



CITY OF HOUSTON

Sylvester Turner

Mayor

P.O. Box 1562
Houston, Texas 77251-1562

Telephone – Dial 311
www.houstontx.gov

February 25, 2016

Ralph D. Marsh
Executive Director
Houston Firefighters' Relief and Retirement Fund
4225 Interwood North Parkway
Houston, TX 77032-3866

Re: Actuarial Audit

Dear Mr. Marsh:

We are in receipt of your February 11, 2016 letter, addressed both to Retirement Horizons, Inc. (RHI) and myself. While we recognize that litigation is ongoing, the City has a duty to perform an actuarial audit of the actuarial valuations, studies, and reports most recently prepared for the Houston Firefighters Relief and Retirement Fund (the Fund) under section 802.1012 of the Texas Government Code, and this preliminary draft was sent to you in furtherance of that duty.

The audit sent to you by Mayor Sylvester Turner under cover letter dated January 15, 2016 was a preliminary draft pursuant to section 802.1012(f). It was for that reason that the letter requested your response within 30 days of receipt, which is what the statute requires. We appreciate your response, provided in the last paragraph of your letter.

Your letter began, however, with a series of contentions (provided in bullet points on the bottom of page 1 and top of page 2) that the City and RHI have failed to comply with provisions of section 802.1012. The City disagrees with these contentions. Specifically, but without limitation, RHI is an independent actuary under the statute, and both the City and RHI have agreed in writing to keep non-public information confidential. However, I made clear in my letter dated March 26, 2015 that we would not be requesting non-public census data to perform this audit. Exhibit A. With respect to your contention that the "relevant parties" have not agreed in writing to keep non-public information confidential, that is a misstatement of the statute. It is only the City and the independent actuary who must agree in writing, and both have done so. Tex. Gov't Code §802.1012(d). In addition, the City requested a meeting under section 802.1012(e) with the Fund manager, but the Fund refused to meet with us on this topic. Exhibit B (emails).

Your other comments in this section are all based on your confusion as to whether the report sent to you was the preliminary draft. Irrespective of this purported confusion, you have provided your response, and we thank you for doing so.

We remain open to discussing any of these issues with the Fund. We look forward to hearing from you.

Sincerely,

Kelly Dowe
Chief Business Officer / Finance Director

Enclosure

cc: Mickey McDaniel, Retirement Horizons, Inc.

EXHIBIT A



CITY OF HOUSTON

Department Name

Annise D. Parker

Mayor

Kelly Dowe
Director
P.O. Box 1562
Houston, Texas 77251-1562

City Information: 311
www.houstontx.gov

March 26, 2015

Ralph D. Marsh
Executive Director
Houston Firefighters' Relief and Retirement Fund
4225 Interwood North Parkway
Houston, TX 77032

Dear Mr. Marsh:

The City of Houston has retained Retirement Horizons Inc. (RHI) to perform an actuarial audit update for all three of its employee retirement systems. In accordance with State of Texas Government Code Sec. 802.1012, the City of Houston is requesting a meeting with representatives of the Houston Firefighters' Relief and Retirement Fund Fund to discuss the scope of the actuarial audit update.

The City of Houston has entered into an agreement with RHI to maintain the confidentiality of any nonpublic information that may be provided by the Houston Firefighters' Relief and Retirement Fund Fund in performing this review. However, the City of Houston has determined it will limit the scope of this examination to published actuarial reports and related studies, as well as financial reports and other information that has been provided to the Board of Trustees or otherwise available in the public domain. Therefore, given that no individual member census data will be requested, it is our understanding that a separate confidentiality agreement between the Fund and RHI should not be required.

Thank you in advance for your cooperation, and I look forward to meeting at your earliest convenience and working with the Houston Firefighters' Relief and Retirement Fund Fund on this important project.

Best regards,

Kelly Dowe, Director
City of Houston, Finance Department

Rasheed, Arif - FIN

From: Rasheed, Arif - FIN
Sent: Thursday, June 11, 2015 3:50 PM
To: Ralph@hfrrf.org
Cc: Mickey McDaniel (mmcdaniel@retirement-horizons.com); Avalos, Erica - FIN; Dowe, Kelly - FIN (Kelly.Dowe@houston.tx.gov)
Subject: FW: Meeting
Attachments: Letter to Kelly Dowe re actuarial audit update.pdf

Ralph –

The purpose of the meeting is 2 fold – Actuarial Audit update as well as a discussion on the steps and information needed from HFRRF for the GASB 68 Implementation by the City. Please let me know if you have any other concerns or questions and would appreciate you letting us know your availability to meet.

Thanks.

Arif

From: Avalos, Erica - FIN
Sent: Thursday, June 04, 2015 4:31 PM
To: Rasheed, Arif - FIN
Subject: FW: Meeting

What is the subject of this meeting w/Fire? See his inquiry below.

Thank you.

From: Ralph D. Marsh [<mailto:Ralph@hfrrf.org>]
Sent: Thursday, June 04, 2015 2:43 PM
To: Avalos, Erica - FIN; mmcdaniel@retirement-horizons.com
Cc: Todd E. Clark; Jonathan W. Needle
Subject: RE: Meeting

Good afternoon Ms. Avalos.

Can you tell me the purpose of the meeting? Per my attached correspondence of April 2, 2015 to Mr. Dowe, I would be happy to meet with City officials to discuss matters related to the Houston Firefighters' Relief and Retirement Fund. That said, can Mr. Dowe please confirm that this meeting request does not relate to Section 802.1012 of the Texas Government Code?

Thank you for your assistance with the matter.

Regards,

Ralph D. Marsh
Executive Director
Houston Firefighter's Relief and Retirement Fund
4225 Interwood North Parkway

Houston, TX 77032-3866

ralph@hfrrf.org

Ofc: 281-372-5100

From: Avalos, Erica - FIN [<mailto:Erica.Avalos@houstontx.gov>]

Sent: Thursday, June 04, 2015 1:36 PM

To: Ralph D. Marsh; mmcdaniel@retirement-horizons.com

Subject: Meeting

Mr. Marsh and Mr. McDaniel,

Arif Rasheed has asked me to set-up a meeting regarding the Fire pension. Please provide me with your availability and I will check Arif's calendar to find a time accordingly.

If you have any questions please let me know.

Thank you,

Erica Avalos

City of Houston

Finance Department

Phone: 832.393.9039

Houston Firefighters'
Relief and Retirement Fund
Investing for Firefighters and Their Families



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Albertino "Al" Mays
Citizen Member

Honorable Carroll G. Robinson
Citizen Member

Ralph D. Marsh
Executive Director

April 2, 2015

Kelly Dowe
Director
City of Houston, Finance Department
P.O. Box 1562
Houston, TX 77251-1562

Dear Mr. Dowe:

I am in receipt of your letter of March 26, 2015. At the outset, I want to let you know that I will be happy to discuss matters of mutual concern with you.

Section 802.1012 of the Texas Government Code makes no provision for an interim "actuarial audit update," and, therefore, I am proceeding under the assumption that your request is outside Section 802.1012. Nonetheless, I would be happy and would look forward to meeting with you to discuss pension matters and your request. I will not have availability to meet until the week of April 27th. Please feel free to call, write or email me a few proposed dates and times.

Best regards,

Ralph Marsh, Executive Director
Houston Firefighters' Relief and Retirement Fund

Cc: Todd Clark
William A. Worthington

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Houston Firefighters'
Relief and Retirement Fund
Investing for Firefighters and Their Families

Board of Trustees

Todd E. Clark
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February 11, 2016

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Kelly Dowe
Chief Business Officer
611 Walker, 10th Floor
Houston, TX 77002

Via Certified Mail with Return Receipt
7099 3220 0001 2481 7481

Francis "Frank" X. Maher
Secretary

Stephen R. Whitehead
Trustee

Mickey McDaniel, FSA EA MAAA
Retirement Horizons Inc.
2201 Timberloch Place, Suite 150
The Woodlands, TX 77380

Via Certified Mail with Return Receipt
7099 3220 0001 2481 7474

Juliet N. Higgins
Trustee

Garry W. Blackmon, Sr.
Trustee

Dear Mr. Dowe and Mr. McDaniel:

Kelly Dowe
City Treasurer

The Houston Firefighters' Relief and Retirement Fund ("HFRRF") has received, under cover of a letter from the Mayor of Houston dated January 15, 2016, an actuarial report dated December 11, 2015 (the "Report") and prepared by Retirement Horizons Inc. ("RHI"), purporting to be an audit report conducted pursuant to, and in accordance with, Texas Government Code §802.1012.

Vacant
Mayor's Representative

Albertino "Al" Mays
Citizen Member

HFRRF does not recognize the Report as an actuarial audit conducted pursuant to Texas Government Code §802.1012 and objects to any classification of the above-referenced document as such. Please note that the subject of actuarial reports regarding HFRRF conducted pursuant to Texas Government Code §802.1012 are a matter of ongoing litigation (the "Mandamus Case") between the City and HFRRF. The Report does not comply with the Texas First Court of Appeals opinion in the Mandamus Case (See Board of Trustees of the Houston Firefighters' Relief and Retirement Fund v. The City of Houston, 466 S.W.3d 182 (Tex. App. - Houston 1st Dist. 2015)). It is unclear to HFRRF whether RHI intends the Report to be a preliminary draft or a final draft; in either case the City and RHI have failed to comply with provisions of §802.1012 that are legal requirements for any actuarial audit conducted pursuant to that section, specifically:

Honorable Carroll G. Robinson
Citizen Member

Ralph D. Marsh
Executive Director

- The City has failed to engage an "independent actuary" in contravention of §802.1012(c). As maintained by HFRRF in the Mandamus Case, HFRRF contends that RHI has not been, for an appreciable period before its retention by the City to produce the Report and throughout the pendency of the Mandamus case proceedings, 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.
- The "relevant parties" have not agreed in writing to maintain the confidentiality of any nonpublic information. (§802.1012(d) and *Bd. of Trustees of HFRRF v. Houston* at 190).
- RHI, if it could act as an independent actuary under 802.1012, has not met with a HFRRF manager to discuss the appropriate assumption to use in the audit (§802.1012(e) and *Bd. of Trustees of HFRRF v. Houston* at 182).
- RHI, if it could act as an independent actuary, states that the Report is based upon valuations, actuarial experience review, and other special studies "over the most recent five year period" (See page 2 of the Report) in contravention of §802.1012(c) which states that only the "most recently prepared" valuation (as of the date a validly prepared preliminary report would have been deliverable to HFRRF) is to be utilized in a §802.1012 audit;
- 30 days after its completion of a preliminary draft of an audit report, RHI, if it could act as an independent actuary under 802.1012, must submit its preliminary draft of the audit to HFRRF

for discussion and clarification. If the Report is intended to be a final draft, then HFRRF never received a preliminary draft of the report in contravention of §802.1012(f);

- RHI, if it could act as an independent actuary under 802.1012, has not discussed the preliminary draft with HFRRF in contravention of §802.1012(g)(1);
- RHI, if it could act as an independent actuary under 802.1012, has not requested in writing that HFRRF submit any response that HFRRF would like to accompany a final audit report in contravention of §802.1012(g)(2);
- RHI, if it could act as an independent actuary under 802.1012, has not independently nor directly submitted its report, whether preliminary or final, to HFRRF, but has already submitted it to the municipality, which then forwarded the document to HFRRF in contravention of §802.1012(f);
- If RHI (provided it could act as an independent actuary under 802.1012) intended the document that the municipality sent to HFRRF to be a final draft, RHI did not submit its Report with HFRRF's response to the City after the 31st day but before the 60th day after the submission of the preliminary report to HFRRF (no such preliminary report was ever submitted to HFRRF in contravention of §802.1012(h)).

