December 13, 2024

Ms. Alma Tamborello
Treasury and Capital Management
City of Houston, Finance Department
611 Walker St., 11th Floor
Houston, TX 77002

Dear Alma:

Definiti is happy to present this actuarial audit report of the July 1, 2023 HFRRF Risk Sharing Valuation Study (RSVS). Per Section 802.1012 of the Texas Government Code ("Code"), an actuarial audit of public retirement systems with total assets of at least $100 million is required. As described in the Code, the final audit report will include the independent actuary's preliminary actuarial audit report provided to the Retirement System and any response to the preliminary report from the Retirement System.

The following documents constitute the final actuarial audit report, as required by Section 802.1012(h) of the Texas Government Code:

1. This cover letter summarizes the information included in the final actuarial audit.
2. Preliminary draft of the actuarial audit report, emailed to HFRRF on October 15, 2024, and
3. As required by the Code, we requested HFRRF provide any response to the preliminary audit within 30 days. HFRRF acknowledged receipt of the preliminary audit and provided the enclosed letter.

In response to HFRRF's comment about appendix A, the final HFRRF experience study document referenced in the preliminary actuarial audit report has been included as intended.

Best regards,

David A. Sawyer, FSA
Director of Actuarial Services

City of Houston Preliminary Actuarial Audit of the Houston Firefighters Relief and Retirement Fund (HFRRF)

October 2024

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Executive Summary

Project Scope

Section 802.1012 of the Texas government code requires an audit of actuarial reports and related studies of certain public sector retirement systems at least every 5 years by an independent actuary. The legislation does not provide detailed guidance on the scope of review required for the actuarial plan audit, leaving that open to interpretation by the governmental entities responsible for conducting the process.

The City of Houston retained Definiti to perform the Actuarial Audit for the HFRRF. The scope of this study included review of the actuarial methods and assumptions used compared to generally accepted actuarial standards of practice, as well as independent testing of valuation results for reasonableness and consistency.

The Actuarial Audit examined the most recently published actuarial funding valuation report and actuarial experience study prior to the most recent valuation. It is important to note that HFRRF performed a new experience study in 2024, but those assumptions will not be used until the next valuation is published. The following applicable reports were provided by the City of Houston:

- Actuarial Valuation Report for the year beginning July 1, 2023 published November 22, 2023
- Actuarial Experience Study published November 2, 2020

Although the actuarial audit update project scope did not include an audit of the underlying census data or plan provisions, the City of Houston may choose to expand its audit review at a later date.

This Actuarial Audit report was prepared by Definiti to assist the City of Houston with compliance under Section 802.1012 of the Texas government code. To prevent its potential misuse, it should not be distributed to any outside party unless the entire report is provided.

Highlights for HFRRF

In our opinion, the actuarial assumptions and methods used in the funding valuation as of July 1, 2023, are reasonable and consistent with generally accepted actuarial standards and practices. The details of this opinion were described in our response to the 2020 Experience Study included in Appendix A. Considering this was the first experience study performed after the 2017 reforms, there were several changes made to the actuarial assumptions. We commend the HFRRF Board for performing regular plan experience studies and engaging in discussions with its actuary in setting the assumptions. While the overall valuation model appears actuarially sound for now, below are notes of some areas that merit careful monitoring:

Executive Summary

- *Retirement Assumptions:* The newest retirement rates were developed based on the 5-year period ending June 30, 2019 and are consistent with generally accepted actuarial practices. It is important to note the retirement provisions for those hired after June 30, 2017 (post-reform hires) differ from earlier hires. To the extent these differences cause changes in behavior, some of the demographic assumptions for the post-reform hires will need to differ from the other active members. While termination experience is already beginning to be phased into the overall plan experience, it will be many years until any retirement experience for the post-reform hires will evolve. For now, the only difference in the model is the post-reform members are not eligible for retirement until reaching 70 points. That is, if a pre-reform member has at least 20 years of service, there is a probability that they will retire in the next year, but that probability is zero for a post-reform member until they reach 70 points.

  Since the Ultimate Entry Age cost method is used, the Normal Cost Rate is based on the plan provisions and assumptions applicable to the post-reform members. This means the retirement rates applicable to the post-reform members are critical in setting the Normal Cost Rate for the entire system as well as measuring the Liability specifically for the post-reform members.

- *Actuarial Communication:* As described in the last section of this report, there are numerous disclosures required with actuarial reports and studies. We commend the HFRRF actuary in their clarity of communication of these complex measurements. On the last page of our report, we provide a couple of additional modifications that may help those using the report. One change would be to provide additional commentary on the causes for the actuarial experience in the prior year. While the impact of the asset volatility is easily determined, there are many reasons why the Actuarial Accrued Liability could be higher or lower than expected and commentary on this would provide the reader with information that would be useful to assess the reasonableness of the results.

  The other recommended change is the disclosure of the average DROP balances in the age/service grids for each cell in which there are at least 20 members. The public disclosure of cash balance accounts, similar in nature to a DROP balance, is already required for the annual government filing for private sector defined benefit plans. Presumably, if DROP was used in the private sector, it would also be a required disclosure. Without the disclosures of the DROP accounts for HFRRF in the age/service grid, it is extremely difficult for another actuary to assess the reasonableness of the actuary's work and the magnitude of this important benefit. By only disclosing for cells with at least 20 members, the privacy of a small group of members' benefit is protected.

Executive Summary

Relevant Professional Standards

As outlined in the following sections of this report, we find that the actuarial methods and assumptions used by HFRRF for the 2023 actuarial valuation are consistent with our understanding of the Actuarial Standards of Practice (ASOPs) that are relevant for retirement plan valuations published by the Actuarial Standards Board.

Standard	Description
ASOP No. 1	Introductory Actuarial Standard of Practice
ASOP No. 4	Measuring Pension Obligations and Determining Pension Plan Costs
ASOP No. 27	Selection of Economic Assumptions for Measuring Pension Obligations
ASOP No. 35	Selection of Demographic and Other Non-Economic Assumptions
ASOP No. 41	Actuarial Communications
ASOP No. 44	Selection and Use of Asset Valuation Methods for Pension Valuations

We have confirmed that at least one of the individuals signing each report in the study period had the necessary professional credentials and were in compliance with the Society of Actuaries Qualification Standards for the 2022-2023 attestation cycle and met the minimum requirements to perform actuarial valuations per Section 802.101 of the Texas government code.

In preparing this report, we relied upon copies of actuarial valuation reports and related studies provided by the City of Houston and the individual retirement systems as detailed earlier. The undersigned has met the "Qualification Standards for Actuaries Issuing Statements of Actuarial Opinions" and is available to respond to any questions regarding the information contained in this report or to provide further details or explanations as needed.

Respectfully submitted by:

Definiti

David A. Sawyer, FSA EA MAAA
Director of Actuarial Services

Pension Funding Overview

Nature of the Pension Promise

Pension plans can be viewed as a form of deferred compensation, representing an employer promise that is both long-term and difficult to predict with certainty. This employer financial commitment is sometimes likened to signing a "blank check" since the obligation for each individual covered by the pension plan depends on several unknown future events:

- *Benefit Commencement Date:* Pension plans typically do not pay benefits until after termination of employment, but the benefit commencement date can vary based on the reason for termination such as retirement, disability or death.

- *Amount of Payment:* The dollar amount of pension benefit is generally based on factors such as age, service and compensation levels, but the exact amount cannot be determined until the date of termination and/or benefit commencement if later, when all the facts are known.

- *Duration of Payment:* Since the normal form of payment under most pension plans is a lifetime annuity, the payment stream can vary for an individual from just a few months to 50 years or more, depending upon individual factors such as age at commencement, health and lifestyle, gender, etc. Marital status and choice of payment option (e.g. joint and survivor annuity vs. lump sum) can also have an impact on the duration and amount of benefit payments.

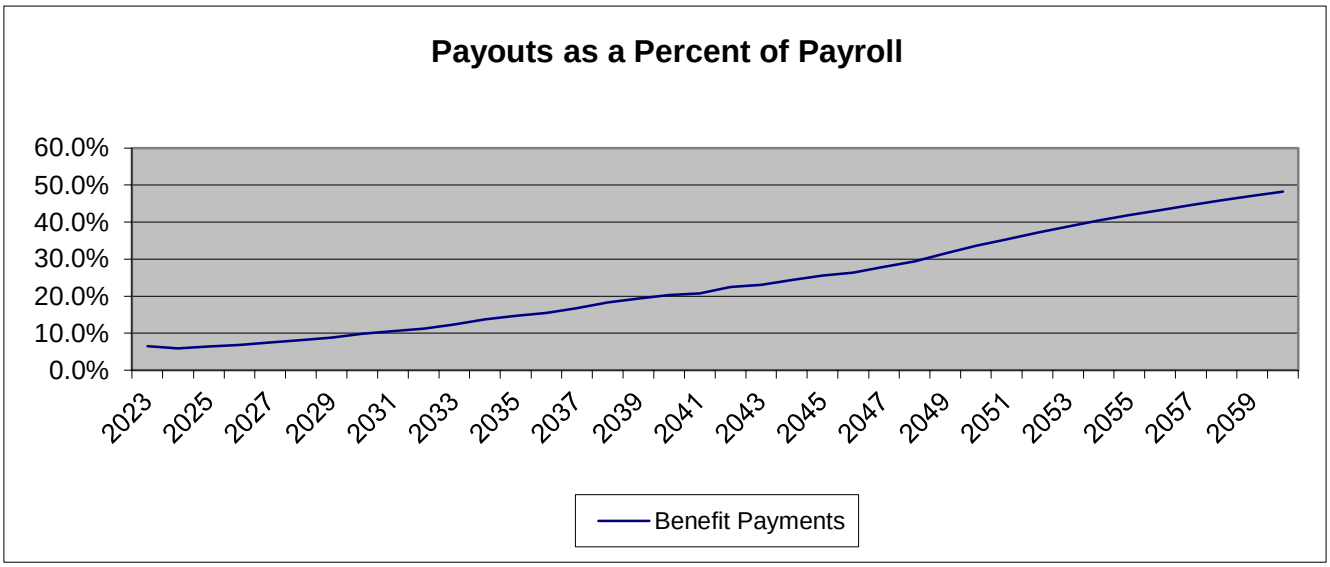
- *Other Considerations*: For pension plans that have a Deferred Retirement Option Plan (DROPs), the benefit is paid out as a combination of a DROP balance drawn down at the member's discretion, subject to certain plan restrictions, as well as a lifetime annuity. The amount of the DROP balance depends on the plan provisions defining the accumulation of the benefit as well as the duration in which the member participates in the DROP.

Pension Funding Overview

Recognition of Pension Cost

The true cost of a pension plan is simply the amount of benefits and expenses paid, accumulated over the lifetime of the program. Annual cost is typically low in the early years after plan establishment but grows rapidly as the total number of pensioners receiving benefits increases over time, compounded by ever higher average payment amounts because of inflation for new retirees.

While disbursement based or "pay-as-you-go" funding may be very affordable in the early stages, the cost in later years may become untenable. As illustrated below, the pay-as-you-go costs for a new hypothetical pension program (2.25% of final average pay times service) would rise significantly over the 35-year period.



Pension benefits are generally viewed as a component of the compensation paid to an employee for services rendered during their period of active employment. The cost of future pension payments should be recognized over each employee's working lifetime, so it is effectively borne by the generation of taxpayers that benefit from the employee services rendered.

