Fire and Police Pension Association of Colorado

2022 Actuarial Experience Study
for the Period Ending December 31, 2021

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June 20, 2022

Board of Directors
Fire and Police Pension Association of Colorado
5290 DTC Parkway, #100
Greenwood Village, Colorado 80111

Subject: Results of the 2022 Experience Study

Dear Members of the Board:

We are pleased to present our report of the results of the 2022 Actuarial Experience Investigation Study for the Fire and Police Pension Association of Colorado ("FPPA"). Our report includes a discussion of the recent experience of the System, 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 of FPPA.

With the Board of Trustees' approval of the recommendations in this report, we believe the actuarial condition of the System will be more accurately measured and portrayed.

This experience investigation study was conducted in accordance with generally accepted actuarial principles and practices, and in full compliance with the Actuarial Standards of Practice as issued by the Actuarial Standards Board. All of the undersigned are members of and meet the Qualification Standards of the American Academy of Actuaries.

We wish to thank the FPPA staff for their assistance in this project.

Respectfully submitted,

Joseph P. Newton, FSA, EA, MAAA
Pension Market Leader & Actuary

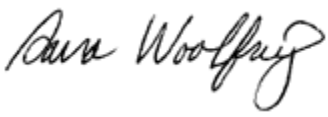

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Table of Contents

SECTION A

EXECUTIVE SUMMARY

Executive Summary

Our recommended changes to the key current actuarial assumptions and methods used in the valuations are summarized below. The rationale for these recommendations, including recommendations for no changes to other assumptions and methods, are described in detail in Section C. A full disclosure of the proposed assumptions is in Section E.

Economic assumptions

1. Based on a recommended unchanged inflation rate of 2.50%, we recommend no change to the current nominal investment assumption for the Long-Term Pool (7.00%), Glide Path Pool (6.50%), or the Short Term Pool (4.50%).
2. We recommend increasing the step-rate increase portion of the salary scale by 0.50% per year for the first 4 years of a member's career and 0.25% for years 5 through 14 in accordance with the observed experience.
3. We recommend reducing the overall payroll growth assumption from 3.50% to 3.00%.

Mortality assumptions

4. Recommend updating the base assumptions for mortality to the recently published Pub-2010 tables for Public Safety. We also recommend updating the table used to build in generational improvements in mortality for the future to the ultimate rates of the MP table 2020 for all years.
    - for Healthy Post-Retirement Mortality (including all beneficiaries) use the Pub-2010 Tables for Healthy Public Safety Retirees.
    - for Occupationally Disabled Post-Retirement Mortality use the same mortality table as Healthy Retirees but with a 3-year set-forward.
    - for Totally Disabled Post-Retirement Mortality use the same mortality table as Healthy Retirees but with a 5-year set-forward and a minimum mortality probability of 3.5% for males and 2.5% for females.
    - for Active Employees use 60% of the Pub-2010 Tables for Public Safety Employees for non-duty related mortality and a flat 0.00015 for duty related mortality for all ages. Duty related mortality will not be projected for future mortality improvement.

Demographic assumptions

5. Increase termination rates slightly overall, but include a multiplier process to have separate termination patterns for Police and Firefighters.
6. Slightly modify Statewide Defined Benefit Plan and Statewide Hybrid Plan retirement rates to reflect increased early retirement utilization for low service members and extend maximum retirement age from 60 to 62.
7. Increase total disability rates by 50% for members covered by a money purchase plan. This brings rates in alignment for both members covered by defined benefit plans and members covered by a money purchase plan. This impacts only the Statewide Death and Disability Plan.
8. Include a load on occupational disability benefits in place for five years or less. This impacts only the Statewide Death and Disability Plan.

SECTION B

INTRODUCTION

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 FPPA. 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 will 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 asymmetric 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 FPPA 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, contribution rates and funding periods for retirement plans, actuaries must make assumptions about the future. Among the assumptions that must be made are:

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

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

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 strength of the national and local 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 economic trends. This study reflects new data based on experience during the four-year period of January 1, 2018 to December 31, 2021 to the data utilized in the last experience study, which was prepared in 2018.

Also, the adoption of new legislation that impacts benefits or compensation may cause a short-term distortion in the experience. For example, if an early retirement window were 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 to observe the plan's experience reduces the influence of such short-term effects. On the other hand, using a much longer period may not immediately reflect 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 four-to six-year period appropriately balances these effects.

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 "expected" is determined from using the probability of the occurrence at the given age, times the "exposures" at that same age. For example, let's look at a rate of retirement of 50% 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 precisely predicted the actual experience the A/E ratio would be 100%. When it varies much from this figure, it is a sign that new assumptions may be needed. Of course, we not only look at the assumptions as a whole, but we also review how well they fit the actual results by sex, by age, and by service.

Please note it is often appropriate to graduate or smooth the results since the actual experience can be quite uneven from age to age or from service year to service year.

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

Plans Studied

This study pertains to the following plans:

- Statewide Defined Benefit Plan (SWDB)
- Statewide Death and Disability Plan (SWDD) which includes members covered under the Defined Benefit (DB) Plans as well as the Money Purchase (MP) Plans
- Statewide Hybrid Plan – Defined Benefit Component (SWH)
- Colorado Springs New Hire Plans
- Local defined benefit pension plans for firefighter and police employees in the State of Colorado hired before April 8, 1978 whose employers have chosen to affiliate with FPPA (Old Hire Plans)
- Volunteer firefighter defined benefit pension plans in the State of Colorado who have chosen to affiliate with FPPA (Volunteer Plans)

The study was largely based on census data for the SWDB plan. The study of disability incidence and disabled mortality was completed using census data for the SWDD plan. Census data for the Volunteer Firefighter plans was used to review the termination and retirement assumption for those plans.

Organization of Report

Section C contains our findings and recommendations for each actuarial assumption. The impact of adopting our recommendations on liabilities and contribution rates is shown in Section D. Section E summarizes the recommended changes. Section E presents a summary of all the actuarial assumptions and methods, including the recommended changes.

SECTION C

ANALYSIS OF EXPERIENCE AND RECOMMENDATIONS

Analysis of Experience and Recommendations

We will begin by discussing the economic assumptions: inflation, the investment return rate, the salary increase assumption, the cost-of-living increases (COLAs), and the payroll growth rate. Next, we will discuss the demographic assumptions: mortality, disability, termination and retirement. Finally, we will discuss the actuarial methods used to calculate the liability, funded status, and contribution rate.

Actuarial Standards of Practice for Setting Economic Assumptions

Actuarial Standard 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 pension plans. This supplements ASOP 4, Measuring Pension Obligations and Determining Plan Costs or Contributions.

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

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

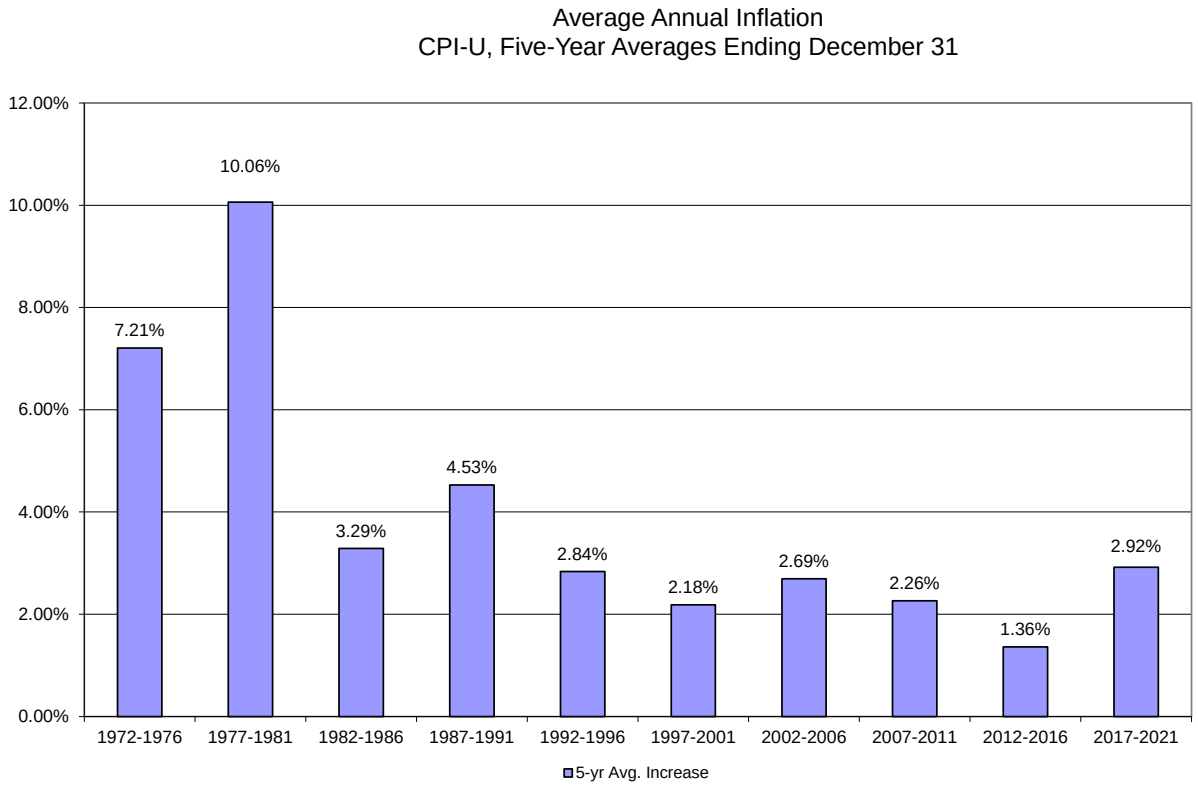
However, the standard explicitly advises an actuary not to give undue weight to recent experience.

Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period. Generally, the economic assumptions are much more subjective in nature than the demographic assumptions.

Inflation rate

"Inflation," refers to price inflation, as measured by annual increases in the Consumer Price Index (CPI). This inflation assumption underlies all of the other economic assumptions we employ. It impacts investment return, salary increases, and cost-of-living increases (COLAs) in retiree benefits.

The chart on the following page shows the average annual inflation in each of the ten consecutive five-year periods over the last fifty years.



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

The table below shows the average inflation over various periods, ending December 2021:

Periods Ending Dec. 2021	Average Annual Increase in CPI-U
Last five (5) years	2.92%
Last ten (10) years	2.14%
Last fifteen (15) years	2.18%
Last twenty (20) years	2.31%
Last twenty-five (25) years	2.28%
Last thirty (30) years	2.37%
Since 1913 (first available year)	3.13%

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

As you can see, while very recent inflation has been higher than the 2.50% assumption, longer term averages have been closer to or lower than the current assumption.

Most investment consulting firms, in setting their capital market assumptions, currently assume that inflation will be less than 2.50%. We examined the 2022 capital market assumption sets for 12 investment consulting firms. The average assumption for inflation was 2.53%, with a range of 2.26% to 3.10%.

The following is a summary of other forward-looking inflation forecasts from various sources:

Forward-Looking Price Inflation Forecasts[a]	
Congressional Budget Office[b]	
5-Year Annual Average	2.58%
10-Year Annual Average	2.49%
Federal Reserve Bank of Philadelphia[c]	
5-Year Annual Average	2.70%
10-Year Annual Average	2.50%
Federal Reserve Bank of Cleveland[d]	
10-Year Expectation	1.95%
20-Year Expectation	2.08%
30-Year Expectation	2.20%
Federal Reserve Bank of St. Louis[e]	
10-Year Breakeven Inflation	2.85%
20-Year Breakeven Inflation	2.81%
30-Year Breakeven Inflation	2.49%
U.S. Department of the Treasury[f]	
10-Year Breakeven Inflation	2.77%
20-Year Breakeven Inflation	2.68%
30-Year Breakeven Inflation	2.52%
50-Year Breakeven Inflation	2.53%
100-Year Breakeven Inflation	2.55%
Social Security Trustees[g]	
Ultimate Intermediate Assumption	2.40%

[a] **End of the First Quarter, 2022**. Version 2022-04-21 by Gabriel, Roeder, Smith & Company

[b] *The Budget and Economic Outlook: 2021 to 2031,* Release Date: July 2021, Consumer Price Index (CPI-U), Percentage Change from Year to Year, 5-Year Annual Average (2021 - 2025), 10-Year Annual Average (2021 - 2030).

[c] *First Quarter 2022 Survey of Professional Forecasters* , Release Date: February 11, 2022, Headline CPI, Annualized Percentage Points, 5-Year Annual Average (2022 - 2026), 10-Year Annual Average (2022 - 2031).

[d] Inflation Expectations, Model output date: March 1, 2022.

[e] The breakeven inflation rate represents a measure of expected inflation derived from X-Year Treasury Constant Maturity Securities and X-Year Treasury Inflation-Indexed Constant Maturity Securities. Observation date: March, 2022.

[f] The Treasury Breakeven Inflation (TBI) Curve, Monthly Average Rates, March, 2022.

[g] *The 2021 Annual Report of The Board of Trustees of The Federal Old-Age And Survivors Insurance and Federal Disability Insurance Trust Funds,* August 31, 2021, Long-range (75-year) assumptions, Intermediate, Consumer Price Index (CPI-W), for 2024 and later.

Recommendation

As shown, several of the forecasts have increased to a level above 2.50%. However, several of the longer-term data points are still close to, if not lower, than 2.50%. As a result, we recommend leaving this assumption unchanged at 2.50%.

Investment and administrative 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.

For FPPA, the practice for administrative expenses has been to explicitly add a load onto the normal cost. This is also our preferred approach and we recommend continuing this practice. Using an explicit load onto the normal cost maximizes transparency, aligns better with the standards of the Governmental Accounting Standards Board, and maintains a parallel between the investment returns used by the investment consultant and the actuary.

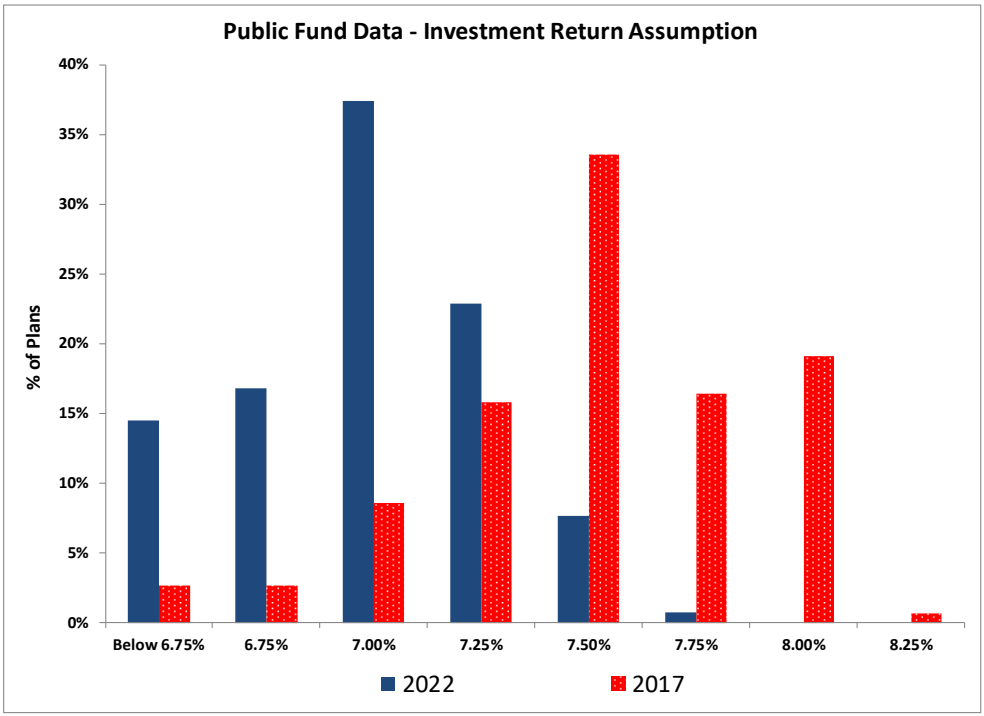
The explicit load is based on actual administrative expenses paid in the prior year. In some cases, this dollar amount is converted to a percentage of payroll based on valuation payroll. For the Volunteer and Old Hire Plans, this amount is based on an average of the actual administrative expenses in the prior two years due to the biennial nature of these plans.

Investment return rate

Currently, FPPA assumes an annual investment return rate of 7.00%. This is the rate used in discounting future benefit payments in calculating the actuarial present value of benefits as of the valuation date. Similar to the inflation assumption, past performance is not a reliable indicator of future performance, even when averaged over a long time period. Also, the actual asset allocation of the trust fund will significantly impact the overall performance, so returns achieved under a different allocation are not meaningful. This assumption was lowered from 7.50% in the 2018 experience study.

Assumption 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 FPPA is compared to its peers. The chart below shows the distribution of the investment return assumptions in the NASRA Public Fund Data as of March 2022.



We have included the same information from the 2017 survey to show the national trends in this assumption. The median rate of return is 7.00% and the average is now 6.99%.

Asset Allocation

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 ten-year period is not long enough to provide reasonable guidance. We believe a better approach to selecting an investment return assumption is to determine the median expected portfolio return given the fund's targeted allocation and an overall set of capital market assumptions. Per information received from FPPA, the Long Term Pool's current target asset allocation is as follows (does not add due to rounding):

Asset Class	Target Allocation
Cash	1 %
Fixed Income	15 %
Absolute Return	8 %
Long Short	8 %
Global Public Equity	35 %
Private Capital	34 %
Total	100 %

We received intermediate and long-term compound return expectations for all three of the FPPA investment pools form FPPA's investment advisor, Cambridge. The expectations were as follows:

	Long Term Pool	Glide Path Pool	Short Term Pool
Current Assumption	7.00%	6.50%	4.50%
Intermediate-Term Expectation	7.28%	6.09%	3.44%
Long-Term Expectation	7.54%	6.87%	

Because GRS is a benefits consulting firm and does not develop or maintain our own capital market assumptions, to verify the results above we utilized the forward-looking return expectations developed by 12 national consulting firms. These investment consulting firms periodically issue reports that describe their capital market assumptions. That is, their estimates of expected returns, volatility, and correlations. While these assumptions are developed based upon historical analysis, many of these firms also incorporate forward-looking adjustments to better reflect near-term expectations.

Given the long-term pool's current asset allocation and the investment consultants' capital market assumptions, the development of the average expected compound return, net of investment expenses, is provided in the following table.

