# Houston Police Officers' Pension System

## 2022 Actuarial Experience Study
## for the Period Ending June 30, 2021

P: 469.524.0000 | www.grsconsulting.com

September 20, 2022

Board of Trustees
Houston Police Officers' Pension System
602 Sawyer, Suite 300
Houston, TX 77007

**Subject: Results of the 2022 Experience Study for HPOPS**

Dear Members of the Board:

We are pleased to present our report of the results of the 2022 Actuarial Experience Investigation Study for the Houston Police Officers' Pension System ("HPOPS" or "the System"). It includes our recommendations for new actuarial assumptions to be effective for the July 1, 2022 actuarial valuation, and it describes the estimated actuarial impact produced by these recommendations as though they had been effective for the July 1, 2021 actuarial valuation.

As you will see, the overall impact of the recommended changes is minor, but with the Board's approval of the recommendations in this report, we do believe the actuarial condition of the System will be more accurately portrayed, especially in regard to the assumed salary increases. The Board's decisions should be based on the appropriateness of each recommendation individually, not on their collective effect on the funding period or the unfunded liability.

We wish to thank the Executive Director, Pat Franey, and the entire HPOPS staff for their assistance in providing the necessary data for this study.

Respectfully submitted,

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

Blake Orth, FSA, EA, MAAA
Consultant

5605 North MacArthur Boulevard | Suite 870 | Irving, Texas 75038-2631

# Table of Contents

# SECTION A

## EXECUTIVE SUMMARY

# Executive Summary

## • Summary of recommendations:

1. Recommend no change to the inflation assumption of 2.30%.
2. Recommend no change to the investment return assumption of 7.00%.
3. Recommend increasing the ultimate salary scale from 2.75% to 3.25% by increasing the productivity component from 0.45% to 0.95%.
4. Recommend increasing the service-related salary increase for members with one year of service from 20% to 30%, based on experience.
5. Recommend no change to the assumed overall payroll growth rate of 2.75%.
6. Recommend increasing the assumed DROP crediting rate of 5.1% per year to 5.4%, based on increased investment volatility expectations.
7. Recommend no change to the assumed COLA of 2.00% per year.
8. Recommend updating the base assumptions for mortality from versions of the RP-2014 tables to the 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 Healthy Post-Retirement Mortality use multiples of the Pub-2010 Tables for Healthy Public Safety Retirees.
    - for Disabled Post-Retirement Mortality use the Pub-2010 Tables for Disabled Public Safety Retirees.
    - for Active Employees use the Pub-2010 Tables for Public Safety Employees and use the below median versions of the tables.
9. Recommend increasing the assumed rates of turnover prior to retirement, based on experience.
10. Recommend no change to the patterns of retirement.
11. Recommend no change to the disability expectations.

## • Impact of all recommended changes:

| | Illustrated July 1, 2021 Valuation Results | |
|---|---|---|
| Item | Current Assumptions | Recommended Assumptions |
| (1) | (2) | (3) |
| Total Normal Cost % | 23.14 % | 24.03% |
| Unfunded Actuarial Accrued Liability ($ in Millions) | $1,039 | $1,037 |
| Funded Ratio | 85.4% | 85.4% |
| Calculated Contribution Rate | 27.02% | 27.89% |
| City Contribution Rate | 31.98% | 31.98% |

# 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 HPOPS. 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 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 HPOPS 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.

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 ten-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 using the probability of the occurrence at the given age, times the "exposures" at that same age. For example, if there was a rate of retirement of 50% at a given age. The number of exposures can only be those members who are that age 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.

## 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 presents a summary of all the actuarial assumptions and methods, including the recommended changes.

**Section F Exhibits Revised for HPOPS**

The exhibits in Section F should generally be self-explanatory. For example, on page 44, we show the exhibit analyzing the termination rates for HPOPS. The second column shows the total number of members 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 members 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 time period. Column (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 assumed 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 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), the payroll growth rate and the DROP interest crediting 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 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 pension plans. ASOP No. 27 supplements ASOP 4, Measuring Pension Obligations and Determining Plan Costs or Contributions.

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 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. considers 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.

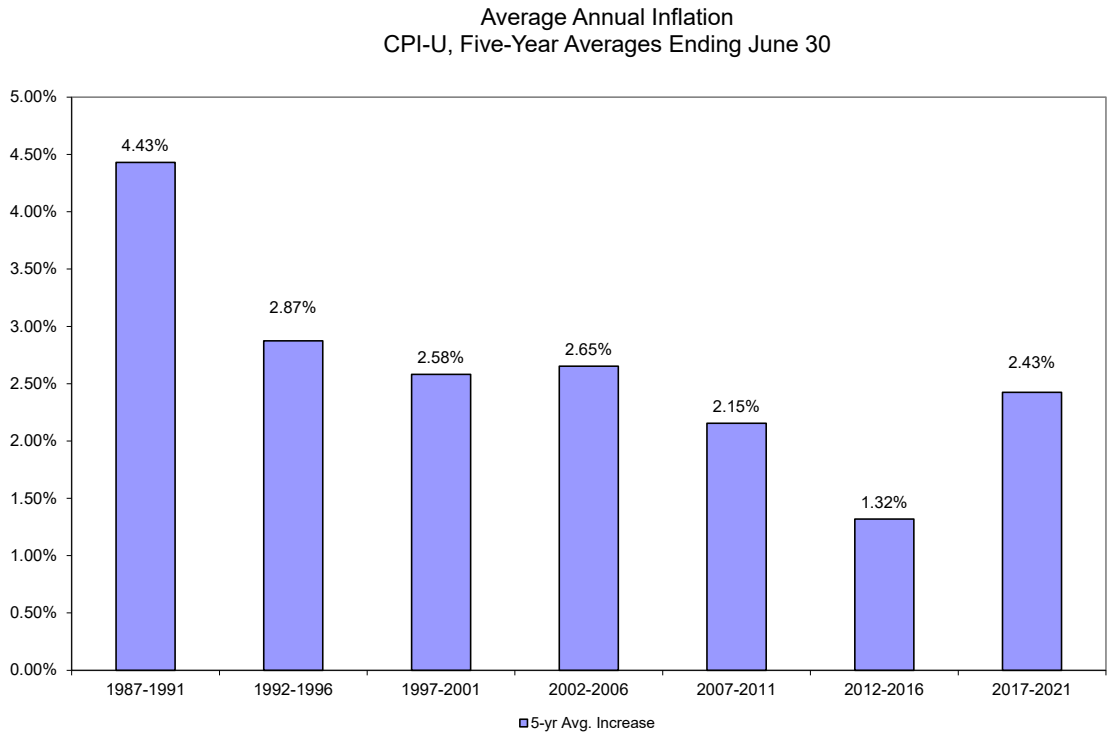
However, the standard explicitly advises an actuary not to give undue weight to recent experience.

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.

## 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.

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 June 2021:

| Periods Ending June 2021 | Average Annual Increase in CPI-U |
|---|---|
| Last five (5) years | 2.43% |
| Last ten (10) years | 1.87% |
| Last fifteen (15) years | 1.97% |
| Last twenty (20) years | 2.14% |
| Last twenty-five (25) years | 2.23% |
| Last thirty (30) years | 2.33% |
| Since 1913 (first available year) | 3.10% |

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

As you can see, inflation has been higher recently, but has been relatively low, even over a longer period of 25 years. However, the prospective inflation rate is only weakly tied to past results.

Most investment consulting firms, in setting their capital market assumptions, currently assume that inflation will be less than 2.50%. We examined the 2021 capital market assumption sets for twelve investment consulting firms. The average assumption for inflation was 2.19%, with a range of 1.92% to 3.10%.

Forecasts from Social Security Administration

In the Social Security Administration's 2021 Trustees Report, the Office of the Chief Actuary is projecting a long-term average annual inflation rate of 2.4% under the intermediate cost assumption. The low cost and high cost scenarios are 1.8% and 3.0%, respectively. All three of these numbers are unchanged from the prior year's report.

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, 2021 yield for 20-year inflation indexed Treasury bonds was -0.63% plus actual inflation. The yield for 20-year non-indexed US Treasury bonds was 1.94%. Simply, this means that on that day the bond market was predicting that inflation over the next twenty years would average 2.57% (1.94% + 0.63%) per year. The difference in yield for 30-year bonds implies 2.38% inflation over the next 30 years. This is consistent with most forecasts of inflation and overall economic growth continuing to be low.

Historically, this has been a consistent predictor of future inflation. 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.

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 (fourth quarter of 2021) was for inflation over the next ten years (2021 to 2030) to average 2.55%.

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

Recommendation

As a result, we find the current 2.30% to be in the middle of several of these sets of expectations and thus recommend no change.

## 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.

On the other hand, for HPOPS, 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. Adding an explicit load to 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.

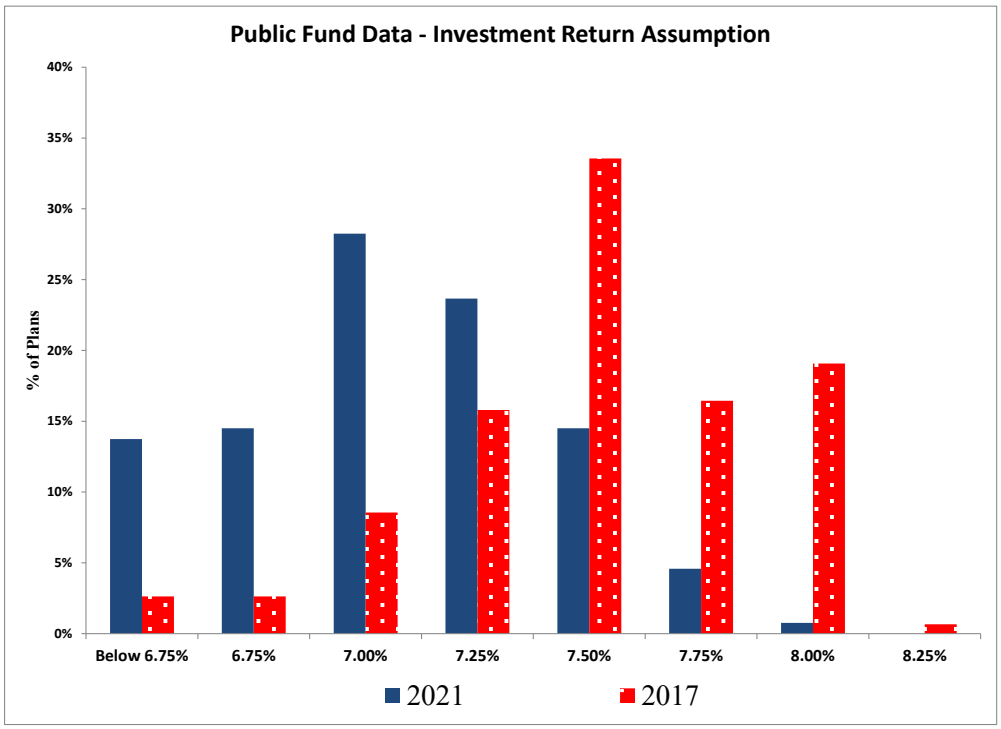
In the 2021 valuation, it was assumed administrative expenses would be 0.84% of covered payroll. Over the last 5 years, the average has been 0.86% of payroll, but it has been trending down. We are recommending no change to the 0.84% assumed expenses.

## Investment return rate

Currently, HPOPS 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.

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 HPOPS is compared to its peers. The chart below shows the distribution of the investment return assumptions in the NASRA Public Fund Data as of December 2021.




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 7.06%.

