	0.25%
16	6.96%	-5.71%	1.25%	0.25%
17	7.51%	-5.71%	1.80%	0.25%
18	6.24%	-5.71%	0.53%	0.25%
19	6.44%	-5.71%	0.73%	0.25%
20	6.92%	-5.71%	1.21%	0.25%
21	5.79%	-5.71%	0.08%	0.25%
22	6.31%	-5.71%	0.60%	0.25%
23	7.11%	-5.71%	1.40%	0.25%
24	5.17%	-5.71%	-0.54%	0.25%
25	5.71%	-5.71%	0.00%	0.00%

GENERAL EMPLOYEES
POST-RETIREMENT MORTALITY - HEALTHY MALE

Age	Actual Benefits	Total Benefits	Actual Rate	Assumed Rate		Expected Benefits		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)
55-59	84	43,667	0.0019	0.0053	0.0051	231	222	36%	38%
60-64	1,529	165,246	0.0093	0.0078	0.0072	1,290	1,194	118%	128%
65-69	3,010	299,031	0.0101	0.0114	0.0103	3,398	3,085	89%	98%
70-74	4,990	278,245	0.0179	0.0163	0.0156	4,537	4,330	110%	115%
75-79	5,101	194,769	0.0262	0.0264	0.0254	5,137	4,944	99%	103%
80-84	7,500	160,328	0.0468	0.0469	0.0444	7,519	7,113	100%	105%
85-89	9,033	99,874	0.0904	0.0841	0.0805	8,398	8,043	108%	112%
90-94	6,278	44,367	0.1415	0.1483	0.1480	6,578	6,566	95%	96%
95-99	2,542	9,595	0.2649	0.2459	0.2466	2,360	2,366	108%	107%
100-104	376	1,211	0.3102	0.3966	0.3408	480	413	78%	91%
105-109	13	26	0.5023	0.0000	0.0000	13	11	100%	116%
Totals	40,456	1,296,359				39,941	38,286	101%	106%

GENERAL EMPLOYEES
POST-RETIREMENT MORTALITY - HEALTHY FEMALE

| Age | Actual Benefits | Total Benefits | Actual Rate | Assumed Rate | | Expected Benefits | | 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)
55-59	373	39,416	0.0095	0.0024	0.0032	96	125	390%	298%
60-64	700	187,623	0.0037	0.0032	0.0032	595	603	118%	116%
65-69	2,023	336,576	0.0060	0.0050	0.0044	1,668	1,492	121%	136%
70-74	3,078	280,209	0.0110	0.0095	0.0093	2,655	2,620	116%	118%
75-79	3,021	180,599	0.0167	0.0164	0.0165	2,964	2,980	102%	101%
80-84	4,261	142,110	0.0300	0.0291	0.0281	4,139	3,997	103%	107%
85-89	5,485	110,699	0.0495	0.0555	0.0521	6,140	5,769	89%	95%
90-94	5,137	52,585	0.0977	0.1036	0.0995	5,446	5,235	94%	98%
95-99	2,464	13,114	0.1879	0.1931	0.1947	2,532	2,553	97%	97%
100-104	454	1,281	0.3545	0.3302	0.3254	423	417	107%	109%
105-109	14	22	0.6101	0.5193	0.4256	12	9	117%	143%
Totals	27,010	1,344,233				26,670	25,801	101%	105%

TEACHERS
POST-RETIREMENT MORTALITY - HEALTHY MALE

Age	Actual Benefits	Total Benefits	Actual Rate	Assumed Rate		Expected Benefits		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)
55-59	13	7,627	0.0017	0.0048	0.0046	37	35	35%	36%
60-64	124	34,923	0.0036	0.0071	0.0067	249	234	50%	53%
65-69	1,314	112,899	0.0116	0.0103	0.0095	1,167	1,072	113%	123%
70-74	1,559	130,231	0.0120	0.0148	0.0143	1,923	1,857	81%	84%
75-79	2,148	104,535	0.0206	0.0238	0.0232	2,492	2,424	86%	89%
80-84	4,017	91,633	0.0438	0.0424	0.0405	3,883	3,713	103%	108%
85-89	3,926	53,105	0.0739	0.0744	0.0720	3,953	3,824	99%	103%
90-94	2,907	15,424	0.1884	0.1303	0.1312	2,010	2,024	145%	144%
95-99	779	2,458	0.3168	0.2148	0.2197	528	540	148%	144%
100-104	32	143	0.2255	0.3820	0.3241	55	46	59%	70%
105-109	14	14	1.0000	0.4500	0.3854	6	6	222%	259%
Totals	16,834	552,992				16,302	15,776	103%	107%

