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City of Austin, Texas

Review of City of Austin Employees' Retirement System

March 5, 2019

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Mr. Art Alfaro
City of Austin
621 Capital Mall Suite 1200
Austin, TX

Dear Mr. Alfaro,

This report addresses our review of the City of Austin Employees' Retirement System (COAERS.) We concluded that:

- The City of Austin Employees' Retirement System Actuarial Valuation Report (Valuation Report) generally complies with the requirements of the Actuarial Standards of Practice (ASOPs). While there are some minor areas for improvement, the Valuation Report is generally complete and thoroughly addresses the issues facing the Board of Trustees for COAERS.
- The Valuation Report is generally in compliance with the Requirements of the Texas State Pension Review Board Guidelines for Actuarial Soundness (State Board.)
- The Valuation Report also includes substantial useful information not required by the ASOPs or State Board Requirements. We found the Valuation Report very helpful in our analysis. We do make a few suggestions regarding additional information that could or should be included.
- The City of Austin Employees' Retirement System Actuarial Experience Study as of December 31, 2015 (Experience Study) thoroughly analyzes recent experience, and future expectations, resulting in a reasonable and internally consistent set of both demographic and economic assumptions.
- The current employer contribution rate (Fixed Rate) of 18% results in fully funding the COAERS in about 30 years. This is longer than recommended by the State Board. COAERS is only about 68% funded. Also, the payroll growth assumption, of 4%, is relatively high. Thus, adverse economic events, such as an economic downturn, are likely to have a greater effect on the COAERS than on a better funded plan. We suggest that the COAERS' actuary, Gabriel Roeder, Smith and Company (GRS) should include additional information on the potential financial risks to the COAERS, as will be required in the December 31, 2018 valuation report by ASOP 51.

The undersigned actuaries are available to answer any questions on the material in this report or to provide explanations or further details as appropriate. We meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained in this report. 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.

Sincerely,

BOLTON

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EXECUTIVE SUMMARY

The City of Austin requested a review of the Actuarial Valuation Report for the City of Austin Employees' Retirement System (COAERS) from January 2013 to December 2017. Bolton was hired to (1) review the reports for compliance with the Texas Government Code, relevant Actuarial Standards of Practice (ASOPs), and any other statutory requirements (2) provide commentary on the completeness of the report and (3) provide any recommendations or enhancements for best practices.

We note the following recommendations for possible improvements or areas where further review may be warranted:

- The use of a Fixed Rate funding approach requires special attention be given to evaluating the adequacy of the Fixed Rate. Currently the Fixed Rate is sufficient to fund the unfunded liabilities over a period of 30-years. Such a period is longer than is typically considered reasonable.
- Consideration should be given to how best to monitor the COAERS' funding levels, and when, how quickly and by how much to increase the contribution levels or, alternatively, to lower the plan benefits so as to maintain or improve the funding levels.

We reviewed the annual actuarial valuation reports for the prior five years, the Experience Study and the benefit provisions described in the City code. We also reviewed the appropriate ASOPs, the State Board provisions and the Conference of Consulting Actuaries (CCA) Public Plans Community's publication *Actuarial Funding Policies and Practices for Public Pension Plans*.

We submitted to our initial draft report dated January 4, 2019. Aside from clarifying some language the report was accepted as written. There was no written response from GRS, the Actuary for COAERS.

PURPOSE & PROCESS

Purpose of the Audit

The City of Austin retained Bolton to conduct an independent review of the City of Austin Employees' Retirement System (COAERS) annual valuations in light of Actuarial Standards of Practice (ASOP) 27 and 35 in order to satisfy the requirements of Texas Government Code Section 802.1012. At a minimum, the audit should address the following:

- Appropriateness of the actuarial cost methods used to calculate the normal cost, actuarial accrued liability and actuarially determined contribution;
- Appropriateness of the method used to develop the actuarial value of assets;
- Appropriateness of the assumptions used in the actuarial valuation;
- Completeness of the valuation report and any additional items which the reviewing actuary believes should be included in future valuation reports and also items which could be omitted from future reports;
- Whether the valuation meets all statutory requirements, the requirements of the Texas State Pension Review Board Guidelines for Actuarial Soundness, and relevant Actuarial Standards Board Standards of Practice; and
- Other items or issues which the Actuary believes should be addressed.

Our assistance could be considered similar to a Level 3 Actuarial Audit (as defined by the Government Finance Officers Association (GFOA)), as we reviewed the plan provisions and actuarial valuation reports, including the methods and assumptions, but did not replicate the liability and cost calculations (Level 1) or review sample lives (Level 2) to confirm the normal cost and accrued liability calculations.

Scope of the Audit

For this actuarial audit, we focused first on the application of the plans' benefit provisions, methods and assumptions and GRS's model reflecting these factors. We evaluated whether the assumptions and methods are appropriate, given prior experience as reflected in the experience studies, actuarial standards of practice and the State Board's legislative provisions regarding plan funding. Then we focused on whether the most recent actuarial report fairly represented the financial condition of COAERS and made suggestions for possible enhancements.

Our review of GRS' work generally starts with a presumption that the work prepared is reasonable, unless we conclude that it is not. We do not attempt to impose what we believe are the best assumptions, but rather only to question assumptions that do not appear reasonable. Thus, for example, if we would typically use 2.5% as an inflation assumption, and GRS uses 2.75%, we would not suggest any change if we concluded that 2.75% was also reasonable.

This audit provides the following:

1. A measurement of economic actuarial assumptions against those used by other public plans and hence an assessment of their reasonableness;
2. A review of the demographic actuarial assumptions for consistency with generally accepted actuarial practices and the specific experience of COAERS, as documented in the two most recent experience studies;
3. Recommendations for changes in procedures, methods, assumptions and forecasts of expectations
4. Commentary on whether the current contribution rate corresponds to a reasonable funding level; and
5. An analysis of the reasonableness of the current fixed contribution rate.

The scope of this study did not include:

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 representative of the Normal Cost and Actuarial Liability of the entire system;
3. Confirmation that the valuation system is valuing benefits as described in the valuation report and consistent with applicable statutes;
4. Any analysis regarding the tax qualification of the COAERS, or of the taxation of any employee contributions to the COAERS;
5. Any analysis of the GASB accounting results;
6. Any analysis of the 2012 experience study or the 2009 audit, other than a review of the recommendations made in the 2012 experience study and the results of the 2009 audit.

Methodology of the Audit for the 2017 Actuarial Valuation

The purpose of this audit is to express an opinion regarding the reasonableness of the actuarial assumptions, methods, and valuation results and whether the 2017 Actuarial Valuation Report adequately documents the results of the valuation so that the reader may understand the funding issues facing the COAERS.

Assumptions Analysis

One of the most critical components in assessing the reasonableness of the funding levels is the selection and application of the actuarial assumptions. With respect to the assumptions, we;

1. Compared the economic assumptions to recent experience studies, market data and other plans to determine the reasonableness of these assumptions.
2. Compared the demographic assumptions to the recent experience studies.

3. Review the experience study for completeness and reasonableness.

Methods Analysis
The second 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), the asset valuation method (including smoothing techniques) and the method used to amortize the unfunded accrued liability. These methods are used to calculate the actuarially determined contribution, as a check on the Fixed Rate contribution actually made by the City.

Completeness and Best Practice
Finally, we reviewed the Valuation Report for compliance with Texas Government Code and best practices. We used the Actuarial Funding Policies and Practices for Public Pension Plans published by the Conference of Consulting Actuaries as a source for some of the best practices. We compared the results of the report to the requirements of the Texas Government Code and provided commentary on how well the report conveys the financial condition of the COAERS and the adequacy of the current contribution rates.

We also include a review of the documentation of the valuation results as provided in the 2017 Valuation Report for compliance with the ASOP's (particularly ASOP 41, Actuarial Communications.)

Background

COAERS provides two tiers of benefits, known as Group A and Group B. Group A participants earn benefits more quickly and are eligible to retire with an unreduced benefit at an earlier age. Both employees and the City contribute to COAERS. Retirees may receive a cost-of-living adjustment at the discretion of the Board, if the plan actuary recommends that such an adjustment will not make the COAERS financially unsound. The Board may also approve an additional lump-sum benefit for retirees. Death, disability and termination benefits are also provided.

ASSUMPTION REVIEW

Introduction

The Actuarial Standards of Practice (ASOPs) provide guidance on the measurement of pension obligations. The relevant ASOP for measuring pension obligations is ASOP 4 (Measuring Pension Obligations and Determining Pension Plan Costs or Contributions). ASOP 4 also references ASOP 27 (Economic Assumptions), 35 (Demographic Assumptions) and 44 Asset Valuation Methods.)

ASOP No. 27 (Selection of Economic Assumptions for Measuring Pension Obligations) and ASOP No. 35 (Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations) provide guidance concerning actuarial assumptions. ASOP 44 (Selection and Use of Asset Valuation Methods for Pension Valuations) provides guidance concerning asset valuation methods. ASOP 4 addresses broader measurement issues including cost allocation procedures and contribution allocation procedures and provides guidance for coordinating and integrating all of these elements of an actuarial valuation of a pension plan.

A links to the ASOPs is provided in Appendix A.

Economic Assumptions

Section 3.6 of ASOP 27 states that each of the economic assumptions selected by the actuary should be reasonable. For this purpose, an assumption is reasonable if it has the following characteristics:

1. It is appropriate for the purpose of the measurement;
2. It reflects the actuary's professional judgment;
3. It takes into account historical and current economic data that is relevant as of the measurement date;
4. It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
5. It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed, or when alternative assumptions are used for the assessment of risk.

Section 4.1 (Communications) of ASOP 27 states that any actuarial report communicating work subject to this standard should contain the following disclosures:

1. Assumptions Used: The actuary should describe each significant assumption used in the measurement of the obligations.
2. Rationale for Assumptions: The actuary should disclose the information and analysis used in selecting each economic assumption that has a significant effect on the measurement.

The 2017 actuarial report contains a section labeled "Statement of Actuarial Methods and Assumptions" which indicates that the assumptions are set by the Board of Trustees based on recommendations made by the plan's actuary. The most recent experience study, completed in conjunction with the December 31, 2015 actuarial valuation provides rationale for the current assumptions. Assumptions were not changed from the prior valuation.

Price Inflation

The 2017 actuarial valuation report discloses the core inflation rate assumption of 2.75%. This inflation rate is utilized in the determination of the rates of salary increase and the investment return rate.

The actuary should review appropriate inflation data which may include consumer price indices, the implicit price deflator, forecasts of inflation, yields on government securities of various maturities, and yields on nominal and inflation-indexed debt.

We reviewed this assumption against the 20-, 30-, and 40- year historical averages of CPI-U. The averages were 2.15%, 2.57%, and 3.54% respectively. We also reviewed the inflation assumption against the spread of 10-, 20- and 30-year treasury bonds with their corresponding year Treasury Inflation-Indexed Bond as of December 31, 2017. The spreads were 1.97%, 1.98%, and 2.01% respectively. The spread between TIPS and treasury bonds (known as Treasury Breakeven Inflation or TBI) give a future expectation of inflation while historical returns provide what inflation has been in the past. Neither is a perfect measure of future inflation and both should be considered when setting an inflation assumption. The past is not always the best prediction of the future as economic conditions may be different now and into the future than in the past. The spread between TIPS and Treasuries are not just impacted by the future expectation of inflation. TIPS' trading volume is much lower than that of Treasuries, so the yield differential can often change due to technical factors not having to do with inflation expectations. As a result, the yield gap can be used as a guide but not as an absolute measure of current inflation expectations. In the past 20 years, the TIPS spread has underestimated inflation levels about two-thirds of the time. Therefore, using an expected inflation rate higher than the TIPS and Treasuries spread is reasonable.

We believe that the 2.75% is supported by both historical data and future expectations and meets the requirements of ASOP 27. However, the more recent averages of CPI-U and the TBI suggest that inflation may be lower in future years and should be considered in setting the inflation assumption for future valuations.

Investment Rate of Return (Discount Rate)

Historically, most sponsors of public sector defined benefit pension plans have set the investment return or discount rate assumption by considering the expected rate of return on the plan's investments.

Section 3.8 of ASOP 27 states that the actuary may consider a broad range of data and other inputs, including the judgment of investment professionals. Some of the factors that the standard recommends that the actuary consider are historical and current investment data including real and nominal returns, inflation, historical performance, investment policy, forecasts of GDP growth, investment volatility,

investment and other administrative expenses, cash flow timing, and benefit volatility. Many of these considerations can be reviewed through an analysis of the expected return and volatility expectations of the plan's portfolio based on a target allocation of investments, which is often stated in the plan's investment policy.

The 2017 actuarial report discloses an investment return assumption of 7.5% per year, net of investment expenses. The components include the 2.75% inflation rate and a 4.75% assumed real rate of return.

We used the Capital Market Assumptions (CMA) contained in Horizon Actuarial Services' 2018 Edition of their Survey of Capital Market Assumptions to test the reasonableness of the 7.5% assumption. The Horizon report (included as Appendix B) blends the capital market assumptions from 34 different investment firms and presents both 10-year return assumptions and 20-year return assumptions. The returns reported are net of investment fees, but not of any administrative fees. We note that this survey was developed for multiemployer pension plans, but the generally long-term investment approach and size of these funds is consistent with that of COAERS. While it is prudent to evaluate both short term and long-term return assumptions, public sector pension plans generally have a long investment horizon. As such, we calculated a 20-year expected geometric return assumption based on the target allocation and the Horizon 20-year capital market assumptions and compared the resulting rate to the investment rate or return assumption of 7.5%. The table below shows our approximate mapping of the asset classes to those used in the Horizon report and the subsequent expected geometric return calculation.

We also reviewed the investment return assumption in light of the National Association of State Retirement Administrators' (NASRA) annual survey of state investment return assumptions (included as Appendix C). The 2018 version reflects a median investment return assumption of 7.5%, consistent with the rate currently used by GRS for valuing the liabilities in the COAERS.

Mapped to Horizon Asset Classes		Real Return (Net of Infl)		Inflation Assumption		Arithmetic Return		Geometric Return			Weighted
Horizon CMAs (all respondents)	Target Allocation	10 Year	20 Year	10 Year	20 Year	10 Year	20 Year	10 Year	20 Year	St. Dev	St. Dev
US Equity - Large Cap	33.73%	5.10%	6.26%	2.24%	2.47%	7.34%	8.73%	6.07%	7.42%	16.39%	5.53%
US Equity - Small/Mid Cap	15.67%	6.25%	7.66%	2.24%	2.47%	8.49%	10.13%	6.57%	8.18%	20.20%	3.16%
Non-US Equity - Developed	8.00%	6.12%	6.99%	2.24%	2.47%	8.36%	9.46%	6.71%	7.71%	18.67%	1.49%
Non-US Equity - Emerging	8.00%	8.28%	9.47%	2.24%	2.47%	10.52%	11.94%	7.64%	8.82%	24.89%	1.99%
US Corp Bonds - Core	11.60%	1.30%	2.16%	2.24%	2.47%	3.54%	4.63%	3.37%	4.46%	5.71%	0.66%
US Corp Bonds - Long Dur.	0.00%	1.66%	2.67%	2.24%	2.47%	3.90%	5.14%	3.32%	4.44%	10.83%	0.00%
US Corp Bonds - High Yield	4.00%	3.05%	3.97%	2.24%	2.47%	5.29%	6.44%	4.78%	5.82%	10.24%	0.41%
Non-US Debt - Developed	5.00%	0.13%	1.09%	2.24%	2.47%	2.37%	3.56%	2.18%	3.22%	6.86%	0.34%
Non-US Debt - Emerging	0.00%	3.39%	4.38%	2.24%	2.47%	5.63%	6.85%	5.00%	6.13%	11.43%	0.00%
US Treasuries (Cash Equiv)	0.00%	0.31%	0.63%	2.24%	2.47%	2.55%	3.10%	2.48%	3.05%	2.74%	0.00%
TIPS (Inflation-Protected)	0.00%	0.84%	1.79%	2.24%	2.47%	3.08%	4.26%	2.88%	4.04%	6.25%	0.00%
Real Estate	9.00%	4.65%	5.20%	2.24%	2.47%	6.89%	7.67%	5.90%	6.66%	13.86%	1.25%
Hedge Funds	0.00%	3.05%	4.14%	2.24%	2.47%	5.29%	6.61%	4.96%	6.19%	7.87%	0.00%
Commodities	3.00%	3.22%	4.00%	2.24%	2.47%	5.46%	6.47%	3.97%	4.92%	17.60%	0.53%
Infrastructure	0.00%	5.37%	5.77%	2.24%	2.47%	7.61%	8.24%	6.56%	7.14%	14.74%	0.00%
Private Equity	2.00%	8.48%	9.70%	2.24%	2.47%	10.72%	12.17%	8.33%	9.52%	22.16%	0.44%
	100.00%										
Portfolio Arithmetic Return						**7.06%**	**8.34%**				
Portfolio Variance										1.67%	
Standard Deviation										12.9%	
Portfolio Geometric Return (net of inv expenses)								**6.22%**	**7.51%**		

We calculated an expected geometric return of 7.51%. The assumed return of 7.50% is consistent with the expected geometric return over a 20-year investment horizon. We note that the 7.51% expected return developed from the Horizon survey is based on an assumed inflation rate of 2.47%, 28 basis points less than the 2.75% assumed in the 2017 actuarial report. If we used a 2.75% inflation assumption, the expected return from the Horizon survey real rates of return would be approximately 7.79%, slightly above the 7.5% assumed rate. As we noted above, the 7.5% investment return is also consistent with the assumptions used by a large group of states and large cities plans. We conclude that the assumption of 7.5% is reasonable. We recommend that the investment assumption should be reduced if assumed inflation rate is reduced.

