Employees' Retirement System of Rhode Island

Actuarial Experience Investigation
for the Period Ending June 30, 2019

GRS

May 6, 2020

Retirement Board
50 Service Avenue, 2nd Floor
Warwick, RI 02886-1021

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

Dear Members of the Board:

We are pleased to present our report on the results of the 2020 Actuarial Experience Investigation Study for the Employees' Retirement System of Rhode Island (ERSRI). It includes a discussion of recent experience, it presents our recommendations for new actuarial assumptions and methods, and it provides information about the actuarial impact of these recommendations on the liabilities and other key actuarial measures. This report contains the results of the experience study for all groups covered under ERSRI, including State Employees, Teachers, MERS, State Police, State Judges, and the Teacher Survivor Benefit Plan.

Using the recommended set of actuarial assumptions should present a more accurate portrayal of ERSRI's financial condition and should reduce the magnitude of future experience gains and losses.

This study was conducted in accordance with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board. The undersigned meet all of the Qualification Standards of the American Academy of Actuaries. In addition, the undersigned have extensive experience as retained public sector actuaries for several large, statewide public retirement systems.

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

Respectfully submitted,

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SECTION I

EXECUTIVE SUMMARY

Section I
Summary of Recommendations

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

I. Separate Correctional Officers from State Employees for all assumptions.
II. Update the underlying mortality tables from the RP-2014 set of tables to the public sector based PUB(10) tables. As adjustments are made based on the actual experience of ERSRI, this had no material impact to the liabilities or contributions.
III. Slightly increase probabilities of turnover.
IV. Slightly decrease probabilities of retirement.
V. Slight modifications to the probabilities of disability, including adding material incidence of disability for members in the age ranges that historically have been eligible to retire but under prospective provisions are not..
VI. Lower wage assumptions for Judges from 3.00% to 2.75%.

The net impact to the valuation process is a slight decrease in liabilities and costs for most groups. The following is a brief summary of our findings.

Economic Assumptions

1. We find the current 2.50% general inflation assumption reasonable. We do find that the actual experience from the past couple of decades has been lower than the 2.50%, and several of the expectations from forward looking sources are lower than the 2.50%, thus a lower assumption would also be reasonable. However, the formula for post-retirement benefit adjustments is partially based on actual inflation results, thus the risk to liability growth is tilted towards higher inflation versus lower. For this reason, we would recommend having an assumption higher in the range of reasonable assumptions. This is consistent with practices of other actuarial practitioners. For example, the actuary for the Social Security Administration uses a 2.6% assumption in valuing projected liabilities, and that program has benefits directly tied to actual inflation.

2. We find the current 7.00% investment return assumption reasonable. Based on the current target portfolio and the 2020 capital market expectations of NEPC, the investment consultant for the Rhode Island SIC, the median expected return net of all expenses is 6.26% over a ten year period and 7.14% over a 30 year period. These same data points based on the 2019 assumptions were 6.80% over a ten year period and 7.71% over a 30 year period. Clearly there was a significant change from year to year, and this was heavily based on the strong returns during 2019.   Likewise, the 2019 numbers were higher than the 2018 expectations because of a weak 2018.   Thus, there is significant volatility in these numbers from year to year.   In fact, if NEPC were to redo their analysis after the first two months of 2020, their expectations could likely be different.

   The direct average of the four data points above would be 6.98%, which is reasonably close to the current assumption of 7.00%. Given the large change in this assumption from 7.50% to 7.00% in the

2017 experience study, and that the budget impact from that change is still being phased in, we recommend no change at this time. Please note this assumption is net of administrative expenses, which are assumed to be 0.10% of plan assets per annum.

3. Based on recent national, regional, and local trends, we continue to find the real (above price inflation) general wage growth assumption of 0.50% to be reasonable.   This is the portion of wage growth tied to general productivity increases across all members. This assumption represents the average increase in wages in the general Rhode Island, regional, and national economy. It is used to index salaries for each cohort of new entrants in projections and as a starting block for the individual salary increase assumptions and for the payroll growth assumption for each System separately to determine projected amortization schedules of the unfunded liability.

4. The assumed salary increase schedules for individuals include an ultimate component that begins with the general wage inflation assumption above and may add on additional increases for individual merit (which would include promotions) and then an additional component for step rates based on service.

    a. For General State Employees, we are recommending no change to the current salary increase schedules. This is an assumed salary increase assumption of 3.25% per annum for longer service members (3.00% GWI plus 0.25%). Over the past decade, members with more than 25 years of service have received increases of 2.63%, or 0.62% below the 3.25% assumed. However, that difference can all be attributed to actual inflation being lower than the 2.50% assumption. The 2.63% is 0.89% higher than the 1.73% actual inflation during the past decade, which compares favorably with the 0.75% built into the current assumption.

    b. For Correctional Officers, we are recommending creating their own set of assumptions, including projected salary increases. The ultimate salary increase is the same 3.25% as general State Employees, but the step portion is quite longer and higher.

    c. Similarly for Teachers, we are recommending no change to the current salary increase schedules.   This is an assumed salary increase assumption of 3.00% per annum for longer service members. Over the past decade, members with more than 10 years of service have received increases of 2.10%, or 0.90% below the 3.00% assumed. However, that difference can all be attributed to actual inflation being lower than the 2.50% assumption. The 2.10% is 0.36% higher than the 1.73% actual inflation during the past decade, which compares favorably with the 0.50% built into the current assumption.

    d. For General MERS Employees, the experience and the current assumptions are very similar to State Employees, and thus we are recommending no change there as well.

    e. For Public Safety Employees, we are recommending no change in the 4.00% ultimate component or the step components. For this group, the step rate portion is much shorter (only 3-6 years) and thus there are more across the board increases and less portioning by service.

    f. For State Police, we are recommending no change in the current salary schedules. The expected increases for this group are quite higher than the other groups, but the data is more volatile

from year to year. Actual experience has outpaced the current assumption, but it is mainly from a large, legislated increase in one of the years that may not be reflective of long term trends.

  g. For Judges, we are recommending a 0.25% decrease from the current 3.00% flat assumption to 2.75%.   The actual increases have been only 0.19% above a very low actual inflation.

5. In conjunction with the mainly unchanged wage inflation assumptions, we are recommending no change to the payroll growth rate assumptions for all groups except Judges. For Judges, consistent with the 0.25% decrease in the salary scale, we are recommending a 0.25% decrease in the payroll growth rate assumption. Changing the payroll growth assumption has no impact on the liabilities, but does assume there is lower growth in the future payroll to amortize the UAAL, which results in an increase in the current contribution requirements.

6. We recommend no change in the assumption for the contingent post-retirement benefit adjustments of 2.15% per year.

Mortality Assumptions

7. Experience has tracked well with the current assumptions. The current assumptions include provisions for further improvement into the future that is also tracking well with experience and lessens the risk of significant changes to the assumptions in the future.   In 2019 new industry standard mortality tables were issued based on public sector data and the shape of the tables do provide a better match across all ages, thus we are recommending changing to using those as our base tables.   For the previous tables and the proposed ones, we adjust the tables based on the actual experience of ERSRI, thus after the adjustments there is not much impact in the liabilities or costs when the change is made. For the improvement scale, we are recommending continued use of the ultimate rates of the MP projection scales.

8. We recommend updating the post-retirement mortality tables for disabled retirees to the new public sector tables for disabled lives as well, based on occupation.

9. We recommend updating the post-retirement mortality tables for active members to the new public sector tables for employees as well, based on occupation.

Other Demographic Assumptions

10. For State Employees, Teachers, and General MERS, we now have six full years of data after the effective date of RIRSA. The current assumption has a flat percentage for all years once the member is eligible, except for the first year the member can retire unreduced, which has a substantially higher rate.   The data for all groups shows members during this first year of eligibility are not electing to retire in the numbers expected by the current assumptions. We have recommended decreases in this probability during the first year of eligibility along with slight decreases at other ages. This change decreased contribution rates.

11. For Corrections, MERS Police and Fire, and State Police, we have increased probabilities of retirement at most service points, but removed the large probability at first eligibility for retirement.

12. For State Employees, and Teachers we have increased the probability of turnover by 5%. For corrections and MERS P&F we have created new tables with materially higher probabilities of turnover than current assumptions. This change will have a positive impact on liabilities and contribution rates.

13. We recommend slightly modifying the rates of disability for most groups based on the experience of the individual group. For members in the age ranges that historically would have been eligible for unreduced retirement and now will not be, we have added 1% to the probability of disability to reflect that some of the previous unreduced retirements could have qualified for disability.

14. We recommend no change to the current marriage assumption and spousal age difference.

15. For the Teacher Survivor Benefit Plan, we recommend no modifications to the current marriage, refund, and number of children assumptions. The current assumptions were developed in the 2017 study based on recent elections for members of the Plan and data from the national census and find them to still be reasonable.

Actuarial Methods and Policies

16. We recommend no change to the current asset smoothing method.

17. We recommend no change to the current funding method. The individual 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. We continue to believe this is the most appropriate funding method.

Impact on Liabilities and Contributions

Item	Current Assumptions and Methods	Recommended Assumptions and Methods	Change
State Employees			
Unfunded actuarial accrued liability	$2,244 million	$2,193 million	-$51 million
Funded ratio	53.27%	53.84%	0.57%
Teachers			
Unfunded actuarial accrued liability	$3,128 million	$3,061 million	-$67 million
Funded ratio	55.28%	55.81%	0.53%
SPRBT			
Unfunded actuarial accrued liability	$26 million	$28 million	$1 million
Funded ratio	84.86%	84.19%	-0.67%
JRBT			
Unfunded actuarial accrued liability	$3 million	$6 million	$2 million
Funded ratio	96.02%	93.35%	-2.67%
MERS General			
Unfunded actuarial accrued liability	$240 million	$228 million	-$12 million
Funded ratio	81.28%	82.07%	0.80%
MERS Police and Fire			
Unfunded actuarial accrued liability	$156 million	$159 million	$3 million
Funded ratio	79.11%	78.79%	-0.32%
Teacher Survivor Benefit Plan			
Unfunded actuarial accrued liability	-$113 million	-$121 million	-$8 million
Funded ratio	149.73%	155.64%	5.90%

SECTION II

INTRODUCTION

Section II
Introduction

Summary of Process

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

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

It is important to recognize that the impact from various outcomes and the ability to adjust from experience deviating from the assumption are not symmetric. Due to compounding economic forces, legal limitations, and moral obligations outcomes from underestimating future liabilities are much more difficult to manage than outcomes of overestimates, 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.

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

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

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

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

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

The last such actuarial experience investigation was performed in conjunction with the June 30, 2017 actuarial valuation. For this experience study, we have analyzed ERSRI's experience for the six-year period from June 30, 2013 through June 30, 2019 (FY 2013 – FY 2019). Note that the first three years were also included in the last experience study.

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

In a few instances, we chose to use a longer period, up to ten to twenty years, in order to further increase the soundness of our conclusions.

In an experience study, we first determine the number of deaths, retirements, etc. that occurred during the period. Then we determine the number expected to occur, based on the current actuarial assumptions. The number of "expected" decrements is determined by multiplying the probability of the occurrence at the given age, by the "exposures" at that same age. For example, let's look at a rate of retirement of 15% at age 55. The number of exposures can only be those members who are age 55 and eligible for retirement at that time. Thus they are considered "exposed" to that assumption. Finally, we calculate the A/E ratio, where "A" is the actual number (of retirements, for example) and "E" is the expected number. If the current assumptions were "perfect", the A/E ratio would be 100%. When it varies much from this figure, it is a sign that new assumptions may be needed. (However, in some cases we prefer to set our assumptions to produce an A/E ratio a little above or below 100%, in order to introduce some conservatism.) Of course we

not only look at the assumptions as a whole, but we also review how well they fit the actual results by gender, by age, and by service.

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

Please bear in mind that, while the recommended assumption set represents our best estimate, there are other reasonable assumptions sets that could be supported.

Organization of Report

Section III contains our findings and recommendations for each actuarial assumption. The impact of adopting our recommendations on liabilities and contribution rates is shown in Section IV. Section V summarizes the recommended changes. Section VI presents a summary of all the actuarial assumptions and methods, including the recommended changes. Finally, tables summarizing the analysis of the assumptions are in Section VII.

Section VII Exhibits

The exhibits in Section VII should generally be self-explanatory. For example, on page 83, we show the exhibit analyzing the termination rates for Teachers. The second column shows the total number of Teachers who terminated during the study period. This excludes members who died, became disabled or retired. Column (3), labeled "Total Count" shows the total exposures. This is the number of Teachers who could have terminated during any of the years. On this exhibit, the exposures exclude anyone eligible for retirement. A member is counted in each year he could have terminated, so the total shown is the total exposures for the six-year period. Colum (4) shows the probability of termination based on the raw data. That is, it is the result of dividing the actual number of terminations (col. 2) by the number exposed (col. 3). Column (5) shows the current termination rate and column (6) shows the new recommended termination rate. Columns (7) and (8) show the expected numbers 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

Section III
Analysis of Experience and Recommendations

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

Inflation and Investment Return Assumptions

Actuarial Standards of Practice (ASOP) No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, provides guidance to actuaries on giving advice on selecting economic assumptions for measuring obligations for defined benefit plans.

Generally, the economic assumptions are much more subjective in nature than the demographic assumptions. As no one knows what the future holds, it is necessary for the actuary to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment. The actuary should consider a number of factors, including the purpose and nature of the measurement, and appropriate recent and long-term historical economic data. However, the standard explicitly advises the actuary not to give undue weight to recent and/or historical experience.

Although recognizing that there is not one right answer, the current standard calls for the actuary to develop a best-estimate for each economic assumption. 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.

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, payroll growth, and cost-of-living increases. The current annual inflation assumption is 2.50%.