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TEACHERS
POST-RETIREMENT MORTALITY - HEALTHY FEMALE

Age	Actual Benefits	Total Benefits	Actual Rate	Assumed Rate		Expected Benefits		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)
55-59	0	13,941	0.0000	0.0022	0.0027	30	37	0%	0%
60-64	405	104,956	0.0039	0.0028	0.0027	298	281	136%	144%
65-69	1,349	332,185	0.0041	0.0045	0.0038	1,510	1,271	89%	106%
70-74	2,588	345,764	0.0075	0.0084	0.0078	2,910	2,695	89%	96%
75-79	2,829	226,468	0.0125	0.0145	0.0137	3,291	3,106	86%	91%
80-84	3,441	146,491	0.0235	0.0256	0.0232	3,747	3,398	92%	101%
85-89	4,432	77,337	0.0573	0.0477	0.0421	3,687	3,253	120%	136%
90-94	2,532	26,422	0.0958	0.0921	0.0831	2,434	2,196	104%	115%
95-99	1,623	7,777	0.2087	0.1728	0.1636	1,344	1,272	121%	128%
100-104	250	1,133	0.2211	0.3129	0.2814	355	319	71%	79%
105-109	94	164	0.5724	0.4594	0.3534	75	58	125%	162%
Totals	19,544	1,282,636				19,680	17,886	99%	109%

POLICE/FIRE
POST-RETIREMENT MORTALITY - HEALTHY MALE

Age	Actual Benefits	Total Benefits	Actual Rate	Assumed Rate		Expected Benefits		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)
55-59	353	126,713	0.0028	0.0060	0.0057	762	724	46%	49%
60-64	1,276	174,718	0.0073	0.0091	0.0082	1,590	1,429	80%	89%
65-69	2,128	190,468	0.0112	0.0135	0.0119	2,563	2,267	83%	94%
70-74	2,406	127,718	0.0188	0.0195	0.0181	2,486	2,312	97%	104%
75-79	2,243	73,196	0.0306	0.0311	0.0292	2,273	2,134	99%	105%
80-84	1,526	28,475	0.0536	0.0537	0.0496	1,529	1,411	100%	108%
85-89	1,245	11,599	0.1074	0.1013	0.0946	1,175	1,097	106%	113%
90-94	898	4,406	0.2038	0.1773	0.1725	781	760	115%	118%
95-99	275	686	0.4003	0.3011	0.2924	207	201	133%	137%
Other	0	0	N\A	0.0000	0.0000	0	0	0%	0%
Totals	12,349	737,978				13,366	12,336	92%	100%

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POLICE/FIRE
POST-RETIREMENT MORTALITY - HEALTHY FEMALE

Age	Actual Benefits	Total Benefits	Actual Rate	Assumed Rate		Expected Benefits		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)
55-59	0	10,410	0.0000	0.0023	0.0031	24	33	0%	0%
60-64	0	6,790	0.0000	0.0035	0.0032	24	22	0%	0%
65-69	0	3,784	0.0000	0.0063	0.0044	24	16	0%	0%
70-74	19	1,477	0.0131	0.0096	0.0085	14	13	136%	154%
75-79	0	474	0.0000	0.0178	0.0160	8	8	0%	0%
80-84	66	464	0.1427	0.0398	0.0301	18	14	359%	474%
85-89	0	224	0.0000	0.0562	0.0487	13	11	0%	0%
90-94	0	53	0.0000			5	4	0%	0%
95-99	0	0	N\A			0	0	0%	0%
100-104	0	0	N\A			0	0	0%	0%
105-109	0	0	N\A			0	0	0%	0%
Totals	86	23,676				131	121	66%	71%

