



## Employees Retirement System of Texas

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*Actuarial Audit and Review of the 2016 Actuarial Valuations*

January 31, 2017



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Submitted by:

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January 31, 2017

Board of Trustees  
Employees Retirement System of Texas  
200 East 18<sup>th</sup> Street  
Austin, TX 78701

Re: *Actuarial Audit of the 2016 Valuations for the  
Employees Retirement System of Texas*

Dear Members of the Board:

Attached is Bolton Partners' actuarial audit of GRS's 2016 valuations of the Employees Retirement System of Texas (ERS), including the Law Enforcement and Custodial Officer Supplemental Retirement Fund of the Employees' Retirement System of Texas (LECOS), the Judicial Retirement System of Texas Plan 1 (JRS1) and the Judicial Retirement System of Texas Plan 2 (JRS2). This is a "Level two" partial replication audit based on a review of sample lives. The purpose of the audit was to:

- Validate the results of the August 31, 2016 actuarial valuations for the plans, using appropriate mathematical modeling and review of appropriate sample lives to conclude if the actuarial liabilities and required contributions are valid
- Determine whether the actuarial valuation methods, assumptions and procedures used by the System's consulting actuary, Gabriel Roeder Smith & Company (GRS), are reasonable and consistent with all applicable laws, Board policies, generally accepted actuarial principles and practices, are appropriate for the plan structure and funding objectives and are applied as stated by GRS
- Assess whether the valuation results are complete and accurate and the conclusions of the valuation reports accurately portray the actuarial status of the System and are properly reflected in the employer contribution rate
- Assess the financial effect of any errors or deviations from generally accepted actuarial principles and practices on the valuation results and employer contribution rates

The plan liabilities are the sum of the liabilities for all of the members. We audited the liability and normal cost calculations that are the heart of these valuations by replicating the results of 53 sample lives chosen to be representative of the participant population as a whole. The sample size was based on the concept that it was more important to cover a variety of situations (known as stratified sampling) than multiple

**Bolton Partners, Inc.**

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*Employee Benefits and Investment Consulting*

common situations, since valuation system errors will often apply to all members with a common set of facts (e.g. in the same plan/tier). Therefore, the sample size and selection process is not the same as selecting a statistically significant sample size as might be the case with a data audit, where errors would apply to a single individual. We have also suggested studies that can help the Trustees and Sponsor understand the future funding needs and risks.

This audit report includes the following sections:

1. *Executive Summary* – A summary of the key findings.
2. *Purpose and Scope of Audit* – A description of the purpose and limitations of the audit.
3. *Review of Actuarial Report and Validation of Results* – A review of the valuation report and results for compliance with actuarial standards and required disclosures under the actuarial standards of practice. This section also includes a discussion of the procedures used to validate the participant data, the test lives selected, and a detailed review of the findings.
4. *Analysis of Assumptions* – An analysis and benchmarking of the actuarial assumptions, including a review of the most recent experience study, utilized in determining the funded status and accrued liability as of August 31, 2016 for compliance with generally accepted actuarial principles.
5. *Recommendations* – Our conclusions and a discussion of potential changes and future studies that the Board should consider.

We thank R. Ryan Falls and Dana Woolfrey, actuaries at GRS, and Anthony Chavez and his colleagues within ERS for their assistance in providing us the required data and sample life information, as well as promptly answering our questions regarding sample life calculations and other issues regarding plan provisions, funding methods and assumptions, participant data and practice.

This review was conducted under the supervision of Thomas Lowman, FSA, EA, MAAA. All of the undersigned actuaries meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein. They are currently compliant with the Continuing Professional Development Requirement of the Society of Actuaries. We are not aware of any direct or material indirect financial interest or relationship, including investments or other services, that could create a conflict of interest that would impair the objectivity of our work.

Respectfully submitted,

**BOLTON PARTNERS, INC.**

Colin England, FSA, EA

Thomas Lowman, FSA, EA

Kristopher Seets, FSA, EA

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## 1. Executive Summary

The Employees Retirement System of Texas (ERS) retained Bolton Partners, Inc. to conduct an independent review of the System's 2016 actuarial report's calculations and assumptions. ERS requested an assessment of whether the valuations were complete and accurate; that the assumptions and procedures used are reasonable, appropriate and correctly applied; that the conclusions of the valuation report accurately portrayed the actuarial status of the plans; and, the effect of any errors or deviations on the results of these valuations. We also provided our thoughts on the current actuarial cost method (e.g. Ultimate Entry Age) and procedures, and commented on alternative methods that might be recommended. ERS also requested a review of the actuarial report and most recent experience analysis and a determination if there is consistency in the presentation of the actuarial results and whether they are consistent with professional standards (including the Actuarial Standards of Practice 4, 27, 35, 41 and 44).

The objective of an actuarial audit and review of any system is to provide validation that the liabilities and costs of the System are reasonable and being calculated as intended. This audit is a partial replication of the actuarial valuation results and a review of the key components in the valuation process that encompass the derivation of the liabilities and costs for the System. These key components are the data, the benefits valued, the actuarial assumptions and funding method used, and the asset valuation method. The valuation report and the valuation output for a select group of test lives provide the detail necessary to provide an opinion on each of these key components.

We reviewed all information supplied to us. We also requested and reviewed additional information provided by GRS. Finally, we considered the reasonableness of the actuarial assumptions and methods in the context of our own experience, and those of other governmental pension systems.

### Statement of Key Findings

#### Validation of the Accuracy of the Valuation Results

We validated the accuracy of the valuation results by choosing 53 sample lives that we believed provided a reasonable test of all key plan provisions and assumptions. We calculated the actuarial liability and normal cost<sup>1</sup> for all 53 sample lives, and compared our results to those of GRS:

$$\text{EAN Actuarial Liability} = \$17,266,466 / \$17,206,326 = 100.35\%$$

$$\text{EAN Normal Cost} = \$293,989 / \$293,463 = 100.18\%$$

GRS provided the normal cost rate for each actively employed participant, rather than the normal cost dollar amount. We derived the normal cost dollar amount by multiplying the normal cost rate times the salary. We derived the accrued liability for each employee by subtracting the present value of future normal costs (including the current year's normal cost) from the present value of benefits.

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<sup>1</sup> Please note that normal cost is \$0 for inactive participants.

## **1. Executive Summary (cont.)**

### **Statement of Key Findings (cont.)**

Overall this level of match is acceptable. We were able to very closely match the actuarial liabilities for all of the retirees (largest difference 0.9%, in the aggregate within 0.075%.) We found larger differences for active members (largest difference 4.0%, in the aggregate within 1.0%.) These differences are expected to be larger due to substantially more complex projections and the differences inherent in the different valuation software systems. We matched the present value of benefits within 1.4% for all employees, and within 1% for nearly all employees (total difference 0.30%).

The largest differences were in the Normal Cost Rate (largest difference 6.7% for JRS1 member, in the aggregate within 0.18%). However, even for this one person the present value of benefits was different by only 1.4%. The Normal Cost difference is also less material because some of the largest differences were for two of the smallest groups, the Legislative (in ERS) and Judiciary Plan 1. We note that this is less than the difference found in the prior (full replication) audit. We do not believe that these differences are actuarially significant. Thus, we conclude that the valuation results are generally complete and accurate and can be relied upon.

Our review of sample lives did identify three issues with the calculations related to assumptions and disclosure of the assumptions, which are discussed in detail in the body of the report. These include:

1. Retirement rates in JRS2 are shown to start at age 65 with 10 or more years of service, although those employed as Judges immediately before retirement are eligible to retire early at age 60 with 10 years of service, and the rates shown as applying at 65/10 actually apply at 60/10. This is most easily adjusted with revisions to the summary of actuarial assumptions in the actuarial report. Our replication was based on applying the retirement rates starting at age 60.
2. Different assumed retirement ages are used for the same individual when the individual is a separated vested participant in one group (LECOS) and an active employee in another (Regular). While the use of two assumed retirement ages for the same person, even though their eligibility for retirement is the same for both benefits is inconsistent, and undervalues the LEeos portion of the benefit (the deferral of the benefit used to determine the separated vested liability past the unreduced retirement date reflects regular employment service), because of the practical limitations of valuation systems, we do not suggest any revisions to achieve consistency, as the total number of employees/separated vested participants is small (12), so consequently the understatement of liabilities is also small.
3. Use of an 8% discount rate for the JRS1 plan which is not consistent with the requirements of ASOP 27, paragraphs 3.8 and 3.9, which discusses the selection of discount rates. Section 3.8 of ASOP 27 is not relevant, since the JRS1 plan is unfunded, and asset returns are not relevant to the determination of the discount rate. Thus, the investment assumption is not based on the experience study and the source of this assumption should be disclosed. If the discount rate is prescribed by the ERS Board or other parties, the actuary should so disclose in the valuation report. We do note that the valuation report does include a disclosure of the liabilities using a discount rate of 2.84%, based on municipal bond rates for general obligation bonds with 20 years to maturity. While outside the scope of this report, we also note that the use of the 8.0% rate would not be consistent

## 1. Executive Summary (cont.)

### Statement of Key Findings (cont.)

with the requirements of GASB 73 if the valuation results are used for financial reporting purposes. We suggest that the actuary should revise the discussion of this assumption to be consistent with purpose of the measurement (ASOP 27, 3.9) and disclose the source of this assumption.

### **Assumptions and Method Are Reasonable, Appropriate and Appropriately Applied**

Independent of our sample life review, we reviewed the methods and assumptions used in the valuations, and concluded that the assumptions and methods are generally reasonable, appropriate for the situation and appropriately applied in the actuarial models. However, there were concerns which should be addressed in the upcoming Experience study. Four key areas include:

1. The most recent experience study was done in 2011, and investment return and inflation expectations have changed greatly since then. We suggest the following two assumptions be revised to better reflect current expectations of future experience:
  - a. The interest rate (discount rate) is 8.0% and substantially higher than either expected returns based on the plans' investment mix (except JRS1 which has no assets), assumptions used in other states, or investment returns based on typical investment mixes. This higher rate appears to be primarily because of the significantly higher inflation assumption anticipated in the 2011 Experience Study, as noted below.
  - b. The discount rate of 8.0% used for the JRS1 plan was described by GRS as "difficult to defend."<sup>2</sup> We agree with GRS' characterization of this assumption, and their inclusion of a liability 50% higher reflecting a bond discount rate of 2.84%. We also suggest using a municipal bond rate for discounting the future payments for the JRS1 plan, as no assets are held in trust to pay these liabilities and the best proxy for the value of the JRS1 liabilities is the cost of the State borrowing the funds necessary to pay for these benefits. Further, we recommend that this bond rate be the only basis used for this plan since using the higher discount rate can be misleading. Using the expected return on a portfolio of assets is only appropriate when a plan is being prefunded, which is not the case with this plan.
  - c. The inflation assumption of 3.5% is substantially higher than expected inflation as estimated by other parties. This assumption used in determining the inflation portion of salary increases, the cost-of-living increases for Judges and the payroll growth assumption for determining the adequacy of the current contribution, as well as a key component in the interest rate assumption.
2. The mortality and mortality improvement assumptions are tied to older tables no longer widely used, and should be revised, as part of an experience study, to reflect more current tables and

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<sup>2</sup> From GRS Audit of the August 31, 2009 ERS valuation reports, page2.