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 Calendar Year Averages
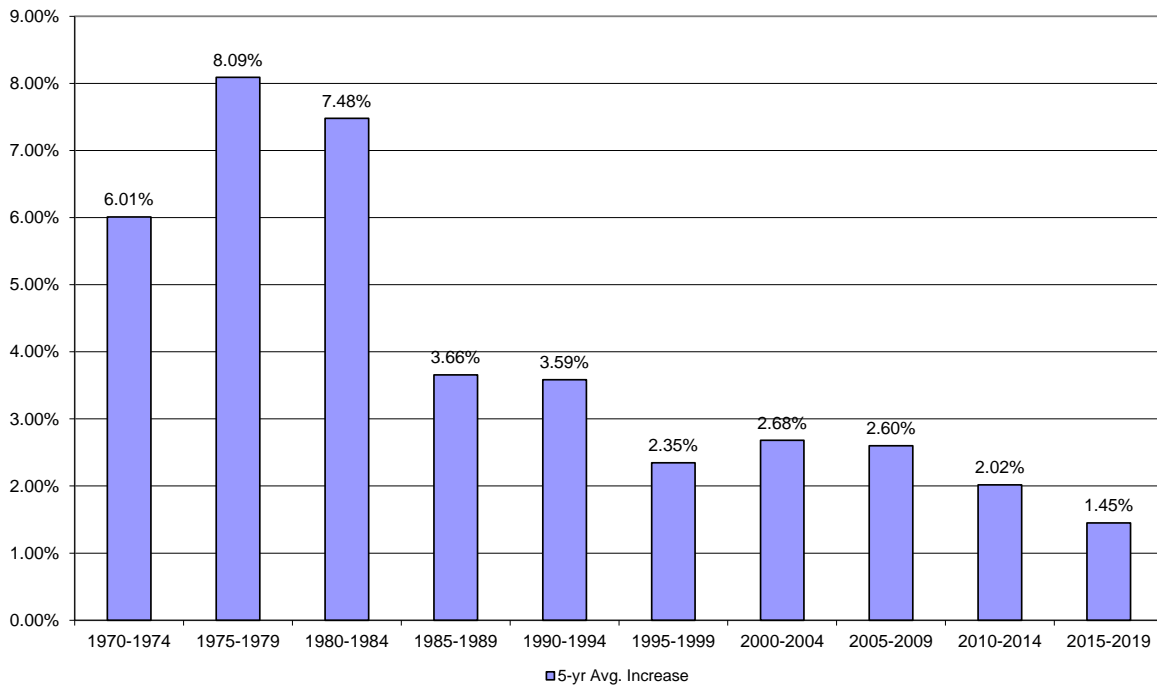
The following table shows the average inflation over various periods, ending June 30, 2019:

Periods Ending June 30, 2019	Average Annual Increase in CPI-U
Last five (5) years	1.45%
Last ten (10) years	1.73%
Last fifteen (15) years	2.02%
Last twenty (20) years	2.19%
Last twenty-five (25) years	2.22%
Last thirty (30) years	2.44%

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.

Forecasts from Investment Consulting Firms

Most investment consulting firms, in setting their capital market assumptions, assume that inflation will be 2.50% or less. A 2019 survey of capital market assumptions of sixteen investment consulting firms who develop longer-term assumptions (20 years or more) performed by Horizon Actuarial Services, LLC, shows that the expected rate of inflation, as measured by CPI-U, for the next 20 years ranged from 1.8% to 2.7% with a median expectation of 2.3%. NEPC, ERS' investment consultant, assumes that inflation will increase at the rate of 2.30% per year over the next ten years and over a 30 year time horizon.

Expectations Implied in the Bond Market

Another source of information about future inflation is the market for US Treasury bonds. For example, the December 31, 2019 yield for 20-year inflation indexed Treasury bonds was 0.39% plus actual inflation. The yield for 20-year non-indexed US Treasury bonds was 2.25%. Simplistically, this means that on that day the bond market was predicting that inflation over the next twenty years would average 1.85% [(1 + 2.25%) / (1 + 0.39%) - 1] per year. This is consistent with most forecasts of inflation and overall economic growth being lower over the next decade. The chart below shows the historical market implied inflation from December 2010 through December 2019..

| | 10 Year | | | 20 Year | | | 30 Year | | |
Date	TIPS	Non-Indexed	Spread	TIPS	Non-Indexed	Spread	TIPS on-Indexed		Spread
12/31/2010	1.00	3.30	2.28%	1.59	4.13	2.50%	1.86	4.34	2.43%
12/31/2011	(0.07)	1.89	1.96%	0.53	2.57	2.03%	0.78	2.89	2.09%
12/31/2012	(0.67)	1.78	2.47%	0.15	2.54	2.39%	0.41	2.95	2.53%
12/31/2013	0.80	3.04	2.22%	1.36	3.72	2.33%	1.64	3.96	2.28%
12/31/2014	0.49	2.17	1.67%	0.68	2.47	1.78%	0.83	2.75	1.90%
12/31/2015	0.73	2.27	1.53%	1.07	2.67	1.58%	1.28	3.01	1.71%
12/31/2016	0.50	2.45	1.94%	0.82	2.79	1.95%	0.99	3.06	2.05%
12/31/2017	0.44	2.40	1.95%	0.61	2.58	1.96%	0.73	2.74	2.00%
12/31/2018	0.98	2.69	1.69%	1.09	2.87	1.76%	1.21	3.02	1.79%
12/31/2019	0.15	1.92	1.77%	0.39	2.25	1.85%	0.58	2.39	1.80%

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

Forecasts from Social Security Administration

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

Survey of Professional Forecasters and Fed Policy

The Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. Their most recent forecast (first quarter of 2020) was for inflation over the next ten years (2020 to 2029) to average 2.20%. Most observers expect inflation to continue to be low as the economy works out of the recession.

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

Comparison of Inflation Expectations from 2017 to 2020

Finally, the table below provides a comparison of the inflation expectations documented in the 2017 experience study report and the current inflation expectations.

	Inflation Expectations		
Source	2017	2020	Change
(1)	(2)	(3)	(4)
ERSRI' Investment Consultant	2.25%	2.30%	+0.05%
Implied Inflation 20-Year Treasuries	2.00%	1.85%	-0.15%
SSA Trustees Report	2.60%	2.60%	0.00%
Survey of Professional Forecasters	2.15%	2.20%	+0.05%

Recommendation

We find the current 2.50% general inflation assumption reasonable. We do find that the actual experience from the past couple of decades has been lower than the 2.50%, and several of the expectations from forward looking sources are lower than the 2.50%, thus a lower assumption would also be reasonable. However, the formula for post-retirement benefit adjustments is partially based on actual inflation results, thus the risk to liability growth is tilted towards higher inflation versus lower. For this reason, we would recommend having an assumption higher in the range of reasonable assumptions. This is consistent with practices of other actuarial practitioners. For example, the actuary for the Social Security Administration uses a 2.6% assumption in valuing projected liabilities, and that program has benefits directly tied to actual inflation.

Investment Return Assumption

The investment return assumption is one of the principal assumptions used in any actuarial valuation of a retirement plan. It is used to discount future expected benefit payments to the valuation date in order to determine the liabilities of the plans. Even a small change to this assumption can produce significant changes to the liabilities and contribution rates. Currently, it is assumed that future investment returns will average 7.00% per year, net of investment and administrative expenses. The current assumption assumes inflation of 2.50% per annum and an annual real rate of return of 4.50%, net of expenses.

The chart below shows a history of ERSRI' market returns through FY 2019.
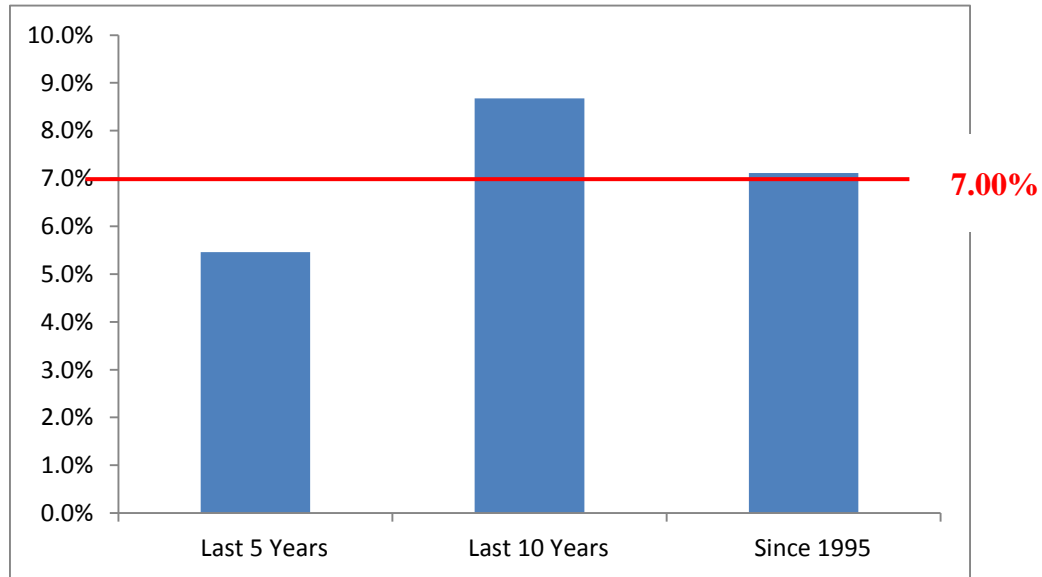
Thus, since 1995, the compound return of the System has achieved the current assumption of 7.0%. Even so, past performance, even averaged over a twenty-five year period, is not a reliable indicator of future performance for this assumption. The actual asset allocation of the trust fund will significantly 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. And of course, bond yields are materially different than they were in 1995.

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 ERSRI 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 2020.

%
>8.5
8.5
>8.0 <8.5
8.0
>7.5 <8.0
7.5
>7.0 <7.5
7.0

%
8.0
>7.5 <8.0
7.5
>7.0 <7.5
Median Current Assumption
= 7.25% for ERSRI
7.0
< 7.0

01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20

Public Fund Survey, NASRA Feb-20

Fiscal Year
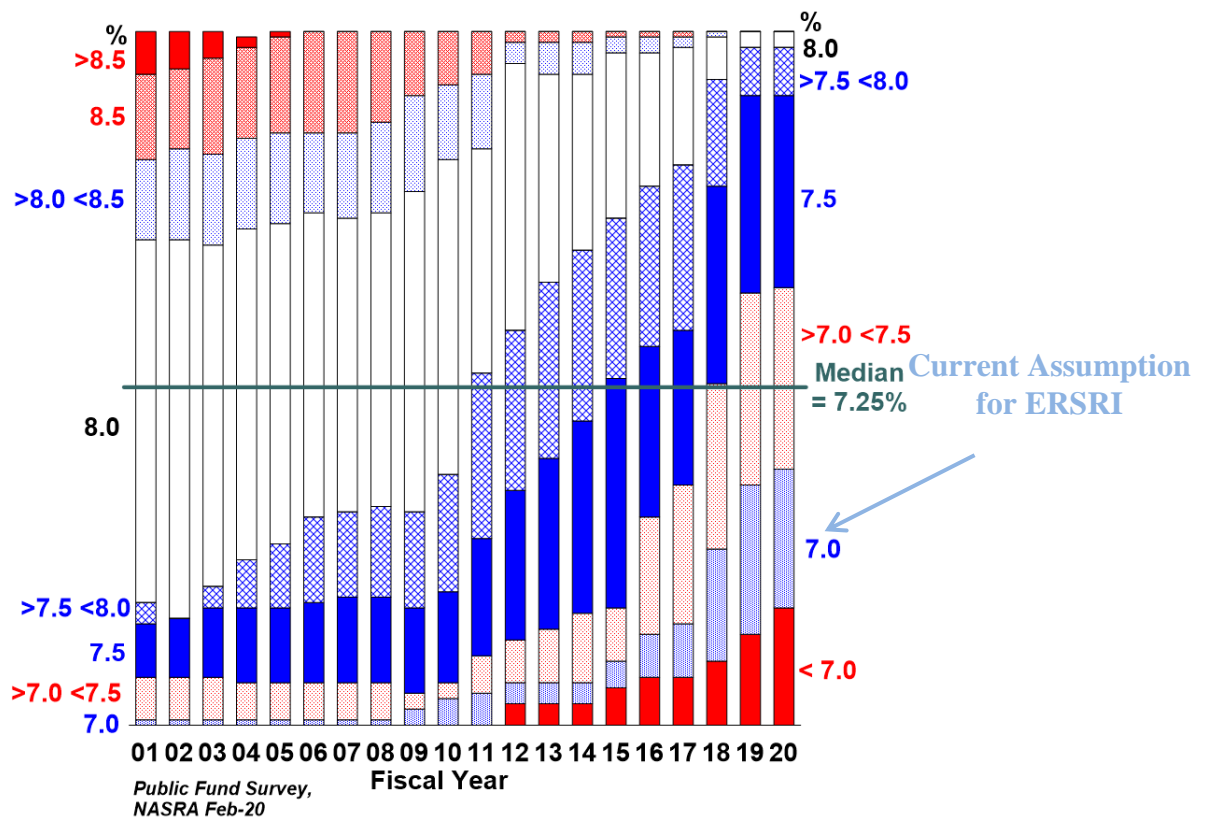
Source: 2020 Public Plans Database. Median investment return assumption: 7.25% nominal return.

The graphic includes the overall national trends in this assumption. The median rate of return is 7.25%, down from 7.50% when reviewed in the 2017 experience study.   However, if the data is filtered to only look at Systems that that performed experience studies in the last 18-24 months, the average is closer to 7.00%, and the number of systems below 7.00% continues to increase.

Expenses

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

For investment expenses, investment consulting firms periodically issue reports that describe their capital market assumptions. The estimates for core investments (i.e., fixed income, equities, and real estate) are generally based on anticipated returns produced by passive index funds that are net of investment related fees. The investment return expectations for the alternative asset class such as private equity and hedge funds are also net of investment expenses. Therefore, we did not make any adjustments to account for investment related expenses. Some of the Retirement Systems may also employ active management investment strategies that result in higher investment expenses compared to strategies that invest in passive index funds. We have assumed that active management strategies would result in the same returns, net of investment expenses, as passive management strategies.

On the other hand, there is a divergence of practice on the handling of administrative expenses. Some actuaries make an assumption that administrative expenses will be some fixed or increasing dollar amount. Others assume that the administrative expenses will be some percentage of the plan's actuarial liabilities or normal cost. And others treat administrative expenses like investment expenses, as an offset to the investment return assumption. The historical practice for ERSRI has been to set the investment return assumption as the net return after payment of both investment and administrative expenses. The following chart shows the administrative expenses for the last six years expressed as a percentage of the assets, adjusted for cash flow, each year:

Fiscal Year	Administrative
2019	0.10%
2018	0.11%
2017	0.10%
2016	0.09%
2015	0.10%
2014	0.11%
Average	0.10%

Based on this information, we have assumed that 0.10% (10 basis points) of each year's investment return will be used to pay administrative expenses. This assumption is then used in setting the investment return assumption.

Asset Allocation

We believe the most appropriate approach to selecting an investment return assumption is to identify expected returns given the funds' asset allocation mapped to forward-looking capital market assumptions. 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 nationally recognized investment consulting firms, including NEPC, which is the SIC's investment consultant.