In short, RHI and the City have not complied with, or have directly violated, a majority of the explicit requirements and procedures of §802.1012, establishing their own preferred methods of proceeding, rather than following §802.1012. Therefore, HFRRF believes that the actuarial report produced by RHI and sent to HFRRF by the City is not an actuarial report that relates to §802.1012 at all. Rather, it is another type of actuarial activity that the City commissioned and pursued on its own volition, apparently believing the project has some relation to §802.1012.

We also note that RHI's report received by HFRRF states that the §802.1012 audits are to be conducted "at least every 5 years". However, §802.1012 clearly and specifically only provides for the §802.1012 audits to be performed "every 5 years." (§802.1012(c) and *Bd. of Trustees of HFRRF v. Houston* at 188).

Without waiving any of the objections above, and notwithstanding that the Report is not in fact any report or audit for purposes of the Texas Government Code §802.1012, HFRRF nevertheless, at the Mayor's request, submits the following in response to the report:

- RHI made a number of observations regarding the assumptions and methods used in the actuarial valuations. For the most part these observations were favorable and confirmed that the valuation of the HFRRF is following the applicable Actuarial Standards of Practice.
- RHI appears to have relied upon, and commented on, the 2010 experience study. We will note that the most recent experience study for the HFRRF was actually performed in 2013.
- RHI performed independent testing in order to replicate the results of the July 1, 2013 funding valuation, using summarized census data. RHI was able to replicate the results within an acceptable range using this method.
- In their replication results, RHI shows the percentage difference in Unfunded Actuarial Liability (UAL). Since this is a "leveraged" number, we do not feel that the percent difference is an appropriate measurement, and could be misleading.

Sincerely,



Ralph Marsh
Executive Director

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FEB 17 2016

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By Eloisa Mata at 12:23 pm, Jul 06, 2016



**Actuarial Audit Update for the City of Houston
Houston Firefighter's Relief & Retirement Fund
Revised Draft as of January 18, 2016**

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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 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 Retirement Horizons Inc. (RHI) to perform an Actuarial Audit Update for all three of the retirement systems sponsored by the City. 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 Update examined published actuarial funding valuation reports as well as actuarial experience reviews and other special studies as performed by the Funds over the most recent five-year period, including separate actuarial calculations performed for GASB Nos. 67 and 68 disclosures. The City of Houston provided the following information related to the HFRRF retirement system:

- 2010 Actuarial Experience Study.
- Actuarial Funding Valuation Report as of July 1, 2009.
- Actuarial Funding Valuation Report as of July 1, 2010.
- Actuarial Funding Valuation Report as of July 1, 2011.
- Actuarial Funding Valuation Report as of July 1, 2012.
- Actuarial Funding Valuation Report as of July 1, 2013.
- GASB 67 and 68 Accounting Valuation Reports as of June 30, 2015.

It is our understanding that the HFRRF Board did not perform a July 1, 2014 funding valuation. As RHI was unable to audit a 2014 funding valuation, the July 1, 2009 funding valuation was included in the audit to cover a full 5-year period. While an actuarial funding valuation is not required by statute every year by the statute, we strongly encourage the City of Houston to recommend the HFRRF Board continue performing annual valuations in following past practice since 2004.

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 Update report was prepared by RHI to assist the City of Houston with compliance under Section 802.1012 of the Texas government code and implementation of new GASB 68 financial disclosures. To prevent its potential misuse, it should not be distributed to any outside party without the express written consent of RHI.

Executive Summary

Highlights for HFRRF

In our opinion, the actuarial assumptions and methods used in the funding valuation as of July 1, 2013, as well as the subsequent GASB 67 and 68 accounting valuations as of June 30, 2015, are reasonable and consistent with generally accepted actuarial standards and practices. On an aggregate basis, plan experience over the study period has been fairly stable, with gains and losses on the actuarial accrued liability averaging less than 1.0% in recent years. However, we recommend the City of Houston work with the HFRRF Board to perform regular plan experience studies every 5 years. While the overall valuation model appears actuarially sound for now, our report notes some areas that we believe merit further review and careful monitoring by the City of Houston:

- ***Interest Rate Assumption:*** The HFRRF long-term assumption of 8.5% net of all expenses is the highest rate reported in the most recent Texas Pension Review Board (PRB) study of large municipal funds. Due to a general consensus of lower future expectations for investment returns by investment firms, the trend in recent years has been to lower this assumption. While we believe the long-term interest rate assumption is consistent with historical plan experience, it is at the high end of our best estimate range. We also recommend the City of Houston discuss with the HFRRF Board using an assumption that is net of investment management expenses only, with a separate explicit assumption for administrative expenses included with the Normal Cost. By adopting this approach, the funding valuation assumption will align with the new GASB requirements.
- ***Salary Scale Assumption:*** Based on the results of the 2010 experience study, salary increases had far exceeded the assumption over the study period with average salary increases of 13.8% per year over the study period compared to the 4.6% assumption. The Fund's actuary recommended increasing the salary scale assumption by 1 percentage point at each age, but the Board did not adopt the assumption. Given the decision not to modify the assumption, we must presume the past experience was determined to be a short term deviation, and that future experience would align better with the long-term assumption. While subsequent salary scale experience was not available, we did observe the payroll growth in recent years has reverted back to more normal levels and there were no years of any significant liability loss experience in the study period. We encourage the City of Houston to discuss with the HFRRF Board updating its plan experience study. In addition, we suggest the City of Houston request that the Board annually isolate the actuarial gain/loss attributable to salary scale experience in the funding valuation report.
- ***DROP Interest Crediting Rate:*** DROP account balances are annually credited with the average annual return from the prior 5 year period, with a minimum interest crediting rate of 5% and a maximum of 10%. While the valuation report does not specify the interest rate credited to DROP balances, we assume the valuation interest rate of 8.50% is used. Due to the asymmetrical corridor around the 8.50% expected return, we would expect the long-term DROP interest crediting rate to be 7.5% - 7.6% depending on the expected standard deviation of the Fund's investment returns. We suggest the City of Houston work with the HFRRF Board to review this assumption.

Executive Summary

- Mortality Assumption: HFRRF uses the RP 2000 Combined Healthy mortality tables with generational longevity improvement projected 10 years in the future using Scale AA. We suggest the City of Houston open discussions with the HFRRF Board regarding the merits of adopting the Society of Actuaries (SOA) RP 2014 mortality tables (healthy and disabled) with longevity projection using Scale MP-2014 or MP-2015. While these mortality assumptions were not published at the time the last experience study was performed, they reflect the most current SOA study of pension mortality. For example, we estimate adoption of the new RP 2014 blue collar tables with MP 2014 projection scale would increase total pension liabilities by 2-3%.

We also recommend the City discuss adoption of the RP-2014 Disabled mortality tables. As only the very largest plans would have sufficient exposure lives data to develop a credible custom disabled mortality table, we recommend use of a standard mortality table. Since this is not a major assumption, it is not anticipated to have a material effect on the results but would agree with generally accepted actuarial practice.

- Future Areas of Study: In reviewing the actuarial reports, there is no assumption disclosed regarding the period over which the DROP account is paid out following retirement. By default, the presumption is that the entire DROP is assumed to be paid immediately at retirement. If immediate payment of the DROP is the assumption, the City of Houston should work with the HFRRF Board to include additional study of the DROP payout experience in setting this assumption. If the DROP is already assumed to be paid out over a number of years, then we recommend disclosing this assumption in the report.
- Actuarial Communication: As described in the last section of this report, there are numerous disclosures required with actuarial reports and studies. On the last page of our report, we provide a few additional modifications in the actuarial valuation reports that may be helpful for the City.
- Assumption Review Meeting: As noted throughout this report, we encourage the City of Houston to work with the Board to review the long-term assumption basis used for the actuarial valuations. We recommend the City request a meeting with the Board each year prior to commencement of the valuation to discuss the current assumption basis. As the City uses the HFRRF Board's GASB valuation results for its financial accounting disclosures, this approach would allow the City to document its understanding of the assumptions used and determine the rationale for their use. In addition, this would allow the City an opportunity to provide input on the assumptions used for consideration by the Board.

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 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 and related accounting guidelines of the Governmental Accounting Standards Boards (GASB):

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
GASB No. 67	Financial Reporting for Pension Plans
GASB No. 68	Accounting and Financial Reporting for Pensions

We have confirmed that at least one of the individuals signing each report in the study period had the necessary professional credentials and was in compliance with the Society of Actuaries Qualification Standards for the 2013-2014 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 have met the “Qualification Standards for Actuaries Issuing Statements of Actuarial Opinions and are 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:

Retirement Horizons Inc.



Mickey G. McDaniel, FSA EA MAAA
Principal



David A. Sawyer, FSA EA MAAA
Consulting Actuary

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:

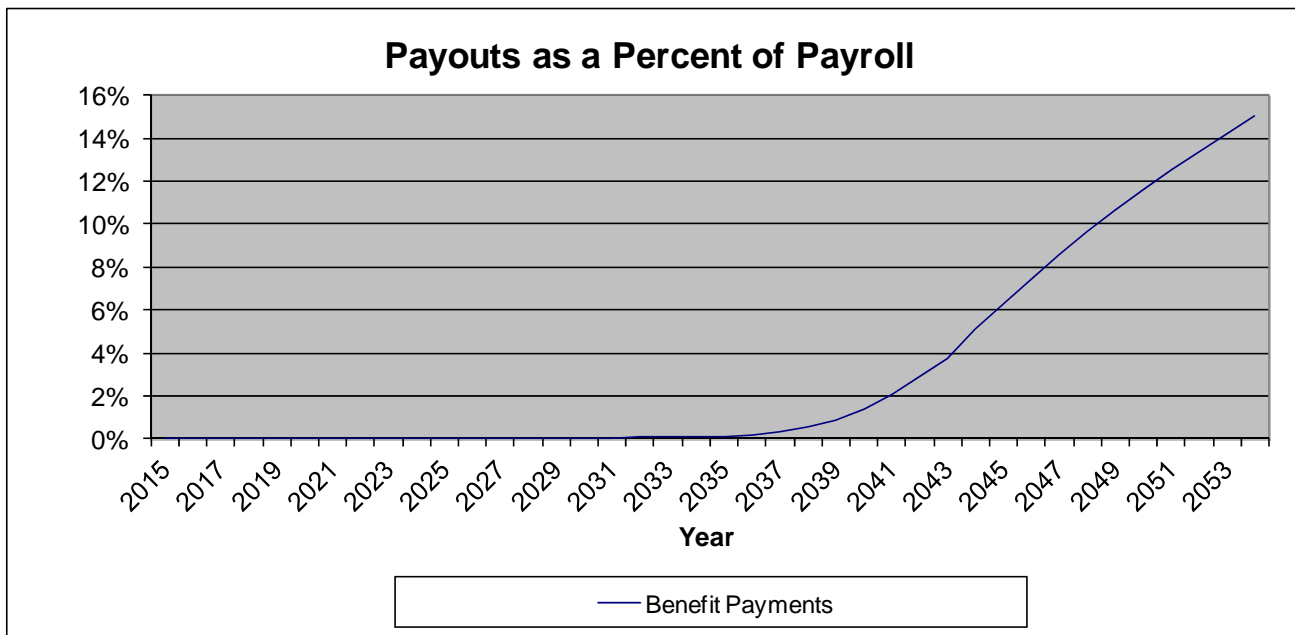
- ***Benefit Commencement Date:*** Pension plans typically do not pay benefits until after termination of employment, but the benefit commencement date can vary based on the reason for termination such as retirement, disability or death.
- ***Amount of Payment:*** The dollar amount of pension benefit 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 Deferred Retirement Option Plan (DROPs), the benefit is paid out with a combination of a DROP balance that subject to certain plan restrictions can be drawn down at the member’s discretion 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 growing exponentially as the total number of pensioners receiving benefits increases over time, compounded by ever higher average payment amounts due to the effects 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 from 0% to 15% of payroll over a 40-year period.