Administrative Expenses

Administration expenses are included in the valuation as an addition to the COAERS' normal cost. The assumption is 0.51% of the prior year's valuation payroll. The assumption is based on the average administrative cost as a percent of payroll from 2011 through 2015.

We looked at the recent experience from the 2016 and 2017 actuarial valuations and the administrative expenses as a percent of prior payroll are 0.48% and 0.46% respectively. The recent 5-year and 7-year averages are both 0.50% with the 3 most recent years being slightly below 0.50%. We believe that the method and resulting assumption for administrative expenses is reasonable and takes into account fluctuations that occur from year to year.

Salary Increase

The salary increase assumption assumes an inflation component plus a productivity component plus a promotional component. The inflation rate of 2.75% and the productivity rate of 1.25% are fixed rates while the promotional rate ranging from 2.25% to 0.00% is based on service. The general wage increase

should generally be based on the average wage increases in the region or the country. We tested the wage increase assumption by looking at the Social Security Wage Index average annual increase over the last 10-, 20- and 30- year. The averages were 2.23%, 3.1%, and 3.42% respectively. Also, the wage increase should generally be slightly higher than the assumed rate of inflation. The productivity portion of the wage increase assumption is 125 basis points. We generally see spreads of 25 to 100 basis points with 50 basis points being the most common spread used between the wage increase and inflation assumptions.

However, we must also consider the results of the Experience Study. The Experience Study looked at the recent 10 years for salary increase assumptions and found that long-service employees participating in COAERS received an average salary increase of 1.57% above inflation. Given the results of the experience study, we believe a 2.75% general inflation increase combined with a 1.25% productivity wage increase is reasonable and complies with the requirements of ASOP 27.

The service based promotional increase rates are supported by data from the 2015 experience study.

Payroll Growth

The employee and employer contribution rates are set by statute. The Systems funding policy is for rates to be sufficient to cover normal cost and amortization of unfunded actuarial accrued liability over a period not to exceed 25 years. To determine if contributions are sufficient an open group projection is performed. The assumption for payroll growth in the open group forecast is 4.00% and is applied to the starting salary of new hires. This rate is reasonably based on the inflation and productivity components used for the salary increase assumption.

However, we note that a payroll growth assumption of 4% is unusually high. The use of this rate implies that the City payroll must increase 4% annually for the unfunded accrued liability is paid within 30 years. While consistent with recent experience, the growth of the City's payroll may slow in future years, extending the period necessary to fund the unfunded accrued liability. Since the 30-year period is already longer than suggested by the State Board, we suggest that some sensitivity analysis related to this assumption be included in future actuarial valuation reports.

Cost of Living Increases

COAERS includes provision so that on January 1 of each year the Board may approve a cost-of-living adjustment for those retirees who retired on or before December 31 of the previous year. The maximum adjustment which can be approved is 6%. The amount of the adjustment is set by the Board upon recommendation by the System's actuary that such an adjustment will not make the Fund financially unsound, and the adjustment is not inconsistent with the Code. COAERS also allows the Board to provide retirees one-time payments in any year.

The 2017 actuarial valuation assumes no future cost of living increases. Based on the Board policy for plan funding and the current funded status of the plan this assumption is reasonable. We suggest that GRS

also include a statement regarding any assumptions regarding future one-time retiree increases as well as the basis for the assumptions related to cost-of-living assumptions.

Demographic

ASOP 35 provides actuaries guidance for the selection of demographic assumptions. ASOP 35 section 3.3.5, provides the criteria for a reasonable assumption:

a. It is appropriate for the purpose of the measurement;
b. It reflects the actuary's professional judgment;
c. It takes into account historical and current demographic data that is relevant as of the measurement date;
d. It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data (if any), or a combination thereof; and
e. It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included (as discussed in section 3.10.1) and disclosed under section 4.1.1 or when alternative assumptions are used for the assessment of risk.

Service Retirement for Active Participants
The assumption for active members retiring is based on age and gender. The rates were developed from the 2015 experience study. For employees hired after 2012, Group B, who become eligible for normal retirement with 7 additional years of service there is an adjustment to double the assumed rate in the first year of eligibility for normal retirement. Group B also has an early retirement assumption for ages 55 through 64. We reviewed the experience study report and the assumed rates seem reasonable based on this analysis. We anticipate that the Group B rates will be monitored as experience with that group becomes available.

Service Retirement for Inactive Participants
The experience study report indicates the assumed age for commencement of deferred benefits as age 62 for Group A and age 65 for Group B. The Valuation Report makes no mention of this assumption. The assumption is not unreasonable. We suggest that future annual valuation reports should include this assumption. Also, the experience study should provide support for the selection of these ages.

Disability
The disability experience in the plan is limited, there were only 41 new retirements due to disability during the five-year period examined in the 2015 study. Therefore, the assumption utilized is the same as that adopted by Texas Municipal Retirement System (TMRS). Additionally, the disability decrement includes the assumption that 10% of all disabilities are occupational. This distinction only applies to eligibility for participants who become disabled with less than 5 years of service. The method of selecting the disability assumption is a reasonable for this plan.

Employee Termination

The termination assumption is gender specific and includes a 3 year select period. During the select period higher termination service-based rates are assumed for all ages. After the select period rates are based on remaining service until eligible for unreduced retirement. The use of termination rates based on the number of years to retirement is unusual for general employees but are consistent with experience and the approach is not unreasonable. The assumed rates are based and the 2015 experience study and are reasonable for COAERS.

Mortality

There are multiple choices in selecting a mortality table. Many actuaries generally prefer the use of generational mortality tables, as this includes a projection of future mortality improvement. 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 for this group of participants.

Since 2012, the Society of Actuaries (SOA) has published two mortality studies. The first study produced the RP 2014 mortality tables and MP projection scales which were based on the mortality experience of corporate pension plans and large public pension plans from 2004 to 2008, with the central year of 2006. The study showed a significant improvement in mortality from the RP-2000 mortality table which is based on a central year of 1992.[1] The Society of Actuaries issued an Exposure Draft of Pub-2010 Public Retirement Plans Mortality Tables Report in August 2018, which develops public plan mortality tables based on public plan participant mortality experience from 2008 to 2013. The exposure draft develops mortality tables for three separate job classifications: General Employees, Teachers, and Public Safety Employees.

Active Member - The 2017 valuation uses sex distinct RP-2014 Employee Mortality Tables with Blue Collar Adjustments, with projected improvement using Scale BB.

Nondisabled Annuitants - The 2017 valuation uses the RP-2014 Sex Distinct Combined Healthy mortality table with Blue Collar adjustment and projected improvement using Scale BB.

Disabled Annuitants - The 2017 valuation uses RP-2014 Combined Healthy Mortality Tables with Blue Collar Adjustments, set forward three years and projected improvement using Scale BB. There is a minimum 3% rate of mortality at all ages.

The 2015 experience study report notes that the Blue Collar adjustment is made to better reflect the life expectancy in Texas rather than the actual work performed by COAERS participants.

[1] Based on the Society of Actuaries RP-2014 Mortality Tables Report dated October 2014 (Revised November 2014)

We believe these mortality assumptions with adjustments and projected improvements is reasonable and should remain so until the next experience study. At that time the SOA Public Retirement Plan Mortality tables may be considered.

DROP Elections

The plan provides members the opportunity to retroactively participate in the DROP for a period up to 60 months prior to the date of election. The 2017 actuarial report assumes 20% of members retiring with at least 20 years of service will elect the backward DROP to the date that maximizes the actuarial value of benefits. This assumption was changed from 15% to 20% after the Experience Study. The Experience Study does not provide a detailed analysis of DROP participation. We do not have enough information to determine if these rates are reasonable. Because of the 10% reduction in the cumulative retirement payments we do not have any major concerns with the assumption.

ACTUARIAL METHODS

Funding Method

The 2017 actuarial report uses the individual entry age normal cost method as a level percentage of pay to determine the normal cost and accrued liability of the plan. Because the contribution rates are set by statute, the actuarial cost method is used to test whether contributions will meet reasonable funding levels.

Section 3.13 of ASOP 4 defines the guidelines for selecting a funding method as follows:

> *When assigning periodic costs or actuarially determined contributions to time periods in advance of the time benefit payments are due, the actuary should select an actuarial cost method that meets the following criteria:*
>
> a. *The period over which normal costs are allocated for a participant should begin no earlier than the date of employment and should not extend beyond the last assumed retirement age. The period may be applied to each individual participant or to groups of participants on an aggregate basis.*
>
> *When a plan has no active participants and no participants are accruing benefits, a reasonable actuarial cost method will not produce a normal cost for benefits. For purposes of this standard, an employee does not cease to be an active participant merely because he or she is no longer accruing benefits under the plan.*
>
> b. *The attribution of normal costs should bear a reasonable relationship to some element of the plan's benefit formula or the participant's compensation or service. The attribution basis may be applied on an individual or group basis. For example, the actuarial present value of projected benefits for each participant may be allocated by that participant's own compensation or may be allocated by the aggregated compensation for a group of participants.*
>
> c. *Expenses should be considered when assigning periodic costs or actuarially determined contributions to time periods.*
>
> d. *The sum of the actuarial accrued liability and the actuarial present value of future normal costs should equal the actuarial present value of projected benefits and expenses, to the extent expenses are included in the actuarial accrued liability and normal cost. For purposes of this criterion, under a spread gain actuarial cost method, the sum of the actuarial value of assets and the unfunded actuarial accrued liability, if any, shall be considered to be the actuarial accrued liability.*

The funding method used is reasonable and meets the criteria outlined in ASOP 4.

Asset Smoothing Method

The method used in the 2017 actuarial report sets the actuarial value of assets equal to the market value of assets less a five-year phase in of the excess/(shortfall) between expected investment return and actual income. The expected investment return each year is calculated based on the actuarial value of assets with the difference from actual income smoothed in over five years. If the current year's difference is opposite sign of the prior years' deferred Excesses/(Shortfalls), then the prior years' bases (starting with the oldest) are reduced dollar for dollar along with the current year's base. Any remaining bases are then recognized over five years from their initial creation. If the resulting preliminary asset value is less than 80% or more than 120% of the market value of assets, then 1/3 of the amount outside of the 80%-120% corridor is recognized in the final actuarial value of assets.

The actuary's guide for determining the reasonableness of an asset smoothing method is Actuarial Standard of Practice (ASOP) 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 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.

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.

The method used in the 2017 actuarial report has two features that we examined. First the offsetting of prior bases when investment returns change from gains to losses. This feature accelerates the recognition of prior bases making the smoothing period effectively shorter than 5 years, if both gains and losses occur in the five year period. Second, when the preliminary actuarial value of assets is outside of the 20% corridor around market value only one-third of the excess is recognized. This allows for the final actuarial value of assets to be outside of the method's corridor.

Additionally, the assumed return on assets is applied to the actuarial value not the market value at the beginning of each year. This is acceptable, although we note that when the actuarial value of assets exceeds market value the return on market value of assets needs to exceed the 7.5% assumption to achieve the expected return on AVA.

We feel that the methods achieve the objectives stated in the ASOPs, but the Board should be aware of the features of the methods operation.

Unfunded Liability Amortization Method

GRS uses the level percent of payroll method, assuming that payroll grows 4%, to determine the period of time necessary for the unfunded accrued liability to be funded. This method is widely used for plans, like the COAERS, which use a fixed contribution rate. We note that the covered payroll has increased 5.4% annually over the last 20 years. However, we believe that annual increases of 4% in payroll, is somewhat aggressive. We believe that this may overstate the likelihood that the COAERS unfunded accrued liability will be paid off in 30 years. As we note elsewhere, we suggest that some sensitivity analysis of this assumption be included in future actuarial valuation reports.

STATUTORY REQUIREMENTS

Texas Government Code

Key Government Code Requirements
Title 8, Subtitle A, Chapter 802 of the Texas Government Code provides guidelines for Actuarial Valuations, Audits of Actuarial Valuations, Studies, and Reports, and Actuarial Experience Studies and Actuarial Soundness among a host of other guidelines.

Section 802.101 of the Government Code provides the following requirements for actuarial valuations:

- A valuation must be done by a qualified actuary once every three years.
- The actuary shall make recommendations to the governing body of the public retirement system to ensure the actuarial soundness of the system.
- The actuary shall define each actuarial term and enumerate and explain each actuarial assumption used in making the valuation.

Furthermore, Chapter 802 requires that if a public retirement system's actuarial valuation shows that the system's amortization period has exceeded 40 years for three consecutive annual actuarial valuations, or two consecutive actuarial valuations in the case of a system that conducts the valuations every two or three years, the governing body of the public retirement system and the associated governmental entity shall formulate a funding soundness restoration plan.

The Pension Review Board has provided the following pension funding guidelines effective June 30, 2017:

1. The funding of a pension plan should reflect all plan obligations and assets.
2. The allocation of the normal cost portion of the contributions should be level or declining as a percentage of payroll over all generations of taxpayers and should be calculated under applicable actuarial standards.
3. Funding of the unfunded actuarial accrued liability should be level or declining as a percentage of payroll over the amortization period.
4. Actual contributions made to the plan should be sufficient to cover the normal cost and to amortize the unfunded actuarial accrued liability over as brief a period as possible, but not to exceed 30 years, with 10 - 25 years being a more the preferable target range. For plans that use multiple amortization layers, the weighted average of all amortization periods should not exceed 30 years. Benefit increases should not be adopted if all plan changes being considered cause a material increase in the amortization period and if the resulting amortization period exceeds 25 years.

5. The choice of assumptions should be reasonable and should comply with applicable actuarial standards.
6. Retirement systems should monitor, review, and report the impact of actual plan experience on actuarial assumptions at least once every five years.

Compliance with Government Code

An actuarial valuation has been conducted every year and reports are available on the COAERS website. Each report was signed by actuaries that meet the requirements of Chapter 802. The actuarial valuation reports were completed by Gabriel Roeder & Smith (GRS). The 2017 actuarial report provides a glossary defining the key terms used in the valuation and a section that summarizes all of the major assumptions used in the report.

The following is our commentary on whether the Valuation Report meets the pension funding guidelines of the Pension Review Board

1. The funding obligations of the COAERS appear to reflect all of the plan's obligations and assets.
2. The normal cost is calculated using the Entry Age Normal Cost method which allocates the annual liability cost as a level percent of pay.
3. The unfunded actuarial accrued liability (UAAL) amortization period is measured by amortizing the UAAL as a level percentage of pay.
4. The current funding policy is projected to amortize the UAAL over 30 years based on the 2017 valuation. Down from 31 years in the previous valuation. The State Board suggests a 10- to 25-year period, but not more than 30 years.
5. We provided commentary on the reasonableness of the assumptions under the Assumptions Section.
6. An experience study was completed in the last 5 years, based on data through December 31, 2015.

