



City of Atlanta General Employees' Pension Fund, Firefighters' Pension Fund, and Police Officers' Pension Fund

Review of Actuarial Valuation Reports and Experience
Studies

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Actuarial Opinion

This report presents the results of the actuarial review of the most recently prepared actuarial valuations and experience studies for the following plans sponsored by the City of Atlanta (“City”), collectively referred to as the “Pension Funds”:

- City of Atlanta General Employees’ Pension Fund (“GE Fund”)
- City of Atlanta Firefighters’ Pension Fund (“Firefighters’ Fund”)
- City of Atlanta Police Officers’ Pension Fund (“Police Officers’ Fund”)

Our review was based on participant data and financial information provided by Segal Consulting (“Segal”) for the GE Fund and by Southern Actuarial Services (“Southern Actuarial”) for the Firefighters’ and Police Officers’ Funds, collectively referred to as the “retained actuaries”, and our interpretation of the applicable Actuarial Standards of Practice (“ASOPs”) issued by the Actuarial Standards Board.

Our review was performed to satisfy the requirements of the City of Atlanta Charter and Related Laws (“City Ordinance”), Subpart A, Article VI, Chapter 3, Section 6-313 (Ord. No. 11-O-0944). This requirement states that “an independent licensed actuary be engaged by the City of Atlanta Audit Committee to conduct an actuarial audit of the City’s General Employee Pension Fund, Firefighter Pension Fund, and Police Pension Fund ...”.

In our opinion as an independent actuary, the July 1, 2017 actuarial valuations and the experience studies as of June 30, 2016 for the GE Fund and July 1, 2011 for the Firefighters’ Fund and Police Officers’ Fund were generally performed in compliance with the applicable ASOPs issued by the Actuarial Standards Board; although, some additional disclosures should be provided to fully comply with the Standards. Additionally, we were able to match the results of the actuarial valuations within a reasonable range, using the same data, assumptions, methods and provisions disclosed by the retained actuaries. However, we did have concerns about the quality of the data provided by the City to the actuary and the inconsistency of methods and assumptions, and related support for the assumptions, between the three funds.

Future actuarial measurements may differ significantly from current measurements presented in this report due to such factors as the following: actual plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operations of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan’s actual future funded status); and changes in plan provisions or applicable law. Our scope did not include analyzing the potential range of such future measurements based on potential impacts of these factors; therefore, we did not perform such an analysis.

The undersigned with actuarial credentials collectively meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

This report was prepared solely for the benefit and internal use of the City. This report is not intended for the benefit of any other party and may not be relied upon by any third party for any purpose, and Deloitte Consulting accepts no responsibility or liability with respect to any party other than the City.

To the best of our knowledge, no employee of the Deloitte U.S. Firms is an officer or director of the employer. In addition, we are not aware of any relationship between the Deloitte U.S. Firms and the employer that may impair or appear to impair the objectivity of the work included in this analysis.

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Executive Summary

Intent

The intent of this report is to review the July 1, 2017 actuarial valuations and most recently completed experience studies for the Pension Funds prepared by Segal and Southern Actuarial for accuracy of results, appropriateness of methodology, and compliance with the applicable Actuarial Standards of Practice issued by the Actuarial Standards Board. This review is intended to satisfy the requirements of the City Ordinance. The scope of this report includes an actuarial review of the actuarial assumptions and most recent experience studies as performed by the retained actuaries.

Process

To achieve the above-stated goals, we have reviewed City-provided census data, census data from the retained actuaries, sample life output, the July 1, 2017 actuarial valuation reports, and the most recent experience study reports (June 30, 2016 for the GE Fund and July 1, 2011 for the Firefighters' Fund and Police Officers' Fund). For each plan, we replicated the liability results as of July 1, 2017 in our valuation software. For the GE Fund, we reviewed the retained actuary's assumption setting process by replicating the June 30, 2016 experience study. For the Firefighters' Fund and Police Officers' Fund we reviewed the retained actuaries' process for setting the assumptions. At the direction of the City, we did not replicate the July 1, 2011 experience studies due to the fact that the underlying data for years 2003-2011 was not readily available.

Results and Recommendations

Our review determined that the results calculated by the retained actuaries match the results calculated by Deloitte within a reasonable range, using the same data, assumptions, methods and provisions disclosed by the retained actuaries. We believe the actuarial valuation reports and experience study reports were generally performed in compliance with the applicable Actuarial Standards of Practice ("ASOPs"); however, for each report we identified several deficiencies related to certain disclosures as prescribed by the ASOPs. We have also provided findings and recommendations that could improve the quality of the data, assumptions, transparency, and consistency of the actuarial valuations. The significant findings of our review are summarized below.

Summary of Significant Findings: Data

The scope of our review included the reasonableness of the valuation data and a comparison of the valuation data to the source data files provided by the City; we did not conduct an audit of the City's data. Our review identified several areas of significant concern regarding the data, which draw into question the overall consistency and quality of the data.

For the GE Fund, we did not identify any issues of significant concern related to the reconciliation process between the City data and the retained actuary data. While we did not conduct a full audit of the City data, the format and overall quality of the City data could be improved. The City data

contained many duplicate records and required a significant number of adjustments by the actuary in order to be used as the basis for the valuation.

For the Police Officers' and Firefighters' Fund, there are substantial inconsistencies between City data and retained actuary data:

- For active participants, the sum of total employee contributions with interest are roughly double in the retained actuary data versus the City data.
- For inactive participants, there is a significant difference in the number of deferred vested records in retained actuary data versus City data. There are 466 and 125 deferred vested participants in the City data for Police and Fire, respectively, compared to 20 and 11 in the retained actuary data.

The Police and Firefighter Funds' retained actuary noted in the 2011 experience study that the data is not of acceptable quality to be the basis for determining any of the demographic assumptions.

Concerns noted by the retained actuary about the data included:

- Beneficiaries cannot be linked to the original retiree
- Retiree deaths are not individually tracked (i.e., those not in the data year over year could be due to return to service)
- The number of retiree deaths are unreasonably low
- Individual data is not tracked when a participant leaves active service (i.e., not know if cause was termination, retirement, disability, or death)
- Disability codes are inconsistent

We strongly recommend the City consider an effort to improve the data quality to improve the actuarial valuation process and the underlying assumptions.

Beyond the data quality concerns, there are also inconsistencies in the format of the data between the GE Fund and the Police Officers' and Firefighters' Funds. The City may wish to standardize the data processes between the three funds to improve the quality and consistency of the data.

Summary of Significant Findings: Assumptions

We identified many recommendations regarding the determination of assumptions and the documentation of assumptions. While we believe certain assumptions could be improved, the overall results of the valuations seem reasonable based on the available data. The Funds should take these recommendations into consideration for future valuations.

For the GE Fund, we did not identify any assumptions of significant concern.

For the Police Officers' and Firefighters' Fund, there are concerns about the economic and demographic assumptions:

- **Economic:** The Police Officers' and Firefighters' Funds inflation assumption is not disclosed but appears to be 3.00%. This is 75 basis points higher than the GE Fund's assumption of 2.25%. The inflation assumption should be consistent across all plans of the City. Inflation is the building block of many other assumptions, including payroll growth, salary scale, cost-of-living adjustments, and investment return. Therefore, changes in the inflation assumption may change some or all of the other economic assumptions. Moreover, the salary scale

equals the payroll growth assumption, which may not be an appropriate assumption and could have a significant impact on the actuarially determined contributions

- **Mortality:** The Police Officers' and Firefighters' Funds are using an outdated mortality table and improvement scale without providing a rationale for the selection of those assumptions. If reliable data cannot be obtained to determine population-specific experience, the Funds should consider updating these assumptions to current mortality tables and improvement scales published by the Society of Actuaries.
- **Withdrawal:** The Police Officers' and Firefighters' Funds are using experience from the mid-1980's as the basis for this assumption. Recent, reliable data should be obtained to determine the appropriateness of this assumption.
- **Retirement:** The Police Officers' and Firefighters' Funds are using a single retirement age for all participants. Recent, reliable data should be obtained to determine the appropriateness of this assumption.

The Police Officers' and Firefighters' Funds have not conducted an experience study since 2011, and the value of this experience study was limited due to:

- Data issues described above; and
- Not including economic assumptions, such as inflation and payroll growth.

We strongly recommend the Police Officers' and Firefighters' Funds perform new experience studies based on recent, reliable data. It is an industry best practice to review experience every 3-5 years, and according to the City Ordinance, Subpart A, Article VI, Chapter 3, Section 6-314 (Ord. No. 11-O-0944), it is required "That every five years or at such regular intervals as determined by City Council, a licensed actuary be engaged by the City of Atlanta Audit Committee to conduct an actuarial experience review of the City's General Employee Pension Fund, Firefighter Pension Fund, and Police Pension Fund."

Due to the passage of time and the lack of reliable data, the experience studied from 2005-2010 is not an appropriate basis to support the current assumptions. We also recommend that the three plans seek to align their assumptions where appropriate.

Basis of Findings

Valuation Reports

Our results and recommendations are based on the review contained in this report, which included the following components:

- Review of plan provisions to confirm all appropriate benefits are valued and valued correctly;
- Review of the data used by the retained actuaries as compared to the City-provided data for consistency or appropriate disclosure of modifications;
- Evaluation of actuarial methods, including the actuarial cost method, amortization/funding method, and actuarial asset valuation method;
- Replication of actuarial results and validation of actuarial calculations;

- Identification of key differences in actuarial calculations and methodologies across plans; and
- Review of the required disclosures and presentation of results.

We have noted recommendations that could improve the transparency and understanding of the actuarial work performed.

These comments are discussed further in the Summary of Key Findings and Recommendations section as well as the detailed sections that follow.

Experience Studies

We recommend that the Firefighters' Fund and Police Officers' Fund perform an experience study based on more recent and more reliable data than that used for the July 1, 2011 experience study performed.

Our results and recommendations are based on the review contained in this report, which included the following components:

- Review of the demographic and economic actuarial assumptions for consistency, reasonableness, and compatibility;
- A full replication (for GE Fund only), review of demographic and economic actuarial assumptions for consistency, reasonableness, and compatibility of the most recent experience studies;
- Identification of key differences in actuarial calculations and methodologies across plans; and
- Review of the required disclosures and presentation of results.

We have noted recommendations that could improve the transparency and understanding of the actuarial work performed.

These comments are discussed further in the Summary of Key Findings and Recommendations section as well as the detailed sections that follow.

Summary of Findings and Recommendations

The tables below summarize the findings and recommendations of our review. The details supporting these findings and recommendations are included in the sections that follow.