Pension Funding Overview

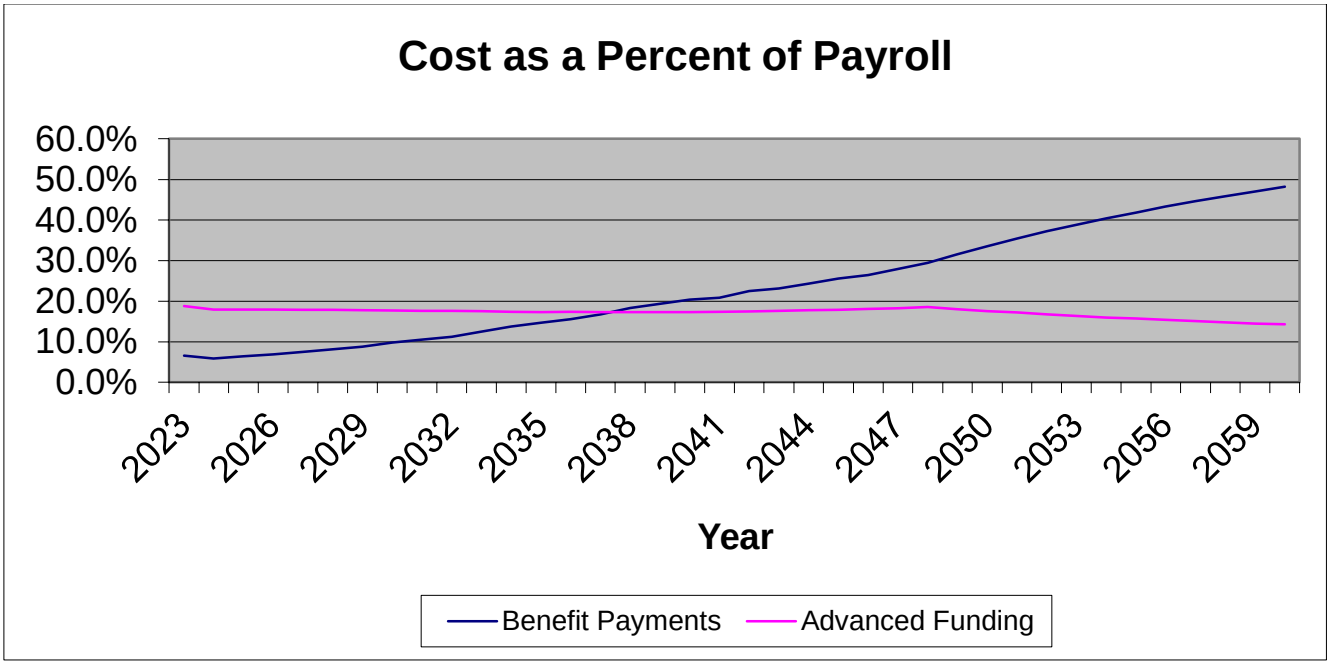
Advance Funding Characteristics

Sound governmental practice dictates employer funding of these pension costs in advance for several reasons:

- Cash Flow Budgeting: Stable and predictable cash flow is essential for the long-term financial survival of any business organization or governmental entity. Advance funding of retirement plan benefits allows the employer to budget these cash flows over time in a systematic fashion.

- Lower Total Contributions: Advance funding results in the accumulation of plan assets that can be invested to generate investment income, which can be used as a direct offset against future benefit payments and expenses. By contributing more in the early years, the employer can reduce the total dollar amount of contributions over the lifetime of the pension plan. For example, each $1,000 of funding today, accumulated at 7.0% annual interest, will pay $3,870 of benefits in 20 years.

- Participant Benefit Security: Although pension benefit security is ultimately dependent on the financial strength of the plan sponsor, having a dedicated pension fund segregated from the general assets of the employer gives employees increased peace of mind and benefit security. Following an actuarial sound funding policy will ensure asset sufficiency and allocate the cost of benefits to the generation of taxpayers receiving the services provided by the members.



Pension Funding Overview

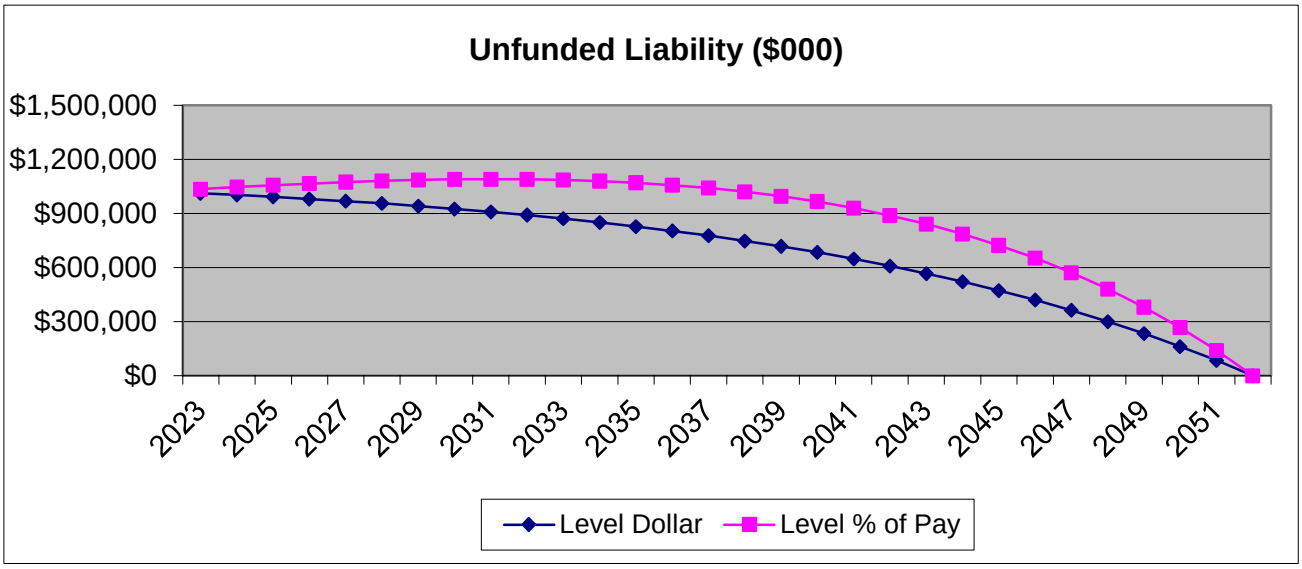
Introduction

The actuarially determined contribution rate produced by the actuarial cost method is equal to the normal cost plus an amortization of the *Unfunded Actuarial Liability (UAL)* over a reasonable time period divided by the valuation compensation. There are several different amortization methods within generally accepted actuarial standards of practice, each of which applied properly, will determine annual contribution requirements that will meet plan obligations for benefit payments and expenses as they come due. These approaches differ in how rapidly the *UAL* will be paid off based on the *Amortization Method* and *Amortization Period.*

Amortization Method

Under the level dollar amortization method, the *UAL* is paid off similar to a traditional home mortgage consisting of interest on the *UAL* plus principal. As the name implies, the total amortization payment is a fixed or "level dollar" amount, with the interest component declining and the principal increasing over the term of the amortization period. Under the level percentage of pay methodology, the dollar amount of amortization payment increases over time based upon an assumed growth in total payroll, but remaining level as a percentage of the payroll base.

It is important to note the level percentage of pay method may not produce an amortization amount sufficient to cover the principal and interest due on the *UAL* over the short-term based on the regular valuation interest rate assumption, in effect paying "negative principal" in the early years with the expectation of increasing the amortization payment in future years as the payroll grows. Level dollar is more conservative because it will reduce the *UAL* more rapidly, with amortization payments as a percentage of pay highest in the initial year, gradually decreasing in later years.

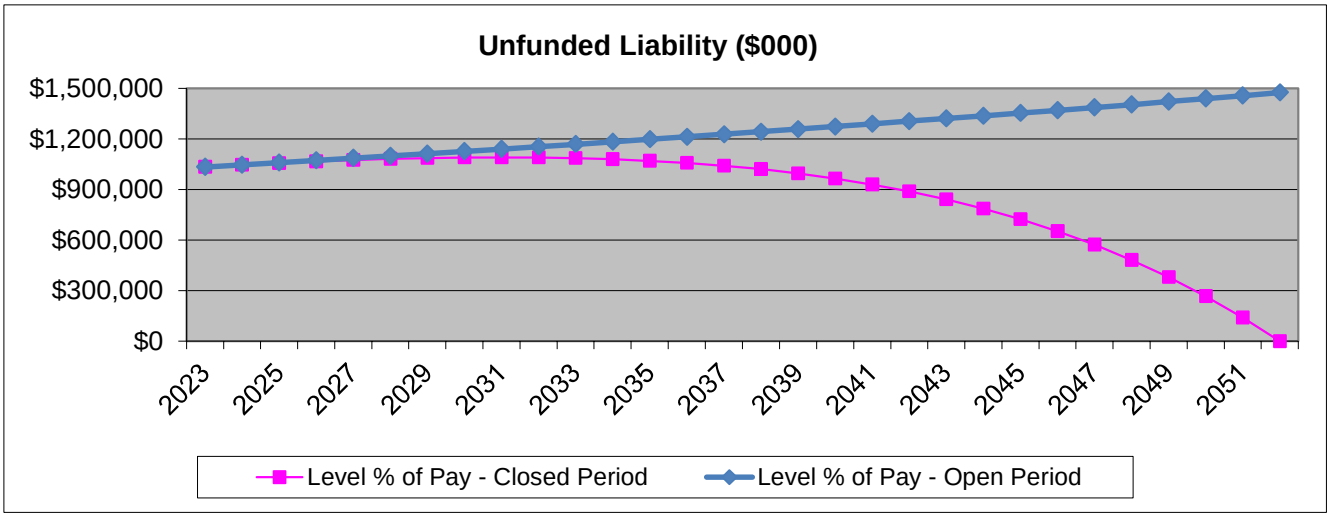


Pension Funding Overview

Amortization Period

Closed period amortization is also similar to the traditional home mortgage concept, with the payoff period set as a fixed number of years from the date of inception, and the *UAL* fully amortized at the end of that time. As unexpected changes in *UAL* emerge due to plan amendment or actuarial gains and losses, a separate new amortization base is created to pay off this additional amount. Under the open period approach, the amortization component of the actuarially determined contribution is recalculated each year based on the remaining *UAL* including any current year changes, with the amortization period commonly remaining constant.

As shown in the graph below, if the amortization period is too large then the open period amortization method never pays off the UAL. Even if all the assumptions are realized, the UAL continues to grow but it becomes a smaller percentage of the projected payroll over time. While the open period amortization allows for a more level contribution as a percent of payroll across generations of taxpayers, it is important to note the only way the UAL is ever paid off is if additional contributions are made, unless benefits for future members are reduced or there is favorable actuarial experience. Because of this, more systems, such as HFRRF, have moved to a closed amortization period.



Professional Guidance

In the spirit of generally accepted actuarial principles that attribute pension cost to periods of employee service, the amortization period would not extend beyond the average future working lifetime of the active employees covered by the plan. Texas PRB funding policy guidelines require contributions adequate to amortize the UAL over a period not to exceed 30 years, with 10 to 25 years being the preferred range.

Pension Funding Overview

Conclusion

Effective with the 2017 passage of SB 2190, HFRRF moved to a closed amortization period but continues to use the level percentage of pay method. The amortization period prescribed in the statute is 30 years for the initial UAL as well as future experience gains/losses, but the amortization period decreases annually for experience gains. This asymmetric amortization period results in more rapid recognition of experience gains than experience losses. In recognition of this, the City contributes more than the actuarially determined contribution rate in years when that rate is less than the Corridor Midpoint.

This is a unique approach, and the practical application is being monitored. Because this is still relatively new, the amortization periods for gains and losses differ by only a few years, but that will change over time. Due to the aggregate favorable experience since SB 2190 was enacted, this approach has worked well with the City contribution being very stable and predictable, and HFRRF receiving contributions in excess of the actuarially determined contribution rate.

Actuarial Assumptions and Methods

The contribution rate is determined based on the census data, plan provisions, and actuarial assumptions and methods in the actuarial model. The actuarial assumptions are forward looking best estimates that should be constantly monitored and periodically updated based on an experience study.

Actuarial Assumptions

HFRRF performed an experience study in 2020. At that time, Definiti reviewed the draft experience study and provided feedback and recommendations for consideration. HFRRF adopted new assumptions and Definiti concurred with the final assumption set. These assumptions were first used in the July 1, 2020 Risk Sharing Valuation Study (RSVS) and continued to be used in the July 1, 2023 RSVS. We recommend these assumptions continue to be monitored by reviewing the levels of future experience gains and losses. Unless there are anomalous periods that occur, the levels of experience gains and losses should be less than 1% of the expected Actuarial Liability each year with some years being gains and some years being losses. Below are some comments regarding the retirement assumption that needs to be monitored.

- *Retirement Assumption:* The current retirement rates were developed based on the 5-year study of plan experience through June 30, 2019 and appear consistent with generally accepted actuarial practices. However, given there is no retirement experience for the members hired after July 1, 2017 this assumption is still based on the experience of the pre-July 1, 2017. As those hired after July 1, 2017 must work to later ages to be retirement eligible and the benefit levels differ, it is reasonable to expect different retirement experience. It will be many years before actual experience for this group will emerge, so reasonable estimates must be made.