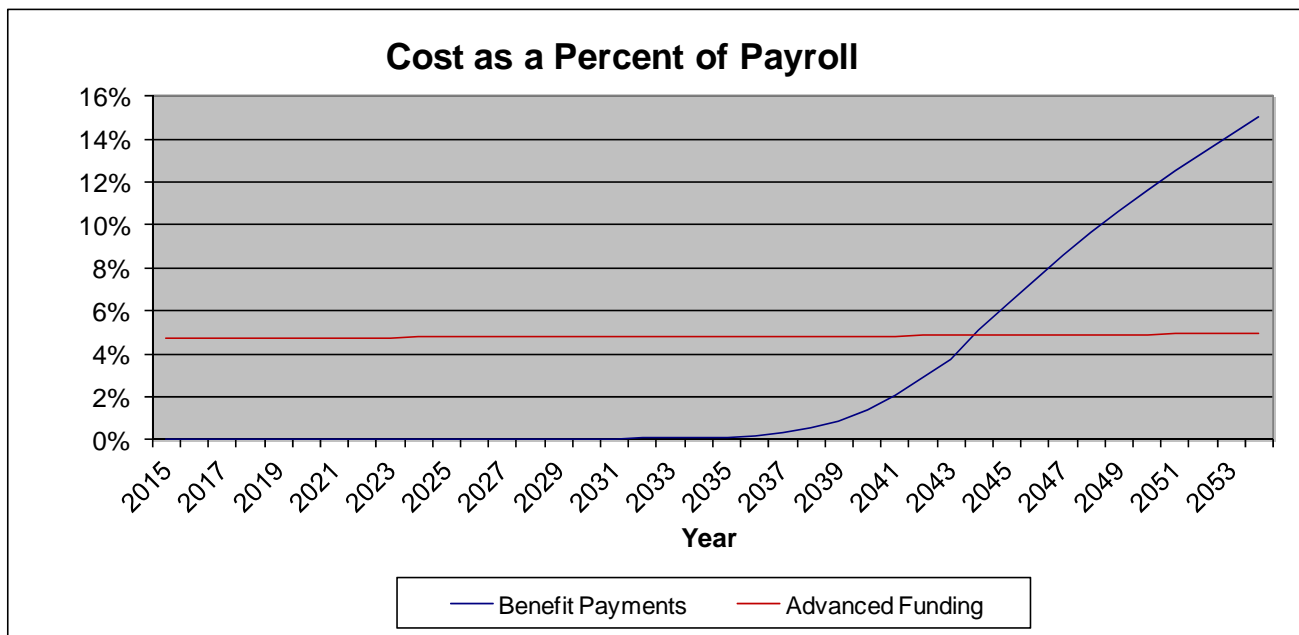
Under generally accepted accounting principles, pension benefits are viewed as a component of the compensation paid to an employee for services rendered during their period of active employment. The cost of future pension payments should be recognized over each employee’s working lifetime, so it is effectively borne by the generation of owners/taxpayers that benefit from the employee services rendered. The expense is accrued as a liability on the employer balance sheet, and then worked off as benefit payments are funded.

Pension Funding Overview

Advance Funding Characteristics

Recognizing the accounting liability on the balance sheet does not necessarily ensure the employer will have the cash required to fund the benefit payments down the road. Sound business 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 8.0% annual interest, will pay \$4,661 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

Actuarial Cost Method

In the actuarial valuation process, a mathematical model is created to project the future stream of plan benefits. The model incorporates current plan provisions and member census data, using the actuarial assumptions to predict future events. Discounting the stream of expected future benefit payments for the time value of money produces the *actuarial present value of projected benefits (PVB)*.

The *PVB* represents the hypothetical amount of plan assets necessary to fully fund all future plan costs for the current members, assuming future plan experience follows the actuarial assumptions over time. This measure of pension liability includes benefits that have not yet been earned for current employees, including the effect of expected future pay increases as well as projected service.

An actuarial cost method is basically a mathematical formula used to allocate the *PVB* over periods of employee service in a systematic fashion. The portion assigned as of the measurement date for the current year is referred to as the *normal cost (NC)*, and the cumulative portion allocated for employee service credit prior to the measurement date is referred to as the *actuarial accrued liability (AAL)*.

The *AAL* represents the expected value of plan assets that would have accumulated as of the valuation date, assuming contributions equal to the normal cost amount were made for all years of prior service credited under the plan. This measurement assumes that historical plan experience has been consistent with the current actuarial valuation basis – assumptions and methods, plan provisions and census data.

The *unfunded actuarial accrued liability (UAL)* equals the excess if any of the *AAL* over the value of plan assets. At the time a plan is first established, a *UAL* will exist if prior service credit is recognized for benefit accrual purposes, sometimes referred to as a past service liability. Over the life cycle of a mature retirement system, a *UAL* may also emerge due to plan improvements that credit past service, or actuarial losses from unfavorable plan experience compared to the long-term actuarial assumptions.

Any actuarially determined contribution produced by the actuarial cost method is basically equal to the normal cost plus amortization of the *UAL* over some period of time. There are a number of different actuarial cost methods that can be used under generally accepted actuarial standards of practice, each of which when properly applied will determine annual contribution requirements that will accumulate with interest to meet plan obligations for benefit payments and expenses as they come due. These cost methods differ in their application, however, in how quickly plan liabilities and assets accumulate over employee service periods.

Asset Valuation Method

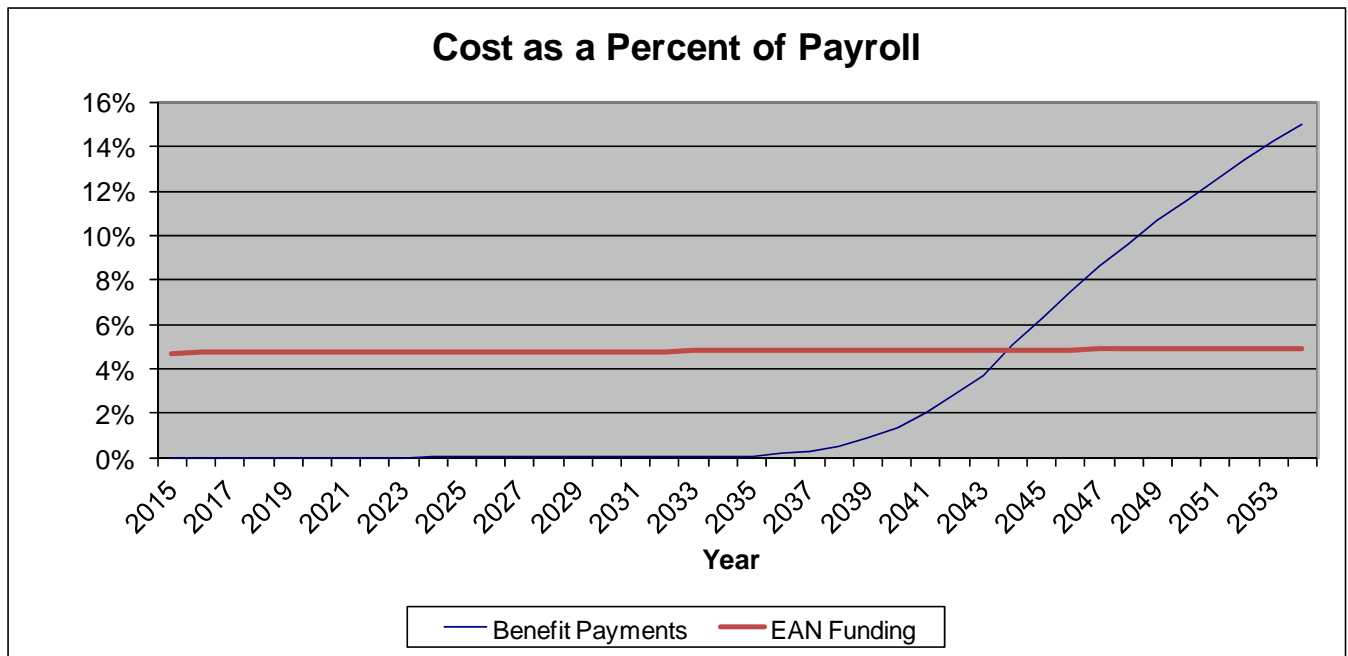
Professional Guidance

As outlined earlier, the actuarial cost method is used to allocate the PVB over periods of employee service in a systematic fashion. In some cases, use of a specific actuarial cost method is dictated by statute or financial accounting standards. For example, the Entry Age Normal method is prescribed under GASB Nos. 67 and 68, with special attribution period modifications required for plans which have a DROP benefit provision. For purposes of the funding valuation, HFRRF has the option of selecting from a number of cost methods and has selected the Entry Age Normal method. This method is an acceptable cost method under ASOP 4 for measuring pension obligations and cost for funding policy purposes.

Entry Age Normal Characteristics

As noted above, HFRRF uses the *Entry Age Normal Cost Method (EAN)* for measuring plan liabilities and developing contribution requirements. The Normal Cost under this method is the actuarial present value of the benefit accruals allocated to the current year, reflecting projected pay increases.

As illustrated below for a hypothetical new Fund, the funding pattern under EAN will produce larger dollar amounts of contribution in early years than pay as you go funding, but will remain fairly stable as a percentage of payroll.



Asset Valuation Method

Survey Data

In December 2014, the Texas Pension Review Board (PRB) published a comparison of 93 actuarially funded public retirement systems in Texas, including 16 large municipal retirement systems (all three City of Houston funds). As shown below, most systems used Entry Age Normal, but Projected Unit Credit was the next most popular cost method.

Actuarial Cost Methods	All Systems	Municipal Only
Entry Age Normal (EAN)	74	14
Ultimate Entry Age Normal	4	1
Projected Unit Credit (PUC)	9	1
Unit Credit	4	0
Aggregate	2	0
Total	93	16

GASB 67 and 68

As noted above, GASB Nos. 67 and 68 prescribe the use of the Entry Age Normal cost method, with special attribution period modifications required for plans which have a DROP benefit provision. We have received confirmation from the HFRRF actuary that the cost method was applied in accordance with the accounting standards. We have also performed some independent testing of the accounting valuation results, and found the movement in actuarial liabilities and normal cost (compared to funding valuation results) were reasonable and consistent with our expectations.