Valuation Reports

GE Fund

We recommend the following changes be considered.

| Area | Recommendations | Purpose |
|-----------------|---|--|
| Plan Provisions | Review the documentation and usage of the breakpoint for new plan provisions to take effect, as the report discloses October 31, 2011, while the City Ordinance discloses September 1, 2011 | Provide additional detail on plan design |
| Plan Provisions | Confirm the source and applicability of the minimum benefit amount of \$12 per month per year of service provision | Provide additional detail on plan design |
| Plan Provisions | Disclose the assumption used to determine the amount of unused sick leave at retirement for future retirements, and how this assumption is developed | Provide additional detail on plan design |
| Plan Provisions | Review the documentation and usage of the vesting schedule | Provide additional detail on plan design |
| Plan Provisions | Clarify the rationale for not including the other potential disability benefits and comment on the materiality, if appropriate | Provide additional detail on plan design |
| Plan Provisions | Include in the Summary of Plan Provisions a clearer separation and description between the Survivor Benefit and the survivor pension benefit | Provide additional detail on plan design |
| Plan Provisions | Clarify whether the COLA applies to deferred benefits and clarify that the COLA is applied on a compound basis | Provide additional detail on plan design |
| Plan Provisions | Clarify that employees hired after September 1, 2011 enter a hybrid plan with different set of plan provisions, including a Defined Contribution component | Provide additional detail on plan design |

| Area | Recommendations | Purpose |
|-----------------------------|---|--|
| Census Data | Disclose any adjustments to City-provided data or assumptions for missing or incomplete data for key fields | Enhance understanding of data assumptions |
| Amortization/Funding Method | Describe the periodic cap analysis in the Risk section | Provide additional detail on the funding policy |
| Amortization/Funding Method | Disclose the implications of exceeding the cumulative cap as summarized in Section 6-2(h) of the City Ordinance | Provide additional detail for the funding policy |
| Amortization/Funding Method | Consider the key funding policy objectives recommended by prominent organizations if changes are made to the ADC | Align funding policy with key objectives |
| Disability Assumption | Clarify how the occupational disability rates are applied by disclosing what percentage of disabilities are assumed to be occupational | Enhance support for assumption selection |
| Form of Payment Assumption | Disclose the actuarial equivalence assumption for calculating the joint and 75% annuity | Enhance support for assumption selection |
| ADC Calculation | Describe components of the calculation in row 9 on page 25 of the report (adjustment for timing for the ADC) | Transparency of ADC calculation |
| Report Content | Disclose 10-20 years of undiscounted cash flows | Enhance understanding of the plan's financial obligation |
| Report Content | Include a description of how closely current actual and target asset allocations align with the target asset allocation used to select the investment return assumption during the experience study | Enhance understanding of the plan's investment policy |
| Report Content | Enhance content of disclosures to fully comply with ASOP 41 | Enhance report disclosures in consideration of ASOPs |

Police Officers' Fund

We recommend the following changes be considered.

| Area | Recommendations | Purpose |
|-----------------|--|--|
| Plan Provisions | Clarify whether or not the vesting schedule applies to the death and disability benefits | Provide additional detail on plan design |
| Plan Provisions | For participants with a 2% multiplier and the maximum years of service of 50 years, review the interpretation of the plan document for this benefit formula, or provide additional documentation for why the cap is 100% rather than 80% | Provide additional detail on plan design |

| Area | Recommendations | Purpose |
|-----------------------------|--|--|
| Plan Provisions | Clarify in the Summary of Plan Provisions that the COLA is applied on a compound basis | Provide additional detail on plan design |
| Plan Provisions | Disclose the software limitation that requires the retained actuary to apply COLA to deferred benefits, and quantify the liability impact of this limitation | Provide additional detail on plan design |
| Plan Provisions | Confirm the approach used to value disability benefits versus retirement benefits and clarify in the Summary of Plan Provisions | Provide additional detail on plan design |
| Plan Provisions | Correct the description for Creditable Service which uses “firefighter” in place of “police officer” | Provide additional detail on plan design |
| Plan Provisions | Clarify that employees hired after September 1, 2011 enter a hybrid plan with different set of plan provisions, including a Defined Contribution component | Provide additional detail on plan design |
| Census Data | Disclose any adjustments to City-provided data or assumptions for missing or incomplete data for key fields | Enhance understanding of data assumptions |
| Census Data | Investigate differences between City data and retained actuary data for total contributions and counts of deferred vested participants | Enhance understanding of data assumptions |
| Census Data | Investigate missing data for beneficiary’s date of birth and sex | Improve accuracy of census data |
| Census Data | Explicitly disclose the average age by status for inactive participants | Provide additional demographic information |
| Amortization/Funding Method | Disclose the implications of exceeding the cumulative cap as summarized in Section 6-2(h) of the City Ordinance | Provide additional detail for the funding policy |
| Amortization/Funding Method | Consider the key funding policy objectives recommended by prominent organizations if changes are made to the ADC | Align funding policy with key objectives |
| Salary Increase Assumption | Clarify the language in the report for whether actual historical salary is used in determination of the Accrued Liability, Normal Cost, or Final-Average-Pay benefits for participants near retirement | Enhance support of calculations |
| Mortality Assumption | Provide an explanation for the rationale for changing the mortality assumption as of July 1, 2017 | Enhance support for assumption selection |

| Area | Recommendations | Purpose |
|----------------------------|--|--|
| Withdrawal Assumption | Include a statement that the withdrawal assumption, and others as appropriate, include a degree of conservatism | Enhance support for assumption selection |
| Form of Payment Assumption | Disclose the form of payment assumption for post-2011 hires and disclose the actuarial equivalence assumption for calculating the joint and 75% annuity | Enhance support for assumption selection |
| ADC Calculation | Disclose on page I-1 of the report the UAAL to support the determination of the ADC as well as a review of the current approach to disclose the lag in contribution timing | Transparency of ADC calculation |
| ADC Calculation | For the various payroll figures disclosed in the report, include enhanced descriptions of the basis for the figures, such as the census data from which the figure was developed, and the assumptions applied to determine each figure | Transparency of ADC calculation and census data |
| Report Content | Include consistent risk measures when applying ASOP 51 for valuation reports issued after November 1, 2018 | Increase understanding of risk |
| Report Content | Include appropriate disclosure of rationale for each assumption determined to have significant impact on the measurement, as described in ASOP 35. | Enhance report discloses in consideration of ASOPs |

Firefighters' Fund

We recommend the following changes be considered.

| Area | Recommendations | Purpose |
|-----------------|--|--|
| Plan Provisions | Clarify whether or not the vesting schedule applies to the death and disability benefits | Provide additional detail on plan design |
| Plan Provisions | For participants with a 2% multiplier and the maximum years of service of 50 years, review the interpretation of the plan document for this benefit formula, or provide additional documentation for why the cap is 100% rather than 80% | Provide additional detail on plan design |
| Plan Provisions | Clarify the source of the '05 Amendment, as the valuation report mentions a group of participants covered by this amendment | Provide additional detail on plan design |
| Plan Provisions | Clarify in the Summary of Plan Provisions that the COLA is applied on a compound basis | Provide additional detail on plan design |

| Area | Recommendations | Purpose |
|----------------------------|--|---|
| Plan Provisions | Disclose the software limitation that requires the retained actuary to apply COLA to deferred benefits, and quantify the liability impact of this limitation | Provide additional detail on plan design |
| Plan Provisions | Confirm the approach used to value disability benefits versus retirement benefits and clarify in the Summary of Plan Provisions | Provide additional detail on plan design |
| Plan Provisions | Clarify that employees hired after September 1, 2011 enter a hybrid plan with different set of plan provisions, including a Defined Contribution component | Provide additional detail on plan design |
| Census Data | Disclose any adjustments to City-provided data or assumptions for missing or incomplete data for key fields | Enhance understanding of data assumptions |
| Census Data | Investigate differences between City data and retained actuary data for total contributions and counts of deferred vested participants | Enhance understanding of data assumptions |
| Census Data | Investigate missing data for beneficiary's date of birth and sex and participants labeled as child beneficiaries that are over the age of 23 | Improve accuracy of census data |
| Census Data | Explicitly disclose the average age by status for inactive participants | Provide additional demographic information |
| Mortality Assumption | Provide an explanation for the rationale for changing the mortality assumption as of July 1, 2017 | Enhance support for assumption selection |
| Withdrawal Assumption | Include a statement that the withdrawal assumption, and others as appropriate, include a degree of conservatism | Enhance support for assumption selection |
| Form of Payment Assumption | Disclose the form of payment assumption for post-2011 hires and disclose the actuarial equivalence assumption for calculating the joint and 75% annuity | Enhance support for assumption selection |
| ADC Calculation | Disclose on page I-1 of the report the UAAL to support the determination of the ADC as well as a review of the current approach to disclose the lag in contribution timing | Transparency of ADC calculation |
| ADC Calculation | For the various payroll figures disclosed in the report, include enhanced descriptions of the basis for the figures, such as the census data from which the figure was developed, and the assumptions applied to determine each figure | Transparency of ADC calculation and census data |

| Area | Recommendations | Purpose |
|----------------|--|--|
| Report Content | Include consistent risk measures when applying ASOP 51 for valuation reports issued after November 1, 2018 | Increase understanding of risk |
| Report Content | Include appropriate disclosure of rationale for each assumption determined to have significant impact on the measurement, as described in ASOP 35. | Enhance report discloses in consideration of ASOPs |

Comparison of Pension Funds

We recommend the following changes be considered for consistency between the Pension Funds.

| Area | Recommendations | Purpose |
|-----------------------------|---|---|
| Plan Provisions | Include a history of plan amendments to the GE Fund valuation report to be consistent with the Police Officers' and Firefighters' Reports | Provide additional detail on plan design |
| Plan Provisions | Create an SPD of similar format to the Police Officers' and Firefighters' Funds for the GE Fund | Provide additional detail on plan design |
| Amortization/Funding Policy | Consider consistency between the plans if alternative funding/amortization methods are reviewed | Consistent foundation underlying funding policy |
| Asset Method | Consider moving to the same asset method for all three Pension Funds | Standardize asset method |
| ADC Calculation | Consider applying the same method for calculating adjustments for timing as a component of ADC for consistency | Standardize ADC calculation |

Experience Studies

GE Fund

We recommend the following changes be considered in future experience studies.