The following is an excerpt from ASOP 27 on the topic of using experts:

> **Section 3.5.6 Views of Experts** – *Economic data and analyses are available from a variety of sources, including representatives of the plan sponsor and administrator, investment advisors, economists, and other professionals. When the actuary is responsible for selecting or giving advice on selecting economic assumptions within the scope of this standard, the actuary may incorporate the views of experts but the selection or advice should reflect the actuary's professional judgement.*

In our professional judgement, it is appropriate to rely on NEPC's input as part of our consideration in making a recommendation as they are the experts and have specialized knowledge in this subject matter. This is the same data being used for investment decision making, and thus is a reasonable set of data for use in decisions on funding as well.

NEPC develops two sets of capital market assumptions, a "short-term" based on a 10-year investment horizon and a "long-term" based on a 30-year investment horizon, and the table below provides the expected forward-looking return (geometric) over each time period.

Expected Geometric Return Statistics based on NEPC's
2020 Capital Market Expectations

Item	Short-Term (10-Year)	Long-Term (30-Year)
(1)	(2)	(3)
Expected Nominal Compound Return	6.16%	7.24%

The expected return for the System based on NEPC's assumptions is approximately 90 basis points higher over the next 30 years compared to the next 10 years. For comparison, the same values based on NEPC's 2019 capital market expectations were 6.70% over the 10-year period and 7.81% over a 30-year time period. Clearly there was a significant change from year to year, and this was heavily based on the strong returns during 2019. Likewise, the 2019 numbers were higher than the 2018 expectations because of a weak 2018. Thus, there is significant volatility in these numbers from year to year. In fact, if NEPC were to redo their analysis after the first two months of 2020, their expectations would likely be different.

For time horizon, the duration of the current liabilities of ERSRI are much longer than the 10 year time horizon in the short term expectations, but the 30 year expectations are likewise much too long. Our typical approach is to use the range of the two values, with the midpoint being an approximation of the appropriate time horizon for a retirement system open to new entrants.

Adjustments should be made for differences in inflation expectations and administrative expenses. For example, NEPC's 10 year inflation assumption is 2.30% while the valuation is assuming 2.50%, thus 0.20% can be added to the 10 year value of 6.16% to produce 6.36%. 0.10% in administrative expenses should also be subtracted to produce a 6.26% 10 year return, net of all expenses, and with the 2.50% inflation assumption. Performing the same exercise on all four data points would produce the following expectations:

NEPC' 2019 and 2020 median expectations for the current Target Portfolio, adjusted for inflation differences and net of administrative expenses			
	10 Year	30 Year	Average
2019	6.80%	7.71%	7.26%
2020	6.26%	7.14%	6.70%
Average	6.53%	7.43%	6.98%

Thus, the midpoint based on time horizon is 6.70% in 2020 and was 7.26% in 2019. The 2019 expectations were determined immediately following a poor calendar year 2018 while the 2020 expectations were

following very strong 2019.   It is valuable to have stability in this assumption and which year a System had an experience study performed should not yield significant differences in the assumption.

Thus, we find the current 7.00% investment return assumption reasonable and are not recommending a change at this time.

Post-Retirement Benefit Increases

Most members of ERSRI are eligible for post-retirement increases if the individual plan they participate in is over 80% funded (State, Teachers, JRBT, and STPL are all commingled to determine if they meet this requirement).

The increase is calculated as the sum of (1) half of the average compounded investment return during the prior five fiscal years, net of expenses, in excess of a subtrahend equal to the investment return assumption less 2.0%, with the result not less than 0% nor greater than 4% and (2) half of the increase in the September CPI-U for the year prior to the COLA, but not more than 3.0%. The five year average return is represented as the annual rate of return on the actuarial value of assets. We perform one system-wide calculation so all retirees who receive an adjustment will receive the same adjustment.

We will continue to assume the investment related portion is 2.0%. For the CPI related component, we currently assume this will average 2.30% over time.

Thus, the assumption for future post-retirement benefit increases will be 2.15% (the average of 2.00% and 2.30%).

Regarding the 80% funded contingency, the upcoming 2020 valuation for State Employees, Teachers, JRBT, and STPL assumed the post-retirement increases would be suspended for 7 years. This fixed ending period was set in 2011 following the pension reform and has been declining by 1 each year. Based on projections from the 2019 valuation and a modified version based on the recommended assumption set in this report, we recommend the continued use of this assumption, meaning the 2020 valuations will assume the increases will be suspended for 7 years following the valuation date. The number of years the post-retirement increases are expected to be suspended will continue to decrease by 1 year in each future valuation.

For MERS, most of the MERS units are either already 80% funded or are very close to being so and thus will be 80% funded over a short period of time.   As such, we have not reflected any suspension in the increases except for one that may be known to occur the year following the valuation.   We recommend continuing this methodology.

General Wage Inflation

The valuation currently assumes that General Wage Inflation (GWI) will be 0.50% above price inflation. The 0.50% 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. Another way to look at this assumption is the projected growth rate of the budget of the plan sponsor. This assumption is used primarily to index each cohort of new entrants used in projections, as a building block for the individual salary increase assumption and as a starting point in determining the payroll growth assumption.

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 and 20 years, for the national economy as a whole, general wage inflation has grown 2.35% and 3.00% annually.

However, wage inflation has outpaced price inflation by about 0.90% for the last 10 years, and for the last 20 years, wage inflation has exceeded price inflation by about 0.80%. Since 1951, wage inflation has been about 0.91% larger than price inflation each year. The recent spread has been during a time of very low inflation, which likely means the spread is slightly overstated and the nominal values should not be ignored.

For ERSRI specifically, the median average salary for State Employees has changed by 2.2% per year over that last decade, while the same value for Teachers has been 1.7%. Netting against the actual inflation of 1.7% produces an actual change above inflation of 0.5% for State Employees and 0.0% for Teachers.

The current assumption is consistent with national trends and ERSRI experience and we recommend no change to the 0.5% spread above inflation. The lower average increase for Teachers above is due to the demographics of that group as discussed below.   If only looking at the change in median average salary for new Teachers over the last decade, the average increase has been consistent with the 2.2% seen overall for State Employees.

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; or
- Merit increases, if available.

Our salary increase assumption is meant to reflect all of these types of increases.

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.

Salary increases for governmental employees can vary significantly from year to year. When the employer's tax revenues stall or increase slowly, salary increases often are small or nonexistent. During good times, salary increases can be larger. Our experience across many governmental plans also shows several occasions

in which salary increases will be low for a period of several years followed by a significant increase in one year. Therefore, for this assumption in particular, we prefer to use data over a longer period in establishing our assumptions. We used a ten-year period for this analysis.

Most actuaries recommend salary increase assumptions that include an element that depends on the member's age or service, especially for large, public retirement systems. It is typical to assume larger pay increases for younger or shorter-service employees. This is done in order to reflect pay increases that accompany step increases, changes in job responsibility, promotions, demonstrated merit, etc. The experience shows salaries have been 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.

Thus, if we graph the increases by service, we usually get a graph where the increases are larger for shorter service employees and then level out at a lower level after a period that may be ten to twenty-five years. It might look like this, although in practice not this smooth:

Therefore, we divide the task of setting the salary increase into two pieces:

1. Determining the assumption for long-service employees
2. Determining the additional increases to be applied to shorter-service employees

The next two subsections will discuss these components of the salary assumption.

Salary increase assumptions for long-service employees (ultimate salary scale)

Many of the factors that result in pay increases are largely inapplicable or have diminished importance for longer-service employees. Step or service-related increases have stopped or are minimal. Promotions occur with less frequency. Additional training or acquisition of advanced degrees usually occurs early in the career. In theory, then, salary increases for longer-service employees are heavily driven by wage inflation, with only a small factor for individual merit. We will define the last value in our salary increase assumption as the ultimate component. This will be made up of price inflation plus general productivity plus individual merit. We may also sometimes refer to the sum of the general productivity and the individual merit as the individual productivity component.

For State Employees, our study shows that for members with at least twenty-five years of service, the average annual salary increase during the ten-year period was 2.63%. Inflation during this 10-year period averaged 1.73%. Therefore, long-service employees received an average salary increase of 0.89% above inflation (individual productivity component). This is very close to the current 0.75% individual productivity component and thus we are recommending no change. The following table summarizes this for all of the groups:

Ultimate Salary Scale (10-Year Experience)							
	State	Corr	Teachers	MERS General	MERS P&F	State Police	Judges
Long Service Definition (Years)	26	26	11	16	9	26	1
Current Assumption	3.25%	3.25%	3.00%	3.25%	4.00%	3.75%	3.00%
Less Assumed Inflation	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%
Assumed Individual Productivity	0.75%	0.75%	0.50%	0.75%	1.50%	1.25%	0.50%
Actual Productivity Above Inflation for last 10 Years	0.89%	1.16%	0.36%	0.69%	1.89%	4.66%	0.19%
Recommended Individual Productivity Assumption	0.75%	0.75%	0.50%	0.75%	1.50%	1.25%	0.25%
Recommended Ultimate Salary Increase Assumption	3.25%	3.25%	3.00%	3.25%	4.00%	3.75%	2.75%
Change	-	-	-	-	-	-	-0.25%

We are not recommending any changes except for Judges. State Police look quite high, but that is heavily driven by one large legislated increase that might distort long term experience. MERS PF is also slightly higher, but looking at just the last three years since the previous study the experience has been lower than the current 1.50%.

Salary increase assumptions for shorter-service employees

To analyze the service-related salary assumption, we looked at the excess in the average increases for shorter-service employees over the average for longer-service employees. For example, Teachers with three years of service received an average annual increase of 7.86%, which was 6.08% more than the average increase of 2.10% for Teachers with eleven or more years of service. The patterns were graduated for a reasonable, stable pattern and compared to the current assumptions. We then if necessary determined

new service-related assumptions reflecting this data. The following is a similar exhibit as above that shows the average increase a member is expected to receive over a 30 year career by category.

Career Average Salary Increase (10-Year Experience)							
	State	Corr	Teachers	MERS General	MERS P&F	State Police	Judges
Current Assumption	4.20%	4.20%	4.88%	3.94%	5.18%	5.70%	3.00%
Less Assumed Inflation	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%
Assumed Average Increase Above Inflation	1.70%	1.70%	2.38%	1.44%	2.68%	3.20%	0.50%
Actual Increase Above Inflation for last 10 Years	1.80%	2.99%	2.03%	1.25%	2.91%	5.33%	0.19%
Recommended Assumption	1.79%	2.28%	2.38%	1.44%	2.68%	3.20%	0.25%
Recommended Average Salary Increase Assumption	4.20%	4.78%	4.88%	3.94%	5.18%	5.70%	2.75%
Change	-	0.58%	-	-	-	-	-0.25%

As shown, we are not recommending many changes at this time. When adjusted for the low inflation environment, either the experience has been reasonably close to the current assumption overall or at the last three years have been reasonably close to the assumption for most groups. Historically Corrections has been grouped with other State Employees, so this is a new assumption set.

Details of our analysis are shown in Section VII.

Payroll growth rate

The salary increase rates discussed above are assumptions applied to individuals and are used in projecting future benefits. We use a separate payroll growth assumption in determining the annual payment needed to amortize the unfunded actuarial accrued liability. The amortization payments are calculated to be a level percentage of payroll. Therefore, as payroll increases over time, these amortization payments will also increase.

In theory, payroll growth in the absence of membership growth should approximate the wage inflation assumption (proposed to be 3.00%). However, we may make adjustments based on the demographics of the individual population. For example, the current Teacher population is disproportioned to older ages based on hiring and staffing patterns over the last decade. Because of this, we anticipate slower growth over the next fifteen to twenty years and use an assumption lower than the GWI assumption.

To analyze this, we need to take into account future projections. We projected the payroll for current members based on the assumed salary increases for the individuals and their assumed termination or retirement rates. We then added in enough new employees each year to replace them. Pay for the first group of new members was initialized based on actual average pay for current new members, and thereafter pay was projected based on the salary assumption and expected retirements and terminations for this cohort of new members. For each subsequent cohort of new members needed to replace the retired and terminated members we increased the starting average pay by the wage inflation assumption of 3.00%.

Based on this analysis, we found that payroll over the next twenty years was reasonably close to the 3.00% wage inflation assumption except for Teachers, which projected much lower growth rates (2.57% over the current amortization period). Therefore we are recommending continuing to set this assumption at 3.00% for State Employees and MERS and 2.50% per year for Teachers. For Judges, consistent with the 2.75% salary scale assumption above, we are recommending a 2.75% payroll growth assumption as well.

This assumption has no impact on the liabilities of the System, but does impact the contribution rates because it is used to project out future payrolls that will be the basis of future contributions. By assuming there will be less payroll in the future to make contributions on, the contribution rate must increase to reproduce the appropriate amount of dollars into the fund.

Post-retirement mortality rates (service retirees)

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

Mortality rates have generally decreased over time in the U.S., meaning that life expectancies have generally increased over time. The assumption for future decreases in mortality is referred to as the mortality improvement assumption. In general, the mortality and mortality improvement assumptions are treated separately.

The current tables are based on adjusted versions of the RP-2014 mortality tables, projected with the ultimate vales of the MP projection scales.   Of course, we also use separate tables for males and females. Separate tables discussed in the following section are used for disabled retirees.

We use separate mortality tables for Teachers and All Other Employees. Life expectancy for Teachers is on average longer than for other state and local government employees. We currently include Public Safety employees in the All Other Employee category.   While historically, retirees from Public Safety occupations had a lower life expectancy than the general population, most recent data sources do not show a significant statistical difference between Public Safety retirees and the general population. In fact, if recent trends continue, it is likely today's 40 year old Public Safety employee will have a longer life expectancy once they retire than today's general employee. The largest data set to confirm this trend is the recently published Pub-2010 Public Retirement Plans Mortality Tables, which do show a difference, but only marginally so. We would rather have one larger, more credible dataset than two less credible ones, so we will continue to combine the groups.

To analyze the data, we began by determining the expected number of deaths in each year at each age for males and females. The analysis uses only the retirees, not the beneficiaries, joint annuitants, or survivors.

We will use a liability-weighted (or benefit weighted) analysis. There are two reasons for using a liability-weighted approach. First, mortality experience across the U.S. has been shown to vary depending on income level. Liability-weighting takes into account differing benefit levels. Second, selecting an assumption based on headcount-weighting is consistent with estimating expected deaths, but selecting an assumption based on liability-weighting is consistent with minimizing gains and losses associated with expected deaths. By weighting the data by annuity amounts, we are giving more weight to members who have larger annuities (and thus have larger liabilities).