Conclusions

For funding policy measurements, the *EAN* actuarial cost method is reasonable and appropriate for measuring plan obligations and cost. Given the mature and stable active population in the HFRRF system, this method should produce contribution patterns that are reasonably level and predictable as a percentage of covered payroll across generations of tax payers.

Based on the PRB study, EAN is by far the most prevalent cost method used. As the GASB 67 and 68 standards now prescribe the use of the EAN cost method, we anticipate some of Funds currently using one of the other cost methods for funding policy measurements will switch to the EAN cost method.

Asset Valuation Method

Fair Market Value

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.

Actuarial Value of Assets

The *actuarial value of assets (AVA)* for HFRRF is calculated as the fair market value as of the measurement date, with deferred recognition of investment gains and losses (compared to the 8.5% long-term assumption) amortized straight-line over 5 years. Effective with the July 1, 2013 valuation, past investment gains and losses were fully recognized by resetting the Actuarial Value of Assets to the Fair Market Value of Assets as of July 1, 2013. Future gains and losses will be amortized straight-line over 5 years.

Professional Guidance

The GASB Nos. 67 and 68 standards require the use of the fair market value of assets, but for funding policy purposes there is no prescribed method and the Fund should adopt a method that complies with generally accepted actuarial practice.

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.

Asset Valuation Method

Survey Data

Based on the 2014 Texas Pension Review Board survey, over 80% of the retirement systems in Texas used some variation of smoothing method, with about 70% of them using a 5 year period. Of the 16 large municipal Funds in the survey, 88% used some variation of smoothing with 63% using a 5 year period.

Actuarial Asset Methods	All Systems	Municipal Only
5-Year Smoothing	65	10
Market Value (MVA)	17	2
10-Year Smoothing	2	1
3-Year Smoothing	1	1
4-Year Smoothing	1	0
Other	7	2
Total	93	16

GASB 67 and 68

For GASB 67 and 68, asset smoothing is not permitted and the fair market value is the prescribed asset method. The HFRRF GASB 67 and 68 reports used the fair market value as required.

Conclusions

In our opinion, use of a 5-year smoothing method for investment gains and losses is reasonable and appropriate for determining the actuarial value of assets for HFRRF. This method is also consistent with relevant actuarial practice standards and clearly in line with best practices of other large public sector retirement systems.

As noted above, the Actuarial Value of Assets was refreshed to the Fair Market Value for the July 1, 2013 valuation, but future gains and losses will be amortized straight-line over 5 years. While changes to the asset method are made based on the objectives of the measurement, the Actuarial Value of Asset methodology should not have a systematic bias towards overstatement or understatement compared to the Fair Market Value. The City of Houston should work with the Board to prevent a bias towards overstatement which could occur indirectly by refreshing to Fair Market Value only in years in which the Fair Market Value exceeds the Actuarial Value of Assets.

Actuarial Contribution Rate

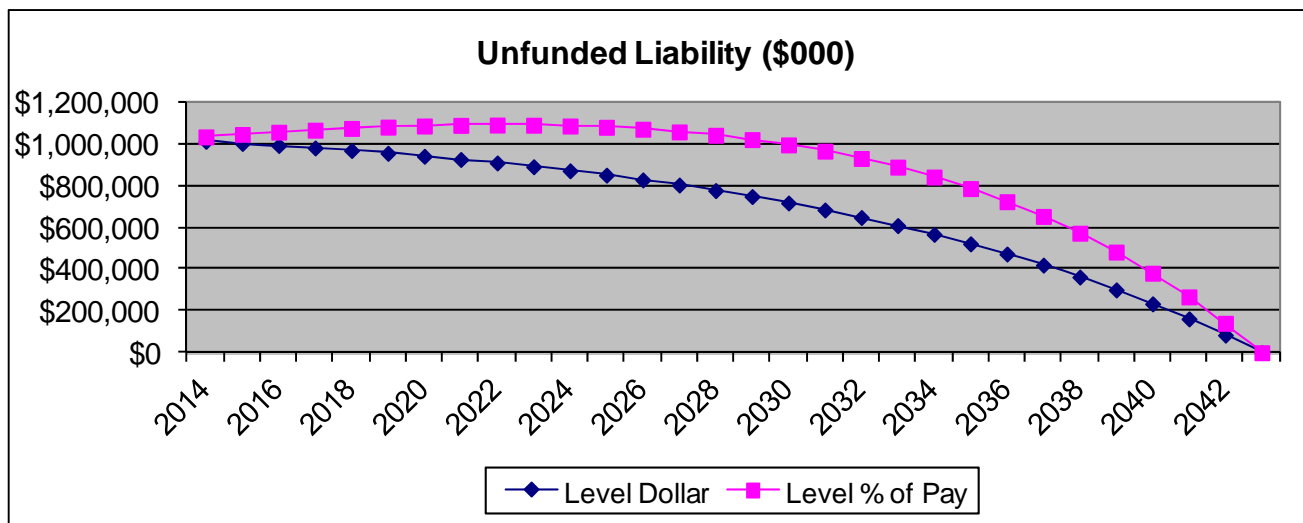
Introduction

The actuarially determined contribution rate produced by the actuarial cost method is basically equal to the normal cost plus amortization of the *Unfunded Actuarial Liability (UAL)* over a reasonable time period. 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.

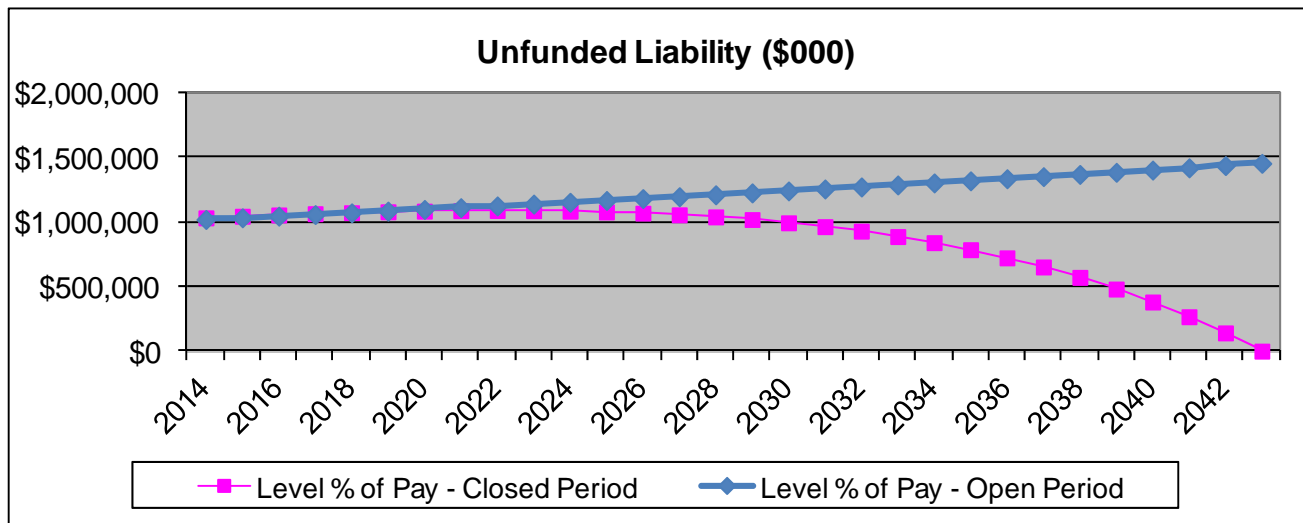


Actuarial Contribution Rate

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, 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.



Professional Guidance

In the spirit of generally accepted accounting and actuarial principles that attribute pension cost to periods of employee service, the amortization period should generally not extend beyond the average future working lifetime of the active employees covered by the plan. Texas PRB guidelines require funding to be adequate to amortize the *UAL* over a period not to exceed 40 years, with 15 to 25 years being the preferred target.

Actuarial Contribution Rate

Survey Data

Based on the PRB survey, more than 80% of systems surveyed currently use the level percentage of pay amortization method, and 90% of the systems use open period amortization. For the 16 municipal systems, it appears all use some form of the level percentage of pay amortization method with the time period open or recalculated each year.

Amortization Methods	All Systems	Municipal Only
Level % Recalculated	53	12
Level % Closed	6	0
Level % Open	17	4
Level \$ Recalculated	9	0
Level \$ Closed	3	0
Level \$ Open	5	0
Total	93	16

GASB 67 and 68

The GASB Nos. 67 and 68 standards have separated the notion of the funding of the pension promise from the accounting cost. Under the new GASB rules, changes in the Net Pension Liability must be recognized more rapidly than those historically used in the calculation of the actuarially determined contribution rate:

- Full and immediate recognition of plan changes and benefit improvements.
- Plan investment gains and losses amortized over 5 years.
- Plan liability gains and losses amortized over average future working lifetime.
- Impact of assumption changes amortized over average future working lifetime.

Conclusions

HFRRF uses the level percent of pay method, with 3.00% annual growth in total payroll and 30-year open period amortization. In our opinion, this approach is reasonable and appropriate for the HFRRF retirement system, producing funding patterns that are stable and predictable as a percentage of payroll across generations of taxpayers. This method is also consistent with relevant ASOP guidelines, as well as the best practices of other large public sector retirement systems.

Economic Assumptions

Interest Rate

The interest rate is the most powerful assumption in the actuarial funding valuation, used to project the average rate of return expected on assets, and often also used to discount future benefit payments in the actuarial present value calculations (similar to the cost of capital model used in business finance). To illustrate the sensitivity, a one-percentage-point *increase* in the interest rate assumption will generally *decrease* plan liabilities and cost about 15% to 20% based on plan demographics.

Throughout the study period, HFRRF has retained a long-term interest rate assumption of 8.5% (net of all expenses) for the funding valuations. Based on the historical CAFR data published by HFRRF, we have independently calculated annual rates of return on the fair market value of assets under the dollar-weighted method net of all expenses, assuming mid-year cash flows.

As summarized below, actual returns met or exceeded the 8.5% assumption 3 out of the last 5 years, with an annual rate of return averaging 9.9% over the period ended June 30, 2015. Expanding the study period to include the financial market crisis of 2008-2009, the HFRRF average annual rate of return was 7.3% for the last 10 years and 8.7% over the 20 year period ended June 30, 2015.