**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 HPOPS, the Fund's current target asset allocation is as follows:

| Asset Class | Target Allocation |
|---|---|
| Private Equity & Energy | 20.0% |
| Real Estate | 10.0% |
| Hedge Funds | 6.5% |
| Domestic Equity | 33.7% |
| International Equity | 18.1% |
| Credit Strategies | 9.8% |
| Fixed Income | 11.7% |
| Cash (Debit for Leverage) | -9.8% |
| Total | 100.0% |

Because GRS is a benefits consulting firm and does not develop or maintain our own capital market assumptions, we utilized the forward-looking return expectations developed by twelve 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 plan'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)**

| Investment Consultant | Distribution of 10-Year Average Geometric Net Nominal Return | | | Probability of exceeding |
|---|---|---|---|---|
| | 40th | 50th | 60th | 7.00% |
| (1) | (2) | (3) | (4) | (5) |
| 1 | 4.90% | 6.07% | 7.26% | 42.1% |
| 2 | 4.85% | 6.09% | 7.33% | 42.6% |
| 3 | 5.03% | 6.12% | 7.21% | 41.9% |
| 4 | 5.17% | 6.19% | 7.23% | 42.2% |
| 5 | 4.94% | 6.23% | 7.53% | 44.0% |
| 6 | 5.15% | 6.26% | 7.38% | 43.3% |
| 7 | 5.29% | 6.53% | 7.77% | 46.2% |
| 8 | 5.39% | 6.57% | 7.76% | 46.3% |
| 9 | 5.39% | 6.58% | 7.78% | 46.4% |
| 10 | 5.65% | 6.92% | 8.22% | 49.4% |
| 11 | 6.01% | 7.19% | 8.39% | 51.7% |
| 12 | 6.44% | 7.73% | 9.04% | 55.7% |
| **Average** | **5.35%** | **6.54%** | **7.74%** | **46.0%** |

The values above represent 7-10 year expectations. Five of the firms also provide longer term expectations over 20-30 year timeframes, and the median result is 7.30% over the longer timeframe.

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 considered 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).

Based on this analysis, we recommend that HPOPS continue to use an investment return assumption of 7.00%. While the expectations over the short term are slightly lower than the 7.0%, the longer term is expected to achieve the 7.00% and the average of the two data points, which would be close to the duration of the liabilities of HPOPS, is 6.92%. There are also more than $1 billion in deferred investment gains in the smoothing mechanisms built into the valuation, so even if returns over the short term are lower than 7%, the contribution levels will remain appropriate. The benefit provisions also have several risk-sharing mechanisms, including the DROP interest crediting and the post retirement benefit increases, which will add even more protection in case returns over the short term don't meet the assumption.

## DROP Interest Crediting Rate

DROP balances are increased by 65% of the actual average 5-year return of the System, with a minimum of 2.5%. The current assumption is that this calculation will yield an average annual credit of 5.1%. Based on the analysis of the capital market expectations above, the expected standard deviation of the target portfolio is about 15%, and with higher volatility the cost of providing downside protection should increase (which is what the minimum 2.5% represents). We calculated the median expected credit assuming that investment returns are distributed lognormally with a mean of 7.00% and an annual standard deviation of 15.00% to be 5.44%. Based on the analysis, we recommend increasing the assumption from 5.1% to 5.4%.

## Cost-of-living (COLAs) increase assumption

Monthly benefits for participants receiving payments are increased each April 1 by the average compounded investment return during the prior five fiscal years in excess of 5.0%, with the result not less than 0% nor greater than 4%. The five-year average return is represented as the annual rate of return on the actuarial value of assets. We will continue to assume the investment related portion is 2.0%.

## 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 applicable.

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).

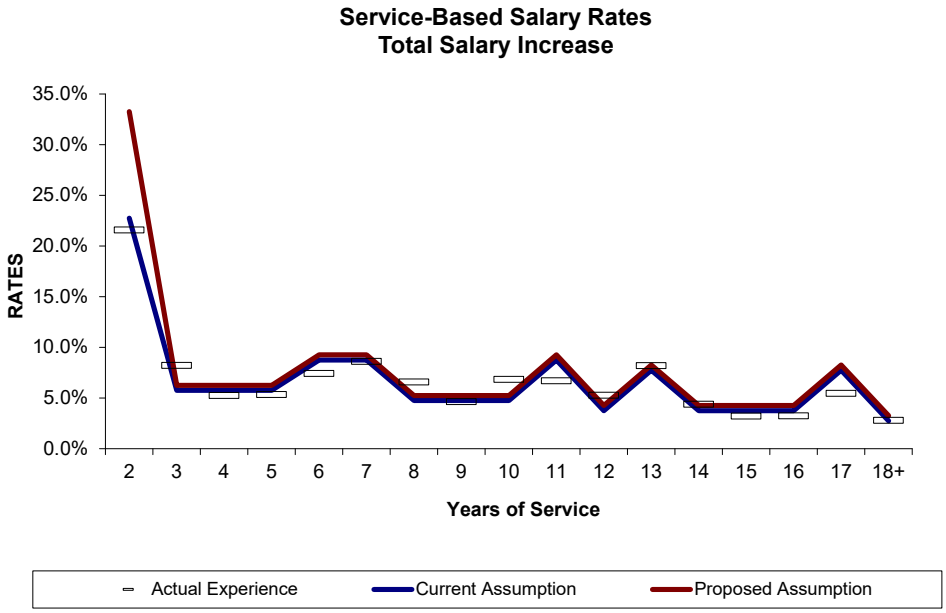
Most actuaries recommend salary increase assumptions that include an element that depends on the member's age or service, especially for large, public retirement systems. It is typical to assume larger pay increases for younger or shorter-service employees. This is done in order to reflect pay increases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

We examined the current union contract to better understand how compensation will change during a member's career. Based on this analysis, there were several times during a member's career when they would likely receive a larger than normal pay increase. One of those was once a member reached 17 years of service, and that appeared to be the last one. Thus, we continue to recommend the last step in the salary scale remain at 17 years of service.

To separate the steps, or promotional component of the schedule, we segregated out members with more than 17 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 or promotion. The actual general productivity increase during the time period was 0.91%, which is higher than our current assumption.

| Change to Fiscal Year Ending | Overall Increase for Long Service Members | Inflation | Increase Above Inflation |
|---|---|---|---|
| 2012 | 0.83% | 2.93% | -2.10% |
| 2013 | 0.86% | 1.66% | -0.80% |
| 2014 | 3.08% | 1.56% | 1.52% |
| 2015 | 3.32% | 0.73% | 2.59% |
| 2016 | 3.78% | 0.67% | 3.11% |
| 2017 | 3.34% | 1.84% | 1.50% |
| 2018 | 3.39% | 2.25% | 1.14% |
| 2019 | 3.04% | 2.07% | 0.97% |
| 2020 | 3.44% | 1.56% | 1.88% |
| 2021 | 2.78% | 2.30% | 0.48% |
| Average, all years | 2.78% | 1.87% | 0.91% |
| Average, 2014-2021 | 3.27% | 1.91% | 1.36% |

The expected increase was 2.75%, so the nominal increases have been close to the current assumption, while the actual inflation experience has been significantly lower than assumed. However, we do not expect the 2012 and 2013 data points to be representative of future experience. Just looking at the last eight years, the average nominal increase has been 3.27%, or 1.36% above actual inflation. We recommend increasing the current 2.75% long-service increase assumption to 3.25%, based on the 2014-2021 data and future expectations. The 3.25% assumption will be made up of a 0.95% general productivity and individual merit component, plus the 2.30% price inflation assumption.




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. As shown, the current pattern seems to match the actual experience very well. These spikes correspond with either significant increases built directly into the compensation structure or points in the career when promotions are most common. However, the first increase received by a member has been higher than the current assumption, so we have adjusted that one rate as appropriate.

## Payroll growth rate

The salary increase rates discussed above are assumptions applied to individuals. They are used in projecting future benefits. We also use a separate payroll growth assumption, which is currently 2.75% per year, in determining the contribution needed to amortize the unfunded actuarial accrued liability. The amortization payments are calculated to be a level percentage of payroll, so, as payroll increases over time, so do the amortization payments. The amortization percentage is dependent on the rate at which payroll is assumed to increase.

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.

Total payroll for HPOPS has grown at a rate of 2.74% over the last 19 years. It has grown on average 2.19% over the last ten years, during a time when inflation was 1.87%. Thus, payroll has grown on average 0.32% above inflation, which is slightly lower than the assumed 0.45%, but much of that was from 2012 and 2013.

Given the above, we are recommending no change to the nominal value of this assumption.

## 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 rates

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 the blue-collar and no collar versions of the RP-2014 mortality tables, projected with the ultimate vales of the pre-2000 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.

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 used 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 considers 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 seven 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 2017. For purposes of this study, proposed mortality rates shown in the tables have been adjusted to the central year 2017 using the proposed projection scales.

We did decide to include the data from 2020-2021, even though it does show higher mortality experience than the previous years. That is one of the reasons we utilize several years of data, to dampen the potential impact from one year, and it is at least potentially likely mortality will be higher going forward because of either direct impact from post-COVID mobility or indirect impacts from the lockdowns. In addition, because of how the credibility model works and HPOPS only yields partial credibility anyway, there was not a significant difference to the final recommended multipliers whether 2020/2021 was included or not.

## 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

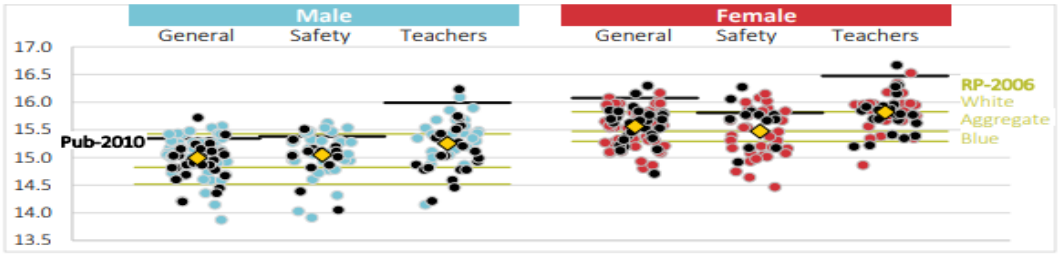



**Figure 2**

2018 AGE 65 ANNUITY FACTORS WITH PUB-2010 AND RP-2006

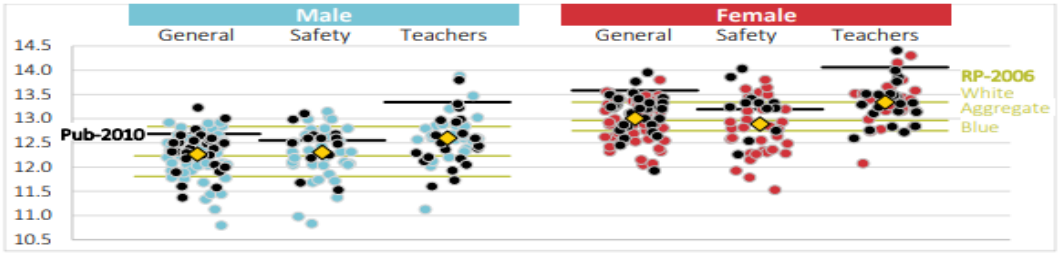
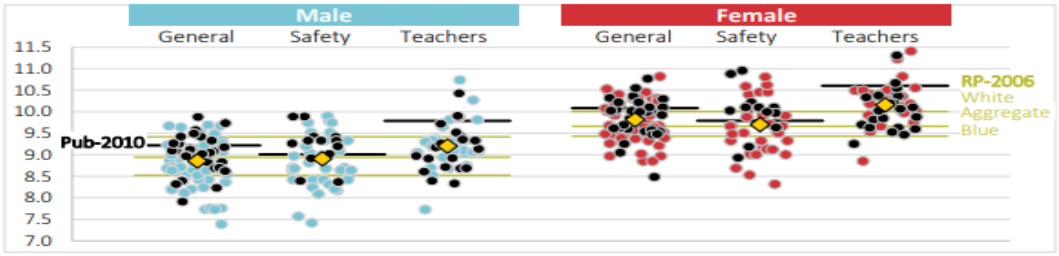



**Figure 3**

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: Pub-2010 for healthy public sector 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 407 male deaths and 18 female deaths, indicating some credibility for males and almost none for females. The following provides the full details with p=90% and r=5%.

| | Healthy HPOPS Retirees | |
|---|---|---|
| | Male | Female |
| Actual Deaths | 407 | 18 |
| Deaths needed for full credibility | | |
| Based on Count | 1,082 | 1,082 |
| Based on Annuity Amount | 1,176 | 1,146 |
| Z Factor | | |
| Based on Count | 61.3% | 12.9% |
| Based on Annuity Amount | 58.8% | 12.5% |

**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-2010 mortality tables. We compared the ratio of the actual deaths to the expected deaths—the A/E ratio— which 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 males the Z-factor of 58.8% suggests the data for that group is 58.8% credible. The Best Fit for that group would be to scale the base tables by 127.9%. The final scale of 116.4% is the credibility-weighted average (116.4% = 58.8% x 127.9% + 41.2% x 100%). Factors for other groups are determined similarly.

| | Healthy HPOPS Retirees | |
|---|---|---|
| | Male | Female |
| Actual Deaths ($000 Annuities) | $203 | $8 |
| Expected Deaths based on Current Assumptions | $214 | $10 |
| A/E Ratio | 94.8% | 86.0% |
| Expected Deaths based on Pub-2010 Median Tables by Occupation | $159 | $8 |
| A/E Ratio based on Best Fit | 127.9% | 103.8% |
| Multiplier based on LFCT | 116.4% | 100.5% |
| Recommended Multiplier | 116.0% | 108.0% |
| Expected Deaths based on Pub-2010 Median Tables by Occupation adjusted by Multiplier | $184 | $9 |
| A/E Ratio | 110.2% | 96.5% |

We have recommended a multiplier of 116% for males, which is a rounded version of the 116.4% multiplier. For females, the credibility approach is not meaningful. We considered just using the base table as is, but, given our work in Texas and with the Houston Municipal Employees Pension System, we believe the base table would be quite conservative. We have selected 108% as the halfway point between the 116% factor used for males and 100% base table.