We have utilized nine years of experience to increase the credibility of the analysis and minimize any variance created by timing of data collection from year to year. During this time, mortality improvement may have occurred. A general procedure is to adjust the actual experience for mortality improvements during the study period to the central year, in this case 2014. For purposes of this study, proposed mortality rates shown in the tables have been adjusted to the central year 2014 using the proposed projection scales.

Pub-2010 Public Retirement Plans Mortality Tables

In January 2019, the Society of Actuaries (SOA) issued the final version of Pub-2010 Public Retirement Plans Mortality Tables. This is the first set of mortality rates published based on U.S. public sector experience. In this study, the SOA examined mortality for Teachers, Public Safety, and General employment categories. The SOA also studied mortality rates by gender, income (in total and separated into above and below median), and status (active employees, retirees, disabled retirees, and contingent survivors). As a consequence, there are over 90 Pub-2010 tables to select from.

In August 2018, the Society of Actuaries (SOA) reviewed the comprehensive annual financial reports of the majority of large public sector employees' retirement systems for a review of their mortality assumptions. The SOA report included analysis of certain annuity values under current assumptions and the new Pub-2010 tables. As can be seen in the charts, the majority of public sector plans would have higher annuity values (i.e., plan costs) under Pub-2010.

Public Plan Mortality Assumption Comparison

Figure 1
2018 AGE 55 ANNUITY FACTORS WITH PUB-2010 AND RP-2006
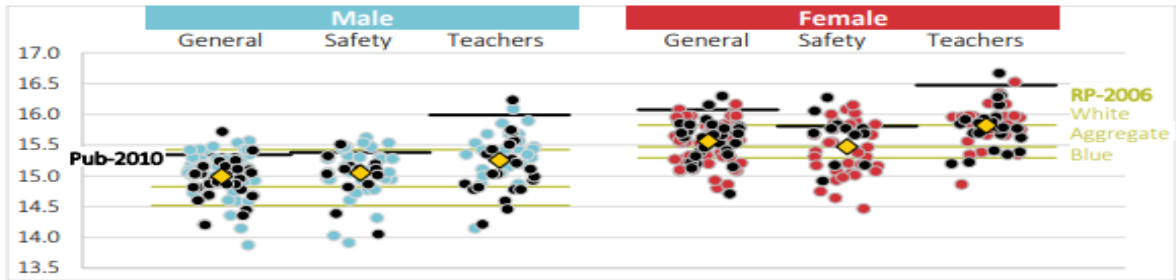
Figure 2
2018 AGE 65 ANNUITY FACTORS WITH PUB-2010 AND RP-2006
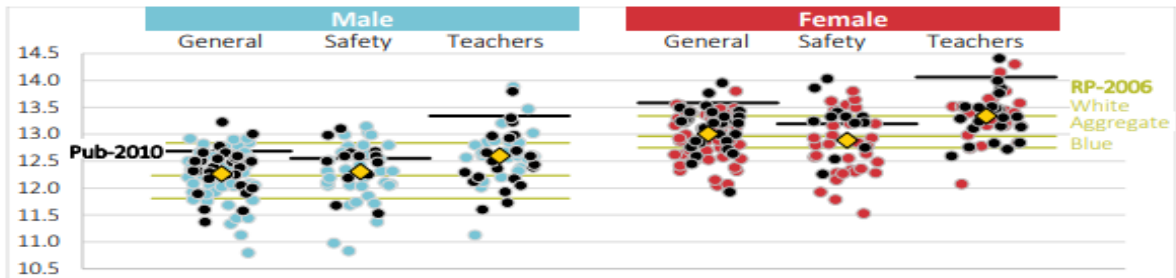
Figure 3
2018 AGE 75 ANNUITY FACTORS WITH PUB-2010 AND RP-2006
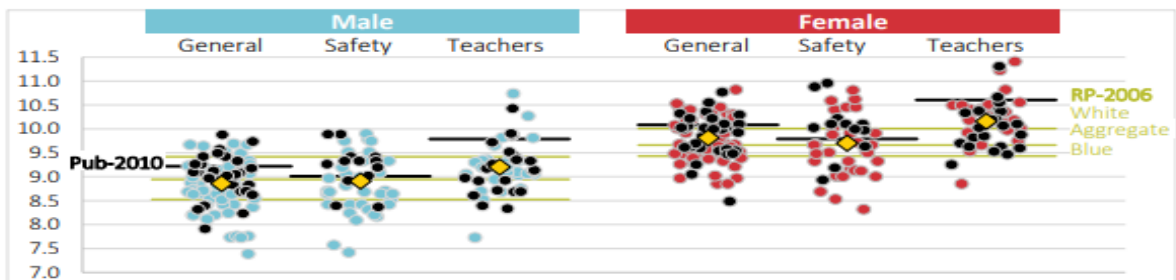
Legend

Black dots	Plans that use RP-2006 or RP-2014 mortality rates (possibly adjusted) in the base table
Blue/red dots	Plans that use neither RP-2006 nor RP-2014 mortality rates (adjusted or otherwise) in the base table
Yellow diamonds	Average of all plans in the job category, weighted one per plan
Black lines	Pub-2010 Mortality Tables (amount-weighted) generationally projected with Scale MP-2017
Green lines	RP-2006 Mortality Tables (amount-weighted) generationally projected with Scale MP-2017: white collar (top), aggregate (middle) and blue collar (bottom)
Assumptions	Monthly single life annuities beginning in 2018, computed at 7% interest with 2% annual benefit increases

However, another observation is the wide range of outcomes across the datasets included in the analysis. Thus, occupation is not the only factor for variance in life expectancy. The report published alongside the Pub-2010 tables states that income was generally the most significant explanatory variable, even excluding job category. For this reason Above Median and Below Median versions of the tables were also published. However, even the range between these versions of the tables is quite wide, especially for general employee males. Other factors could be duration of retirement, geographic region, access to health insurance, and definitions of disability. Some of these factors can be analyzed by trying to match these characteristics of the group to the baseline table, but if the dataset is large enough, this process can be analyzed through statistical techniques to scale the table to the experience.

In this analysis, we look at a subset of the tables illustrated in that study: PubG-2010 for healthy general retirees, PubG-2010 for healthy retired teachers, and PubNS-2010 for disabled retirees. In certain cases, the Pub-2010 tables do not have rates below or above certain ages. In cases where rates are absent, we have extended the published tables with cubic splines or exponentials in a manner similar to the way the tables were created.

Credibility

When choosing an appropriate mortality assumption, actuaries typically use standard mortality tables. 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 definition of disability in the plan, 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 client specific data was warranted.   We apply a credibility procedure in accordance with ASOP No. 25, Credibility Procedures to determine partial credibility based on the limited fluctuation method to determine appropriate adjustments to the base table to be applied to each gender within each member classification. We utilized approaches described in this paper https://www.soa.org/globalassets/assets/files/static-pages/sections/retirement/credibility-resource-pension.pdf for this analysis. The paper shows that to be +/-5% with 90% confidence requires 1,082 deaths per gender. However, when using a benefit weighted approach to the analysis, even more deaths are required as the variance in the benefit amounts decreases the overall credibility.

During the period, there were 2,093 male deaths and 2,346 female deaths for the Non-Teacher group, indicating they are a highly credible group. For the Teacher group, there were 741 male deaths and 1,103 female deaths, giving them good credibility as well. The following provides the full details with p=90% and r=5%.

Group	Other Employees		Teachers	
	Male	Female	Male	Female
Actual Deaths	2,112	2,401	741	1,103
Deaths needed for full credibility				
Based on Count	1,082	1,082	1,082	1,082
Based on Annuity Amount	1,765	1,840	1,214	1,256
Z Factor				
Based on Count	100.0%	100.0%	82.8%	100.0%
Based on Annuity Amount	100.0%	100.0%	78.1%	93.7%

Base Tables

While there is no requirement to update to the new tables, the new tables are based specifically on public sector data and appear to have a better fit across the spectrum of ages. Thus, we have compared the data from the study period to variants of the newer PUB(10) mortality tables.   We compared the ratio of the actual deaths to the expected deaths—the A/E ratio—tells us whether the assumptions are reasonable.

We use the limited fluctuation credibility procedure to determine the appropriate scaling factor of the base mortality tables for each gender and each member classification on a benefits weighted basis. In each case, the Z-factor (shown above) is computed based on the experience of the group being studied. This Z-factor is a measure of the credibility of the pertinent group.

The Best Fit is the ratio of actual to expected deaths using the base table. The final scale is then determined as the weighted average of the Best Fit and 100% based on the Z-factor. For example, for male Teachers, the Z-factor of 78.1% suggests the data for that group is 78.1% credible. The Best Fit for that group would be to scale the base tables by 110.8%. The final scale of 108.4% is the credibility-weighted average (108.4% = 78.1% x 108.4% + 21.9% x 100%). Factors for other groups are determined similarly.

Group	Other Employees		Teachers	
	Male	Female	Male	Female
Actual Deaths ($000 Annuities)	$49,956	$36,187	$32,170	$40,959
Expected Deaths based on Current Assumptions	$50,324	$35,060	$31,068	$41,762
A/E Ratio	99.3%	103.2%	103.5%	98.1%
Expected Deaths based on PUB(10) Median Tables by Occupation	$43,315	$32,463	$29,042	$35,230
A/E Ratio based on Best Fit	115.3%	111.5%	110.8%	116.3%
Multiplier based on LFCT	115.3%	111.5%	108.4%	115.2%
Recommended Multiplier	115.0%	111.0%	108.0%	115.0%
Expected Deaths based on PUB(10) Median Tables by Occupation adjusted by Multiplier	$49,812	$36,034	$31,365	$40,515
A/E Ratio	100.3%	100.4%	102.6%	101.1%

The A/E Ratio on the proposed assumptions for Teachers are slightly farther from 100% because they are slightly less credible and thus use partial credibility.

We also examined the results in five-year age groups, checking how well the pattern in the table matched actual experience. Most importantly, we look at life expectancies in the actual data and the tables, looking for a good fit. A summary of the comparison of life expectancies is shown below:

Group	Other Employees		Teachers	
	Male	Female	Male	Female
Life Expectancy of 65 year old retiree in years (current assumption)	18.99	21.99	21.42	22.96
Life Expectancy of 65 year old retiree in years (actual, smoothed)	19.12	21.89	21.06	22.90
Life Expectancy of 65 year old retiree in years (proposed)	19.13	21.82	21.21	22.89
A/E ratio	99.9%	100.3%	99.3%	100.0%

Without Projection, Central Year 2014

As shown, this produces a reasonable match. Also, because a similar process was utilized to match the RP-2014 tables in the previous study, the assumptions in the valuation are not significantly different between the two sets of underlying tables. We recommend moving to the variants of the median PUB-2010 tables shown above. For Judges, we are recommending 100% of the above median variant of the general employee table.

More detail is shown on the tables in Section VII.

Recommended Mortality Improvement Assumption

We use a fully generational approach to this assumption. Because of this strategy of building in continuous improvement, life expectancies for today's younger active members are expected to be materially longer than those of today's retirees, and this provides substantial stability and dependability on costs and liabilities. We currently use the ultimate value of the MP projection scales, which is approximately 1% per year across most ages. We recommend no change.

Post-retirement mortality rates (disabled retirees)

This is a relatively minor assumption, and it has little impact on the liabilities of ERSRI. We are recommending this assumption also be moved to the PUB(10) set of tables, using 100% of the disabled tables by occupation.

Active mortality rates

This is a relatively minor assumption, and it has little impact on the liabilities of ERSRI. We are recommending this assumption also be moved to the PUB(10) set of tables, using 100% of the median active employee tables by occupation.

Disability rates

We analyzed disability separately for males and females, State Employees, Teachers, MERS General and MERS P&F, and ordinary and accidental disability.

We compared the number of actual and expected disabilities by group, taking into account the fact that members with less than five years of service and members eligible for retirement are not eligible for ordinary disability.

For disability, there is often a lag time between when the member leaves active service to when the member is approved for disability. In many cases, this timeframe can span over a valuation cycle, meaning a member is active in year 1, shows as an inactive in year 2, and then a disabled member in year 3. We have used the actual disabled records in the 2019 valuation data for members with dates of disability in the six-year period January 1, 2012 through December 31, 2017 as an approximation of our actual disabilities as the FY19 experience likely doesn't completely include members who are in processing as of June 30, 2019.

For this assumption, an A/E close to, but less than, 100% is preferable. The analysis shows a reasonably close match across the groups, given the relatively small numbers. We have made recommendations on a few of the groups, and for those have provided the A/E ratio based on the proposed assumptions.   For most groups, the size is too small to give full credibility so in most cases the recommended assumption only partially reflect the recent experience. Although there are detailed tables on each of the groups in Section VII, here are tables showing some summary information:

State Employees				
Group/Type	Actual Number	Expected Number	A/E Ratio	A/E on Proposed Assumption
State/Corr male ordinary	68	50	136%	97%
State/Corr female ordinary	66	72	92%	
State/Corr male accidental	20	42	48%	71%
State/Corr female accidental	17	39	44%	68%
Teacher male ordinary	19	23	83%	
Teacher female ordinary	61	59	103%	82%
Teacher male accidental	0	3	0%	0%
Teacher female accidental	4	11	36%	50%
MERS General male ordinary	23	29	79%	
MERS General female ordinary	13	24	54%	72%
MERS General male accidental	17	19	89%	
MERS General female accidental	4	12	33%	50%
MERS P&F ordinary	4	5	80%	
MERS P&F accidental	36	61	59%	72%
Total disabilities	352	449	78%	81%

In addition, for groups that have historically had ages ranges that were eligible for unreduced retirement, but now are not, we are adding 2% to the probability of ordinary disability in those age ranges to reflect the reality that some members who retired under old eligibility provisions would have qualified for disability, but did not apply because there was no need to do so.

These changes will have a minor impact on the liabilities and contribution requirements. Details are shown in Section VII.

Retirement pattern

The current assumptions were estimates of the impact the changes from RIRSA would have on behavior, and had several categories based on cohorts of members becoming eligible to retire. In general, most of the reasons to have the various cohorts has passed as we are now 9 years past the passage of RIRSA. Also, in general, less people are retiring than currently assumed, especially at first eligibility. We are recommending lowering these expectations, especially at the year a member is first eligible to retire, for State Employees, Teachers, and General MERS. We are also recommending changes to the patterns for Correctional Officers and Police and Fire to simplify the assumptions where appropriate. The following is a summary of the data.