Rate of Return	1-year	5-year	10-year	15-year	20-year
2015	1.1%	9.9%	7.3%	7.2%	8.7%
2014	17.2%	13.1%	9.0%	7.8%	9.0%
2013	11.0%	4.6%	9.0%	7.0%	
2012	1.6%	3.1%	8.5%	7.1%	
2011	20.0%	6.0%	8.0%	8.4%	
2010	16.8%	4.8%	5.8%	8.3%	
2009	-20.9%	5.0%	5.2%	7.6%	
2008	3.4%	13.6%	8.2%		
2007	16.4%	14.1%	9.1%		
2006	13.8%	10.0%	9.7%		
2005	17.4%	6.8%	10.1%		
2004	17.5%	5.4%	9.0%		
2003	5.6%	3.0%			
2002	-3.0%	4.3%			
2001	-1.6%	9.3%			
2000	9.7%	13.5%			
1999	4.8%	12.6%			
1998	12.6%				
1997	22.5%				
1996	18.6%				

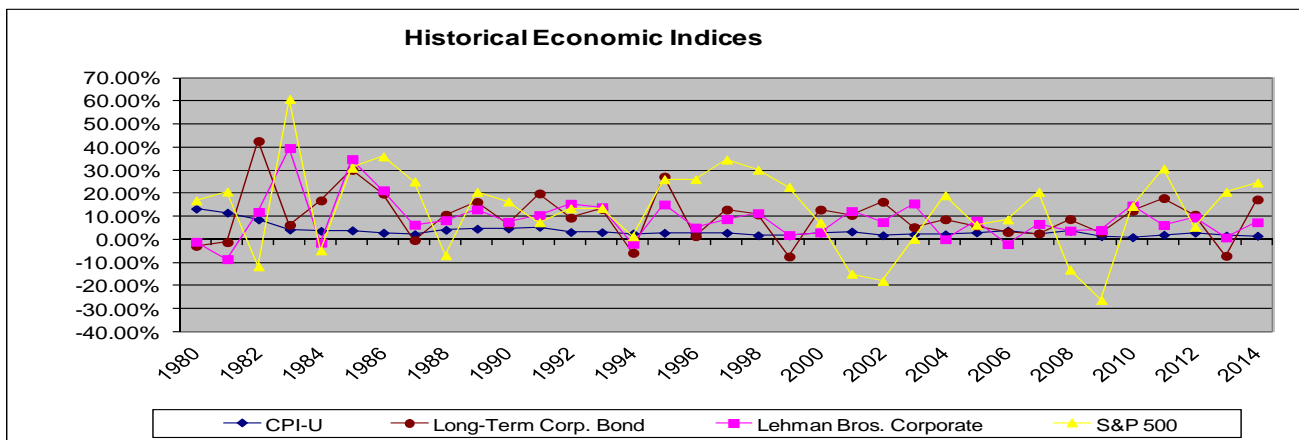
Economic Assumptions

Professional Guidance

Under generally accepted actuarial principles, each individual assumption should represent a best estimate of expected long-term experience, sometimes referred to as “explicit” assumptions, and also be reasonable and realistic on a combined or “aggregate” basis. ASOP No. 27 provides a framework for the actuary in providing advice on development of economic actuarial assumptions, but makes an important distinction that the Board is ultimately responsible for final selection of these assumptions.

Because no one knows for certain what the future holds with respect to volatile financial markets and a dynamic global economy, ASOP No. 27 emphasizes the use of professional judgment to develop a best estimate for each economic assumption. The standard recommends use of a building-block approach, with the interest rate assumption made up of three basic components:

- **Inflation:** General inflation is the foundation of any economic assumption, with the most common measurement being the Consumer Price Index for all Urban Consumers (CPI-U) as reported by the U.S. Bureau of Labor Statistics. As illustrated in the graph below, CPI-U has averaged 3.62% over the last 35 years, ranging from a low of 0.97% to a high of 13.3% during that period.
- **Risk-Free Return:** The risk-free rate of return is measured as the spread between Long-term U.S. Treasury investments and the inflation rate for the same measurement period. The nominal rate of return on Long-term U.S. Treasuries has averaged 10.15% over the last 35 years, with the risk-free return spread averaging 6.53%. It is important to note the spread is not always positive, ranging from -16.13% to 33.96% during that time period with significant volatility.
- **Risk Premium:** The risk premium is measured as the spread between the rate of return the plan expects to earn from its investment strategy in excess of the risk-free nominal rate. The average risk premium has been a negative 1.29% over the last 35 years for the Lehman Brothers Corporate Bond Index, compared to 3.15% for the S&P 500 Stock Index, although both show significant volatility over time.



Economic Assumptions

In setting the interest rate assumption, the historical experience is reviewed and considered, but the assumption should be based on the future expectation for these components. The sum of all three components, based on their effect on the asset allocation, equals the total rate of return for the Fund.

Given the cyclical nature of the financial markets, the choice of time period can have a significant impact on the relative values of the historical indices and conclusions drawn about the underlying economic variables. For example, while inflation has average 3.62% over the last 35 years, it has averaged only 2.4% over the last 20 years. As illustrated by the difference in risk premium between the fixed income and equity indices above, investment policy and asset allocation strategy of the retirement system should also be considered in setting the interest rate assumption.

Please note revisions to ASOP 27 were recently adopted and apply to measurements occurring on or after September 30, 2014. The new standard replaces the best-estimate range concept in determining the reasonableness of an assumption with the requirement that in the actuary's professional opinion the assumption is appropriate for the purpose used, considers relevant historical data, reflects the actuary's estimate of future experience, and is expected to have no significant bias.

Survey Data – Texas PRB

Based on the 2014 Texas Pension Review Board (PRB) survey of public sector retirement systems in Texas, the median interest rate assumption was 8.00%, ranging from a low of 4.0% to a high of 8.5%. For the 16 large municipal systems, the median interest rate assumption was 7.75%, but the range of 7.25% to 8.50% was much smaller.

As the recent trend has been to lower the interest rate assumption, an update to this survey is expected to show further reductions. It is also worth noting that only 2 of the municipal retirement systems in the study use an interest rate greater than 8.0% (HMEPS and HFRRF from City of Houston).

Interest Rate – Texas PRB Survey	All Systems	Municipal Only
Less than 7.00%	4	0
7.00% - 7.24%	10	0
7.25% - 7.49%	5	2
7.50% - 7.74%	17	3
7.75% - 7.99%	15	4
8.00% - 8.24%	33	5
8.25% - 8.49%	5	0
8.50%	4	2
Total	93	16

Economic Assumptions

Survey Data – NASRA

The Public Fund Survey published by the National Association of State Retirement Administrators (NASRA) provides some insight into actuarial assumptions used by governmental retirement systems. The most recent report for FYE 2013 includes data for over 100 retirement systems representing over \$2.86 trillion in assets and 20.8 million members – 85% of the public sector pension universe.

Based on the NASRA survey, the most common interest rate assumption was 8.0%, ranging from a low of 6.5% to a high of 8.5%. Based on commentary from the survey, the trend has been a reduction in this assumption with the median rate dropping from 8.00% in prior surveys down to 7.75%.

Interest Rate – NASRA Survey	Number	Percentage
Less than 7.00%	4	3%
7.00% - 7.24%	5	4%
7.25% - 7.49%	7	6%
7.50% - 7.74%	29	23%
7.75% - 7.99%	20	16%
8.00% - 8.24%	55	43%
8.25% - 8.49%	4	3%
8.50%	2	2%
Total	126	100%

GASB 67 and 68

Under GASB 67 and 68 accounting guidelines, the long-term interest rate assumption is generally used to discount the benefit payments for years in which the projected assets are sufficient to pay expected benefits due that year. However, for years in which the projected assets are not sufficient to cover the expected benefit payments, the shortfall is discounted using a high quality municipal bond index rate.

An effective composite discount rate is then developed based on these discounted benefits, which is equal to the single discount rate that if used on all projected benefit payments would result in the same present value as the sum of the benefit payments discounted using the two separate discount rates. If the projected assets are sufficient to pay all future benefit payments, then the single effective discount rate is simply the long-term interest rate assumption.

To demonstrate asset sufficiency, a projection of assets, contributions, expenses, and benefit payments is performed. The HFRRF GASB 67 report includes this illustration demonstrating that plan assets are projected to be sufficient to pay all future benefit payments, provided the City of Houston continues to fund the actuarially determined contribution rate, resulting in a discount rate equal to the long-term interest rate assumption of 8.5% net of investment expenses.

Economic Assumptions

Conclusions – Interest Rate

As summarized earlier, actual returns met or exceeded the 8.5% assumption 3 out of the last 5 years, with an annual rate of return averaging 9.9% over the period ended June 30, 2015. Expanding the study period to include the financial market crisis of 2008-2009, the average annual rate of return was 7.3% for the last 10 years and 8.7% over the 20 year period ended June 30, 2015.

The 8.50% interest rate assumption is determined based on capital market expectations and the target asset allocations from its investment policy. As this is the most important assumption in the actuarial model, we find it curious that this assumption was absent from the 2010 experience study. However, the GASB 67 report did include target asset allocations and long-term expected rates of return for each asset class that appear somewhat optimistic compared to capital market expectations published by investment consulting firms such as JP Morgan's 2015 long-term capital market return assumptions. In fact, using the information from the GASB 67 report would suggest an expected return of almost 9.50% if actually realized.

After adjusting for the 3% inflation assumption, the real rate of return (8.5% - 3.0%) would equate to 5.5%. Compared with the other large Texas municipal funds, the HFRRF real rate of return is about 100 basis points higher than the 4.50% average for the other funds.

In light of the survey information and future capital market expectations from a number of investment consulting firms, the HFRRF interest rate assumption of 8.5% net of all expenses appears optimistic. However, as the actual returns over the last 20 year period support the 8.50% net of all expenses assumption, it could be considered reasonable if the Board believes the past investment strategy is expected to replicate similar returns in the future. As review of this assumption was not included in the 2010 experience study, we recommend the City of Houston work with the Board to review this critical assumption. While historical performance actually exceeded 8.50% over the past 20-year period, this is a forward looking assumption and should not rely exclusively on past experience.

Salary Scale

The salary scale used to project expected future pay increase for active members is also an important economic assumption used in the actuarial valuation model for pay-related plans, having about 50% to 75% of the impact that would result from a change in the interest rate assumption of similar magnitude (since it applies to the active employee portion of pension obligations only).

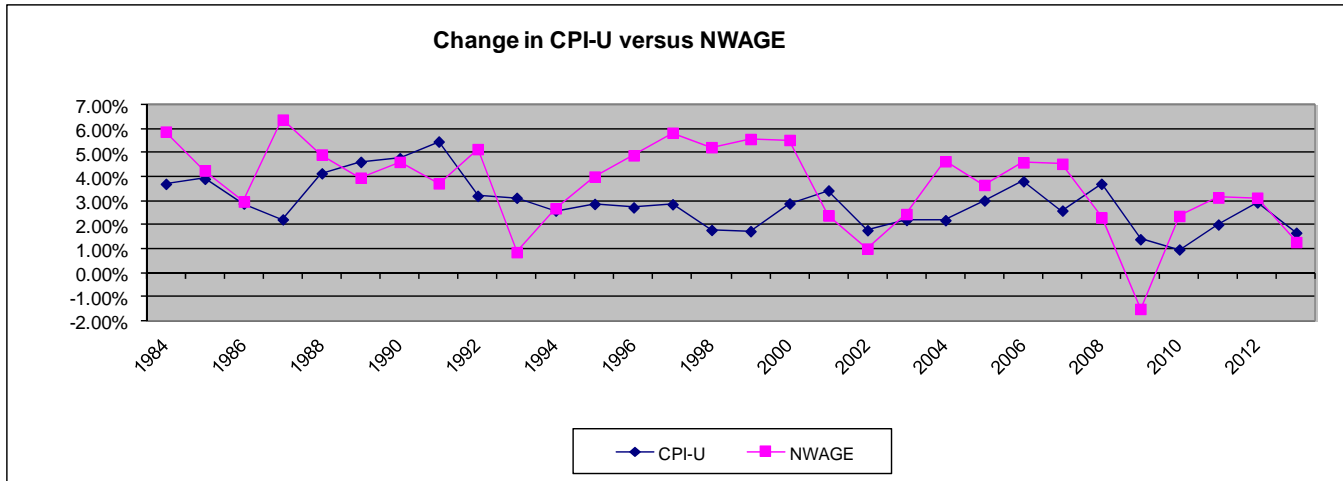
HFRRF currently uses a baseline nominal salary scale assumption of 3.0% (inflation) plus a merit and promotion scale grading down from 4.0% at age 20 to 0.0% at age 55.