## 1. Executive Summary (cont.)

### Statement of Key Findings (cont.)

expectations of future improvements, such as the RP 2014 mortality table and the MP 2016 mortality improvement table. In addition:

- a. We note that retired mortality experience is used to determine the mortality for employees. Typically, employee mortality is substantially lower than retiree mortality. We suggest that lower mortality be assumed for employees, perhaps 70% or 75% of the retiree mortality, based on the prior experience study.
  - b. We note that there is no assumption regarding the improvement of mortality experience for disabled participants. We suggest that this be revised to reflect mortality improvement, perhaps using table MP 2016. Unfortunately, mortality improvement cannot be easily judged through an experience table, as very large numbers of participants over many years are required to reasonably assess mortality improvement experience.
  - c. We note that the mortality tables in use are applied to all groups of employees, even though certain groups (judges, legislature) typically are expected to have longer than average lifespans and others (public safety employees) typically are expected to have shorter than average lifespans. However, since total mortality experience is used to adjust the chosen mortality table to reflect actual experience, this approach is likely to approximate total liabilities, although possibly overstating them for LECOS and understating them for JRS1 and JRS2.
3. We suggest revising the funding method from the ultimate entry age normal method to another version of entry age normal, such as the method chosen by GASB in Statements 67 and 68.
  4. We suggest revising the asset smoothing method from recognizing 20% of the difference between actuarial value and market value of assets, to a method with a limit on the difference between market and actuarial value of assets (for example, limiting actuarial value to be between 80% and 120% of market value) and to spread investment returns in excess (deficit) of expected in each year over 5 years. We note that a similar recommendation was made in the prior 2010 actuarial audit prepared by GRS.

We note that the most recent experience study was done more than 5 years ago, and the recommendations adopted in February, 2013. We understand that a new study is planned and should begin soon. Any suggestions we make regarding actuarial assumptions, funding methods and procedures should be considered in light of the new experience study.

### **Funding Policy**

1. The Fixed-Rate nature of the contributions to the plans require a different approach to reviewing the plans' funding methods. The contributions determined using the valuation funding methods is simply a trip-wire to identify potential future insufficiency in the fixed-rate contributions in

## 1. Executive Summary (cont.)

### Statement of Key Findings (cont.)

time for the Board and legislature to act to correct the potential problem. Thus the funding methods must be considered in the light of their usefulness in identifying future funding issues well in advance of these issues becoming problems, allowing the Board to identify these issues to the legislature in sufficient time for the issues to be addressed.

2. The Board should consider the actuarial funding method in light of the trade-off between use as a trip-wire and the desire to pay for employees' benefits during their working lifetime. The ultimate entry age normal method does not result in funding employees' benefits over their career, resulting in payments being made to fund their benefits after their retirement.
3. The method used to amortize the unfunded accrued liability (UAL) – the level percent of pay method – when combined with the long period necessary to fund the UAL also creates issues in providing the Board information to understand, and communicate to others (such as the legislature) the path to fulling funding the plans. The Board should consider transitioning to shorter amortization periods, in light of recent trends in pension funding. The current amortization method will result in an increase in the amount of the unfunded accrued liability over the next 15 years, even though the plans are expected to be fully funded in 31 years, potentially obscuring the eventual climb out of underfunding and encouraging premature changes to the plans' benefits.
4. Future risks to the System: We recommend the Board consider and measure the increase in future risks due to the continuing maturation of the plans. While this issue may be addressed in presentations prepared regarding the results of these reports we suggest that this should be an integral part of the valuation reports. We suggest adding measures that reflect the risk associated with the expected future growth of the plan. For example, over the last 10 years' liabilities have grown by 47% which is substantially faster than the growth in payroll (29%) for the ERS plan. Investment risk increases when assets grow faster than payroll even if investment return volatility does not change<sup>3</sup>. The plan has not seen this type of growth in risk over the last 10 years since the funded ratios have declined. As the plan's funding level improves, the impact of a bad year in the market could be 33% (517%/389% -1) to 50% higher in the future when the plan is better funded even without a change in the investment mix. We recommend having discussions including both the plans' actuary, GRS, and the plans' investment advisor to discuss whether the Board should disclose and measure this future risk dynamic, what level of risk is acceptable and whether and what changes should be made to reduce the risk to acceptable levels. More information on this topic is included in the GFOA Best Practice: Enhancing Reliability of Actuarial Valuations for Pension Plans – Actuarial Projections and in the ASB Exposure draft on risk disclosure.

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<sup>3</sup> We define investment risk for a pension plan as the risk of significant increases in the actuarially determined contribution rate or a reduction in benefit levels due to investment losses, as we believe that the risk to both plan sponsors and participants is based on the magnitude of the need for substantial future contribution increases, rather than simply the risk of asset losses. For example, a 10% drop in plan assets has a much greater effect on the contribution rates for a plan where the assets are 10 times payroll than for a plan where the assets are 5 times payroll.

## 1. Executive Summary (cont.)

### Statement of Key Findings (cont.)

5. Use of Ultimate Entry Age Normal Funding Method: We recommend the Board consider changing the funding method from the current method to another version of Entry Age Normal (or other method) because this method, as compared to other versions of Entry Age Normal, results in transferring a substantial portion of the future normal cost to accrued liability for employees earning benefits under prior tiers, and spreading the funding of an employee's benefit over a period longer than their working lifetime.
6. Asset Smoothing Method: We recommend that the Board consider a different asset smoothing method than currently used because "The use of an open period [in recognizing the difference between the market value and the actuarial value of assets] results in convergence over approximately 30 years and may not comply with the standard [ASOP 44, section 3.3, as issued in 2011]. In addition, since there is no corridor around the market value of assets, the funding value and the market value could become unreasonably far apart during periods of large market growth or large market downturns."<sup>4</sup> We agree with this statement by GRS from the prior audit.

Thus, we concluded that the methods and assumptions are reasonable and generally appropriate, and are mostly consistently applied, with minor deviations that were not material to the results. However, we suggest that the issues mentioned above should be considered in preparing future actuarial valuations for the plans.

### Financial Effect of Errors or Deviations

There are no significant errors or deviations that require correction.

The two most substantial suggested area of improvements in assumptions to consider as part of the 2017 Experience Study are:

1. Use of lower discount rates and inflation assumptions, including the use of an appropriate discount rate for the JRS 1 plan since the plan is unfunded.
2. Revisions to the selection and use of the mortality tables for active employees and disabled retirees.

Since the degree of change will be determined as part of the GRS Experience study and need not impact the 2016 valuation, we have not quantified the potential impact.

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<sup>4</sup> Page 6, GRS' Actuarial Audit of the August 31, 2009 Actuarial Valuations of ERS.

## **1. Executive Summary (cont.)**

### **Statement of Key Findings (cont.)**

#### **Conclusions**

Our audit validates the findings of the 2016 actuarial valuation. The investment return and inflation assumptions should be studied in the experience study, in light of current industry trends and expected future investment returns and consumer price increases (CPI), and the Board should consider whether these assumptions should be revised in future valuations to assume lower inflation and a lower investment return. The mortality table for disabled participants should also be revised to include a projection of the improvement in the future mortality (or disclosure of the reason projections are not appropriate), and the mortality table for employees should be revised to reflect lower mortality experience than for retired participants. However, we believe the stated methods and assumptions were properly employed in determining the cost of the Plan.

Finally, we offer ideas to improve the quality and understanding of the valuation report. Several suggestions and recommendations are made throughout this document. Some changes are simply for clarity while others may have a minor effect on the contribution rate.

## 1. Executive Summary (cont.)

### Statement of Key Findings (cont.)

### Plan Actuary's Response to Audit Findings



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January 27, 2017

Board of Trustees  
Employees Retirement System of Texas  
200 East 18th Street  
Austin, TX 78701

**Re: Response to Actuarial Audit and Review of the 2016 Actuarial Valuations of the Employees Retirement System of Texas**

Dear Members of the Board:

Gabriel, Roeder, Smith & Company ("GRS") offers our comments below on the draft actuarial audit report prepared by Bolton Partners ("Bolton") that we received on January 24, 2016. The draft report provides Bolton's actuarial audit and review of the 2016 actuarial valuations of the Employees Retirement System of Texas ("ERS").

#### **General Comments**

We are pleased with the results of the actuarial audit of ERS. We would like to quote the following passage from the *Recommendations* section of the actuarial audit report:

**"The plans' actuary appears to have reasonably valued the expected liability of the System. They have applied the methodology consistently and their report generally conforms to accepted actuarial principle and practices."**

These statements should provide both ERS Staff and the Board with the confidence that the actuarial results they are receiving are both accurate and reasonable.

In the remainder of our letter, we will focus on the primary areas of recommendations from Bolton in the actuarial audit report. These recommendations can be separated into three primary areas: Valuation Reports, Assumptions, and Funding Methods.

#### **A. Valuation Report**

*Bolton's Recommendations:*

1. Enhance reports by including standard historic risk related measures
2. Enhance reports by including longer term projections of future assumed payroll, funding levels and expected benefit payments
3. Enhance reports by including projections of future risk metrics
4. Clarify the application of retirement assumptions for members of JRS2 who reach retirement eligibility prior to age 65

## 1. Executive Summary (cont.)

### Statement of Key Findings (cont.)

#### Plan Actuary's Response to Audit Findings

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**GRS Response:** We appreciate Bolton's suggestions about improving the communication of the annual actuarial valuation. We believe that the valuation reports currently provide a reasonable amount of detail pertaining to each plan. In addition, the valuation presentation to the Board provides longer projections and discussions about risk. We believe that the combination of these documents provide a clear picture about the health of the retirement plans. However, we are open to any changes that the ERS Staff and Board believe will improve the communication of these important concepts.

#### **B. Assumptions**

*Bolton's Recommendations:*

1. Complete experience study, and consider
  - a. Lower discount rate
    - i. Reflect directly, or indirectly, expected investment expenses
  - b. Lower discount rate for unfunded JRS1 plan to municipal bond discount rate of appropriate duration
  - c. Lower expected inflation assumption
  - d. Update retirement assumptions
  - e. Update mortality assumptions to current, pension plan related mortality experience and mortality improvement
  - f. Revise mortality assumption for employees to reflect significantly lower mortality than that for retirees
2. Add mortality improvement assumption to disability mortality assumptions

**GRS Response:** We appreciate Bolton's comments about the actuarial assumptions and we concur with a majority of their recommendations. The actuarial experience study is currently underway and we look forward to speaking with the Board about the assumptions noted by Bolton and all of the other assumptions that are critical to the annual actuarial valuation.