State Employees				
Group/Type	Actual Number	Expected Number	A/E Ratio	A/E on Proposed Assumption
State, at First Eligibility	203	377	54%	75%
State female, after First Eligibility	808	873	93%	
State male, after First Eligibility	704	766	92%	
Corrections, svc 25 to 39	110	112	98%	90%
Teacher, at First Eligibility	292	387	75%	94%
Teacher female, after First Eligibility	804	1,081	74%	94%
Teacher male, after First Eligibility	221	310	71%	79%
Teacher female accidental	4	11	36%	50%
MERS General, at First Eligibility	112	205	55%	77%
MERS General male, after First Eligibility	355	442	80%	
MERS General female, after First Eligibility	658	890	74%	
MERS General female accidental	4	12	33%	50%
MERS P&F	38	32	119%	83%
State Police	50	60	83%	86%
Judges	6	9	67%	67%
Total disabilities	4,369	5,567	78%	86%

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.

We use separate termination rates for males and females and for all groups. The current rates are structured as a function of service. No terminations are assumed once a member becomes eligible for retirement. The current tables were based on ERSRI experience and developed in prior experience studies. For this analysis, we have extended the experience period to ten years as termination patterns tend to be very cyclical with the overall economy. We also weight the data based on the liability of the member.

Our analysis showed that for State Employees and Teachers, the rates of turnover have increased and we have increased the rates by 5%.   Also, we have created a separate table for Correctional Officers based on their experience. Full detail in the tables in Section VII.

Spousal age difference

Currently, we assume that male members are three years older than their spouses and female members are three years younger than their spouses. This is reasonable, based on general census statistics and we are not recommending changing this assumption.

Refund of contributions

We currently assume that members who are vested and terminate in the future will choose the more valuable of a refund or a deferred annuity. This is a bit conservative, since some people do choose a refund when the deferred benefit is worth more, but we are recommending no change in this assumption.

Other assumptions

There are other technical assumptions made in the course of a valuation, such as the timing of terminations and retirements during the year, and the timing of pay increases. We reviewed these and are recommending no changes.

Actuarial cost method

The individual Entry Age Normal cost method (EAN) is the current funding method being used to allocate the actuarial costs of the Fund. Under this method, the normal cost for each member is determined to be the level percentage of payroll which, if contributed from the date of entry to the date of retirement, would accumulate assets sufficient to pay the retirement benefits when due. Use of this method is required by statute. 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 fashion. It is by far the most commonly used actuarial cost method for large public retirement systems. We continue to believe this is the best funding method for ERSRI and recommend no change.

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 system.

The current method smooths the differences between the expected returns (based on the annual investment return assumption) and actual returns, net of expenses, over a five-year period. For example, if the actual return is 12.00% in one year, then currently 7.00% is reflected immediately in the AVA, and the other 5.00% is recognized in 20% increments over five years, beginning with 20% for the current year.

The actuarial value of assets is based on the market value of assets with a five-year phase-in of actual investment return in excess of (less than) expected investment income. Offsetting unrecognized gains and losses are immediately recognized, with the shortest remaining bases recognized first and the net remaining bases continuing to be recognized on their original timeframe. Expected investment income is determined

using the assumed investment return rate and the market value of assets (adjusted for receipts and disbursements during the year). The returns are computed net of administrative and investment expenses.

Amortization period

The unfunded actuarial accrued liability is being amortized over a closed 25-year period from June 30, 2010. The current amortization period is 16 years. New gains and losses will be "laddered" on individual 20 year bases once the period on the large base decreases below 20. We are not recommending any change to this in connection with the current experience study.

Election Assumptions for the Teacher Survivor Benefit plan

We reviewed the current election and family distribution assumptions for the Teacher Survivor Benefit Plan. The current assumptions were developed in the previous experience study and are tracking well with experience, thus we are not recommending any changes.

	By Attained Age									
	20	25	30	35	40	45	50	55	60	65
Spouse Only	5%	14%	14%	10%	11%	15%	32%	75%	75%	70%
Spouse and 1 Child	5%	12%	20%	17%	22%	23%	18%	0%	0%	0%
Spouse and 2 or More Children	4%	13%	36%	46%	41%	35%	24%	0%	0%	0%
One Child Alone	5%	6%	3%	7%	8%	10%	6%	0%	0%	0%
Two Children Alone	3%	7%	4%	7%	6%	3%	1%	0%	0%	0%
Three or More Children Alone	1%	4%	4%	5%	4%	1%	1%	0%	0%	0%
Dependent Parent Alone	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
No Dependents/Refund	77%	44%	19%	8%	8%	13%	18%	25%	25%	30%

SECTION IV

ACTUARIAL IMPACT OF RECOMMENDATIONS

Section IV
Impact of Proposed Changes to Actuarial Assumptions

Under Rhode Island General Laws, the employer contribution rates are certified annually by the State of Rhode Island Retirement Board. These rates are determined actuarially, based on the plan provisions in effect as of the valuation date, the actuarial assumptions adopted by the Board, and the methodology set forth in the statutes. The Board's current policy is that the contribution rates determined by a given actuarial valuation become effective two years after the valuation date. For example, the rates determined by the June 30, 2020 actuarial valuation will be applicable for the year beginning July 1, 2022 and ending June 30, 2023.

The actuarial cost method and the amortization period are set by statute. Contribution rates and liabilities are computed using the Entry Age Normal actuarial cost method. The employer contribution rate is the sum of two pieces: the employer normal cost rate and the amortization rate. The normal cost rate is determined as a percent of pay. The employer normal cost is the difference between this and the member contribution rate. The amortization rate is determined as a level percent of pay. It is the amount required to amortize the unfunded actuarial accrued liability over a closed period. The amortization rate is adjusted for the two-year deferral in contribution rates. Separate employer contribution rates are determined for State Employees, Teachers, Judges, State Police, and individual MERS units.

Effect of the proposed assumptions

We are not recommending the June 30, 2019 valuation be restated, but instead, these recommended assumptions be used in this upcoming June 30, 2020 valuation. Shown below is a table that compares key results from the June 30, 2020 actuarial valuation with these same results recalculated using the recommended actuarial assumptions and methods. As you can see, the assumption changes generally increase the contribution requirements and liabilities.

State Employees			
Item	Current Assumptions and Methods	Recommended Assumptions and Methods	Change
Normal cost	8.44%	8.30%	-0.14%
Unfunded actuarial accrued liability	$2,244 million	$2,193 million	-$51 million
Funded ratio	53.27%	53.84%	0.57%
Projected FY 2023 Annual Required Contribution			
a. Percent of payroll	28.68%	28.22%	-0.47%
b. Estimated dollar amount	$232.0 million	$228.3 million	-$3.8 million
Projected FY 2024 Annual Required Contribution			
a. Percent of payroll	29.46%	28.71%	-0.76%
b. Estimated dollar amount	$245.5 million	$239.2 million	-$6.3 million

Teachers			
Item	Current Assumptions and Methods	Recommended Assumptions and Methods	Change
Normal cost	7.75%	7.71%	-0.04%
Unfunded actuarial accrued liability	$3,128 million	$3,061 million	-$67 million
Funded ratio	55.28%	55.81%	0.53%
Projected FY 2023 Annual Required Contribution			
a. Percent of payroll	26.35%	26.05%	-0.30%
b. Estimated dollar amount	$308.4 million	$304.9 million	-$3.5 million
Projected FY 2024 Annual Required Contribution			
a. Percent of payroll	27.07%	26.53%	-0.54%
b. Estimated dollar amount	$324.8 million	$318.3 million	-$6.5 million

SPRBT			
Item	Current Assumptions and Methods	Recommended Assumptions and Methods	Change
Normal cost	21.91%	22.13%	0.22%
Unfunded actuarial accrued liability	$26 million	$28 million	$1 million
Funded ratio	84.86%	84.19%	-0.67%
Projected FY 2023 Annual Required Contribution			
a. Percent of payroll	19.91%	20.36%	0.45%
b. Estimated dollar amount	$5.8 million	$5.9 million	$0.1 million
Projected FY 2024 Annual Required Contribution			
a. Percent of payroll	20.63%	21.38%	0.76%
b. Estimated dollar amount	$6.2 million	$6.4 million	$0.2 million

JRBT			
Item	Current Assumptions and Methods	Recommended Assumptions and Methods	Change
Normal cost	32.43%	32.65%	0.22%
Unfunded actuarial accrued liability	$3 million	$6 million	$2 million
Funded ratio	96.02%	93.35%	-2.67%
Projected FY 2023 Annual Required Contribution			
a. Percent of payroll	21.71%	22.97%	1.25%
b. Estimated dollar amount	$2.4 million	$2.5 million	$0.1 million
Projected FY 2024 Annual Required Contribution			
a. Percent of payroll	22.48%	24.91%	2.42%
b. Estimated dollar amount	$2.5 million	$2.8 million	$0.3 million

MERS General			
Item	Current Assumptions and Methods	Recommended Assumptions and Methods	Change
Normal cost	8.44%	8.39%	-0.05%
Unfunded actuarial accrued liability	$240 million	$228 million	-$12 million
Funded ratio	81.28%	82.07%	0.80%
Projected FY 2023 Annual Required Contribution			
a. Percent of payroll	13.12%	12.88%	-0.24%
b. Estimated dollar amount	$37.8 million	$37.1 million	-$0.7 million
Projected FY 2024 Annual Required Contribution			
a. Percent of payroll	13.69%	13.25%	-0.44%
b. Estimated dollar amount	$40.6 million	$39.3 million	-$1.3 million

MERS Police and Fire			
Item	Current Assumptions and Methods	Recommended Assumptions and Methods	Change
Normal cost	20.29%	19.46%	-0.83%
Unfunded actuarial accrued liability	$156 million	$159 million	$3 million
Funded ratio	79.11%	78.79%	-0.32%
Projected FY 2023 Annual Required Contribution			
a. Percent of payroll	20.43%	19.70%	-0.72%
b. Estimated dollar amount	$25.5 million	$24.6 million	-$0.9 million
Projected FY 2024 Annual Required Contribution			
a. Percent of payroll	21.18%	20.57%	-0.61%
b. Estimated dollar amount	$27.3 million	$26.5 million	-$0.8 million

Teacher Survivor Benefit Plan			
Item	Current Assumptions and	Recommended Assumptions and	Change
Unfunded actuarial accrued liability	-$113 million	-$121 million	-$8 million
Funded ratio	149.73%	155.64%	5.90%

SECTION V

SUMMARY OF ASSUMPTIONS AND METHODS INCORPORATING THE RECOMMENDED ASSUMPTIONS

Section V
Summary of Assumptions and Methods
Incorporating the Recommended Assumptions

I.   <u>Valuation Date</u>

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.   <u>Actuarial Cost Method</u>

The actuarial valuation uses the Entry Age actuarial cost method. Under this method, the employer contribution rate is the sum of (i) the employer normal cost rate, and (ii) a rate that will amortize the unfunded actuarial accrued liability (UAAL).

1. First, the actuarial present value of future benefits is determined by discounting the projected benefits for each member back to the valuation date using the assumed investment return rate as the discount rate. For active members, the projected benefits are based on the member's age, service, gender and compensation, and based on the actuarial assumptions. The calculations take into account the probability of the member's death, disability, or termination of employment prior to becoming eligible for a retirement benefit, as well as the possibility of the member will remain in service and receive a service retirement benefit. Future salary increases are anticipated. The present value of the expected benefits payable to all active members is added to the present value of the expected future payments to retired participants and beneficiaries to obtain the present value of all expected benefits. Liabilities for future members are not included.

2. The employer contributions required to support the benefits are determined as a level percentage of salary, and consist of a normal contribution and an amortization contribution.

3. The normal contribution is determined using the Entry Age Normal method. Under this method, a calculation is made to determine the rate of contribution which, if applied to the compensation of each individual member during the entire period of anticipated covered service, would be required to meet the cost of all benefits payable on his behalf. The salary-weighted average of these rates is the normal cost rate. This calculation reflects the plan provisions that apply to each individual member.

4. The employer normal cost rate is equal to (i) the normal cost rate, minus (ii) the member contribution rate.

5. The actuarial accrued liability is equal to the present value of all benefits less the present value of future normal costs. The unfunded actuarial accrued liability (UAAL) is then determined as (i) the actuarial accrued liability, minus (ii) the actuarial value of assets.

6. The amortization contribution rate is the level percentage of payroll required to reduce the UAAL to zero over the remaining amortization period. The UAAL was initially being amortized over the remainder of a closed 30-year period from June 30, 1999. In conjunction with The Rhode Island Retirement Security Act of 2011, the amortization period was reset to 25 years as of June 30, 2010. The employer contribution rate determined by this valuation will not be effective until two years after the valuation date. The determination of the contribution rate reflects this deferral. The unfunded actuarial accrued liability (UAAL) and covered payroll are projected forward for two years, and we then determine the amortization charge required to amortize the UAAL over the remaining amortization period from that point. In projecting the UAAL, we increase the UAAL for interest at the assumed rate and we decrease it for the amortization payments. The amortization payments for these two years are determined by subtracting the current employer normal cost from the known contribution rates for these years, based on the two prior actuarial valuations. Contributions are assumed to be made monthly throughout the year.

III. Actuarial Value of Assets

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

IV. Actuarial Assumptions

A. Economic Assumptions

1. Investment return: 7.00% per year, compounded annually, composed of an assumed 2.50% inflation rate and a 4.50% net real rate of return. This rate represents the assumed return, net of all investment and administrative expenses.

2. Salary increase rate:

For MERS P&F: The sum of (i) a 4.00% wage inflation assumption (composed of a 2.50% price inflation assumption and a 1.50% additional general increase), and (ii) a service-related component as shown below:

MERS P&F		
Years of Service	Service-Related Component	Total Increase
1	10.00%	14.00%
2	9.00	13.00
3	7.00	11.00
4	4.00	8.00
5	2.50	6.50
6	3.00	7.00
7	0.50	4.50
8	0.50	4.50
9 or more	0.00	4.00

For State Employees and MERS General: The sum of (i) a 3.25% wage inflation assumption (composed of a 2.50% price inflation assumption and a 0.75% additional general increase), and (ii) a service-related component as shown on next page.

For Teachers: The sum of (i) a 3.00% wage inflation assumption (composed of a 2.50% price inflation assumption and a 0.50% additional general increase), and (ii) a service-related component as shown on next page.