Other ASOPs

Data Quality

ASOP 23 provides guidance to actuaries when selecting data, performing a review of data, using data, or relying on data supplied by others, in performing actuarial services. Sections 3.1, 3.3 and 3.5 of ASOP 23 state the following:

> *The actuary should use available data that, in the actuary's professional judgment, allow the actuary to perform the desired analysis. However, if significant data limitations are known to the actuary, the actuary should disclose those limitations and their implications in accordance with section 4.1(b). The following sections discuss such considerations in more detail.*

> *The actuary should perform a review [of the data], unless, in the actuary's professional judgment, such review is not necessary or not practical. In exercising such professional judgment, the actuary should take into account the purpose and nature of the assignment, any relevant constraints, and the extent of any known checking, verification, or audit of the data that has already been performed.*
>
> *The accuracy and completeness of data supplied by others are the responsibility of those who supply the data. The actuary may rely on data supplied by others, subject to the guidance in sections 3.3 and 3.4. The actuary should disclose reliance on data supplied by others in an appropriate actuarial communication, in accordance with section 4.1(h).*

The statements made in the 2017 actuarial report provide evidence that the actuary performed a review of the data and appropriately disclosed their reliance on data supplied by others as required by ASOP 23. The data summaries disclosed in the 2017 actuarial report assist readers of the report to gain some understanding of the appropriateness of the data. We believe that the actuary has appropriately followed the requirements of ASOP 23 regarding the quality of the data used for the 2017 actuarial report.

COMPLETENESS & BEST PRACTICES

The Statement of Work for this project requested commentary on the completeness of the valuation report and any additional items which the reviewing actuary believes should be included in future valuation reports and also items which could be omitted from future reports.

We reviewed the 2017 Actuarial Valuation Report for completeness and best practices. The Valuation Report generally provides all of the necessary information required by the Texas State Board and the ASOPs and includes several items not required by either the State Board or the ASOPs which are very helpful to the COAERS Board of Trustees as well as other users of the Valuation Report, such as the discussion of the funding period, funding periods and historical member data.

We recommend the following enhancements that may improve the understanding of the results provided in the Valuation Report:

- The report does not show any measures of the "riskiness" and/or maturity of the plan. We recommend showing some risk measures to give the readers of the report some context for the ability to maintain and/or achieve targeted funding levels for the plan. Some examples are the ratio of retiree liability to total liability, the ratio of assets to payroll, the ratio of liabilities to payroll, and ratio of benefit payments to contributions. All of these measures show how large the plan is compared to the City's ability to make contributions to fund any losses in the plan's liabilities or assets and achieve targeted funding goals.
- The Actuarial Standards Board recently issued Actuarial Standard of Practice No. 51 (ASOP 51), *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions*. This actuarial standard of practice (ASOP) provides guidance to actuaries when measuring obligations under a defined benefit pension plan and calculating actuarially determined contributions for such plans, with regard to the assessment and disclosure of the risk that actual future measurements may differ significantly from expected future measurements. The effective date of the ASOP is for measurement dates after November 1, 2018. The requirements of ASOP No. 51 are not effective for the 2017 Actuarial Valuation Report but will be for the 2018 Actuarial Valuation Report. The2017 Actuarial Valuation Report would most likely not comply to ASOP 51 and we recommend that the actuary provide recommendations to the Board on including information to satisfy the requirements of ASOP 51.
- Page B-3 of the 2017 Actuarial Report references the open group projection used to determined when the unfunded liability is expected to be paid off. We recommend that more information be provided concerning the projection. We also recommend doing

the open group projections at alternative asset returns to demonstrate the downside risk of the Plan. This last suggestion may satisfy some of the requirements of ASOP 51

CONCLUSION

Based on our review, we concluded that:

- The City of Austin Employees' Retirement System Actuarial Valuation Report (Valuation Report) generally complies with the requirements of the ASOPs, including ASOPs 4, 23, 27, 35, 41 and 44. While there are some minor areas for improvement, the Valuation Report is generally complete and thoroughly addresses the issues facing the Board of Trustees for COAERS.
- The Valuation Report is generally in compliance with the Requirements of the Texas State Pension Review Board Guidelines for Actuarial Soundness (State Board.)
- The Valuation Report also includes substantial useful information not required by the ASOPs or State Board Requirements. We found the Valuation Report very helpful in our analysis. We do make a few suggestions regarding additional information that could or should be included.
- The City of Austin Employees' Retirement System Actuarial Experience Study as of December 31, 2015 (Experience Study) thoroughly analyzes recent experience, and future expectations, resulting in a reasonable and internally consistent set of both demographic and economic assumptions.
- The current employer contribution rate (Fixed Rate) of 18% results in fully funding the COAERS in about 30 years. This is longer than recommended by the State Board. COAERS is only about 68% funded. Also, the payroll growth assumption, of 4%, is relatively high. Thus, adverse economic events, such as an economic downturn, are likely to have a greater effect on the COAERS than on a better funded plan. We suggest that the COAERS' actuary, GRS, should include additional information on the potential financial risks to the COAERS, as will be required in the December 31, 2018 valuation report by ASOP 51.

We note the following areas where we think improvements can be made or further review may be warranted:

- The funding approach of using a Fixed Rate requires attention to be paid to the adequacy of the fixed rate. Currently the Fixed Rate is sufficient to fund the unfunded liabilities over a 30-year period. This is a longer period than is typically considered reasonable.
- Consideration should be given to how best to monitor the COAERS' funding levels, and when, how quickly and by how much to increase the contribution levels or, alternatively, to lower the plan benefits so as to maintain or improve the funding levels.
- Consider including more details about the operation and effect of the method used to determine the actuarial value of assets. Specifically, be sure there is understanding that a 7.5% return on market value of assets is not the same as the assumed 7.5% return on AVA, that it is clear the AVA may be outside the corridor, and that it is clear that the smoothing period may at times be shorter than 5 years.

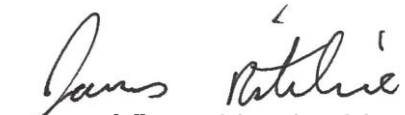
ACTUARIAL CERTIFICATION

The undersigned credentialed 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.

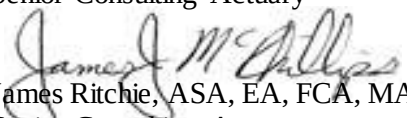
We are available to answer any questions on the material in this report to provide explanations or further details as appropriate.

Sincerely,

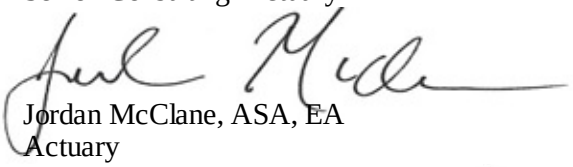
BOLTON



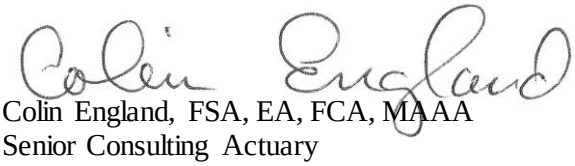
James McPhillips, FSA. EA, FCA, MAAA
Senior Consulting Actuary



James Ritchie, ASA, EA, FCA, MAAA
Senior Consulting Actuary



Jordan McClane, ASA, EA
Actuary



Colin England, FSA, EA, FCA, MAAA
Senior Consulting Actuary

APPENDIX A – RELEVANT ASOPS

See links at http://www.actuarialstandardsboard.org/standards-of-practice/

APPENDIX B – HORIZON 2018 SURVEY

Horizon Actuarial Services, LLC

Survey of Capital Market Assumptions

2018 Edition

Horizon Actuarial Services, LLC is proud to serve as the actuary to over 100 multiemployer defined benefit pension plans across the United States and across various industries. As actuary to these plans, we must develop assumptions regarding future investment returns on plan assets. We then use those assumptions as we determine the actuarial values of the benefits promised by these plans to their participants and beneficiaries, as well as to project plan funding and solvency levels years into the future.

At Horizon Actuarial, we are actuaries, not investment professionals. Therefore, when developing assumptions as to what returns a pension plan's assets might be expected to earn in the future, we look to our colleagues in the investment advisory community. Each year, as part of this survey, we ask different investment firms to provide their "capital market assumptions" – their expectations for future risk and returns for different asset classes in which pension plans commonly invest. The information gathered from this survey can help answer the common question: "Are my plan's investment return assumptions reasonable?"

There are many factors to consider when evaluating a plan's investment return assumptions, such as its asset allocation and the maturity of its participant population. Any of these factors can make the expected return for one plan very different from others. Therefore, this report does not opine on the reasonableness of any one plan's investment return assumptions. Nevertheless, we hope this report will be a useful resource for trustees, actuaries, and investment professionals alike.

Horizon Actuarial sincerely thanks the 34 investment advisors who participated in this survey.

Atlanta ▪ Cleveland ▪ Denver ▪ Irvine ▪ Los Angeles
Miami ▪ San Diego ▪ Washington, D.C.

 www.horizonactuarial.com Published: August 2018

Survey of Capital Market Assumptions: 2018 Edition

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Horizon Actuarial Services, LLC is an independent consulting firm specializing in providing actuarial and consulting services to multiemployer benefit plans. Horizon Actuarial does not provide investment, legal, or tax advice. Please consult with your investment advisor, legal counsel, or tax advisor for information specific to your plan's investment, legal, or tax implications.

Summary

Horizon Actuarial first conducted this survey in 2010, and it included 8 investment advisors. In 2012, we first published a report on the survey results, which included 17 advisors. The survey has expanded considerably over the past few years; this 2018 edition of the survey includes assumptions from 34 different investment firms.

In general, expected returns have declined in recent years. When we focus on the 22 advisors who participated in each of the last five surveys, we see that expected returns for equity and alternative investments generally decreased from 2014 to 2018. During the same period, expected returns for core fixed income and U.S. Treasuries have remained relatively flat. Expected volatilities for alternative investments have decreased in recent years, but have not changed significantly for other asset classes.

As we have seen in prior surveys, expected returns are noticeably lower over the short term than over the long term. This trend is apparent when we focus on the 13 advisors who provided assumptions for both the short term (up to 10 years) and long term (20 years or more). In fact, the difference between short-term and long-term expectations is more pronounced in this 2018 survey than it has been in any year since the survey began developing separate 10-year and 20-year expected returns in 2013.

For ongoing pension plans without solvency issues, we believe a horizon of 20 years or more is appropriate for evaluating the reasonableness of the long-term investment return assumption. A shorter horizon, such as 10 years, may be more appropriate for evaluating the return assumption for a plan that is more mature or has solvency issues. Even for plans with long-term investment horizons, it is important to understand the potential impact of lower expected returns over the short term. Therefore, this survey shows return expectations over horizons of both 10 years and 20 years.

For illustration, this report also constructs an asset allocation for a hypothetical multiemployer pension plan and uses the results from the survey to develop a range of reasonably expected returns for the plan. When compared to the 2017 edition of the survey, the expected returns for this 2018 edition were lower over 10-year and 20-year horizons by 23 and 16 basis points, respectively. These decreases were primarily driven by lower expected returns across most asset classes for many of the advisors who participated in both the 2017 survey and the 2018 survey.

If you have questions about how the results of this survey relate to your multiemployer plan, please contact your consultant at Horizon Actuarial or visit the "contact us" page on our website, www.horizonactuarial.com. For questions about the survey itself, please contact Ben Ablin at ben.ablin@horizonactuarial.com.

Survey Participants

Exhibit 1 below lists the 34 investment advisors whose capital market assumptions are included in the 2018 survey. This report does not attribute specific assumptions to individual firms, which is a precondition of the survey.

Originally, this survey was exclusive to the multiemployer plan community; it included only assumptions from investment advisors to multiemployer pension plans. The survey has expanded over the years, and it now includes assumptions from investment advisors outside of the multiemployer plan community.

Of the 34 sets of capital market assumptions included in the 2018 edition of the survey, 27 were provided by investment advisors to multiemployer plans, 4 were obtained from published white papers, and 3 were provided by investment advisors who do not consult with multiemployer plans. A complete listing of the firms participating in the survey is provided below.

Exhibit 1

2018 Survey Participants

AJ Gallagher	*Marquette Associates*
Alan Biller	*Meketa Investment Group*
AndCo Consulting	*Merrill Lynch Global Institutional Consulting*
Aon Hewitt	*Morgan Stanley Wealth Management*
The Atlanta Consulting Group	*New England Pension Consultants (NEPC)*
*Bank of New York Mellon**	*Pavilion Advisory Group*
*BlackRock**	*Pension Consulting Alliance*
Callan Associates	*PFM Asset Management, LLC*
Cambridge Associates	*RVK*
CapTrust	*Segal Marco Advisors*
Ellwood Associates	*SEI*
*Envestnet***	*Sellwood Consulting*
Goldman Sachs Asset Management	*Summit Strategies Group*
Graystone Consulting	*UBS*
Investment Performance Services, LLC (IPS)	*Verus*
Janney Montgomery Scott, LLC	*Voya Investment Management**
*J.P. Morgan Asset Management**	*Willis Towers Watson***

* Assumptions obtained from published white paper
** Advisor from outside multiemployer community

Investment Horizons

When evaluating the expected return assumption for an active, ongoing multiemployer pension plan, actuaries usually consider investment returns over a long-term investment horizon of 20 years or more. A shorter time horizon, say over the next 10 years, may be more appropriate when evaluating the return assumption for a mature plan, a plan that has high negative cash flows, or a plan that is projected to become insolvent.

It is also important to understand the sensitivity of plan funding to changes in future investment returns. For example, the actuary for an active, ongoing pension plan will typically set the plan's investment return assumption based on expectations over a long-term horizon. However, evaluating the sensitivity of funding results to short-term investment returns that are expected to be higher or lower than the long-term assumption also plays an integral role in the decision making process.

Survey participants were requested to provide their most recent capital market assumptions: expected returns for different asset classes, standard deviations (i.e., volatilities) for those expected returns, and a correlation matrix. The survey participants were also requested to indicate the investment horizon(s) to which their assumptions apply. If the participant develops separate assumptions for different time horizons, they were requested to provide each set of assumptions.

In the 2018 edition of the survey, 21 advisors provided one set of assumptions: of those, 19 specified a time horizon of 10 years and 2 specified a time horizon of 10 to 15 years. The remaining 13 advisors provided assumptions over both shorter-term (5 to 10 years) and longer-term (20 years or more) horizons.

Exhibit 2 below summarizes the time horizons specified by each advisor, grouped by type.

Exhibit 2

Investment Time Horizons

Advisor Type	(A)	(B)	(C)	Total
10 Years	14	3	2	19
10 to 15 Years	1	1	-	2
Both Short- and Long-Term	12	-	1	13
Total	27	4	3	34

(A) Multiemployer plan investment advisor
(B) Published white paper
(C) Advisor from outside multiemployer community

Short-Term vs. Long-Term

As noted in the previous section, survey participants provided expected returns over different time horizons. Given current market conditions, many investment advisors may expect returns for certain asset classes to be different in the short term versus over the long term.

For comparability, this survey groups expected returns into two time horizons: 10 years and 20 years. As pension plan actuaries, we often refer to the 10-year expected returns as "short-term" and the 20-year expected returns as "long-term." Note, however, that many investment firms consider 10-year expectations to be "long-term."

When comparing the expected returns for the 13 advisors who provided both short-term and long-term assumptions,[1] we see some interesting differences. See Exhibit 3 below. Expected returns are geometric and are generally considered to be indexed and net of fees.