ALL EMPLOYEES
POST-RETIREMENT MORTALITY - HEALTHY MALE

| | Actual | | Actual | Assumed Rate | | Expected Benefits | | Actual/Expected | |
| Age | Benefits | Total Benefits | Rate | Current | Proposed | Current (3) * (5) | Proposed (3) * (6) | Current (2) / (7) | Proposed (2) / (8) |
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
40-44	0	253	0.0000	0.0007	0.0008	0	0	0%	0%
45-49	36	8,688	0.0042	0.0014	0.0021	12	18	310%	203%
50-54	250	52,735	0.0047	0.0028	0.0035	149	186	168%	134%
55-59	449	178,008	0.0025	0.0051	0.0049	907	880	50%	51%
60-64	2,929	374,887	0.0078	0.0077	0.0071	2,892	2,671	101%	110%
65-69	6,453	602,398	0.0107	0.0113	0.0103	6,831	6,201	94%	104%
70-74	8,955	536,195	0.0167	0.0163	0.0156	8,744	8,347	102%	107%
75-79	9,492	372,499	0.0255	0.0263	0.0253	9,800	9,432	97%	101%
80-84	13,043	280,436	0.0465	0.0467	0.0442	13,107	12,400	100%	105%
85-89	14,205	164,577	0.0863	0.0837	0.0801	13,769	13,183	103%	108%
90-94	10,083	64,197	0.1571	0.1474	0.1470	9,463	9,440	107%	107%
95-99	3,595	12,739	0.2822	0.2448	0.2458	3,118	3,131	115%	115%
100-104	408	1,354	0.3013	0.3995	0.3424	541	464	75%	88%
Other	0	0	N\A	0.0000	0.0000	0	0	0%	0%
Totals	69,925	2,649,006				69,354	66,370	101%	105%

ALL EMPLOYEES
POST-RETIREMENT MORTALITY - HEALTHY MALE

Age	Actual Benefits	Total Benefits	Actual Rate	Assumed Rate		Expected Benefits		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)
40-44	0	253	0.0000	0.0007	0.0056	0	1	0%	0%
45-49	36	8,688	0.0042	0.0014	0.0078	12	68	310%	53%
50-54	250	52,735	0.0047	0.0028	0.0078	149	413	168%	60%
55-59	449	178,008	0.0025	0.0051	0.0078	907	1,389	50%	32%
60-64	2,929	374,887	0.0078	0.0077	0.0079	2,892	2,951	101%	99%
65-69	6,453	602,398	0.0107	0.0113	0.0103	6,831	6,201	94%	104%
70-74	8,955	536,195	0.0167	0.0163	0.0156	8,744	8,347	102%	107%
75-79	9,492	372,499	0.0255	0.0263	0.0253	9,800	9,432	97%	101%
80-84	13,043	280,436	0.0465	0.0467	0.0442	13,107	12,400	100%	105%
85-89	14,205	164,577	0.0863	0.0837	0.0801	13,769	13,183	103%	108%
90-94	10,083	64,197	0.1571	0.1474	0.1470	9,463	9,440	107%	107%
95-99	3,595	12,739	0.2822	0.2448	0.2458	3,118	3,131	115%	115%
100-104	408	1,354	0.3013	0.3995	0.3424	541	464	75%	88%
Other	0	0	N\A	0.0000	0.0000	0	0	0%	0%
Totals	69,925	2,649,006				69,354	67,438	101%	104%