| Area | Recommendations | Purpose |
|-----------------|--|--|
| Payroll Growth | Include additional support for the justification of the 0.75% real wage growth assumption | Support assumption selection |
| Salary Increase | Include exposed lives during the study period in the experience study | Support assumption selection |
| COLA Assumption | Provide more context for the basis of the recommended assumption | Support assumption selection |
| Mortality | Investigate status transitions to non-participating and whether they should be included in experience study analysis | Improve appropriateness of assumption selection |
| Mortality | Include more detail counts of exposed lives and observed deaths for each group | Support assumption selection |
| Mortality | Disclose the basis for selecting the adjustment factors for disabled and active mortality | Support assumption selection |
| Mortality | Discuss the basis for the selection of the Blue-Collar and multiplier adjustment | Support assumption selection |
| Mortality | Explain the rationale for the selection of the SSA2016-2D mortality improvement scale | Support assumption selection |
| Mortality | Review the appropriateness of updating the base mortality table to the Pub-2010 mortality tables | Align assumption to recently released industry accepted standard |
| Retirement | Review the methodology for determining expected retirements | Improve appropriateness of assumption selection |
| Retirement | Include more detailed reporting of exposed lives and observed retirements by age group and service level | Support assumption selection |
| Retirement | Study the retirement behavior of deferred vested participants | Align assumption selection with expected behavior based on plan provisions |
| Retirement | Develop a separate retirement assumption for those hired after October 31, 2011 | Align assumption selection with expected behavior based on plan provisions |
| Retirement | Consider the use of liability weighted retirement rates | Improve appropriateness of assumption selection |
| Withdrawal | Develop a separate withdrawal assumption for those hired after October 31, 2011 | Align assumption selection with expected behavior based on plan provisions |

| Area | Recommendations | Purpose |
|------------------------------------|---|--|
| Withdrawal | Include more detailed reporting of exposed lives and observed terminations | Support assumption selection |
| Withdrawal | Review the methodology for determining expected and actual retirements versus terminations taking into consideration the plan provisions for retirement eligibility | Improve appropriateness of assumption selection |
| Withdrawal | Consider the use of liability weighted withdrawal rates | Improve appropriateness of assumption selection |
| Disability | Review the assumption that occupational disability rates are 10% of ordinary disability rates | Improve appropriateness of assumption selection |
| Disability | Clarify how the occupational disability rates are applied | Support assumption selection |
| Disability | Supplement historical data with industry-standard data for disability incidence for similar job types | Improve appropriateness of assumption selection |
| Disability | Include more detailed breakout of the exposures and disabilities by age group and gender | Support assumption selection |
| Marital Status and Form of Payment | Exclude post-2011 hires from future analysis | Align assumption selection with expected behavior based on plan provisions |
| Marital Status and Form of Payment | Disclose the actual and expected annuitants electing a joint and survivor benefit | Support assumption selection |
| Age of Survivor | Continue to monitor this assumption as recent studies show a decreasing gap between ages | Improve appropriateness of assumption selection |
| Age of Survivor | Explicitly state the actual and expected annuitants electing a joint and survivor benefit | Support assumption selection |
| Age of Survivor | Clarify the source data for spousal dates of birth | Support assumption selection |

Police Officers' Fund

We recommend the following changes be considered.

| Area | Recommendations | Purpose |
|----------------|--|---|
| Inflation | Explicitly study and disclose this assumption in future studies | Improve appropriateness of assumption selection |
| Payroll Growth | Explicitly study the payroll growth assumption, and review its consistency with the salary increase assumption | Improve appropriateness of assumption selection |

| Area | Recommendations | Purpose |
|-------------------|---|--|
| Investment Return | Provide analysis on the expected future return based on the target asset allocation | Align assumption selection with anticipated experience |
| Investment Return | Disclose the target asset allocation used in the analysis | Support assumption selection |
| Investment Return | Consider benchmarking sources in the experience study | Align assumption with industry standards |
| Investment Return | Consider inflation, real rates of return, and investment expenses in developing assumption | Improve appropriateness of assumption selection |
| Salary Increase | Consider an age and/or service-based merit/promotional increase table with inflation and real wage growth assumptions | Align assumption with industry standards |
| COLA | Confirm consistency between the COLA assumption and inflation assumption | Improve appropriateness of assumption selection |
| COLA | Revise the assumption for Post-2011 hires considering the maximum COLA of 1.00% | Improve appropriateness of assumption selection |
| Mortality | Consider a data clean-up effort to enhance the data collection and data transformation process | Improve appropriateness of assumption selection |
| Mortality | Make a clear recommendation for the mortality assumption, or clearly state that they are proposing no change to the assumption. | Support assumption selection |
| Mortality | Include more analysis on industry-standard tables | Align assumption with industry standards |
| Mortality | Consider credibility analysis to support the selection of assumptions | Support assumption selection |
| Mortality | Consider updating the mortality table and improvement scales to more recently published tables such as the Pub-2010 tables and updated versions of improvement scale MP | Align assumption with industry standards |
| Retirement | Study the assumption and consider an age and/or service-based assumption | Improve appropriateness of assumption selection |
| Retirement | Consider specific plan provisions such as eligibility for unreduced retirement | Align assumption selection with expected behavior based on plan provisions |
| Withdrawal | Consider a data clean-up effort to enhance the data collection and data transformation process | Improve appropriateness of assumption selection |
| Withdrawal | Consider basing the assumption on actual experience or a blending of plan experience with an industry standard table | Align assumption selection with expected behavior based on plan provisions |

| Area | Recommendations | Purpose |
|------------------------------------|--|--|
| Disability | Consider a data clean-up effort to enhance the data collection and data transformation process | Improve appropriateness of assumption selection |
| Marital Status and Form of Payment | Study the refund contribution behavior of terminated vested participants | Align assumption selection with expected behavior based on plan provisions |
| Age of Survivor | Continue to monitor this assumption as recent studies show a decreasing gap between ages | Improve appropriateness of assumption selection |
| Age of Survivor | Include analysis of this assumption in the next experience study | Improve appropriateness of assumption selection |

Firefighters’ Fund

We recommend the following changes be considered.

| Area | Recommendations | Purpose |
|-------------------|--|--|
| Inflation | Explicitly study and disclose this assumption in future studies | Improve appropriateness of assumption selection |
| Payroll Growth | Explicitly study the payroll growth assumption, and review its consistency with the salary increase assumption | Improve appropriateness of assumption selection |
| Investment Return | Provide analysis on the expected future return based on the target asset allocation | Align assumption selection with anticipated experience |
| Investment Return | Disclose the target asset allocation used in the analysis | Support assumption selection |
| Investment Return | Consider benchmarking sources in the experience study, such as from a NASRA study | Align assumption with industry accepted standard |
| Investment Return | Consider inflation, real rates of return, and investment expenses in developing assumption | Improve appropriateness of assumption selection |
| Salary Increase | Consider an age and/or service-based merit/ promotional increase table with a flat inflation and real wage growth assumption | Align assumption with industry accepted standard |
| COLA | Confirm consistency between the COLA assumption and inflation assumption | Improve appropriateness of assumption selection |
| COLA | Revise the assumption for Post-2011 hires considering the maximum COLA of 1.00% | Improve appropriateness of assumption selection |
| Mortality | Consider a data clean-up effort to enhance the data collection and data transformation process | Improve appropriateness of assumption selection |

| Area | Recommendations | Purpose |
|------------------------------------|--|--|
| Mortality | Make a clear recommendation for the mortality assumption, or clearly state that they are proposing no change to the assumption. | Support assumption selection |
| Mortality | Include more analysis on industry-standard tables | Align assumption with industry accepted standard |
| Mortality | Consider credibility analysis to support the selection of their assumption | Support assumption selection |
| Mortality | Update the mortality table and improvement scales to more recently published tables such as the Pub-2010 tables and updated versions of improvement scale MP | Align assumption with industry accepted standard |
| Retirement | Study the assumption and consider an age and/or service-based assumption | Improve appropriateness of assumption selection |
| Retirement | Consider specific plan provisions such as eligibility for unreduced retirement | Align assumption selection with expected behavior based on plan provisions |
| Withdrawal | Consider a data clean-up effort to enhance the data collection and data transformation process | Improve appropriateness of assumption selection |
| Withdrawal | Consider basing the assumption on actual experience or a blending of plan experience with an industry standard table | Align assumption selection with expected behavior based on plan provisions |
| Disability | Consider a data clean-up effort to enhance the data collection and data transformation process | Improve appropriateness of assumption selection |
| Marital Status and Form of Payment | Study the refund contribution behavior of terminated vested participants | Align assumption selection with expected behavior based on plan provisions |
| Age of Survivor | Continue to monitor this assumption as recent studies show a decreasing gap between ages | Improve appropriateness of assumption selection |
| Age of Survivor | Include analysis of this assumption in the next experience study | Improve appropriateness of assumption selection |

Comparison of Pension Funds

We recommend the following changes be considered for consistency between the Pension Funds.

| Area | Recommendations | Purpose |
|-----------------------------|--|---|
| Quality of Experience Study | The Police Officers' and Firefighters' Funds should work to enhance the detail and scope of their experience study | Improve appropriateness of assumption selection |

| | | |
|--|---|--|
| <p>Quality of Underlying Experience Study Data</p> | <p>The Police Officers' and Firefighters' Funds should work to enhance its data process to improve the quality of the data so it can be relied upon for the experience study. Since the data is not trustworthy enough to be relied upon for an experience study, this brings larger concerns for whether the system-wide data as a whole for the Police Officers' and Firefighters' Funds is reliable.</p> | <p>Improve appropriateness of assumption selection</p> |
| <p>Frequency of Experience Study</p> | <p>The Police Officers' and Firefighters' Funds should conduct more frequent experience studies, as required by the City Ordinance</p> | <p>Improve appropriateness of assumption selection</p> |
| <p>Assumptions</p> | <p>The Police Officers' and Firefighters' Funds should consider adopting more of a "best practice" approach to the above assumptions to strengthen the appropriateness of the assumptions</p> | <p>Improve appropriateness of assumption selection</p> |

Review of Plan Provisions

The plan provisions and certain actuarial assumptions and methods are prescribed in the City Ordinance. Our review identifies the requirements of the City Ordinance, and compares these requirements against the provisions, assumptions, and methods valued and disclosed in the reports provided by the retained actuaries. We also relied on our valuation replication to assess whether certain benefits have been valued accurately.

Applicable ASOPs

Actuarial Standard of Practice No. 4, *Measuring Pension Obligations*, provides guidance regarding plan provisions. According to Section 3.5 of this ASOP:

When measuring pension obligations and determining periodic costs or actuarially determined contributions, the actuary should reflect all significant plan provisions known to the actuary, as appropriate for the purpose of the measurement. However, if in the actuary's professional judgment, omitting a significant plan provision is appropriate for the purpose of the measurement, the actuary should disclose the omission in accordance with section 4.1(d).

Comments and Recommendations

GE Fund

As described above, we reviewed the Summary of Plan Provisions on pages 51-53 of the valuation report and assessed the completeness of the summary provided in comparison to the City Ordinance, and we used our replication of the GE Fund valuation to assess whether certain benefits have been valued accurately.