Economic Assumptions

Professional Guidance

Similar to the approach for selecting the interest rate assumption, ASOP No. 27 recommends use of a building-block approach, with the salary scale assumption made up of an underlying inflation rate and two other basic components:

- **Productivity Growth:** Changes in pay levels due to change in the real value of goods and services per unit of work, reported by the Bureau of Labor Statistics as the National Average Wage and Salary Index (NWAGE). As the chart below illustrates, the NWAGE nominal rate averaged 3.68% over the 30 years from 1984 to 2013, ranging from a low of -1.51% to a high of 6.38% during that period. The spread between NWAGE and CPI averaged 0.78% over the same period, from a low of -2.90% to a high of +4.16%, but as shown below this spread has recently been much lower.
- **Merit Scale:** In addition to inflation and productivity growth, employees also receive pay increases due to factors that vary by employer and individual circumstances such as base pay and incentive compensation programs, collective bargaining agreements, competitive industry demands, personal performance, promotion, seniority and other factors. The merit scale component tends to be higher during the early to middle stages of an individual's career, then tapering off during the later years.



Survey Data

Salary scale information was not included in the NASRA and PRB surveys. Because this assumption is heavily dependent on the merit component of the covered members' profession, comparison to survey information may be misleading. For this reason, this assumption is often created based on long-term inflation and productivity component plus a merit component determined based on plan experience.

Economic Assumptions

Conclusions – Salary Scale

We understand the salary scale assumption was reviewed in the 2010 experience study, and the salary increases were significantly higher than the assumption. While the HFRRF actuary recommended increasing the salary scale by 1% at every age, the Board did not adopt the recommendation. This may have been a reasonable result if the Board determined the experience from the 2010 experience study was due to short term circumstances, and that the future salary increases would better align with the current assumption. While we are not aware of any subsequent review of salary scale experience, we did observe the average annual salary growth was as high as 9.2% for fiscal year ending June 30, 2006, but has not exceeded 3.8% in any year since the experience study was completed.

The current salary scale assumption used by HFRRF is consistent with the basic building block model of ASOP No. 27, with a baseline rate of 3.00% (3.00% inflation and 0.00% productivity growth) plus a merit and promotion scale grading down from 4.00% at age 20 to 0.0% at age 55. Given the results of the 2010 experience study, this assumption should be reviewed to determine if actual experience subsequent to 2010 has normalized to again align with the current assumption.

We encourage the City of Houston to discuss with the HFRRF Board when changes to hiring and compensation practices are under consideration, and to continue regular plan experience study updates to verify the salary scale assumption remains on track and consistent with City budget projections. In addition, we suggest the City of Houston request that the Board annually isolate the actuarial gain/loss attributable to salary scale experience as part of the annual funding valuation report.

Payroll Growth

The assumption used to project growth in total payroll for calculating amortization of the *UAL* should not necessarily be the same as the salary scale assumption. Individual employees may experience this rate of pay growth as they progress through their careers, but employees exiting the workforce (due to termination, retirement, etc.) will in effect be replaced by lower paid entry level employees. Assuming the total number of employees remains constant (i.e. no increase in head count), the net growth in total payroll will generally be less than the salary scale assumption and closer to the assumed inflation rate.

Conclusions – Payroll Growth

Based on historical data provided in the most recent actuarial report as of July 1, 2013, the actual rate of payroll growth averaged 4.2% per annum over the last 20 years, and 2.6% per annum over the last 5 years. After adjusting for growth in the active membership, the payroll growth was 3.0% over the last 20 years, and 3.3% over the last 5 years.

HFRRF uses a payroll growth assumption of 3.00% per annum, same as the underlying assumed rate of inflation, which is consistent with the building block approach of ASOP No. 27 and appears reasonable based on recent experience.

Economic Assumptions

DROP Interest Credit

DROP account balances are annually credited with the average annual return from the prior 5 year period, with a minimum interest crediting rate of 5% and a maximum of 10%. While the valuation report does not specify the interest rate credited to DROP balances, we assume the valuation interest rate of 8.50% is used.

For a typical pension fund with an 8.50% expected rate of return assumption, we would expect the distribution of the returns to have a standard deviation of at least 11%. For such a fund, Monte Carlo simulation can be performed in setting this assumption. Due to the asymmetrical corridor around the 8.50% expected return, and we would expect the long-term DROP interest crediting rate to be 7.5% - 7.6%. We suggest the City of Houston work with the HFRRF Board to review this assumption.

Demographic and Other Non-Economic Assumptions

Introduction

The population of participants covered by a retirement system and the benefits they receive are directly impacted by unknown future contingencies such as employee termination, retirement, disability and death. Under generally accepted actuarial practices, the probability of each one of these outcomes can be projected using decrement tables to predict changes in employee status which may depend upon parameters such as age, service, gender, health status, occupation, or calendar year. In some cases, point estimates (100% probability of the event at a specific point in time) may be more appropriate.

For example, using a standard mortality table, the probability of death within the next year is .00097 for a male age 45, increasing to .00828 for a male age 65. Of course in the real world, you cannot have .00828 deaths; the number is either zero or one. However, increasing the sample population size from 1 to 100,000 gives a more meaningful number of 828 expected deaths for males age 65.

In addition to these demographic-type assumptions, other non-economic assumptions are necessary to predict election of optional forms of benefit – for example plans like HFRRF that include a Deferred Retirement Option Plan (DROP) – or to factor in the probability of ancillary benefit payments to a surviving spouse or other dependent.

Professional Guidance

ASOP No. 35 requires the actuary to use professional judgment in the selection of demographic and other non-economic actuarial assumptions considering the relevant universe of possible choices. It also directs the actuary to consider the specific characteristics of the particular benefit provisions and covered group of the plan being valued.

Reasonable demographic assumptions are defined as those that are expected to appropriately model the contingency being measured without producing any significant cumulative actuarial gains and losses over the measurement period. ASOP No. 35 encourages the use of more sophisticated approaches if appropriate for the situation (e.g. large plans) while also acknowledging that simplified techniques may actually be more accurate in other situations (e.g. small plans).

Demographic and Other Non-Economic Assumptions

Mortality Assumption

Even for a large retirement system such as HFRRF, the number of plan participants covered may not necessarily represent a fully credible size population for development of a plan specific mortality table. The Society of Actuaries (SOA) performs comprehensive studies of mortality experience in the United States, and has published a number of standardized mortality tables over the years. The two most recent studies of mortality experience produced the following tables commonly used today:

- *RP-2000 Mortality Table*: Initially, developed to measure the Current Liability reported to the IRS for uninsured pension plans per the Retirement Protection Act of 1994.
- *RP-2014 Mortality Table*: Developed as an update to the RP-2000 mortality study with the underlying mortality experience again based on uninsured pension plans. Based on the results of this study, the population experienced longevity improvements even greater than expected.

The SOA studies include a variety of mortality tables within each study for consideration, for example a set of blue collar mortality rates that reflect shorter life expectancy for those with stressful, physically demanding, and potentially dangerous jobs. In addition, both SOA studies include a set of disabled mortality tables for pension funds that offer these ancillary disability benefits.

While blue collar mortality tables are often applied in valuations of public safety employee retirement systems, a number of actuaries have asked for the SOA to perform a specific mortality study for these special groups. The SOA has formally acknowledged this is an important segment of the population that deserves further research, and they have begun the process of gathering data to perform this study. The preliminary results of the study will not be available for several years, but we encourage the City of Houston to work with the HFRRF board to consider the results of this forthcoming study as soon as it is published.

Very few U.S. retirement programs are large enough to develop fully credible mortality tables based exclusively on the plan's own experience. The selection of appropriate mortality assumptions for most pension funds relies on standard tables, typically developed by the SOA. Depending on the size and demographic characteristics of the covered population, one or more of these standard tables could be used without adjustment, with appropriate loads, or as the reference table for credibility-weighted blended mortality rates.

Because the number of disabled members is a small percentage of the member population, fully credible fund specific mortality experience for the disabled population is extremely rare. For this reason, generally accepted actuarial practice would rely heavily on the disabled mortality experience from a standard table such as the SOA studies.

Demographic and Other Non-Economic Assumptions

Longevity Improvement Assumption

ASOP No. 35 provides some specific guidance for the selection of mortality assumptions, including consideration of the likelihood and extent of longevity improvement in future years. Both modern standard tables include longevity improvement scales through their respective creation dates, and the studies for each recommend that future longevity improvements be used in practice. This longevity projection can be accomplished using a generational table in which the mortality varies by age and year of birth. As creation of a projection scale requires significantly more experience data, all but the very largest funds will generally rely on a standard projection scale.

Projecting longevity improvements is not a new concept, but due to actuarial software limitations the use of generational mortality tables has not been part of main stream actuarial practice until recently. Due to modern updates in actuarial software, generational longevity projections are replacing prior approaches used to estimate of the effect of longevity improvement.

Several years after publishing the RP-2000 mortality study, the SOA began the process of updating this mortality study. Preliminary results indicated that longevity improvements were significantly higher than the original projections from using Scale AA. Prior to publishing the final results for RP-2014, the SOA released an interim longevity improvement Scale BB. As part of the RP-2014 study, the SOA released Scale MP-2014 which is intended to replace the interim Scale BB. Finally, earlier this year the SOA released Scale MP-2015 with updated experience which indicated a modest reversal in the trend of mortality improvement.

HFRRF Mortality Assumption

For healthy members, HFRRF adopted the gender distinct RP-2000 Combined Healthy mortality tables with projections to year 2023 using Scale AA. HFRRF currently uses the same mortality basis for active and post-retirement members.

For disabled lives, the report disclosed sample rates but they do not appear to align with recent SOA studies of disabled mortality. As shown below, the sample rates are 25% - 50% higher than the rates from the male RP 2000 Disabled Mortality Table, and double (or more) the rates from the male RP 2014 Disabled Mortality Table.

Age	Sample Mortality Rates	RP 2000 Disabled Mortality	RP 2014 Disabled Mortality
20	2.3	0.0	0.7
30	2.9	2.3	0.8
40	3.1	2.3	1.1
50	4.1	2.9	2.0
60	6.5	4.2	2.7

Demographic and Other Non-Economic Assumptions

Conclusion

In reviewing the mortality basis used for healthy lives over the study period, we believe the mortality assumption used was reasonable and based on generally accepted actuarial practice. Recognizing that the RP-2014 study was not formally published until October 2014, we suggest the City of Houston discuss the findings of this new study with the HFRRF Board before the next valuation. We would also note that the RP-2014 study did not publish a set of Combined Healthy mortality tables, but rather a separate set of mortality tables applicable for active and retired participants.