#### **C. Funding Methods**

*Bolton's Recommendations:*

1. Along with the assumption changes that will be suggested as part of the experience study, we suggest that the Board:
  - a. Consider revising the funding method to from the Ultimate Entry Age Normal to another funding method, perhaps to the version of EAN required for accounting purposes.
  - b. Revise the asset valuation method to more quickly reach the market value of assets and to limit the potential deviation from the market value of assets.
  - c. Adopt, as part of the funding policy, an amortization method that amortizes gains and losses over a shorter, closed, period so as to improve, over time, the Board's ability to improve the plans' funding levels.

**GRS Response:** We appreciate Bolton's comments about the funding methods. We intend to address each of these methods as part of the actuarial experience study that is currently underway. We do have a few comments on the specific recommendations pertaining to the Funding Methods:

## 1. Executive Summary (cont.)

### Statement of Key Findings (cont.)

#### Plan Actuary's Response to Audit Findings

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Use of Ultimate Entry Age Normal – We believe that the use of the Ultimate Entry Age Normal actuarial cost method provides a reasonable way to assess the fixed contribution rates that ERS receives from members and the State. The method also provides for a more stable normal cost and Actuarially Determined Contribution on an annual basis. We are open to considering the use of the Individual Entry Age Normal actuarial cost method based on the direction from the ERS Staff and Board, but we believe that it could provide challenges during intense legislative sessions because of the additional steps necessary to calculate Actuarially Determined Contributions and funding periods under that method.

Amortization Periods – The actuarial valuations currently disclose the actuarially sound contribution (ASC) rate which is outlined in Section 811.006 of the Texas Government Code for ERS. Section 811.006 defines actuarially sound as a retirement system that is receiving a total contribution rate sufficient to cover the normal cost, administrative expenses, and amortize the UAAL over a period of 31 years, or less. As noted, the ASC is calculated based on a 31-year open amortization period. This means that the ASC contribution will always be calculated with the same 31-year period and the UAAL would never completely disappear. Even though the contributions to ERS are not based on this ASC, we agree that the Board may want to consider adopting a funding policy that includes an ultimate goal of eliminating the UAAL over a shorter period. This type of funding policy will allow the Board to better assess the level of contributions received from the employers and the State.

If you have any questions or need any additional clarifying information with regard to our comments, please do not hesitate to contact us.

Respectfully submitted,  
**Gabriel, Roeder, Smith & Company**



R. Ryan Falls, FSA, EA, MAAA  
Senior Consultant



Joseph P. Newton, FSA, EA, MAAA  
Senior Consultant

## **2. Purpose, Scope and Methodology of the Audit**

### **Purpose of the Audit**

ERS retained Bolton Partners, Inc. to conduct an independent review to determine if the System's current actuarial calculations are complete and accurate, and that the assumptions and methods used are reasonable and internally consistent. ERS requested we:

1. Validate the results (liabilities, normal cost and contributions) of the August 31, 2016 valuation using a "level 2" audit (i.e. using sample lives rather than a replication valuation to review the liability and normal cost calculations), as well as appropriate mathematical models.
2. Determine whether the actuarial valuation assumptions and procedures used by GRS are:
  - a. Reasonable and consistent with all requirements
  - b. Appropriate for the plans' benefit structures and funding objectives
  - c. Applied consistently with the assumptions and methods specified in the actuarial valuation report prepared by GRS.
3. Assess whether the actuarial valuation complies with all appropriate laws, policies and principals and practices and that the conclusions of the valuation reports accurately portray the actuarial status of the System and that the valuation reports properly determine the employer contribution rates.
4. Assess the financial effect of any errors or deviations on the valuation results and the Actuarially Determined Contribution rates.

### **Scope of the Audit**

This actuarial audit focuses first on the review of the application of the plans' benefit provisions, methods and assumptions and GRS's model reflecting these factors by first reviewing sample lives to ensure internal consistency and second by reviewing the use of the liability and normal cost values in determining the appropriate annual contribution amounts. Next, we focus on whether the assumptions and methods are appropriate, largely based on prior experience as reflected in the experience studies, actuarial standards of practice and the legislated provisions regarding plan funding. Then we focused on the actuarial communications of the results of the valuations from the presentation report, and the four valuation reports, and whether these communications accurately and completely communicate the actuarial status of the plans, including through the appropriate calculation of annual employer contribution rates. Finally, for the issues we identified, we analyzed the effect of the errors and discrepancies on the results of the valuations.

## **2. Purpose, Scope and Methodology of the Audit (cont.)**

### **Scope of the Audit (cont.)**

What this audit provides is:

1. Assurance that appropriate benefits are being valued;
2. Confirmation that the valuation system is accurately calculating present value of benefits and appropriately dividing these present values into accrued liabilities and normal cost, by testing sample lives as being representative of the Normal Cost and Actuarial Liability of the entire system;
3. Confirmation that the program is valuing benefits as described in the valuation report and consistent with applicable statutes;
4. A review of the demographic actuarial assumptions for consistency with generally accepted actuarial practices and the specific experience of the plans, as documented in the last two experience studies;
5. A measurement of economic actuarial assumptions against those used by other public plans and hence an assessment of their reasonableness;
6. An indication as to whether the liabilities and Actuarially Determined Contribution rates shown are not reasonable or are incorrectly calculated; and
7. Recommendations for changes in procedures, methods, assumptions and forecasts of expectations.

The scope of this study did not include:

1. any analysis of the reasonableness of the current fixed contribution rate
2. any analysis regarding the tax qualification of the ERS plans, nor of the taxation of any employee contributions to the plans
3. any analysis of the GASB accounting results
4. any analysis of the 2011 experience study or the 2009 audit, other than a review of the recommendations made in the 2011 experience study and the results of the 2009 audit.

### **Methodology of the Audit for the 2016 Actuarial Valuation**

The purpose of this audit is to express an opinion regarding the reasonableness and accuracy of the actuarial assumptions, methods, and valuation results. This started with a review of 53 “sample lives.”

## **2. Purpose, Scope and Methodology of the Audit (cont.)**

### **Methodology of the Audit for the 2016 Actuarial Valuation (cont.)**

#### **Sample Life Review**

The measurement of the reasonableness of the funding levels encompasses three key analyses:

1. A verification of the benefits being projected for future payment;
2. A verification of the appropriateness of the actuarial assumptions that are used in calculating the liability; and
3. A verification of the appropriateness of the funding and asset valuation methods.

#### **Benefits Analysis**

We developed Excel models that enabled us to compare our results with GRS's results. These models also allowed us to confirm that the GRS valuation projects benefits in a manner consistent with the Benefit Provisions summary in the valuation report, and that the summary is consistent with state statutes applicable to the Employees Retirement System of Texas, the Law Enforcement and Custodial Officer Supplemental Retirement Fund of the Employees Retirement System of Texas and the Judicial Retirement System of Texas, Plans 1 and 2. For purposes of this study, we regard differences of less than 1% to be immaterial for the Total Present Value of Benefits (PVB) and 2% to be immaterial for the review of normal cost or accrued liability. We expect the primary cause of these small differences to be due to differences in our actuarial software and models.

#### **Assumptions Analysis**

The second critical component in assessing the reasonableness of the funding levels is in the selection and the application of the actuarial assumptions. With respect to the assumptions, we;

1. Reviewed the Four-Year Experience Study report for the period covering September 1, 2006 to August 31, 2011, prepared by Buck Consultants;
2. Benchmarked the economic assumptions against a survey of state retirement systems; and
3. Examined individual test life calculations to make sure that the assumptions described in GRS reports were properly applied.

## **2. Purpose, Scope and Methodology of the Audit (cont.)**

### **Methodology of the Audit for the 2016 Actuarial Valuation (cont.)**

#### **Methods Analysis**

The third component in assessing funding levels is the selection and application of the actuarial cost method (including the method for amortizing the unfunded actuarial accrued liability) and the asset valuation method (including smoothing techniques). This includes items unique to a particular system, such as ERS's.

### **3. Review of Actuarial Report and Validation of Liabilities Valued**

#### **Review of Valuation Report**

The valuation reports (for the Employees' Retirement System of Texas) must be considered in combination with the presentation report (Actuarial Valuations of the ERS Retirement Funds as of August 31, 2016), as a single combined actuarial communication of the results of the annual actuarial valuations, because no current single report includes all of the information necessary to understand the financial condition of the plans. The presentation report is intended to provide the Retirement Board with an understanding of the key results that affect the operation of the retirement plans and projections of future funding events. The valuation report is intended to provide the backup information supporting the analysis, sufficient that "another actuary qualified in the same practice area could make an objective appraisal of the reasonableness of the actuary's work as presented in the actuarial report."<sup>5</sup>

With respect to the contents of the valuation reports, we suggest ERS consider one of the following approaches:

1. Add some standard measures of the risk and risk trends of each plan, such as the ratio of assets to payroll, liabilities to payroll, the percentage of liabilities due to retirees and other inactive participants and expected future benefit payments to current and future retired participants.
2. We suggest that additional projections, such as the expected future funding levels, be included, so as to provide the reader a better understanding of the likely future financial condition of the plans. For example, membership history shows that the plans have become much more mature over the last five years, but begs the question as to whether and by how much the plans will continue to mature. As another example, historical trends of non-investment cash flows (e.g. benefit payment projections and expected administrative expenses) provide useful information regarding the relationship of contributions to benefit payments, but does not answer the question of whether contributions are expected to more closely approach benefit payments or lag further behind benefit payments.
3. Additional information should be included in any funded status graph showing any discontinuities due to changes in plan provisions (as in 2009) or assumption changes so that the reader understands that the change, or lack thereof, was due to unusual events.
4. Have GRS provide a discussion of whether the trustees stated desire to improve the funded status of the plan is consistent with the amortization method and period used to determine the Actuarially Determined Contribution.

GRS provides comprehensive actuarial valuation reports, which generally includes enough information for an individual to gain a clear understanding of the current financial picture of the System. We believe that

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<sup>5</sup> ASOP 41, Actuarial Communications, section 3.2.

### **3. Review of Actuarial Report and Validation of Liabilities Valued**

#### **Review of Valuation Report (cont.)**

the extensive use of tables significantly improved the ability of the reader to digest the information provided. As with most State plans the material presented is complex and voluminous, and could be significantly more difficult to comprehend but for GRS's efforts to present the results clearly. The material was generally sufficient for us to understand the development of the Actuarially Determined Contributions and liabilities. In particular:

1. The assumption section is more comprehensive than most actuarial reports. This allows another actuary to understand in much greater detail than usual how calculations were prepared, and significantly simplified our review of sample life calculations. In particular, the service calculation explanation is quite helpful in understanding how these calculations are performed.
2. The plan provisions were well organized and in sufficient detail to understand the benefits provided to each group of employees.