Salary Increase Rates						
	State Employees		Teachers		MERS General	
Service	Service-Related Component	Total Increase	Service-Related Component	Total Increase	Service-Related Component	Total Increase
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	1.00%	4.25%	10.00%	13.00%	4.00%	7.25%
2	2.00%	5.25%	9.00%	12.00%	3.00%	6.25%
3	3.00%	6.25%	6.25%	9.25%	2.75%	6.00%
4	2.75%	6.00%	5.50%	8.50%	2.50%	5.75%
5	2.75%	6.00%	5.00%	8.00%	2.25%	5.50%
6	2.50%	5.75%	5.00%	8.00%	2.00%	5.25%
7	1.25%	4.50%	4.50%	7.50%	1.25%	4.50%
8	1.00%	4.25%	4.25%	7.25%	0.75%	4.00%
9	1.00%	4.25%	4.00%	7.00%	0.50%	3.75%
10	1.00%	4.25%	4.00%	7.00%	0.50%	3.75%
11	1.00%	4.25%	0.00%	3.00%	0.25%	3.50%
12	2.00%	5.25%	0.00%	3.00%	0.25%	3.50%
13	1.25%	4.50%	0.00%	3.00%	0.25%	3.50%
14	1.00%	4.25%	0.00%	3.00%	0.25%	3.50%
15	1.00%	4.25%	0.00%	3.00%	0.25%	3.50%
16	1.00%	4.25%	0.00%	3.00%	0.00%	3.25%
17	0.50%	3.75%	0.00%	3.00%	0.00%	3.25%
18	0.50%	3.75%	0.00%	3.00%	0.00%	3.25%
19	0.50%	3.75%	0.00%	3.00%	0.00%	3.25%
20	0.50%	3.75%	0.00%	3.00%	0.00%	3.25%
21	0.50%	3.75%	0.00%	3.00%	0.00%	3.25%
22	0.25%	3.50%	0.00%	3.00%	0.00%	3.25%
23	0.25%	3.50%	0.00%	3.00%	0.00%	3.25%
24	0.25%	3.50%	0.00%	3.00%	0.00%	3.25%
25 or more	0.00%	3.25%	0.00%	3.00%	0.00%	3.25%

Salary increases are assumed to occur once a year, on July 1. Therefore the pay used for the period year following the valuation date is equal to the reported pay for the prior year, increased by the salary increase assumption. For employees with less than one year of service, the reported rate of pay is used rather than the fiscal year salary paid.

3. Payroll growth rate: In the amortization of the unfunded actuarial accrued liability, payroll is assumed to increase 3.00% for State Employees, MERS P&F and MERS General and 2.50% for Teachers per year. This increase rate is solely due to the effect of wage inflation on salaries, with no allowance for future membership growth.

4. Post-retirement Benefit Increase: Post-retirement benefit increases are assumed to be 2.15%, per annum, while the plan has a funding level that exceeds 80%; however, an interim COLA will be granted in four-year intervals while the COLA is suspended. The second such COLA will be applicable in Calendar Year 2021. As of June 30, 2019, it is assumed that the COLAs will be suspended for 8 years due to the current funding level of the plans. The actual COLA will be determined based on the plan's five-year average investment rate of return (return on actuarial assets) minus 5.0% and will range from zero to 4.0%.

B. Demographic Assumptions

1. Post-termination mortality rates (non-disabled)

    a. Male State Employees, MERS General and MERS P&F: PUB(10) Median Table for Healthy General Employee Males, loaded by 115%, projected with Scale Ultimate MP16.

    b. Female State Employees, MERS General and MERS P&F: PUB(10) Median Table for Healthy General Employee Females, loaded by 111%, projected with Scale Ultimate MP16.

    c. Male Teachers: PUB(10) Median Table for Healthy Teacher Males, loaded by 108%, projected with Scale Ultimate MP16.

    d. Female Teachers: PUB(10) Median Table for Healthy Teacher Females, loaded by 115%, projected with Scale Ultimate MP16.

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					
Group	Year of Retirement				
	2020	2025	2030	2035	2040
State Employee - Male	22.8	23.2	23.6	24.0	24.4
State Employee - Female	24.6	25.0	25.3	25.7	26.1
Teacher - Male	20.7	21.1	21.5	21.9	22.3
Teacher - Female	23.5	23.9	24.3	24.7	25.1

2. Post-retirement mortality (disabled lives):

    a. Males: PUB(10) Tables for Disabled Reitrees by Occupation for males, projected with Scale Ultimate MP16.

    b. Females: PUB(10) Tables for Disabled Reitrees by Occupation for females, projected with Scale Ultimate MP16.

3. Pre-retirement mortality:

    a. Males: PUB(10) Tables for Employees by Occupation for males, projected with Scale Ultimate MP16.

    b. Females: PUB(10) Tables for Employees by Occupation for females, projected with Scale Ultimate MP16.

4. Disability rates: Sample rates are shown below. Ordinary disability rates are not applied to members eligible for retirement. One half the accidental disabilities are assumed to be totally and permanently disabled from any occupation.

Age	Number of Disabilities per 1,000							
	State Ordinary Males	State Accidental Males	State Ordinary Females	State Accidental Females	Teachers Ordinary Males	Teachers Accidental Males	Teachers Ordinary Females	Teachers Accidental Females
25	0.45	0.09	0.36	0.07	0.27	0.02	0.23	0.02
30	0.55	0.11	0.44	0.09	0.33	0.02	0.28	0.02
35	0.75	0.15	0.6	0.12	0.45	0.03	0.38	0.03
40	1.1	0.22	0.88	0.18	0.66	0.04	0.55	0.04
45	1.8	0.36	1.44	0.29	1.08	0.07	0.90	0.07
50	3.05	0.61	2.44	0.49	1.83	0.12	1.53	0.12
55	5.05	1.01	4.04	0.81	3.03	0.20	2.53	0.20
60	7.05	1.41	5.64	1.13	4.23	0.28	3.53	0.28
65	11.55	2.31	9.24	1.85	6.93	0.46	5.78	0.46

Age	MERS General, Ordinary, Males	MERS General, Accidental, Males	MERS General, Ordinary, Females	MERS General, Accidental, Females	MERS P&F, Ordinary, Males and Females	MERS P&F, Accidental, Males and Females
25	0.45	0.14	0.18	0.04	0.45	0.7
30	0.55	0.17	0.22	0.04	0.55	0.9
35	0.75	0.23	0.30	0.06	0.75	1.2
40	1.1	0.33	0.44	0.09	1.1	1.8
45	1.8	0.54	0.72	0.14	1.8	2.9
50	3.05	0.92	1.22	0.24	3.05	4.9
55	5.05	1.52	2.02	0.40	5.05	8.1
60	7.05	2.12	2.82	0.56	7.05	11.3
65	11.55	3.47	4.62	0.92	11.55	18.5

In addition ,for General Employees and Teachers that are age 55 with 20 Years of service and not eligible to retire, another 1% is added to the rates above. In adition, if the member is above age 60, another 1% is added to the rates above.

5.   Termination rates (for causes other than death, disability, or retirement) are a function of the member's service. Termination rates are not applied to members eligible for retirement. Rates are shown below:

Service	State Employees	Teachers	MERS General	MERS P&F
1	0.168	0.1575	0.175000	0.100000
2	0.106218	0.105	0.118774	0.055650
3	0.084806	0.07875	0.101396	0.043890
4	0.072281	0.068052	0.086148	0.037012
5	0.063394	0.050571	0.072887	0.032131
6	0.056501	0.040169	0.061471	0.028346
7	0.050868	0.03328	0.051757	0.025253
8	0.046107	0.028385	0.043604	0.022637
9	0.041982	0.024731	0.036868	0.020372
10	0.038344	0.0219	0.031408	0.018374
11	0.035089	0.019643	0.027082	0.016586
12	0.032145	0.017804	0.023746	0.014969
13	0.029457	0.016275	0.021259	0.013493
14	0.026984	0.014985	0.019479	0.012135
15	0.024695	0.013881	0.018263	0.010878
16	0.022563	0.012928	0.017470	0.009708
17	0.02057	0.012094	0.016956	0.008613
18	0.018697	0.011361	0.016579	0.007584
19	0.016931	0.01071	0.016198	0.006615
20	0.015262	0.010128	0.015669	0.000000
21	0.013677	0.009606	0.014851	0.000000
22	0.01217	0.009135	0.013602	0.000000
23	0.010733	0.008707	0.011778	0.000000
24	0.00936	0.008316	0.009239	0.000000
25	0.008045	0.007959	0.005841	0.000000

6.   Retirement rates (unreduced):

For State Employees (except Correctional Officers) and MERS General: a flat 20% per year retirement probability for members eligible for unreduced retirement. A 25% retirement probability at first eligibility will be only applied if they have reached age 65 or with at least 25 years of service.

For Teachers: a flat 20% per year retirement probability for members under the age of 67 eligible for unreduced retirement, a flat 35% per year retirement probability for members at age 67 or older eligible for unreduced retirement. A 30% retirement probability at first eligibility will be only applied if they have reached age 65 or with at least 25 years of service.

For MERS P&F: Unisex, service based rates are used for police and fire.

Service	Retirement Probabilities
25	13.0%
26	16.0%
27	19.0%
28	20.0%
29	20.0%
30-34	25.0%
35-39	35.0%
40+	100.0%

For Correctional Officers: A set of unisex rates, indexed by service, as shown below.

Corrections	
Service	Ret. Rate
25	10.00%
26	5.00%
27	5.00%
28	5.00%
29	5.00%
30	6.00%
31	7.00%
32	8.00%
33	9.00%
34	10.00%
35	25.00%
36	20.00%
37	20.00%
38	20.00%
39	20.00%
40	100.00%

7.   Reduced retirement Members are eligible to retire with reduced benefit five years prior to their normal retirement age. Rates are on the years from normal retirement age, as shown below:

Year from Normal Retirement Age	Ret. Rate
5	2%
4	2%
3	2%
2	3%
1	4%

C.   <u>Other Assumptions</u>

1. Valuation payroll (used for determining the amortization contribution rate): Prior aggregate fiscal year payroll projected forward one year using the overall payroll growth rate.

2. Percent married: For State Employees and Teachers, 85% of employees are assumed to be married. For MERS employees (both MERS General and MERS P&F), 80% of employees are assumed to be married.

3. Age difference: Male members are assumed to be three years older than their spouses, and female members are assumed to be three years younger than their spouses.

4. Percent electing annuity on death (when eligible): All of the spouses of vested, married participants are assumed to elect an annuity. The spousal annuity death benefit for vested married participants is valued using a static optional form conversion factor of 0.84 and 0.78 for males and females respectively.

5. For active death benefits, the liability is initially calculated based on the ordinary death benefit provisions, and then a 7.5% load is applied to account for duty related benefits.

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. Recovery from disability: None assumed.

8. Remarriage: It is assumed that no surviving spouse will remarry and there will be no children's benefit.

9. Assumed age for commencement of deferred benefits: Members electing to receive a deferred benefit are assumed to commence receipt at the first age at which unreduced benefits are available.

10. Investment and administrative expenses: The assumed investment return rate represents the anticipated net return after payment of all investment and administrative expenses.

11. Inactive members: Liabilities for inactive members are approximated as a multiple of their member contribution account balances. For non-vested inactive members, the multiple is 1.0. For vested inactive members, the multiple is 8.0 for members with 25 or more years of service, 3.0 for vested inactive members age 45 or older with less than 25 years of service, and 1.0 for other vested inactive members younger than age 45.

12. Decrement timing: For all non-teachers employees (State Employees, MERS General, and MERS P&F), decrements are assumed to occur at the middle of the year. For Teachers the retirement and termination decrements are assumed to occur at the beginning of the year, while death and disability are assumed to occur at the middle of the year.

13. 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.

14. Decrement relativity: Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.

15. 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.

16. Benefit Service: All members are assumed to accrue one year of eligibility service each year.

17. All calculations were performed without regard to the compensation limit in IRC Section 401(a)(17) and the benefit limit under IRC Section 415.

D.   Participant Data

Participant data was supplied on electronic files. There are separate files for (i) active and inactive members, and (ii) members and beneficiaries receiving benefits.

The data for active members included name, an identification number, gender, a code indicating whether the member was active or inactive, a code indicating employee type (State Employee, Teacher, MERS General or MERS P&F), date of birth, service, salary, date of last contribution, accumulated member contributions without interest, accrued benefit multiplier as of June 30, 2014, Final Average Compensation as of June 30, 2012, Article 7 Retirement Date, and the Rhode Island Retirement Security Act Retirement Date. For retired members and beneficiaries, the data included name, an identification number, gender, date of birth, date of retirement, amount of benefit, the amount of adjustment after age 62 for anyone electing the Social Security option, a code indicating the option elected and the type of retiree (service retiree, disabled retiree, beneficiary), and if applicable, the joint pensioner's date of birth and gender.

Salary supplied for the current year was based on the earnings for the fiscal year preceding the valuation date. However, for members with less than one year of service, the current rate of salary was used. This salary was adjusted by the salary increase rate for one year.

In defining who was an active member, members with a date of last contribution in the final quarter of the fiscal year were considered active. Otherwise, the member was defined as inactive.

To correct for incomplete and inconsistent data, we first attempted to pulled data from prior valuation files and then made general assumptions to fill in the rest. These modifications had no material impact on the results presented.