Expected Annual Geometric Returns and Return Probabilities
(Based on Current Capital Market Assumptions)

GRS 2022 CMAM				
Capital Market Assumption Set (CMA)	**Distribution of 10-Year Average Geometric Net Nominal Return**			**Probability of exceeding**
	40th	**50th**	**60th**	**7.00%**
(1)	(2)	(3)	(4)	(5)
1	4.34%	5.41%	6.49%	35.45%
2	4.81%	5.91%	7.02%	40.14%
3	4.93%	6.21%	7.51%	43.86%
4	5.24%	6.26%	7.29%	42.75%
5	5.05%	6.31%	7.58%	44.50%
6	5.20%	6.52%	7.85%	46.32%
7	5.44%	6.60%	7.77%	46.50%
8	5.71%	6.89%	8.09%	49.10%
9	5.60%	6.90%	8.22%	49.25%
10	5.75%	6.96%	8.18%	49.65%
11	6.14%	7.32%	8.50%	52.70%
12	8.16%	9.55%	10.95%	67.98%
Average	**5.53%**	**6.73%**	**7.95%**	**47.35%**

As shown, based on this survey, the average expected median return for the next 10 years is 6.73%. We do have six sources of longer-term expectations (20-30 years), and they are 0.50%-0.75% higher.

Thus, based on this analysis, we recommend no change to the 7.00% investment return assumption used for valuing plans participating in the long-term pool. In our opinion, the process above meets all of the requirements needed to use that as a basis for our analysis. The results were appropriate for the purpose of the measurement, as the estimates were medium to longer term forecasts of market expectations. They took into account historical and current economic data that is relevant as of the measurement date, represent an estimate of future experience and an observation of market data, and had no significant bias (i.e., it is not significantly optimistic or pessimistic).

Other Asset Pools

The real return analysis and nominal investment return recommendations are highly dependent on the asset allocation targets currently in place for the assets under FPPA management. There is a Short-Term Pool, which contains very mature closed plans that generally have one or two retirees left and investment performance has a very minor impact on the valuation as they are mainly pay-as-you-go or way overfunded. We believe the current 4.50% return assumption for this group is reasonable. There is also a Glide Path Pool, which is for larger, closed plans that still have 15-20 year time horizons. The expectations from Cambridge are slightly lower than the 6.50%, but this is based on the market value of assets as of January 1, 2022, while the valuation only needs to earn 6.50% based on the actuarial value of assets going forward. Given the amount of deferred investment gains as of January 1, 2022 and the funding policy that holds contributions higher than the actuarially determined contribution in each valuation if it is declining, we are comfortable with the 6.50% assumption for this group.

Salary increase rates

In order to project future benefits, the actuary must project future salary increases for individuals. 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.

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 (but also looked back at older studies).

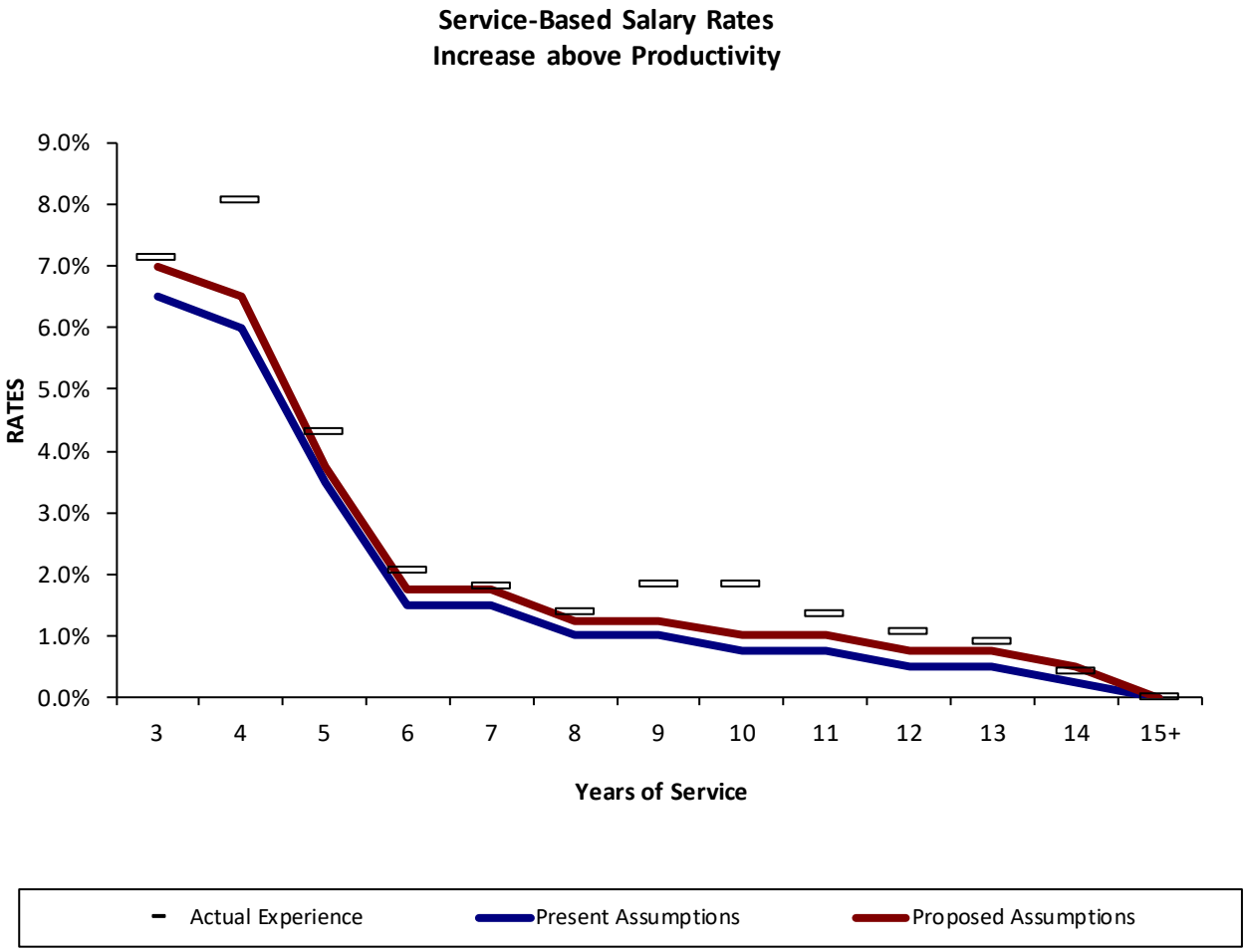
Most actuaries recommend salary increase assumptions that include an element that depends on the member's age or service, especially for large, public retirement systems. It is typical to assume larger pay increases for younger or shorter-service employees. This is done in order to reflect pay increases 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.

The current salary increase assumption is a service related table that begins with 11.75% annual increases for new members decreasing to 4.25% annual increases for members with 15 or more years of service.

To separate the steps, or promotional component of the schedule, we segregated out members with more than 14 years of service. Most of these members should be past the promotional and step portions of their careers and, therefore, only receive the general increases granted and a small amount of individual merit.

Period	Overall Increase for Long Service Members	Inflation	Increase Above Inflation
Calendar Year 2012	3.86%	1.74%	2.11%
Calendar Year 2013	2.58%	1.50%	1.08%
Calendar Year 2014	1.70%	0.76%	0.94%
Calendar Year 2015	3.51%	0.73%	2.78%
Calendar Year 2016	5.35%	2.07%	3.27%
Calendar Year 2017	3.29%	2.11%	1.18%
Calendar Year 2018	4.94%	1.91%	3.03%
Calendar Year 2019	5.09%	2.29%	2.80%
Calendar Year 2020	4.81%	1.36%	3.45%
Calendar Year 2021	3.25%	7.04%	-3.78%
Average	**3.83%**	**2.14%**	**1.69%**

The average actual increase of 3.83% was lower than the expected 4.25% increase. However, the actual inflation experience has been significantly lower for most of the time period than assumed. The actual general productivity increases during the ten-year period were 1.69%, which is close to the current assumption of 1.75%. So, while the current assumption may look overly conservative compared to the nominal experience, it appears in line when looked at net of actual inflation. Also, the very recent high inflation has not had time to be reflected in the salary experience. Combined with the unchanged inflation assumption of 2.50%, we recommend continuing to use a nominal ultimate pay increase assumption of 4.25% (2.50% inflation plus 1.75% productivity and merit).



The above exhibit models the portion of the salary increases for short term members that exceeded the salary increases for long term members based on the current assumptions, the actual experience, and a set of new proposed assumptions if applicable. Based on the observed experience, the service-based increases assumed at short tenures were increased 0.50% per year for the first four years of the member's career and 0.25% for years 5 through 14. The net impact will be a 4.5% increase in the member's projected salary at the end of 14 years, and thus will increase the normal cost for the salary-based plans.

General Payroll Growth

The salary increase rates discussed above are assumptions applied to individuals. They are used in projecting future benefits. For purposes of determining certain results as a level percentage of pay or indexing cohorts of future members into open group projections, we also use a separate general payroll growth assumption, which is currently 3.50% per year. This number is used in determining the contribution needed to amortize the unfunded actuarial accrued liability as a level percentage of pay (if applicable in the SWDB plan) and in determining the new entrant pay in the funding projections. Since the SWDB plan currently has no unfunded actuarial accrued liability, this assumption is only used for indexing the new entrant pay and has little impact on the valuation results.