We suggest the following additional, minor revisions to the report:

1. We recommend that the reports include the plan's asset mix. We note that this was also recommended by GRS in their audit of the 2009 valuations. This information will be important to the System's review of investment risks and expectations.
2. We recommend that, in addition to the historic benefit payments and administrative expenses included in the ERS valuation reports, that a projection of future expected benefit payments and administrative expenses be included in the ERS, LECOS and JRS2 plans. The JRS1 plan already includes a projection of expected benefit payments.
3. Our understanding is that one of the key goals for the ERS board is the improvement of the funding levels of the plans. We note that 5- year funding ratio projections are included in the ERS, LECOS and JRS2 valuation reports, and that 30 and 50 year projections are included in the presentation report for the ERS. We suggest that projections, of 30 or more years in the future<sup>6</sup>, be included to show when the unfunded accrued liability will be paid off reflecting the fixed rate and the ADC. The Board should consider showing these projections based on both payment of the fixed rate and the Actuarially Determined Contribution amount. As our concern is with communicating the expected direction of changes, we suggest that this information is best shown in the form of graphs, indicating the trends to expect rather than the actual dollar amounts. We suggest 30 years, because the combination of the fixed rate contribution and the level percent of pay amortization method is expected to result in the unfunded liability increasing for 15 years and remaining above the current unfunded accrued liability for the 24 years, before declining to \$0 (i.e. fully funded) in 31 years. We believe that the Board should be intimately aware of this, as others may question the progress toward fully funding the plans, particularly when the unfunded liability continues to increase for many years, appearing to be in conflict with the Board's stated goals.

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<sup>6</sup> We note that the presentation report includes 30 and 50 year projections for the ERS plan.

### 3. Review of Actuarial Report and Validation of Liabilities Valued

#### Review of Sample Lives

We requested specific test lives in order to compare the benefit amounts projected in the valuations against our understanding of the benefits summarized in the valuation reports. Based on our review of the plan designs, features, tiers, and population compositions and cost considerations we recommended an audit size of 53 members, distributed as follows.

	Actives	Retired <sup>7</sup>	TV <sup>8</sup>
<b>1. Employees' Retirement System of Texas (ERS)</b>	15	13	4
<b>2. Law Enforcement and Custodial Officer Supplemental Retirement Fund of the Employees Retirement System of Texas (LECOSRF)</b>	7	3	1
<b>3. Judicial Retirement System of Texas, Plan 1 (JRS1)</b>	1	2	0
<b>4. Judicial Retirement System of Texas, Plan 2 (JRS2)</b>	3	3	1
<b>Totals</b>	26	21	6

Because of the maturity of the plan, retirees are about one-half the plans' liabilities, and because of the differences in types of benefits and cost-of-living adjustments we chose 21 retirees from the four plans. Because of the differences between the employee groups covered (general employees, legislative employees, judicial employees and law enforcement and custodial employees), as well as the tiers of benefits within the pension plans, we chose 26 employees, with the largest numbers from the largest and most complex plan. We primarily included employees also included in the 2015 valuation, but added a few newly hired employees chosen from the 2016 employee information to make sure we were accurately testing the most recent tiers as well. Finally, we chose 6 terminated employees with the rights to deferred retirement benefits (Terminated Vested) because, while the liabilities for these participants is relatively small, we felt it necessary to review at least one from each plan to make sure that their accrued liabilities are correctly calculated.

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<sup>7</sup> Includes beneficiaries and disabled members.

<sup>8</sup> TV means terminated vested or deferred vested. These members are no longer working in covered employment but also not yet receiving annuity payments.

### **3. Review of Actuarial Report and Validation of Liabilities Valued (cont.)**

#### **Review of Sample Lives (cont.)**

Based on our review of the individual test life calculations, we have the following observations and/or recommendations:

Observation #1: The test life results on the following pages are organized by plan and show both GRS and Bolton results. A match of 99% to 101% (in the ratio of Bolton to GRS numbers) is ideal and almost all of the Present Values of Future Benefits fall in this range.

Observation # 2: The Present Value of Future Salaries fell between and 99.1% and 100.4% giving us confidence that the pre-retirement decrements were being applied as stated in the valuation reports.

Observation #3: There were a few higher variations in Normal Cost and Actuarial Liabilities but these were within reasonable variation and likely attributable to differences between Bolton and GRS software models.

Observation #4: We did modify our understanding of one benefit provision and one retirement decrement to improve the match for two individuals. These issues are discussed elsewhere in the report.

### 3. Review of Actuarial Report and Validation of Liabilities Valued (cont.)

#### August 31, 2016 Valuation Test Life Comparison – Employees

#### Employees' Retirement System (ERS) – Employee Class

Type	Participant Information			EAN Actuarial Liability			EAN Normal Cost			Present Value of Future Benefits			Present Value of Future Salary		
	Age	Service	Salary	Bolton	GRS	Ratio	Bolton	GRS	Ratio	Bolton	GRS	Ratio	Bolton	GRS	Ratio
Active #1	53	27.58	294,588	1,924,598	1,918,886	100.3%	9.94%	9.86%	100.9%	1,978,233	1,972,080	100.3%	539,349	539,350	100.0%
Active #2	47	14.67	77,024	243,442	241,794	100.7%	11.94%	11.90%	100.3%	315,845	313,954	100.6%	606,608	606,609	100.0%
Active #3	45	19.00	89,187	389,155	385,606	100.9%	9.78%	9.78%	100.0%	451,669	448,126	100.8%	639,116	639,116	100.0%
Active #4	52	25.17	33,348	199,423	199,031	100.2%	9.58%	9.75%	98.3%	204,639	204,338	100.1%	54,442	54,442	100.0%
Active #5	36	1.17	29,206	10,896	10,733	101.5%	12.33%	12.28%	100.4%	40,316	40,052	100.7%	238,684	238,684	100.0%
Active #6	38	4.75	8,221	6,044	6,036	100.1%	12.34%	12.16%	101.5%	16,319	16,161	101.0%	83,289	83,289	100.0%
Active #7	58	4.92	76,339	56,931	56,543	100.7%	16.31%	16.20%	100.7%	120,755	119,931	100.7%	391,253	391,253	100.0%
Active #8	36	1.58	27,942	4,019	4,029	99.7%	12.49%	12.44%	100.4%	31,064	30,979	100.3%	216,582	216,582	100.0%
Active #9	32	2.00	11,371	2,348	2,359	99.5%	10.90%	10.88%	100.2%	12,737	12,729	100.1%	95,275	95,274	100.0%
Active #10	37	1.17	37,132	11,770	11,719	100.4%	15.09%	14.99%	100.7%	63,265	62,849	100.7%	341,156	341,156	100.0%
Active #11	65	21.25	35,575	196,885	196,033	100.4%	14.00%	14.48%	96.7%	199,897	199,149	100.4%	21,513	21,513	100.0%
Active #12	62	2.83	42,972	20,287	19,506	104.0%	15.26%	15.33%	99.5%	56,476	55,869	101.1%	237,214	237,214	100.0%
Active #13	46	1.08	41,314	6,076	6,025	100.8%	15.06%	14.93%	100.9%	55,668	55,178	100.9%	329,198	329,198	100.0%

#### Inactive Member Sample

Type	Participant Information			Present Value of Future Benefits		
	Age	Benefit Form	Amount	Bolton	GRS	Ratio
Retiree #1	49	Deferred Annuity	1,378	183,056	182,481	100.3%
Retiree #2	71	50% PopUp	944	110,548	110,582	100.0%
Retiree #3	88	Life Annuity	4,837	247,461	248,067	99.8%
Retiree #4	68	67% PopUp	4,694	636,333	636,135	100.0%
Retiree #5	74	100% PopUp	704	87,261	87,306	99.9%
Beneficiary #1	76	Life Annuity	1,265	143,916	144,009	99.9%
Beneficiary #2	96	Life Annuity	1,613	64,360	64,530	99.7%
Disabled #1	43	Life Annuity	1,002	130,683	130,643	100.0%
Disabled #2	70	Life Annuity	544	33,387	33,345	100.1%
TV #1	51	Deferred Annuity	1,752	107,718	107,517	100.2%
TV #2	44	Deferred Annuity	927	33,755	33,773	99.9%

### 3. Review of Actuarial Report and Validation of Liabilities Valued (cont.)

#### August 31, 2016 Valuation Test Life Comparison – Elected

#### Employees' Retirement System (ERS) – Elected Class

Type	Participant Information			EAN Actuarial Liability			EAN Normal Cost			Present Value of Future Benefits			Present Value of Future Salary		
	Age	Service	Salary	Bolton	GRS	Ratio	Bolton	GRS	Ratio	Bolton	GRS	Ratio	Bolton	GRS	Ratio
Active #1	59	19.75	153,750	389,456	379,654	102.6%	17.41%	17.86%	97.5%	524,701	518,440	101.2%	776,992	777,030	100.0%
Active #2	53	9.58	7,200	397,175	386,044	102.9%	309.91%	327.79%	94.5%	516,152	511,905	100.8%	38,391	38,397	100.0%

#### Inactive Member Sample

Type	Participant Information			Present Value of Future Benefits		
	Age	Benefit Form	Amount	Bolton	GRS	Ratio
Retiree #1	57	100% PopUp	6,644	1,420,232	1,421,239	99.9%
Retiree #2	65	75% PopUp	4,045	673,511	674,188	99.9%
Beneficiary	65	Life Annuity	5,078	765,530	766,146	99.9%
Retiree #3	58	50% PopUp	16,496	2,217,418	2,218,617	99.9%
TV #1	52	Deferred Annuity	2,147	262,722	264,981	99.1%
TV #2	60	Deferred Annuity	2,147	371,828	372,509	99.8%

### 3. Review of Actuarial Report and Validation of Liabilities Valued (cont.)

#### August 31, 2016 Valuation Test Life Comparison – Law Enforcement Supplemental

#### Law Enforcement and Custodial Officer Supplemental Retirement Fund (LECOSRF)

Type	Participant Information			EAN Actuarial Liability			EAN Normal Cost			Present Value of Future Benefits			Present Value of Future Salary		
	Age	Service	Salary	Bolton	GRS	Ratio	Bolton	GRS	Ratio	Bolton	GRS	Ratio	Bolton	GRS	Ratio
Active #1	47	26.75	42,119	49,635	49,191	100.9%	1.29%	1.25%	103.5%	51,554	51,043	101.0%	148,350	148,350	100.0%
Active #2	37	1.17	37,132	2,274	2,332	97.5%	2.71%	2.67%	101.5%	11,524	11,437	100.8%	341,156	341,156	100.0%
Active #3	65	21.25	35,575	43,056	42,792	100.6%	1.45%	1.49%	97.1%	43,367	43,112	100.6%	21,513	21,513	100.0%
Active #4	62	2.83	42,972	493	481	102.5%	0.42%	0.43%	98.7%	1,500	1,490	100.7%	237,214	237,214	100.0%
Active #5	33	1.50	40,038	2,941	2,737	107.4%	2.35%	2.38%	98.6%	11,484	11,397	100.8%	364,012	364,011	100.0%
Active #6	54	14.25	47,541	1,072	1,052	101.9%	0.33%	0.34%	98.3%	2,222	2,207	100.7%	344,003	344,004	100.0%
Active #7	46	1.08	41,314	406	404	100.6%	1.00%	0.99%	101.3%	3,707	3,676	100.9%	329,198	329,198	100.0%