SECTION VI

SUMMARY OF DATA AND EXPERIENCE

List of Tables

General Employees
POST-RETIREMENT MORTALITY - HEALTHY MALE
Weighted by Annual Benefits in $000s

Age	Actual Deaths	Total Benefits	Actual Rate	Assumed Rate Current	Assumed Rate Proposed	Expected Current (3) * (5)	Expected Proposed (3) * (6)	Actual/Exp Current (2) / (7)	Actual/Exp Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55-59	$ 552	$ 120,030	0.0046	0.0069	0.0055	$ 827	$ 659	67%	84%
60-64	2,408	280,268	0.0086	0.0098	0.0079	2,755	2,207	87%	109%
65-69	5,322	389,476	0.0137	0.0150	0.0122	5,856	4,767	91%	112%
70-74	6,652	294,548	0.0226	0.0237	0.0210	6,973	6,196	95%	107%
75-79	6,946	194,147	0.0358	0.0383	0.0371	7,445	7,208	93%	96%
80-84	8,740	141,464	0.0618	0.0636	0.0669	9,003	9,458	97%	92%
85-89	10,533	90,340	0.1166	0.1070	0.1187	9,663	10,724	109%	98%
90-94	6,862	35,011	0.1960	0.1777	0.1968	6,221	6,891	110%	100%
95-99	1,663	6,912	0.2405	0.2605	0.2970	1,801	2,053	92%	81%
Totals	$ 49,677	$ 1,552,196	0.0320	0.0326	0.0323	$ 50,543	$ 50,163	98%	99%
65-74	11,974	684,024	0.0175	0.0188	0.0160	12,829	10,962	93%	109%
75-84	15,687	335,611	0.0467	0.0490	0.0497	16,448	16,666	95%	94%
85-94	17,394	125,351	0.1388	0.1267	0.1405	15,884	17,615	110%	99%

General Employees
POST-RETIREMENT MORTALITY - HEALTHY FEMALE
Weighted by Annual Benefits in $000s

Age	Actual Benefits	Total Benefits	Actual Rate	Assumed Rate Current	Assumed Rate Proposed	Expected Current (3) * (5)	Expected Proposed (3) * (6)	Actual/Exp Current (2) / (7)	Actual/Exp Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55-59	$ 369	$ 98,632	0.0037	0.0041	0.0034	$ 425	$ 345	87%	107%
60-64	1,111	247,323	0.0045	0.0062	0.0048	1,570	1,243	71%	89%
65-69	2,922	313,263	0.0093	0.0097	0.0081	3,060	2,573	95%	114%
70-74	3,271	261,700	0.0125	0.0156	0.0142	4,074	3,719	80%	88%
75-79	4,710	190,358	0.0247	0.0256	0.0252	4,851	4,795	97%	98%
80-84	6,493	136,797	0.0475	0.0432	0.0456	5,925	6,255	110%	104%
85-89	8,133	98,588	0.0825	0.0760	0.0853	7,443	8,340	109%	98%
90-94	6,799	45,830	0.1484	0.1333	0.1524	5,824	6,657	117%	102%
95-99	2,334	9,107	0.2563	0.2136	0.2398	1,828	2,056	128%	114%
Totals	$ 36,143	$ 1,401,600	0.0258	0.0250	0.0257	$ 35,000	$ 35,983	0%	0%
65-74	6,193	574,963	0.0108	0.0124	0.0109	7,134	6,291	87%	98%
75-84	11,204	327,155	0.0342	0.0329	0.0338	10,777	11,049	104%	101%
85-94	14,932	144,419	0.1034	0.0919	0.1038	13,268	14,997	113%	100%

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

Age	Actual Deaths	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	$ 163	$ 38,842	0.0042	0.0044	0.0028	$ 169	$ 108	96%	150%
60-64	703	208,584	0.0034	0.0060	0.0045	1,248	939	56%	75%
65-69	3,025	391,168	0.0077	0.0091	0.0077	3,565	3,015	85%	100%
70-74	4,547	336,710	0.0135	0.0154	0.0143	5,177	4,817	88%	94%
75-79	5,591	204,735	0.0273	0.0265	0.0273	5,428	5,584	103%	100%
80-84	7,110	121,753	0.0584	0.0473	0.0514	5,763	6,254	123%	114%
85-89	5,734	64,490	0.0889	0.0876	0.0963	5,646	6,212	102%	92%
90-94	4,227	22,383	0.1889	0.1581	0.1727	3,539	3,866	119%	109%
95-99	1,070	3,616	0.2958	0.2511	0.2766	908	1,000	118%	107%
Totals	$ 32,170	$1,392,283	0.0231	0.0226	0.0228	$ 31,444	$ 31,795	102%	101%
65-74	7,572	727,879	0.0104	0.0120	0.0108	8,742	7,832	87%	97%
75-84	12,701	326,489	0.0389	0.0343	0.0363	11,190	11,838	113%	107%
85-94	9,962	86,873	0.1147	0.1057	0.1160	9,186	10,077	108%	99%

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

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	$ 422	$ 120,292	0.0035	0.0031	0.0025	$ 396	$ 321	106%	131%
60-64	1,997	576,252	0.0035	0.0049	0.0037	2,939	2,255	68%	89%
65-69	4,450	805,945	0.0055	0.0079	0.0060	6,395	4,908	70%	91%
70-74	4,898	473,779	0.0103	0.0129	0.0109	5,983	5,062	82%	97%
75-79	5,065	244,423	0.0207	0.0218	0.0210	5,257	5,062	96%	100%
80-84	6,559	155,220	0.0423	0.0383	0.0404	5,937	6,260	110%	105%
85-89	8,235	101,188	0.0814	0.0696	0.0768	6,947	7,662	119%	107%
90-94	6,222	44,875	0.1387	0.1266	0.1427	5,462	6,159	114%	101%
95-99	3,110	12,226	0.2544	0.2102	0.2447	2,425	2,813	128%	111%
Totals	$ 40,959	$2,534,199	0.0162	0.0165	0.0160	$ 41,741	$ 40,501	0%	0%
65-74	9,348	1,279,724	0.0073	0.0097	0.0078	12,378	9,970	76%	94%
75-84	11,624	399,643	0.0291	0.0280	0.0283	11,194	11,321	104%	103%
85-94	14,457	146,063	0.0990	0.0850	0.0946	12,409	13,821	117%	105%

STATE EMPLOYEES
SERVICE BASED WITHDRAWAL EXPERIENCE

				Assumed Rate		Expected Withdrawal		Actual/Expected	
	Actual		Actual					Current	Proposed
Service	Withdrawal	Total Count	Rate	Current	Proposed	Current	Proposed	(2) / (7)	(2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	11,991	105,174	0.114009	0.160000	0.168000	16,828	17,669	71%	68%
2	28,714	245,209	0.117102	0.101160	0.106218	24,805	26,046	116%	110%
3	20,389	232,279	0.087776	0.080768	0.084806	18,761	19,699	109%	104%
4	20,290	245,924	0.082505	0.068839	0.072281	16,929	17,776	120%	114%
5	19,282	270,973	0.071157	0.060375	0.063394	16,360	17,178	118%	112%
6	17,190	282,064	0.060943	0.053810	0.056501	15,178	15,937	113%	108%
7	13,228	274,942	0.048113	0.048446	0.050869	13,320	13,986	99%	95%
8	14,051	281,983	0.049828	0.043911	0.046107	12,382	13,001	113%	108%
9	13,544	299,750	0.045185	0.039983	0.041982	11,985	12,584	113%	108%
10	13,766	322,380	0.042700	0.036518	0.038344	11,773	12,361	117%	111%
11	11,653	342,959	0.033978	0.033418	0.035089	11,461	12,034	102%	97%
12	13,978	371,074	0.037670	0.030614	0.032145	11,360	11,928	123%	117%
13	10,354	382,159	0.027092	0.028054	0.029457	10,721	11,257	97%	92%
14	10,936	373,413	0.029287	0.025699	0.026984	9,596	10,076	114%	109%
15	10,450	369,679	0.028268	0.023519	0.024695	8,694	9,129	120%	114%
16	9,179	370,340	0.024786	0.021489	0.022564	7,958	8,356	115%	110%
17	8,810	404,964	0.021754	0.019590	0.020570	7,933	8,330	111%	106%
18	8,466	433,050	0.019551	0.017807	0.018697	7,711	8,097	110%	105%
19	9,026	448,429	0.020128	0.016125	0.016932	7,231	7,593	125%	119%
20	7,934	475,867	0.016673	0.014535	0.015261	6,917	7,262	115%	109%
21	6,196	508,549	0.012184	0.013026	0.013677	6,624	6,955	94%	89%
22	6,961	557,622	0.012484	0.011590	0.012170	6,463	6,786	108%	103%
23	6,747	631,113	0.010691	0.010222	0.010733	6,451	6,773	105%	100%
24	9,939	698,533	0.014228	0.008914	0.009359	6,227	6,538	160%	152%
25	6,639	720,450	0.009215	0.007662	0.008045	5,520	5,796	120%	115%
Totals	309,712	9,648,879				279,189	293,148	111%	106%

TEACHERS
SERVICE BASED WITHDRAWAL EXPERIENCE

Service (1)	Actual Withdrawal (2)	Total Count (3)	Actual Rate (4)	Assumed Rate Current (5)	Assumed Rate Proposed (6)	Expected Withdrawal Current (7)	Expected Withdrawal Proposed (8)	Actual/Expected Current (2)/(7) (9)	Actual/Expected Proposed (2)/(8) (10)
1	9,479	37,562	0.252365	0.150000	0.157500	5,634	5,916	168%	160%
2	44,654	307,880	0.145038	0.100000	0.105000	30,788	32,327	145%	138%
3	29,563	299,596	0.098676	0.075000	0.078750	22,470	23,593	132%	125%
4	21,929	314,778	0.069665	0.064811	0.068052	20,401	21,421	107%	102%
5	19,288	356,399	0.054119	0.048163	0.050571	17,165	18,023	112%	107%
6	19,091	399,403	0.047800	0.038256	0.040169	15,280	16,044	125%	119%
7	16,561	460,103	0.035994	0.031695	0.033280	14,583	15,312	114%	108%
8	16,916	532,210	0.031785	0.027033	0.028385	14,387	15,107	118%	112%
9	13,620	624,106	0.021823	0.023553	0.024731	14,700	15,435	93%	88%
10	15,230	738,271	0.020630	0.020857	0.021900	15,398	16,168	99%	94%
11	20,075	851,396	0.023579	0.018708	0.019643	15,928	16,724	126%	120%
12	23,625	907,974	0.026019	0.016956	0.017804	15,396	16,165	153%	146%
13	17,088	974,064	0.017543	0.015500	0.016275	15,098	15,853	113%	108%
14	19,252	1,034,979	0.018601	0.014271	0.014985	14,770	15,509	130%	124%
15	19,428	1,100,595	0.017652	0.013220	0.013881	14,550	15,277	134%	127%
16	22,599	1,151,111	0.019632	0.012312	0.012928	14,172	14,881	159%	152%
17	18,184	1,164,328	0.015617	0.011518	0.012094	13,411	14,081	136%	129%
18	18,183	1,177,037	0.015448	0.010820	0.011361	12,736	13,372	143%	136%
19	14,932	1,163,063	0.012839	0.010200	0.010710	11,863	12,456	126%	120%
20	13,133	1,224,801	0.010723	0.009646	0.010128	11,814	12,405	111%	106%
21	13,480	1,196,296	0.011268	0.009149	0.009606	10,945	11,492	123%	117%
22	13,597	1,166,128	0.011660	0.008700	0.009135	10,145	10,653	134%	128%
23	11,946	1,171,508	0.010197	0.008292	0.008707	9,714	10,200	123%	117%
24	14,641	1,134,162	0.012909	0.007920	0.008316	8,983	9,432	163%	155%
25	10,143	1,103,059	0.009196	0.007580	0.007959	8,361	8,779	121%	116%
Totals	456,638	20,590,809				358,692	376,627	127%	121%

MERS GENERAL EMPLOYEES
SERVICE BASED WITHDRAWAL EXPERIENCE

Service (1)	Actual Withdrawal (2)	Total Count (3)	Actual Rate (4)	Assumed Rate		Expected Withdrawal		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
1	4,810	33,197	0.144883	0.175000	0.175000	5,809	5,809	83%	83%
2	10,101	84,876	0.119009	0.118774	0.118774	10,081	10,081	100%	100%
3	9,033	89,986	0.100387	0.101396	0.101396	9,124	9,124	99%	99%
4	7,607	91,653	0.082994	0.086148	0.086148	7,896	7,896	96%	96%
5	7,892	99,755	0.079112	0.072887	0.072887	7,271	7,271	109%	109%
6	5,828	107,993	0.053971	0.061471	0.061471	6,638	6,638	88%	88%
7	6,050	117,668	0.051413	0.051757	0.051757	6,090	6,090	99%	99%
8	6,985	134,220	0.052042	0.043604	0.043604	5,853	5,853	119%	119%
9	6,473	156,974	0.041237	0.036868	0.036868	5,787	5,787	112%	112%
10	7,450	183,925	0.040508	0.031408	0.031408	5,777	5,777	129%	129%
11	7,504	203,671	0.036844	0.027082	0.027082	5,516	5,516	136%	136%
12	6,849	216,557	0.031626	0.023746	0.023746	5,142	5,142	133%	133%
13	6,935	223,067	0.031090	0.021259	0.021259	4,742	4,742	146%	146%
14	4,688	228,687	0.020498	0.019479	0.019479	4,455	4,455	105%	105%
15	4,552	234,605	0.019402	0.018263	0.018263	4,285	4,285	106%	106%
16	3,807	239,243	0.015911	0.017470	0.017470	4,180	4,179	91%	91%
17	4,518	244,077	0.018509	0.016956	0.016956	4,139	4,138	109%	109%
18	3,795	237,809	0.015958	0.016579	0.016579	3,943	3,943	96%	96%
19	3,368	227,397	0.014811	0.016198	0.016198	3,683	3,683	91%	91%
20	2,423	224,145	0.010812	0.015669	0.015669	3,512	3,512	69%	69%
21	3,256	230,035	0.014156	0.014851	0.014851	3,416	3,416	95%	95%
22	2,851	224,917	0.012676	0.013602	0.013602	3,059	3,059	93%	93%
23	2,673	225,977	0.011830	0.011778	0.011778	2,662	2,662	100%	100%
24	2,903	217,196	0.013364	0.009239	0.009239	2,007	2,007	145%	145%
25	2,213	204,997	0.010793	0.005841	0.005841	1,197	1,197	185%	185%
Totals	134,564	4,482,627				126,264	126,262	107%	107%

POLICE AND FIRE OFFICERS
SERVICE BASED WITHDRAWAL EXPERIENCE

Service	Actual Withdrawal	Total Count	Actual Rate	Assumed Rate		Expected Withdrawal		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	6,052	62,029	0.097559	0.100000	0.100000	6,203	6,203	98%	98%
2	7,808	138,145	0.046954	0.047300	0.055650	6,534	7,688	120%	102%
3	7,207	129,528	0.054335	0.036903	0.043890	4,780	5,685	151%	127%
4	5,386	137,605	0.035789	0.030821	0.037012	4,241	5,093	127%	106%
5	5,043	148,466	0.035751	0.026506	0.032131	3,935	4,770	128%	106%
6	4,390	151,500	0.029032	0.023158	0.028346	3,509	4,294	125%	102%
7	5,007	154,410	0.032515	0.020424	0.025253	3,154	3,899	159%	128%
8	5,310	169,615	0.031925	0.018111	0.022637	3,072	3,840	173%	138%
9	2,878	168,091	0.016115	0.016108	0.020372	2,708	3,424	106%	84%
10	3,944	169,917	0.019781	0.014342	0.018374	2,437	3,122	162%	126%
11	3,227	190,686	0.014585	0.012761	0.016586	2,433	3,163	133%	102%
12	2,969	192,414	0.016354	0.011332	0.014969	2,180	2,880	136%	103%
13	2,874	198,052	0.015231	0.010026	0.013493	1,986	2,672	145%	108%
14	3,000	199,365	0.014807	0.008826	0.012135	1,760	2,419	170%	124%
15	5,003	212,382	0.023165	0.007714	0.010878	1,638	2,310	305%	217%
16	3,141	196,087	0.016691	0.006679	0.009708	1,310	1,904	240%	165%
17	703	200,500	0.003674	0.005711	0.008613	1,145	1,727	61%	41%
18	460	195,180	0.001048	0.004802	0.007584	937	1,480	49%	31%
19	297	214,370	0.001451	0.003944	0.006615	846	1,418	35%	21%
20	3,042	214,695	0.014848	0.000000	0.000000	0	0	0%	0%
21	891	214,143	0.004271	0.000000	0.000000	0	0	0%	0%
22	0	199,066	0.000000	0.000000	0.000000	0	0	0%	0%
23	0	183,115	0.000000	0.000000	0.000000	0	0	0%	0%
24	0	166,133	0.000000	0.000000	0.000000	0	0	0%	0%
25	0	157,205	0.000000	0.000000	0.000000	0	0	0%	0%
Totals	78,632	4,362,698				54,808	67,991	143%	116%