Payroll often grows at a rate different from the average pay increases for individual members. Reasons include when older, longer-service members leave employment they are generally replaced with new members who are starting with a lower salary. Because of this, in most populations that are not growing in size, the growth in total payroll will be smaller than the average pay increase for members. On the other hand, payroll can grow due to an increase in the size of the group.

After adjusting for counts, payroll in the Statewide Defined Benefit Plan has grown on average 2.46% over the last ten years, during a time when inflation was 2.14%. Thus, payroll has grown on average 0.32% above inflation.

We believe the 0.32% might be low because the recent high inflation values have not had time to be reflected in the overall payroll change. For example, the same exercise as of December 31, 2020 would have yielded an average increase over inflation of 0.71%. A reasonable range for this assumption is between the 2.50% inflation assumption and 3.25%, or 0.75% above inflation. We are recommending lowering this assumption to 3.00%.

Cost-of-living (COLAs) increase assumption

Cost-of-living increases are at the discretion of the FPPA Board for the three statewide plans (SWDB, SWH-DB, SWDD). As such, no cost-of-living adjustment is assumed for the baseline valuation results.

For the Colorado Springs New Hire Plans, increases are automatic and tied to inflation. As no change was recommended to the inflation assumption, no change is recommended to the cost-of-living adjustment assumption used for these two plans.

Some Old Hire Plans include a rank escalation increase in benefits (as active members receive an increase in pay, retirees receive a similar increase). Generally, we recommend that the rank escalation assumption tie to the payroll growth assumption, and the recommendation was to reduce the payroll growth by 0.50%. However, reducing the rank escalations assumptions results in a more aggressive assumption for these Old Hire Plans. As such, we recommend no changes to the Old Hire rank escalation assumptions.

Demographic Assumptions

As previously mentioned, actuaries are guided by the Actuarial Standards of Practice (ASOP) adopted by the Actuarial Standards Board (ASB). One of these standards is ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*. This standard provides guidance to actuaries giving advice on selecting noneconomic assumptions for measuring obligations under defined benefit plans. We believe the recommended assumptions in this report were developed in compliance with this standard.

Post-retirement mortality probabilities

The longer retirees live and receive their benefits, the larger the liability of the plan, thus increasing the contributions necessary to fund the plan. We currently use the RP-2014 Combined Mortality Table for males and females, with full generational mortality projection using the ultimate values of pre-2020 MP projection scales for all plans under FPPA. The current assumption set was recommended in the last experience study based on the standard mortality tables available at the time.

Credibility

The Old Hire Plans use a very different mortality definition than the Statewide Defined Benefit Plan. Currently the Old Hire Plans have nearly as many disability retirees as normal service retirements indicating a low threshold for disability eligibility. This low threshold for disability retirement may indicate that the remaining non-disabled service retirees would have above average life expectancy, and may not be appropriate for study of the general FPPA retiree population. The Statewide Defined Benefit plan is still a relatively young plan with a small retiree population. For example, during the last nine years, within the Statewide Defined Benefit Plan there were less than 100 deaths, indicating very limited credibility. As such, neither population provides an adequate experience base from which to develop an FPPA population specific mortality assumption, and we recommend continuing to use a standard base table.

Base Table: 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.

We are recommending the use of the median public safety tables from the Pub-10 universe of tables for healthy retirees and all beneficiaries.

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 a 1% improvement assumption per year across most ages.

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

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

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

We find it would be reasonable to use either set of improvement scales, but give preference to the more recently published report all else being equal. Given the material increase in healthcare costs it has required over the last few decades to allow for the rates of improvement that have existed, and the general worsening in morbidity factors in the United States, we find it reasonable to assume the future improvement would be approximate to or less than it has been historically across most ages. The 2020 report provides several pages of rationale and disclosure of the process used to generate the new long-term rates, including comparing to historical trends, and we find the analysis thorough and reasonable. Thus, we are recommending use of the ultimate rates in the MP-2020 scales, applied for all years.

The following is a table with the life expectancy for a retired member who attains age 60 based on the proposed assumption set, by calendar year. As shown, the life expectancy is expected to increase into the future.

Proposed Mortality Assumption – Male Life Expectancy for an Age 60 Retiree in Years					
Group	**Year of Retirement**				
	2022	**2027**	**2032**	**2037**	**2042**
Healthy Retiree – Current	25.5	26.0	26.4	26.9	27.3
Healthy Retiree - Proposed	26.1	26.5	26.9	27.3	27.7

This mortality recommendation applies to all healthy retirees under the FPPA system. The net impact of the proposed mortality assumptions would be an increase in liabilities.

Totally Disabled mortality rates

We currently use the RP-2014 table for disabled lives for totally disabled retirees. As the other mortality tables are moving to the Pub(10) universe of tables, we would prefer to update this assumption as well. However, the data used to create the Pub(10) table for disabled public safety retirees has the same issue as the old hire data for FPPA in that the definitions of disability are not consistent across the dataset. In fact, the mortality rates for the standard public safety disabled table are not very impaired. We are recommending the same underlying mortality table as used for healthy retirees, except with a 5-year set-forward. We are going to continue to place a minimum probability of death across all of the age groups to reflect the high impairment for this population, upping the minimum to 3.5% for males and 2.5% for females. These rates are consistent with other mortality tables for retirees with an "unable to engage in any substantial gainful activity" definition of disability.

This assumption applies to the SWDD plan and the Volunteer Plans, although it is immaterial in the case of the Volunteer Plans.

Occupationally Disabled mortality rates

The standard for Occupational Disability only requires that a participant can no longer be employed as a police officer or firefighter which is a much lower threshold than is associated with standard disabled mortality tables. Using a standard disabled mortality table would overestimate the level of impairment and underestimate the lifespan of these members. Rather than using a disabled mortality table, we recommend continuing to use the healthy retiree rates with a three-year set-forward (age 60 uses age 63 rate) to reflect partial impairment. This assumption applies to the SWDD plan and the Old Hire Plans for participants disabled prior to January 1, 1980.

Active mortality rates

For non-duty death, we are recommending the 60% of Pub(10) public safety table for active employees and fully generational mortality, projected using the same projection scale as discussed above. For duty death, we recommend maintaining the current flat rate of 0.015% per year. Making this change results in minimal impact to the valuations.

Disability rates

FPPA uses separate disability rates for disability type (occupational vs. total disability) and for member retirement plan type (defined benefit plan vs. money purchase plan). During the four-year study period, the money purchase occupational disability experience was similar to historical experience and there were slightly fewer than expected occupational disabilities in the defined benefit experience based on the previously assumed rates. There was a significant change to this assumption in the previous experience study to reflect a stark increase in the number of occupational disabilities and an increasing trend over time. The experience from this study shows the current assumption to be reasonable, if not slightly conservative. Thus, we recommend no change to this assumption.

Money Purchase Plan Occupational Disability Experience				
Actual Occupational Disabilities	Expected Disabilities - Current	Expected Disabilities - Proposed	Actual/Expected - Current	Actual/Expected - Proposed
73	77.3	77.3	94%	94%
Defined Benefit Plan Occupational Disability Experience				
Actual Occupational Disabilities	Expected Disabilities - Current	Expected Disabilities - Proposed	Actual/Expected - Current	Actual/Expected - Proposed
141	169.3	169.3	83%	83%

The actual number of total disabilities was also higher than expected for the money purchase plan members and lower than expected for defined benefit plan members. We recommend increasing the money purchase total disability rates by 50%. This results in the total disability rates being in alignment between the money purchase and defined benefit members. The resulting unchanged actual to expected for the defined benefit experience is 59% which is quite conservative. However, members retiring under the

occupational disability provisions have an opportunity to qualify for a total disability within a five-year window. The total disability experience during the four-year period already reflects many of these conversions, however, we find that to fully recognize the effects of this administrative rule over the four-year experience period, we would need to add roughly two money purchase actual total disabilities and five defined benefit actual total disabilities to the experience.

Money Purchase Plan Total Disability Experience				
Actual Total Disabilities	Expected Disabilities - Current	Expected Disabilities - Proposed	Actual/Expected - Current	Actual/Expected - Proposed
9	5.9	8.9	152%	101%*
Defined Benefit Plan Total Disability Experience				
Actual Total Disabilities	Expected Disabilities - Current	Expected Disabilities - Proposed	Actual/Expected - Current	Actual/Expected - Proposed
11	18.8	18.8	59%	59%*

*The actual to expected ratios based on the proposed rates, after accounting for additional occupational conversions, are 85% and 123% respectively for the money purchase and defined benefit experience. The total actual to expected ratio across both money purchase and defined benefit experience is 97%.

Termination rates

Statewide Defined Benefit Plan and Statewide Hybrid Plan – Defined Benefit Component

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, and whether the member takes a refund or keeps his/her account balance on deposit. The current termination rates reflect the member's service. We typically weight the results by salary and use 10 years for termination analysis. However, based on the potentially abnormal turnover experience for 2020 and 2021, especially for Police, we have used data from 2012 through 2019.

Actual termination rates for the Statewide Defined Benefit Plan were slightly higher than the current assumption resulting in an actual to expected ratio of 108%, generally understating turnover later in the member's career. We have re-graduated the probabilities in total producing a new baseline table with an actual to expected ratio of 105%. In addition, we have analyzed the data for Fire and Police separated and have found quite a variance between the two. Thus, we have introduced a multiplier by occupation so that the total between the two achieves a similar result as using the same table for both, but should provide a better representation of the actual liability for the individual groups.