As noted above, HFRRF is currently using the Scale AA longevity projection scale for all purposes. Even prior to publishing the RP-2014 mortality table, the SOA published projection scale BB because Scale AA was not tracking well with observed mortality improvement. Now that the MP-2014 and MP-2015 projection scales are available, we anticipate they will become the standard of practice in the near future. With all other variables held constant, we estimate adoption of the RP-2014 blue collar mortality tables with MP-2014 generational longevity improvement scale would increase pension liabilities and costs about 2-3%.

As previously mentioned, the current disabled mortality assumption has higher rates of mortality than the SOA's standard RP 2000 and RP 2014 disabled mortality rates. As there is not enough experience to create a custom mortality table that would be fully credible, generally accepted actuarial practice would be to use a standard disabled mortality table. As the current assumption has been in effect for many years, we encourage the City of Houston to discuss adopting the new RP-2014 Disabled mortality tables with the Board to reflect the most recent findings. As this is not a major assumption, it is not anticipated to have a material effect on the results but would reflect recent trends in mortality improvement for the disabled population.

Demographic and Other Non-Economic Assumptions

Retirement Assumption

While use of standardized tables is appropriate to predict the probability of death, other demographic assumptions are more often customized based on the particular plan provisions and population being valued. For example, an employer can encourage early retirement with generous “subsidized” pension plan benefits, or provide incentive to continue working by offering even higher rates of benefit accrual at later age/service levels to retain experienced workers. Other employer provided benefits such as retiree medical coverage, along with eligibility for Social Security and Medicare benefits can impact the timing of employee retirements.

HFRRF currently uses a service based table to predict incidence of retirement with rates varying by years of service.

Years of Service	Retirement Rates
20-24	1%
25-29	5%
30-34	15%
35-36	25%
37	30%
38	35%
39	40%
40+	100%

The retirement rates were updated with the July 1, 2010 valuation based on recommendations from the 2010 experience study. A subsequent update to the retirement rates for long service employees were adopted with the July 1, 2013 valuation based on recent experience. As noted above, use of custom tables is appropriate for this assumption and should generally align with recent experience unless there are reasons that the recent experience is not representative of future expectations. The current set of retirement rates appears reasonable and consistent with generally accepted actuarial practice.

Demographic and Other Non-Economic Assumptions

Termination Assumption

HFRRF uses a custom age based table to predict the probability of employee termination prior to retirement eligibility. By private sector standards the termination rates are fairly low, ranging from less than 2% at age 20 and then gradually declining to 0% at age 50. For employees hired around age 27 (average entry age), there is about a 9.5% probability the member will terminate before earning the minimum 10-years of service required for a vested pension. Based on the employee age/service distribution in the 2013 actuarial report indicating slightly fewer than 2,800 active employees with less than 20 years of service, we would expect about 20 employee terminations per year. In reviewing the reconciliation exhibits in the actuarial reports, the number of terminations over the audit period has average about 16 per year with some years below 20 and others above 20. Given these results, the assumption appears reasonable.

The current termination assumption has been used for at least 10 years, and appears consistent with generally accepted actuarial practices. Actual experience from the 2010 experience study confirmed it remained a reasonable assumption and no change was recommended. Although the turnover assumption is not as powerful in the actuarial valuation model as the mortality table or retirement rates, we suggest the City of Houston work with the HFRRF Board to include this assumption as part of regular experience study updates every 3-5 years.

Disability Assumption

HFRRF uses a custom age-based table to predict the probability of employee disability, with age-based graduated percentages of them assumed to be duty-related benefits and non-duty related. Disability rates range from 0.75% at ages 20-30, increasing to 3.00% by age 60. For example, employees hired around age 27 (average entry age) have about a 23% probability of becoming disabled before completing the full 20-years of service required for a service related pension. Based on the employee age/service distribution in the 2013 actuarial report indicating slightly fewer than 2,800 active employees with less than 20 years of service, we would expect around 35 employee disabilities per year. In reviewing the reconciliation exhibits in the actuarial reports, the number of disabilities over the audit period has averaged about 20 per year. Given these results, this assumption could be modified to lower the rate of disability incidence.

The current disability assumption has been used for at least 10 years, and appears consistent with generally accepted actuarial practices. Actual experience from the 2010 experience study showed the assumed rates to be high compared with recent experience, but confirmed it remained a reasonable assumption and no change was recommended. Although the disability assumption is not as powerful in the actuarial valuation model as the mortality table or retirement rates, we encourage the City of Houston to work with the HFRRF Board to include this assumption as part of regular experience study updates every 3-5 years.

Demographic and Other Non-Economic Assumptions

Other Non-Economic Assumptions

In addition to the principal economic and demographic assumptions outlined above, there are a number of other non-economic assumptions used in the actuarial valuation model. Below is a summary of the more significant other non-economic assumptions used by HFRRF and some observations for the City of Houston to consider:

- *Marital/Beneficiary Status*: In projecting future benefits for current active members, 90% of them are assumed to be married at the time of benefit eligibility. Husbands are assumed 3 years older than wives, and dependent children are included as beneficiaries only if in payment status as of the valuation date. These assumptions appear reasonable and consistent with generally accepted actuarial practice, but we recommend confirmation with actual experience in the next experience study if the necessary census data is readily available.
- *Valuation Pay*: Compensation for active members is based on actual pension eligible pay for the year preceding the valuation date projected forward one year with the nominal individual pay increase rate. In projecting valuation pay for future years, the salary scale assumption is applied. Given the past history of HFRRF with changes in compensation structure and the definition of eligible pay having a powerful impact on liabilities and costs, we encourage the City of Houston to work with the HFRRF Board to continuously monitor that the compensation data and assumptions used to project pension plan liabilities and costs remain reasonable and appropriate.
- *Census Data and Plan Provisions*: Please note that under the limited project scope, RHI has not performed an independent audit of the census data or plan benefit provisions valued.
- *DROP Entry Age*: Active members (not currently in DROP) are assumed to retire after having been in DROP for an assumed duration. Based on past experience, a distribution of DROP durations lasting 5, 8 and 10 years were assumed. Using the assumed retirement age and the DROP duration assumption, the DROP Entry Age is derived. Once in DROP, members are assumed to remain in DROP for up to ten years or until they are assumed to retire if earlier. In determining whether it is reasonable to assume a member would want to maximize to take full advantage of the DROP, it is important to compare the economic value of the DROP benefits to the value of the fund's annuity as if the member never entered DROP.

Demographic and Other Non-Economic Assumptions

Based on the hypothetical data (as summarized in the Valuation Testing section), we were able to duplicate the liability close enough to draw conclusions regarding its economic value. Based on the analysis below, it is clear those eligible for the DROP would benefit by maximizing the DROP duration. However, based on the results of the 2010 experience study, there are enough that didn't maximize the DROP duration period to justify use of the alternative assumption.

Sample Member as of July 1, 2013

	Never Elect DROP	Enter DROP at Age 46
Age	55	55
Years of Service *	29	20
Final Average Pay (FAP) *	\$75,392	\$55,265
Lifetime Annuity *	\$58,052	\$27,632
DROP Balance at Age 55	\$0	\$477,811
Estimate Annuity from DROP	\$0	\$30,337
Total Equivalent Annuity	\$58,052	\$69,295
FAP Replaced at Retirement	77%	92%

* For the DROP scenario, these values are shown based on values at the date of DROP entry. The ultimate lifetime annuity paid at retirement age 55 will equal \$38,958 after adjusting for the COLA and 2% per year increase for DROP participation.

Sample Member as of July 1, 2013

	Never Elect DROP	Enter DROP at Age 50
Age	60	60
Years of Service *	35	25
Final Average Pay (FAP) *	\$75,526	\$55,019
Lifetime Annuity *	\$60,421	\$35,763
DROP Balance at Age 60	\$0	\$713,997
Estimate Annuity from DROP	\$0	\$48,081
Total Equivalent Annuity	\$60,421	\$103,295
FAP Replaced at Retirement	80%	137%

* For the DROP scenario, these values are shown based on values at the date of DROP entry. The ultimate lifetime annuity paid at retirement age 60 will equal \$55,214 after adjusting for the COLA and 2% per year increase for DROP participation.

It is important to note that the lifetime annuity is eligible for future COLA increases assumed to equal 3.0% per year and includes a 100% survivor benefit for the spouse. This information regarding the annuity features along with current HFRRF interest rate and mortality assumptions was used to convert the estimated DROP balance to a lifetime annuity equivalent.

Independent Testing

Introduction

As part of the actuarial audit, the City of Houston originally intended to perform a full replication of the funding valuation results. As the HFRRF Board did not provide census data for this purpose, the City limited the project scope to include independent reasonableness testing of the valuation results. To accomplish this objective, RHI constructed a hypothetical member census data file relying on the demographic summaries included in the HFRRF funding valuation report as of July 1, 2013. Below is a comparison of key results from the RHI independent testing process:

- Present value of projected benefits margin of error less than 1% (RHI results higher).
- Actuarial accrued liability margin of error about 1% (RHI results lower).
- Total annual normal cost margin of error less than 1% (RHI results higher).
- City contribution rate margin of error less than 1% (RHI results lower).

While the replication margin of error may appear reasonable on a percentage basis, the absolute dollar amounts of the differences are substantial. It is also important to note that significant differences and systematic bias may exist due to the simplified data methods and assumptions used, with the potential for offsetting errors that cannot be detected without more detailed information from the HFRRF actuary that was not available from their published report.

Much of the difference in the present value of projected benefits for the active members in DROP is offset by the difference for other active members, resulting in a low net margin of error. However, we believe obtaining the current DROP balances and post-retirement annuity values for this group is crucial to improving the accuracy of this testing. While a similar breakdown of actuarial liability and normal cost was not available from the HFRRF published actuarial report, we believe a similar trend would be found in these measurements as well.

With that being said, however, we believe these testing results still provide a reasonable starting point for the City to use to independently evaluate long-term funding requirements and budget sustainability of its financial commitment to its retirement systems, including sensitivity analysis and alternative assumption sets, in terms of the relative value of changes as a percentage of total liabilities and costs.