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 | Healthy HPOPS Retirees | |
|---|---|---|
| | Male | Female |
| Life Expectancy of 65-year-old retiree in years (current assumption) | 18.6 | 21.4 |
| Life Expectancy of 65-year-old retiree in years (actual, smoothed) | 18.6 | 19.6 |
| Life Expectancy of 65-year-old retiree in years (proposed) | 18.9 | 21.2 |
| A/E ratio | 98.4% | 92.5% |

Without Projection, Central Year 2017

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.

**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 65 based on the proposed assumption set, by calendar year. As shown, the life expectancy is expected to increase into the future.

| Proposed Mortality Assumption - Life Expectancy for an Age 65 Retiree in Years | | | | | |
|---|---|---|---|---|---|
| **Group** | **Year of Retirement** | | | | |
| | **2022** | **2027** | **2032** | **2037** | **2042** |
| Healthy Retiree - Male | 20.2 | 20.6 | 21.0 | 21.3 | 21.7 |
| Healthy Retiree - Female | 22.6 | 23.0 | 23.4 | 23.7 | 24.1 |

## Disabled mortality rates

We are recommending the Pub-2010 Safety Tables for Disabled Retirees, and fully generational mortality, projected using the ultimate rates in the MP-2020 scales.

## Active mortality rates

We are recommending the Pub-2010 table for Below-Median Income Safety Employees, and fully generational mortality, projected using the ultimate rates in the MP-2020 scales. While the data is not large enough to be credible, the actual HPOPS experience has outpaced the baseline assumption, and the Below-Median tables provide higher incidence of mortality. Since HPOPS provides a meaningful benefit to the surviving spouse and children, it is important to not underestimate costs and thus we have chosen the Below-Median tables.

## Disability rates

There were 26 new disabled retirees during the period, compared to 24 expected during the five-year period ending June 30, 2021. We find the current assumption reasonable and are recommending no change to the base table. We continue to believe that some of the current members who could qualify as disabled, but are eligible to retire, choose to just elect to retire and thus are not showing in the disability pattern. If these members were post-2004 hires, they may not have been eligible and would have filed for disability. To add an impact for this, we recommend continued use of adding a 1% probability of becoming disabled to members who would have been eligible based on pre-2004 retirement eligibilities but are not eligible based on post-2004 eligibilities.

## Retirement rates

The valuation currently uses retirement rates that vary by age and service. In addition, the same retirement tables are currently used for members hired prior to 2004 and those hired after, except for a 3% load at first eligibility for each year the member is past age 45 for members hired after 2004 to represent the potential "pent up" demand for retirement.

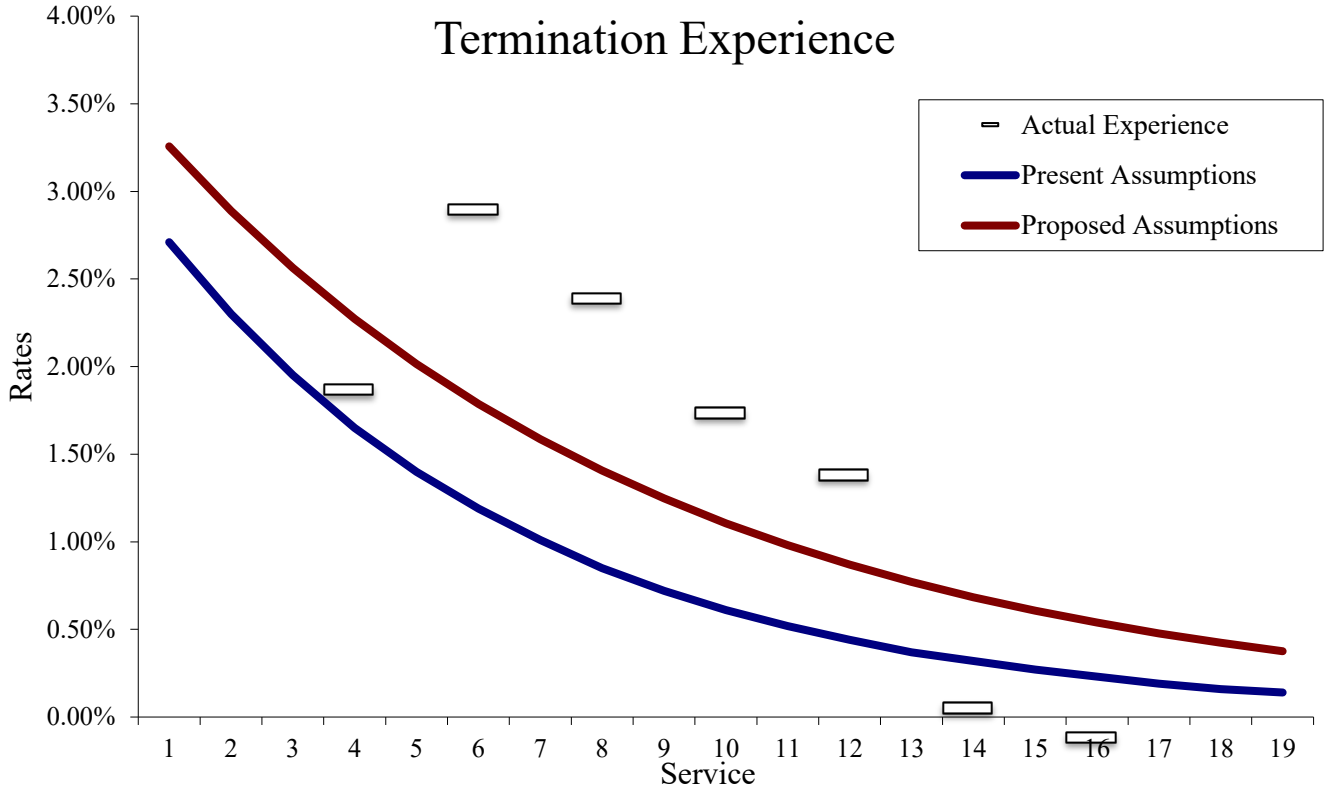
There was a significant pension reform process during 2017, which produced more than twice as many retirements during that year than normal years. Also, during the legislation, there were changes to the DROP program and so we increased the patterns of retirement by 10% thinking members may not be as incentivized to stay longer. Since this time, the observed experience has matched very close with the modified patterns.

There were 654 retirements during the four-year period ending June 30, 2021 (after spike from the legislation). This includes only members who retired from active status. It excludes those who were inactive for over a year before retiring. The analysis shows an overall A/E ratio of 98% for members before the age of 65, meaning the current assumption has provided a good fit for the time period. In addition, the A/E ratios appear to provide a good fit for the three service tiers and at individual ages. Therefore, we are recommending no changes to the retirement patterns. For more detail, please see Section E.

## 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, and whether the member takes a refund or keeps his/her account balance on deposit in HPOPS. The current termination rates vary by the member's years of service.

The termination assumption usually has little impact on a public safety actuarial valuation as the turnover experience of public safety groups tends to be very low. Actual termination rates have been significantly higher than the current assumption. Specifically, we have observed a trend over the last ten years towards increased rates of termination. It is possible that the change in pattern is at least partially impacted by the change in retirement benefits for the post-2004 hires, but it could also have to do with several other non-pension related issues with being a police officer. The following exhibit is a summary of the experience and the recommended changes.




## Payout of DROP/PROP balances

The current model assumes members in DROP take their DROP balance in 10 equal installments after retirement. For members in PROP, we currently assume they take their balance in 10 equal installments following the valuation date. Based on annual payments, it appears members leave their money on deposit even longer than the 10 years. We recommend no change to this assumption.

## Other assumptions and refunds

There are other assumptions made in the course of a valuation, such as the percentage of members who are married, the age difference between members and spouses, the likelihood that a terminating employee will take a refund, etc. We have 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, shown below is a table that compares key statistics from the July 1, 2021 actuarial valuation report with the current and recommended assumptions.

| Item | Current Assumptions | Recommended Assumptions |
|---|---|---|
| (1) | (2) | (3) |
| Total Normal Cost % | 23.14 % | 24.03% |
| Unfunded Actuarial Accrued Liability ($ in Millions) | $1,039 | $1,037 |
| Funded Ratio | 85.4% | 85.4% |
| Calculated Contribution Rate | 27.02% | 27.89% |
| City Contribution Rate | 31.98% | 31.98% |

# SECTION E

## SUMMARY OF ASSUMPTIONS AND METHODS INCORPORATING THE RECOMMENDED ASSUMPTIONS

# Summary of Actuarial Methods and Assumptions

The following methods and assumptions were used in preparing the July 1, 2021 actuarial valuation report.

1. Valuation Date

   The valuation date is as of July 1st, the first day 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.

2. Actuarial Cost Method

   The Ultimate Entry Age Normal (UEAN) actuarial cost method allocates the System's actuarial present value of future benefits to various periods based upon service. The portion of the present value of future benefits allocated to years of service prior to the valuation date is the actuarial accrued liability, and the portion allocated to years following the valuation date is the present value of future normal costs. The normal cost is determined for each active member as the level percent of payroll necessary to fully fund the expected benefits to be earned over the career of each individual active member. Under UEAN, the normal cost calculation is done assuming all members earn benefits that would be applicable to a newly hired member so that the normal cost should remain fairly stable as the relative distribution of active employees in different benefit groups changes. The normal cost is partially funded with active member contributions with the remainder funded by employer contributions.

   An unfunded accrued liability exists in the amount equal to the excess of accrued liability over valuation assets. The amortization period of the System is the number of years required to fully amortize the unfunded accrued liability, on an actuarial value of asset basis, with the expected amount of employer contributions in excess of the employers' portion of the normal cost.

   The contribution rate determined by this valuation will not be effective until one year later, but the determination of the rate does not reflect this deferral. It is assumed that there will be no change in the employer normal cost rate due to the deferral, and it is assumed that payments are made uniformly throughout the year.

3. 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 market value and the expected actuarial value of assets each year, and recognizes the cumulative excess return (or shortfall) over at a minimum rate of 20% per year. Each year a base is set up to reflect this difference. If the current year's base is of opposite sign to the deferred bases then it is offset dollar for dollar against the deferred bases. Any remaining bases are then recognized over the remaining period for the base (5 less the number of years between the bases year and the valuation year). This is intended to ensure the smoothed value of assets will converge towards the market value in a reasonable amount of time. 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 investment expenses.

4. Economic Assumptions

a. Investment return: 7.00% per year, compounded annually, composed of an assumed 2.30% inflation rate and a 4.70% net real rate of return. This rate represents the assumed return, net of all investment expenses.

b. Cost of Living Adjustment (COLA): Monthly benefits for participants receiving payments are increased each April 1 by the five-year average investment return minus 5.00%, with a minimum of 0.00% and a maximum of 4.00%. For this valuation, the annual COLA is assumed to be 2.00%.

c. Salary increase rate: A service-related component, plus a 3.25% inflation and general productivity component, as follows:

| Years of Service | Service-related Component | Total Annual Rate of Increase Including 2.75% Inflation and Productivity Component |
|---|---|---|
| (1) | (2) | (3) |
| 1 | 30.00% | 33.25% |
| 2 | 3.00% | 6.25% |
| 3 | 3.00% | 6.25% |
| 4 | 3.00% | 6.25% |
| 5 | 6.00% | 9.25% |
| 6 | 6.00% | 9.25% |
| 7 | 2.00% | 5.25% |
| 8 | 2.00% | 5.25% |
| 9 | 2.00% | 5.25% |
| 10 | 6.00% | 9.25% |
| 11 | 1.00% | 4.25% |
| 12 | 5.00% | 8.25% |
| 13 | 1.00% | 4.25% |
| 14 | 1.00% | 4.25% |
| 15 | 1.00% | 4.25% |
| 16 | 5.00% | 8.25% |
| 17 or more | 0.00% | 3.25% |

D. Payroll growth rate: In the amortization of the unfunded actuarial accrued liability, payroll is assumed to increase 2.75% per year. This increase rate is solely due to the effect of inflation on salaries, with no allowance for future membership growth.