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ALL EMPLOYEES
POST-RETIREMENT MORTALITY - HEALTHY FEMALE

Age	Actual Benefits	Total Benefits	Actual Rate	Assumed Rate		Expected Benefits		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)
45-49	0	533	0.0000	0.0008	0.0000	0	0	0%	0%
50-54	0	5,976	0.0000	0.0014	0.0025	9	15	0%	0%
55-59	373	63,767	0.0059	0.0021	0.0029	143	188	261%	199%
60-64	1,105	299,369	0.0037	0.0029	0.0030	889	891	124%	124%
65-69	3,372	672,545	0.0050	0.0045	0.0042	3,166	2,809	107%	120%
70-74	5,685	627,450	0.0091	0.0090	0.0087	5,557	5,432	102%	105%
75-79	5,849	407,540	0.0144	0.0154	0.0153	6,241	6,218	94%	94%
80-84	7,769	289,065	0.0269	0.0270	0.0259	7,826	7,490	99%	104%
85-89	9,917	188,260	0.0527	0.0519	0.0476	9,630	8,967	103%	111%
90-94	7,669	79,060	0.0970	0.1013	0.0922	7,656	7,291	100%	105%
95-99	4,087	20,891	0.1957	0.1922	0.1808	3,781	3,778	108%	108%
100-104	705	2,414	0.2919	0.3452	0.3066	769	740	92%	95%
105-109	107	186	0.5768	0.5000	0.3928	90	73	119%	147%
Totals	46,640	# 2,657,055				45,757	43,889	102%	106%

ALL EMPLOYEES
POST-RETIREMENT MORTALITY - HEALTHY FEMALE

Age	Actual Benefits	Total Benefits	Actual Rate	Assumed Rate		Expected Benefits		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)
45-49	0	533	0.0000	0.0008	0.0000	0	0	0%	0%
50-54	0	5,976	0.0000	0.0014	0.0025	9	15	0%	0%
55-59	373	63,767	0.0059	0.0021	0.0030	143	188	261%	198%
60-64	1,105	299,369	0.0037	0.0029	0.0030	889	910	124%	121%
65-69	3,372	672,545	0.0050	0.0045	0.0042	3,166	2,805	107%	120%
70-74	5,685	627,450	0.0091	0.0090	0.0087	5,557	5,432	102%	105%
75-79	5,849	407,540	0.0144	0.0154	0.0153	6,241	6,218	94%	94%
80-84	7,769	289,065	0.0269	0.0270	0.0259	7,826	7,490	99%	104%
85-89	9,917	188,260	0.0527	0.0519	0.0476	9,630	8,967	103%	111%
90-94	7,669	79,060	0.0970	0.1013	0.0922	7,656	7,291	100%	105%
95-99	4,087	20,891	0.1957	0.1922	0.1808	3,781	3,778	108%	108%
100-104	705	2,414	0.2919	0.3452	0.3066	769	740	92%	95%
105-109	107	186	0.5768	0.5000	0.3928	90	73	119%	147%
Totals	46,640	# 2,657,055				45,757	43,906	102%	106%

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ALL EMPLOYEES
POST-RETIREMENT MORTALITY - DISABLED MALE

Age	Actual Benefits	Total Benefits	Actual Rate	Assumed Rate		Expected Benefits		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)
50-54	92	3,650	0.0252	0.0350	0.0350	128	128	72%	72%
55-59	252	9,136	0.0276	0.0350	0.0350	320	320	79%	79%
60-64	562	14,055	0.0400	0.0350	0.0350	492	492	114%	114%
65-69	568	13,817	0.0411	0.0350	0.0350	484	484	118%	118%
70-74	492	8,565	0.0574	0.0350	0.0350	300	300	164%	164%
75-79	361	4,890	0.0737	0.0456	0.0431	223	211	162%	171%
80-84	204	2,043	0.0997	0.0870	0.0833	178	170	115%	120%
85-89	169	1,447	0.1170	0.1556	0.1553	225	225	75%	75%
90-94	202	984	0.2050	0.2509	0.2490	247	245	82%	82%
95-99	37	328	0.1135	0.4247	0.3561	139	117	27%	32%
Other	19	1,484	0.0128	0.0000	0.0000	0	0	0%	0%
Totals	2,992	60,445				2,757	2,709	109%	110%