#### Inactive Member Sample

Type	Participant Information			Present Value of Future Benefits		
	Age	Benefit Form	Amount	Bolton	GRS	Ratio
Beneficiary	57	Life Annuity	278	41,673	41,682	100.0%
Disabled	55	Life Annuity	340	38,745	38,766	99.9%
Retiree	71	50% PopUp	205	24,034	24,041	100.0%
TV	48	Deferred Annuity	7,000	477,054	475,059	100.4%

### 3. Review of Actuarial Report and Validation of Liabilities Valued (cont.)

#### August 31, 2016 Valuation Test Life Comparison – Judges

##### Judicial Retirement System, Plan 1 (JRS1)

Type	Participant Information			EAN Actuarial Liability			EAN Normal Cost			Present Value of Future Benefits			Present Value of Future Salary		
	Age	Service	Salary	Bolton	GRS	Ratio	Bolton	GRS	Ratio	Bolton	GRS	Ratio	Bolton	GRS	Ratio
Active	66	31.25	140,000	1,254,063	1,238,425	101.3%	21.73%	20.37%	106.7%	1,294,429	1,276,274	101.4%	185,796	185,796	100.0%

##### **Inactive Member Sample**

Type	Participant Information			Present Value of Future Benefits		
	Age	Benefit Form	Amount	Bolton	GRS	Ratio
Retiree	91	100% PopUp	5,628	401,802	402,172	99.9%
Beneficiary	85	Life Annuity	4,788	559,509	561,145	99.7%

##### Judicial Retirement System, Plan 2 (JRS2)

Type	Participant Information			EAN Actuarial Liability			EAN Normal Cost			Present Value of Future Benefits			Present Value of Future Salary		
	Age	Service	Salary	Bolton	GRS	Ratio	Bolton	GRS	Ratio	Bolton	GRS	Ratio	Bolton	GRS	Ratio
Active #1	62	27.00	154,000	1,122,704	1,111,263	101.0%	17.12%	17.04%	100.5%	1,178,426	1,166,751	101.0%	325,541	325,541	100.0%
Active #2	49	1.67	154,000	80,865	78,604	102.9%	26.37%	26.34%	100.1%	394,093	391,170	100.7%	1,187,741	1,186,766	100.1%
Active #3	55	3.75	168,000	210,253	206,847	101.6%	28.69%	28.57%	100.4%	511,773	507,134	100.9%	1,051,036	1,051,089	100.0%

##### **Inactive Member Sample**

Type	Participant Information			Present Value of Future Benefits		
	Age	Benefit Form	Amount	Bolton	GRS	Ratio
Retiree	66	Life Annuity	4,974	547,533	548,293	99.9%
Beneficiary	86	Life Annuity	4,750	375,271	376,299	99.7%
Disabled	61	Life Annuity	6,250	659,929	659,518	100.1%
TV	59	Deferred Annuity	504	24,929	25,158	99.1%

## **4. Analysis of Actuarial Assumptions**

### **Actuarial Assumptions**

We reviewed the principal assumptions used in the actuarial valuation in light of the experience study report for the five-year period ending August 31, 2011. For this purpose, we have reviewed the assumptions for reasonableness. We also compared the current investment return assumptions to the NASRA (National Association of State Retirement Plan Administrators) survey covering other state and local plans. With the exception of the Public Safety disability mortality assumption (lack of mortality improvement projection or disclosure of the reason for no projection), we found the assumptions reasonable, in light of the environment as of August 31, 2011. We strongly suggest the completion of an experience study in the near future to update the actuarial assumptions for the revisions in the economic and demographic experience in the last six years, as well as improvements in actuarial practice since 2011.

When reviewed in the timeframe of the 2011 Experience Study, the economic and demographic actuarial assumptions adopted by the System are reasonable and consistent with generally accepted actuarial standards and practices contained in Actuarial Standard of Practice No. 27 covering economic assumptions and Actuarial Standard of Practice No. 35 covering demographic and non-economic assumptions. However, there are areas requiring updates in the next Experience Study.

Assumptions requiring attention are shown in approximate order to their effect on the results of an actuarial valuation.

### **Investment Return**

As shown on the attached 2016 NASRA chart (Appendix A, page 3), investment return assumptions have been declining nationwide. This coincides with declining return expectations of many investment advisors. The plans used a 8.0% investment return assumption for the 2016 valuation, consisting of a 3.5% inflation rate and a 4.5% real investment return assumption. When compared to the peer group, the 8.00% investment return assumption is above the median of about 7.5% but consistent with surveys that existed at the time of the 2011 Experience Study. We expect future survey results to continue to show decreases in the average and median investment return assumptions. Although the inflation assumption of 3.5% is higher than many states, the real investment return assumption appears to be consistent with others in the peer group. Typical 10-year inflation expectations are in the 2.25% to 2.5% range.

Notwithstanding the reasonableness of the 8.0% assumption in 2011, we also looked at the Buck experience study done for the plans in 2011 and the more recent (2015) GRS experience study for the State of Maryland. While Buck recommended 8.0%, the more recent GRS experience study recommended a discount rate of 7.50% (or perhaps as low as 7.25%). Both were focused on long term investment yields, and assumed relatively similar future investment mixes. GRS referred to the ASOP 27 “Best-Estimate Range” concept: For each economic assumption, the narrowest range within which the actuary reasonably anticipates that the actual results, compounded over the measurement period, are more likely than not to fall. We note that between the time of the Buck experience study in 2011 and the GRS experience study in 2015, the median investment return assumption in the NASRA survey decreased from 8.0% to 7.5%. It appears that the plan’s investment advisors are also suggesting that 8.0% might no longer be a reasonable assumption.

## **4. Analysis of Actuarial Assumptions (cont.)**

### **Actuarial Assumptions (cont.)**

Thus, we find the 8.0% investment return assumption acceptable in the past but the Board should consider reducing the discount rate in light of investment professionals' reduced investment return expectations, which continue to decline.

We reviewed the other assumptions and the 2011 Experience Study. We only have a few comments about the other assumptions.

### **Selecting Rates Between Prior Assumptions and Current Experience**

Buck often selected assumptions between the prior assumptions and current experience. This is a common practice given the unusual economic times during the 2006 – 2011 experience study period. However, the Board should be prepared to again lower employee turnover and retirement rates after the next study if experience is similar and possibly move more quickly toward recognizing the current experience.

### **CPI and Other Economic Assumptions**

In addition to the investment return assumption, the Consumer Price Index (CPI), Cost-of-living adjustment (COLA), the salary increase and payroll growth assumption should be related. In each of the plans' valuations, these assumptions are tightly tied to each other. The inflation component of the salary increase assumption is consistently equal to the CPI and payroll growth (for the three funded plans). All of these assumptions are consistently 3.5%.

As noted above, the CPI assumption used by the plans are higher than typical. While, the plans' post-retirement benefits are mostly not affected by the CPI assumption (except for the benefits in JRS1), the CPI assumption is critical as a building block for all of the other economic assumptions.

### **Mortality for Employees and Other Retirees**

There are multiple choices in selecting a mortality table. We prefer, as does GRS, the use of generational mortality tables, as this includes a projection of future mortality improvement. We note that the disability mortality table (RP-2000, set forward 6 years for males and set back one year for females) is used without a mortality projection scale. We suggest that mortality improvement projection be applied to this table, as well, since the mortality table recommended in the prior experience study included no margin for mortality improvement. We note that ASOP 35, section 3.5.3 ii requires either the use of a mortality improvement scale or the disclosure of why one is not reasonable.

## **4. Analysis of Actuarial Assumptions (cont.)**

### **Actuarial Assumptions (cont.)**

We note that the GAM 94 table is a table built using the mortality experience of people covered by group annuity contracts. This experience is not necessarily the same as experience for people working for employers sponsoring pension plans. While the RP 2000 and RP 2014 mortality tables are not ideal as they reflect the experience of employees and retirees who work for (or worked for) private sector employers, rather than those who worked for public sector employers, this table is better suited to be used as the basis for the expected mortality experience of the ERS plans.

There are separate age adjustments (i.e. using a mortality rate at either an earlier or later age than shown in the table) being used with the mortality table for healthy lives for males and females, with the female adjustment to increase expected mortality. We note that a recent SOA study shows an increase in mortality improvements, particularly for females.

GRS should also consider the use of the RP2014 table (for healthy participants), particularly if using that table allows a reduction in the need for adjustments. However, we recommend using a multiplier to reduce the mortality expected of employees from that expected of retirees, which is consistent with the experience shown in the prior experience study, which showed that male employees died at about 70% (and females 76%) of the proposed mortality table. We note that multipliers far from a value of 1.000 (e.g. the female teachers' multiplier of 0.765) can distort the shape of the mortality rate curve at older ages; however, this distortion at older ages is generally not relevant to active employees.

The disabled life mortality table does not include any projection of future mortality improvement. We note that the actual/expected values on page 3 of the most recent Experience study (for experience through August 31, 2011) shows no margin for future mortality improvements. No explanation is provided in the actuarial valuation reports for the lack of a disabled life mortality improvement assumption either for the period between when the experience study was completed and the valuation date, or for the future period after the valuation date and until all benefits are provided, as required in ASOP 35, section 3.5.3.

### **Other Assumptions**

In addition to the significant assumptions that should be reviewed as part of an experience study and assumption review, we suggest that the following minor assumptions also be considered in an experience study:

1. Actuarially equivalent form conversion policies: We understand that the State intends the alternative forms of payment to be actuarially equivalent to the normal form. However, for the benefit form conversion factors to be truly actuarially equivalent they need to vary by COLA type. These factors do not currently reflect the differences in the post-retirement COLAs. These factors have only a minor impact on the valuation because these factors affect (1) certain death and disability annuity benefits and (2) generate actuarial gains and losses based on employees' elections at retirement. We understand that these factors vary between disabled and non-disabled lives and between public safety and non-public safety. We recommend that GRS study the factors being used and either (1) recommend appropriate changes to the factors being used or (2) explain

## **4. Analysis of Actuarial Assumptions (cont.)**

### **Actuarial Assumptions (cont.)**

the impact of not making changes. Our experience is that some boards make changes whenever assumptions, or COLA provisions, are changed and others do not. The Board should consider adopting a formal policy regarding future changes that would warrant changing actuarial equivalence factors.