5. Demographic Assumptions

a. Retirement Rates

| Age | Service | | |
|---|---|---|---|
| | <25 | 25-29 | 30+ |
| 40-49 | 3.0% | 3.0% | 9.0% |
| 50-54 | 4.0% | 6.0% | 10.0% |
| 55-59 | 6.8% | 10.2% | 17.0% |
| 60-64 | 9.6% | 14.4% | 24.0% |
| 65+ | 100.0% | 100.0% | 100.0% |

For members hired after October 9, 2004, 3% per year the member's first retirement eligibility exceeds 45 is added to the retirement rate at first eligibility up to a maximum increase of 30% at age 55. For members in DROP as of July 1, 2016, retirement rates are multiplied by 110% to reflect that future employee contributions are no longer credited to the DROP balance.

b. DROP Participation

100% of eligible active participants are assumed to elect the DROP.

c. DROP Entry Date

Active members (not already in DROP) are assumed to take advantage of the DROP and enter when first eligible. Participants are assumed to elect the maximum duration for the back DROP, up to 20 years.

d. DROP Interest Credit

Interest in the amount of 65% of the five-year average investment return, with a minimum of 2.50%, will be credited to existing DROP accounts on a monthly basis. For this actuarial valuation, the drop interest credit is assumed to be 5.40%.

e. Withdrawal of DROP and PROP Balances

Members are assumed to withdraw balances in equal annual installments over 10 years.

f. Mortality rates (for active and retired members)

- Healthy retirees - The Gender-Distinct Pub-2010 Public Safety Healthy Mortality Tables for males and females. The base rates were multiplied by 116% for males and 108% for females. The rates are projected on a fully generational basis by the ultimate values of scale MP-20 to account for future mortality improvements.

- Disabled males and females – The Gender-Distinct Pub-2010 Public Safety Disabled Retiree Mortality Tables are used without adjustment. The rates are projected on a fully generational basis by the ultimate values of scale MP-20 to account for future mortality improvements.

- Active members - The Gender-Distinct Pub-2010 Below-Median Income Public Safety Mortality Tables are used without adjustment. The rates are projected on a fully generational basis by the ultimate values of scale MP-20 to account for future mortality improvements.

Sample rates are shown below for 2022 (after multipliers):

| Age | Healthy Retired Males | Healthy Retired Females | Disabled Males | Disabled Females | Active Males | Active Females |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 25 | 0.04% | 0.02% | 0.11% | 0.07% | 0.05% | 0.03% |
| 30 | 0.04% | 0.03% | 0.12% | 0.09% | 0.06% | 0.04% |
| 35 | 0.05% | 0.04% | 0.14% | 0.12% | 0.06% | 0.05% |
| 40 | 0.06% | 0.05% | 0.17% | 0.16% | 0.08% | 0.07% |
| 45 | 0.12% | 0.09% | 0.24% | 0.22% | 0.11% | 0.09% |
| 50 | 0.19% | 0.15% | 0.35% | 0.30% | 0.16% | 0.12% |
| 55 | 0.31% | 0.26% | 0.48% | 0.46% | 0.23% | 0.17% |
| 60 | 0.51% | 0.45% | 0.74% | 0.70% | 0.35% | 0.23% |
| 65 | 0.88% | 0.77% | 1.19% | 1.06% | 0.55% | 0.31% |
| 70 | 1.57% | 1.33% | 1.91% | 1.61% | 1.02% | 0.61% |
| 75 | 2.83% | 2.30% | 3.24% | 2.44% | 1.90% | 1.22% |
| 80 | 5.10% | 3.96% | 5.60% | 3.96% | 3.56% | 2.43% |

g. Termination Rates and Disability Rates

Termination rates (for causes other than death, disability or retirement) are a function of the member's service and are not applied after a member becomes eligible for a retirement benefit. Disability rates are age-based and not applied for members in the DROP. All disabilities are assumed to be duty-related. Rates at selected ages and service levels are shown below.

| Termination | | |
|---|---|---|
| Service | Male | Female |
| 1 | 3.26% | 3.26% |
| 3 | 2.56% | 2.56% |
| 5 | 2.02% | 2.02% |
| 7 | 1.59% | 1.59% |
| 9 | 1.25% | 1.25% |
| 11 | 0.98% | 0.98% |
| 13 | 0.77% | 0.77% |
| 15 | 0.61% | 0.61% |
| 17 | 0.48% | 0.48% |
| 19 | 0.38% | 0.38% |
| 20+ | 0.10% | 0.10% |

| Age Based Rates of Disability | | |
|---|---|---|
| Age | Male | Female |
| 20 | 0.1149% | 0.1149% |
| 25 | 0.1145% | 0.1145% |
| 30 | 0.1197% | 0.1197% |
| 35 | 0.1321% | 0.1321% |
| 40 | 0.1516% | 0.1516% |
| 45 | 0.1785% | 0.1785% |
| 50 | 0.2126% | 0.2126% |
| 55 | 0.2538% | 0.2538% |
| 60 | 0.3023% | 0.3023% |

1% is also added to the rates above during the period that members hired post-2004 would have been eligible to retire under pre-2004 retirement eligibilities, but are not yet eligible.

6. Other Assumptions

a. Percent married: 90% of employees are assumed to be married. (No beneficiaries other than the spouse assumed.)

b. Valuation payroll: To determine the amortization rate, the payroll used is the amount budgeted by the City for the fiscal year following the valuation date increased by one year of payroll growth.

c. 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.

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

e. Percent electing deferred termination benefit: 50% of vested terminating members are assumed to elect a refund rather than take a deferred benefit.

f. There will be no recoveries once disabled.

g. No surviving spouse will remarry.

h. 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.

i. Administrative expenses: Administrative expenses are accounted for as an explicit component on the normal cost rate.

j. 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.

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

l. 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.

m. Decrement relativity: Decrement rates are converted to probabilities in order to account for multiple decrements.

n. Incidence of Contributions**:** Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in our Report, and the actual payroll payable at the time contributions are made.

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

7. Participant Data

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

The data for active members included birth date, gender, most recent hire date, salary paid during last fiscal year, hours worked by the employee, and employee contribution amounts. For retired members and beneficiaries, the data included date of birth, gender, amount of monthly benefit, and date of retirement. Also included was the member's Group and for members participating in DROP, their account balances and monthly DROP income.

All healthy and disabled retirees are assumed to have 100% joint and survivor annuities, prorated by the 90% marriage assumption and reflecting the three-year spousal age differential described above. All beneficiaries are assumed to have life annuity only benefits.

Salary supplied for the current year was based on the earnings for the year preceding the valuation date. This salary was adjusted by the salary increase rate for one year.

In fiscal years when a 27$^{th}$ pay period occurs the individual pays for employees who were employed throughout the year will be adjusted by multiplying their reported pay by the ratio of 26/27. In years that have only 26 pay periods no adjustment would be needed.

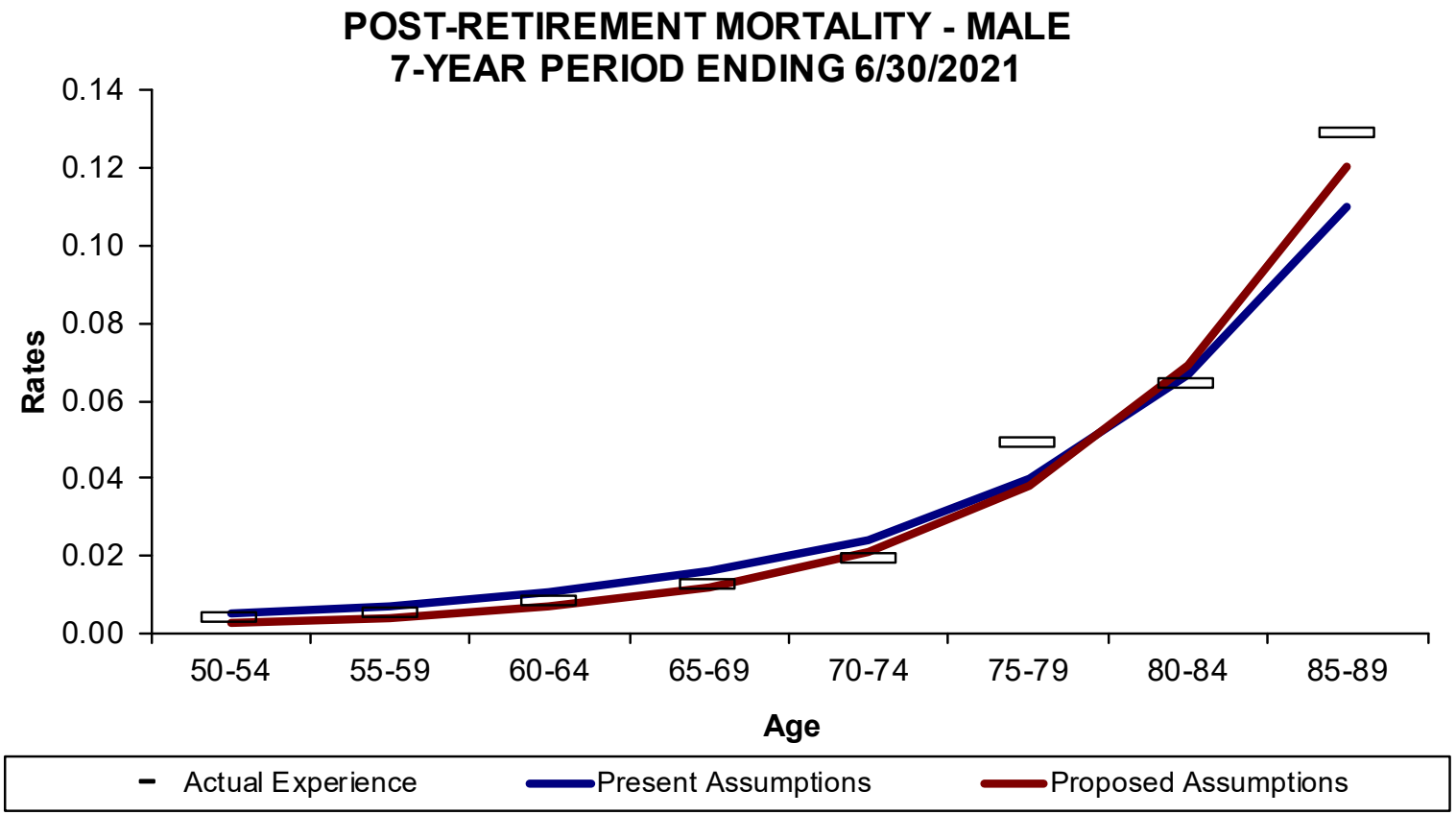
Assumptions were made to correct for missing, bad, or inconsistent data. These had no material impact on the results presented.