  The plan provisions for the post-July 1, 2017 firefighters are materially different including later retirement eligibility, the basic formula accrues at a lower rate, and they are not eligible for DROP. Because of all of these differences, future retirement experience could be expected to be materially different than for the other firefighters. Because retirement eligibility is later, the actuarial model doesn't allow retirement probabilities strictly at 20 years of service, so the post-July 1, 2017 firefighters will not be assumed to retire at the earliest ages the other firefighters can. In addition, the benefits for these firefighters are not as generous, so there may be an expectation of working longer to accrue additional benefits. However, as the post-July 1, 2017 firefighters are not eligible for DROP, there is less pension incentive to work as long.

  In addition to trying to measure the Actuarial Liability for the post-July 1, 2017 firefighters, this assumption has another important application to the actuarial valuation. Since the Ultimate Entry Age cost method is used, the measurement of the post-July 1, 2017 benefits, including the underlying assumptions for these benefits, is critical in setting the Normal Cost Rate for the entire system.

Actuarial Assumptions and Methods

Actuarial Methods

The actuarial methods selected also have an important role in determining the actuarially determined cost. Included in the actuarial methods are the selection of the valuation date, the cost method and the method of determining the actuarial value of assets.

Valuation Date
The HFRRF valuation date is selected as the first day of the plan year. This is the date the actuarial liability and actuarial value of assets are determined. This is a popular date to use as many systems are designed to gather information annually. In addition, the actuarially determined City Contribution Rate (CCR) is applied to the following plan year contributions, so using the first day of the plan year allows for the RSVS results to be completed well in advance of the time the city will implement the new contribution rate.

Cost Method
The actuarial cost method allocates the actuarial value of benefits to various periods. The rate and timing of the cost varies depending on the cost method used. HFRRF currently uses the Ultimate Entry Age Normal cost method as required by Article 6243g-4 of the Revised Texas Statute.

There is current debate in the actuarial community regarding this cost method. One of the tenets of an actuarial cost method is that the normal cost is reasonably related to the expected cost of that member's benefit. Under Ultimate Entry Age, the Normal Cost for all members is determined based on the plan provisions for new members rather than the provisions that apply to that member. The actuarial present value of the difference from using the lower and level Normal Cost for the members with more valuable benefits is captured in the Actuarial Accrued Liability. For the following reasons, we believe this cost method continues to be a reasonable cost method for HFRRF:

1. The amortization period for any loss layer is never greater than 30 years, so the initial Actuarial Liability as of the passage of SB 2190 is amortized over a reasonable closed period.
2. The city contributes based on the statutory Corridor, which is often in excess of the actuarially determined City Contribution Rate (CCR).
3. This cost method (assuming no future plan changes) gradually phases into the regular Entry Age Normal cost method that is used by most public sector plans.

It is also worth noting that this cost method is specifically called out in the recent revisions to Actuarial Standards of Practice (ASOP) No. 4 over concerns that the Normal Cost Rate is not representative of all of the plan provisions. When this actuarial method is used for funding policy measurements, a separate Actuarial Determined Contribution (ADC), using a cost method deemed by the ASOP to be reasonable along with other reasonable parameters, must be calculated and disclosed. A separate ADC was calculated and disclosed in the July 1, 2023 report using these reasonable parameters.

Actuarial Assumptions and Methods

Actuarial Value of Assets
Although determination of the actuarial accrued liability is based on a complex mathematical model and the application of a number of long-range actuarial assumptions, the value of pension plan assets is generally readily available as the *fair market value (FMV)* reported by the fund trustee or custodian. While fair market does represent the "real value" of plan assets at the measurement date, it emphasizes current sale price, even for assets for which there may be no intention to liquidate.

Strict use of market value, with its inherent short-term volatility, may make a stable funding policy difficult to obtain for an ongoing retirement system. For this reason, generally accepted actuarial practice standards permit smoothing of market gains and losses in calculating actuarially determined contribution rates. By using a smoothed asset value, the valuation results provide a more predictable pattern of contributions and measurement of long-term funded status.

The *actuarial value of assets (AVA)* for HFRRF is calculated as the fair market value of assets as of the measurement date, with adjustment for deferred recognition of investment gains and losses amortized over 5 years. Each year's gain or loss is based on the difference between the actual and expected fair market value. The expected fair market value is based on the assumed rate of return on investments and is net of investment expenses. Then 20% of each year's gain or loss is recognized each year.

Professional Guidance

ASOP No. 44 does not spell out specific rules and regulations, but rather provides a framework for determination of *AVA* that emphasizes basic principles. The asset valuation method should bear a reasonable relationship to *FMV*, recognizing investment gains and losses over an appropriate time period. The methodology should avoid systematic bias that would overstate or understate *AVA* in comparison to *FMV*, although application of corridor limits centered on *FMV* may be appropriate.

Conclusions

In our opinion, the use of this 5-year smoothing method for investment gains and losses is reasonable and appropriate for determining the actuarial value of assets for HFRRF. Even though short-term asset fluctuations may not have a direct impact on contribution requirements due to the Risk Sharing Corridor, use of the asset valuation method does reduce volatility in the City Contribution Rate measurement and reporting of funding progress over time. This method is also consistent with relevant actuarial practice standards and in line with best practices of other large public sector retirement systems.

Independent Replication

Introduction

As part of the actuarial audit, a replication of the July 1, 2023 funding valuation was performed. This included comparison to aggregate results.

Plan Benefit Provisions

Definiti performed the valuation testing based on the plan provisions summarized in the Fund's July 1, 2023 actuarial report.

Actuarial Assumptions

Definiti performed the valuation testing based on the actuarial assumption as summarized in the HFRRF funding valuation report as of July 1, 2023. Our approach is consistent with the valuation basis described in the HFRRF valuation report.

Aggregate Results

Below is a comparison of aggregate results from the Definiti independent testing process (see next page for more detailed numerical results:

- Present value of projected benefits margin of error about (1.6%) (Definiti results lower).
- Actuarial accrued liability margin of error about (1.2%) (Definiti results lower).
- City normal cost rate (2.9%) (Definiti results higher).

We believe these testing results provide a reasonable approximation of the HFRRF actuarial results.

Independent Replication

Funding Valuation Results

July 1, 2023 ($ 000)	HFRRF	Definiti	Difference	Percentage
Present Value of Projected Benefits				
• **Total PV of Benefits**	$6,004,259	$5,910,132	($94,127)	(1.6%)
Actuarial Accrued Liability				
• **Total Active Members**	$1,520,149	$1,508,842	($11,307)	(0.7%)
• **Inactive Members**	$3,757,795	$3,704,259	($53,536)	(1.4%)
• **Total Actuarial Liability**	$5,277,944	$5,213,101	($64,843)	(1.2%)
Actuarial Value of Assets	$5,064,764	$5,064,765	$1	0.0%
Unfunded Actuarial Liability (UAL)	$213,180	$148,336	($64,844)	(30.4%)
City Contribution Rate				
• **City Normal Cost Rate** [1]	14.53%	14.95%	0.42%	2.9%
• **UAL Amortization Rate** [2]	11.58%	8.93%	(2.65%)	(22.9%)
• **City Contribution Rate**	26.11%	23.88%	(2.23%)	(8.5%)
Corridor Minimum	26.89%			
Corridor Midpoint	31.89%			

[1] Includes 1.25% of payroll for administrative expenses.

[2] Because the City Contribution Rate of the Municipal and Fund actuaries differed by more than 2 percentage points, the UAL Amortization Rate was subsequently modified, according to the statute, resulting in a final City Contribution Rate of 26.89%.

Census Data

Active Member Census Data

The most accurate approach to performing the valuation replication is to start with an exact duplicate copy of the census data files used by the Fund actuary. The summary below confirms that data provided aligned very closely with the data summarized in the Fund actuary's report.

July 1, 2023	HFRRF	Definiti	Difference	Percentage
Total Active Members				
• **Number**	3,685	3,685	0	0.0%
• **Average Age**	42.6	42.6	0.0	0.0%
• **Average Service**	15.2	15.2	0	0.0%
• **Average Prior Year Pay**	$75,959	$75,959	$0	0.0%
• **Valuation Compensation**	$279,908,176	$279,908,176	$0	0.0%
Retired Members				
• **Number**	2,534	2,534	0	0.0%
• **Average Annual Benefit**	$59,016	$59,100	($3)	(0.0%)
Beneficiaries in Pay Status				
• **Number**	703	703	0	0.0%
• **Average Annual Benefit**	$51,187	$51,038	($149)	(0.3%)
Disabled Members				
• **Number**	292	292	0	0.0%
• **Average Annual Benefit**	$57,979	$57,822	($157)	(0.3%)
Deferred Vested				
• **Number**	35	35	0	0.0%
• **Average Annual Benefit**	$13,020	$12,343	($677)	(5.2%)

Plan Experience Analysis

Overview

Under generally accepted actuarial principles, each individual assumption should represent a best estimate of expected long-term experience and should also be reasonable and realistic in the aggregate. In addition to measuring gains and losses on plan assets and liabilities, the underlying assumptions themselves should be compared to actual plan experience and adjusted if necessary.

Measuring plan asset gain/loss experience is fairly straight-forward, using readily available financial statements to compare the actual rate of return earned by the Fund to the assumed long-term interest rate. However, a detailed gain/loss analysis of plan liability experience including the demographic and other non-economic assumptions requires historical census data reconciled with status codes assigned for each time period evaluated, which may not be available without extensive reconstructive effort.

Based on the published actuarial reports over the period 2019-2023, below we compare the aggregate actuarial gain/loss that occurred for the plan liability and asset components respectively over the study period. Minor fluctuations from year-to-year are common, but substantial differences or consistent trend over time merit further investigation.

Actuarial Liability

As summarized below, the annual actuarial (gain)/loss due to demographic experience (excluding assumption changes or impact of plan amendments) as a percentage of the actuarial liability was less than 2%. For plans the size of HFRRF, annual liability gains and losses in the range of 0% to 1.0% are likely the result of normal deviations from the assumptions. In years in which the liability gains and losses exceed this threshold, we recommend additional detail explaining the cause of the change be included in the report.

Valuation Year $000	2019	2020	2021	2022	2023
Actuarial Liability	$5,057,759	$4,932,407	$4,881,608	$5,075,516	$5,277,944
Liability (Gain)/Loss	($27,113)	($89,454)	($162,871)	$69,104	$74,580
% of AL	(0.5%)	(1.8%)	(3.3%)	1.4%	1.4%

Plan Experience Analysis

Plan Assets

Actual returns on *FMV* for HFRRF has only exceeded the assumption 1 out of the last 5 years, with an annual rate of return averaging 8.3% for the 5-year period ended June 30, 2023 when the assumed rate of return was set to 7%. After applying the asset smoothing method, the annual rate of return on *AVA* averaged 9.0% over the same period.

Fiscal Year Ended 6/30 $000	**2019**	**2020**	**2021**	**2022**	**2023**
Actual Return on FMV	5.42%	2.04%	33.37%	0.01%	3.99%
Actual Return on AVA	8.06%	6.86%	11.61%	10.22%	8.53%

As summarized below, the net actuarial gain/(loss) due to plan asset experience as a percentage of *AVA* ranged from (0.1%) to 3.1% over this period. As of July 1, 2023, the FMV was 101% of the AVA. This means there is a small prior investment gain that will be recognized over the next several years.

Valuation Year, 7/1 $000	**2019**	**2020**	**2021**	**2022**	**2023**
Expected AVA	$4,149,224	$4,257,893	$4,358,737	$4,699,824	$4,992,123
Asset Gain/(Loss)	$41,710	($6,042)	$191,731	$143,913	$72,532
% Change	1.0%	(0.1%)	4.4%	3.1%	1.5%

The other source of plan experience not already mentioned is the impact of contributions differing from the actuarially determined amount. Contributions differ from the actuarially determined contribution due to actual payroll differing from the expected payroll as well as the application of the corridor. In each year since the pension reforms were enacted, the City has contributed at a rate that equaled or exceeded the final City Contribution Rate.

Plan Experience Analysis

Funded Status Progress

The funded status is an important measurement of the progress toward securing the pension promise and ensuring the plan cost is allocated evenly across generations of taxpayers. The HFRRF funded ratio increased from 83% in 2019 to 96% in 2023. The City of Houston should continue to monitor the funded status, but the post-reform results have been positive.

In reviewing the adequacy of the funding policy, we considered the UAL amortization period for compliance with the Texas Pension Review Board Guidelines: Based on the most recent Funding Policy Guidelines, the System should satisfy the following requirements:

1. The funding of a pension plan should reflect all plan liabilities and assets.
2. The allocation of the normal cost portion of contributions should be level as a percent of payroll over all generation of taxpayers.
3. Funding of the Unfunded Actuarial Liability should be level or declining as a percentage of payroll over the amortization period.
4. Funding should be adequate to amortize the unfunded actuarial liability over a period which should never exceed 30 years, with 10-25 years being the preferred range.
5. The choice of assumptions should be realistic and reasonable in the aggregate.