Exhibit 3

Average Expected Returns: Short-Term vs. Long-Term
Subset of 13 Survey Respondents

Asset Class	10-Year Horizon	20-Year Horizon	Difference
US Equity - Large Cap	6.24%	7.42%	1.18%
US Equity - Small/Mid Cap	6.97%	8.18%	1.21%
Non-US Equity - Developed	7.05%	7.71%	0.66%
Non-US Equity - Emerging	7.85%	8.82%	0.97%
US Corporate Bonds - Core	3.59%	4.46%	0.87%
US Corporate Bonds - Long Dur.	3.36%	4.44%	1.08%
US Corporate Bonds - High Yield	4.81%	5.82%	1.01%
Non-US Debt - Developed	2.19%	3.22%	1.03%
Non-US Debt - Emerging	5.24%	6.13%	0.89%
US Treasuries (Cash Equivalents)	2.51%	3.05%	0.54%
TIPS (Inflation-Protected)	3.23%	4.04%	0.81%
Real Estate	5.87%	6.66%	0.79%
Hedge Funds	5.46%	6.19%	0.73%
Commodities	4.73%	4.92%	0.19%
Infrastructure	6.77%	7.14%	0.37%
Private Equity	8.59%	9.52%	0.93%
Inflation	2.41%	2.47%	0.06%

The 10-year and 20-year returns shown above are the averages for the 13 advisors who provided both short-term and long-term assumptions.
Expected returns are annualized (geometric).

The consensus among these 13 advisors was that returns are expected to be lower in the short term compared to the long term. In general, the difference between long-term and short-term returns is more pronounced for US equity and fixed income investments.

As noted earlier, the results shown in Exhibit 3 are based on a subset of 13 advisors. If we include all 34 survey advisors, the short-term and long-term expected returns do not change dramatically. See Exhibit 4 below.

Exhibit 4

Average Expected Returns: Short-Term vs. Long-Term
All Survey Respondents

Asset Class	10-Year Horizon	20-Year Horizon	Difference
US Equity - Large Cap	6.07%	7.42%	1.35%
US Equity - Small/Mid Cap	6.57%	8.18%	1.61%
Non-US Equity - Developed	6.71%	7.71%	1.00%
Non-US Equity - Emerging	7.64%	8.82%	1.18%
US Corporate Bonds - Core	3.37%	4.46%	1.09%
US Corporate Bonds - Long Dur.	3.32%	4.44%	1.12%
US Corporate Bonds - High Yield	4.78%	5.82%	1.04%
Non-US Debt - Developed	2.18%	3.22%	1.04%
Non-US Debt - Emerging	5.00%	6.13%	1.13%
US Treasuries (Cash Equivalents)	2.48%	3.05%	0.57%
TIPS (Inflation-Protected)	2.88%	4.04%	1.16%
Real Estate	5.90%	6.66%	0.76%
Hedge Funds	4.96%	6.19%	1.23%
Commodities	3.97%	4.92%	0.95%
Infrastructure	6.56%	7.14%	0.58%
Private Equity	8.33%	9.52%	1.19%
Inflation	2.24%	2.47%	0.23%

10-year horizon results include all 34 survey respondents.
20-year horizon results include a subset of 13 survey respondents.
Expected returns are annualized (geometric).

The 10-year expected returns shown above include assumptions from all 34 advisors, while the 20-year expected returns include assumptions from only the 13 advisors who provided longer-term assumptions.

While past editions of this survey have indicated lower expected returns over the short term than over the long term, the difference has increased in recent years for most asset classes. For example, the difference between short term expected returns and long term expected returns for large cap US equity based on the average assumptions from the 2018 survey is 135 basis points. For comparison, the difference was 88 basis points based on the average assumptions from the 2014 survey.

For this reason, it may be more important than ever for the actuary to evaluate the sensitivity of funding results to short-term investment returns that are expected to be lower than the long-term assumption.

[1] In cases where an advisor indicated a time horizon shorter than 10 years, the shorter-term expected returns were combined with the longer-term expected returns to achieve a 10-year horizon. Similarly, if an advisor indicated a time horizon longer than 20 years, the longer-term expected returns were combined with the shorter-term expected returns to achieve a 20-year horizon.

Differing Opinions

Exhibit 5 below shows the distribution of expected returns and standard deviations (i.e., volatilities) for each asset class in the survey, as provided by the 34 individual advisors in the survey. Expected returns are geometric and apply to a 10-year investment horizon. Average assumptions from the 2018 survey are listed in brackets for each asset class. As noted earlier, returns are assumed to be indexed and net of fees.

Note that the exhibit below focuses on a 10-year horizon in order to include assumptions from all 34 advisors. See Exhibit 16 in the appendix to this report for the assumptions over a 20-year horizon, based on the 13 advisors who provided longer-term assumptions. Also note that the exhibit considers both expected returns and standard deviations. The ranges of expected returns by asset class can be found in the appendix as Exhibits 17 and 18.

The exhibit below shows that there are significant differences in expected returns and standard deviations among investment advisors. As the saying goes, "reasonable people may differ."

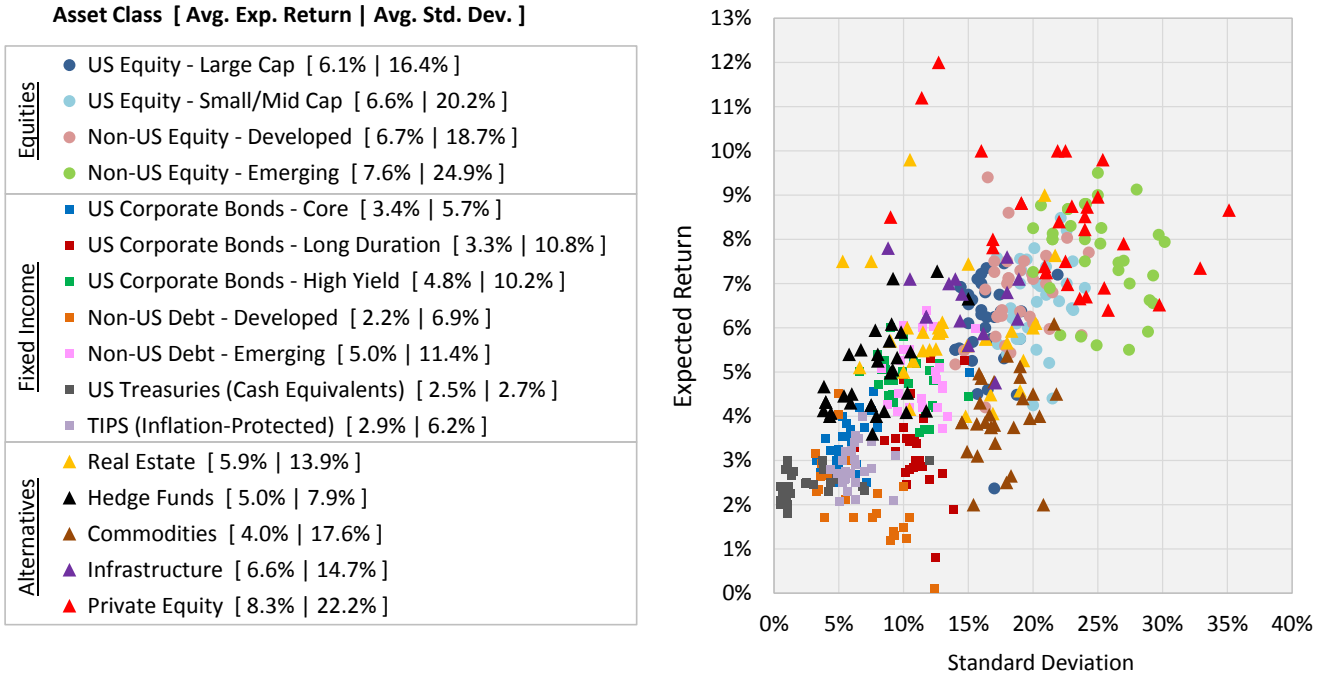
The differences in assumptions are more pronounced for alternative investments such as real estate, hedge funds, and private equity. A contributing factor may be differences in the underlying strategies different advisors apply to these alternative investments (for example, opportunistic versus defensive). To contrast, the differences in expected returns and volatilities are smaller for more traditional investments, such as US equity and US fixed income.

A summary of the average survey assumptions can be found in the appendix to this report as Exhibit 15. This summary includes expected returns, standard deviations, and a correlation matrix.

Exhibit 5

2018 Survey: Distribution of Expected Returns and Standard Deviations

10-Year Horizon | Geometric Returns



Changing Outlooks: 2014 to 2018

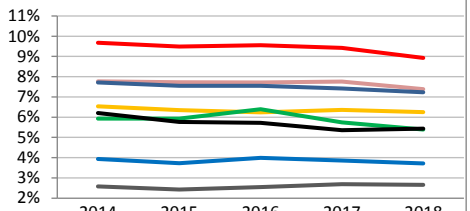
In recent years, there has been much discussion about whether it is reasonable to expect that future investment returns will be as high as they have been historically. Citing various reasons such as increased equity prices, tightening credit spreads, and continuing low interest rates, many advisors have lowered their expectations over the last five years, especially from 2017 to 2018.

Exhibit 6 below shows average expected returns for selected asset classes each year from 2014 to 2018. For consistency, this exhibit includes only the 22 advisors who participated in the survey in each of these years.

Note that the expected returns shown below are based on a 20-year horizon for advisors who provided longer-term assumptions and a 10-year horizon for others.[2] For that reason (as well as the fact that we include only a subset of advisors), the expected returns shown below are not directly comparable with those in other sections or previous surveys.

Exhibit 6

Average Expected Returns: 2014 - 2018



	2014	2015	2016	2017	2018
Private Equity	9.7%	9.5%	9.6%	9.4%	8.9%
Non-US Eq. (Dev)	7.8%	7.7%	7.7%	7.8%	7.4%
US Eq. (Large Cap)	7.7%	7.5%	7.5%	7.4%	7.2%
Real Estate	6.5%	6.4%	6.2%	6.4%	6.2%
US Bonds (HY)	5.9%	5.9%	6.4%	5.7%	5.4%
Hedge Funds	6.2%	5.8%	5.7%	5.4%	5.4%
US Bonds (Core)	3.9%	3.7%	4.0%	3.9%	3.7%
US Treasuries	2.6%	2.4%	2.5%	2.7%	2.7%

Figures are average geometric returns for selected asset classes for the 22 advisors who participated in each of the surveys from 2014 through 2018.

For this subset of advisors, average expected returns have decreased for every asset class except US Treasuries over the last five years. The sharpest declines from 2017 to 2018 were for the asset classes with the highest expected returns – private equity and non-US developed equity.

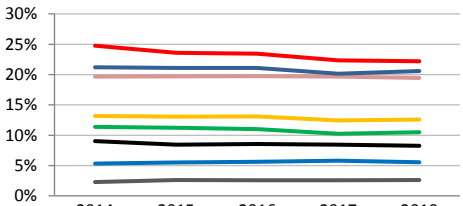
Other asset classes, such as large cap US equity, real estate, high-yield bonds, and hedge funds have seen more gradual declines over the course of the last five years.

Average expected returns asset classes with lower expected returns such as core fixed income and US Treasuries remained relatively flat from 2014 to 2018.

In addition to expected returns, it is also important to consider expected volatility of the returns, measured by standard deviations. Average standard deviations over the last five years are shown in Exhibit 7 below.

Exhibit 7

Average Standard Deviations: 2014 - 2018



	2014	2015	2016	2017	2018
Private Equity	24.8%	23.6%	23.4%	22.3%	22.2%
Non-US Eq. (Dev)	19.7%	19.7%	19.7%	19.7%	19.5%
US Eq. (Large Cap)	21.2%	21.1%	21.1%	20.1%	20.6%
Real Estate	13.2%	13.1%	13.1%	12.4%	12.6%
US Bonds (HY)	11.4%	11.2%	11.0%	10.3%	10.5%
Hedge Funds	9.0%	8.5%	8.6%	8.4%	8.3%
US Bonds (Core)	5.3%	5.5%	5.6%	5.8%	5.6%
US Treasuries	2.3%	2.6%	2.6%	2.6%	2.6%

Figures are average standard deviations for selected asset classes for the 22 advisors who participated in each of the surveys from 2014 through 2018.

In general, average standard deviations have decreased from 2014 to 2018. This decrease may be related to the decrease in average expected returns over the same period as investments with lower expected returns are often less volatile than investments with higher expected returns. This trend of decreasing standard deviations is most apparent for private equity, but noticeable shifts have occurred for large cap US equities, real estate, and high-yield bonds as well.

On the contrary, average standard deviations have increased for investments whose returns are more closely tied to interest rates such as core US bonds and US Treasuries. This increase may indicate greater uncertainty about the timing of future changes in interest rates or the rate at which those rates are expected to change.

[2] Of the 13 survey advisors who provided both shorter-term and longer-term assumptions, 11 of them indicated no difference in the standard deviations of the expected returns over the short term versus the long term. For the other 2 advisors, the differences between short-term and long-term standard deviations were very minor.

Evaluating the Return Assumption

Multiemployer pension plans are usually invested in a well-diversified mix of stocks, bonds, real estate, and alternative investments structured to meet the goals of the Trustees. This typically involves maximizing returns over the long term while minimizing return volatility.

The actuary of a multiemployer pension plan must evaluate the plan's asset allocation and, based on expectations of future returns, develop an assumption for what plan assets are projected to earn over the long term. This assumption is then used (along with others) to determine the actuarial present value of the benefits promised by the plan to its participants and beneficiaries.

The actuary will often rely on the future return expectations of the plan's investment advisor in developing the plan's investment return assumption. However, as noted earlier, different investment advisors often have widely differing opinions on what future returns will be. Therefore, it can be beneficial to keep in mind other advisors' expectations when setting the investment return assumption.

In the following exhibits, we will evaluate the investment return assumption for a hypothetical multiemployer pension plan. Exhibit 8 below shows the asset allocation for this hypothetical plan. The asset allocations are arbitrary, except for the fact that we made sure to include at least a small allocation to every asset class in the survey.

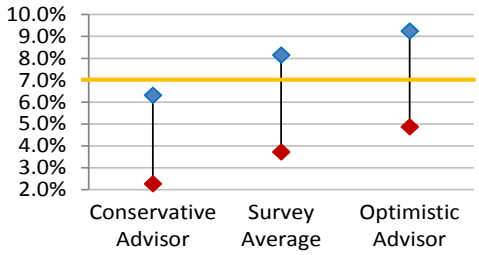
Exhibit 8

Hypothetical Multiemployer Plan	
Asset Class	**Weight**
US Equity - Large Cap	20.0%
US Equity - Small/Mid Cap	10.0%
Non-US Equity - Developed	7.5%
Non-US Equity - Emerging	5.0%
US Corporate Bonds - Core	7.5%
US Corporate Bonds - Long Duration	2.5%
US Corporate Bonds - High Yield	5.0%
Non-US Debt - Developed	5.0%
Non-US Debt - Emerging	2.5%
US Treasuries (Cash Equivalents)	5.0%
TIPS (Inflation-Protected)	5.0%
Real Estate	10.0%
Hedge Funds	5.0%
Commodities	2.5%
Infrastructure	2.5%
Private Equity	5.0%
TOTAL PORTFOLIO	**100.0%**

Exhibit 9 shows expected annualized (geometric) returns for the hypothetical plan over a 10-year horizon. These results may be appropriate for modeling sensitivities of future funding results to short-term investment returns, or for evaluating the return assumption for a plan with severely negative cash flows or solvency issues.

Exhibit 9

Annualized Expected Returns
Hypothetical Multiemployer Pension Fund
10-Year Horizon

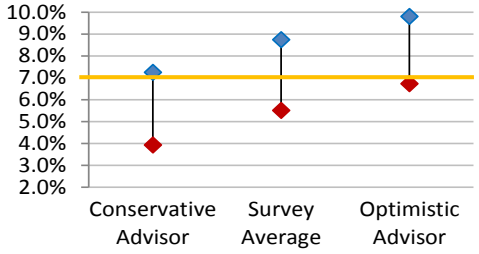


	Conservative Advisor	Survey Average	Optimistic Advisor
75th percentile	6.32%	8.16%	9.25%
25th percentile	2.27%	3.73%	4.87%
Probability of Meeting or Exceeding:			
7.50% per Year	14.2%	31.8%	44.6%
7.00% per Year	18.3%	37.4%	50.7%
6.50% per Year	23.1%	43.3%	56.8%

Exhibit 10 shows expected annualized (geometric) returns for the hypothetical plan over a 20-year horizon based on assumptions from the 13 advisors who provided longer-term assumptions. These results may be more appropriate for evaluating the return assumption for an ongoing plan with no projected solvency issues.