The retained actuary's actual programming of benefits was not provided for our review, but through our replication we have identified several inconsistencies that we recommend that the retained actuary review to determine if the benefits are accurately programmed and summarized in their Summary of Plan Provisions.

| Provision | Recommendation |
|---|---|
| Normal Pension Eligibility; Normal Pension Amount; Early Retirement Service Requirement; Early Retirement Amount; and Employee Contributions | In various sections of the City Ordinance, September 1, 2011 is disclosed as the breakpoint for new plan provisions to take effect. However, the Summary of Plan Provisions discloses October 31, 2011 as the breakpoint. We recommend that the retained actuary review the documentation and usage of this breakpoint. |
| Minimum Amount | The Summary of Plan Provisions notes that the monthly amount cannot be less than \$12 per month for each year of service, while this minimum does not appear in the City Ordinance. We recommend reviewing the applicability of this minimum benefit amount and disclosing the source of the information. |

| Provision | Recommendation | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------------|--|---------------------------------------|-------------------|-------------|----|---|-----|---|-----|---|-----|---|-----|---|-----|----|-----|----|-----|----|-----|----|-----|----|-----|----|------|
| Unused Sick Leave | Section 6-2(d) of the City Ordinance notes that some participants can utilize unused sick leave to increase their benefit at retirement. The “Credited Service” section of the Summary of Plan Provisions mentions that additional credit is granted for accumulated sick leave for those who qualify. We recommend that the retained actuary disclose the assumption used to determine the amount of unused sick leave at retirement for future retirements, and how this assumption is developed. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vesting | <p>Section 6-2(d) of the City Ordinance defines vesting for those hired after June 30, 2010 as:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="background-color: #d3d3d3;">Completed Years of Creditable Service</th> <th style="background-color: #d3d3d3;">Vested Percentage</th> </tr> </thead> <tbody> <tr> <td>Less than 5</td> <td>0%</td> </tr> <tr> <td>5</td> <td>25%</td> </tr> <tr> <td>6</td> <td>30%</td> </tr> <tr> <td>7</td> <td>35%</td> </tr> <tr> <td>8</td> <td>40%</td> </tr> <tr> <td>9</td> <td>45%</td> </tr> <tr> <td>10</td> <td>50%</td> </tr> <tr> <td>11</td> <td>55%</td> </tr> <tr> <td>12</td> <td>60%</td> </tr> <tr> <td>13</td> <td>65%</td> </tr> <tr> <td>14</td> <td>70%</td> </tr> <tr> <td>15</td> <td>100%</td> </tr> </tbody> </table> <p>This definition is inconsistent with the vesting schedule in the Summary of Plan Provisions. The retained actuary acknowledged this inconsistency and corrected the vesting schedule for the July 1, 2018 Valuation report.</p> | Completed Years of Creditable Service | Vested Percentage | Less than 5 | 0% | 5 | 25% | 6 | 30% | 7 | 35% | 8 | 40% | 9 | 45% | 10 | 50% | 11 | 55% | 12 | 60% | 13 | 65% | 14 | 70% | 15 | 100% |
| Completed Years of Creditable Service | Vested Percentage | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Less than 5 | 0% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 25% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | 30% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 35% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | 40% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | 45% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 50% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | 55% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | 60% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | 65% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | 70% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | 100% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Long Term Disability Benefit | Section 6-2(e) of the City Ordinance defines several scenarios where participants would be eligible for different benefits, ranging from minor disability to catastrophic injuries. Should an Eligible Employee meet certain criteria, employee contributions could cease and/or the benefit formula could change. The summary of plan provisions only differentiates between disability in the line of duty and not in the line of duty. We recommend that the retained actuary clarify their rationale for not including the other potential disability benefits and comment on the materiality, if appropriate. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Survivor Benefit | Section 6-2(f) of the City Ordinance describes the distinction between the Survivor Benefit and the survivor pension benefit. The Summary of Plan Provisions does not describe this distinction. We recommend that the valuation report include clearer separation and description between the Survivor Benefit and the survivor pension benefit. | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Provision | Recommendation |
|--|--|
| COLA | Clarify whether the COLA applies to deferred benefits and clarify that the COLA is applied on a compound basis |
| Provisions for those hired after September 1, 2011 | Clarify that employees hired after September 1, 2011 enter a hybrid plan with different set of plan provisions, including a Defined Contribution component |

Other than the recommendations above, the summary provisions are consistent with the provisions described in the City Ordinance, and do not omit any other plan provisions described in the City Ordinance that could have a significant impact on plan obligations.

It is our assumption that the liabilities were programmed by the retained actuaries in accordance with the Summary of Plan Provisions as described in the valuation report. Of the issues identified above, we were able to estimate the impact of the change in vesting schedule. If the vesting schedule from the City Ordinance were used instead of the schedule as disclosed in the valuation report, we estimate less than a 0.1% increase in liability. Please refer to the *Summary of Replication* section below for additional details regarding our replication.

Police Officers' Fund

As described above, we reviewed the Summary of Plan Provisions on pages V-1 to V-7 of the valuation report and assessed the completeness of the summary provided in comparison to the City Ordinance, and we used our replication of the Police Officers' Fund valuation to assess whether certain benefits have been valued accurately.

The retained actuary's actual programming of benefits was not provided for our review, but through our replication we have identified several inconsistencies that we recommend that the retained actuary review to determine if the benefits are accurately programmed and summarized in their Summary of Plan Provisions.

| Provision | Recommendation |
|-------------------------|---|
| Vesting | The retained actuary's report is unclear as to whether the vesting schedule is applied to the death and disability benefits. In response to Deloitte's question, the retained actuary confirmed that disability benefits and service-connected death benefits are not subject to the vesting schedule, while non-service-connected death benefits are subject to the vesting schedule. We recommend that the retained actuary clarify this in the Summary of Plan Provisions. |
| Monthly Accrued Benefit | Section 6-2(d) of the City Ordinance describes that the Years of Service multiplier may not exceed 80%. The retained actuary translates this concept into a maximum of X years of service (e.g. 80 years of service for participants with the 1% multiplier), which is appropriate. However, for participants with a 2% multiplier, the maximum years of service is disclosed as 50 years, implying that the cap is 100%. We recommend the retained actuary review the |

| Provision | Recommendation |
|--|--|
| | interpretation of the plan document for this benefit formula or provide additional documentation for why the cap is 100% in this situation. |
| COLA | <p>The current description in the Summary of Plan Provisions is unclear as to whether the COLA applies to deferred benefits and does not clearly state that the COLA is applied on a compound basis (as opposed to a simple basis). We recommend that the retained actuary clarify these items in the Summary of Plan Provisions.</p> <p>In response to Deloitte's question, the retained actuary confirmed that COLA does not apply to deferred benefits. However, due to limitations with the retained actuary's valuation software, they are applying COLA to the deferred benefit for current vested members. Due to the small number of deferred vested members, we do not believe the impact is material. We recommend the retained actuary disclose the methodology being applied and their opinion on materiality.</p> |
| Disability Benefits vs. Retirement Benefits | Based on our understanding of the SPD, disability benefits are only applicable until age 55, after which the benefit is re-calculated, including credited service for the period of disability, but excluding any COLAs that were applied to the previous disability benefit. In response to Deloitte's question, the retained actuary confirmed this approach. We recommend that the retained actuary clarify the treatment of these benefits in the Summary of Plan Provisions. |
| Creditable Service | The description for this section appears to have used the word "firefighter" in place of "police officer". |
| Provisions for those hired after September 1, 2011 | Clarify that employees hired after September 1, 2011 enter a hybrid plan with different set of plan provisions, including a Defined Contribution component |

Other than the recommendations above, the summary provisions are consistent with the provisions described in the City Ordinance, and do not omit any other plan provisions described in the City Ordinance that could have a significant impact on plan obligations.

It is our assumption that the liabilities were programmed by the retained actuaries in accordance with the Summary of Plan Provisions as described in the valuation report. None of the issues identified above lend themselves to allow us to easily estimate the impact of the issue on the liability. Please refer to the *Summary of Replication* section below for additional details regarding our replication.

Firefighters' Fund

As described above, we reviewed the Summary of Plan Provisions on pages V-1 to V-7 of the valuation report and assessed the completeness of the summary provided in comparison to the City

Ordinance, and we used our replication of the Firefighters’ Fund valuation to assess whether certain benefits have been valued accurately.

The retained actuary’s actual programming of benefits was not provided for our review, but through our replication we have identified several inconsistencies that we recommend that the retained actuary review to determine if the benefits are accurately programmed and summarized in their Summary of Plan Provisions.

| Provision | Recommendation |
|-------------------------|--|
| Vesting | The retained actuary’s report is unclear as to whether the vesting schedule is applied to the death and disability benefits. In response to Deloitte’s question, the retained actuary confirmed that disability benefits and service-connected death benefits are not subject to the vesting schedule, while non-service-connected death benefits are subject to the vesting schedule. We recommend that the retained actuary clarify this in the Summary of Plan Provisions. |
| Monthly Accrued Benefit | Section 6-2(d) of the City Ordinance describes that the Years of Service multiplier may not exceed 80%. The retained actuary translates this concept into a maximum of X years of service (e.g. 80 years of service for participants with the 1% multiplier), which is appropriate. However, for participants with a 2% multiplier, the maximum years of service is disclosed as 50 years, implying that the cap is 100%. We recommend the retained actuary review the interpretation of the plan document for this benefit formula or provide additional documentation for why the cap is 100% in this situation. |
| Monthly Accrued Benefit | The report indicates that there was a group of participants who were covered in the ‘05 Amendment. We did not find this distinction in the City Ordinance and recommend clarifying the source of this amendment. |
| COLA | <p>The current description in the Summary of Plan Provisions is unclear as to whether the COLA applies to deferred benefits and does not clearly state that the COLA is applied on a compound basis (as opposed to a simple basis). We recommend that the retained actuary clarify these items in the Summary of Plan Provisions.</p> <p>In response to Deloitte’s question, the retained actuary confirmed that COLA does not apply to deferred benefits. However, due to limitations with the retained actuary’s valuation software, they are applying COLA to the deferred benefit for current vested members. Due to the small number of deferred vested members, we do not believe the impact is material. We recommend the retained actuary disclose the methodology being applied and their opinion on materiality.</p> |

| Provision | Recommendation |
|--|---|
| Disability Benefits vs. Retirement Benefits | Based on our understanding of the SPD, disability benefits are only applicable until age 55, after which the benefit is re-calculated, including credited service for the period of disability, but excluding any COLAs that were applied to the previous disability benefit. In response to Deloitte's question, the retained actuary confirmed this approach. We recommend that the retained actuary clarify the treatment of these benefits in the Summary of Plan Provisions. |
| Provisions for those hired after September 1, 2011 | Clarify that employees hired after September 1, 2011 enter a hybrid plan with different set of plan provisions, including a Defined Contribution component |

Other than the recommendations above, the summary provisions do not conflict with the provisions described in the plan document, nor do they omit any other plan provisions described in the plan document that could have a significant impact on plan benefits.

It is our assumption that the liabilities were programmed by the retained actuaries in accordance with the Summary of Plan Provisions as described in the valuation report. None of the issues identified above lend themselves to allow us to easily estimate the impact of the issue on the liability. Please refer to the *Summary of Replication* section below for additional details regarding our replication.

Comparison of Pension Funds

Each of the three reports contain a comprehensive plan provision summary as would be expected in an actuarial valuation report. It is important to include such a summary to confirm that the retained actuary's understanding of the plan provisions reflect the promised benefits to the participants. Should the provisions be programmed incorrectly, the cost of seemingly minor benefit provisions could change the calculated contribution for the City.

The valuation reports for the Police Officers' and Firefighters' Funds disclose a history of amendments over the past decade which is helpful to give context to the reader. The GE Fund's report does not contain a history of amendments; we recommend the GE Fund's report add this history for consistency and context.

The Police Officers' and Firefighters' Funds have Summary Plan Descriptions (SPDs) from 2013, while the most recent SPD for the GE Plan is from 2005. The retained actuary clarified that a new SPD is being drafted for the GE Fund by the City.

Review of Census Data

There are typical and anticipated adjustments made to census data in preparing an actuarial valuation. This section assesses the reasonableness of the retained actuary's reconciliation and data adjustment procedures, including their documentation in the valuation report. To perform this analysis, we received data files from the City and valuation data files from the retained actuaries. The City data was used by the retained actuaries to develop the census data used as the basis for the actuarial valuation.

The purpose of this review is to assess the processes and procedures by which the retained actuaries prepare the valuation data. It is not considered the role of the retained actuaries or the reviewing actuaries to assess the quality of the City's data, however, the retained actuaries should perform an annual check to confirm that the City's data does not appear invalid or unreasonable.