2. Current retirement assumptions are substantially higher (81% to 84% for Regular and CPO/CO classes) than actual experience from the prior study. This generally results in an overstatement of plan costs. However, the ratio for younger ages is the reverse – more retirements than assumed (98%-122% for retirement before age 50, for Regular and CPO/CO classes). These are typically the highest cost retirements, and should be better reflected by a revision to the shape of the retirement curve.
  - a. We further note that most plans experienced substantial decreases in the rates of retirement between 2008 and 2010 (which has only recently begun to increase), so that these rates may still appear to be more conservative (i.e. higher) than actual experience. We suggest trying to remain conservative, because of the possibility of a reversion to the earlier norm (that is, pre 2008) in the future.
3. Investment expenses are netted out of investment returns. Investment expenses should be considered during the experience study, as the expected future investment returns available from investment advisors are typically before any adjustment for investment expenses. We suggest that the ultimate investment return assumption reflect expected investment experience net of investment expenses.
4. Administrative expenses are tied to payroll, although the reason for any such relationship is not clear. We also note that both the number of retirees and the percentage of total participants that are retired has been increasing. We suggest that expenses be included in the experience study, and reflected in an increase in annual plan cost, perhaps tied to the average of the last two or three years of expenses.
5. We note that the ERS valuations do not reflect either the retirement benefit limits of IRC §415 or the limit on pay used to compute a plan benefit in IRC §401(a)(17). These limits are complicated and not material to the results of the valuation. We do not have a concern with this simplification to the valuation and commend GRS for disclosing this information.

## 4. Analysis of Actuarial Assumptions (cont.)

### Asset Valuation Method

Assets in the Trust are valued using the expected value of assets plus (or minus) 20% of the difference between the market-related value of assets and the expected value. This method smooths investment gains and losses (that is, investment returns above or below the assumed investment return of, currently, 8.0%) by adding or subtracting 20% of the accumulated, unrecognized investment gains or losses each year. However, this method would not ever match the market value, because of the asymptotic method of adjusting for 20% of the difference between the market value and the actuarial value. The current method also does not impose a collar (such as limiting the actuarial value to be between 80%/120% of market value) and could result in significant differences between the actuarial value of assets (AVA) and the market value of assets (MVA).

An essential part of the public sector budgeting process is that material budget items, including pension contributions, should have a level cost pattern from year to year to the extent possible. Bolton recognizes the importance of this requirement and assists clients in establishing reasonable methodologies for recognizing investment gains and losses and limiting the potential volatility that may result in increased contributions due to investment results.

The actuary's guide for determining the reasonableness of an asset smoothing method is Actuarial Standard of Practice (ASOP) No. 44. The following is an excerpt from this ASOP that establishes the qualities a reasonable asset smoothing method must exhibit.

#### **From the Actuarial Standard of Practice No. 44**

*3.3 Selecting Methods Other Than Market Value -- If the considerations in section 3.2 have led the actuary to conclude that an asset valuation method other than market value may be appropriate, the actuary should select an asset valuation method that is designed to produce actuarial values of assets that bear a reasonable relationship to the corresponding market values. The qualities of such an asset valuation method include the following:*

- a. The asset valuation method is likely to produce actuarial values of assets that are sometimes greater than and sometimes less than the corresponding market values.*
- b. The asset valuation method is likely to produce actuarial values of assets that, in the actuary's professional judgment, satisfy both of the following:*
  - 1. The asset values fall within a reasonable range around the corresponding market values. For example, there might be a corridor centered at market value, outside of which the actuarial value of assets may not fall, in order to assure that the difference from market value is not greater than the actuary deems reasonable.*
  - 2. Any differences between the actuarial value of assets and the market value are recognized within a reasonable period of time. For example, the actuary might use a method where the actuarial value of assets converges toward market value at a pace that the actuary deems reasonable, if the investment return assumption is realized in future periods.*

## 4. Analysis of Actuarial Assumptions (cont.)

### Asset Valuation Method (cont.)

*In lieu of satisfying both (1) and (2) above, an asset valuation method could satisfy section 3.3(b) if, in the actuary's professional judgment, the asset valuation method either (i) produces values within a sufficiently narrow range around market value or (ii) recognizes differences from market value in a sufficiently short period.*

Two key principles arise from ASOP 44. These are that acceptable asset smoothing must create asset values that fall within a reasonable range around market value and are recognized in a reasonable period of time. In lieu of satisfying both of these principles, a smoothing method could satisfy the requirements if, in the actuary's professional judgment, the range around market value is sufficiently narrow or the differences are recognized in a sufficiently short period.

It can be reasonably argued that the ERS' method does not meet either of these two key requirements, as:

1. The method could result in significant variation from the market value of assets in the event of large asset gains or losses since it does not include a "collar" to keep the actuarial value within a sufficiently narrow range around the market-related value of assets.
2. Adjusting annually for 20% of the difference between market value and actuarial value of assets does not provide for a sufficiently short period for recognizing the differences between the market value and the actuarial value of assets.

Bolton's policy, consistent with others in the actuarial community, is that five years is a sufficiently short period to constitute a reasonable asset smoothing method but not with the asymptotic design. Therefore, our opinion is that the method utilized by ERS should be revised in future valuations, as it is unclear that it meets the requirements for a reasonable asset valuation method. We note that GRS, in their actuarial audit of the ERS Plan (Page 6, GRS' Actuarial Audit of the August 31, 2009 Actuarial Valuations of ERS) also concluded that the asset smoothing method was not appropriate.

### Ultimate Entry Age Normal Funding Method

The actuarial cost method used for the ERS plans is the ultimate entry age normal method (UEAN). This method, like the entry age normal method (EAN) spreads the cost of an employee's pension benefits (as well as all other benefits provided by the pension plan) over their working lifetime, as a level percentage of the employee's pay. These two methods result in different normal cost and accrued liability only in plans which have different levels of benefits for employees based on their date of hire (known as benefit tiers). The key difference between the EAN method and the UEAN method is in the derivation of normal cost. In the EAN method, the total cost of benefits is spread over the present value of salaries as of the entry age, as a level percent. In the UEAN method, the cost of the pension benefit based on the current tier of benefits, is spread over the employee's career, as a level percent of pay. The difference between the present value of employee's pension benefits and the present value of the employee's future normal cost is then

## 4. Analysis of Actuarial Assumptions (cont.)

### Ultimate Entry Age Normal Funding Method (cont.)

determined to be the accrued liability. The effect of the UEAN method is that with the implementation of a tier providing a lower level of benefits for new employees is a significant increase in the accrued liability for current participants and a significant drop in their normal cost. This effectively defeats the purpose of the EAN method of funding an employee's benefit over their career by artificially increasing the employee's accrued liability, which will then be funded not over the employee's working lifetime but over the period for the amortization of unfunded accrued liability.

For plans such as the ERS plans, which are funded by a level contribution rate, the use of the UEAN method provides as well as omits significant information. First, it clarifies the sufficiency of the current level of employer and employee contributions for newly hired employees, making it clear whether the current level of contributions will be sufficient to pay for the benefits being earned by employees once all current employees are replaced by employees in the new tier. However, the use of UEAN does not provide information regarding the total value of benefits currently being earned by all employees.

UEAN was considered in the 2014 CCA White Paper on Actuarial Funding Policies and Practices for Public Pension Plans. The paper stated that UEAN method was not recommended for funding in part because the method fails the policy objective of providing that "The expected cost of each year of service (generally known as the Normal Cost or service cost) for each active member should be reasonably related to the expected cost of that member's benefit." That being said it does provide certain value which the CCA papers describes as:

"While not recommended for funding, the Normal Cost under the Ultimate Entry Age method discussed above may nonetheless be useful when a new open tier is adopted for future hires. The combined normal cost rate for the open and closed tiers (as determined under the LCAM Entry Age method) will change over time as members of the closed tier are replaced by members in the new tier. This will result in an increasing or decreasing combined normal cost rate (depending on whether the new tier has higher or lower benefits), consistent with the transition of the workforce overtime to the new benefit level. However, the Ultimate Entry Age Method Normal Cost for the combined tiers will reflect the expected long term Normal Cost for the entire workforce (unlike the LCAM Normal Cost which reflects only the recent hires in the new tier). For that reason, Normal Cost under Ultimate Entry Age may be useful for projecting longer-term costs or for evaluating a fixed contribution rate."<sup>9</sup>

Also, GASB 67 and GASB 68 make clear that the UEAN method is not appropriate for purposes of both pension accounting and plan sponsor accounting for pension plans (from GASB 68; paragraph 46 of GASB 67 is identical.<sup>10</sup>)

"32. The **entry age actuarial cost method** should be used to attribute the actuarial present value of projected benefit payments of each employee to periods in conformity with the following:

...

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<sup>9</sup> *Actuarial Funding Policies and Practices for Public Pension Plans*, October 2014, page 14.

<sup>10</sup> We note that the GRS audit of ERS in 2009 suggested the use of UEAN for accounting purposes, but GASB67 and 68 had not yet been promulgated by GASB.

## **4. Analysis of Actuarial Assumptions (cont.)**

### **Ultimate Entry Age Normal Funding Method (cont.)**

(e) Each employee's service costs should be determined based on the same benefit terms reflected in that employee's actuarial present value of projected benefit payments."

For these three reasons, we believe that ERS should consider switching from the UEAN funding method to a funding method, that does not have these issues, such as the EAN funding method.

## 5. Recommendations

This partial replication audit reviewed the data used, the benefits valued, and the actuarial methods and assumptions employed in the August 31, 2016 actuarial valuation. The test lives provided by the actuary reflect the plan provisions of ERS and related plans as stated in the 2016 actuarial valuation reports. These test lives also demonstrate the application of the actuarial assumptions to the benefits as stated in the valuation report. The actuarial assumptions, methods, and procedures are reasonable and reflect the benefit promises made to ERS members.

Below we summarize our recommendations for your consideration:

### A. Valuation Report

1. Enhance reports by including standard historic risk related measures
2. Enhance reports by including longer term projections of future assumed payroll, funding levels and expected benefit payments
3. Enhance reports by including projections of future risk metrics
4. Clarify the application of retirement assumptions for members of JRS2 who reach retirement eligibility prior to age 65

### B. Assumptions

1. Complete experience study, and consider
  - a. Lower discount rate
    - i. Reflect directly, or indirectly, expected investment expenses
  - b. Lower discount rate for unfunded JRS1 plan to municipal bond discount rate of appropriate duration
  - c. Lower expected inflation assumption
  - d. Update retirement assumptions
  - e. Update mortality assumptions to current, pension plan related mortality experience and mortality improvement
  - f. Revise mortality assumption for employees to reflect significantly lower mortality than that for retirees
2. Add mortality improvement assumption to disability mortality assumptions

## **5. Recommendations (cont.)**

### **C. Funding Methods**

1. Along with the assumption changes that will be suggested as part of the experience study, we suggest that the Board:
  - a. Consider revising the funding method to from the Ultimate Entry Age Normal to another funding method, perhaps to the version of EAN required for accounting purposes.
  - b. Revise the asset valuation method to more quickly reach the market value of assets and to limit the potential deviation from the market value of assets.
  - c. Adopt, as part of the funding policy, an amortization method that amortizes gains and losses over a shorter, closed, period so as to improve, over time, the Board's ability to improve the plans' funding levels.