Exhibit 10

Annualized Expected Returns
Hypothetical Multiemployer Pension Fund
20-Year Horizon



	Conservative Advisor	Survey Average	Optimistic Advisor
75th percentile	7.25%	8.73%	9.80%
25th percentile	3.92%	5.50%	6.73%
Probability of Meeting or Exceeding:			
7.50% per Year	21.9%	43.7%	63.1%
7.00% per Year	28.3%	52.0%	71.0%
6.50% per Year	35.6%	60.2%	78.0%

Evaluating the Return Assumption (cont)

It is important to keep in mind that the expected returns shown in Exhibits 9 and 10 apply only to the hypothetical asset allocation shown in Exhibit 8. The expected returns will be different – perhaps significantly – for different asset allocations.

Exhibit 13 in the appendix to this report shows more detail regarding the derivation of the expected returns for this hypothetical pension plan.

The following are points to consider when reviewing the results in Exhibits 9 and 10:

Range of Reasonable Assumptions: When setting the investment return assumption for pension valuations, actuaries traditionally constructed a range of reasonable assumptions and then selected a best-estimate point within that range. Actuaries would often consider the reasonable range to be the middle 50 percent of possible results, bounded by the 25th and 75th percentiles.

The applicable actuarial standards of practice were updated in 2013, and the new standards de-emphasize use of the reasonable range when setting the investment return assumption. Nevertheless, considering this range remains instructive; it may be difficult for an actuary to justify an assumption outside of this range.

Based on the average assumptions in this 2018 survey, the middle 50 percent range for this hypothetical pension plan is very wide: 5.50% to 8.73% over the next 20 years. Note that the range is even wider for a 10-year horizon: 3.73% to 8.16%. This is due to the fact that, while returns may be volatile from one year to the next, deviations will be lower when returns are annualized (in other words, smoothed out) over longer horizons.

Probability of Meeting/Exceeding the Benchmark: For example, say that the actuary for this hypothetical pension plan expects its investment returns to be 7.00% per year, represented by the gold lines in Exhibits 9 and 10. Based on the average assumptions in this 2018 survey, there is a 52.0% probability the plan will meet or beat its 7.00% benchmark on an annualized basis over a 20-year period. The probability is lower, 37.4%, that the plan will meet or beat its benchmark over the next 10 years.

Also note that over a 20-year period, the probability that the annualized investment return will exceed 7.50% (arbitrarily, 50 basis points above the benchmark return) is 43.7%. The probability that the annualized return will exceed 6.50% (50 basis points below the benchmark) is 60.2%. These probabilities are a bit lower when focusing on a 10-year horizon rather than a 20-year horizon.

Optimistic and Conservative Assumptions: As previously noted, different investment advisors may have widely varying future capital market expectations. Therefore, it may also be interesting to consider the range of expected returns based on the assumptions provided by the most conservative and most optimistic advisors in the survey.

For this hypothetical asset allocation, the assumptions from the most conservative advisor indicate that the probability of beating the 7.00% benchmark assumption over the next 20 years is 28.3%. Using assumptions from the most optimistic advisor results in a probability of 71.0%. Again, reasonable people may differ.

Limitations: The following are some important limiting factors to keep in mind when reviewing these results. In most cases, adjustments made to account for these limitations tended to slightly lower the expected returns in the survey, for the sake of conservatism.

- The asset classes in this survey do not always align perfectly with the asset classes provided by the investment advisors. Adjustments were made to standardize the different asset classes provided.
- Many of the advisors develop their future assumptions based on investment horizons of no more than 10 years, and returns are generally expected to be lower in the short term. The typical multiemployer pension plan will have an investment horizon that is much longer than 10 years.
- The return expectations are based on indexed returns. In other words, they do not reflect any additional returns that may be earned due to active asset managers outperforming the market ("alpha"), net of investment expenses.
- The return expectations do not adjust for plan size. Specifically, they do not take into account the fact that certain investment opportunities are more readily available to larger plans, as well as the fact that larger plans may often receive more favorable investment fee arrangements than smaller plans.
- The ranges of expected annualized returns were constructed using basic, often simplified, formulas and methodologies. More sophisticated investment models – which may consider various economic scenarios, non-normal distributions, etc. – could produce significantly different results.

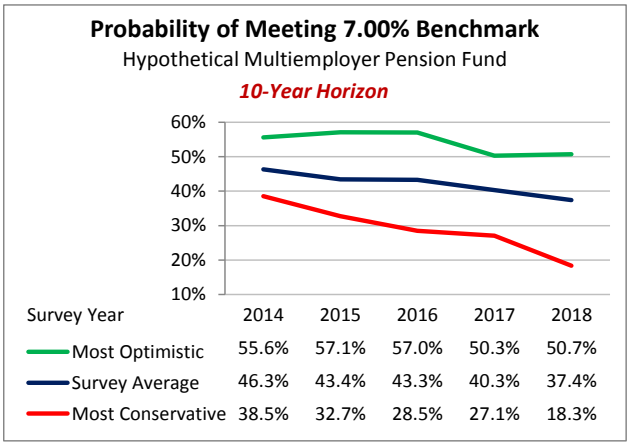
Use of the Survey: This survey is not intended to be a substitute for the expectations of individual portfolio managers, advisors, or actuaries performing their own independent analyses. The actuarial standards of practice provide for various methods of selecting the investment return assumption. This survey is intended to be used in conjunction with these methods, with appropriate weighting of various resources based on the plan actuary's professional judgment.

Comparison with Prior Surveys

Exhibits 6 and 7 showed how expected returns and standard deviations for certain asset classes have changed over the past few years. Similarly, Exhibits 11 and 12 below show how return expectations for the hypothetical multiemployer pension plan whose asset allocation is shown in Exhibit 8 have changed from 2014 to 2018.

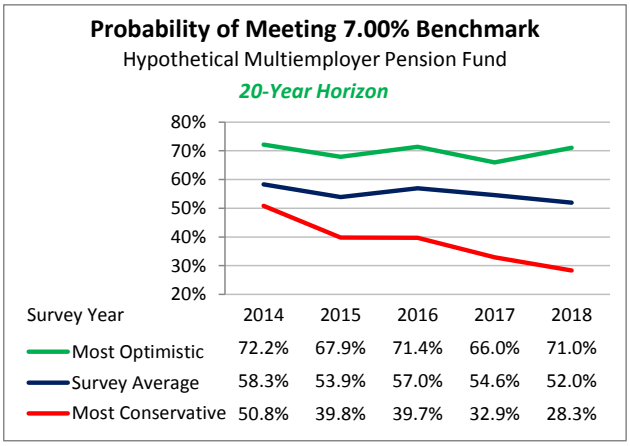
Both exhibits show the probabilities that the hypothetical pension plan will meet or exceed its 7.00% benchmark return on an annualized basis over the given time horizon. Exhibit 11 focuses on expected returns over a 10-year period, and Exhibit 12 focuses on expected returns over a 20-year period. Probabilities are shown for the survey average for each year from 2014 through 2018. For comparison, probabilities are also shown for the most conservative and optimistic advisors in each survey.

Exhibit 11



Survey Year	2014	2015	2016	2017	2018
Most Optimistic	55.6%	57.1%	57.0%	50.3%	50.7%
Survey Average	46.3%	43.4%	43.3%	40.3%	37.4%
Most Conservative	38.5%	32.7%	28.5%	27.1%	18.3%

Exhibit 12



Survey Year	2014	2015	2016	2017	2018
Most Optimistic	72.2%	67.9%	71.4%	66.0%	71.0%
Survey Average	58.3%	53.9%	57.0%	54.6%	52.0%
Most Conservative	50.8%	39.8%	39.7%	32.9%	28.3%

As shown in Exhibits 11 and 12, the probabilities that this hypothetical pension plan would meet or beat a benchmark return of 7.00% have generally decreased from 2014 to 2018. The decrease is more pronounced when considering a 10-year horizon versus a 20-year horizon.

For example:

- Based on the average assumptions from the 2018 survey, the probability of this hypothetical plan meeting or exceeding an annualized return of 7.00% over the next 10 years is 37.4%. For comparison, the probability was considerably higher (46.3%) five years ago when the 2014 survey was conducted.

- Based on the average assumptions from the 2018 survey, the probability of this hypothetical plan meeting or exceeding an annualized return of 7.00% over the next 20 years is 52.0%. While the probability was higher (58.3%) based on the average assumptions from 2014, the decrease over time for longer-term expectations is less pronounced than it has been for shorter-term expectations.

Other points of note when comparing the results from the 2018 survey to those from prior years:

- The results for the most conservative advisor in each survey from 2014 through 2018 have changed more dramatically than the results for the survey average and the most optimistic advisors. Based on the assumptions of the most conservative advisor in the 2014 survey, the probability of this hypothetical plan meeting or exceeding its 7.00% benchmark over the next 20 years was 38.5%. This can be compared to a probability of only 18.3% for the most conservative advisor in the 2018 survey.

- The results for the most optimistic advisor in each survey have generally remained more stable over the past five years, though there was a significant decrease in the probability of meeting the 7.00% benchmark over a 10-year horizon from 2016 to 2017. Nevertheless, the probability of meeting the 7.00% benchmark over a 10-year horizon based on the most optimistic advisor in the 2017 and 2018 surveys is still greater than 50%.

- Note that the most conservative and most optimistic advisors are not necessarily the same from year to year.

Glossary

The following are basic definitions of some of the investment terminology used in this report.

Expected Return

The *expected return* is the amount, as a percentage of assets, that an investment is expected to earn over a period of time. Expected returns presented in this survey are generally assumed to be indexed and net of fees.

Arithmetic vs. Geometric Returns

The *arithmetic* return is the average return in any one year; in other words, it has a one-year investment horizon. A *geometric* return is the annualized return over a multi-year period. In general, when evaluating expected returns over multi-year horizons, it is more appropriate to focus on geometric returns. However, arithmetic returns are also important. For example, the expected return of a portfolio is calculated as the weighted average of arithmetic returns, not geometric returns.

This survey focuses on geometric returns. Many advisors provide both arithmetic and geometric expected returns. For advisors who provided expected returns only on an arithmetic basis, we converted them to geometric returns for consistency. The following formula was used in making this conversion.

$$E[R_G] = ((1 + E[R_A])^2 - VAR[R])^{1/2} - 1$$

In this formula, $E[R_G]$ is the expected geometric return, $E[R_A]$ is the expected arithmetic return, and VAR[R] is the variance of the expected annual return.

Standard Deviation

The *standard deviation* is a measure of the expected volatility in the returns. Generally, the standard deviation expresses how much returns may vary in any one year. Assuming that returns are "normally distributed," there is about a 68% probability that the actual return for a given year will fall within one standard deviation (higher or lower) of the expected return. There is about a 95% probability that the actual return will fall within two standard deviations of the expected return.

Correlation

An important aspect of capital market assumptions is the degree to which the returns for two different asset classes move in tandem with one another: this is their *correlation*. For example, if two asset classes are perfectly correlated, their correlation coefficient will be 1.00; in other words, if one asset class has a return of X% in a given market environment, then the other asset class is expected to also have a return of X%. A portfolio becomes better diversified as its asset classes have lower (or even negative) correlations with each other.

Methodology

The following is a high-level description of the methodology used in compiling the survey results.

Standardized Asset Classes

Not all investment advisors use the same asset classes when developing their capital market assumptions. Some are very specific (more asset classes), while others keep things relatively simple (fewer asset classes).

We exercised judgment in classifying each advisor's capital market assumptions into a standard set of asset classes. In the event that an advisor did not provide assumptions for a given asset class, the average assumptions from the other advisors was used when developing expected returns for that advisor.

Investment Horizons

This survey considers "short-term" expected returns to apply to a 10-year investment horizon, and "long-term" expected returns to apply to a 20-year horizon.

In this 2018 edition of the survey, 23 of the 34 advisors provided only short-term assumptions, indicating a horizon of no more than 10 years. Included in this group are 2 advisors who provided assumptions over a horizon of 10 to 15 years.

All 13 advisors who provided long-term assumptions over horizons of 20 years or more also provided short-term assumptions. In cases where such an advisor indicated a horizon shorter than 10 years, the shorter-term expected returns were combined with the longer-term expected returns to achieve a 10-year horizon. If an advisor indicated a time horizon longer than 20 years, the longer-term expected returns were combined with the shorter-term expected returns to achieve a 20-year horizon.

No Adjustment for Alpha

No adjustment was made to reflect the possible value added by an active investment manager outperforming market returns (earning "alpha").

Normally-Distributed Returns

This survey assumes that investment returns will be normally distributed according to the capital market assumptions provided. The survey also assumes that the investment return in one year does not affect the investment return in the following year.

Equal Weighting

Each advisor was given equal weight in developing the average assumptions for the survey, regardless of factors such as total assets under advisement, number of clients in common with Horizon Actuarial, etc.

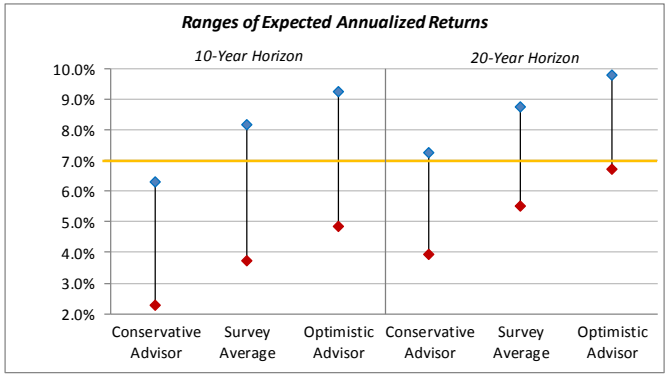
Exhibit 13

The following exhibit evaluates the investment return assumption for a hypothetical multiemployer pension plan. It reflects the same hypothetical asset allocation as shown in Exhibit 8, and it provides more detail than Exhibits 9 and 10. Note that the most conservative and optimistic advisors for the 10-year horizon are not necessarily the same as the most conservative and optimistic advisors for the 20-year horizon. This hypothetical pension plan has a benchmark return of 7.00% per year, which is indicated by the gold line in the exhibit below.

Hypothetical Multiemployer Plan
2018 Survey of Capital Market Assumptions

		Average Survey Assumptions		
Asset Class	Portfolio Weight	10-Year Horizon	20-Year Horizon	Standard Deviation
US Equity - Large Cap	20.0%	6.07%	7.42%	16.39%
US Equity - Small/Mid Cap	10.0%	6.57%	8.18%	20.20%
Non-US Equity - Developed	7.5%	6.71%	7.71%	18.67%
Non-US Equity - Emerging	5.0%	7.64%	8.82%	24.89%
US Corporate Bonds - Core	7.5%	3.37%	4.46%	5.71%
US Corporate Bonds - Long Duration	2.5%	3.32%	4.44%	10.83%
US Corporate Bonds - High Yield	5.0%	4.78%	5.82%	10.24%
Non-US Debt - Developed	5.0%	2.18%	3.22%	6.86%
Non-US Debt - Emerging	2.5%	5.00%	6.13%	11.43%
US Treasuries (Cash Equivalents)	5.0%	2.48%	3.05%	2.74%
TIPS (Inflation-Protected)	5.0%	2.88%	4.04%	6.25%
Real Estate	10.0%	5.90%	6.66%	13.86%
Hedge Funds	5.0%	4.96%	6.19%	7.87%
Commodities	2.5%	3.97%	4.92%	17.60%
Infrastructure	2.5%	6.56%	7.14%	14.74%
Private Equity	5.0%	8.33%	9.52%	22.16%
Inflation	N/A	2.24%	2.47%	1.76%
TOTAL PORTFOLIO	**100.0%**	*Expected returns are geometric.*		

	10-Year Horizon			*20-Year Horizon*		
	Conservative Advisor	**Survey Average**	**Optimistic Advisor**	**Conservative Advisor**	**Survey Average**	**Optimistic Advisor**
Expected Returns						
Average Annual Return (Arithmetic)	4.72%	6.45%	7.55%	6.16%	7.65%	8.74%
Annualized Return (Geometric)	4.29%	5.95%	7.06%	5.59%	7.12%	8.26%
Annual Volatility (Standard Deviation)	9.48%	10.38%	10.27%	11.03%	10.72%	10.19%
Range of Expected Annualized Returns						
75th Percentile	6.32%	8.16%	9.25%	7.25%	8.73%	9.80%
25th Percentile	2.27%	3.73%	4.87%	3.92%	5.50%	6.73%
Probabilities of Exceeding Certain Returns						
7.50% per Year, Annualized	14.2%	31.8%	44.6%	21.9%	43.7%	63.1%
7.00% per Year, Annualized	18.3%	37.4%	50.7%	28.3%	52.0%	71.0%
6.50% per Year, Annualized	23.1%	43.3%	56.8%	35.6%	60.2%	78.0%



Considerations and Limitations

- Allocations may be approximated if certain asset classes are not included in the survey.
- Many investment advisors provided only shorter-term assumptions (10 years or less).
- Assumptions are based on indexed returns and do not reflect anticipated alpha.
- Assumptions do not reflect investment opportunities or fee considerations available to larger funds.