Applicable ASOPs

Actuarial Standard of Practice No. 23, Data Quality, provides general guidance for determining if data is appropriate for its intended purpose and whether it is sufficiently reasonable, consistent, and comprehensive. Section 3.1 of the ASOP effective for the July 1, 2017 actuarial valuation report states:

Appropriate data that are accurate and complete may not be available. 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.

Section 3.5 of this Standard also addresses the actuary's responsibilities in reviewing data upon which they rely and states that in such cases:

... the actuary should perform a review, 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.

And Section 3.4c. of this Standard states:

...judgmental adjustments or assumptions can be applied to the data that allow the actuary to perform the analysis. Any judgmental adjustments to data or assumptions should be disclosed...

Consistency with City Data

The retained actuaries' final valuation files are generally consistent with the data files provided by the City. The following tables provide a summary comparing the demographic statistics for each plan between the City data and the retained actuaries as disclosed in the valuation reports.

GE Fund

Reconciliation for Active Participants

| | City Data | Retained Actuary Data | Difference | Difference (%) |
|----------------------------|---------------|-----------------------|-------------|----------------|
| Active Participants | 3,687 | 3,688 | 1 | 0.03% |
| Average Age | 46.4 | 46.4 | 0 | -0.03% |
| Average Service | 10.7 | 10.7 | 0 | -0.12% |
| Average Salary | \$43,052 | \$43,069* | \$18 | 0.04% |
| Total Contributions | \$133,237,873 | \$133,303,265 | \$65,391.61 | 0.05% |

* The valuation report discloses \$45,527.

The average salary of \$45,527 disclosed in the valuation report does not reconcile with the census data provided by the retained actuaries, which showed an average salary of \$43,069. If the retained actuaries are making an assumption or adjustment to the salary field, we recommend that the retained actuaries disclose the assumption or adjustment in the valuation report.

Additionally, there are 516 active participants with a blank date of hire in the retained actuary data. These participants have a reasonable amount for benefit service, and therefore this deficiency does not appear to affect the valuation. However, we recommend the retained actuaries investigate the cause of the missing dates of hire.

In addition to reconciling counts and averages for the data, we conducted a detailed reconciliation of each key field between City data and retained actuary data for ten sample participants. For each participant, the data matched between City data and retained actuary data, except in the case where the City data was zero or incomplete, where we assume the retained actuaries populated the missing data via data questions with the City.

Reconciliation for Inactive Participants

| | City Data | Retained Actuary Data | Difference | Difference (%) |
|-------------------------------|-----------|-----------------------|------------|----------------|
| Vested Terminated | 50* | 89 | 39 | 78% |
| Inactive Nonvested | 202* | 327** | 125 | 62% |
| Deferred Beneficiaries | 1 | 1 | 0 | 0% |
| Retirees | 2842 | 2847 | 5 | 0% |
| Average Age | 69.0 | 69.0 | 0 | 0% |
| Average Benefit | \$2,736 | \$2,736*** | \$1 | 0% |
| Suspended Retirees | 1 | 10 | 9 | 900% |
| Disabled Retirees | 237 | 237 | 0 | 0% |
| Average Age | 62.6 | 62.6 | 0 | 0% |
| Average Benefit | \$1,891 | \$1,891 | \$0 | 0% |

| | City Data | Retained Actuary Data | Difference | Difference (%) |
|----------------------|-----------|-----------------------|------------|----------------|
| Beneficiaries | 779 | 795 | 16 | 2% |
| Average Age | 76.1 | 74.0*** | -2 | -3% |
| Average Benefit | \$1,632 | \$1,629 | -\$3 | 0% |

* The City data has significantly fewer vested terminated and inactive nonvested participants than the retained actuary data. See below for additional discussion.

** The valuation report discloses 330, but the census data contains 327 participants.

*** Averages shown are based on the census data and are slightly different from what is shown in valuation report.

We have several observations regarding the reconciliation of the inactive data:

- The City data has significantly fewer vested terminated and inactive nonvested participants than the retained actuary data. A majority of these participants not in the City data terminated more than two years ago. It appears that the City is not maintaining data for deferred participants, and instead the retained actuary is responsible for tracking deferred participants. If this is what is happening, at a high level the discrepancy in counts may be reasonable.
- Similarly, for suspended retirees, the City data only contains one participant, while the retained actuary data contains ten. Again, the City data may not maintain the data for suspended retirees, but it appears the retained actuary is maintaining the data for these participants.
- For terminated vested participants, the retained actuary data has the data for the participant's monthly deferred benefit amount. However, this amount is not present in the City data. It is unclear how the retained actuary obtains this deferred benefit amount. Without additional information, we cannot be sure of the retained actuary's process for populating this amount. We recommend the retained actuary clarify how they determine the benefit amount for deferred vested retirees.
- The count of retirees and beneficiaries do not match between the City data and retained actuary data. The inactive data comes from the City on four separate tabs, and the presence of duplicate records and potential inconsistencies between retiree records and beneficiary records appears to be what is leading to the inconsistency in counts. If the retained actuary is making an assumption or adjustment for retired participants, we recommend it be disclosed in the valuation report.

In addition to reconciling counts and averages for the data, we conducted a detailed reconciliation of each key field between City data and retained actuary data for eight sample participants. For each participant, the data matched for every field except "Date of Birth" for beneficiaries. It appears that there may be a disconnect between City data and retained actuary data for whether the Date of Birth for beneficiaries' ties to the original participant or the beneficiary. Looking at all 795 beneficiaries in the retained actuary data, roughly 40% of them have dates of birth that do not match the City data. If the retained actuary is making a correction, assumption, or adjustment for beneficiary dates of birth, we recommend it be disclosed in the valuation report.

Police Officers' Fund

Reconciliation for Active Participants

| | City Data | Retained Actuary Data | Difference | Difference (%) |
|----------------------------|--------------|-----------------------|-----------------|----------------|
| Active Participants | 1,847 | 1,847 | 0 | 0% |
| Average Age | 38.4 | 38.4 | 0 | 0% |
| Average Service | 10.6 | 10.6* | 0 | 0% |
| Total Compensation | \$93,498,820 | \$91,328,871 | -\$2,169,950 | -2% |
| Total Contributions | \$66,323,503 | \$115,090,925 | \$48,767,422.01 | 74% |

* The valuation report discloses 10.1, but the average based on the census data provided is 10.6.

We have several observations regarding the reconciliation of the active data files:

- The average service of 10.1 disclosed in the valuation report does not reconcile with the census data provided by the retained actuaries, which showed an average service of 10.6. If the retained actuaries are making an assumption or adjustment to the service field, we recommend it be disclosed in the valuation report.
- The total compensation is slightly smaller in the retained actuary data compared to the City data. The retained actuaries were asked about the difference between the annualized compensation amount and the covered payroll along with how the total annualized compensation was calculated. Their response was,

The total annualized compensation is \$91,328,879 for the prior year... We do show an expected payroll of \$90,947,614 for the 2017/2018 fiscal year... The annualized payroll is just a statistic. The expected payroll is calculated by applying the assumed decrements for the active employees as well as the assumed salary increase. The expected payroll is used to determine the required contribution as a percentage of payroll.

We recommend that the retained actuaries further clarify the contents of the calculation of both the expected payroll and the total annualized compensation. If the retained actuaries are making an assumption or adjustment to the salary field, we recommend it be disclosed in the valuation report.

- The total contributions in the retained actuary data are significantly larger than in the City data. We recommend the retained actuaries and City investigate the reason for this large difference. If the total contributions from the City data is not reliable, the retained actuary should disclose those limitations and their implications, as per ASOP 23.

In addition to reconciling counts and averages for the data, we conducted a detailed reconciliation of each key field between City data and retained actuary data for seven sample participants. For each participant, the data matched for every field except for "Current Year Wage" and "Total Contributions with Interest" (the same fields as above that did not match for the population as a whole). Again, we recommend the retained actuaries investigate the source of these differences, and/or disclose any adjustments or assumptions made to the data in the valuation report.

Reconciliation for Inactive Participants

| | Raw Data | Retained Actuary Data | Difference | Difference (%) |
|-------------------------------|----------|-----------------------|------------|----------------|
| Service Retirements | 1,236 | 1,236* | 0 | 0% |
| Average Benefit | \$3,501 | \$3,533 | \$32 | 1% |
| Beneficiary | 229 | 228* | -1 | 0% |
| Average Benefit | \$2,030 | \$2,029 | -\$1 | 0% |
| Disability Retirements | 103 | 104 | 1 | 1% |
| Average Benefit | \$3,477 | \$3,054 | -\$423 | -12% |
| Deferred Vested | 466 | 20 | -446 | -96% |
| Average Benefit | N/A | \$691 | N/A | N/A |
| Total Participants | 1,568 | 1,588 | 0 | 1% |

* The valuation report discloses 1,243 service retirements and 221 beneficiaries but based on the census data provided 7 of the service retirements should be listed as beneficiaries.

We have identified one **significant concern** with the retained actuary data. According to the City's active data file, there are 466 participants with STATUS CODE = 3 (Inactive Vested). Of these 466 participants, only 20 are included in the valuation (these 20 are shown above). The other 446 participants are not included in the retained actuary's active data file or inactive data file. If these participants have taken a lump sum refund of contributions, they should be coded differently in the raw data. If these participants are still entitled to future benefits, they should be included in the actuarial valuation. We strongly recommend the retained actuaries investigate the source of this issue and confirm if the valuation is missing 446 deferred vested participants.

We have several additional observations regarding the reconciliation of the inactive data files :

- The count of service retirements of 1,243 and 221 beneficiaries disclosed in the valuation report does not reconcile with the census data provided by the retained actuaries, which showed a count of 1,236 service retirements and 228 beneficiaries. If the retained actuaries are making an adjustment to the counts based on status, we recommend it be disclosed in the valuation report.
- The count of participants and average benefit do not exactly match between City data and retained actuary data. If the retained actuaries are making an assumption or adjustment to these fields, we recommend it be disclosed in the valuation report.
- Over 700 retirees have a joint & survivor annuity, but the participants do not have data for the beneficiary's sex or date of birth. We recommend the retained actuaries investigate the source of this missing data.

In addition to reconciling counts and averages for the data, we conducted a detailed reconciliation of each key field between City data and retained actuary data for nine sample participants. For each participant, the data matched for every field.

Firefighters' Fund

Reconciliation for Active Participants

| | City Data | Retained Actuary Data | Difference | Difference (%) |
|----------------------------|--------------|-----------------------|--------------|----------------|
| Active Participants | 981 | 981 | 0 | 0% |
| Average Age | 39.7 | 39.7 | 0 | 0% |
| Average Service | 11.5 | 11.5* | 0 | 0% |
| Total Compensation | \$45,464,455 | \$47,196,437 | \$1,731,982 | 4% |
| Total Contributions | \$34,357,238 | \$61,308,945 | \$26,951,707 | 78% |

* The valuation report discloses 11.0, but the average based on the census data provided is 11.5.