# SECTION F

## SUMMARY OF DATA AND EXPERIENCE

**HOUSTON POLICE OFFICERS' PENSION SYSTEM**
**POST-RETIREMENT MORTALITY - HEALTHY MALE**
**7-YEAR PERIOD ENDING 6/30/2021**

| | | | | Assumed Rate | | Expected Deaths | | Actual/Expected | |
|---|---|---|---|---|---|---|---|---|---|
| Age | Actual Deaths | 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) |
| 50-54 | 3 | 705 | 0.45% | 0.51% | 0.26% | 3.6 | 1.8 | 89% | 175% |
| 55-59 | 11 | 1,944 | 0.57% | 0.73% | 0.41% | 14.2 | 7.9 | 78% | 141% |
| 60-64 | 21 | 2,476 | 0.83% | 1.07% | 0.68% | 26.4 | 16.7 | 78% | 123% |
| 65-69 | 30 | 2,339 | 1.29% | 1.60% | 1.18% | 37.4 | 27.6 | 81% | 109% |
| 70-74 | 30 | 1,554 | 1.92% | 2.43% | 2.07% | 37.7 | 32.2 | 79% | 93% |
| 75-79 | 36 | 733 | 4.95% | 3.98% | 3.79% | 29.2 | 27.8 | 124% | 131% |
| 80-84 | 30 | 469 | 6.44% | 6.70% | 6.92% | 31.4 | 32.5 | 96% | 93% |
| 85-89 | 29 | 228 | 12.89% | 11.02% | 12.04% | 25.1 | 27.4 | 117% | 107% |
| 90-94 | 11 | 46 | 23.86% | 17.65% | 19.96% | 8.0 | 9.1 | 135% | 120% |
| Totals | 202 | 10,492 | 1.92% | 2.03% | 1.74% | 213.0 | 183.1 | 95% | 110% |
| 65-74 | 60 | 3,892 | | | | 75.1 | 59.9 | 80% | 100% |
| 75-84 | 67 | 1,202 | | | | 60.6 | 60.2 | 110% | 110% |
| 85-94 | 40 | 273 | | | | 33.1 | 36.5 | 121% | 110% |

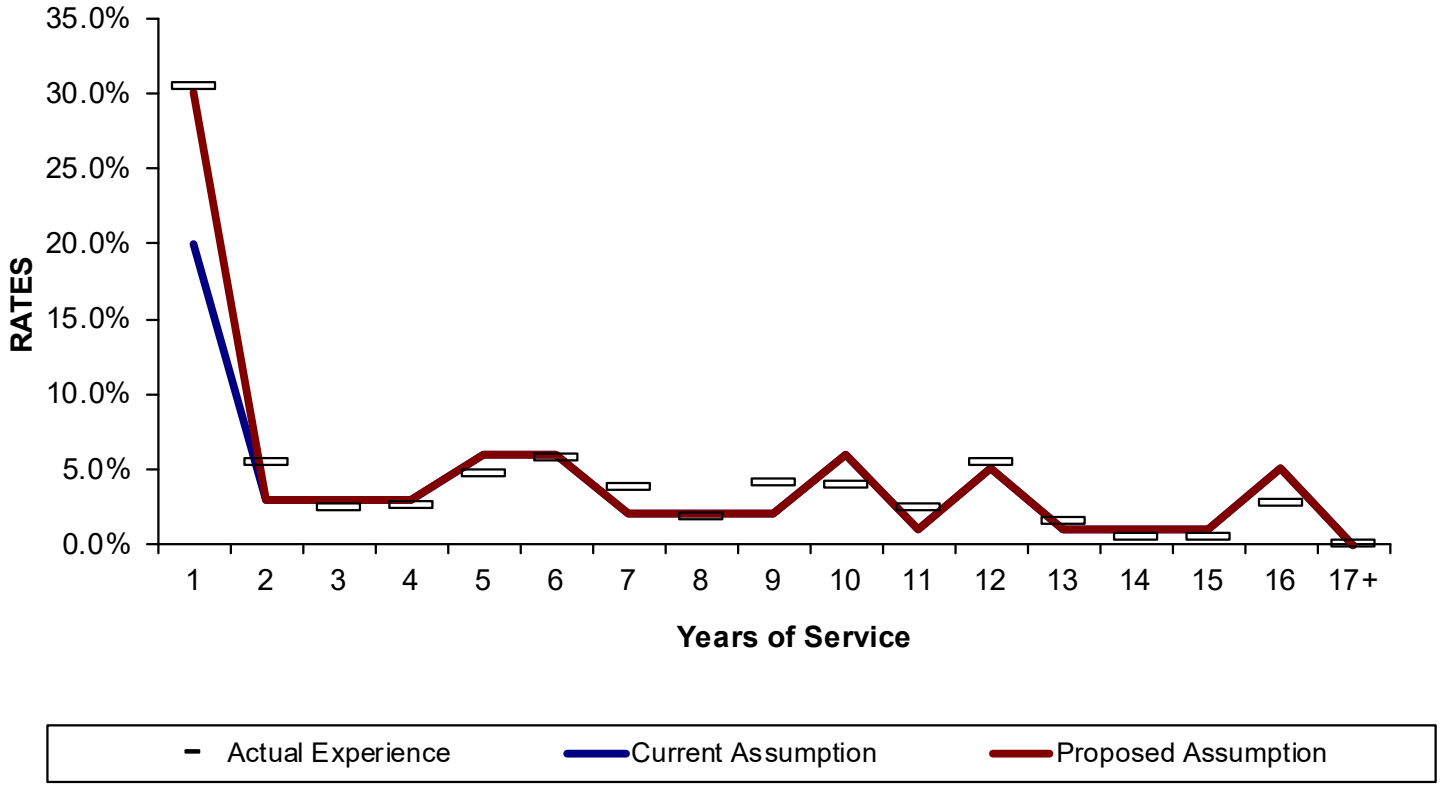

POST-RETIREMENT MORTALITY - MALE
7-YEAR PERIOD ENDING 6/30/2021
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Rates
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
Age
Actual Experience
Present Assumptions
Proposed Assumptions

## HOUSTON POLICE OFFICERS' PENSION SYSTEM
## SERVICE BASED SALARY EXPERIENCE
## 10-YEAR PERIOD ENDING 6/30/2021

| | 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 | 22.75% | 20.00% | 33.22% | 31.35% | 30.43% | 33.25% | 30.00% |
| 2 | 5.75% | 3.00% | 8.19% | 6.32% | 5.41% | 6.25% | 3.00% |
| 3 | 5.75% | 3.00% | 5.22% | 3.35% | 2.44% | 6.25% | 3.00% |
| 4 | 5.75% | 3.00% | 5.31% | 3.44% | 2.53% | 6.25% | 3.00% |
| 5 | 8.75% | 6.00% | 7.41% | 5.54% | 4.63% | 9.25% | 6.00% |
| 6 | 8.75% | 6.00% | 8.58% | 6.71% | 5.80% | 9.25% | 6.00% |
| 7 | 4.75% | 2.00% | 6.55% | 4.68% | 3.77% | 5.25% | 2.00% |
| 8 | 4.75% | 2.00% | 4.61% | 2.74% | 1.83% | 5.25% | 2.00% |
| 9 | 4.75% | 2.00% | 6.81% | 4.94% | 4.03% | 5.25% | 2.00% |
| 10 | 8.75% | 6.00% | 6.68% | 4.81% | 3.90% | 9.25% | 6.00% |
| 11 | 3.75% | 1.00% | 5.25% | 3.38% | 2.46% | 4.25% | 1.00% |
| 12 | 7.75% | 5.00% | 8.16% | 6.29% | 5.38% | 8.25% | 5.00% |
| 13 | 3.75% | 1.00% | 4.36% | 2.49% | 1.57% | 4.25% | 1.00% |
| 14 | 3.75% | 1.00% | 3.20% | 1.33% | 0.41% | 4.25% | 1.00% |
| 15 | 3.75% | 1.00% | 3.23% | 1.36% | 0.45% | 4.25% | 1.00% |
| 16 | 7.75% | 5.00% | 5.45% | 3.58% | 2.67% | 8.25% | 5.00% |
| 17+ | 2.75% | 0.00% | 2.78% | 0.91% | 0.00% | 3.25% | 0.00% |

| | | | |
|---|---|---|---|
| Current Inflation Assumption | 2.30% | Proposed Inflation Assumption | 2.30% |
| Current Productivity Component | 0.45% | Proposed Productivity Component | 0.95% |
| Actual CPI-U Inflation for Period | 1.87% | | |
| Apparent Productivity Component | 0.91% | | |

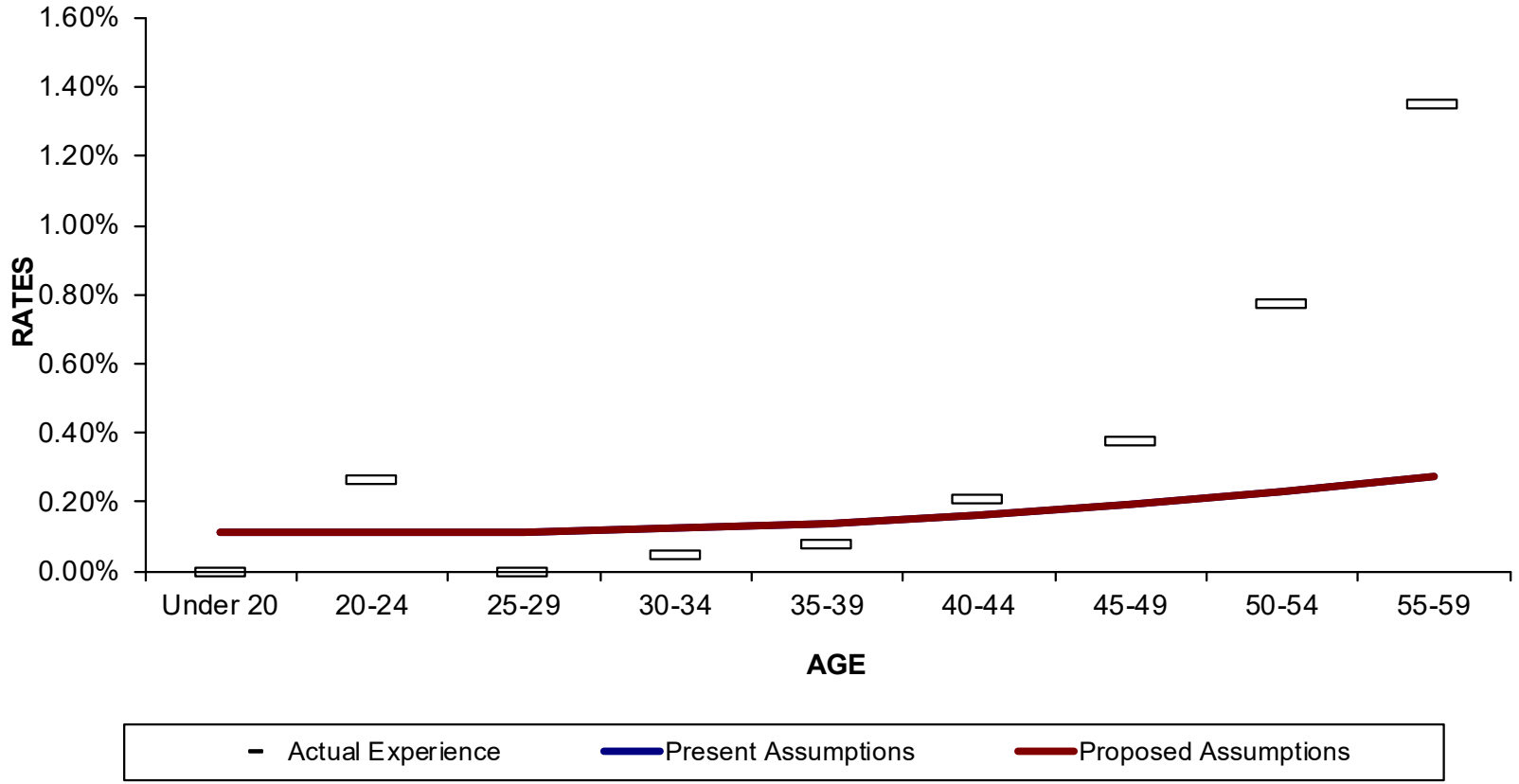
## SERVICE-BASED SALARY STEP RATES
## 10-YEAR PERIOD ENDING 6/30/2021



**HOUSTON POLICE OFFICERS' PENSION SYSTEM**
**DISABILITY EXPERIENCE**
**5-YEAR PERIOD ENDING 6/30/2021**

| | | | | Assumed Rate | | Expected Disabilities | | Actual/Expected | |
|---|---|---|---|---|---|---|---|---|---|
| Age | Actual Disabilities | Total Count | Actual Rate | Current | Proposed | Current | Proposed | Current (2) / (7) | Proposed (2) / (8) |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Under 20 | - | - | N/A | 0.115% | 0.115% | - | - | N/A | N/A |
| 20-24 | 1 | 382 | 0.262% | 0.115% | 0.115% | - | - | N/A | N/A |
| 25-29 | - | 3,003 | 0.000% | 0.116% | 0.116% | 4 | 4 | 0% | 0% |
| 30-34 | 2 | 3,990 | 0.050% | 0.124% | 0.124% | 5 | 5 | 40% | 40% |
| 35-39 | 3 | 3,705 | 0.081% | 0.139% | 0.139% | 5 | 5 | 60% | 60% |
| 40-44 | 6 | 2,878 | 0.208% | 0.162% | 0.162% | 5 | 5 | 120% | 120% |
| 45-49 | 7 | 1,849 | 0.379% | 0.191% | 0.191% | 4 | 4 | 175% | 175% |
| 50-54 | 5 | 645 | 0.775% | 0.228% | 0.228% | 1 | 1 | 500% | 500% |
| 55-59 | 1 | 74 | 1.351% | 0.272% | 0.272% | - | - | N/A | N/A |
| 60-64 | 1 | 5 | 20.000% | 0.324% | 0.324% | - | - | N/A | N/A |
| Totals | 26 | 16,531 | 0.157% | 0.145% | 0.145% | 24.0 | 24.0 | 108% | 108% |