SOURCE: Horizon Actuarial 2018 Survey of Capital Market Assumptions

Expected returns over a 10-year horizon include all 34 survey participants.

Expected returns over a 20-year horizon are based a subset of 13 survey participants who provided longer-term assumptions.

Exhibit 14

The following exhibit shows the distribution of expected annualized returns and annual standard deviations for the same hypothetical asset allocation that is shown in Exhibit 13. The expected annualized return and annual standard deviation of the hypothetical asset allocation are shown separately for each advisor who participated in the survey. Individual advisors are grouped by type and investment horizon, and the survey average assumptions are shown in red. The exhibit shows that there are a wide variety of investment return assumptions that could be considered to be reasonable for any given asset allocation.

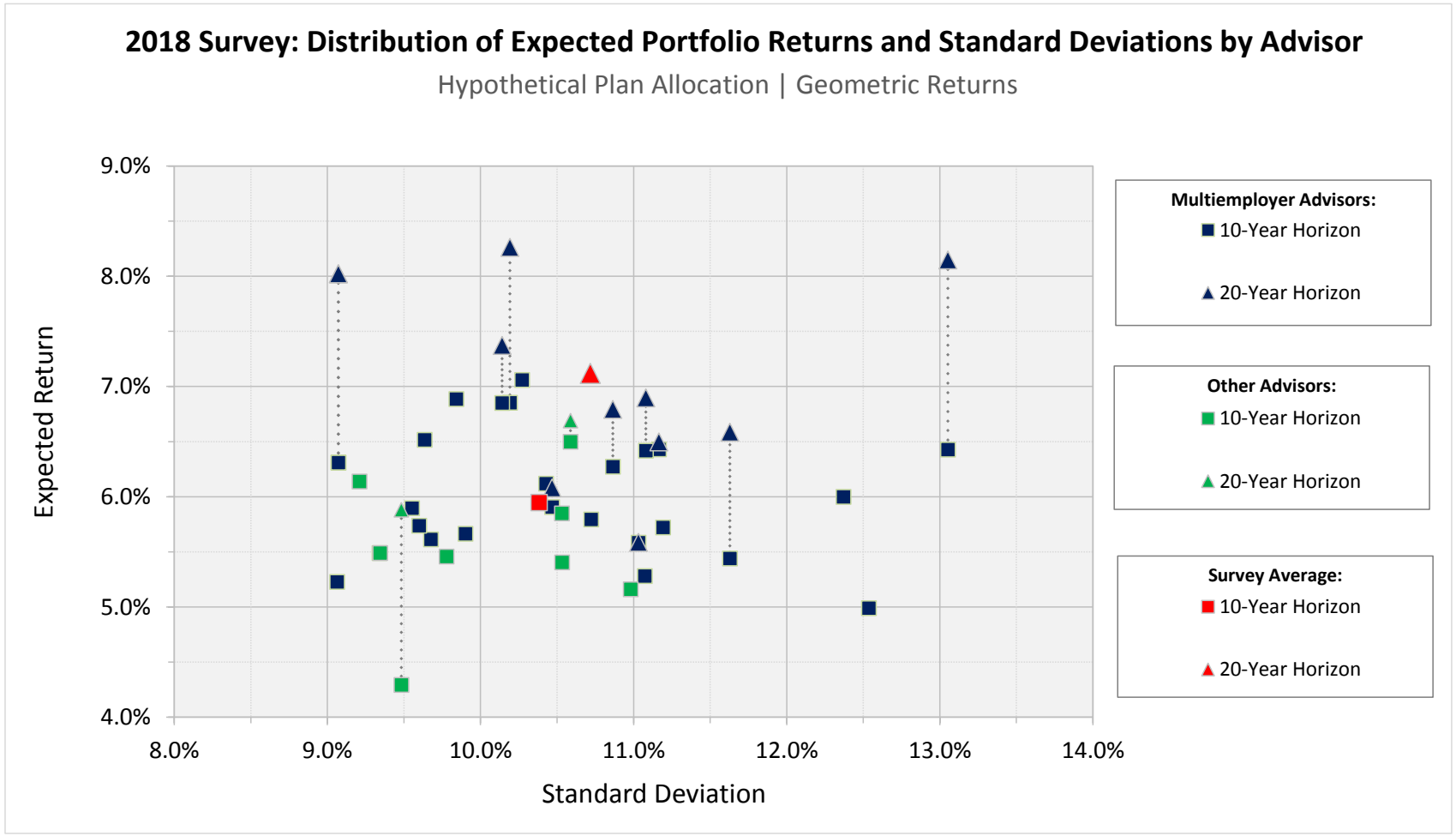


Exhibit 15

The following exhibit provides the average capital market assumptions for all 34 investment advisors in the 2018 survey. Each of the 34 advisors was given equal weight in determining the average assumptions. For reference, expected returns are shown over 10-year and 20-year horizons. Expected returns are also provided on both an arithmetic basis (one-year average) and geometric basis (multi-year annualized). The standard deviations (volatilities) and correlations apply to both arithmetic and geometric expected returns.

Horizon Actuarial 2018 Survey of Capital Market Assumptions

Average Survey Assumptions

		Expected Returns				
		10-Year Horizon		20-Year Horizon		Standard
	Asset Class	Arith.	Geom.	Arith.	Geom.	Deviation
1	US Equity - Large Cap	7.34%	6.07%	8.73%	7.42%	16.39%
2	US Equity - Small/Mid Cap	8.49%	6.57%	10.13%	8.18%	20.20%
3	Non-US Equity - Developed	8.36%	6.71%	9.46%	7.71%	18.67%
4	Non-US Equity - Emerging	10.52%	7.64%	11.94%	8.82%	24.89%
5	US Corporate Bonds - Core	3.54%	3.37%	4.63%	4.46%	5.71%
6	US Corporate Bonds - Long Duration	3.90%	3.32%	5.14%	4.44%	10.83%
7	US Corporate Bonds - High Yield	5.29%	4.78%	6.44%	5.82%	10.24%
8	Non-US Debt - Developed	2.37%	2.18%	3.56%	3.22%	6.86%
9	Non-US Debt - Emerging	5.63%	5.00%	6.85%	6.13%	11.43%
10	US Treasuries (Cash Equivalents)	2.55%	2.48%	3.10%	3.05%	2.74%
11	TIPS (Inflation-Protected)	3.08%	2.88%	4.26%	4.04%	6.25%
12	Real Estate	6.89%	5.90%	7.67%	6.66%	13.86%
13	Hedge Funds	5.29%	4.96%	6.61%	6.19%	7.87%
14	Commodities	5.46%	3.97%	6.47%	4.92%	17.60%
15	Infrastructure	7.61%	6.56%	8.24%	7.14%	14.74%
16	Private Equity	10.72%	8.33%	12.17%	9.52%	22.16%
	Inflation	2.24%	2.24%	2.48%	2.47%	1.76%

Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	1.00															
2	0.89	1.00														
3	0.84	0.76	1.00													
4	0.72	0.67	0.79	1.00												
5	0.12	0.07	0.14	0.14	1.00											
6	0.11	0.05	0.13	0.10	0.83	1.00										
7	0.61	0.60	0.60	0.62	0.36	0.26	1.00									
8	0.17	0.11	0.30	0.24	0.55	0.55	0.24	1.00								
9	0.54	0.49	0.58	0.66	0.44	0.37	0.59	0.41	1.00							
10	(0.10)	(0.12)	(0.09)	(0.07)	0.33	0.28	(0.03)	0.26	0.06	1.00						
11	0.05	0.01	0.10	0.16	0.68	0.57	0.31	0.52	0.40	0.33	1.00					
12	0.44	0.41	0.40	0.33	0.10	0.11	0.30	0.09	0.24	0.03	0.10	1.00				
13	0.66	0.64	0.68	0.67	0.14	0.06	0.58	0.15	0.48	(0.07)	0.13	0.35	1.00			
14	0.31	0.29	0.39	0.43	0.10	0.03	0.35	0.22	0.34	0.02	0.26	0.24	0.42	1.00		
15	0.54	0.49	0.53	0.47	0.20	0.21	0.41	0.33	0.43	(0.08)	0.18	0.31	0.41	0.29	1.00	
16	0.73	0.69	0.70	0.61	0.03	0.03	0.48	0.10	0.40	(0.08)	0.04	0.39	0.60	0.30	0.39	1.00

Expected returns over a 10-year horizon include all 34 survey participants.

Expected returns over a 20-year horizon are based a subset of 13 survey participants who provided long-term assumptions.

Exhibit 16

Earlier in this report, Exhibit 5 showed the distribution of expected returns and standard deviations over an investment horizon of 10 years. The exhibit below shows the same distribution, but for a horizon of 20 years. Note that while Exhibit 5 included assumptions for all 34 advisors in the survey, the exhibit below includes only assumptions for the 13 advisors who provided longer-term assumptions (horizons of 20 years or more).

2018 Survey: Distribution of Expected Returns and Standard Deviations

20-Year Horizon | Geometric Returns

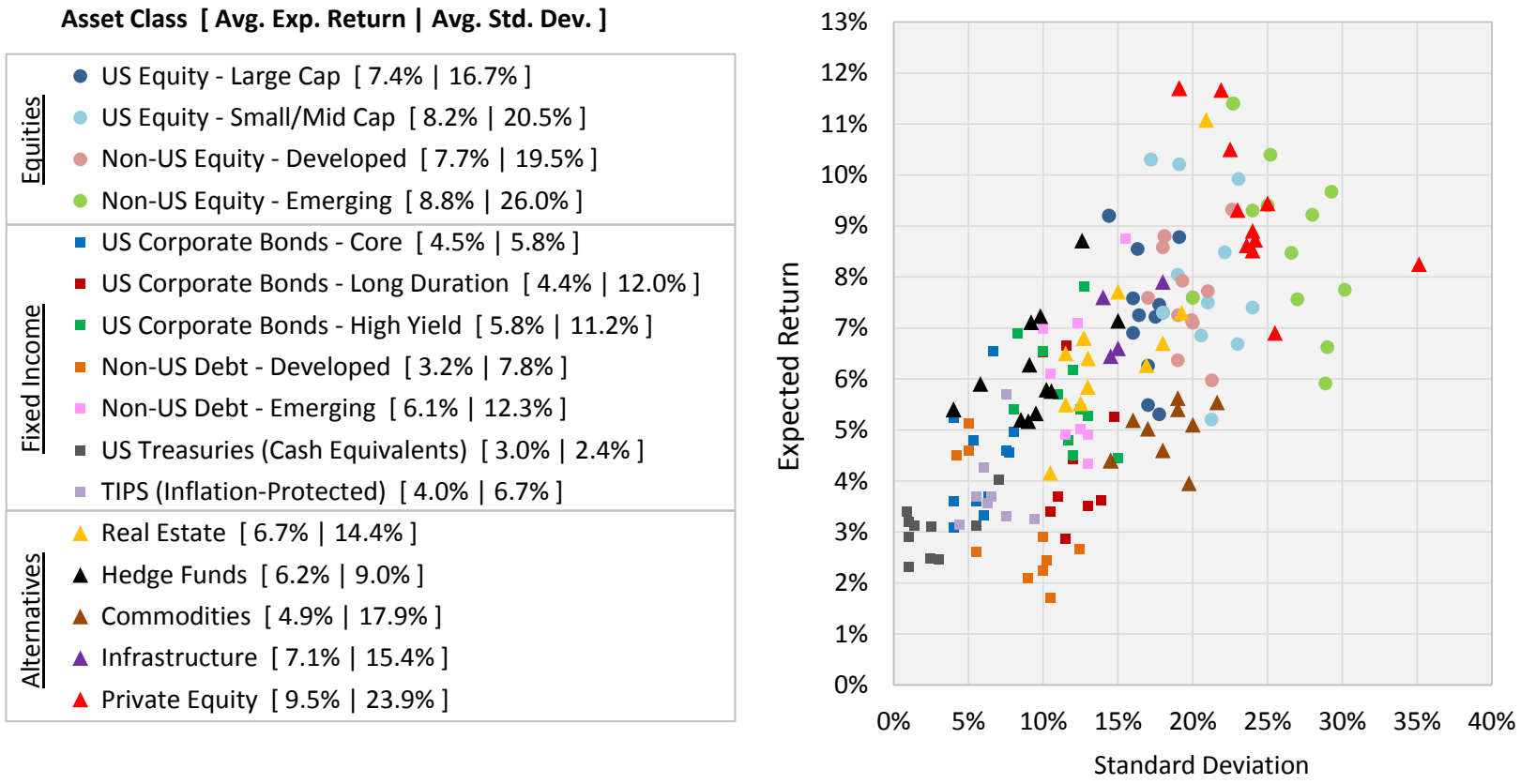
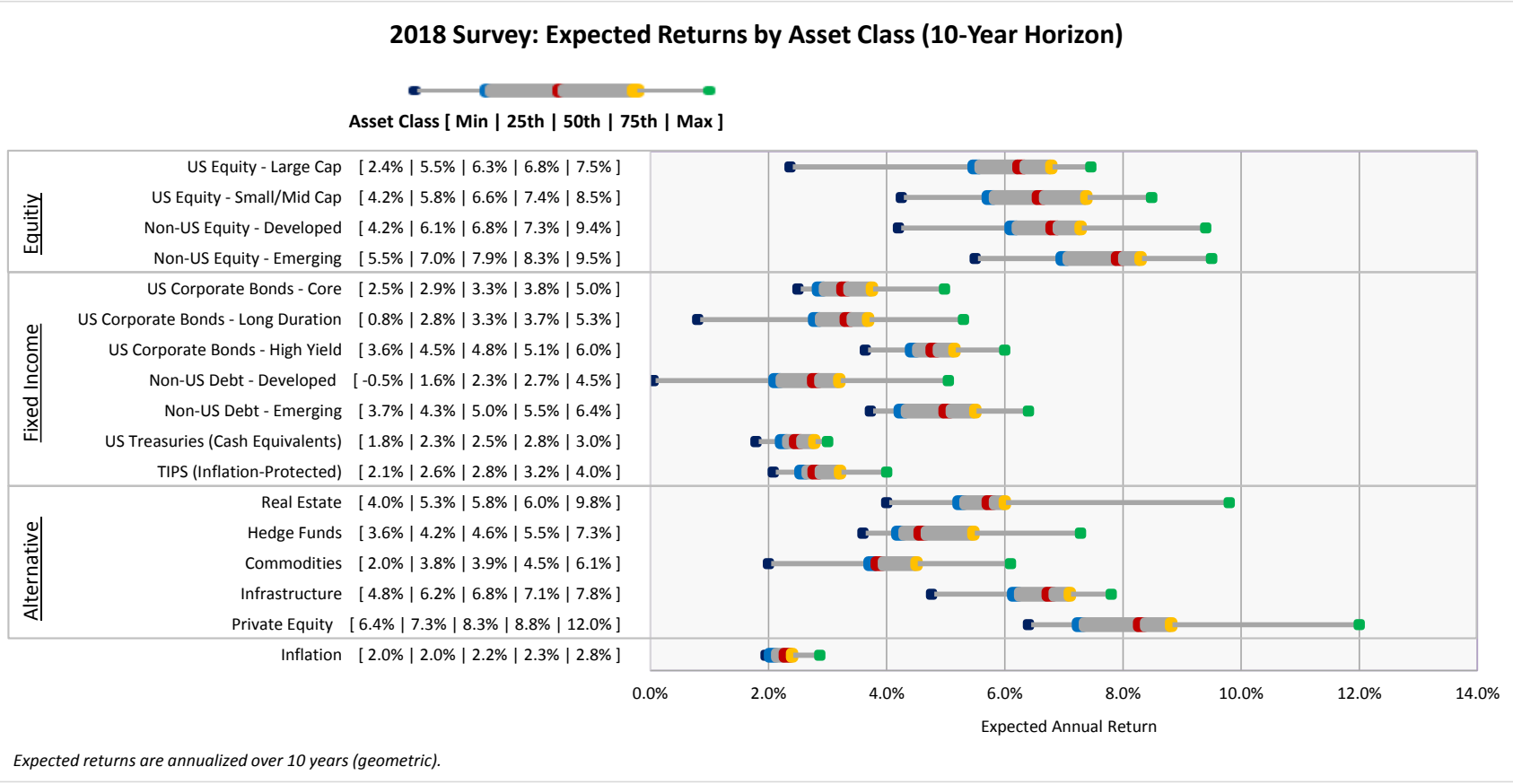


Exhibit 17

The exhibit below shows the ranges of expected annual returns for different asset classes over a 10-year investment horizon. The ranges shown below include assumptions for all the 34 advisors in the 2018 survey. Expected returns shown below are annualized (geometric).