We have several observations regarding the reconciliation of the active data:

- The average service of 11.0 disclosed in the valuation report does not reconcile with the census data provided by the retained actuaries, which showed an average service of 11.5. If the retained actuaries are making an assumption or adjustment to the service field, we recommend it be disclosed in the valuation report.
- The total compensation is slightly larger in the retained actuary data compared to the City data. The retained actuaries were asked about the difference between the annualized compensation amount and the covered payroll along with how the total annualized compensation was calculated. Their response was,

The total annualized compensation is \$47,196,423 for the prior year... We do show an expected payroll of \$46,961,913 for the 2017/2018 fiscal year... The annualized payroll is just a statistic. The expected payroll is calculated by applying the assumed decrements for the active employees as well as the assumed salary increase. The expected payroll is used to determine the required contribution as a percentage of payroll.

We recommend that the retained actuaries further clarify the contents of the calculation of both the expected payroll and the total annualized compensation. If the retained actuaries are making an assumption or adjustment to the salary field, we recommend it be disclosed in the valuation report.

- The total contributions in the retained actuary data are significantly larger than in the City data. We recommend the retained actuary and City investigate the reason for this large difference. If the total contributions from the City data is not reliable, the retained actuary should disclose those limitations and their implications, as per ASOP 23.

In addition to reconciling counts and averages for the data we conducted a detailed reconciliation of each key field between City data and retained actuary data for seven sample participants. For each participant, the data matched for every field except for "Current Year Wage" and "Total Contributions with Interest" (the same fields as above that did not match for the population as a whole). Again, we recommend the retained actuaries investigate the source of these differences, and/or disclose any adjustments/assumptions made to the data in the valuation report.

Reconciliation for Inactive Participants

| | Raw Data | Retained Actuary Data | Difference | Difference (%) |
|-------------------------------|----------|-----------------------|------------|----------------|
| Service Retirements | 712 | 708* | -4 | -1% |
| Average Benefit | \$4,099 | \$4,103 | \$4 | 0% |
| Beneficiary | 195 | 193* | -2 | -1% |
| Average Benefit | \$1,970 | \$1,950 | -\$20 | -1% |
| Disability Retirements | 125 | 125 | 0 | 0% |
| Average Benefit | \$3,375 | \$3,375 | \$0 | 0% |
| Deferred Vested | 125 | 14 | -111 | -89% |
| Average Benefit | N/A | \$1,272 | N/A | N/A |
| Total Participants | 1157 | 1040 | -117 | -10% |

* The valuation report discloses 706 service retirements and 195 beneficiaries but based on the census data provided 2 of the beneficiaries should be listed as service retirements.

We have identified one **significant concern** with the retained actuary data. According to the active data file from the City, there are 125 participants with STATUS CODE = 3 (Inactive Vested). Of these 125 participants, only 11 are included in the valuation (these 11 are part of the 14 shown above). The other 114 participants are not included in the retained actuary active data file or inactive data file. If these participants have taken a lump sum refund of contributions, they should be coded differently in the City data. If these participants are still entitled to future benefits, they should be included in the actuarial valuation. We strongly recommend the retained actuary investigate the source of this issue and confirm if the valuation is missing 114 deferred vested participants.

We have several additional observations regarding the reconciliation of the inactive data file:

- The count of service retirements of 706 and 195 beneficiaries disclosed in the valuation report does not reconcile with the census data provided by the retained actuaries, which showed a count of 708 service retirements and 193 beneficiaries. If the retained actuaries are making an adjustment to the data for these participants, we recommend it be disclosed in the valuation report.
- The count of participants and average benefit do not exactly match between City data and retained actuary data. If the retained actuaries are making an assumption or adjustment to these fields, we recommend it be disclosed in the valuation report.
- The retained actuary data includes two child beneficiaries who are over age 23. Per the provisions of the plan, children cannot be covered beyond age 23. We recommend the retained actuaries investigate these participants and confirm their eligibility for benefits.
- Over 400 retirees have a joint & survivor annuity, but the participants do not have data for the beneficiary's sex or date of birth. We recommend the retained actuaries investigate the source of this missing data.

In addition to reconciling counts and averages for the data, we conducted a detailed reconciliation of each key field between City data and retained actuary data for nine sample participants. For each participant, the data matched for every field.

Comparison of Pension Funds

We did not review the entirety of the retained actuaries' data processes for reconciling from raw data to final data. However, based on our review as detailed above, we have noted differences in data quality and methodology between Southern Actuarial and Segal. These are noted below.

| Scenario | Details |
|---------------------------------------|---|
| Terminated Vested Data | As discussed above, for the Police Officers' Fund and Firefighters' Fund, we identified a significant concern that the retained actuary data did not appear to contain all terminated vested participants. Meanwhile, the retained actuary data for the GE fund appears to be tracking terminated vested participants properly. |
| Format of City Data | We would generally expect the format of the City data to be similar for all three plans, assuming the data at the City is maintained in the same administrative system. We recommend the City consider standardizing the format of the data provided to the retained actuaries to add efficiency. |
| Deficiencies of Retained Actuary Data | <p>As described above, for the Police Officers' Fund and Firefighters' Fund we identified several deficiencies with the retained actuary data, including missing beneficiary information for joint annuitants, child beneficiaries beyond age 23, and large inconsistencies in the total contribution field compared to the City data. For the GE Fund, the only deficiency we found in the retained actuary data was missing dates of hire (however, benefit service was populated and appeared reasonable).</p> <p>Additionally, as discussed in the <i>Review of Demographic Assumptions</i> section below, Southern Actuarial did not believe the data for the Police Officers' Fund and Firefighters' Fund was of sufficient quality to be the basis of the 2011 experience study.</p> <p>For these reasons, we believe that the quality and fidelity of the data for the GE Fund is significantly higher than for the Police Officers' Fund and Firefighters' Fund. We recommend the City consider actions necessary to increase the quality of the data for the Police Officers' Fund and Firefighters' Fund.</p> |

Review of Actuarial Methods

This section determines if the actuarial cost method, amortization/funding method, and actuarial asset valuation method used by the Pension Funds are reasonable and consistent with generally accepted actuarial practice and relevant ASOPs. It also determines if the funding method conforms to the Georgia State Code Section 47-20-10.

Actuarial Cost Method

Applicable ASOPs

Actuarial Standard of Practice No. 4, *Measuring Pension Obligations*, provides guidance regarding the actuarial cost method for pension valuations. According to Section 3.13 of this ASOP, an “acceptable actuarial cost method” meets the following criteria:

- costs are allocated over the period of time that benefits are earned; and
- costs are allocated on a basis that has a logical relationship to the plan’s benefit formula (compensation, service, benefit level, etc.).

Comments and Recommendations

GE Fund

The retained actuary discloses the actuarial cost method on page 49 of the report:

Entry Age Actuarial Cost Method. Entry Age is current age minus years of service. Normal Cost and Actuarial Accrued Liability are calculated on an individual basis and are allocated by salary.

The actuarial cost method used is Entry Age Normal (EAN) as a level percentage of pay. Under this method, the present value of future benefits (PVFB) is determined for each employee and is then spread evenly as a level percentage of pay over each employee's career. This method therefore produces employer contributions that are level as a percentage of payroll. This method also produces an actuarial accrued liability that allocates more cost to early time periods, as opposed to deferring cost to later time periods, when compared to other cost methods.

This meets the “acceptable actuarial cost method” criteria above.

Police Officers’ Fund

The retained actuary discloses the actuarial cost method on page IV-1 of the report:

Individual entry age normal cost method. Under this actuarial cost method, a level funding cost is developed with respect to each benefit for each participant. The level funding cost for each benefit applies to the period beginning when the participant’s service commences and ending when the participant is assumed to cease active participation due to each respective decrement. The actuarial accrued liability is equal to the accumulated level funding cost to the valuation date for

all participants. The normal cost is equal to the level funding cost for the year immediately following the valuation date for all active participants.

The actuarial cost method used is Entry Age Normal (EAN) as a level percentage of pay. Under this method, the present value of future benefits (PVFB) is determined for each employee and is then spread evenly as a level percentage of pay over each employee's career. This method therefore produces employer contributions that are level as a percentage of payroll. This method also produces an actuarial accrued liability that allocates more cost to early time periods, as opposed to deferring cost to later time periods, when compared to other cost methods.

In response to Deloitte's questions, the retained actuary clarified their approach:

The entry age normal cost is calculated for each active participant by multiplying the ratio of the present value of benefits at entry (which is the current age present value of benefits discounted to the entry age based on current service) to the present value of pay at entry (where entry is based on current service) and multiplied by expected pay for the year following the valuation date.

The method of determining the present value of benefits at entry as the current age present value of benefits discounted to the entry age based on current service is different from a "typical" approach using the EAN cost method. The retained actuary's method ignores decrement probabilities between entry age and current age. This will understate liability and overstate normal cost compared to the "typical" EAN method (because losses are getting absorbed into normal cost).

While GASB disclosures was not within the scope of this review, it is worth noting that this method does not conform with the requirements of GASB 67/68. Despite this difference, the retained actuary's methodology for the cost method meets the "acceptable actuarial cost method" criteria above.

Firefighters' Fund

The retained actuary discloses the actuarial cost method on page IV-1 of the report:

Individual entry age normal cost method. Under this actuarial cost method, a level funding cost is developed with respect to each benefit for each participant. The level funding cost for each benefit applies to the period beginning when the participant's service commences and ending when the participant is assumed to cease active participation due to each respective decrement. The actuarial accrued liability is equal to the accumulated level funding cost to the valuation date for all participants. The normal cost is equal to the level funding cost for the year immediately following the valuation date for all active participants.

The actuarial cost method used is Entry Age Normal (EAN) as a level percentage of pay. Under this method, the present value of future benefits (PVFB) is determined for each employee and is then spread evenly as a level percentage of pay over each employee's career. This method therefore produces employer contributions that are level as a percentage of payroll. This method also produces an actuarial accrued liability that allocates most cost to early time periods, as opposed to deferring cost to later time periods, when compared to other cost methods.

In response to Deloitte's questions, the retained actuary clarified their approach:

The entry age normal cost is calculated for each active participant by multiplying the ratio of the present value of benefits at entry (which is the current age present value of benefits discounted to the entry age based on current service) to the present value of pay at entry (where entry is based on current service) and multiplied by expected pay for the year following the valuation date.

The method of determining the present value of benefits at entry as the current age present value of benefits discounted to the entry age based on current service is different from a “typical” approach using the EAN cost method. The retained actuary’s method ignores decrement probabilities between entry age and current age. This will understate liability and overstate normal cost compared to the “typical” EAN method (because losses are getting absorbed into normal cost).

While GASB disclosures was not within the scope of this review, it is worth noting that this method does not conform with the requirements of GASB 67/68. Despite this difference, the retained actuary’s methodology for the cost method meets the “acceptable actuarial cost method” criteria above.

Comparison of Pension Funds

While the retained actuaries used different nomenclature and different methodologies, the actuarial cost methods used for all three Pension Funds all meet the requirements of an acceptable and appropriate method under ASOP No. 4.

Amortization/Funding Method

Applicable ASOPs

Actuarial Standard of Practice No. 4, *Measuring Pension Obligations*, provides guidance regarding the amortization/funding method for pension valuations. According to Section 3.14 of this ASOP:

A cost allocation procedure or contribution allocation procedure typically combines an actuarial cost method, an asset valuation method, and an amortization method to determine the plan cost or contribution for the period.