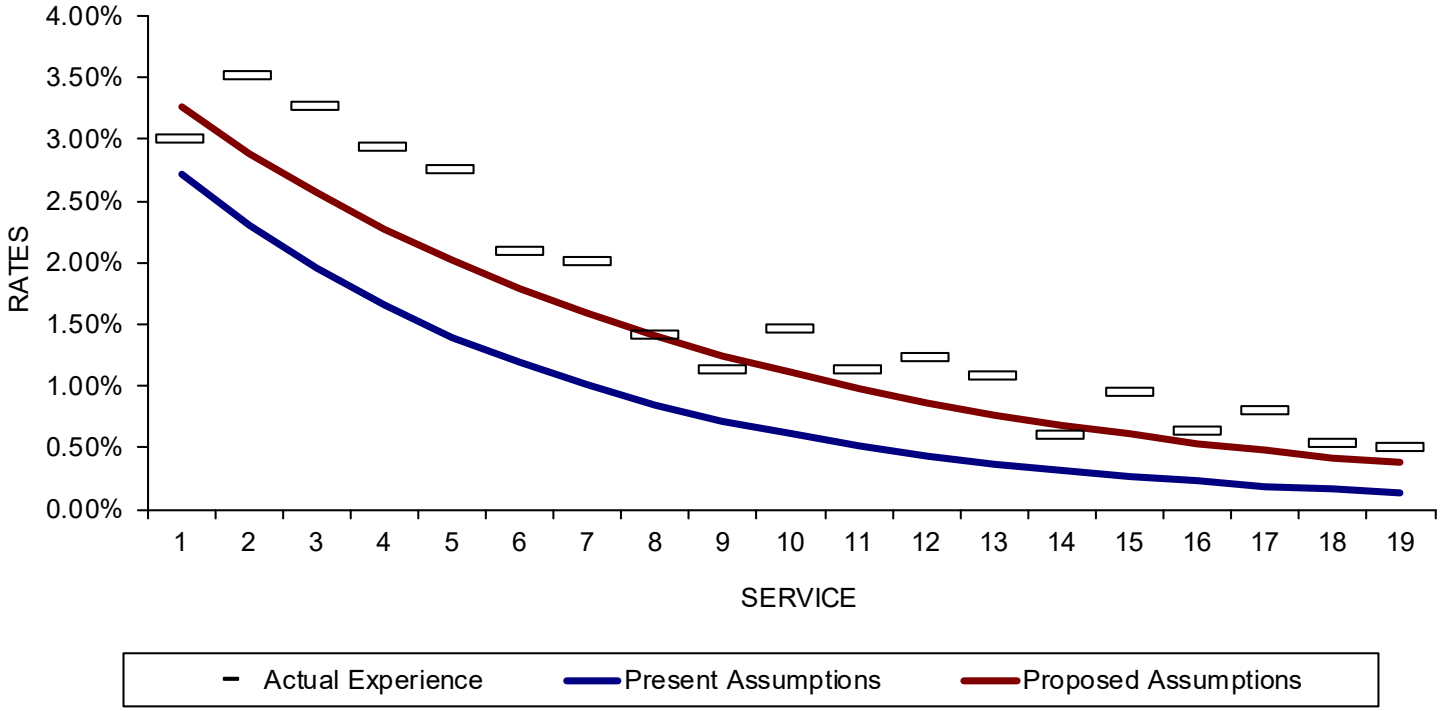
## DISABILITY EXPERIENCE
## 5-YEAR PERIOD ENDING 6/30/2021



**HOUSTON POLICE OFFICERS' PENSION SYSTEM**
**TERMINATION EXPERIENCE**
**10-YEAR PERIOD ENDING 6/30/2021**

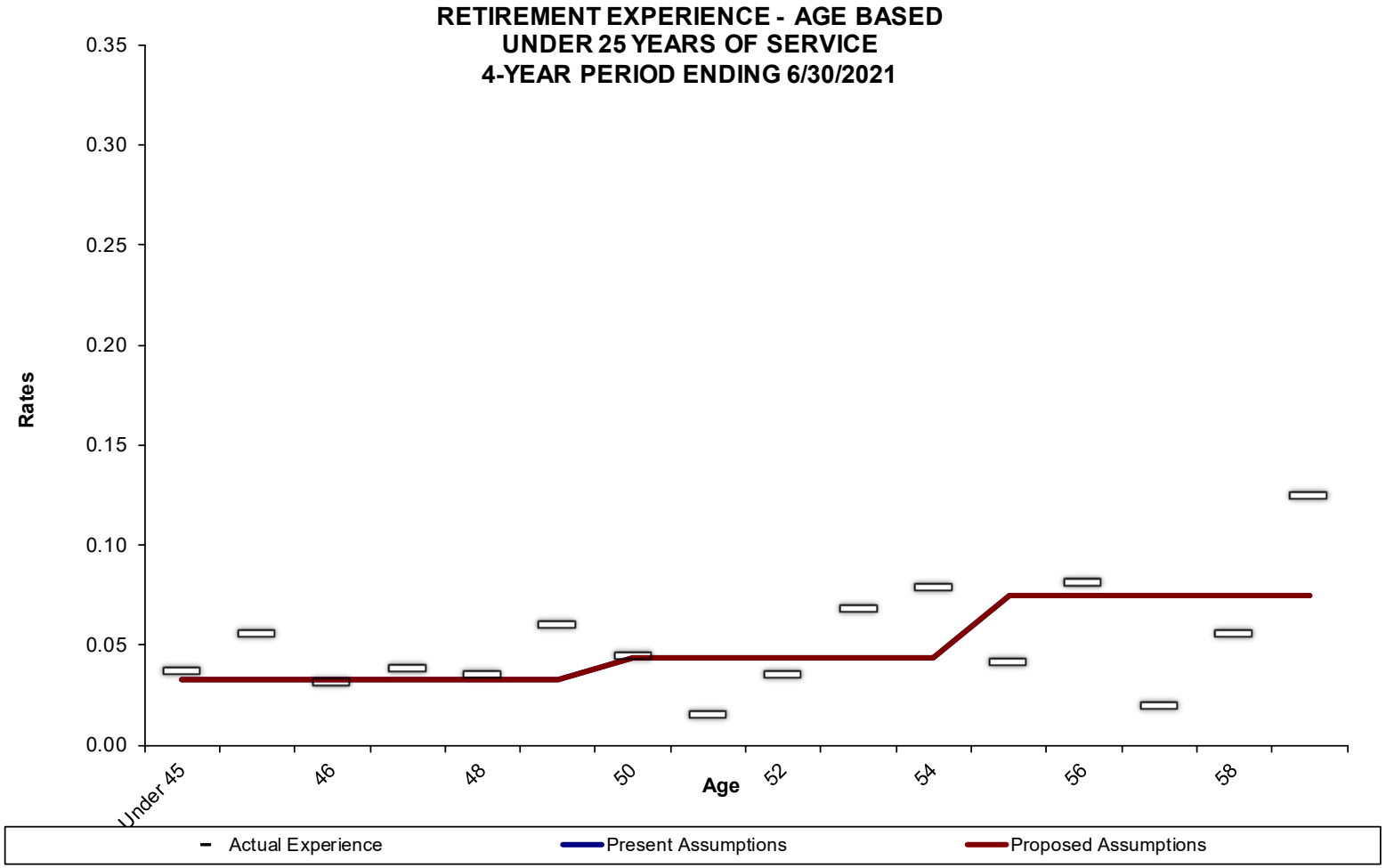
| | | | | Assumed Rate | | Expected Withdrawal | | Actual/Expected | |
|---|---|---|---|---|---|---|---|---|---|
| Service | Actual Withdrawals | Total Count | Actual Rate | Current | Proposed | Current | Proposed | Current (2) / (7) | Proposed (2) / (8) |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| 1 | 85 | 2,821 | 3.01% | 2.71% | 3.26% | 76.5 | 91.9 | 111% | 92% |
| 2 | 162 | 4,601 | 3.53% | 2.30% | 2.89% | 105.8 | 132.9 | 153% | 122% |
| 3 | 179 | 5,486 | 3.27% | 1.95% | 2.56% | 107.0 | 140.5 | 168% | 128% |
| 4 | 165 | 5,615 | 2.94% | 1.65% | 2.27% | 92.6 | 127.6 | 178% | 130% |
| 5 | 150 | 5,408 | 2.77% | 1.40% | 2.02% | 75.7 | 109.0 | 198% | 137% |
| 6 | 109 | 5,163 | 2.10% | 1.19% | 1.79% | 61.4 | 92.3 | 177% | 118% |
| 7 | 105 | 5,181 | 2.02% | 1.01% | 1.59% | 52.3 | 82.1 | 200% | 127% |
| 8 | 79 | 5,532 | 1.42% | 0.85% | 1.41% | 47.0 | 77.8 | 167% | 101% |
| 9 | 67 | 5,891 | 1.13% | 0.72% | 1.25% | 42.4 | 73.5 | 157% | 91% |
| 10 | 93 | 6,289 | 1.47% | 0.61% | 1.11% | 38.4 | 69.6 | 241% | 133% |
| 11 | 78 | 6,834 | 1.14% | 0.52% | 0.98% | 35.5 | 67.0 | 219% | 116% |
| 12 | 89 | 7,136 | 1.24% | 0.44% | 0.87% | 31.4 | 62.1 | 282% | 143% |
| 13 | 71 | 6,483 | 1.09% | 0.37% | 0.77% | 24.0 | 50.0 | 295% | 142% |
| 14 | 38 | 6,221 | 0.61% | 0.32% | 0.68% | 19.9 | 42.6 | 191% | 89% |
| 15 | 59 | 6,248 | 0.95% | 0.27% | 0.61% | 16.9 | 37.9 | 352% | 157% |
| 16 | 40 | 6,337 | 0.63% | 0.23% | 0.54% | 14.6 | 34.1 | 276% | 118% |
| 17 | 63 | 7,851 | 0.80% | 0.19% | 0.48% | 14.9 | 37.5 | 420% | 167% |
| 18 | 52 | 9,469 | 0.55% | 0.16% | 0.42% | 15.2 | 40.1 | 343% | 129% |
| 19 | 55 | 11,002 | 0.50% | 0.14% | 0.38% | 15.4 | 41.3 | 359% | 134% |
| Totals | 1,737 | 119,569 | 1.45% | 0.74% | 1.18% | 886.9 | 1,409.8 | 196% | 123% |