Independent Testing

Funding Valuation Results

July 1, 2013 (\$ millions)	HFRRF	RHI	Difference	Percentage
Present Value of Projected Benefits				
• Actives in DROP	\$1,063.3	\$1,023.0	-\$40.3	-3.8%
• Other Actives	\$1,245.7	\$1,285.7	\$40.0	3.2%
• Retirees and Beneficiaries	\$2,360.0	\$2,370.5	\$10.5	0.4%
• Terminated Vested	\$1.2	\$1.2	\$0.0	0.0%
• Total Present Value Benefits	\$4,670.2	\$4,680.4	\$10.2	0.2%
Actuarial Accrued Liability				
• Total Active Members	\$1,601.9	\$1,547.1	-\$54.8	-3.4%
• Retirees and Beneficiaries	\$2,360.0	\$2,370.5	\$10.5	0.4%
• Terminated Vested	\$1.2	\$1.2	\$0.0	0.0%
• Total Actuarial Liability	\$3,963.1	\$3,918.8	-\$44.3	-1.1%
Actuarial Value of Assets	\$3,430.4	\$3,430.4	\$0.0	0.0%
Unfunded Actuarial Liability (UAL)	\$532.7	\$488.4	-\$44.3	-8.3%
Other Actuarial Present Values				
• Valuation Compensation	\$2,540.6	\$2,735.2	\$194.6	7.7%
• Total Future Normal Cost	\$707.1	\$761.6	\$54.5	7.7%
• Member Contributions	\$214.3	\$246.2	\$31.9	14.9%
• City's PV Future Normal Cost	\$492.8	\$515.4	\$22.6	4.6%
Total Annual Normal Cost (BOY)	\$73.9	\$74.2	\$0.3	0.4%
City Required Contribution Rate				
• Normal Cost	19.4%	20.1%	0.7%	3.6%
• UAL Amortization	13.8%	13.0%	-0.8%	-5.8%
• Total City Rate	33.2%	33.1%	-0.1%	-0.3%
Annual City Contribution Amount	\$90.2	\$87.9	-\$2.4	-2.6%
Total Valuation Compensation	\$271.8	\$265.5	-\$6.3	-2.3%

Independent Testing

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. Based on the limited scope for this project, a hypothetical data set was created for active members based on the age/service grids provided in the actuarial report (active participants and DROP participants).

The age and service were set at mid-range value using average pay within each 5-year cell. Compensation history was developed by regression from the cell average pay for each hypothetical data record using the salary scale assumption. While the report did not summarize the data by gender, we assumed the group was comprised of 100% males with spouses assumed to be the opposite gender of the member.

July 1, 2013	HFRRF	RHI	Difference	Percentage
Active Members in DROP				
• Number	819	819	0	0.0%
• Average Age	52.73	52.73	0	0.0%
• Average Service	29.32	29.09	-0.23	-0.8%
• Average Prior Year Actual Pay	\$80,665	\$80,665	\$0	0.0%
• Total Valuation Compensation	\$70,782,734	\$68,232,510	-\$2,550,224	-3.6%
Other Active Members				
• Number	2,926	2926	0	0.0%
• Average Age	36.88	36.88	0	0.0%
• Average Service	10.07	10.13	0.06	0.6%
• Average Prior Year Actual Pay	\$64,130	\$64,130	\$0	0.0%
• Total Valuation Compensation	\$201,045,266	\$197,274,682	-\$3,770,584	-1.9%
Total Active Members				
• Number	3,745	3745	0	0.0%
• Average Age	40.35	40.34	-0.01	0.0%
• Average Service	14.28	14.27	-0.01	-0.1%
• Average Prior Year Actual Pay	\$67,746	\$67,746	\$0	0.0%
• Total Valuation Compensation	\$271,828,000	\$265,507,192	-\$6,320,808	-2.3%

Independent Testing

Inactive Member Census Data

Hypothetical data records were created for inactive members based on the average annual pension benefit for each of the valuation membership groups for benefits in pay status (retirees, beneficiaries and disabled) as well as deferred vested members. Because average age data for inactive members was not provided in the HFRRF actuarial report, we estimated each of these members' ages as illustrated below.

July 1, 2013	HFRRF	RHI
Retired Members		
• Number	2,036	2,036
• Average Age	n/a	63
• Average Annual Benefit	\$44,810	\$44,810
Beneficiaries in Pay Status		
• Number	543	543
• Average Age	n/a	68
• Average Annual Benefit	\$34,084	\$34,084
Disabled Members		
• Number	327	327
• Average Age	n/a	55
• Average Annual Benefit	\$43,851	\$43,851
Deferred Vested Members		
• Number	8	8
• Average Age	n/a	48
• Average Annual Benefit	\$10,729	\$10,729

Of the retired, disabled and deferred vested members, 100% were assumed to be males with all beneficiaries and dependent spouses being the opposite gender. We also assumed 100% of the inactive members were married with female spouses being two years younger than their male spouse. Each inactive member was assumed to be receiving the average annual benefit based on their respective membership group.

Independent Testing

DROP Balance Estimation

HFRRF includes a Deferred Retirement Option Plan (DROP) for active members. Because detailed census data for individual members was not readily available, RHI estimated this important component of total plan liabilities and costs as part of the development of the hypothetical census data.

We estimated the value of account balances for active members in DROP as of the measurement date based on annuity amounts developed in the independent testing process, with historical interest credited at the assumed rate of 8.5% per annum. As shown below, we assumed DROP entry date for each cohort of the celled service groups that was approximately equal to the mid-point between the current service and first eligibility (20 years of service) to project future DROP participation:

Service as of July 1, 2013	22 Years	27 Years	32 Years	37 Years	41 Years
Service at DROP Entry	21 Years	23 Years	27 Years	29 Years	31 Years

Our testing produced a total July 1, 2013 DROP account value of \$315.5 million for active members in DROP. As the total DROP account was reported as \$958.2 million as of June 30, 2013 as published in the 2014 CAFR, we estimate the DROP account value for inactive members was the \$642.7 million difference.

It is clear that our hypothetical data method requires further refinement, given the difference of \$40.3 million (about 3.8% margin of error) in the total PVB for active members in DROP. We suspect that the DROP account value is understated in the testing process due to our regression of member compensation using the valuation salary scale assumption rather than actual compensation history and use of a constant 8.50% per annum assumed rate for DROP account interest credits.

Plan Benefit Provisions

RHI performed the valuation testing based on the plan provisions summarized in the Fund's July 1, 2013 actuarial report. We believe our methodology is consistent with the valuation summary described in the most recent valuation report, but we did not audit this summary of the plan provisions.

Independent Testing

Actuarial Assumptions and Methods

RHI performed the valuation testing based on the actuarial assumptions and methods as summarized in the HFRRF funding valuation report as of July 1, 2013. Our approach is consistent with the valuation basis described in the HFRRF valuation report, subject to the following interpretations and clarifications by RHI:

- For active members in DROP, we estimated the DROP entry date was approximately halfway between the current age and the age at first eligibility.
- For active members not in DROP, members were assumed to have a 9 year DROP duration period rather than the 5, 8, and 10 year distribution.
- Valuation pay was based on the compensation shown in the age/service grid of the actuarial report.
- Linear interpolation was used to determine the rates of termination between sample rates provided.
- Linear interpolation was used to determine the rates of disability incidence between the sample rates.
- All pre-retirement deaths were assumed to be duty related.
- 50% of disabilities were assumed to be duty related and 50% were assumed to be non-duty related.
- 50% of terminated vested members eligible for an annuity are assumed to elect an annuity and 50% are assumed to elect a refund of contributions

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 2009-2013, below we compare the aggregate actuarial gain/loss that occurred for the plan asset and liability 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.

Plan Assets

Actual returns on *FMV* for HFRRF have exceeded the assumption 3 out of the last 5 years, with an annual rate of return averaging 4.82% over the funding valuation study period ended June 30, 2013. After applying the asset smoothing method, the annual rate of return on *AVA* averaged 5.8% over the study period, as losses from the 2008-2009 market crises were recognized in the smoothing method.

As summarized below, the net actuarial gain/(loss) due to plan asset experience as a percentage of *AVA* ranged from -5.20% to -3.08% over years 2009-2013. The gradual recognition of the investment losses from the 2008-2009 market crises significantly influenced these results. As of July 1, 2013, past investment gains and losses were fully recognized as the *AVA* was set to the *FMV* as of July 1, 2013, but with future gains and losses to be amortized straight line over 5 years.

Valuation Year	2009	2010	2011	2012	2013
AVA	\$3,062,174	\$3,116,848	\$3,222,288	\$3,263,265	\$3,430,437
Asset Gain/(Loss)	(\$101,923)	(\$162,222)	(\$99,107)	(\$151,503)	(\$111,583)
% Change	-3.33%	-5.20%	-3.08%	-4.64%	-3.25%

Plan Experience Analysis

Actuarial Liability

As summarized below, the actuarial (gain)/loss due to plan liability experience (excluding assumption changes or impact of plan amendments) as a percentage of the actuarial liability was -2.39% in 2009, but averaged around -0.90% for years 2009-2013. For plans the size of HFRRF, annual liability gains and losses in the range of 1% to 2% 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.

The liability gains and losses in the years 2010 - 2013 is relatively small (averaging less than 1.0%), in each year there was an experience gain except for a small loss in 2011. Given this consistent trend, we recommend the City of Houston work with the Board to perform an updated experience study.

Valuation Year	2009	2010	2011	2012	2013
Actuarial Liability	\$3,209,670	\$3,337,473	\$3,558,210	\$3,752,907	\$3,963,082
Liability (Gain)/Loss	(\$76,701)	(\$27,205)	\$2,184	(\$18,328)	(\$32,910)
% of AL	-2.39%	-0.82%	0.06%	-0.49%	-0.83%

Normal Cost Rate

The Entry Age Normal Level Percent of Pay cost method allocates the current year's cost that will remain level as a percentage of the participant's pay. This cost method not only allocates the true cost of the plan over an employee's working lifetime but it also produces a cost pattern that is more fair and equitable across generations of tax payers.

Over the study period, the City's portion of the Normal Cost has slightly decreased from 19.8% in 2009 to 19.4% in 2013. Unless there are changes to the plan provisions, actuarial assumptions or major changes in the demographics, the cost method will continue to produce a stable normal cost 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 fairly across generations of tax payers. The HFRRF funded ratio dropped from 95% in 2009 down to 87% in 2013. The City of Houston should continue to monitor the funded status, to ensure the current funding policy will be adequate to amortize the unfunded actuarial liability over a reasonable period.

In reviewing the reasonableness of the funded status, we considered the UAL amortization period for compliance with the Texas Pension Review Board Guidelines: Based on the most recent Guidelines for Actuarial Soundness, the Fund 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 Accrued Liability should be level or declining as a percent of payroll over the amortization period.
4. Funding should be adequate to amortize the unfunded actuarial liability over a period which should never exceed 40 years, with 25-30 years being a more preferable target.
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.

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 back 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 could go further to state they are not aware of any conflicts of interest in performing their professional duties.
2. The certification could confirm the signing actuaries are not aware of any subsequent events that require disclosure. However, the lack of this statement implies 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, we found only limited explanation of the results beyond the numerical exhibits, and would recommend additional information comparing results to the prior valuation and discussing emerging trends. Below are some additional recommendations centering on providing additional content in certain situations.

1. In years in which the liability gain or loss exceed 1% of the total Actuarial Liability, we recommend a brief explanation as to the cause of the gain or loss. For example, the liability loss was primarily due to higher than assumed salary increases in the prior year.
2. In order to assess the reasonability of the pension valuation results by another actuary, it is generally accepted actuarial practice to include a summary of the participant data used. The HFRRF valuation report includes much of this information in the Membership Data summary, but additional information would be beneficial. In particular, we recommend the valuation report include the average age of the inactive participants and a summary of the applicable DROP and PROP balances for each of the participant groups.
3. We recommend the GASB 68 report be modified to include a full description of the Entry Age Normal cost method with sufficient clarity that the reader can determine the GASB 68 specific attribution period applicable to DROPs was used.