ALL EMPLOYEES
POST-RETIREMENT MORTALITY - DISABLED FEMALE

Age	Actual Benefits	Total Benefits	Actual Rate	Assumed Rate		Expected Benefits		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)
50-54	66	1,965	0.0334	0.0250	0.0250	49	49	134%	134%
55-59	148	4,359	0.0339	0.0250	0.0250	109	109	136%	136%
60-64	292	9,492	0.0308	0.0250	0.0250	237	237	123%	123%
65-69	387	10,635	0.0364	0.0250	0.0250	266	266	146%	146%
70-74	110	6,516	0.0169	0.0250	0.0250	163	163	68%	68%
75-79	193	2,956	0.0652	0.0276	0.0269	82	79	236%	242%
80-84	62	1,585	0.0392	0.0533	0.0496	84	79	74%	79%
85-89	96	2,150	0.0447	0.1015	0.0967	218	208	44%	46%
90-94	55	684	0.0804	0.1821	0.1811	125	124	44%	44%
95-99	25	131	0.1895	0.3195	0.3070	42	40	59%	62%
Other	6	914	0.0066	0.0000	0.0000	0	0	0%	0%
Totals	1,440	41,399				1,381	1,359	104%	106%

GENERAL EMPLOYEES
SERVICE BASED WITHDRAWAL EXPERIENCE - SALARY WEIGHTED

				Assumed Rate		Expected		Actual/Expected	
Service	Actual	Total	Actual Rate	Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	71,024,209	368,559,449	0.1927	0.1859	0.1859	68,515,202	68,528,132	104%	104%
2	199,404,340	1,176,876,944	0.1694	0.1525	0.1525	179,473,734	179,511,686	111%	111%
3	144,890,838	1,088,513,261	0.1331	0.1246	0.1246	135,628,752	135,677,935	107%	107%
4	106,573,462	983,061,031	0.1084	0.1016	0.1016	99,879,001	99,914,713	107%	107%
5	78,587,859	897,375,600	0.0876	0.0829	0.0829	74,392,437	74,397,709	106%	106%
6	65,869,356	822,047,565	0.0801	0.0679	0.0679	55,817,030	55,810,263	118%	118%
7	55,148,751	698,140,802	0.0790	0.0561	0.0561	39,165,699	39,144,547	141%	141%
8	43,416,936	675,858,305	0.0642	0.0470	0.0470	31,765,340	31,733,662	137%	137%
9	37,099,802	686,666,007	0.0540	0.0401	0.0401	27,535,307	27,530,667	135%	135%
10	28,727,073	640,927,927	0.0448	0.0351	0.0351	22,496,570	22,483,111	128%	128%
11	26,123,470	577,756,366	0.0452	0.0315	0.0315	18,199,326	18,220,762	144%	143%
12	20,776,714	519,991,226	0.0400	0.0291	0.0291	15,131,745	15,148,389	137%	137%
13	17,287,694	470,735,691	0.0367	0.0276	0.0276	12,992,305	12,976,264	133%	133%
14	16,558,830	432,338,019	0.0383	0.0266	0.0266	11,500,191	11,491,029	144%	144%
15	11,932,541	408,252,176	0.0292	0.0259	0.0259	10,573,731	10,593,481	113%	113%
16	11,511,423	400,496,910	0.0287	0.0255	0.0255	10,212,671	10,208,701	113%	113%
17	9,589,543	380,857,468	0.0252	0.0251	0.0251	9,559,522	9,543,208	100%	100%
18	8,669,213	370,946,870	0.0234	0.0245	0.0245	9,088,198	9,103,247	95%	95%
19	6,349,445	362,753,127	0.0175	0.0239	0.0239	8,669,800	8,658,563	73%	73%
20	8,316,258	361,066,770	0.0230	0.0230	0.0230	8,304,536	8,307,785	100%	100%
21	6,252,423	352,606,159	0.0177	0.0220	0.0220	7,757,335	7,744,897	81%	81%
22	5,985,846	343,266,164	0.0174	0.0208	0.0208	7,139,936	7,132,442	84%	84%
23	6,126,420	343,447,573	0.0178	0.0195	0.0195	6,697,228	6,707,209	91%	91%
24	5,714,991	337,049,493	0.0170	0.0183	0.0183	6,168,006	6,179,765	93%	92%
25	3,392,103	229,803,857	0.0148	0.0174	0.0174	3,998,587	3,987,298	85%	85%
26	87,629	112,134,879	0.0008	0.0168	0.0168	1,883,866	1,880,503	5%	5%
27	0	110,835,707	0.0000	0.0168	0.0168	1,862,040	1,858,716	0%	0%
28	0	103,615,014	0.0000	0.0168	0.0168	1,740,732	1,737,625	0%	0%
29	0	92,088,907	0.0000	0.0168	0.0168	1,547,094	1,544,332	0%	0%
30	0	80,687,248	0.0000	0.0168	0.0168	1,355,546	1,353,126	0%	0%
Totals	995,417,169	14,428,756,515				889,051,467	889,109,764	112%	112%