### **D. Valuation Programming and Calculations**

1. No recommendations

### **E. Potential Future Projects for the Plan Actuary**

We suggest the Board consider the following:

1. Analyze the potential effect on future contributions and funding level of substantial future investment market losses using either stochastic methods or a deterministic scenario. This should also include an analysis of the effect of the future maturation of the employee population, and its effect on this risk.

We note that the Board appears to be receiving information of this kind in the presentation report, dated December 1, 2016.

The plans' actuary appears to have reasonably valued the expected liability of the System. They have applied the methodology consistently and their report generally conforms to accepted actuarial principle and practices. In this report, we have noted areas that we believe will improve the usefulness and clarity of the System's annual actuarial valuation. We are available to discuss any aspect of our review with System staff or the System's actuary.

# Appendix

# NASRA Issue Brief: Public Pension Plan Investment Return Assumptions



Updated February 2016

As of September 30, 2015, state and local government retirement systems held assets of \$3.56 trillion.<sup>1</sup> These assets are held in trust and invested to pre-fund the cost of pension benefits. The investment return on these assets matters, as investment earnings account for a majority of public pension financing. A shortfall in long-term expected investment earnings must be made up by higher contributions or reduced benefits.

Funding a pension benefit requires the use of projections, known as actuarial assumptions, about future events. Actuarial assumptions fall into one of two broad categories: demographic and economic. Demographic assumptions are those pertaining to a pension plan's membership, such as changes in the number of working and retired plan participants; when participants will retire, and how long they'll live after they retire. Economic assumptions pertain to such factors as the rate of wage growth and the future expected investment return on the fund's assets.

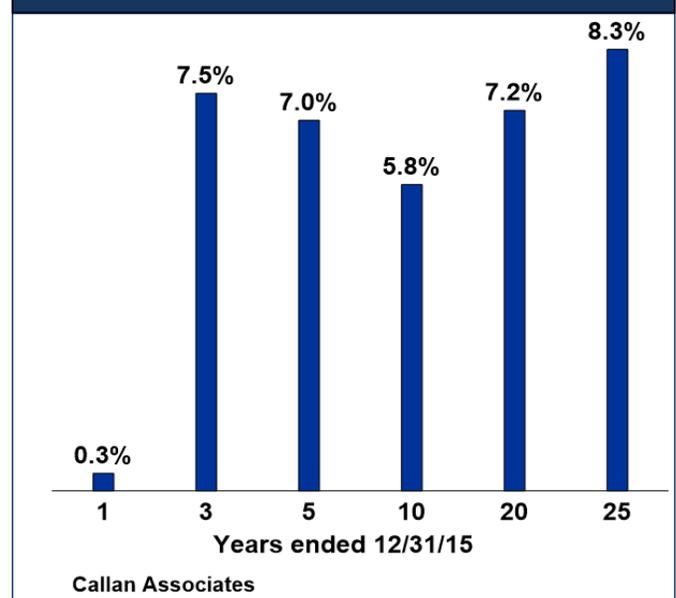
As with other actuarial assumptions, projecting public pension fund investment returns requires a focus on the long-term. This brief discusses how investment return assumptions are established and evaluated, and compares these assumptions with public funds' actual investment experience.

Some critics of current public pension investment return assumption levels say that current low interest rates and volatile investment markets require public pension funds to take on excessive investment risk to achieve their assumption. Because investment earnings account for a majority of revenue for a typical public pension fund, the accuracy of the assumption has a major effect on the plan's finances and actuarial funding level.

An investment return assumption that is set too low will overstate liabilities and costs, causing current taxpayers to be overcharged and future taxpayers to be undercharged. A rate set too high will understate liabilities, undercharging current taxpayers, at the expense of future taxpayers. An assumption that is significantly wrong in either direction will cause a misallocation of resources and unfairly distribute costs among generations of taxpayers.

Although public pension funds, like other investors, experienced sub-par returns in the 2008-09 decline in global equity markets, and in 2015, median public pension fund returns over a longer period exceed the assumed rates used by most plans. Specifically, as shown in Figure 1, the median annualized investment return for the 25-year period ended December 31, 2015, exceeds the average assumption of 7.62 percent.

Figure 1: Median public pension annualized investment returns for period ended 12/31/2015



<sup>1</sup> Federal Reserve, *Flow of Funds Accounts of the United States: Flows and Outstandings, Third Quarter 2015*, Table L.120

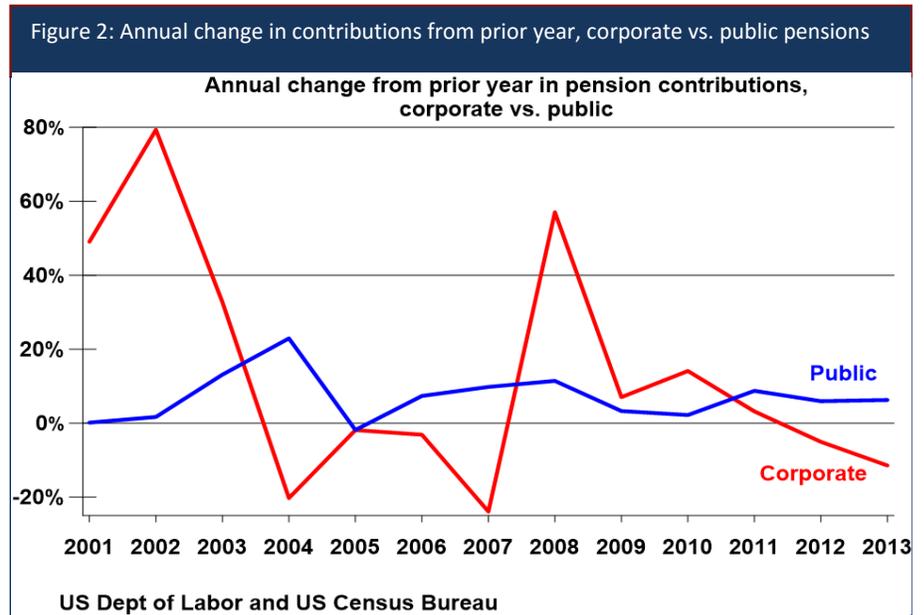
Public retirement systems typically follow guidelines set forth by the Actuarial Standards Board to set and review their actuarial assumptions, including the expected rate of investment return. Most systems review their actuarial assumptions regularly, pursuant to state or local statute or system policy. Actuarial Standards of Practice No. 27 (Selection of Economic Assumptions for Measuring Pension Obligations) (ASOP 27) prescribes the considerations actuaries should make in setting an investment return assumption. As described in ASOP 27, the process for establishing and reviewing the investment return assumption involves consideration of various financial, economic, and market factors, and is based on a very long-term view, typically 30 to 50 years. A primary objective for using a long-term approach in setting public pensions' return assumption is to promote stability and predictability of cost to ensure intergenerational equity among taxpayers.

The investment return assumption used by public pension plans typically contains two components: inflation and the real rate of return. The sum of these is the nominal return rate, which is the rate that is most often used and cited. The inflation assumption typically is applied also to other actuarial assumptions, such as the assumed level of wage growth and, depending on the plan's benefit structure, assumed rates of cost-of-living adjustments.

The second component of the investment return assumption is the real rate of return, which is the return on investment after adjusting for inflation. The real rate of return is intended to reflect the return produced as a result of the risk taken in investing the assets. Achieving a return approximately commensurate with the inflation rate normally is attainable by investing in securities, such as US Treasury bonds, that are considered to be risk-free, i.e., that pay a guaranteed rate of return that is absolutely risk-free. Achieving a return higher than the risk-free rate requires taking some investment risk; for public pension funds, this risk takes the form of investments in public and private equities, real estate, and other asset classes.

The average real rate of return among plans in the Public Fund Survey has risen since FY 01, from approximately 4.25 percent to 4.60 percent. This has occurred as a result of some plans that have reduced their inflation assumption without changing their nominal investment return assumption; or reductions in inflation assumptions by an amount greater than they have reduced their nominal assumption; or both.

Unlike public pension plans, corporate plans are required by federal regulations to make contributions on the basis of current interest rates. As Figure 2 shows, this method results in plan costs that are volatile and uncertain, often changing dramatically from one year to the next. This volatility is due in part to fluctuations in interest rates and has been identified as a leading factor in the decision among corporations to abandon their pension plans. By focusing on the long-term and relying on a stable investment return assumption, public plans experience less volatility of costs.



Source: Compiled by NASRA based on U.S. Department of Labor and U.S. Census Bureau data

As shown in Figure 3, since 1985, public pension funds have accrued an estimated \$6.7 trillion in revenue, of which \$4.3 trillion, or 64 percent, is estimated to have come from investment earnings. Employer contributions account for \$1.63 trillion, or nearly one-quarter of the total, and employee contributions total \$755 billion, or 11 percent.<sup>2</sup>

Public retirement systems operate over long timeframes and manage assets for participants whose involvement with the plan can last more than half a century. Consider the case of a newly-hired public school teacher who is 30 years old. If this pension plan participant elects to make a career out of teaching school, he or she may work for 35 years, to age 65, and live another 25 years, to age 90. This teacher’s pension plan will receive contributions for the first 35 years and then pay out benefits for another 25 years. During the entire 60-year period, the plan is investing assets on behalf of this participant. To emphasize the long-term nature of the investment return assumption, for a typical career employee, more than one-half of the investment income earned on assets accumulated to pay benefits is received *after* the employee retires.

The investment return assumption is established through a process that considers factors such as economic and financial criteria; the plan’s liabilities; and the plan’s asset allocation, which reflects the plan’s capital market assumptions, risk tolerance, and projected cash flows. <http://www.nasra.org/publicfundsurvey>

Standards for setting an investment return assumption, established and maintained by professional actuaries, recommend that actuaries consider a range of specified factors, including current and projected interest rates and rates of inflation; historic and projected returns for individual asset classes; and historic returns of the fund itself. The investment return assumption reflects a value within the projected range.

As shown in Figure 4, many public pension plans have reduced their return assumption in recent years. Among the 127 plans measured, more than one-half have reduced their investment return assumption since fiscal year 2008. The average return assumption is 7.62 percent. Appendix A details the assumptions in use or adopted by the 127 plans in this dataset.