The calculation of the HFRRF actuarially determined contribution satisfies the five requirements of the PRB Actuarial Soundness Guidelines. In addition, the application of the Corridor will likely result in contributions above the actuarially determined rate in some years accelerating the growth in the funded status.

Actuarial Reports

Introduction

The communication of the results of an actuarial study requires careful consideration of the purpose of the study, the intended users, as well as compliance with the relevant ASOPs. For recurring projects like actuarial funding policy or pension accounting valuations, much of the report is based on a standard format that is updated each year. While the report format may not change significantly from year to year, it is critical that the results of the study as well as the valuation basis (assumptions, methods, plan provisions) are clearly documented within. In addition, the report should provide additional information as needed to explain the reasons for results that vary materially from prior expectations including summarizing any changes in the valuation basis from prior studies.

Professional Guidance

ASOP No. 41 provides guidance to actuaries issuing actuarial communications that include an actuarial opinion or other actuarial findings. This ASOP requires the actuary to take appropriate steps to ensure the following with each actuarial communication taking into account the intended users:

1. The form and content are appropriate to the particular circumstances.
2. The communication is clear and uses language appropriate to the particular circumstances.
3. Each actuarial communication is issued within a reasonable time period.
4. Identify the responsible actuaries and the actuary's affiliated organization.

ASOP No. 41 also requires a number of disclosures typically found in an introductory certification letter at the beginning of the report. In addition, ASOP No. 4 requires additional disclosures specifically related the measurement of pension obligations. The required disclosures include the following:

1. Scope and intended purpose of the engagement or assignment.
2. Identification of the intended users, and any limitation on its use by unintended users.
3. Acknowledgement of qualifications.
4. Any limitations or constraints on the use or applicability of the actuarial findings.
5. Cautions regarding possible uncertainty or risk in any results.
6. Any conflicts of interest that is not apparent.
7. Any reliance on other sources for data or other information.
8. Identification of the party responsible for each material assumption and method.
9. Information date of the report.
10. Any relevant event that becomes known by the actuary after the information date, before the report is issued, and it is impractical to review the report before it is issued.
11. Outline or summary of plan provisions included in the actuarial valuation, description of known changes in the plan provisions since the most recent measurement, and a description of any significant plan provisions not included in the actuarial valuation and rationale for its exclusion.
12. Description of the actuarial cost method and the manner in which normal costs are allocated.
13. Description of the actuarial assumptions and any changes from the most recent measurement.

Actuarial Reports

Actuarial Certification Disclosures

The actuarial certification found at the front of the annual valuation report includes the required ASOP No. 41 disclosures listed above. As some of the disclosures are more implicitly referenced, we have the following suggestions for consideration:

1. The certification acknowledges the signing actuaries are independent, but it could go further to state they are not aware of any conflicts of interest in performing their professional duties.
2. Finally, the certification could confirm the signing actuaries are not aware of any subsequent events that require disclosure. However, under the ASOPs, the lack of this statement indicates the actuary had nothing to disclose.

Additional Findings for Consideration

In addition to the required disclosures, the report should include appropriate content and clarity. In reviewing the HFRRF actuarial valuation reports and experience studies, we found the information provided for this complex process was clearly communicated. Our findings and recommendations center on either providing additional content in certain situations or ensuring that the report language is annually updated for changes to the standard report format when necessary.

1. Actuarial experience that exceeds 1% of the Actuarial Accrued Liability should result in additional disclosures as to their cause. These causes could be related to higher/lower salary increases than assumed or similar comments related to retirement/termination experience, DROP growth, City contribution amounts, etc.

2. To assess the reasonability of the pension valuation results by another actuary, it is generally accepted actuarial practice to include an age/service grid for the active participants as well as a summary of the participant data by status (active, former vested members, retirees\beneficiaries). The HFRRF valuation report includes much of this information in the Membership Data section. We recommend the valuation report include a summary of the average DROP amounts in the age/service grid as well as the total DROP amounts for each of the member groups in the summary by status. To protect individual members, the averages would not be included for age/service cells with less than 20 members.

APPENDIX A

Houston Firefighters' Relief and Retirement Fund

Actuarial Experience Study – Final

October 15, 2024

BUCK
A Gallagher Company

Agenda

Purpose and scope of the study

Assumptions

- Demographic
- Economic

Impact of Proposed Changes

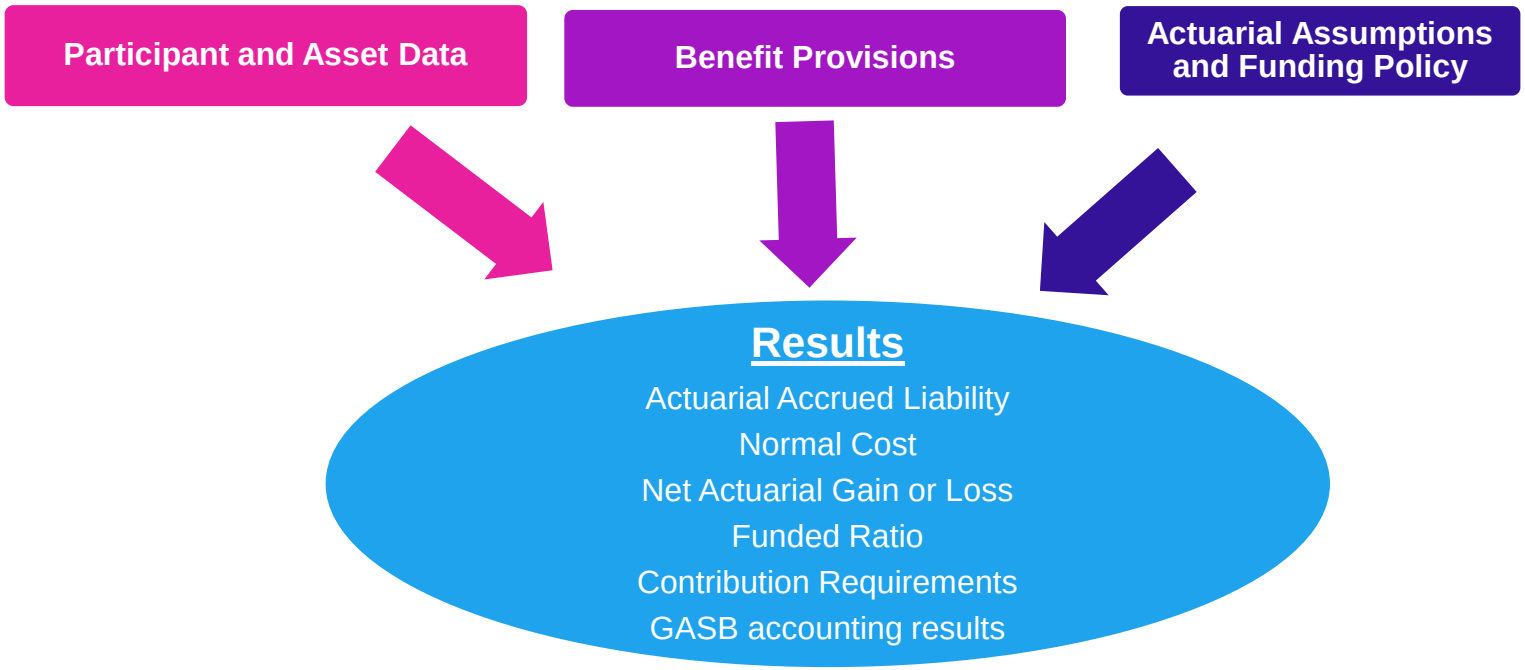
Takeaways and Next Steps

Purpose and Scope of the Study

Risk Sharing Valuation Study (RSVS) Process

- Texas statute article 6243e.2(1), Section 13B sets forth requirements for an annual RSVS of the Fund
  - The actuary determines the rate of contributions to be made to the Fund according to prescribed contribution policy
  - The contribution is determined through the RSVS, which is summarized in the annual actuarial RSVS report
  - In addition, the RSVS:
    - Determines the funded ratio
    - Satisfies regulatory and accounting requirements
    - Explores why the results of the current RSVS differ from the results of the RSVS of the previous year

Risk Sharing Valuation Study Process



- The actuarial assumptions and funding policy are reviewed as part of an experience study process required at least every four years under Section 13D of the statute
- This experience study is conducted to determine the assumptions that will serve as the basis for the RSVS from 2024 – 2027
- The funding policy and certain assumptions are prescribed by statute

2017 Senate Bill 2190 (SB2190)

- SB2190 reformed the funding and benefit provisions of the Houston Firefighters' Relief and Retirement Fund (Fund)
- Funding reforms
  - Perform an annual Risk Sharing Valuation Study (RSVS)
  - **Requires an experience study at least once every four years**
- Benefit reforms effective July 1, 2017
  - Pensionable pay for benefit accruals after June 30, 2017 includes base pay
  - Increase member contributions to 10.5% of pay
  - Revised the calculation to determine COLA
  - Members hired prior to July 1, 2017 (legacy members)
    - Changed service retirement benefit accrual formula for service after June 30, 2017
    - Reduced the DROP credits
  - Members hired after June 30, 2017
    - Lower benefit accrual formula than legacy member, maximum 80% of pay
    - Service retirement eligibility at age when the sum of the member's age and service equals 70
    - Not eligible to participate in DROP

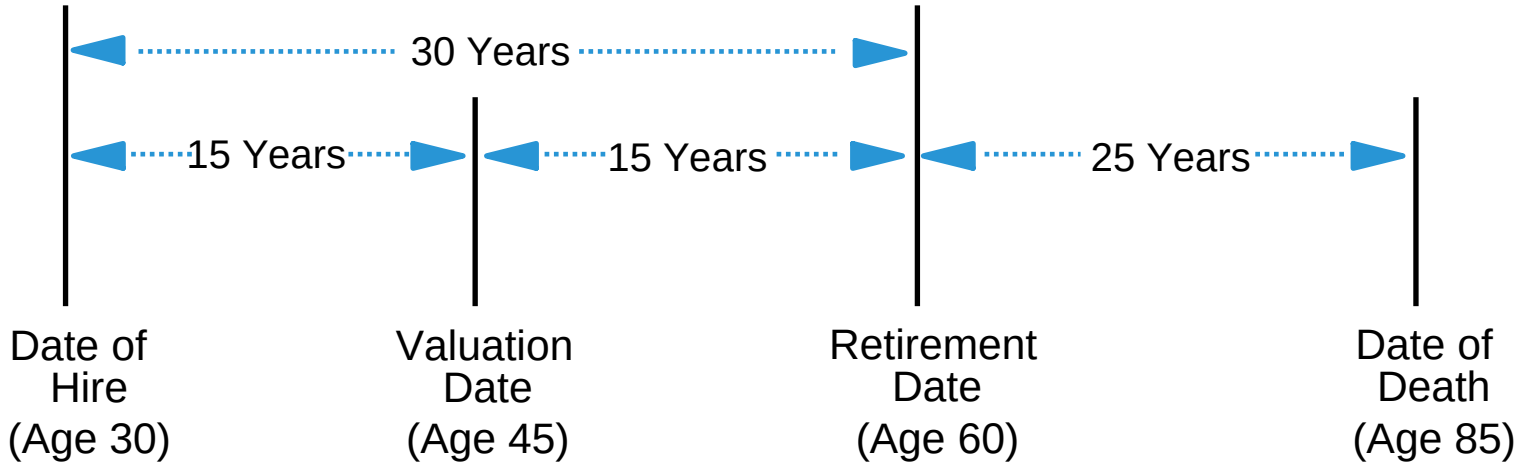
Experience Study

- Determine how actual experience or frequency of events (such as retirement, terminations, etc.) differs from expectations using current actuarial assumptions
  - This experience study covers the period from Fiscal Year Ending June 30, 2019 through Fiscal Year Ending June 30, 2023 (FYE2019 – FYE2023)
  - The amount of data accumulated applicable to members hired after June 30, 2017, is not enough to examine emerging trends for demographic assumptions
    - While patterns of behavior may be different from legacy membership, we have not proposed an alternative set of demographic assumptions
    - We will review again when the next scheduled study is prepared in 2027 and proposed changes, if warranted, will be recommended at that time
    - The base assumptions, however, are adjusted for differing Fund provisions (e.g., eligibility)
- Develop recommendations for changes in those actuarial assumptions, if necessary
  - When selecting assumptions, it is important to account for a plan sponsor's expectations for future years that may differ from past experience
- Assess impact of changes on the Proposed RSVS as of July 1, 2023
- Goal is to improve accuracy of results and forecasts