Defined Benefit Plan Turnover Experience						
Group	Actual Turnover	Proposed Multiplier	Expected Turnover – Proposed Baseline Table	Expected Turnover – With Multiplier	Actual/Expected - Baseline	Actual/Expected – With Multiplier
Police	$58.9	1.25	44.8	$56.1	131.2%	105.0%
Fire	57.8	0.83	66.1	54.8	87.5%	105.4%
Total	$116.7	1.00	$110.9	$110.9	105.2%	105.2%

Statewide Hybrid Plan – Defined Benefit Component termination rates are set consistent with the Statewide Defined Benefit Plan.

Colorado Springs New Hire Plans

We recommend retaining the Colorado Springs New Hire Plans termination assumption of 110% of the rates based on the Statewide Defined Benefit Plan experience. The service-based rates start at higher levels and grade down over the member's tenure. Because these plans were closed in 2006 and all members have 16 years of service or more, this assumption is becoming increasingly immaterial to the projection of benefits under these plans.

Volunteer Firefighter Plans

The termination experience for the Volunteer Firefighter plans was studied based on the eight-year period ending December 31, 2021 for plans that remained open to new members during this time period. The actual to expected ratio for members with less than 20 years of service was 124%. Because there may be significant variability in this experience by employer, we prefer to leave some conservatism. We recommend no change to this assumption.

Retirement rates

Statewide Defined Benefit Plan and Statewide Hybrid Plan – Defined Benefit Component

We currently use two different sets of retirement rates. For members that are at least 55 and have at least 25 years of service (normal retirement), age-based rates are applied with 100% retirement assumed at age 60. For members that have at least five years of service, but less than 25 (early retirement), service-based rates are applied starting at age 55. There is also a new rule of 80 provision for unreduced, but there has not been time to collect significant data for those ages below 55 as of yet. It is important to note that a member entering Deferred Retirement Option Plan (DROP) appears to be a retirement in the actuarial valuation and so any reference to retirement will include members entering DROP as well as members who retire directly from active status.

We recommend continued use of the current rate structure with modest adjustment to the rates themselves. In the early retirement experience for the Statewide Defined Benefit Plan at low service levels, we saw more retirement than anticipated and recommend an increase to those rates. In the normal retirement experience at ages after 60, we saw slightly fewer retirements than expected and recommend

pushing the 100% retirement assumption to age 62. The actual retirement rates starting at age 62 are substantially less than the 100% assumption, however, the actual experience or exposure becomes thinner at this point, and using the 100% rate is a conservative approach.

Statewide Hybrid Plan – Defined Benefit Component retirement rates are set consistent with the Statewide Defined Benefit Plan.

Colorado Springs New Hire Plans

During 2018 and 2019, the number of retirements under the Colorado Springs New Hire Plan – Police Component was less than expected. During 2020 and 2021, the number of retirements was about as expected. Given that the plan is closed and the emphasis this puts on near-term behavior, and given recent shifts in police job satisfaction across the country, we recommend placing more emphasis on the 2020 and 2021 experience and keeping the rates as they are.

In 2022, Colorado Springs New Hire Plan – Fire Component implemented a Rule of 80 for unreduced benefits with a minimum of age 50. We recommend keeping the 7.5% early retirement rate in place for those situations where the Rule of 80 is not met and recommend mirroring the Statewide Defined Benefit Plan rates in cases of eligibility for unreduced benefits.

Volunteer Firefighter Plans

The Volunteer Firefighter valuations assume 50% of members eligible to retire in a given year will retire, until age 65 when 100% retirement is assumed. Based on the 2019 valuation results, 223 retirements were expected during the 2019 and 2020 calendar years. During that time there were 225 actual retirements resulting in an actual to expected ratio of 101%. We recommend no change to this assumption.

Other assumptions

Spouse Assumption – Statewide Defined Benefit Plan

We currently assume 100% of members are married or in a civil union, but we combine this with a reduction in the baseline active mortality rates. While this method does not have a large impact on the results, it does help better align the assumptions with the data that we receive since an active death may simply appear as a refund in cases where no spouse or civil union partner is available to collect a death benefit.

Spouse Assumption – Colorado Springs New Hire Plans

The spouse assumption is more material for the Colorado Springs New Hire Plans because those plans offer a subsidized post-retirement death benefit for married participants. Data for retirements over the last four years indicates 86% of members were married at retirement. We recommend keeping the 85% marriage assumption for purposes of valuing the post-retirement death benefit.

Spouse Assumption - Volunteer Fire Plans

Similarly, the spouse assumption is material for the Volunteer Fire Plans because they offer a subsidized post-retirement death benefit. Data for recent retirements indicates less than 90% of members were married at retirement. We recommend keeping the 90% marriage assumption for purposes of valuing the post-retirement death benefit to maintain some margin of conservatism, to account for possible re-marriage post-retirement, and to account for potential variability by employer.

Load on Occupational Disability Benefits – Statewide Death and Disability Plan

As mentioned in the disability rate section, some conservatism was included in the total disability rates to account for the fact that members that initially go out through occupational disability can reapply for, and if approved, convert to total disability within five years of retirement. This accounts for current active members, but does not account for the current occupational disability annuitants that are within the five-year window that may convert. To account for these participants, we propose loading occupational disability benefits by four percent for those members who have retired within the last five years. This reflects that approximately 10 percent will convert, and those conversions will generally increase benefits by about 40 percent.

Other Assumptions

There are other assumptions made in the course of a valuation that make up the full assumption set used. We have thoroughly reviewed all of these ancillary assumptions, and believe they are generally appropriate and reasonable. Therefore, we recommend no changes to these other assumptions. A listing of all of these assumptions is in Section E.

Actuarial methods

We recommend no change to any of the actuarial methods being used.

Administrative procedures

We have reviewed the current processes used to determine default ages, salaries, genders, etc. for missing or inconsistent data and recommend no changes.

SECTION D

ACTUARIAL IMPACT OF RECOMMENDATIONS

Estimated Actuarial Impact of Recommendations

For illustrative purposes, the tables shown below show the impact of the proposed assumption changes on the results of the most recent valuations.

Statewide Defined Benefit Plan Valuation Results as of January 1, 2022 ($ in millions)		
	Current	**All Proposed**
Normal cost	16.54%	16.92%
Unfunded actuarial accrued liability (UAAL)	($165)	($106)
Funded ratio	104.9%	103.1%
Actuarially Determined Contribution (ADC)	16.05%	16.80%
Est Breakeven COLA (AVA) in 2022	0.40%	0.25%

Statewide Death and Disability Plan Valuation Results as of January 1, 2022 ($ in millions)		
	Current	**All Proposed**
Normal cost (EAN) w/ admin	3.93%	3.97%
Unfunded actuarial accrued liability (UAAL)	$118	$133
Funded ratio	81.1%	79.2%
Aggregate Funding Cost	4.19%	4.32%

SECTION E

SUMMARY OF ASSUMPTIONS AND METHODS INCORPORATING THE RECOMMENDED ASSUMPTIONS

Summary of Actuarial Methods and Assumptions

The following presents a summary of the actuarial assumptions and methods used in the valuation of the SWDB, SWH-DB and the SWDD. This report focuses on those two plans because the assumptions and methods derived from those two plans translate well to the other plans covered under FPPA. Additional information regarding assumptions specific to the Volunteer Plan and Colorado Springs New Hire Plans can be found on pages 42 and 43.

I. Valuation Date

The valuation date is January 1st of each plan year. This is the date as of which the actuarial present value of future benefits and the actuarial value of assets are determined.

II. Actuarial Cost Method

The SWDB and SWH-DB actuarial valuation use the Entry Age Normal 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 liability.

1. The valuation is prepared on the projected benefit basis. The present value of each participant's expected benefit payable at retirement or termination is determined, based on age, service, sex, compensation, and the interest rate assumed to be earned in the future 7.00%. The calculations take into account the probability of a participant's death or termination of employment prior to becoming eligible for a benefit, as well as the possibility of his terminating with a service benefit. Future salary increases are also anticipated. The present value of the expected benefits payable on account of the active participants 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 payable from the Plan on account of the present group of participants and beneficiaries.

2. The employer contributions required to support the benefits of the Plan are determined following a level funding approach, and consist of a normal cost contribution and an accrued liability contribution.

3. The normal cost contribution is determined using the Entry Age Normal method. Under this method, a calculation is made to determine the average uniform and constant percentage rate of employer contribution which, if applied to the compensation of each new participant during the entire period of his anticipated covered service, would be required in addition to the contributions of the participant to meet the cost of all benefits payable on their behalf.

4. The unfunded accrued liability contributions are determined by subtracting the actuarial value of assets from the actuarial accrued liability. In cases of surplus, this amount is amortized over 30 years. In cases of unfunded liability, this amount is amortized over a period such that the amortization provides for at least the interest accruing on the unfunded liability during the year. It is assumed that payments are made monthly throughout the year.

The SWDD actuarial valuation uses the Aggregate Funding Method. Under this method, the contribution rate is calculated to fully fund the present value of all benefits over the remaining working career of the active employees. The contribution rate is determined as a percentage of increasing payroll.

1. The valuation is prepared on the projected benefit basis. The present value of each participant's expected benefit payable at retirement or termination is determined, based on age, service, sex, compensation, and the interest rate assumed to be earned in the future 7.00%. The calculations take into account the probability of a participant's death or termination of employment prior to becoming eligible for a benefit, as well as the possibility of his terminating with a service benefit. Future salary increases are also anticipated. The present value of the expected benefits payable on account of the active participants 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 payable from the Plan on account of the present group of participants and beneficiaries.