Figure 3: Public Pension Sources of Revenue, 1985-2014

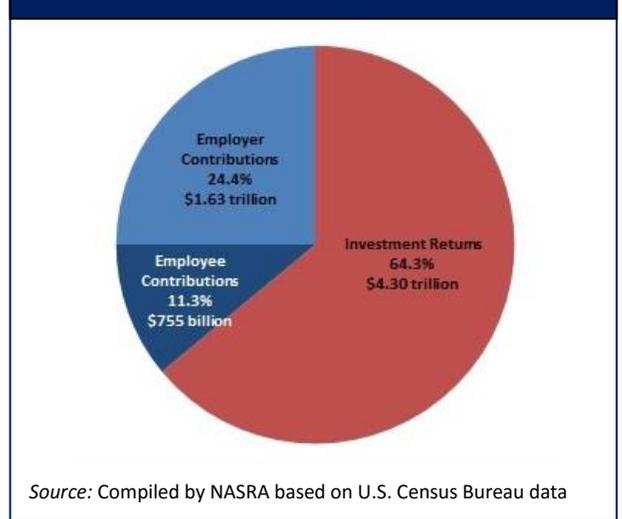
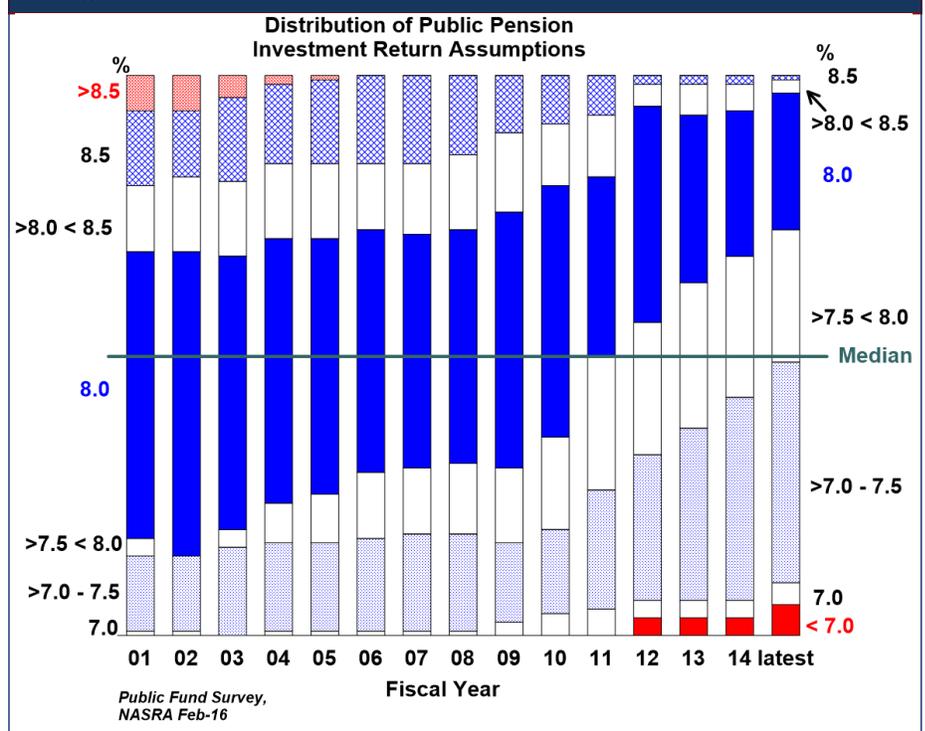


Figure 4: Change in distribution of public pension investment return assumptions, FY 01 through February 2016



<sup>2</sup> US Census Bureau, Annual Survey of Public Pensions, State & Local Data

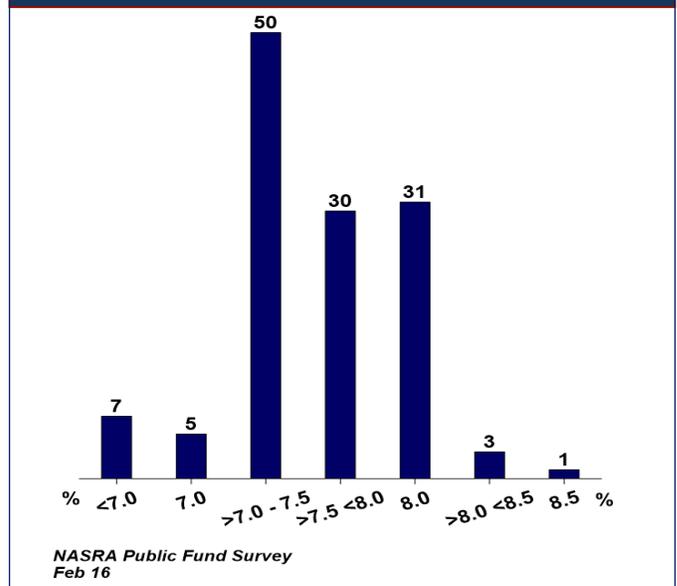
## Conclusion

Over the last 25 years, a period that has included three economic recessions and four years when median public pension fund investment returns were negative, public pension funds have exceeded their assumed rates of investment return. Changes in economic and financial conditions are causing many public plans to reconsider their investment return assumption. Such a consideration must include a range of financial and economic factors while remaining consistent with the long timeframe under which plans operate.

### See Also:

- [Actuarial Standards of Practice No. 27](#), Actuarial Standards Board
- [The Liability Side of the Equation Revisited](#), Missouri SERS, September 2006
- The [Public Fund Survey](#) is sponsored by the National Association of State Retirement Administrators (registration required).

Figure 5: Distribution of investment return assumptions



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[National Association of State Retirement Administrators](#)

## Appendix A: Investment Return Assumption by Plan

(Figures reflect the nominal assumption in use, or announced for use, as of February 2016)

Plan	Rate (%)
Alaska PERS	8.00
Alaska Teachers	8.00
Alabama ERS	8.00
Alabama Teachers	8.00
Arkansas PERS	7.50
Arkansas Teachers	8.00
Arizona Public Safety Personnel	7.50
Arizona SRS	8.00
Phoenix ERS	7.50
California PERF	7.50
California Teachers	7.50
Contra Costa County	7.25
LA County ERS	7.50
San Diego County	7.50
San Francisco City & County	7.50
Colorado Affiliated Local	7.50
Colorado Fire & Police Statewide	7.50
Colorado Municipal	7.50
Colorado School	7.50
Colorado State	7.50
Denver Employees	8.00
Denver Public Schools	7.50
Connecticut SERS	8.00
Connecticut Teachers	8.00
DC Police & Fire	6.50
DC Teachers	6.50
Delaware State Employees	7.20
Florida RS	7.65
Georgia ERS	7.50
Georgia Teachers	7.50
Hawaii ERS <sup>1</sup>	7.55
Iowa PERS	7.50
Idaho PERS	7.00
Chicago Teachers	7.75
Illinois Municipal	7.50
Illinois SERS	7.25
Illinois Teachers	7.50
Illinois Universities	7.25
Indiana PERF	6.75
Indiana Teachers	6.75

Kansas PERS	8.00
Kentucky County	6.75
Kentucky ERS	6.75
Kentucky Teachers	7.50
Louisiana Parochial Employees	7.25
Louisiana SERS	7.75
Louisiana Teachers	7.75
Massachusetts SERS	7.50
Massachusetts Teachers	7.50
Maryland PERS	7.55
Maryland Teachers	7.55
Maine Local	7.13
Maine State and Teacher	7.13
Michigan Municipal	7.75
Michigan Public Schools	8.00
Michigan SERS	8.00
Duluth Teachers	8.00
Minnesota PERF	8.00
Minnesota State Employees	8.00
Minnesota Teachers <sup>2</sup>	8.40
St. Paul Teachers	8.00
Missouri DOT and Highway Patrol	7.75
Missouri Local	7.25
Missouri PEERS	8.00
Missouri State Employees	8.00
Missouri Teachers	8.00
St. Louis School Employees	8.00
Mississippi PERS	7.75
Montana PERS	7.75
Montana Teachers	7.75
North Carolina Local Government	7.25
North Carolina Teachers and State Employees	7.25
North Dakota PERS	8.00
North Dakota Teachers	7.75
Nebraska Schools	8.00
New Hampshire Retirement System	7.75
New Jersey PERS	7.90
New Jersey Police & Fire	7.90
New Jersey Teachers	7.90

New Mexico PERF	7.75
New Mexico Teachers	7.75
Nevada Police Officer and Firefighter	8.00
Nevada Regular Employees	8.00
New York City ERS	7.00
New York City Teachers	8.00
New York State Teachers	7.50
NY State & Local ERS	7.00
NY State & Local Police & Fire	7.00
Ohio PERS	8.00
Ohio Police & Fire	8.25
Ohio School Employees	7.75
Ohio Teachers	7.75
Oklahoma PERS	7.50
Oklahoma Teachers	8.00
Oregon PERS	7.50
Pennsylvania School Employees	7.50
Pennsylvania State ERS	7.50
Rhode Island ERS	7.50
Rhode Island Municipal	7.50
South Carolina Police	7.50
South Carolina RS	7.50
South Dakota PERS <sup>3</sup>	7.25
TN Political Subdivisions	7.50

TN State and Teachers	7.50
City of Austin ERS	7.75
Houston Firefighters	8.50
Texas County & District	8.00
Texas ERS	8.00
Texas LECOS	8.00
Texas Municipal	6.75
Texas Teachers	8.00
Utah Noncontributory	7.50
Fairfax County Schools	7.50
Virginia Retirement System	7.00
Vermont State Employees <sup>4</sup>	8.10
Vermont Teachers <sup>4</sup>	7.90
Washington LEOFF Plan 1 <sup>5</sup>	7.80
Washington LEOFF Plan 2	7.50
Washington PERS 1 <sup>5</sup>	7.80
Washington PERS 2/3 <sup>5</sup>	7.80
Washington School Employees Plan 2/3 <sup>5</sup>	7.80
Washington Teachers Plan 1 <sup>5</sup>	7.80
Washington Teachers Plan 2/3 <sup>5</sup>	7.80
Wisconsin Retirement System	7.20
West Virginia PERS	7.50
West Virginia Teachers	7.50
Wyoming Public Employees	7.75

1. The Hawaii ERS rate is scheduled to change to 7.50 percent effective 7/1/17.
2. The Minnesota Legislature is responsible for setting the investment return assumption for pension plans in the state. Legislation approved in 2015 established a rate of 8.0 percent for all plans except the TRA, which is using a select and ultimate rate pending completion of an actuarial experience study. (For more information on select-and-ultimate rates, please see Actuarial Standards of Practice No. 27: [http://www.actuarialstandardsboard.org/pdf/asops/asop027\\_145.pdf](http://www.actuarialstandardsboard.org/pdf/asops/asop027_145.pdf).) The Minnesota Legislative Commission on Pensions and Retirement recommended that the legislature adopt a rate for the TRA of 8.0 percent; the legislature may act on this recommendation during its session that ends in May.
3. The SDRS set the rate at 7.25% through FY 2017, after which the rate will rise to 7.50% unless the SDRS board takes action otherwise.
4. The Vermont retirement systems adopted select-and-ultimate rates in 2011; the rates shown reflect the single rates most closely associated with the funding results for the respective plans, based on their projected cash flows.
5. For all Washington State plans except LEOFF Plan 2, the assumed rate of return will be reduced to 7.7% on July 1, 2017, under current state law.