## TERMINATION EXPERIENCE
## 10-YEAR PERIOD ENDING 6/30/2021



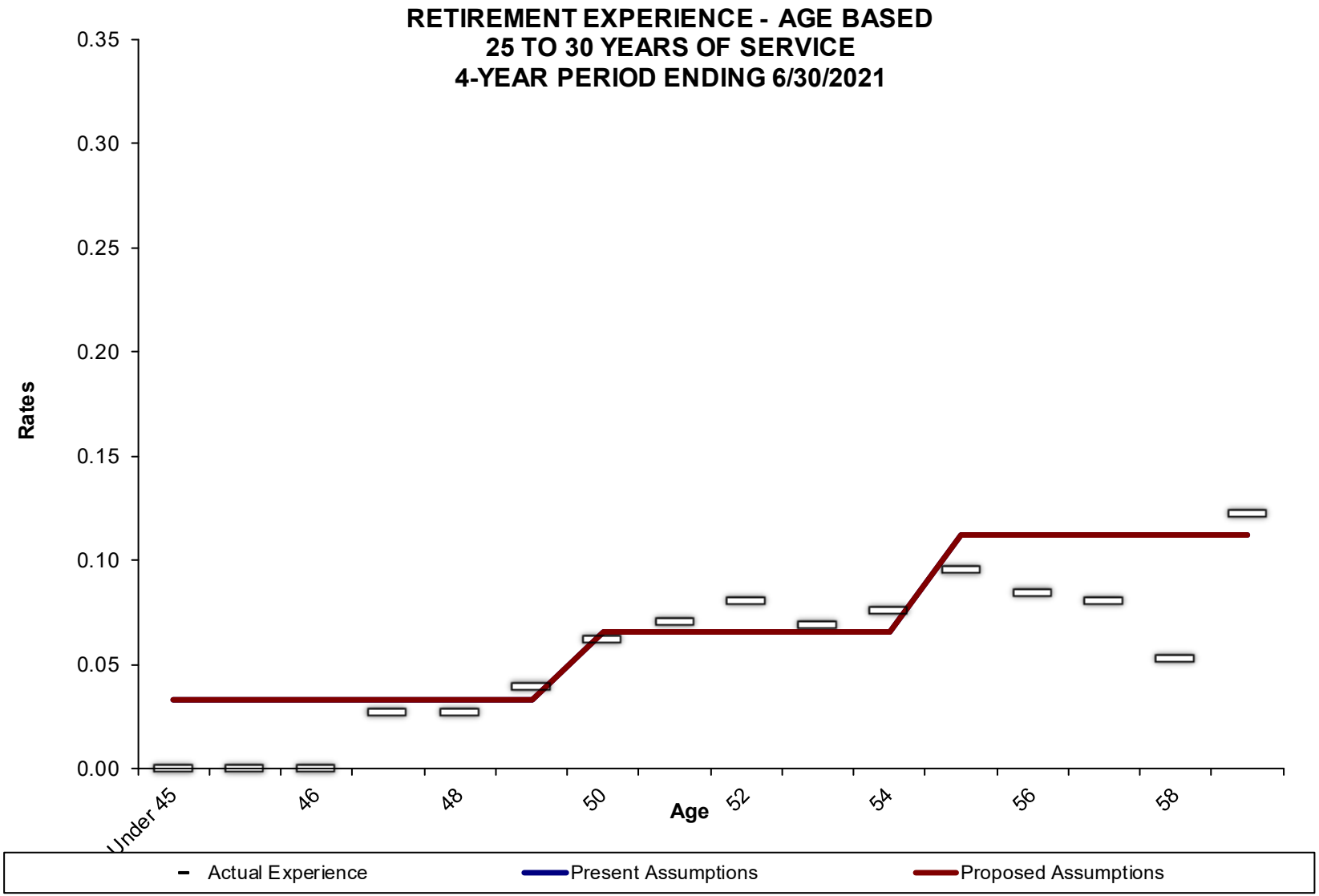
**HOUSTON POLICE OFFICERS' PENSION SYSTEM**
**RETIREMENT EXPERIENCE - AGE BASED, <25 YEARS OF SERVICE**
**4-YEAR PERIOD ENDING 6/30/2021**

| | | | | Assumed Rate | | Expected Retirement | | Actual/Expected | |
|---|---|---|---|---|---|---|---|---|---|
| Age | Actual Retirements | Total Count | Actual Rate | Current | Proposed | Current (3) * (5) | Proposed (3) * (6) | Current (2) / (7) | Proposed (2) / (8) |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Under 45 | 8 | 215 | 3.7% | 3.3% | 3.3% | 7 | 7 | 113% | 113% |
| 45 | 11 | 196 | 5.6% | 3.3% | 3.3% | 6 | 6 | 170% | 170% |
| 46 | 8 | 254 | 3.1% | 3.3% | 3.3% | 8 | 8 | 95% | 95% |
| 47 | 13 | 337 | 3.9% | 3.3% | 3.3% | 11 | 11 | 117% | 117% |
| 48 | 13 | 362 | 3.6% | 3.3% | 3.3% | 12 | 12 | 109% | 109% |
| 49 | 22 | 365 | 6.0% | 3.3% | 3.3% | 12 | 12 | 183% | 183% |
| 50 | 14 | 312 | 4.5% | 4.4% | 4.4% | 14 | 14 | 102% | 102% |
| 51 | 4 | 268 | 1.5% | 4.4% | 4.4% | 12 | 12 | 34% | 34% |
| 52 | 8 | 226 | 3.5% | 4.4% | 4.4% | 10 | 10 | 80% | 80% |
| 53 | 11 | 161 | 6.8% | 4.4% | 4.4% | 7 | 7 | 155% | 155% |
| 54 | 9 | 114 | 7.9% | 4.4% | 4.4% | 5 | 5 | 179% | 179% |
| 55 | 4 | 96 | 4.2% | 7.5% | 7.5% | 7 | 7 | 56% | 56% |
| 56 | 6 | 74 | 8.1% | 7.5% | 7.5% | 6 | 6 | 108% | 108% |
| 57 | 1 | 51 | 2.0% | 7.5% | 7.5% | 4 | 4 | 26% | 26% |
| 58 | 2 | 36 | 5.6% | 7.5% | 7.5% | 3 | 3 | 74% | 74% |
| 59 | 3 | 24 | 12.5% | 7.5% | 7.5% | 2 | 2 | 167% | 167% |
| 60 | 1 | 13 | 7.7% | 10.6% | 10.6% | 1 | 1 | 73% | 73% |
| 61 | 1 | 7 | 14.3% | 10.6% | 10.6% | 1 | 1 | 135% | 135% |
| 62 | - | 4 | 0.0% | 10.6% | 10.6% | 0 | 0 | 0% | 0% |
| 63 | 1 | 4 | 25.0% | 10.6% | 10.6% | 0 | 0 | 237% | 237% |
| 64 | - | 3 | 0.0% | 10.6% | 10.6% | 0 | 0 | 0% | 0% |
| Subtotal | 140 | 3,122 | 4.5% | 4.1% | 4.1% | 128.9 | 128.9 | 109% | 109% |
| 65 & Over | 1 | 9 | 11.1% | 110.0% | 110.0% | 10 | 10 | 10% | 10% |
| Total | 141 | 3,131 | 4.5% | 4.4% | 4.4% | 138.8 | 138.8 | 102% | 102% |


RETIREMENT EXPERIENCE - AGE BASED
UNDER 25 YEARS OF SERVICE
4-YEAR PERIOD ENDING 6/30/2021
Rates
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Under 45
46
48
50
52
54
56
58
Age
Actual Experience
Present Assumptions
Proposed Assumptions

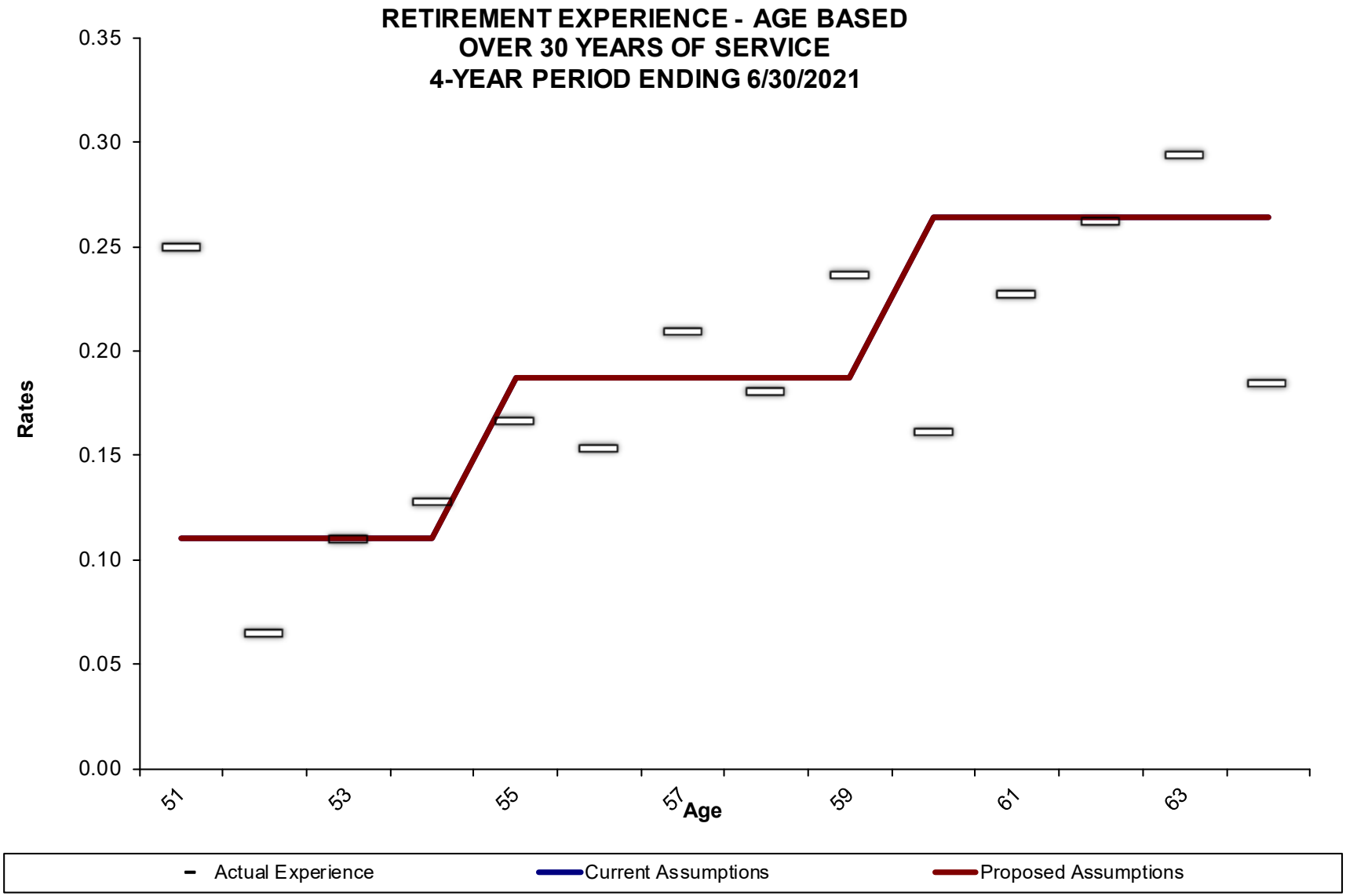
**HOUSTON POLICE OFFICERS' PENSION SYSTEM**
**RETIREMENT EXPERIENCE - AGE BASED, 25-30 YEARS OF SERVICE**
**4-YEAR PERIOD ENDING 6/30/2021**

| | | | | Assumed Rate | | Expected Retirement | | Actual/Expected | |
|---|---|---|---|---|---|---|---|---|---|
| Age | Actual Retirements | Total Count | Actual Rate | Current | Proposed | Current (3) * (5) | Proposed (3) * (6) | Current (2) / (7) | Proposed (2) / (8) |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Under 45 | - | - | N\A | 3.3% | 3.3% | - | - | N\A | N\A |
| 45 | - | - | N\A | 3.3% | 3.3% | - | - | N\A | N\A |
| 46 | - | 2 | 0.0% | 3.3% | 3.3% | 0 | 0 | 0% | 0% |
| 47 | 1 | 36 | 2.8% | 3.3% | 3.3% | 1 | 1 | 84% | 84% |
| 48 | 3 | 109 | 2.8% | 3.3% | 3.3% | 4 | 4 | 83% | 83% |
| 49 | 8 | 201 | 4.0% | 3.3% | 3.3% | 7 | 7 | 121% | 121% |
| 50 | 21 | 337 | 6.2% | 6.6% | 6.6% | 22 | 22 | 94% | 94% |
| 51 | 29 | 410 | 7.1% | 6.6% | 6.6% | 27 | 27 | 107% | 107% |
| 52 | 32 | 396 | 8.1% | 6.6% | 6.6% | 26 | 26 | 122% | 122% |
| 53 | 25 | 362 | 6.9% | 6.6% | 6.6% | 24 | 24 | 105% | 105% |
| 54 | 20 | 261 | 7.7% | 6.6% | 6.6% | 17 | 17 | 116% | 116% |
| 55 | 17 | 177 | 9.6% | 11.2% | 11.2% | 20 | 20 | 86% | 86% |
| 56 | 12 | 142 | 8.5% | 11.2% | 11.2% | 16 | 16 | 75% | 75% |
| 57 | 8 | 99 | 8.1% | 11.2% | 11.2% | 11 | 11 | 72% | 72% |
| 58 | 4 | 75 | 5.3% | 11.2% | 11.2% | 8 | 8 | 48% | 48% |
| 59 | 7 | 57 | 12.3% | 11.2% | 11.2% | 6 | 6 | 109% | 109% |
| 60 | 5 | 41 | 12.2% | 15.8% | 15.8% | 6 | 6 | 77% | 77% |
| 61 | 4 | 30 | 13.3% | 15.8% | 15.8% | 5 | 5 | 84% | 84% |
| 62 | 3 | 18 | 16.7% | 15.8% | 15.8% | 3 | 3 | 105% | 105% |
| 63 | 1 | 12 | 8.3% | 15.8% | 15.8% | 2 | 2 | 53% | 53% |
| 64 | 1 | 7 | 14.3% | 15.8% | 15.8% | 1 | 1 | 90% | 90% |
| Subtotal | 201 | 2,772 | 7.3% | 7.5% | 7.5% | 207 | 207 | 97% | 97% |
| 65 & Over | 1 | 9 | 11.1% | 110.0% | 110.0% | 10 | 10 | 10% | 10% |
| Total | 202 | 2,781 | 7.3% | 7.8% | 7.8% | 217 | 217 | 93% | 93% |