Things That Happen to Members (Illustrative) (Demographics Assumptions)

- **KNOWN at valuation date:**
  1. Age
  2. Gender
  3. Service to date

- **ASSUMED at valuation date:**
  1. Retirement rates
  2. Death rates before and after retirement
  3. Disability rates
  4. Termination rates



Things That Happen to Members – Salary Increases (Illustrative) (Economic Assumptions)

- KNOWN at valuation date:

Salary History	
Age 43	$ 48,857
Age 44	51,422
Age 45	54,019
Total	$154,298

Current 78 pay period average

$154,298/3 = $51,433

- ASSUMED at valuation date:

at Retirement	
Age 57	$ 80,138
Age 58	82,542
Age 59	85,018
Total	$247,698

Projected 78 pay period average

$247,698/3 = $82,566

Things That Happen to Money (Economic Assumptions)

- KNOWN at valuation date:

  1. Market value of Fund assets
  2. Composition of Fund assets
     - Stocks
     - Bonds
     - Short term
     - Long term
     - International
     - Real estate
     - Alternative investments

- ASSUMED at valuation date:

  1. Future rates of investment return
  2. Future rates of inflation
  3. No change in composition of Fund assets

Selection of Actuarial Assumptions

What Assumption	Who Decides
➢ Economic:	
• Investment return	• Agreement between municipality and Board (not to exceed 7%)
• Inflation	• Board, with limitations
• Payroll growth and projected salary increases	• HFRRF consultation with municipality's finance director with discussion based on Actuary's review
➢ Demographic:	
• Termination of Employment, Disability, Retirement, Mortality, other misc.	• Mostly Actuary, with input from HFRRF and Board
➢ Actuarial methods:	
• Actuarial cost method • Actuarial asset valuation method • Amortization method • Administration expense load	• Prescribed by statute

Actuarial Assumptions - Demographic

- Termination of Employment
  - For members hired prior to July 1, 2017 -
    - Refund of contributions if less than 10 years of service
    - Vested benefit with at least 10 years but less than 20 years of service
  - For members hired after June 30, 2017 – Refund of contributions if terminate prior to date at which the sum of the member's age and service equals 70
  - Form of payment (Immediate Contribution Refund vs. Deferred Pension Benefit)

- Retirement
  - Members hired prior to July 1, 2017: 20 years of service
    - DROP participation rate
    - DROP duration upon participation
    - Payment of DROP balances
  - Members hired after June 30, 2017: Age at which the sum of the member's age and service equals 70

- Marriage
  - Married percentage of retiring members
  - Age difference between member and spouse

Actuarial Assumptions - Demographic

- Disability
  - Non-Service-Connected
  - Service-Connected
    - Capable of performing any substantial gainful activity
    - Not capable of performing any substantial gainful activity
- Death After Retirement
  - Healthy retired members
  - Disabled retired members
  - Beneficiary in receipt
- Death in Active Service
  - Non-Service-Connected
  - Service-Connected

Demographic Assumptions

Setting Demographic Assumptions

- Based on 4-year Experience Review
- Full review covers June 30, 2019 - June 30, 2023
- Compare past experience (“actual”) with assumptions (“expected”)
- Determine trends
- Make judgments about future

Mortality

Setting Demographic Assumptions

➢ Mortality

- Mortality rates have generally continued to improve over time and are expected to improve in the future
  - ASOP No. 35 states that the actuary should “include an assumption as to expected mortality improvement after the measurement date.”

- Mortality trends among the plan population groups are examined through the relationship of liability that was expected to be released due to deaths versus the actual amount released due to actual deaths.
  - The expected release of liability based on the mortality table being examined (expected)
  - The actual liability released based on the mortality table being examined (actual)
  - If the ratio of actual to expected is 100%, the table has predicted what actually occurred in the aggregate. If the ratio of actual to expected is greater than 100%, then the table has underestimated actual experience. If the ratio is less than 100%, then the table has overestimated actual experience
  - The ideal adjustment to the current mortality related rates is to find a mortality table basis that produces an expected liability released that is close to the liability actually released

Mortality Table

- In January 2015 the Society of Actuaries (SOA) and the Retirement Plans Experience Committee (RPEC or “the Committee”) initiated a mortality study of public pension plans
  - The primary focus of this study was a comprehensive review of recent mortality experience of public retirement plans in the United States
- In January 2019 the SOA published the Pub-2010 Public Retirement Plans Mortality Tables Report
  - The analysis included several versions of the tables based on job types (Public Safety, Teachers and General Employees) and income levels (above and below median)
  - Pub-2010 base tables adopted by Board in previous experience study
- Recommend continuing to select from the SOA Pub-2010 tables for Public Safety workers unless there is credible experience to support another assumption

Mortality Improvement Scale

- In general, the rates of mortality observed in America decline over time; each generation lives longer than preceding generations
- Actuarial professional standards of practice recommend projecting these mortality improvements into the future
- Theoretically will not have to update mortality rates (as much) in future experience reviews
- For purposes of our analysis, the base mortality tables are generationally projected from 2010 using the MP-2021 Improvement Scale, the most recent improvement scale published by the SOA

Experience Credibility

- The decision on what table to use and whether to adjust for actual plan experience is based on the “exposures” and expected number of deaths
  - For our review, the exposures and expected number of deaths are weighted by liability amounts
- Generally, retiree mortality will have more credibility because the plan will have a sufficient amount of experience
- Active and disabled member mortality generally have less credibility due to limited plan experience of active deaths and participants who go on disability
- Credibility factor is a measurement of the reliability of the plan experience as compared to the broader experience reflected in standard tables

Mortality Rates - Male Service Retirees

$millions	Actual Liability Released	Expected Liability Released	Ratio of Actual to Expected
Current Assumption: SOA Public Safety Mortality (Below Median) Amount Weighted-Male, 97.2% adjusted, generationally projected with scale MP-2019	$123.8	$134.6	92.0%
SOA Public Safety Mortality (Below Median) Amount Weighted-Male, generationally projected with scale MP-2021	$123.8	$137.9	89.7%
SOA Public Safety Mortality (Below Median) Amount Weighted-Male, 95.9% adjusted, generationally projected with scale MP-2021	$123.8	$132.3	93.6%

- We recommend the SOA Public Mortality Safety (Below Median) Amount Weighted Male Table, with a 95.9% adjustment, generationally projected with scale MP-2021
  - The credibility factor is 40.15%. During FYE2019 – FYE2023, there were 218 deaths
  - The 95.9% adjustment = .4015 x .897 + .5985 x 1

Mortality Rates - Female Beneficiaries

$millions	Actual Liability Released	Expected Liability Released	Ratio of Actual to Expected
Current Assumption: SOA Public Cont. Surv. Mortality (Below Median) Amount Weighted-Female,106.0% adjusted, generationally projected with scale MP-2019	$32.1	$31.3	102.5%
SOA Public Cont. Surv. Mortality (Below Median) Amount Weighted-Female, generationally projected with scale MP-2021	$32.1	$29.3	109.6%
SOA Public Cont. Surv. Mortality (Below Median) Amount Weighted-Female,106.0% adjusted, generationally projected with scale MP-2021	$32.1	$31.0	103.4%

- The current mortality assumption produced assumed experience generally in line with actual experience. We recommend maintain the current base mortality assumption and updating mortality improvement to scale MP-2021.

Mortality Rates - Groups with No Experience Credibility

- All other groups have no experience credibility, and we recommend the mortality basis below. The only update from the prior assumption for the groups below is to update the mortality improvement to scale MP-2021.

Group	# Deaths during Study Period	Mortality basis recommendation
Female Service Retirees	0	SOA Public Safety Mortality (Below Median) Amount Weighted Female Table, projected generationally with scale MP-2021
Male Beneficiaries	1	SOA Public Contingent Survivor Mortality (Below Median) Amount Weighted Male Table, projected generationally with scale MP-2021
Male Disableds	34	SOA Public Safety Disability Mortality Amount Weighted Male Table, projected generationally with scale MP-2021
Female Disableds	0	SOA Public Safety Disability Mortality Amount Weighted Female Table, projected generationally with scale MP-2021
Male Actives	26	SOA Public Safety Mortality (Below Median) Amount Weighted Male Table, projected generationally with scale MP-2021
Female Actives	0	SOA Public Safety Mortality (Below Median) Amount Weighted Female Table, projected generationally with scale MP-2021

Mortality Recommendation

- The SOA 2010 Public Mortality Amount Weighted tables provides the best fit based on the makeup of the plan participants, therefore recommend using these tables:
  - Service retirees
    - Males - Public Safety (Below-Median) Amount Weighted Male Table with a 95.9% adjustment for credibility
    - Females - Public Safety (Below-Median) Amount Weighted Female Table
  - Survivor beneficiaries
    - Males - Contingent Survivor (Below-Median Male) Amount Weighted Male Table
    - Females - Contingent Survivor (Below-Median Female) Amount Weighted Female Table with a 106.0% adjustment
  - Disabled retirees – Sex-distinct Public Safety Disabled Retiree Amount Weighted Tables
  - All others, including actives and vested terminated participants
    - Pre-commencement of benefits: Sex-distinct Public Safety (Below-Median) Amount Weighted Tables
    - Post-commencement of benefits: Use applicable table above
- These base mortality tables will then be generationally projected from 2010 using the Mortality Improvement Scale MP-2021

Mortality - Percentage of Active Service-Connected Deaths

- The pre-retirement death benefit formula is based on whether the death was service-connected or non-service connected
  - Current assumption varies death type by age
  - Experience

Group	# Observed	Actual Rate
Service-Connected Deaths	13	0.50
Non-Service-Connected Deaths	13	0.50

  - Assumption modifications as follows

Age	Current	Proposed (All Ages)
25	80%	50%
35	80%	50%
45	40%	50%
55	20%	50%

Non-Mortality Demographic Assumptions

Setting Demographic Assumptions

- Non-Mortality

  - The expected number of separations from service on account of withdrawal, retirement and disability is calculated by multiplying the rates of separation used as a basis for the active service tables by the number of those exposed to risk

  - The actual number of those who had separated from service is then compared with the expected number

  - If the ratio of actual to expected is 100%, the table has predicted what actually occurred in the aggregate. If the ratio of actual to expected is greater than 100%, then the table has underestimated actual experience. If the ratio is less than 100%, then the table has overestimated actual experience

  - The ideal adjustment, taking into account credibility, to the current non-mortality related rates tends to produce an expected number that falls between the current expected number predicted by the assumption and the actual number of separations

Termination

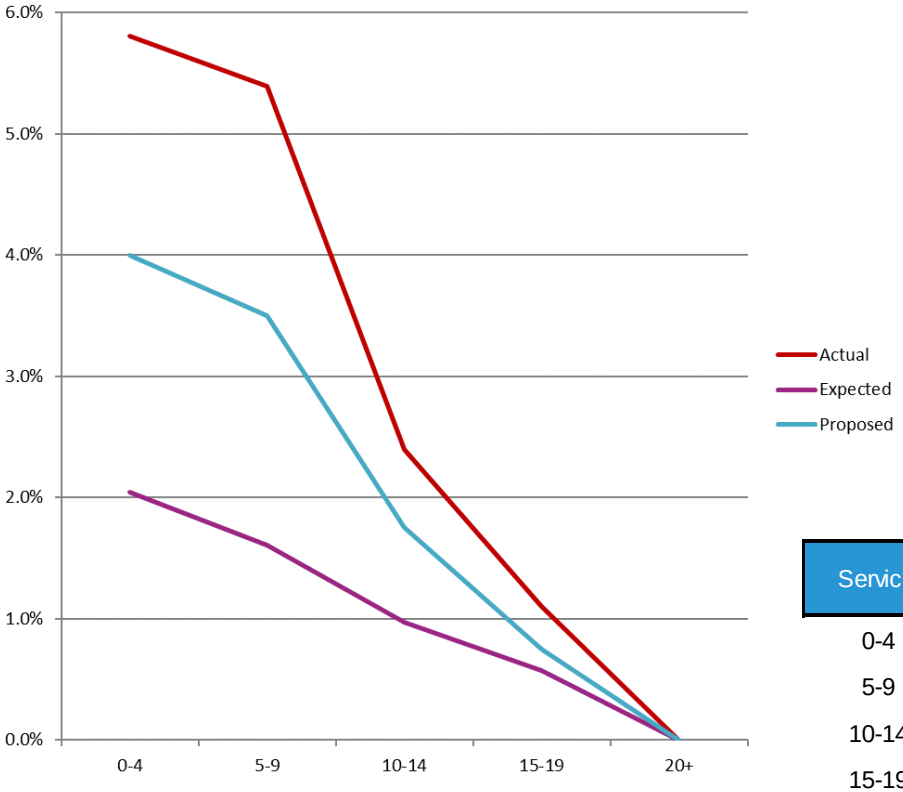
Termination - Termination Rates Prior to Service Retirement Eligibility