Correctional Officers
SERVICE BASED WITHDRAWAL EXPERIENCE

| | Actual | | | Assumed Rate | | Expected Withdrawal | | Actual/Expected | |
| Service | Withdrawal | Total Count | Actual Rate | Current | Proposed | Current | Proposed | Current (2) / (7) | Proposed (2) / (8) |
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1,102	11,023	0.099965	0.160000	0.100000	1,764	1,102	62%	100%
2	1,496	21,326	0.070171	0.101160	0.070000	2,157	1,493	69%	100%
3	1,179	23,401	0.050379	0.080768	0.057393	1,890	1,343	62%	88%
4	1,710	28,534	0.059935	0.068839	0.049595	1,964	1,415	87%	121%
5	2,034	35,647	0.057059	0.060375	0.045034	2,152	1,605	95%	127%
6	1,781	40,238	0.044263	0.053810	0.041797	2,165	1,682	82%	106%
7	1,876	39,612	0.047367	0.048446	0.039287	1,919	1,556	98%	121%
8	1,790	41,454	0.043191	0.043911	0.037236	1,820	1,544	98%	116%
9	2,079	42,890	0.048468	0.039983	0.035502	1,715	1,523	121%	137%
10	1,263	49,608	0.025456	0.036518	0.033999	1,812	1,687	70%	75%
11	2,255	59,137	0.038136	0.033418	0.032674	1,976	1,932	114%	117%
12	2,111	60,622	0.034816	0.030614	0.031489	1,856	1,909	114%	111%
13	2,869	62,343	0.046020	0.028054	0.030417	1,749	1,896	164%	151%
14	1,562	57,551	0.027143	0.025699	0.029438	1,479	1,694	106%	92%
15	1,695	53,465	0.031711	0.023519	0.028537	1,257	1,526	135%	111%
16	2,346	54,279	0.043213	0.021489	0.027704	1,166	1,504	201%	156%
17	1,931	55,611	0.034722	0.019590	0.026927	1,089	1,497	177%	129%
18	1,868	58,239	0.032074	0.017807	0.026201	1,037	1,526	180%	122%
19	2,356	74,877	0.031466	0.016125	0.025519	1,207	1,911	195%	123%
20	1,592	97,480	0.016329	0.014535	0.024876	1,417	2,425	112%	66%
21	2,491	107,889	0.023089	0.013026	0.024268	1,405	2,618	177%	95%
22	3,262	112,156	0.029083	0.011590	0.023691	1,300	2,657	251%	123%
23	3,387	122,999	0.027533	0.010222	0.023142	1,257	2,846	269%	119%
24	2,400	127,420	0.018837	0.008914	0.022619	1,136	2,882	211%	83%
25	1,463	127,189	0.011506	0.007662	0.022119	974	2,813	150%	52%
Totals	49,899	1,564,990				39,666	46,587	126%	107%

Salary Scale Assumption
State Employees

Year	Average Long Service Increase	CPI	Productivity
2010	4.49%	1.05%	3.44%
2011	1.94%	3.56%	-1.62%
2012	4.79%	1.66%	3.13%
2013	0.84%	1.75%	-0.92%
2014	0.76%	2.07%	-1.31%
2015	3.75%	0.12%	3.62%
2016	2.19%	1.00%	1.20%
2017	1.67%	1.63%	0.03%
2018	1.82%	2.87%	-1.06%
2019	4.12%	1.65%	2.47%
Average	2.63%	1.73%	0.89%
Proposed	3.25%	2.50%	0.75%

Years of Service	Average Pay Increase	Less Actual Inflation and Productivity Components	Actual Step-Rate/Promotional Component	Proposed Step-Rate/Promotional Component
2	4.11%	(2.63%)	1.49%	2.00%
3	6.25%	(2.63%)	3.62%	3.00%
4	5.64%	(2.63%)	3.02%	2.75%
5	5.23%	(2.63%)	2.60%	2.75%
6	5.28%	(2.63%)	2.66%	2.50%
7	4.13%	(2.63%)	1.50%	1.25%
8	3.92%	(2.63%)	1.29%	1.00%
9	3.61%	(2.63%)	0.98%	1.00%
10	3.83%	(2.63%)	1.21%	1.00%
11	3.73%	(2.63%)	1.10%	1.00%
12	4.49%	(2.63%)	1.87%	2.00%
13	3.70%	(2.63%)	1.08%	1.25%
14	3.14%	(2.63%)	0.51%	1.00%
15	3.53%	(2.63%)	0.90%	1.00%
16	3.64%	(2.63%)	1.01%	1.00%
17	2.90%	(2.63%)	0.27%	0.50%
18	2.95%	(2.63%)	0.33%	0.50%
19	2.80%	(2.63%)	0.17%	0.50%
20	2.83%	(2.63%)	0.20%	0.50%
21	3.21%	(2.63%)	0.59%	0.50%
22	2.81%	(2.63%)	0.18%	0.25%
23	2.72%	(2.63%)	0.10%	0.25%
24	3.14%	(2.63%)	0.51%	0.25%
25+	2.63%	(2.63%)	0.00%	0.00%

Salary Scale Assumption
Teachers

Year	Average Long Service Increase	CPI	Productivity
2010	6.14%	1.05%	5.09%
2011	3.45%	3.56%	-0.11%
2012	2.79%	1.66%	1.12%
2013	2.50%	1.75%	0.74%
2014	4.06%	2.07%	1.99%
2015	1.58%	0.12%	1.46%
2016	-2.53%	1.00%	-3.53%
2017	1.93%	1.63%	0.29%
2018	2.08%	2.87%	-0.79%
2019	0.33%	1.65%	-1.32%
Average	2.23%	1.73%	0.50%
Proposed	3.00%	2.50%	0.50%

Years of Service	Average Pay Increase	Less Actual Inflation and Productivity Components	Actual Step-Rate/Promotional Component	Proposed Step-Rate/Promotional Component
2	8.28%	(2.10%)	6.19%	9.00%
3	7.86%	(2.10%)	5.77%	6.25%
4	7.39%	(2.10%)	5.30%	5.50%
5	7.42%	(2.10%)	5.32%	5.00%
6	6.63%	(2.10%)	4.54%	5.00%
7	6.37%	(2.10%)	4.27%	4.50%
8	6.40%	(2.10%)	4.31%	4.25%
9	6.79%	(2.10%)	4.69%	4.00%
10	3.59%	(2.10%)	1.50%	4.00%
11	2.10%	(2.10%)	0.00%	0.00%

Salary Scale Assumption
General Employees

Year	Average Long Service Increase	CPI	Productivity
2010	1.52%	1.05%	0.46%
2011	2.05%	3.56%	-1.51%
2012	1.50%	1.66%	-0.17%
2013	2.04%	1.75%	0.29%
2014	1.61%	2.07%	-0.46%
2015	2.58%	0.12%	2.46%
2016	2.44%	1.00%	1.44%
2017	3.96%	1.63%	2.33%
2018	3.43%	2.87%	0.55%
2019	3.10%	1.65%	1.45%
Average	3.14%	1.73%	0.69%
Proposed	3.25%	2.50%	0.75%

Years of Service	Average Pay Increase	Less Actual Inflation and Productivity Components	Actual Step-Rate/Promotional Component	Proposed Step-Rate/Promotional Component
2	4.16%	-2.42%	1.74%	3.00%
3	5.36%	-2.42%	2.94%	2.75%
4	4.93%	-2.42%	2.51%	2.50%
5	4.28%	-2.42%	1.86%	2.25%
6	4.74%	-2.42%	2.32%	2.00%
7	3.94%	-2.42%	1.52%	1.25%
8	3.38%	-2.42%	0.96%	0.75%
9	3.33%	-2.42%	0.91%	0.50%
10	3.47%	-2.42%	1.05%	0.50%
11	3.36%	-2.42%	0.94%	0.25%
12	2.62%	-2.42%	0.21%	0.25%
13	2.21%	-2.42%	-0.21%	0.25%
14	2.58%	-2.42%	0.16%	0.25%
15	2.97%	-2.42%	0.55%	0.25%
16+	2.42%	-2.42%	0.00%	0.00%

Salary Scale Assumption
Police and FireFighters

Year	Average Long Service Increase	CPI	Productivity
2004	4.07%	3.27%	0.80%
2005	0.01%	2.53%	(2.52%)
2006	9.03%	4.32%	4.71%
2007	5.89%	2.69%	3.21%
2008	2.76%	5.02%	(2.26%)
2009	3.33%	(1.43%)	4.76%
2010	3.25%	1.05%	2.19%
2011	3.16%	3.56%	(0.40%)
2012	5.70%	1.66%	4.03%
2013	2.50%	1.75%	4.03%
Average	5.31%	2.43%	1.52%
Proposed	4.00%	2.75%	1.25%

Years of Service	Average Pay Increase	Less Actual Inflation and Productivity Components	Actual Step-Rate/Promotional Component	Proposed Step-Rate/Promotional Component
2	14.44%	(3.94%)	10.50%	9.00%
3	10.79%	(3.94%)	6.84%	7.00%
4	8.07%	(3.94%)	4.12%	4.00%
5	6.11%	(3.94%)	2.17%	2.50%
6	6.77%	(3.94%)	2.83%	3.00%
7	4.29%	(3.94%)	0.35%	0.50%
8	4.27%	(3.94%)	0.33%	0.50%
9	3.94%	(3.94%)	0.00%	0.00%

Salary Scale Assumption
Correctional Officers

Year	Average Long Service Increase	CPI	Productivity
2010	-0.43%	1.05%	-1.48%
2011	5.00%	3.56%	1.44%
2012	7.63%	1.66%	5.97%
2013	-0.61%	1.75%	-2.36%
2014	0.76%	2.07%	-1.31%
2015	0.75%	0.12%	0.62%
2016	0.50%	1.00%	-0.50%
2017	9.17%	1.63%	7.53%
2018	2.62%	2.87%	-0.25%
2019	4.03%	1.65%	2.38%
Average	2.89%	1.73%	1.16%
Proposed	3.25%	2.50%	0.75%

Years of Service	Average Pay Increase	Less Actual Inflation and Productivity Components	Actual Step-Rate/Promotional Component	Proposed Step-Rate/Promotional Component
2	3.55%	(2.89%)	0.66%	3.00%
3	10.70%	(2.89%)	7.81%	4.00%
4	7.85%	(2.89%)	4.96%	3.75%
5	6.82%	(2.89%)	3.92%	3.75%
6	5.24%	(2.89%)	2.35%	3.50%
7	5.42%	(2.89%)	2.53%	2.25%
8	5.21%	(2.89%)	2.32%	2.00%
9	4.40%	(2.89%)	1.50%	2.00%
10	5.47%	(2.89%)	2.58%	2.00%
11	3.66%	(2.89%)	0.77%	1.50%
12	3.51%	(2.89%)	0.62%	2.50%
13	3.90%	(2.89%)	1.01%	1.75%
14	5.53%	(2.89%)	2.63%	1.50%
15	3.41%	(2.89%)	0.51%	1.50%
16	3.43%	(2.89%)	0.54%	1.00%
17	4.13%	(2.89%)	1.24%	1.00%
18	2.40%	(2.89%)	-0.49%	1.00%
19	8.22%	(2.89%)	5.33%	1.00%
20	3.90%	(2.89%)	1.01%	1.00%
21	4.15%	(2.89%)	1.26%	1.00%
22	5.62%	(2.89%)	2.72%	1.00%
23	3.62%	(2.89%)	0.73%	1.00%
24	4.48%	(2.89%)	1.59%	1.00%
25+	2.89%	(2.89%)	0.00%	0.00%

CORRECTIONAL OFFICERS
RETIREMENT EXPERIENCE - SERVICE BASED

Service Year	Actual Retirement	Total Count	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
25	6	130	0.046	0.050	0.050	4	13	150%	46%
26	16	172	0.093	0.050	0.050	5	9	320%	178%
27	4	173	0.023	0.050	0.050	5	9	80%	44%
28	6	167	0.036	0.050	0.050	7	8	86%	75%
29	4	129	0.031	0.050	0.050	6	6	67%	67%
30	10	111	0.090	0.130	0.130	7	7	143%	143%
31	3	98	0.031	0.130	0.130	7	7	43%	43%
32	7	101	0.069	0.130	0.130	8	8	88%	88%
33	8	87	0.092	0.200	0.200	8	8	100%	100%
34	10	73	0.137	0.200	0.200	7	7	143%	143%
35	13	63	0.206	0.350	0.350	19	16	68%	81%
36	6	43	0.140	0.250	0.250	11	9	55%	67%
37	5	33	0.152	0.250	0.250	8	7	63%	71%
38	6	23	0.261	0.250	0.250	6	5	100%	120%
39	2	13	0.154	0.250	0.250	3	3	67%	67%
40	2	9	0.222	1.000	1.000	9	9	22%	22%
41	2	8	0.250	1.000	1.000	8	8	25%	25%
42	-	6	0.000	1.000	1.000	6	6	0%	0%
43	1	6	0.167	1.000	1.000	6	6	17%	17%
44	2	4	0.500	1.000	1.000	4	4	50%	50%
45	-	2	0.000	1.000	1.000	2	2	0%	0%
Total	113	1,451	0.078			146	157	77%	72%

POLICE AND FIRE OFFICERS
RETIREMENT EXPERIENCE - SERVICE BASED
For members who reach 20 years of service

Service Year	Actual Retirement	Total Count	Actual Rate	Assumed Rate		Expected Retirement		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
25	12	93	0.129	0.120	0.120	11	12	109%	100%
26	9	59	0.153	0.120	0.120	6	9	150%	100%
27	7	37	0.189	0.120	0.120	4	7	175%	100%
28	3	20	0.150	0.120	0.120	2	4	150%	75%
29	3	15	0.200	0.120	0.120	2	3	150%	100%
30 or more	4	34	0.118	0.235	0.353	8	12	50%	33%
Total	234	1,502	0.156			209	209	112%	112%