RETIREMENT EXPERIENCE - AGE BASED
25 TO 30 YEARS OF SERVICE
4-YEAR PERIOD ENDING 6/30/2021
Rates
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Under 45
46
48
50
52
54
56
58
Age
Actual Experience
Present Assumptions
Proposed Assumptions

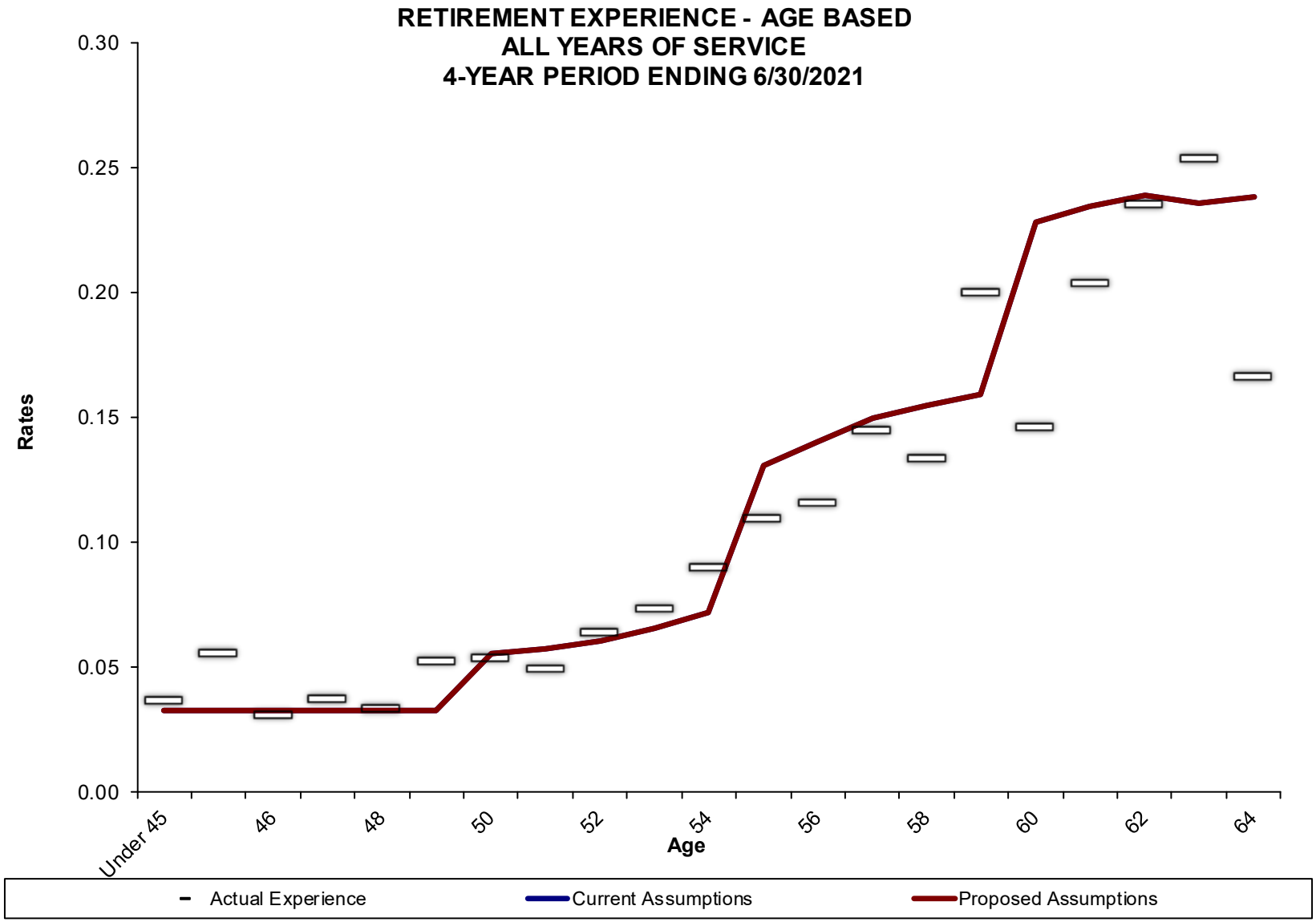
**HOUSTON POLICE OFFICERS' PENSION SYSTEM**
**RETIREMENT EXPERIENCE - AGE BASED, >30 YEARS OF SERVICE**
**4-YEAR PERIOD ENDING 6/30/2021**

| | | | | Assumed Rate | | Expected Retirement | | Actual/Expected | |
|---|---|---|---|---|---|---|---|---|---|
| Age | Actual Retirements | Total Count | Actual Rate | Current | Proposed | Current (3) * (5) | Proposed (3) * (6) | Current (2) / (7) | Proposed (2) / (8) |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Under 45 | 0 | 0 | N\A | 0.060 | 0.100 | 0 | 0 | N\A | N\A |
| 45 | 0 | 0 | N\A | 0.060 | 0.100 | 0 | 0 | N\A | N\A |
| 46 | 0 | 0 | N\A | 0.060 | 0.100 | 0 | 0 | N\A | N\A |
| 47 | 0 | 0 | N\A | 0.060 | 0.100 | 0 | 0 | N\A | N\A |
| 48 | 0 | 0 | N\A | 0.060 | 0.100 | 0 | 0 | N\A | N\A |
| 49 | 0 | 0 | N\A | 0.060 | 0.100 | 0 | 0 | N\A | N\A |
| 50 | 0 | 0 | N\A | 0.060 | 0.100 | 0 | 0 | N\A | N\A |
| 51 | 1 | 4 | 0.250 | 0.110 | 0.110 | 0 | 0 | 227% | 227% |
| 52 | 2 | 31 | 0.065 | 0.110 | 0.110 | 3 | 3 | 59% | 59% |
| 53 | 8 | 73 | 0.110 | 0.110 | 0.110 | 8 | 8 | 100% | 100% |
| 54 | 16 | 125 | 0.128 | 0.110 | 0.110 | 14 | 14 | 116% | 116% |
| 55 | 26 | 156 | 0.167 | 0.187 | 0.187 | 29 | 29 | 89% | 89% |
| 56 | 29 | 189 | 0.153 | 0.187 | 0.187 | 35 | 35 | 82% | 82% |
| 57 | 42 | 201 | 0.209 | 0.187 | 0.187 | 38 | 38 | 112% | 112% |
| 58 | 34 | 188 | 0.181 | 0.187 | 0.187 | 35 | 35 | 97% | 97% |
| 59 | 40 | 169 | 0.237 | 0.187 | 0.187 | 32 | 32 | 127% | 127% |
| 60 | 20 | 124 | 0.161 | 0.264 | 0.264 | 33 | 33 | 61% | 61% |
| 61 | 25 | 110 | 0.227 | 0.264 | 0.264 | 29 | 29 | 86% | 86% |
| 62 | 21 | 80 | 0.263 | 0.264 | 0.264 | 21 | 21 | 99% | 99% |
| 63 | 15 | 51 | 0.294 | 0.264 | 0.264 | 13 | 13 | 111% | 111% |
| 64 | 7 | 38 | 0.184 | 0.264 | 0.264 | 10 | 10 | 70% | 70% |
| Subtotal | 286 | 1,539 | 0.186 | 0.196 | 0.196 | 301 | 301 | 95% | 95% |
| 65 & Over | 25 | 74 | 0.338 | 1.100 | 1.100 | 81 | 81 | 31% | 31% |
| Total | 311 | 1,613 | 0.193 | 0.237 | 0.237 | 382 | 382 | 81% | 81% |


RETIREMENT EXPERIENCE - AGE BASED
OVER 30 YEARS OF SERVICE
4-YEAR PERIOD ENDING 6/30/2021
Rates
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
51
53
55
57
59
61
63
Age
Actual Experience
Current Assumptions
Proposed Assumptions

**HOUSTON POLICE OFFICERS' PENSION SYSTEM**
**RETIREMENT EXPERIENCE - AGE BASED, ALL YEARS OF SERVICE**
**4-YEAR PERIOD ENDING 6/30/2021**

| | | | | Assumed Rate | | Expected Retirement | | Actual/Expected | |
|---|---|---|---|---|---|---|---|---|---|
| Age | Actual Retirements | Total Count | Actual Rate | Current | Proposed | Current (3) * (5) | Proposed (3) * (6) | Current (2) / (7) | Proposed (2) / (8) |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Under 45 | 8 | 215 | 0.037 | 0.033 | 0.033 | 7.1 | 7.1 | 113% | 113% |
| 45 | 11 | 196 | 0.056 | 0.033 | 0.033 | 6.5 | 6.5 | 170% | 170% |
| 46 | 8 | 256 | 0.031 | 0.033 | 0.033 | 8.4 | 8.4 | 95% | 95% |
| 47 | 14 | 373 | 0.038 | 0.033 | 0.033 | 12.3 | 12.3 | 114% | 114% |
| 48 | 16 | 471 | 0.034 | 0.033 | 0.033 | 15.5 | 15.5 | 103% | 103% |
| 49 | 30 | 566 | 0.053 | 0.033 | 0.033 | 18.7 | 18.7 | 161% | 161% |
| 50 | 35 | 649 | 0.054 | 0.055 | 0.055 | 36.0 | 36.0 | 97% | 97% |
| 51 | 34 | 682 | 0.050 | 0.058 | 0.058 | 39.3 | 39.3 | 87% | 87% |
| 52 | 42 | 653 | 0.064 | 0.060 | 0.060 | 39.5 | 39.5 | 106% | 106% |
| 53 | 44 | 596 | 0.074 | 0.065 | 0.065 | 39.0 | 39.0 | 113% | 113% |
| 54 | 45 | 500 | 0.090 | 0.072 | 0.072 | 36.0 | 36.0 | 125% | 125% |
| 55 | 47 | 429 | 0.110 | 0.131 | 0.131 | 56.2 | 56.2 | 84% | 84% |
| 56 | 47 | 405 | 0.116 | 0.140 | 0.140 | 56.8 | 56.8 | 83% | 83% |
| 57 | 51 | 351 | 0.145 | 0.150 | 0.150 | 52.5 | 52.5 | 97% | 97% |
| 58 | 40 | 299 | 0.134 | 0.155 | 0.155 | 46.3 | 46.3 | 86% | 86% |
| 59 | 50 | 250 | 0.200 | 0.159 | 0.159 | 39.8 | 39.8 | 126% | 126% |
| 60 | 26 | 178 | 0.146 | 0.228 | 0.228 | 40.6 | 40.6 | 64% | 64% |
| 61 | 30 | 147 | 0.204 | 0.235 | 0.235 | 34.5 | 34.5 | 87% | 87% |
| 62 | 24 | 102 | 0.235 | 0.239 | 0.239 | 24.4 | 24.4 | 98% | 98% |
| 63 | 17 | 67 | 0.254 | 0.236 | 0.236 | 15.8 | 15.8 | 108% | 108% |
| 64 | 8 | 48 | 0.167 | 0.239 | 0.239 | 11.5 | 11.5 | 70% | 70% |
| Subtotal | 627 | 7,433 | 0.084 | 0.086 | 0.086 | 636.7 | 636.7 | 98% | 98% |
| 65 & Over | 27 | 92 | 0.293 | 1.100 | 1.100 | 101.2 | 101.2 | 27% | 27% |
| Total | 654 | 7,525 | 0.087 | 0.098 | 0.098 | 737.9 | 737.9 | 89% | 89% |


RETIREMENT EXPERIENCE - AGE BASED
ALL YEARS OF SERVICE
4-YEAR PERIOD ENDING 6/30/2021
Rates
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Under 45
46
48
50
52
54
56
58
60
62
64
Age
Actual Experience
Current Assumptions
Proposed Assumptions