Service Group	Exposed	Actual	Expected		Actual/Expected	
			Current	Proposed	Current	Proposed
0-4	2,032	118	41.6	81.3	2.84	1.45
5-9	2,653	143	42.7	92.9	3.35	1.54
10-14	2,381	57	23.2	41.7	2.46	1.37
15-19	4,082	45	23.5	30.6	1.91	1.47
20+	0	0	0.0	0.0	N/A	N/A
Total	11,148	363	131.0	246.5	2.77	1.47

Recommendations:

- Change from age-based to service-based rates since vesting and retirement eligibility is generally based on service
- Increase termination rates since the total incidence of actual terminations is more than expected.
- Note – we reviewed the experience on a liability-weighted basis and the results are generally consistent with the headcount basis shown above

Termination - Termination Rates Prior to Service Retirement Eligibility



Active Termination by Service

Service	Actual	Expected	Proposed	Actual / Expected	Actual / Proposed
0-4	0.0581	0.0205	0.0400	2.84	1.45
5-9	0.0539	0.0161	0.0350	3.35	1.54
10-14	0.0239	0.0097	0.0175	2.46	1.37
15-19	0.0110	0.0058	0.0075	1.91	1.47
20+	-	-	-	-	-
Total	**0.0326**	**0.0118**	**0.0221**	**2.77**	**1.47**

Termination – Form of Payment

- Prior to eligibility for service retirement, a vested pension is available to members hired prior to July 1, 2017, who terminate with at least 10 years of service but less than 20 years of service*
  - Current assumption for members hired prior to July 1, 2017: 80% of those eligible for a vested pension will elect an immediate refund of contributions, while 20% will elect a deferred monthly pension benefit payable at age 50
  - Experience and proposed assumption modifications for members hired prior to July 1, 2017, as follows

Form of Payment	# Exposed	Actual	Expected Rate	Actual Rate	Proposed Rate
Immediate Contribution Refund	76	64	0.80	0.84	0.80
Deferred Pension Benefit	76	12	0.20	0.16	0.20

*All other members are only eligible to receive a refund of contributions without interest if terminating prior to retirement eligiblity

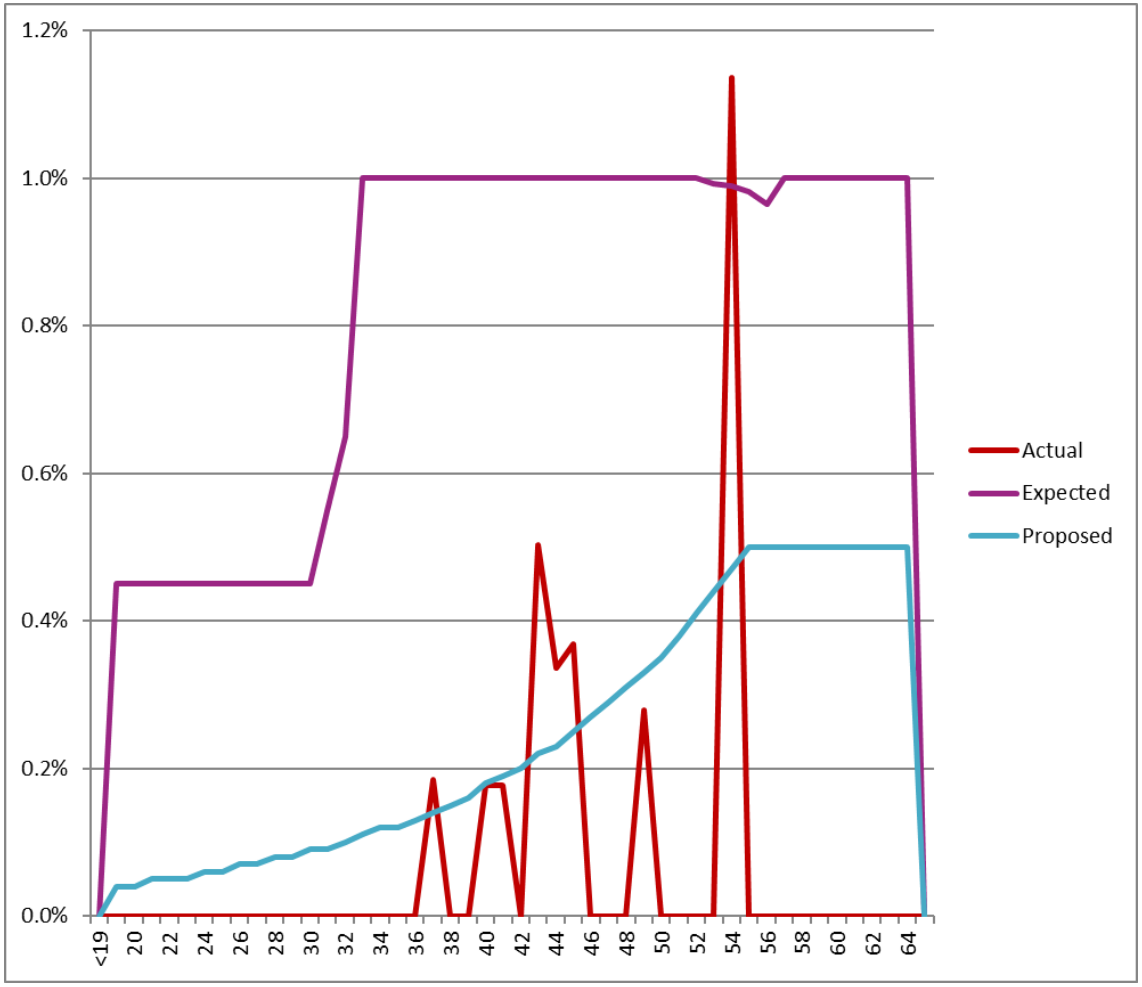
Disability

Disability – Combined Rates for Service-Connected and Non-Service-Connected Disability Retirements

Central Age Group	Exposed	Actual	Expected		Actual/Expected	
			Current	Proposed	Current	Proposed
21	101	0	0.5	0.1	0.0	0.0
26	785	0	3.5	0.6	0.0	0.0
31	2,056	0	13.2	2.0	0.0	0.0
36	2,661	1	26.6	3.5	0.0	0.3
41	2,848	5	28.5	5.4	0.2	0.9
46	2,447	4	24.5	6.5	0.2	0.6
51	1,212	1	12.1	4.5	0.1	0.2
>53	190	1	1.9	0.9	0.5	1.1
Total	12,300	12	110.8	23.5	0.1	0.5

Recommendation: Decrease the rates since the total incidence of actual disabilities is less than expected.

Disability – Combined Rates for Service-Connected and Non-Service-Connected Disability Retirements



Disability – Combined Rates for Service-Connected and Non-Service-Connected Disability Retirements

Age	Actual Rate	Expected Rate	Proposed Rate
19	-	0.0045	0.0004
20	-	0.0045	0.0004
21	-	0.0045	0.0005
22	-	0.0045	0.0005
23	-	0.0045	0.0005
24	-	0.0045	0.0006
25	-	0.0045	0.0006
26	-	0.0045	0.0007
27	-	0.0045	0.0007
28	-	0.0045	0.0008
29	-	0.0045	0.0008
30	-	0.0045	0.0009
31	-	0.0055	0.0009
32	-	0.0065	0.0010
33	-	0.0100	0.0011
34	-	0.0100	0.0012
35	-	0.0100	0.0012
36	-	0.0100	0.0013
37	0.0018	0.0100	0.0014
38	-	0.0100	0.0015
39	-	0.0100	0.0016
40	0.0018	0.0100	0.0018
41	0.0018	0.0100	0.0019
42	-	0.0100	0.0020

Age	Actual Rate	Expected Rate	Proposed Rate
43	0.0050	0.0100	0.0022
44	0.0034	0.0100	0.0023
45	0.0037	0.0100	0.0025
46	-	0.0100	0.0027
47	-	0.0100	0.0029
48	-	0.0100	0.0031
49	0.0028	0.0100	0.0033
50	-	0.0100	0.0035
51	-	0.0100	0.0038
52	-	0.0100	0.0041
53	-	0.0100	0.0044
54	0.0114	0.0100	0.0047
55	-	0.0100	0.0050
56	-	0.0100	0.0050
57	-	0.0100	0.0050
58	-	0.0100	0.0050
59	-	0.0100	0.0050
60	-	0.0100	0.0050
61	-	0.0100	0.0050
62	-	0.0100	0.0050
63	-	0.0100	0.0050
64	-	0.0100	0.0050
65+	-	-	-

Disability - Percentage of Service-Connected Disabilities

- The disability benefit formula is based on whether the incident was service-connected or non-service connected. If it is service-connected, the benefit is based on whether the member is capable of performing any substantial gainful activity (SGA)
  - Current assumption provides that 80% of disabilities are assumed to be service-connected and that 50% of service-connected disabilities cannot perform SGA
  - Experience and proposed assumption modifications as follows:

Disability Type	# Observed	Expected Rate	Actual Rate	Proposed Rate
Service-Connected Disabilities	16	0.80	0.89	0.85
Non-Service-Connected Disabilities	2	0.20	0.11	0.15

Service-Connected Disabilities	# Observed	Expected Rate	Actual Rate	Proposed Rate
Not Able to Perform SGA	9	.50	0.56	0.50
Able to Perform SGA	7	.50	0.44	0.50

The proposed rates are uniform rates at all ages for each category

Retirement

Retirement Assumption for RSVS Purposes

- Current RSVS retirement assumptions are unnecessarily complex and involve the following:
  - Commencement assumption – varying based on when a participant entered the DROP for current DROP members
  - Multiple assumed DROP durations, given years of service at commencement
    - I.e. for future DROP members, and given a particular commencement age, a portion will have been in DROP for 5 years, a portion will have been in DROP for 8 years, etc.
  - 100% DROP participation except for a small portion of active population who are allowed to bypass DROP based on age at entry
- Recommend simplifying approach to retirement assumption
  - Identify service levels at which members are commencing their benefit or entering the DROP
  - Identify portion of population expected to enter the DROP
  - Identify single average duration that members are in the DROP
  - Translate new retirement assumption from the previous points