Generally, an “acceptable contribution allocation procedure” meets the following criteria:

- In the actuary’s professional judgment, the procedure is consistent with the plan accumulating adequate assets to make benefit payments when due;
- The procedure should consider relevant input received from the principal, such as a desire for stable or predictable costs or contributions, or a desire to achieve a target funding level within a specified time frame.

Georgia State Code

Georgia State Code Section 47-20-10 provides guidance for the determination of a plan’s minimum annual employer contribution, including the amortization of the Unfunded Actuarial Accrued Liability (UAAL). To summarize from the code:

Subsection (a) states that the minimum annual employer contribution shall be the sum of the amounts below, provided that the minimum employer contribution shall not be less than zero or result in a contribution credit:

1. The normal cost for the year; plus
2. Amounts necessary to amortize:
 - a. The initial UAAL over a period of 40 years based upon the first actuarial valuation on or after January 1, 1984
 - b. The increase, if any, in UAAL over a period of 20 years for changes in plan provisions
 - c. The increase, if any, in UAAL over a period of 15 years for experience under the actuarial assumptions
 - d. The increase, if any, in UAAL over a period of 30 years for changes in actuarial assumptions; plus
3. If not otherwise included above:
 - a. The amount necessary to amortize over 10 equal annual installments the increase, if any, in UAAL resulting from benefit increases granted during the year for beneficiaries; or
 - b. The amount necessary to pay the amount of increase in benefits granted during the year to beneficiaries under a pay-as-you-go- basis; minus
4. Amounts necessary to amortize:
 - a. The decrease, if any, in UAAL over a period of 20 years for changes in plan provisions
 - b. The decrease, if any, in UAAL over a period of 15 years for experience under the actuarial assumptions
 - c. The decrease, if any, in UAAL over a period of 30 years for changes in actuarial assumptions; minus
5. The excess of the minimum annual employer contribution which accumulates after January 1, 1984; minus
6. Employee contributions for the year.

Under subsection (b), for plans which use a formula related to compensation as the basis for calculating benefits, the amortization amounts (aside from 3 above), may be determined as a level percentage of future compensation. If this method is used, the actuarial assumption for future annual payroll growth shall not exceed the actuarial assumed valuation interest rate less 2.5%. The minimum standards of subsection (a) are deemed to have been met if such level percentage amortization is used and the employer contribution is equal to or greater than the annual required contribution as is determined in accordance with the provisions of Governmental Accounting Standards Board Statements No. 25 and No. 27 as in effect on June 15, 2013.

GASB 67 and 68 replaced GASB 25 and 27 and no longer prescribe an annual required contribution. Plans have flexibility in selecting how they determine the ADC. However, since the Georgia State Code Section 47-20-10 still references GASB 25 and 27, we considered the plans' funding policies in relation to those Statements.

Section 6-2(h)(1) of the City Ordinance (Subpart B) imposes a cap of 35% of payroll on the ADC and outlines what happens if the ADC exceeds the 35% cap. To summarize from the City Ordinance:

1. The actuary must present an analysis of the ADC's escalation

2. For the first fiscal year in which the ADC exceeds the cap, the City will pay the full amount of the overage.
3. A committee will be formed to identify potential solutions and will seek to enact legislation.
4. If no legislation is enacted, for future fiscal years in which the ADC exceeds the cap the overage will be shared equally between the City and members through increased contribution rates.

Comments and Recommendations

GE Fund

The retained actuary discloses the amortization/funding method on page 25 of the report:

The actuarially determined contribution is equal to the employer normal cost payment and a payment on the unfunded actuarial accrued liability...The City sets the methodology used to calculate the actuarially determined contribution based on a closed level percentage of payroll amortization period of 30 years, established with the July 1, 2010 valuation. As of the July 1, 2017 valuation, there are 23 years remaining on this schedule.

Furthermore, the retained actuary describes the history of the Unfunded Actuarial Accrued Liability (UAAL) amortization on page 34 of the report:

Prior to the 2005 valuation, the Plan had adopted the policy of amortizing the unfunded actuarial liability as a level percentage of payroll over a closed 40-year period from January 1, 1979. At January 1, 2005, the amortization was reset to a closed 20-year period. Effective July 1, 2008, the amortization period was changed to an open 30-year period and effective July 1, 2010, the amortization period was changed to a closed 30-year period. The contributions determined under this method continue to meet the Georgia minimum funding requirements by virtue of Georgia Code Section 47-20-10(b).

GASB No. 27 required the UAAL to be amortized over at most 30 years. Therefore, the current amortization method meets that requirement.

The July 1, 2017 valuation interest rate is 7.25%. Payroll growth is 3.00% therefore this meets the Georgia State Code requirement that the payroll growth not exceed the valuation interest rate less 2.5%, or 4.75% for July 1, 2017.

The current amortization method meets the requirements for minimum funding as noted by Georgia State Code Section 47-20-10(b).

In the Risk section of the report, we recommend disclosing the results of the most recent cap analysis performed for the City. Additionally, we recommend the retained actuaries disclose the implications of exceeding the cap as summarized in Section 6-2(h) of the City Ordinance.

Police Officers' Fund

The retained actuary discloses the amortization/funding method on page IV-2 of the report:

Total payroll has been assumed to grow at the rate of 4.00% per year for purposes of amortizing the unfunded actuarial accrued liability as a level percentage of payroll; the amortization period is established by the City ordinance as a closed 30-year period beginning July 1, 2011.

GASB No. 27 required the UAAL to be amortized over at most 30 years. Therefore, the current amortization method meets that requirement.

The July 1, 2017 valuation interest rate is 7.50%. Payroll growth is 4.00% therefore this meets the Georgia State Code requirement that the payroll growth not exceed the valuation interest rate less 2.5%, or 5.0% for July 1, 2017.

The current amortization method meets the requirements for minimum funding as noted by Georgia State Code Section 47-20-10(b).

While the retained actuary does disclose the funding/amortization method in the report appendix, we recommend adding a description of the method on page I-1 as it would increase transparency and give context to the graphic and determination of the Minimum Required Contribution Rate.

The retained actuary provided a graphic on page I-2 to illustrate the sensitivity of the contribution rate. We recommend disclosing the actual contribution rate as a data label or adding labels to the x-axis and y-axis to give more context to this graph.

Firefighters' Fund

The retained actuary discloses the amortization/funding method on page IV-2 of the report:

Total payroll has been assumed to grow at the rate of 4.00% per year for purposes of amortizing the unfunded actuarial accrued liability as a level percentage of payroll; the amortization period is established by the City ordinance as a closed 30-year period beginning July 1, 2011.

GASB No. 27 required the UAAL to be amortized over at most 30 years. Therefore, the current amortization method meets that requirement.

The July 1, 2017 valuation interest rate is 7.50%. Payroll growth is 4.00% therefore this meets the requirement that the payroll growth not exceed the valuation interest rate less 2.5%, or 5.0% for July 1, 2017.

The current amortization method meets the requirements for minimum funding as noted by Georgia State Code Section 47-20-10(b).

While the retained actuary does disclose the funding/amortization method in the report appendix, we recommend adding a description of the method on page I-1 as it would increase transparency and give context to the graphic and determination of the Minimum Required Contribution Rate.

The retained actuary provided a graphic on page I-2 to illustrate the sensitivity of the contribution rate. We recommend disclosing the actual contribution rate as a data label or adding labels to the x-axis and y-axis to give more context to this graph.

Comparison of Pension Funds

All three Pension Funds meet the requirements for minimum funding as noted by Georgia State Code Section 47-20-10(b), as they are amortizing the UAAL over a closed 30-year amortization period. However, the GE Fund implemented this policy as of July 1, 2010, whereas the Police Officers' Fund and Firefighters' Fund implemented this policy as of July 1, 2011. We recommend that consistency between the plans continue to be considered if alternative funding/amortization methods are reviewed.

Several prominent government and actuarial organizations (Society of Actuaries, American Academy of Actuaries, Conference of Consulting Actuaries, California Actuarial Advisory Panel, the Government Finance Officers Organization, and the Big Seven) opined on funding methods within the past seven years. These publications generally shared the following key objectives of a funding policy:

1. **Benefit Security and Adequacy:** Ensure that promised benefits will be met with the planned future contributions and current assets
2. **Intergenerational Equity:** Ensure that the cost of employee benefits is paid by the respective generation of taxpayers who were receiving services
3. **Contribution Stability:** Keep contribution levels relatively predictable to increase the ease of budgeting
4. **Transparency:** Provide clear communication on how and when plan funding will progress

The closed 30-year amortization period generally meets all of these requirements; however, there is significant risk of a lack of contribution stability as the remaining amortization period shortens. For example, assuming the current funding policy remains in effect, as the funds near the end of the 30-year closed amortization period in 2040 or 2041, contributions could become very volatile, as gains or losses due to asset experience, demographic experience, assumption changes, or plan changes could lead to very large swings in ADC. Considering the implications of exceeding the 35% of payroll cap on contributions, contribution stability is important for these three funds.

While several funding strategies exist, the City may want to consider a layered approach similar to 47-20-10(a), potentially with shorter amortization periods, in the future to address the potential volatility the current method may create.

We recommend that the City consider the reports from these prominent organizations if changes are made to the determination of ADC.

Segal confirmed that the City performs periodic calculations of the aggregate ADC as a percentage of total covered payroll to confirm compliance with section 6.2-a(2) and 6.2-a(5) of the City Ordinance.

Actuarial Asset Valuation Method

Applicable ASOPs

Actuarial Standard of Practice No. 44, *Selection and Use of Asset Valuation Methods for Pension Valuations*, governs the asset valuation method for pension valuations, which is used to develop the actuarial value of assets (AVA). In short, the Standard does not take issue with using Market Value of Assets (MVA) as a Plan's Actuarial Value of Assets (AVA).

When a plan uses a smoothing method, the ASOP provides that the actuary should select an asset valuation method that is designed to produce actuarial asset values that bear a reasonable relationship to the corresponding market values. In making that determination, the Standard indicates that such a method would be likely to produce:

- AVAs that are sometimes greater than and sometimes less than the corresponding market values
- AVAs that fall within a reasonable range of market values
- Recognition of differences between a plan's AVA and MVA within a reasonable period of time

All three requirements above are considered to be met if in the actuary's professional judgment the asset valuation method:

- Produces AVAs within a sufficiently narrow range of market values; and/or
- Recognizes differences between AVA and MVA in a sufficiently short period

Comments and Recommendations

GE Fund

The retained actuary describes the AVA method on page 49 of the report:

Market value of assets less unrecognized returns in each of the last five years. Unrecognized return is equal to the difference between the actual market return and the expected return on the market value, and is recognized over a five-year period, further adjusted, if necessary, to be within 20% of the market value.

The current AVA method is consistent with the requirements of ASOP 44.

Police Officers' Fund

The retained actuary describes the AVA method on page IV-1 of the report:

The actuarial value of assets is equal to the market value of assets.

The current AVA method is consistent with the requirements of ASOP 44.

Firefighters' Fund

The retained actuary describes the AVA method on page IV-1 of the report:

The actuarial value of assets is equal to the market value of assets.