TEACHERS
SERVICE BASED WITHDRAWAL EXPERIENCE - SALARY WEIGHTED

| Service | Actual | Total | Actual Rate | Assumed Rate | | Expected | | Actual/Expected | |
| | | | | Current | Proposed | Current (3) * | Proposed (3) * | Current | Proposed |
(1)	(2)	(3)	(4)	(5)	(6)	(5) (7)	(6) (8)	(2) / (7) (9)	(2) / (8) (10)
1	30,666,357	131,873,530	0.2325	0.2436	0.2436	32,124,392	32,127,877	95%	95%
2	104,184,579	540,056,819	0.1929	0.2008	0.2008	108,443,409	108,467,676	96%	96%
3	88,943,968	496,670,699	0.1791	0.1647	0.1647	81,801,664	81,795,566	109%	109%
4	59,733,923	450,344,629	0.1326	0.1344	0.1344	60,526,318	60,542,472	99%	99%
5	45,436,217	423,652,901	0.1072	0.1094	0.1094	46,347,627	46,351,996	98%	98%
6	34,126,160	393,780,872	0.0867	0.0890	0.0890	35,046,498	35,035,411	97%	97%
7	27,362,721	359,989,846	0.0760	0.0725	0.0725	26,099,264	26,106,871	105%	105%
8	21,983,305	347,874,511	0.0632	0.0595	0.0595	20,698,533	20,698,076	106%	106%
9	18,210,664	349,607,854	0.0521	0.0494	0.0494	17,270,628	17,265,347	105%	105%
10	15,574,874	337,056,772	0.0462	0.0417	0.0417	14,055,267	14,055,267	111%	111%
11	13,898,328	314,225,209	0.0442	0.0360	0.0360	11,312,108	11,313,398	123%	123%
12	11,108,829	295,956,469	0.0375	0.0319	0.0319	9,441,011	9,440,177	118%	118%
13	9,438,157	277,459,259	0.0340	0.0290	0.0290	8,046,319	8,051,605	117%	117%
14	8,809,804	266,516,685	0.0331	0.0270	0.0270	7,195,950	7,209,120	122%	122%
15	6,472,070	252,878,902	0.0256	0.0257	0.0257	6,498,988	6,500,963	100%	100%
16	5,743,430	244,207,752	0.0235	0.0248	0.0248	6,056,352	6,045,036	95%	95%
17	4,447,180	233,124,761	0.0191	0.0240	0.0240	5,594,994	5,591,786	79%	80%
18	3,275,282	220,084,760	0.0149	0.0232	0.0232	5,105,966	5,115,799	64%	64%
19	3,444,000	216,188,942	0.0159	0.0224	0.0224	4,842,632	4,844,357	71%	71%
20	2,414,455	210,586,389	0.0115	0.0214	0.0214	4,506,549	4,505,496	54%	54%
21	2,717,103	207,306,493	0.0131	0.0202	0.0202	4,187,591	4,180,224	65%	65%
22	2,360,429	204,396,400	0.0115	0.0187	0.0187	3,822,213	3,825,268	62%	62%
23	1,139,264	194,670,825	0.0059	0.0171	0.0171	3,328,871	3,325,933	34%	34%
24	1,685,476	176,413,198	0.0096	0.0154	0.0154	2,716,763	2,708,408	62%	62%
25	1,197,336	134,296,993	0.0089	0.0136	0.0136	1,826,439	1,831,316	66%	65%
26	0	46,381,512	0.0000	0.0121	0.0121	561,216	560,936	0%	0%
27	0	47,283,713	0.0000	0.0109	0.0109	515,392	516,502	0%	0%
28	0	48,842,857	0.0000	0.0104	0.0104	507,966	506,139	0%	0%
29	0	44,921,065	0.0000	0.0107	0.0107	480,655	480,159	0%	0%
30	0	39,894,432	0.0000	0.0100	0.0100	398,944	398,944	0%	0%
Totals	524,373,911	7,506,545,049				529,360,519	529,398,125	99%	99%