To illustrate the distribution of expected returns, the exhibit shows the range of the middle 50 percent of results: the range between the 25th and 75th percentiles. It also shows the median expected return for each asset class: the 50th percentile. Note that the expected returns for the *median* advisor shown below are not the same as the *average* expected returns shown elsewhere in the report. In most cases, however, the differences between median and average expected returns are relatively small.

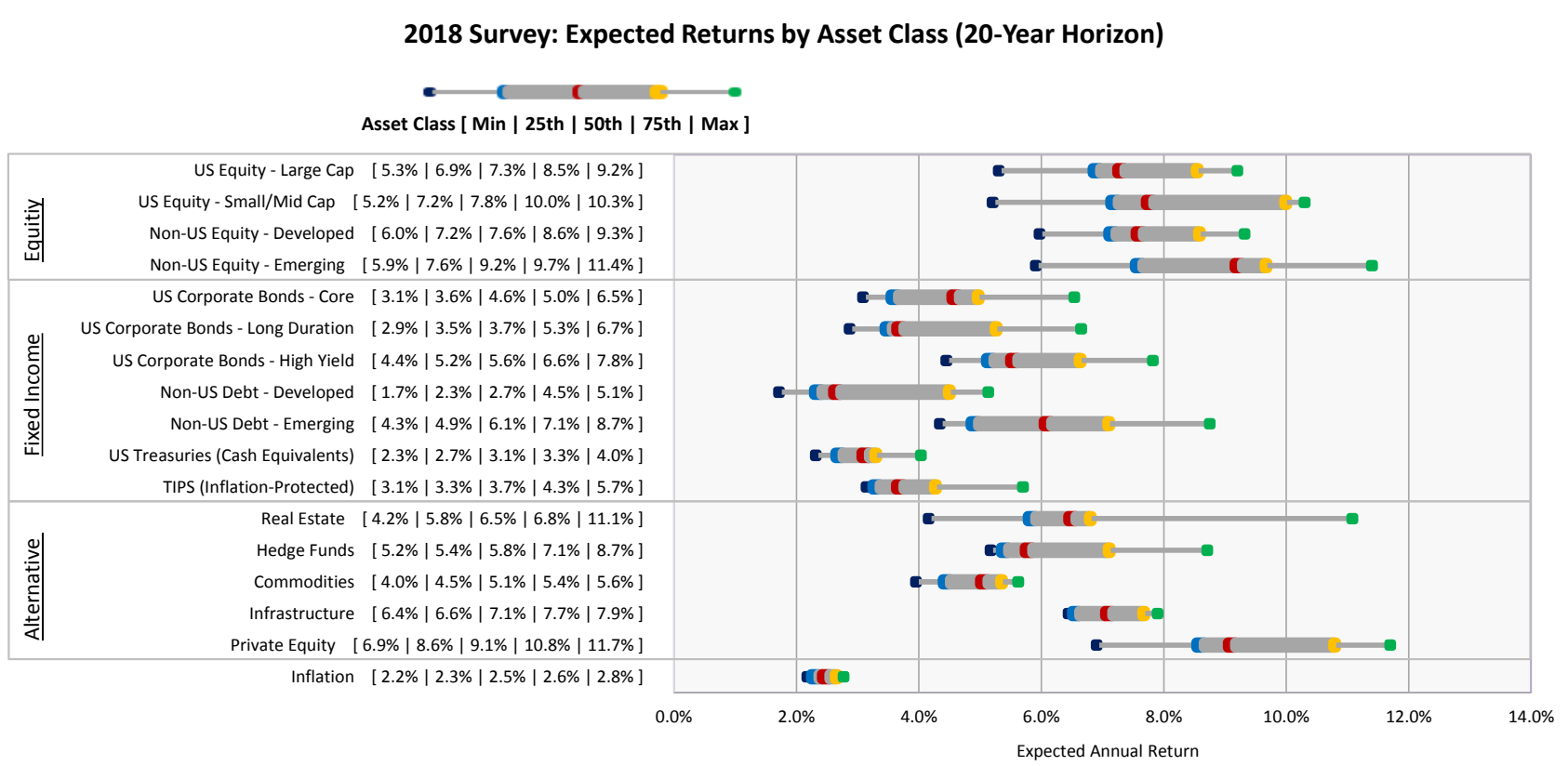


Expected returns are annualized over 10 years (geometric).

Exhibit 18

The exhibit below shows the ranges of expected annual returns for different asset classes over a 20-year investment horizon. The ranges shown below are based on the assumptions for 13 advisors who provided longer-term assumptions (horizons of 20 years or more). Expected returns shown below are annualized (geometric). Note that the ranges of expected returns are somewhat narrower when the investment horizon is longer.

To illustrate the distribution of expected returns, the exhibit shows the range of the middle 50 percent of results: the range between the 25th and 75th percentiles. It also shows the median expected return for each asset class: the 50th percentile. Note that the expected returns for the *median* advisor shown below are not the same as the *average* expected returns shown elsewhere in the report. In most cases, however, the differences between median and average expected returns are relatively small.



Expected returns are annualized over 20 years (geometric), based on a subset of 13 advisors who provided longer term assumptions.

APPENDIX C – NASRA BRIEF

NASRA Issue Brief:
Public Pension Plan Investment Return Assumptions

Updated February 2018

As of September 30, 2017, state and local government retirement systems held assets of $4.16 trillion.[1] 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.

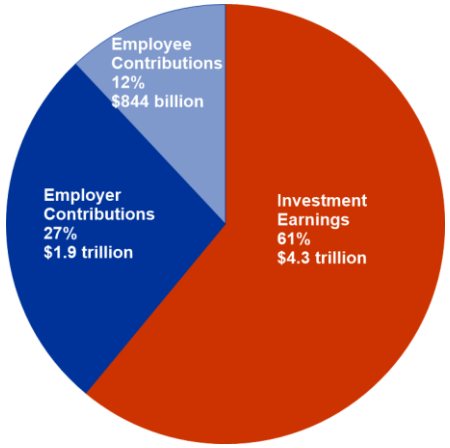
Funding a pension benefit requires the use of projections, known as actuarial assumptions, about future events. Actuarial assumptions fall into one of two broad categories: demographic and economic. Demographic assumptions are those pertaining to a pension plan's membership, such as changes in the number 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, compares these assumptions with public funds' actual investment experience, and the challenging investment environment public retirement systems currently face.

Because investment earnings account for a majority of revenue for a typical public pension fund, the accuracy of the return assumption has a major effect on a 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.

As shown in Figure 1, since 1987, public pension funds have accrued approximately $7.0 trillion in revenue, of which $4.3 trillion, or 61 percent, is from investment earnings. Employer contributions account for $1.9 trillion, or 27 percent of the total, and employee contributions total $844 billion, or 12 percent.[2]

Figure 1: Public Pension Sources of Revenue, 1987-2016



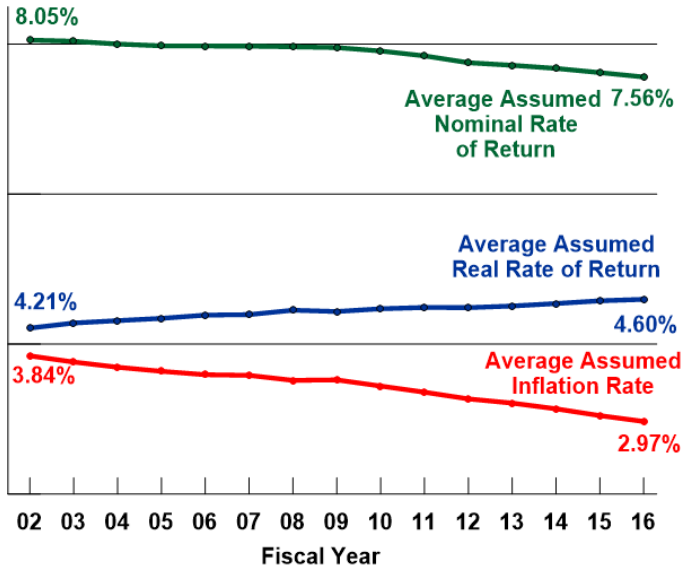
Compiled by NASRA based on U.S. Census Bureau data

Most public retirement systems review their actuarial assumptions regularly, pursuant to state or local statute or system policy. The entity (or entities) responsible for setting the return assumption, as identified in Appendix B, typically works with one or more professional actuaries, who follow guidelines set forth by the Actuarial Standards Board in Actuarial Standards of Practice No. 27 (Selection of Economic Assumptions for Measuring Pension Obligations) (ASOP 27). ASOP 27 prescribes the factors actuaries should consider in setting economic actuarial assumptions, and recommends that actuaries consider the context of the measurement they are making, as defined by such factors as the purpose of the

[1] Federal Reserve, *Flow of Funds Accounts of the United States: Flows and Outstandings, Third Quarter 2017*, Table L.120
[2] US Census Bureau, Annual Survey of Public Pensions, State & Local Data

measurement, the length of time the measurement period is intended to cover, and the projected pattern of the plan's cash flows.

Figure 2: Average nominal and real rate of return, and average assumed inflation rate, FY 02 – FY 16



Public Plans Data and Public Fund Survey

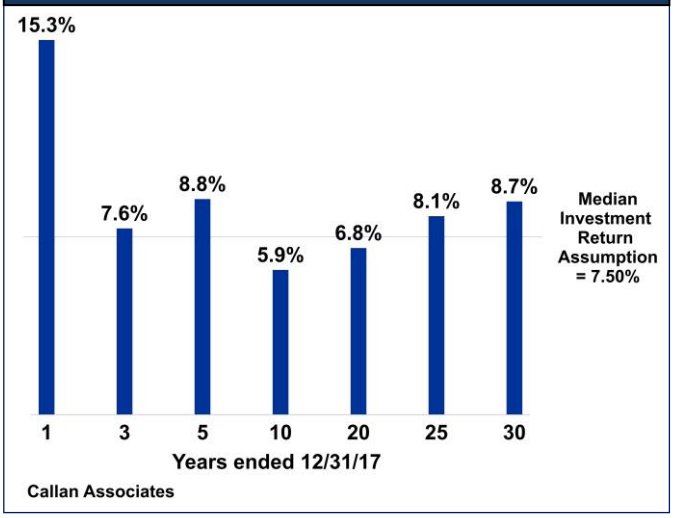
ASOP 27 also advises that actuarial assumptions be reasonable, defined in subsection 3.6 as being consistent with five specified characteristics; and requires that actuaries consider relevant data, such as current and projected interest rates and rates of inflation; historic and projected returns for individual asset classes; and historic returns of the fund itself. For plans that remain open to new members, actuaries focus chiefly on a long investment horizon, i.e., 20 to 30 years, which is the length of a typical public pension plan's funding period. One key purpose for relying on a long timeframe is to promote the key policy objectives of cost stability and predictability, and 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 components is the nominal return rate, which is the rate that is most often used and cited. The system's inflation assumption typically is applied also to other actuarial assumptions, such as the level of wage growth and, where relevant, assumed rates of cost-of-living adjustments (COLAs). Achieving an investment return approximately commensurate with the inflation rate normally is attainable by investing in securities, such as US Treasury bonds, that are often characterized as risk-free, i.e., that pay a guaranteed rate of return.

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 by investing the assets. 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 assets such as public and private equities and real estate, which contain more risk than Treasury bonds.

Figure 2 illustrates the changes in the average nominal (non-inflation-adjusted) return, the inflation assumption, and the resulting real rate of return assumption. As the chart shows, although the average nominal public pension fund investment return has been declining, because the average rate of assumed inflation has been dropping more quickly, the average real rate of return has risen, from 4.21 percent in FY 02 to 4.60 percent in FY 16. One factor that may be contributing to the higher real rate of return is public pension funds' higher allocations to alternative assets, particularly to private equities, which usually have a higher expected return than other asset classes.

Figure 3: Median public pension annualized investment returns for period ended 12/31/2017

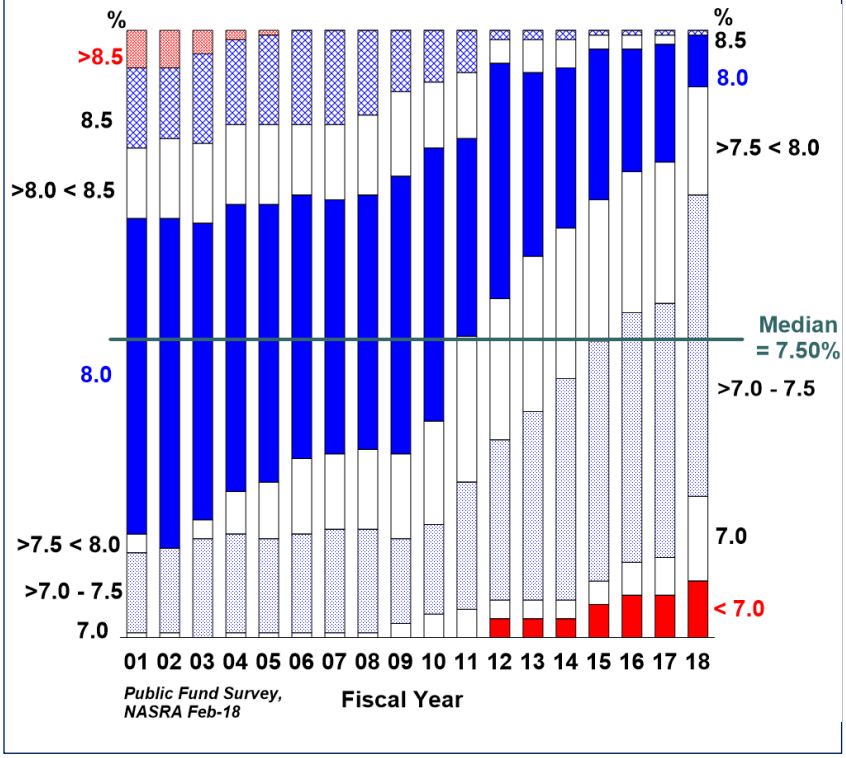


Callan Associates

Figure 3 plots median public pension fund annualized investment returns for a range of periods ended December 31, 2017. As the figure shows, relatively strong returns in recent years are somewhat offset by the effects of market declines of 2000-02 and 2008-09, which are affecting returns for the 10- or 20-year periods ended 12/31/17, or both.

In the wake of the 2008-09 decline in capital markets and Great Recession, global interest rates and inflation have remained low by historic standards, due partly to so-called quantitative easing of central banks in many industrialized economies, including the U.S. Now in their ninth year, these low interest rates, with low rates of projected global economic growth, have led to reductions in projected returns for most asset classes, which, in turn, have resulted in an unprecedented number of reductions in the investment return assumption used by public pension plans. This trend is illustrated by Figure 4, which plots the distribution of investment return assumptions among a representative group of plans since 2001. Among the 129 plans measured, nearly three-fourths have reduced their investment return assumption since fiscal year 2010, resulting in a decline in the average return assumption from 7.91 percent to 7.36 percent. If projected returns continue to decline, investment return assumptions are likely to also to continue their downward trend. Appendix A lists the assumptions in use or adopted for future use by the 129 plans in this dataset.