Incidence of Commencement or DROP Entry

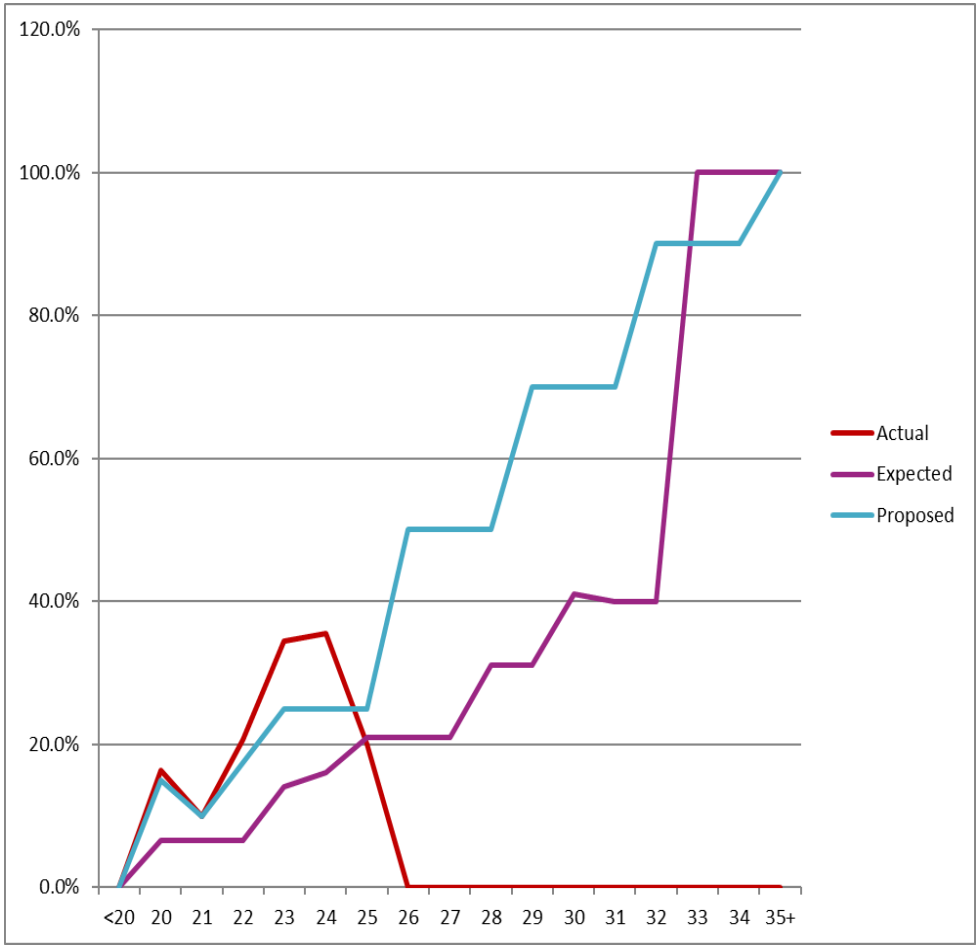
Years of Service	Exposed	Actual	Expected		Actual/Expected	
			Current*	Proposed	Current	Proposed
20	448	73	29.1	67.2	2.51	1.09
21	312	31	20.3	31.2	1.53	0.99
22	194	40	12.6	34.0	3.17	1.18
23	113	39	15.8	28.3	2.47	1.38
24	62	22	9.9	15.5	2.22	1.42
25	15	3	3.2	3.8	0.94	0.79
26	1	0	0.2	0.5	0.00	0.00
27	1	0	0.2	0.5	0.00	0.00
28	1	0	0.3	0.5	0.00	0.00
29	0	0	0.0	0.0	N/A	N/A
30	0	0	0.0	0.0	N/A	N/A
31	0	0	0.0	0.0	N/A	N/A
32	0	0	0.0	0.0	N/A	N/A
33	1	0	1.0	0.9	0.00	0.00
34	1	0	1.0	0.9	0.00	0.00
35+	3	0	3.0	3.0	0.00	0.00
Total	1,152	208	96.6	186.3	2.15	1.12

* Implied from current commencement assumption and assuming a single 7-year DROP duration

Recommendation: Align assumed incidence of commencement or DROP entry with experience due to change in valuation approach

Note – we reviewed the experience on a liability-weighted basis and the results are generally consistent with the headcount basis shown above

Incidence of Commencement or DROP Entry



Years of Service	Actual Rate	Expected Rate	Proposed Rate
20	0.1629	0.0650	0.1500
21	0.0994	0.0650	0.1000
22	0.2062	0.0650	0.1750
23	0.3451	0.1400	0.2500
24	0.3548	0.1600	0.2500
25	0.2000	0.2100	0.2500
26	0.0000	0.2100	0.5000
27	0.0000	0.2100	0.5000
28	0.0000	0.3100	0.5000
29	0.0000	0.3100	0.7000
30	0.0000	0.4100	0.7000
31	0.0000	0.4000	0.7000
32	0.0000	0.4000	0.9000
33	0.0000	1.0000	0.9000
34	0.0000	1.0000	0.9000
35+	0.0000	1.0000	1.0000

DROP Participation Rate

- Currently, 100% of active participants who are projected to have at least 25 years of service at age 55 and eligible to participate in the DROP are assumed to participate in the DROP
  - Actual experience over study period and proposed rates, are as follows:

Years of Service	A = Actives who Bypassed DROP and Retired	B = Actives who Entered DROP	C = Exposures = A + B	D = B/C = DROP Take Rate
Total	48	191	239	79.9%

  - The 79.9% total DROP participation rate indicates that fewer participants are electing to enter the DROP than previously
- Propose decreasing the assumed DROP participation rate to 85% for all DROP-eligible members

DROP Duration

- As a portion of legacy active members of the Fund are assumed to participate in the DROP, “duration” is the assumption of how long the member remain in DROP until the member retires. We are proposing a change to this assumption to a single assumed DROP duration period.
- The four-year experience suggests an average DROP duration of 7.99 years. We recommend an assumed DROP duration of 8 years for future DROP members and current DROP members.
- Commencement assumption for actives not currently in DROP is shown on the next slide:
  - Assumption implied based on 1) incidences of commencement or DROP entry, 2) assumed DROP duration, and 3) assumed DROP participation rate
  - Assume immediate commencement of benefit for DROP members already in the DROP for 8 years.

* See Appendix for a complete development.

Commencement Assumption (Actives Not Currently in DROP or Never Eligible for DROP)

Years of Service	Proposed Rate*	Note
<=20	0.02250	15% of corresponding row on slide 40
21	0.01500	
22	0.02625	
23	0.03750	
24	0.03750	
25	0.03750	
26	0.07500	
27	0.07500	
28	0.20250	15% of corresponding row on slide 40, plus 85% of row on slide 40 corresponding to years of service minus 8
29	0.19000	
30	0.25375	
31	0.31750	
32	0.34750	
33	0.34750	
34	0.56000	
35	0.57500	
36	0.57500	
37	0.74500	
38	0.74500	
39	0.74500	
40	0.91500	
41	0.91500	
42	0.91500	
43+	1.00000	100% commencement

* For actives never eligible for DROP (hired on or after July 1, 2017), increase rate by 5 percentage points in first year where sum of age and service equals or exceeds 70.

Payment of DROP Balances – Active members

- Current assumption - DROP balances will be distributed over 15 years from pension commencement date
- Data to analyze the experience during the covered period is not provided for the annual RSVS
  - As discussed with the Fund's staff, payment information provided for the Fund's "415-limit" testing was used
  - Available data estimates - it will take an average of 16.9 years to fully distribute a DROP balance assuming the DROP balance is paid in equal annual payments
- Recommend changing to a 16-year installment of a DROP balance assumption

Payment of DROP/PROP Balances – Inactive members

- Current assumption - The liability for DROP/PROP balances of members who have left active service is assumed to be equal to the value of a 7.5-year level installment of the Retirement Fund's remaining DROP/PROP balance, applied based on the difference between the assumed investment rate of return and the assumed DROP interest crediting rate (defined to be 65% of the assumed investment rate of return)
- We recommend assuming an 8.0-year level installment of the Retirement Fund's remaining DROP/PROP balance, applied based on the difference between the assumed investment rate of return and the assumed DROP interest crediting rate (defined to be 65% of the assumed investment rate of return)

Marriage Assumptions

- Currently, 82.0% of male and 85.0% of female retiring active participants are assumed to be married
  - Actual experience over study period and proposed rates, are as follows:

Retiree Gender	Over study period	Current Assumption	Proposed Assumption
% of Males married at retirement	83.6%	82.0%	83.0%
% of Females married at retirement	43.8%	85.0%	75.0%

- Currently, male participants are assumed to be two years older than wives, and female participants are assumed to be six years younger than husbands
  - Actual experience over study period and proposed age differences, are as follows:

Retiree Gender	Average over study period	Current Assumption	Proposed Assumption
Males	+1.62	+2	+2
Females	-3.12	-6	-4

Economic Assumptions

Setting Economic Assumptions

- Review Past Experience
- Review General Practice
- Develop component parts of each assumption
  - Maintain linkage with investments
  - Maintain internal consistency
- Make Judgment About Future
  - Make use of forward-looking models
- Apply Statutory provisions

Investment Return & Inflation

Investment Return

- Current statute requires that the annual RSVS assumed rate of return may not exceed 7.00% per annum (net of investment expenses)
- Current actuarial standards of practice allow for the investment return assumption to be based on the expected returns of the underlying portfolio
- Current target asset allocation:

Asset Class	Policy Target Weight	Benchmarks
Cash & Short Term	2%	BofAML 9-12 Mo. US Treasury Index
Public Equity- Domestic	19%	Russell 3000 Index
Public Equity- International	19%	MSCI All Country World Ex-US Index
Aggregate Bonds	5%	Barclays US Aggregate Index
Intermediate Credit	3%	Barclays US Aggregate Index
Intermediate High Yield	5%	CS LLI 50%/ICE BofAML HY 50%
Hedge Funds	2%	70% - HFR Risk Parity Vol 10 Institutional Index / 30% - Cash + CPI benchmark
Private Equity	25%	Cambridge Associates US Private Equity 1QA
Private Debt	10%	CS LLI 50%/ICE BofAML HY 50%
Real Estate	10%	NCREIF Property
	100%	

Investment Return

- Recent GEMS* Model results (gross benchmark returns)

Time Horizon	10	20	30
2023 Capital Market Assumptions			
Nominal Returns - Percentile (Geometric)			
75th	11.14%	10.21%	9.86%
65th	10.11%	9.51%	9.25%
50th	8.64%	8.53%	8.44%
35th	7.47%	7.41%	7.45%
25th	6.31%	6.66%	6.86%

Time Horizon	10	20	30
2022 Capital Market Assumptions			
Nominal Returns - Percentile (Geometric)			
75th	12.02%	11.08%	10.95%
65th	10.99%	10.28%	10.10%
50th	9.34%	9.10%	9.17%
35th	7.67%	8.00%	8.20%
25th	6.40%	7.07%	7.42%

Time Horizon	10	20	30
2021 Capital Market Assumptions			
Nominal Returns - Percentile (Geometric)			
75th	8.08%	8.39%	8.25%
65th	7.16%	7.59%	7.65%
50th	6.04%	6.48%	6.81%
35th	4.79%	5.42%	5.93%
25th	3.69%	4.69%	5.25%

Time Horizon	10	20	30
2020 Capital Market Assumptions			
Nominal Returns - Percentile (Geometric)			
75th	8.01%	8.34%	8.61%
65th	6.29%	7.16%	7.64%
50th	5.29%	6.49%	7.05%
35th	4.28%	5.70%	6.42%
25th	2.65%	4.55%	5.43%

- Recent capital market assumptions have increased expected returns for many asset classes

* See Appendix

Investment Return

- Future considerations
  - 7.00% return assumption continues to be supportable in the short-term
  - Upward movement of capital market assumptions might at some point require us to soften position on assumption: Disclose that expected return “does not significantly conflict with what, in the actuary’s professional judgment, is reasonable for the purpose of the measurement”
  - NASRA survey (published November 2023 based on FY 2022) indicates median rate assumed by 131 large public plans is 7.00%
  - NCPERS 2023 Public Retirement Systems Study indicates average rate assumed by 195 state and local government pension funds is 6.86%

Inflation

- Current assumption – 2.50% per annum
- As prescribed by statute, the assumption should be based on:
  - *"the most recent headline consumer price index 10-year forecast published in the Federal Reserve Bank of Philadelphia Survey of Professional Forecasters"* or, if not available, another standard agreed to by the Municipality and the Fund's board
  - Further, "*the price inflation assumption as of the most recent actuarial experience study…may be reset by the board by plus or minus 50 basis points based on that actuarial experience study*"
- The published "*headline consumer price index 10-year forecast"* (Long-Term Annual Average for 2024-2033) is currently 2.24% per annum
- Recommend updating inflation assumption to 2.25% per annum

Future Cost-of-Living Adjustments (COLAs)

- Current assumption – Assumed to be equal to the assumed asset return less 4.75% (current 7% less 4.75% equal 2.25%)
- Assumption continues to be supportable
- Proposed clarification - Assumed to be equal to the assumed asset return less 4.75% (current 7% less 4.75% equal 2.25%) **and applied each October following the valuation date**