2. The actuarial value of assets is subtracted from the present value of all expected benefits to determine the present value of future normal costs. The future normal costs are spread across the future value of salaries to be paid to the current active population to determine a contribution rate.

III. Actuarial Value of Assets

The actuarial value of assets is equal to the market value of assets less a five-year phase in of the excess (shortfall) between expected investment return and actual income. The actual calculation is based on the difference between actual earnings and expected earnings each year, and recognizes the cumulative excess return (or shortfall) over at a minimum rate of 20% per year. The speed of the recognition will increase if the Plan continues to be in the same net deferred position (net gain or net loss) from one year to the next. This is intended to ensure the smoothed value of assets will converge towards the market value in a reasonable amount of time. In addition, a gain or loss that is in the opposite direction of the current net position will be immediately recognized.

Expected earnings are determined using the assumed investment return rate and the beginning of year actuarial 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 annum, compounded annually, composed of an assumed 2.50% inflation rate and a 4.50% real rate of return. This rate represents the assumed return, net of all investment expenses.
2. Salary increase rate: Inflation rate of 2.50%, plus productivity component of 1.75%, plus step-rate/ promotional component as shown:

Years of Service	Annual Step-rate/ Promotional Rate	Total Annual Rate of Increase Including 2.50% Inflation Component and 1.75% Productivity Component
(1)	(2)	(3)
1	7.50%	11.75%
2	7.50%	11.75%
3	7.00%	11.25%
4	6.50%	10.75%
5	3.75%	8.00%
6	1.75%	6.00%
7	1.75%	6.00%
8	1.25%	5.50%
9	1.25%	5.50%
10	1.00%	5.25%
11	1.00%	5.25%
12	0.75%	5.00%
13	0.75%	5.00%
14	0.50%	4.75%
15	0.00%	4.25%

Salary increases are assumed to occur once a year, on January 1. Therefore, the pay used for the period between the valuation date and the first anniversary of the valuation date is equal to the reported pay for the prior year, annualized if necessary, and then increased by the salary increase assumption.

3. Payroll growth rate: In the amortization of the unfunded actuarial accrued liability, payroll is assumed to increase 3.00% per year. This increase rate is primarily due to the effect of inflation on salaries, with no allowance for future membership growth.

B. Demographic Assumptions

1. Mortality rates (members in payment status) –

a. Healthy retirees and beneficiaries: Pub-2010 Safety Healthy Annuitant Mortality Tables for males and females, amount-weighted, projected with the ultimate values of the MP-2020 projection scale.

	Annual Rate per 1,000 Members				
Attained Age in 2022	Males	Females	Attained Age in 2022 (cont.)	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)
50	1.63	1.27	70	13.50	11.44
55	2.60	2.19	75	24.54	19.93
60	4.32	3.79	80	44.69	34.70
65	7.52	6.57	85	82.26	61.61

b. Occupationally disabled retirees: Pub-2010 Safety Healthy Annuitant Mortality Tables for males and females, amount-weighted, projected with the MP-2020 Ultimate projection scale.

	Annual Rate per 1,000 Members				
Attained Age in 2022	Males	Females	Attained Age in 2022 (cont.)	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)
50	2.15	1.76	70	19.22	15.88
55	3.50	3.04	75	34.97	27.66
60	5.98	5.25	80	63.57	48.16
65	10.60	9.12	85	114.96	85.51

c. Totally disabled retirees: Pub-2010 Safety Healthy Annuitant Mortality Tables for males and females, amount-weighted, set forward five years projected with the MP-2020 Ultimate projection scale, with minimum probability of 3.5% for males and 2.5% for females.

	Annual Rate per 1,000 Members				
Attained Age in 2022	Males	Females	Attained Age in 2022 (cont.)	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)
50	35.00	25.00	70	35.00	25.00
55	35.00	25.00	75	44.31	34.40
60	35.00	25.00	80	80.00	59.92
65	35.00	25.00	85	142.81	106.39

2. Mortality rates (active members): Pub-2010 Safety Healthy Employee Mortality Tables for males and females, amount-weighted, projected with the MP-2020 Ultimate projection scale, 60% multiplier for off-duty mortality. Increased by 0.00015 for on-duty related Fire and Police experience. Sample rates are shown below:

	Annual Rate per 1,000 Members				
Attained Age in 2022	Males	Females	Attained Age in 2022 (cont.)	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)
20	0.36	0.23	40	0.45	0.40
25	0.34	0.25	45	0.57	0.49
30	0.36	0.29	50	0.76	0.61
35	0.39	0.33	55	1.04	0.78

3. Disability rates: Sample rates are shown below by age and disability type.

	Annual Rate per 1,000 Members			
Age	Occupational Disability Rates (MP)	Occupational Disability Rates (SWDB)	Total Disability Rates (MP)	Total Disability Rates (SWDB)
(1)	(2)	(3)	(4)	(5)
25	0.25	0.48	0.02	0.02
30	1.18	2.26	0.17	0.17
35	1.60	3.05	0.34	0.34
40	2.35	4.48	0.52	0.52
45	4.09	5.53	0.72	0.72
50	8.86	8.22	0.94	0.94
55	15.53	11.56	1.17	1.17

4. Termination rates (for causes other than death, disability or retirement): Termination rates are based on service. Termination rates are not applied after a member becomes eligible for a retirement benefit. Rates at selected ages are shown:

	Annual Rate per 1,000 Members				
Service	Rates	Service (cont.)	Rates	Service (cont.)	Rates
0	91.9	9	25.8	18	12.3
1	70.4	10	22.9	19	11.7
2	62.2	11	20.6	20	11.2
3	54.9	12	18.6	21	10.6
4	48.3	13	17.0	22	9.8
5	42.5	14	15.6	23	9.0
6	37.4	15	14.5	24	7.9
7	33.0	16	13.7	25	6.6
8	29.1	17	12.9	26	5.1

For police members, these rates are multiplied by 1.25. For fire members, these rates are multiplied by 0.83.

5. Retirement rates:

Members of the SWDD Plan are assumed to retire at the time of attaining:

A. Statewide Defined Benefit Plan Members and other New Hire Plan Members: Age 55 with 22 years of service or current age, if greater.

B. Money Purchase Plan Members: The earliest of Age 65 or Age 55 with 25 years of service; or current age, if greater. For members age 55 with less than 25 years of service, service-based rates consistent with the SWDB service-based rates shown below.

C. Denver Police Old Hire Plan Members: Age after 25 years of service, or current age, if greater.

D. Denver Fire Old Hire Plan Members: Age 50 and 25 years of service, or current age, if greater.

E. All Other Plan members: Age 52 or current age, if greater.

Age-Based Retirement rates, for SWDB members with more than 25 years of service

Age	Annual Rate per 100 Members
55	60
56-61	45
62	100

The rates above apply to members first meeting normal retirement eligibility at age 55 or later. For those that meet the Rule of 80 prior to age 55, rates from eligibility age to age 55 were as follows:

- First eligibility: (Age-50)x10% + 10%
- After first eligibility but before age 55: 45% - 5%x(55-Age)
- Age 55: 45%

Service-Based Retirement rates for SWDB members*

Service	Annual Rate per 100 Members
5-14	8
15	9
16	9
17	10
18	11
19	12
20	13
21	15
22	20
23-24	25

*Rates first applied at age 55; 100 percent retirement assumed at age 70.

C. Other Assumptions

1. Administrative expenses: Based on actual administrative expenses paid in the prior year.

2. Percent married: 100% of employees are assumed to be married or in a civil union.

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

4. Cost of living escalators (COLA): Current Law – 0%.

5. Percent electing annuity on death (when eligible): All of the spouses of vested, married participants are assumed to elect an annuity.

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. For the SWDB plan, 10% of members who become occupationally disabled after the age of 50 will transfer back to the SWDB plan at age 55.

8. 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. Pay increase timing: Beginning of (fiscal) year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.

11. Decrement timing: Decrements of all types are assumed to occur mid-year.

12. 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.

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

14. 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.

15. Benefit Service: All members are assumed to accrue 1 year of service each year. Exact fractional service is used to determine the amount of benefit payable.

16. Inactive Population: All members included in the inactive non-vested population with at least 10 years of service are valued using two times member contributions.

17. For SWDD Plan, Money Purchase Offset: For members where no data is available, the current money purchase balance is estimated using current pay, estimated pay histories, actual plan investment returns, and the current money purchase contribution rate specific by employer. The balance is projected forward using 7.00% investment returns, and the current money purchase contribution rate specific by employer. The money purchase account used for offset is limited based on the specific money purchase contribution rate by employer and the contribution rate requirements for the Statewide Death & Disability Plan. At decrement, the limited account is converted to an annuity using current actuarial equivalence factors.

18. For SWDD Plan, SRA Offset: The SRA balances are projected forward using 7.00% investment returns. No future SRA contributions are assumed. At decrement, the account is converted to an annuity using current actuarial equivalence factors.

19. For SWDD Plan, Retirement Processing: In order to reflect the lengthy application period and associated processing lag, a load is included in the Present Value of Future Benefits equal to the liability associated with new retirees in this year's valuation data who had not been included in the previous year's valuation data due to processing.

D. Participant Data

Participant data was supplied on electronic files in the form of spreadsheets. There were separate tabs for (i) active and non-vested inactive members, and (ii) members and beneficiaries receiving benefits or vested inactives.