POLICE & FIRE EMPLOYEES
SERVICE BASED WITHDRAWAL EXPERIENCE - SALARY WEIGHTED

			Actual	Assumed Rate		Expected		Actual/Expected	
				Current	Proposed	Current (3) *	Proposed (3)	Current	Proposed
Service	Actual	Total	Rate	Current	Proposed	(5)	* (6)	(2) / (7)	(2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	3,532,306	27,922,744	0.1265	0.1100	0.1100	3,071,502	3,071,502	115%	115%
2	8,999,201	90,392,111	0.0996	0.0950	0.0950	8,587,251	8,587,251	105%	105%
3	4,194,797	103,089,761	0.0407	0.0370	0.0370	3,814,321	3,818,857	110%	110%
4	2,976,260	103,485,768	0.0288	0.0301	0.0301	3,114,922	3,119,876	96%	95%
5	3,429,060	103,571,009	0.0331	0.0261	0.0261	2,703,203	2,704,644	127%	127%
6	2,902,993	105,168,583	0.0276	0.0233	0.0233	2,450,428	2,445,354	118%	119%
7	2,220,892	102,111,137	0.0217	0.0210	0.0210	2,144,334	2,147,571	104%	103%
8	2,922,544	106,090,899	0.0275	0.0192	0.0192	2,036,945	2,038,832	143%	143%
9	1,939,485	112,685,967	0.0172	0.0177	0.0177	1,994,542	1,992,754	97%	97%
10	1,804,599	116,946,665	0.0154	0.0164	0.0164	1,917,925	1,912,737	94%	94%
11	1,803,038	115,477,836	0.0156	0.0152	0.0152	1,755,263	1,753,394	103%	103%
12	1,522,566	117,570,997	0.0130	0.0141	0.0141	1,657,751	1,661,934	92%	92%
13	1,450,715	116,596,717	0.0124	0.0132	0.0132	1,539,077	1,537,601	94%	94%
14	1,500,117	114,380,685	0.0131	0.0123	0.0123	1,406,882	1,409,360	107%	106%
15	1,300,809	117,368,142	0.0111	0.0115	0.0115	1,349,734	1,352,705	96%	96%
16	1,700,455	115,243,772	0.0148	0.0108	0.0108	1,244,633	1,243,252	137%	137%
17	1,335,136	119,150,407	0.0112	0.0101	0.0101	1,203,419	1,203,611	111%	111%
18	881,566	119,168,286	0.0074	0.0095	0.0095	1,132,099	1,127,274	78%	78%
19	1,317,637	117,439,116	0.0112	0.0089	0.0089	1,045,208	1,040,083	126%	127%
20	828,683	115,469,542	0.0072	0.0083	0.0083	958,397	956,976	86%	87%
21	1,117,567	115,093,965	0.0097	0.0077	0.0077	886,224	891,953	126%	125%
22	1,053,662	113,189,674	0.0093	0.0072	0.0072	814,966	819,432	129%	129%
23	1,214,208	112,146,173	0.0108	0.0068	0.0068	762,594	757,440	159%	160%
24	997,083	109,288,501	0.0091	0.0063	0.0063	688,518	687,558	145%	145%
25	762,103	68,981,688	0.0110	0.0058	0.0058	400,094	403,472	190%	189%
Totals	53,707,482	2,658,030,145				48,680,230	48,685,423	110%	110%