Salary Increase

Salary Increase

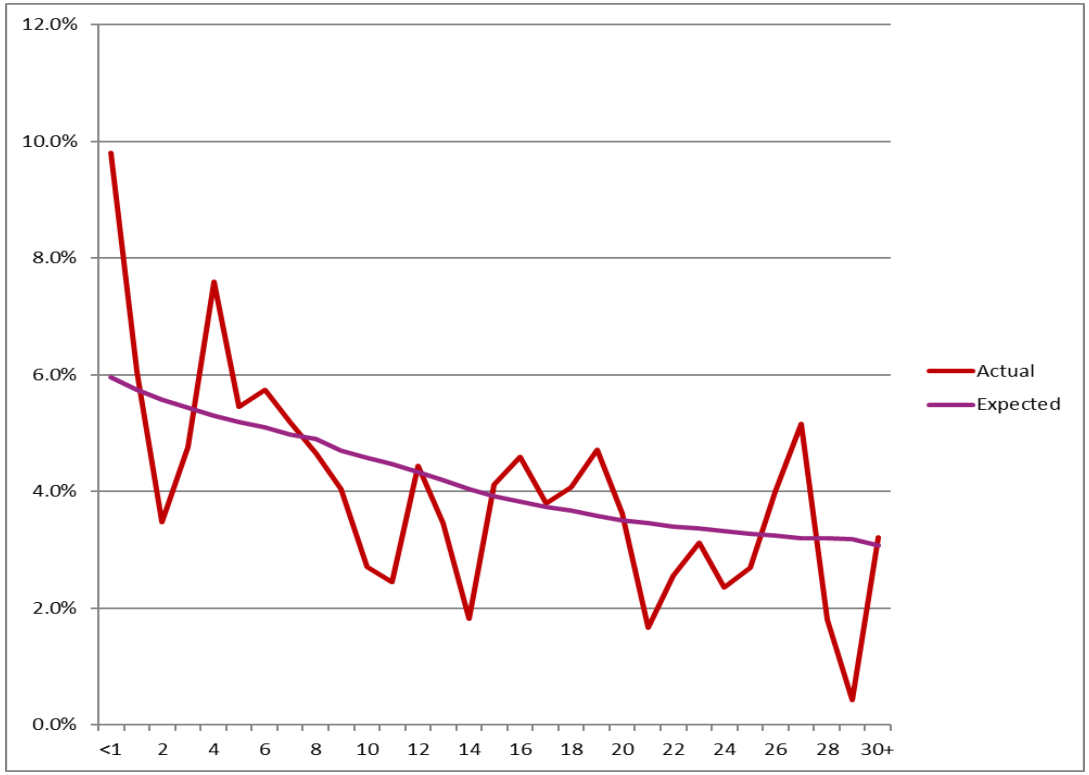
- When selecting assumptions, it is important to account for the Fund sponsor's expectations for future years that may differ from past experience

- Discussions with the Fund's staff: the last five years may not be a good proxy for the future:
  - Lack of contract settlements during the examination period
    - Expectation of new contracts in the near future
- No change is recommended at this time
  - Salary increase assumption will be reviewed when the next scheduled study is prepared as of June 30, 2027 and proposed changes, if warranted, will be recommended at that time.
  - An interim study of this assumption may be prudent upon contract settlement

Salary Increase

Central Svc Group	Exposed	Prior Year Salary	Current Year Salary	Expected Salary	Current Year/Expected
0-4	2,614	132,233,000	140,666,000	139,569,878	1.0079
5-9	2,189	133,636,000	140,459,000	140,320,055	1.0010
10-14	2,644	176,877,000	181,969,000	184,468,338	0.9865
15-19	3,767	267,290,000	278,591,000	277,362,485	1.0044
20-24	1,673	128,397,000	131,868,000	132,775,809	0.9932
25-29	972	75,468,000	77,709,000	77,904,231	0.9975
30+	404	33,053,000	34,115,000	34,067,697	1.0014
Total	14,263	946,954,000	985,377,000	986,468,493	0.9989

Salary Increase



Svc	Actual Rate	Expected Rate
<1	0.0980	0.0596
1	0.0605	0.0574
2	0.0347	0.0557
3	0.0475	0.0544
4	0.0760	0.0530
5	0.0544	0.0519
6	0.0574	0.0510
7	0.0520	0.0498
8	0.0466	0.0490
9	0.0404	0.0470
10	0.0271	0.0458
11	0.0245	0.0447
12	0.0444	0.0434
13	0.0346	0.0420
14	0.0183	0.0404
15	0.0412	0.0392
16	0.0460	0.0383
17	0.0380	0.0374
18	0.0407	0.0367
19	0.0472	0.0358
20	0.0363	0.0351
21	0.0167	0.0346
22	0.0256	0.0340
23	0.0312	0.0336
24	0.0236	0.0333
25	0.0269	0.0327
26	0.0400	0.0324
27	0.0516	0.0319
28	0.0180	0.0319
29	0.0042	0.0318
30+	0.0321	0.0307

Payroll Growth

- The amortization of the Fund's unfunded accrued liability uses a level percentage of payroll method which produces a payment stream that is designed to increase based on the expected growth in payroll
- The current assumption is 3% and statute indicates the payroll growth may not exceed 3%
- The last five years may not be a good proxy for payroll expectations in the future

FYE 6/30	Covered Payroll ($000)	% Change from Prior Year
2019	272,498	
2020	259,235	(4.87)
2021	243,045	(6.25)
2022	255,100	4.96
2023	269,091	5.48
	Avg	(0.17)

- No change is recommended at this time
  - Payroll growth assumption will be reviewed when the next scheduled study is prepared as of June 30, 2027 and proposed changes, if warranted, will be recommended at that time.
  - An interim study of this assumption may be prudent upon contract settlement

Impact of Proposed Changes

Actuarial Impact of Recommended Changes: Based on July 1, 2023 Proposed RSVS, published November 2023

($000)	Current Assumptions	Proposed Assumptions	Change
Present Value of Future Benefits	$6,004,258	$5,955,128	($49,130)
Actuarial Accrued Liability	$5,277,944	$5,417,938	$139,994
Actuarial Value of Assets (AVA)	$5,064,764	$5,064,764	$0
Unfunded Accrued Liability	$213,180	$353,174	$139,994
AVA - Funded Ratio	96.0%	93.5%	(2.5%)
City Normal Cost Rate[1]	14.53%	10.87%	(3.66%)
City Accrued Liability Rate	11.58%	14.66%	3.08%
Total City Contribution Rate[2]	26.11%	25.53%	(0.58%)
Estimated City Contribution for following Fiscal Year	$75,277	$73,604	($1,673)
Employee Contribution Rate	10.50%	10.50%	0.00%

1. Contains an allowance for administrative expenses equal to 1.25% of payroll
2. As a percentage of pensionable compensation

Takeaways and Next Steps

Takeaways

- The proposed assumption changes result in a decrease in overall costs of the pension plan
- Setting assumptions closer to expected future experience should reduce gains and losses over time and make long term costs more predictable

Next Steps

- ✓ Substantially final draft of the study to be provided to the City's actuary, including:
  - All assumptions and methods recommended by the Fund actuary
  - Summaries of the reconciled actuarial data used in creation of the experience study
- ✓ Fund actuary and City actuary confer and cooperate on reconciling and producing a final experience study
- ➢ No Longer Applicable: City actuary to notify in writing any assumptions and methods not reconciled, and City actuary's rationale
- ➢ No Longer Applicable : If applicable, Fund must notify City actuary, in writing, of any changes the Fund does not accept
  - Recommend names of three independent actuaries
  - City actuary must select one of the three names (cost shared 50/50)
  - Independent actuary reviews and sides with either fund actuary or city actuary assumption or method
  - If Fund does not accept a City assumption or method recommended by the independent actuary, City actuary can use the assumption in future RSVS reports
- ➢ **Board cannot adopt any final experience study until 180 days has elapsed**

Disclosures

The information contained herein is developed for the Board of Trustees and Staff of Houston Firefighters' Relief and Retirement Fund by Buck Global, LLC using generally accepted actuarial principles and techniques in accordance with all applicable Actuarial Standards of Practice (ASOPs). The presentation contains key results of the June 30, 2023 four-year experience study. All recommendations contained in this report are consistent with each other, as appropriate. Interested parties should refer to the July 1, 2023 Proposed Risk Sharing Valuation, which was published November 2023, for a detailed explanation regarding data, assumptions, methods, plan provisions, applicable ASOPs and disclosures.

The purpose of this presentation is to provide information to assist the Board in adopting assumptions to be used in the actuarial valuation of the Fund. Any cost information provided is estimated and should not be used to determine the actual contributions needed for funding purposes.

No third-party recipient of Buck's work product should rely upon Buck's work product absent involvement of Buck or without our approval.

Future actuarial measurements may differ significantly from current measurements due to plan experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in plan provisions or applicable law. An analysis of the potential range of future results is beyond the scope of this valuation.

I am a Fellow of the Society of Actuaries and a Member of the American Academy of Actuaries. I meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. I am available to answer any questions on the material contained herein, or to provide explanations or further details as may be appropriate.

Michael A. Ribble, FSA, EA, MAAA, FCA

Principal, Consulting Actuary

Questions?

THANK YOU

Appendix

Analysis for Duration Modifications

Analysis for DROP Duration

- DROP Duration Analysis:

Years in DROP	Exposed	Count who Exited DROP	Rate of DROP Exit	Probability of Continuing in DROP (a)	Probability of DROP Exit = 1 – (a)	% of DROP Exits
0	74	11	14.9%	100.0%	0.0%	3.8%
1	99	5	5.1%	85.1%	14.9%	1.7%
2	209	7	3.3%	80.8%	19.2%	2.4%
3	321	14	4.4%	78.1%	21.9%	4.9%
4	382	19	5.0%	74.7%	25.3%	6.6%
5	413	25	6.1%	71.0%	29.0%	8.7%
6	319	19	6.0%	66.7%	33.3%	6.6%
7	218	21	9.6%	62.7%	37.3%	7.3%
8	182	25	13.7%	56.7%	43.3%	8.7%
9	140	29	20.7%	48.9%	51.1%	10.1%
10	95	24	25.3%	38.8%	61.2%	8.4%
11	87	23	26.4%	29.0%	71.0%	8.0%
12	68	35	51.5%	21.3%	78.7%	12.2%
13	36	22	61.1%	10.3%	89.7%	7.7%
14	12	4	33.3%	4.0%	96.0%	1.4%
15	7	3	42.9%	2.7%	97.3%	1.0%
16	1	0	0.0%	1.5%	98.5%	0.0%
17	0	0	0.0%	1.5%	98.5%	0.0%
18	0	0	0.0%	0.0%	100.0%	0.0%
19	0	0	0.0%	0.0%	100.0%	0.0%
>19	4	0	0.0%	0.0%	100.0%	0.0%

- At year 0, 100% are participating in the DROP. Each succeeding year, the probability of continuing in the DROP is the prior year's amount and the prior year's probability of continuing (i.e., 1 minus the rate of retirement)
- Avg. DROP Duration is the sum of the products of Years in DROP and % of DROP Exits = 7.99 years

GEMS Capital Market Model

Buck's Capital Market Model

- Buck's capital market assumptions are derived from the General Economy and Market Simulator ("GEMS") developed by Conning & Company.
  - Buck determines a set of capital market assumptions based on the GEMS modeling of the key economic variables and the asset class returns that result from a factor model that forecasts future values for all asset classes in the model
- GEMS Model
  - Incorporates historical data to develop the factor model
  - Calibrates to current economic and market conditions,
  - Models the general economy and capital markets
  - Asset class means, volatilities, and correlations are determined dynamically to reflect the change over time
  - Asset class return distributions will vary depending on the time horizon modeled
- Returns modeled are benchmark returns and results don't include reductions for fees and/or expenses.

Houston Firefighters' Relief and Retirement Fund

Investing for Firefighters and Their Families

November 4, 2024

David Sawyer
Definiti LLC d/b/a Retirement Horizons Inc.
2201 Timberloch Place, Suite 150
The Woodlands, TX 77002

Dear Mr. Sawyer,

The Houston Firefighters' Relief and Retirement Fund ("HFRRF") has received, under cover of an email from you on October 15, 2024, an actuarial audit report ("Report"), dated October 2024, prepared by Definiti[1] pursuant to Texas Government Code §802.1012. HFRRF submits the following in response to the Report and expects this letter to be included in any final draft thereof:

- Page 21 Additional Findings for Consideration:
  - Item 1 Response: Buck's 2023 valuation report meets actuarial standards for disclosure of actuarial experience gain and loss sources.
  - Item 2 Response: Note, each year Gallagher supplies the data required for the City actuary to assess the reasonableness of the liability associated with the Fund's DROP provisions.
- Other notes about the report:
  - The report references Appendix A included their response to the 2020 Experience Study. However, this Appendix A was not provided in the copy forwarded to HFRRF.
  - Page 16: The row for Retired Members' Average Annual Benefit appears to include a typo. Our average annual benefit of $59,016 matches the 2023 RSVS. If Definiti's average annual benefit of $59,100 is their correct number, then the difference column should be ($84) and the Percentage difference column should be (0.1%). Otherwise, perhaps Definiti's average annual benefit should have been reported as $59,013 (in which case the difference and percentage difference would be correct).

Sincerely,

Timothy Schauer
Executive Director

[1] Nothing in this response waives HFRRF's objection that RHI/Definiti does not meet the requirements of an "independent actuary" within the meaning of Texas Gov't Code §802.1012 due to RHI's close association and extensive consulting relationship with the City of Houston.