The data for active members included birthdate, sex, service, salary and employee contribution account balance. For retired members and beneficiaries, the data included date of birth, sex, spouse's date of birth (where applicable), amount of monthly benefit, date of retirement, and a form of payment code.

Salary supplied for the current year was based on the earnings for the year preceding the valuation date adjusted for service accrued during the year. In cases where the earnings for the year two years prior to the valuation date was higher, this higher amount was used. This salary was adjusted by the salary increase rate for one year.

Assumptions were made to correct for missing, bad, or inconsistent data. These had no material impact on the results presented.

E. Allocation to SRA

The SRA contribution rate is determined annually based on the normal cost plus amortization of unfunded liability (surplus). The excess of the total contribution rate (21.00% in 2022, ratcheted up by 0.50% until reaching 25.0% in 2030) over the actuarial requirement is available as the SRA contribution rate. The Board has the authority and responsibility to choose the SRA rate. Other considerations may be evaluated such as:

1. Investment performance subsequent to the actuarial valuation
2. Potential future plan changes under consideration
3. Stability of SRA
4. Projections of future SRA contributions
5. Ability to grant future benefit adjustments to retired members

Summary of Alternate Actuarial Methods and Assumptions

The following presents a summary of any actuarial assumptions and methods used in the valuation of the Volunteer, Old Hire, and Colorado Springs New Hire Plans where the assumptions do not translate directly from the SWDB and SWDD assumptions.

Colorado Springs New Hire – Fire Component:

Age-Based Retirement rates, for CS NH Fire members with more than 25 years of service

Age	Annual Rate per 100 Members
55	60
56-59	45
60	100

The rates above apply to members first meeting normal retirement eligibility at age 55 or later. For those that meet the Rule of 80 prior to age 55, rates from eligibility age to age 55 were as follows:

- First eligibility: (Age-50)x10% + 10%
- After first eligibility but before age 55: 45% - 5%x(55-Age)
- Age 55: 45%

Members eligible for early retirement have a 7.5% rate of retirement applied starting at age 50.

Termination rates are 110% of the SWDB plan rates.

Percent married: For purposes of valuing the post-retirement death benefit, 85% of employees are assumed to be married or in a civil union.

Colorado Springs New Hire – Police Component:

Age-Based Retirement rates, for CS NH Police members with more than 25 years of service

Age	Annual Rate per 100 Members
50	60
51-54	45
55	100

*Rates first applied at age 50; 100 percent retirement assumed at age 70.

Early retirement rates are set equal to termination rates. 10% early retirement rates for members hired on or after October 1, 2013.

Termination rates are 110% of the SWDB plan rates.

Percent married: For purposes of valuing the post-retirement death benefit, 85% of employees are assumed to be married or in a civil union.

Volunteer Fire:

Retirement — Age 50 and 20 years of service.

Age	Annual Rate Per 100
50	50
55	50
60	50
65	100

Withdrawal (any reason other than retirement, death, or disability)

Annual Rate Per 1,000 Withdrawals			
Service	Rates	Service	Rates
1	182.37	11	83.96
2	169.99	12	77.23
3	158.17	13	71.06
4	146.92	14	65.45
5	136.24	15	60.41
6	126.12	16	55.94
7	116.56	17	52.02
8	107.56	18	48.68
9	99.13	19	45.89
10	91.27		

Twenty percent (20%) of members age 50 and eligible for a terminated vested benefit which would commence immediately are assumed to withdraw each year.

Percent married: For purposes of valuing the post-retirement death benefit, 90% of employees are assumed to be married or in a civil union.

Administrative expenses: Based on average actual administrative expenses paid in the prior two years.

Old Hire Plans:

Administrative expenses: Based on average actual administrative expenses paid in the prior two years.

SECTION F

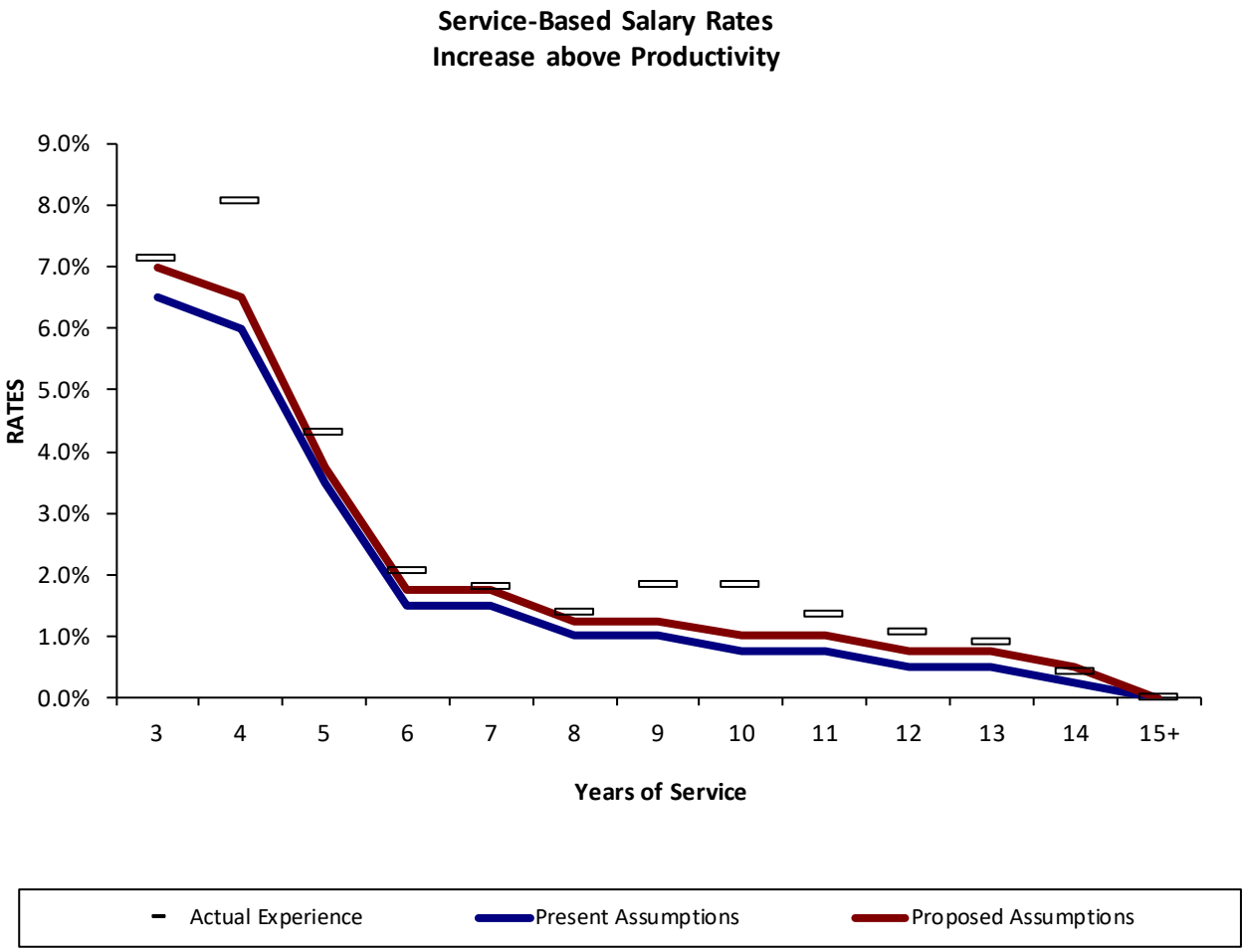
SUMMARY OF DATA AND EXPERIENCE

Statewide Defined Benefit Plan
Service-Based Salary Experience

Current Salary Scale			Actual Experience			Proposed Salary Scale	
Years of Service	Total	Step Rate/ Promotional	Total	Above Inflation	Step Rate/ Promotional	Total	Step Rate/ Promotional
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	11.25%	7.00%	11.34%	9.60%	7.51%	11.75%	7.50%
2	11.25%	7.00%	12.15%	10.41%	8.32%	11.75%	7.50%
3	10.75%	6.50%	10.96%	9.22%	7.13%	11.25%	7.00%
4	10.25%	6.00%	11.91%	10.17%	8.08%	10.75%	6.50%
5	7.75%	3.50%	8.15%	6.40%	4.32%	8.00%	3.75%
6	5.75%	1.50%	5.89%	4.15%	2.06%	6.00%	1.75%
7	5.75%	1.50%	5.63%	3.89%	1.80%	6.00%	1.75%
8	5.25%	1.00%	5.22%	3.48%	1.39%	5.50%	1.25%
9	5.25%	1.00%	5.68%	3.94%	1.85%	5.50%	1.25%
10	5.00%	0.75%	5.67%	3.93%	1.84%	5.25%	1.00%
11	5.00%	0.75%	5.20%	3.45%	1.37%	5.25%	1.00%
12	4.75%	0.50%	4.90%	3.16%	1.07%	5.00%	0.75%
13	4.75%	0.50%	4.74%	3.00%	0.91%	5.00%	0.75%
14	4.50%	0.25%	4.26%	2.52%	0.43%	4.75%	0.50%
15+	4.25%	0.00%	3.83%	2.09%	0.00%	4.25%	0.00%

Current Inflation Assumption	2.50%	Proposed Inflation Assumption	2.50%
Current Productivity Component	1.75%	Proposed Productivity Component	1.75%
Actual CPI-U Inflation for Period	1.74%		
Apparent Productivity Component	2.09%		