Figure 4: Change in Distribution of Public Pension Investment Return Assumptions, FY 01 to FY 18



One challenging facet of setting the investment return assumption that has emerged more recently is a divergence between expected returns over the near term, i.e., the next five to 10 years, and over the longer term, i.e., 20 to 30 years[3]. A growing number of investment return projections are concluding that near-term returns will be materially lower than both historic norms as well as projected returns over longer timeframes. Because many near-term projections calculated recently are well below the long-term assumption most plans are using, some plans face the difficult choice of either maintaining a return assumption that is higher than near-term expectations, or lowering their return assumption to reflect near-term expectations.

If actual investment returns in the near-term prove to be lower than historic norms, plans that maintain their long-term return assumption risk experiencing a steady increase in unfunded pension liabilities and corresponding costs. Alternatively, plans that reduce their assumption in the face of diminished near-term projections will experience an immediate increase unfunded liabilities and required costs. As a rule of thumb, a 25 basis point reduction in the return assumption, such as from 8.0 percent to 7.75 percent, will increase the cost of a plan that has a COLA, by three percent of pay (such as from 10 percent to 13 percent), and a plan that does not have a COLA, by two percent of pay.

Conclusion

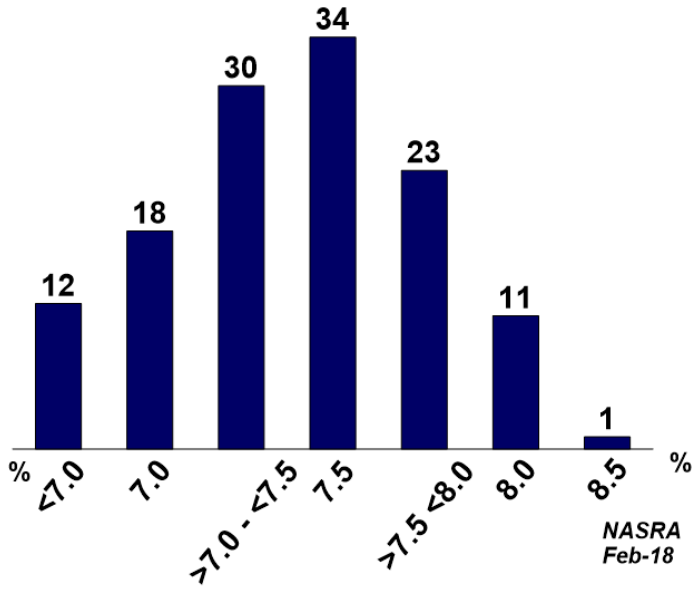
The investment return assumption is the single most consequential of all actuarial assumptions in terms of its effect on a pension plan's finances. The sustained period of low interest rates since 2009 has caused many public pension plans to re-evaluate their long-term expected investment returns, leading to an uprecedented number of reductions in plan investment return assumptions. Absent other changes, a lower investment return assumption increases both the plan's unfunded liabilities and cost. The process for evaluating a pension plan's investment return assumption should include abundant input and feedback from professional experts and actuaries, and should reflect consideration of the factors prescribed in actuarial standards of practice.

[3] Horizon Actuarial Services, "Survey of Capital Market Assumptions, 2017 Edition (August 2017) p4

See Also:

- Actuarial Standards of Practice No. 27, Actuarial Standards Board
- The Liability Side of the Equation Revisited, Missouri SERS, September 2006

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 2018[1])

Plan	Rate (%)
Alabama ERS	7.75
Alabama Teachers	7.75
Alaska PERS	8.0
Alaska Teachers	8.0
Arizona Public Safety Personnel	7.40
Arizona SRS	7.50
Arkansas PERS	7.15
Arkansas State Highway ERS	8.0
Arkansas Teachers	7.50
California PERF[2]	7.375
California Teachers[3]	7.25
Chicago Teachers	7.75
City of Austin ERS	7.50
Colorado Affiliated Local	7.50
Colorado Fire & Police Statewide	7.50
Colorado Municipal	7.25
Colorado School	7.25
Colorado State	7.25
Connecticut SERS	6.90
Connecticut Teachers	8.0
Contra Costa County	7.25
DC Police & Fire	6.50
DC Teachers	6.50
Delaware State Employees	7.0
Denver Employees	7.75
Denver Public Schools	7.25
Duluth Teachers	8.0
Fairfax County Schools	7.50
Florida RS	7.50
Georgia ERS	7.50
Georgia Teachers	7.50
Hawaii ERS	7.0
Houston Firefighters	7.0
Idaho PERS	7.0
Illinois Municipal	7.50
Illinois SERS	7.25
Illinois Teachers	7.0
Illinois Universities	7.25
Indiana PERF	6.75
Indiana Teachers	6.75
Iowa PERS	7. 0
Kansas PERS	7.75
Kentucky County	6.25
Kentucky ERS[4]	5.25
Kentucky Teachers	7.50
Los Angeles County ERS	7.50
Louisiana Parochial Employees	7.0
Louisiana SERS[5]	7.70
Louisiana Teachers[5]	7.70
Maine Local	6.875
Maine State and Teacher	6.875
Maryland PERS[6]	7.50
Maryland Teachers[6]	7.50
Massachusetts SERS	7.50
Massachusetts Teachers	7.50
Michigan Municipal	7.75
Michigan Public Schools[7]	7.05
Michigan SERS	7.0
Minnesota PERF	8.0
Minnesota State Employees	8.0
Minnesota Teachers[8]	8.50
Mississippi PERS	7.75
Missouri DOT and Highway Patrol	7.75
Missouri Local	7.25
Missouri PEERS	7.60
Missouri State Employees	7.65
Missouri Teachers	7.60
Montana PERS	7.65
Montana Teachers	7.75
Nebraska Schools	7.50
Nevada Police Officer and Firefighter	7.50
Nevada Regular Employees	7.50
New Hampshire Retirement System	7.25
New Jersey PERS[9]	7.50
New Jersey Police & Fire[9]	7.50
New Jersey Teachers[9]	7.50
New Mexico PERA[10]	7.51
New Mexico Teachers	7.25
New York City ERS	7.0
New York City Teachers	7.0
New York State Teachers	7.25
North Carolina Local Government	7.20
North Carolina Teachers and State Employees	7.20
North Dakota PERS	7.75
North Dakota Teachers	7.75
NY State & Local ERS	7.0
NY State & Local Police & Fire	7.0
Ohio PERS	7.50
Ohio Police & Fire	8.0
Ohio School Employees	7.50

Ohio Teachers	7.45
Oklahoma PERS	7.0
Oklahoma Teachers	7.50
Orange County ERS	7.0
Oregon PERS	7.20
Pennsylvania School Employees	7.25
Pennsylvania State ERS	7.25
Phoenix ERS	7.50
Rhode Island ERS	7.0
Rhode Island Municipal	7.0
San Diego County	7.25
San Francisco City & County	7.46
South Carolina Police	7.25
South Carolina RS	7.25
South Dakota RS	6.50
St. Louis School Employees	7.50
St. Paul Teachers	8.0
Texas County & District	8.0
Texas ERS	7.50
Texas LECOS	7.50
Texas Municipal	6.75

Texas Teachers	8.0
Tennessee Political Subdivisions	7.25
Tennessee State and Teachers	7.25
Utah Noncontributory	6.95
Vermont State Employees	7.50
Vermont Teachers	7.50
Virginia Retirement System	7.0
Washington LEOFF Plan 1[11]	7.70
Washington LEOFF Plan 2[12]	7.50
Washington PERS 1[11]	7.70
Washington PERS 2/3[11]	7.70
Washington School Employees Plan 2/3[11]	7.70
Washington Teachers Plan 1[11]	7.70
Washington Teachers Plan 2/3[11]	7.70
West Virginia PERS	7.50
West Virginia Teachers	7.50
Wisconsin Retirement System	7.20
Wyoming Public Employees	7.0

1. This list of nominal investment return assumptions is updated at www.nasra.org/latestreturnassumptions
2. CalPERS is reducing its investment return assumption from 7.50 percent to 7.0 percent over three years. In February 2017 the CalPERS Board adopted a risk mitigation policy, effective beginning FY 2021, that calls for a reduction in the system's investment return assumption commensurate with the pension fund achieving a specified level of investment return. Details are available online: https://www.calpers.ca.gov/docs/board-agendas/201702/financeadmin/item-9a-02.pdf.
3. CalSTRS is reducing its investment return assumption from 7.50 percent to 7.0 percent over two years.
4. The Kentucky ERS is composed of two plans: Hazardous and Non-Hazardous. The rate shown applies to the plan's Non-Hazardous plan, which accounts for more than 90 percent of the Kentucky ERS plan liabilities. The investment return assumption used for the Hazardous plan is 6.25 percent.
5. The Louisiana State Employees' Retirement System and Teachers' Retirement System are reducing their discount rate from 7.75 percent to 7.50 percent by 2021 in annual increments of 0.05 percent. The discount rate used to determine the FY 2018/2019 funding requirement is 7.65%, which is net of gain-sharing. The investment return assumption differs from the discount rate because of the effective cost of providing potential future ad hoc postretirement benefit increases, or gain-sharing. The investment return assumption, which includes gain-sharing, is reducing incrementally to 7.50% by 2021.
6. The assumed rate of return for the Maryland Public Employees' Retirement System and Teachers Retirement Systems is scheduled to decrease to 7.45 percent beginning July 1, 2018.
7. The Michigan Public School Employees' Retirement System administers three plans: a defined benefit plan and two hybrid plans (Pension Plus and Pension Plus 2). The rate shown applies to the defined benefit plan. The investment return assumption used for the Pension Plus plan is 7.0 percent, and 6.0 percent for Pension Plus 2.
8. Legislation approved by the Minnesota Legislature in 2016 would have reduced the return assumption of the Teachers' Retirement Association to 8.0 percent, but was vetoed by the governor for reasons extraneous to the assumption.
9. The assumed rate of return for the New Jersey PERS, Police & Fire, and Teachers plans is scheduled to decrease to 7.3 percent for FY 21 and FY 22, and to 7.0 percent effective FY 23.
10. Reflects a weighted average rate based on 7.25 percent for FY17-26 and 7.75 percent thereafter.
11. For all Washington State plans except LEOFF Plan 2, the assumed rate of return is scheduled to decrease to 7.5 percent for the 2019-21 biennium.
12. The assumed rate of return for the Washington LEOFF Plan 2 is scheduled to decrease to 7.4 percent for the 2019-2021 biennium.

Appendix B: Entity Responsible for Setting Investment Return Assumption for Selected State Plans

State	System	Investment Return Assumption Set By
AK	Alaska Public Employees Retirement System	Alaska Retirement Management Board
AK	Alaska Teachers Retirement System	Alaska Retirement Management Board
AL	Retirement Systems of Alabama	Retirement board
AR	Arkansas Public Employees Retirement System	Retirement board
AR	Arkansas State Highway Employees' Retirement System	Retirement board
AR	Arkansas Teachers Retirement System	Retirement board
AZ	Arizona Public Safety Personnel Retirement System	Retirement board
AZ	Arizona State Retirement System	Retirement board
CA	California Public Employees Retirement System	Retirement board
CA	California State Teachers Retirement System	Retirement board
CO	Colorado Public Employees Retirement Association	Retirement board
CO	Fire & Police Pension Association of Colorado	Retirement board
CT	Connecticut State Employees Retirement System	State Employees Retirement Commission
CT	Connecticut Teachers Retirement Board	Retirement board
DC	District of Columbia Retirement Board	Retirement board
DE	Delaware Public Employees Retirement System	Retirement board
FL	Florida Retirement System	FRS Actuarial Assumption Estimating Conference[1]
GA	Georgia Employees Retirement System	Retirement board
GA	Georgia Teachers Retirement System	Retirement board
HI	Hawaii Employees Retirement System	Retirement board
IA	Iowa Public Employees Retirement System	IPERS Investment Board
ID	Idaho Public Employees Retirement System	Retirement board
IL	Illinois State Universities Retirement System	Retirement board
IL	Illinois State Employees Retirement System	Retirement board
IL	Illinois Municipal Retirement Fund	Retirement board
IL	Illinois Teachers Retirement System	Retirement board
IN	Indiana Public Retirement System	Retirement board
KS	Kansas Public Employees Retirement System	Retirement board
KY	Kentucky Retirement Systems	Retirement board
KY	Kentucky Teachers Retirement System	Retirement board
LA	Louisiana State Employees Retirement System	Retirement board
LA	Louisiana Parochial Employees' Retirement System	Retirement board
LA	Louisiana Teachers Retirement System	Retirement board
MA	Massachusetts State Employees Retirement System	Collaborative between the legislature, state treasurer, governor, and the Massachusetts Public Employee Retirement Administration Commission
MA	Massachusetts Teachers Retirement Board	Collaborative between the legislature, state treasurer, governor, and the Massachusetts Public Employee Retirement Administration Commission
MD	Maryland State Retirement and Pension System	Retirement board
ME	Maine Public Employees Retirement System	Retirement board
MI	Michigan Public School Employees Retirement System	Retirement board
MI	Michigan State Employees Retirement System	Retirement board
MI	Municipal Employees' Retirement System of Michigan	Retirement board
MN	Minnesota Public Employees Retirement Association	Legislature
MN	Minnesota State Retirement System	Legislature
MN	Minnesota Teachers Retirement Association	Legislature

MO	Missouri Local Government Employees Retirement System	Retirement board
MO	Missouri Public Schools Retirement System	Retirement board
MO	Missouri State Employees Retirement System	Retirement board
MO	MoDOT & Patrol Employees' Retirement System	Retirement board
MS	Mississippi Public Employees Retirement System	Retirement board
MT	Montana Public Employees Retirement Board	Retirement board
MT	Montana Teachers Retirement System	Retirement board
NC	North Carolina Retirement Systems	Retirement board
ND	North Dakota Public Employees Retirement System	Retirement board
ND	North Dakota Teachers Fund for Retirement	Retirement board
NE	Nebraska Public Employees Retirement System	Retirement board
NH	New Hampshire Retirement System	Retirement board
NJ	New Jersey Division of Pension and Benefits	Retirement board and state treasurer
NM	New Mexico Educational Retirement Board	Retirement board
NM	New Mexico Public Employees Retirement Association	Retirement board
NV	Nevada Public Employees Retirement System	Retirement board
NY	New York State & Local Retirement Systems	State comptroller
NY	New York State Teachers Retirement System	Retirement board
OH	Ohio Police and Fire Pension Fund	Retirement board
OH	Ohio Public Employees Retirement System	Retirement board
OH	Ohio School Employees Retirement System	Retirement board
OH	Ohio State Teachers Retirement System	Retirement board
OK	Oklahoma Public Employees Retirement System	Retirement board
OK	Oklahoma Teachers Retirement System	Retirement board
OR	Oregon Public Employees Retirement System	Retirement board
PA	Pennsylvania Public School Employees Retirement System	Retirement board
PA	Pennsylvania State Employees Retirement System	Retirement board
RI	Rhode Island Employees Retirement System	Retirement board
SC	South Carolina Retirement Systems	Legislature
SD	South Dakota Retirement System	Retirement board
TN	Tennessee Consolidated Retirement System	Retirement board
TX	Teacher Retirement System of Texas	Retirement board
TX	Texas County & District Retirement System	Retirement board
TX	Texas Employees Retirement System	Retirement board
TX	Texas Municipal Retirement System	Retirement board
UT	Utah Retirement Systems	Retirement board
VA	Virginia Retirement System	Retirement board
VT	Vermont State Employees Retirement System	Retirement board
VT	Vermont Teachers Retirement System	Retirement board
WA	Washington Department of Retirement Systems	Legislature
WI	Wisconsin Retirement System	Retirement board
WV	West Virginia Consolidated Public Retirement Board	Retirement board
WY	Wyoming Retirement System	Retirement board

1. The Conference consists of staff from the Florida House, Senate, and Governor's office