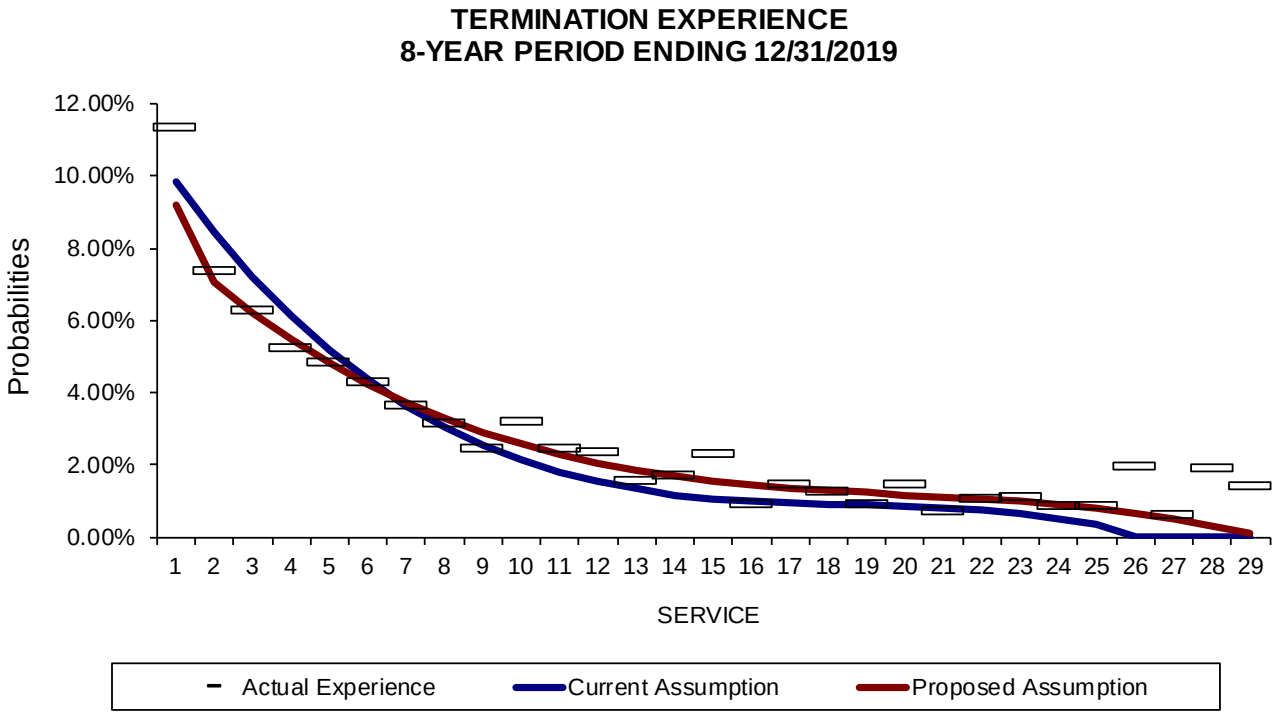
Statewide Defined Benefit Plan
Service-Based Salary Experience



Statewide Defined Benefit Plan
Service-Based Termination Experience

Service	Actual Termination Weighted By Salary $M	Total Eligible Salary $M	Crude Rate	Assumed Rate		Expected Termination Weighted By Salary $M		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	14.8	130.4	11.33%	9.85%	9.19%	12.8	12.0	115%	123%
2	15.9	216.0	7.36%	8.46%	7.04%	18.3	15.2	87%	105%
3	11.6	185.0	6.29%	7.23%	6.22%	13.4	11.5	87%	101%
4	8.9	169.5	5.27%	6.14%	5.49%	10.4	9.3	86%	96%
5	7.9	162.5	4.87%	5.19%	4.83%	8.4	7.9	94%	101%
6	6.8	158.6	4.32%	4.36%	4.25%	6.9	6.7	99%	102%
7	5.7	155.1	3.67%	3.65%	3.74%	5.7	5.8	101%	98%
8	4.9	157.0	3.14%	3.05%	3.30%	4.8	5.2	103%	95%
9	3.8	155.6	2.46%	2.55%	2.91%	4.0	4.5	97%	85%
10	5.0	157.4	3.19%	2.13%	2.58%	3.4	4.1	150%	124%
11	4.1	165.6	2.48%	1.79%	2.29%	3.0	3.8	138%	108%
12	4.0	171.1	2.36%	1.53%	2.06%	2.6	3.5	154%	115%
13	2.7	172.5	1.57%	1.33%	1.86%	2.3	3.2	118%	84%
14	2.8	163.4	1.71%	1.17%	1.70%	1.9	2.8	146%	101%
15	3.6	154.0	2.34%	1.07%	1.56%	1.6	2.4	219%	150%
16	1.3	139.1	0.93%	0.99%	1.45%	1.4	2.0	93%	64%
17	2.0	133.6	1.47%	0.94%	1.37%	1.3	1.8	156%	107%
18	1.7	132.9	1.28%	0.91%	1.29%	1.2	1.7	141%	99%
19	1.1	123.0	0.92%	0.88%	1.23%	1.1	1.5	105%	75%
20	1.6	111.4	1.47%	0.85%	1.17%	0.9	1.3	172%	125%
21	0.7	97.4	0.75%	0.81%	1.12%	0.8	1.1	92%	67%
22	1.0	91.3	1.07%	0.75%	1.06%	0.7	1.0	143%	101%
23	0.9	82.8	1.13%	0.65%	0.98%	0.5	0.8	174%	115%
24	0.6	72.6	0.90%	0.52%	0.90%	0.4	0.7	172%	100%
25	0.6	64.4	0.88%	0.34%	0.79%	0.2	0.5	259%	111%
26	1.0	48.9	1.98%	0.00%	0.66%	0	0.3	N/A	298%
27	0.3	43.9	0.64%	0.00%	0.51%	0	0.2	N/A	126%
28	0.7	37.6	1.91%	0.00%	0.31%	0	0.1	N/A	609%
29	0.4	31.0	1.41%	0.00%	0.08%	0	0.0	N/A	1715%
Totals	117	3,684	3.17%	2.93%	3.01%	108	111	108.1%	105.2%

Statewide Defined Benefit Plan
Service-Based Termination Experience



Statewide Defined Benefit Plan
Early (<25 yos) Retirement Experience

				Assumed Rate		Expected Retirement		Actual/Expected	
Service	Actual Retirement	Total Count	Actual Rate	Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
5	5	34	0.149	0.060	0.080	2	3	248%	186%
6	7	38	0.181	0.060	0.080	2	3	302%	227%
7	4	41	0.087	0.060	0.080	2	3	145%	109%
8	5	39	0.119	0.060	0.080	2	3	198%	148%
9	3	40	0.076	0.060	0.080	2	3	126%	95%
10	11	51	0.218	0.060	0.080	3	4	363%	272%
11	9	66	0.130	0.060	0.080	4	5	216%	162%
12	9	86	0.104	0.060	0.080	5	7	173%	130%
13	11	135	0.078	0.070	0.080	9	11	112%	98%
14	16	191	0.085	0.080	0.080	15	15	106%	106%
15	33	212	0.157	0.090	0.090	19	19	174%	174%
16	23	255	0.091	0.090	0.090	23	23	101%	101%
17	27	254	0.106	0.100	0.100	25	25	106%	106%
18	23	269	0.087	0.110	0.110	30	30	79%	79%
19	48	387	0.124	0.120	0.120	46	46	104%	104%
20	76	507	0.151	0.130	0.130	66	66	116%	116%
21	91	590	0.154	0.150	0.150	89	89	103%	103%
22	131	636	0.206	0.200	0.200	127	127	103%	103%
23	114	602	0.189	0.250	0.250	150	150	76%	76%
24	137	571	0.240	0.250	0.250	143	143	96%	96%
Totals	782	5,003	0.156			767	776	102%	101%

Statewide Defined Benefit Plan
Normal Retirement Experience

				Assumed Rate		Expected Retirement		Actual/Expected	
Age	Actual Retirement	Total Count	Actual Rate	Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	1,148	2,168	0.529	0.541	0.541	1,173	1,173	98%	98%
56	466	1,234	0.378	0.450	0.450	556	556	84%	84%
57	357	1,026	0.348	0.450	0.450	462	462	77%	77%
58	353	866	0.407	0.450	0.450	390	390	90%	90%
59	207	571	0.363	0.450	0.450	257	257	81%	81%
60	185	563	0.328	1.000	0.450	563	253	33%	73%
61	188	446	0.422	1.000	0.450	446	201	42%	94%
62	117	271	0.432	1.000	1.000	271	271	43%	43%
63	88	155	0.572	1.000	1.000	155	155	57%	57%
64	25	95	0.261	1.000	1.000	95	95	26%	26%
65	41	87	0.476	1.000	1.000	87	87	47%	47%
66	14	61	0.220	1.000	1.000	61	61	22%	22%
67	6	42	0.150	1.000	1.000	42	42	15%	15%
68	6	26	0.209	1.000	1.000	26	26	21%	21%
69	14	22	0.655	1.000	1.000	22	22	64%	64%
Subtotal	3,214	7,633	0.421			4,606	4,051	70%	79%
70-74	20	104	0.197	1.000	1.000	104	104	20%	20%
Subtotal	3,235	7,738	0.418			4,710	4,155	69%	78%