The current AVA method is consistent with the requirements of ASOP 44.

Comparison of Pension Funds

The AVA methods differ between the GE Fund and the Police Officers' and Firefighters' Funds. The GE Fund utilizes a smoothed actuarial value of assets; the Police Officers' and Firefighters' Funds utilized a market approach. While a market approach recognizes gains and losses immediately, thereby reducing deferred gains and losses, it can lead to large fluctuations year-over-year. A smoothed actuarial value of assets reduces annual volatility due to market fluctuations. Both approaches are acceptable under ASOP 44.

We recommend that the City consider moving to the same method for all three Pension Funds.

Review of Economic Assumptions

Actuarial calculations inherently make predictions about future events to estimate financial costs on a present value basis and to quantify and/or assess the risks and volatility associated with the financial costs. To do so, actuaries must make best-estimate assumptions about these possible future events and establish methods for performing the calculations. Actuarial assumptions are needed to determine the value of plan obligations to its participants, and actuarial methods create a schedule for allocating costs over a participant's career. The assumptions and methods are established by adhering to best practices for determination, studying historical experience, utilizing relevant external data, and considering internal and reputable external opinions on expected future experience. Comprehensive disclosure of the assumptions and methods is required under ASOPs 27, 35, and 41.

Actuarial assumptions used in the valuation of retirement benefits are generally broken into two categories: economic and demographic. This section considers only those assumptions we have categorized as economic, which include assumptions dependent on economic factors, such as the inflation rate, payroll growth rate, investment return, and salary increase rate.

This section determines if the economic assumptions are reasonable and consistent with generally accepted actuarial practice and relevant ASOPs. To the extent that the experience studies (as of June 30, 2016 for the GE Fund and as of July 1, 2011 for the Police Officers' and Firefighters' Funds) included analysis on economic assumptions, we include commentary on the experience study reports. For the GE Fund, we include a full replication of the experience study for the Salary Increase Rate and Investment Return.

Applicable ASOPs

Actuarial Standards of Practice No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*, provides guidance to actuaries in selecting and recommending economic assumptions. ASOP No. 27 has been revised effective for any actuarial work product with a measurement date on or after September 30, 2014.

The following process is set forth by ASOP 27 in selecting an identified economic assumption:

- a. Identify any components of the assumption
- b. Evaluate relevant data
- c. Consider factors specific to the measurement
- d. Consider other general factors
- e. Select a reasonable assumption

The standard also requires the actuary to review the entire assumption set upon selection of each individual assumption to ensure internal consistency and make adjustments as necessary.

The standard defines a reasonable assumption as follows:

3.6 — *Selecting a Reasonable Assumption*—Each economic assumption selected by the actuary should be reasonable. For this purpose, an assumption is reasonable if it has the following characteristics:

- 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 economic 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, 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 and disclosed under section 3.5.1, or when alternative assumptions are used for the assessment of risk.*

3.6.1 — *Reasonable Assumption Based on Future Experience or Market Data*—The actuary should develop a reasonable economic assumption based on the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof.

3.6.2 — *Range of Reasonable Assumptions*—The actuary should recognize the uncertain nature of the items for which assumptions are selected and, as a result, may consider several different assumptions reasonable for a given measurement. The actuary should also recognize that different actuaries will apply different professional judgment and may choose different reasonable assumptions. As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice.

ASOP 27 provides assumption specific guidance for each of the assumptions below. The remainder of this section of our report presents our review of selected economic assumptions to ensure the retained actuaries have followed the ASOP's general guidance and the assumption-specific guidance provided by the ASOP.

Inflation

The inflation assumption is not directly used to measure the liabilities of the plan; rather it is a component of all economic assumptions, including payroll growth, investment return, cost-of-living adjustment, and salary increase.

Applicable ASOPs

The Actuarial Standards of Practice has brief guidance regarding inflationary data to consider, as noted below:

ASOP No. 27, Section 3.7.1 – Data –*The actuary should review appropriate inflation data. These data 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.*

GE Fund

Retained Actuary's Assumption

The GE Fund uses an inflation assumption of 2.25%.

Experience Study Considerations

In the experience study, the retained actuary considered the 2016 OASDI Trustees Report, quoting a low-cost projection of 2.0% and a high-cost projection of 3.2% for the forward-looking 30-year inflation forecasts.

The retained actuary also considered historical Consumer Price Index (CPI) data for various lengths of time over the past century, noting that inflation continues at relatively low levels from a historical perspective:

| Average Annual Change in CPI-U, Through 2016 | |
|--|-------|
| Last 5 years | 1.36% |
| Last 10 years | 1.81% |
| Last 20 years | 2.12% |
| Last 30 years | 2.64% |
| Last 100 years | 3.08% |

Based on the historical data collected in the experience study as well as information gathered from other public sector plans and forward-looking data, a reasonable inflation range was determined to be between 1.75% - 3.25%. The inflation assumption was changed as of June 30, 2017 from 2.75% to 2.25%.

Comments and Recommendations

The retained actuary does not disclose the context for using the 2016 OASDI Trustees Report to study inflation rates, but this is a common reference in the industry for inflation projections. The 2016 OASDI Trustees Report provides the following description for the high-cost and low-cost assumptions.

The three alternative sets of economic assumptions provide a reasonable range for estimating the financial status of the trust funds. The intermediate assumptions reflect the Trustees' consensus expectation of sustained moderate economic growth and their best estimate for various other economic parameters. The low-cost assumptions represent a more optimistic outlook: a faster recovery, stronger long-term economic growth, and relatively optimistic levels for other parameters. The high-cost assumptions represent a more pessimistic scenario: a slower recovery, interrupted by a brief recession, weaker long-term economic growth, and relatively pessimistic levels for other parameters.

As a minor note, the 2016 OASDI Trustees Report uses 3.2% for the low-cost projection and 2.0% for the high-cost projection for the forward-looking 30-year inflation forecasts. The retained actuary flipped the two measurements in their report.

As required, the experience study considered both historical and forward-looking data. Based on the historical data collected in the experience study as well as the forward-looking data considered in the experience study, the recommended inflation assumption of 2.25% is reasonable.

Police Officers' Fund

Retained Actuary's Assumption

The inflation assumption is not explicitly disclosed in the valuation report nor the experience study.

Experience Study Considerations

This assumption was not considered during the July 1, 2011 experience study.

Comments and Recommendations

Inflation is a component of all economic assumptions, including payroll growth, investment returns, cost-of-living adjustments, and salary increase. We recommend that this assumption be explicitly studied and disclosed in future valuations and experience studies.

Firefighters' Fund

The inflation assumption is not explicitly disclosed in the valuation report nor the experience study.

Experience Study Considerations

This assumption was not considered during the July 1, 2011 experience study.

Comments and Recommendations

Inflation is a component of all economic assumptions, including payroll growth, investment returns, cost-of-living adjustments, and salary increase. We recommend that this assumption be explicitly studied and disclosed in future valuations and experience studies.

Payroll Growth and Wage Inflation

The assumed aggregate payroll growth is used in the amortization of the unfunded actuarial accrued liability. Payroll growth is generally selected using a building block approach in which the inflation assumption is added to the assumed real wage growth. Real wage growth includes wage growth due to productivity, but excludes individual compensation increases above wage growth, (e.g., merit increases and promotions).

Applicable ASOPs

The section of ASOP No. 27 addressing payroll growth provides the actuary with general guidance but is far from prescriptive:

ASOP No. 27, Section 3.11.3 — Rate of Payroll Growth—*As a result of terminations and new participants, total payroll generally grows at a different rate than does a participant's salary or the average of all current participants combined. As such, when a payroll growth assumption is needed, the actuary should use an assumption that is consistent with but typically not identical to the compensation increase assumption. One approach to setting the payroll growth assumption may be to reduce the compensation increase assumption by the effect of any assumed merit increases. The actuary should apply professional*

judgment in determining whether, given the purpose of the measurement, the payroll growth assumption should be based on a closed or open group and, if the latter, whether the size of that group should be expected to increase, decrease, or remain constant.

GE Fund

Retained Actuary's Assumption

The plan uses a payroll growth assumption of 3.00%, composed of 2.25% inflation plus 0.75% real wage growth (i.e. productivity).

Experience Study Considerations

The payroll growth assumption was revised as of July 1, 2017 from 3.50% to 3.00% to reflect the 0.50% decrease in the inflation assumption, while maintaining the real wage growth assumption of 0.75%.

Comments and Recommendations

National real wages can be studied by reviewing increases in the historical Average Wage Index, or AWI, published by the Social Security Administration. The AWI from 1977 to 2017, is shown below. Real Payroll Growth is the AWI less the CPI-U.

| Period | Years | AWI | CPI-U (US) | Real Payroll Growth |
|-----------|-------|-------|------------|---------------------|
| 2012-2017 | 5 | 2.31% | 1.02% | 1.29% |
| 2007-2017 | 10 | 1.99% | 1.30% | 0.69% |
| 1997-2017 | 20 | 2.82% | 2.06% | 0.76% |
| 1987-2017 | 30 | 3.24% | 2.46% | 0.78% |
| 1977-2017 | 40 | 3.98% | 3.37% | 0.61% |

Also, the Office of the Chief Actuary of the Social Security Administration provided real payroll growth forecasts for a 30-year period in the 2017 OASDI Trustees Report:

| Scenario | Payroll Differential |
|-------------------|----------------------|
| Low Cost | 1.82% |
| Intermediate Cost | 1.20% |
| High Cost | 0.58% |

Based on the information above, the payroll growth assumption of 3.00% and the real wage growth assumption of 0.75% are reasonable. However, we recommend that the experience study include additional support for the justification of the 0.75% real wage growth assumption.

Police Officers' Fund

Retained Actuary's Assumption

The plan uses a payroll growth assumption of 4.00%, which is equal to the plan's salary assumption.

Experience Study Considerations

This assumption was not considered during the July 1, 2011 experience study.

Comments and Recommendations

Payroll growth was not considered during the experience study and is instead equal to the salary increase assumption.

According to ASOP 27 above, the payroll growth assumption is generally less than the salary increase assumption:

When a payroll growth assumption is needed, the actuary should use an assumption that is consistent with but typically not identical to the compensation increase assumption. One approach to setting the payroll growth assumption may be to reduce the compensation increase assumption by the effect of any assumed merit increases.

In the experience study's analysis of the salary increase assumption, the retained actuary specifically mentions:

This rate is intended to reflect both the across-the-board annual inflationary pay increases that may be granted from time to time as well as the individual step increases that may be realized by each employee over the course of his or her career.

By assuming that payroll growth equals salary increases, the retained actuary has not considered merit and promotion increases that exist within the salary increase assumption. As a result, the payroll growth assumption may be too high and is potentially inconsistent with the salary increase assumption. It may not accurately reflect the fact that older, higher-paid employees retire and are replaced by younger, lower-paid employees. As another consequence, if the payroll growth assumption were lower, the amortization of the UAAL component of ADC would be higher, resulting in higher plan contributions.

We recommend the payroll growth assumption be explicitly studied and be revised to be consistent with the salary increase and inflation assumptions.

Firefighters' Fund

Retained Actuary's Assumption

The plan uses a payroll growth assumption of 4.00%, which is equal to the plan's salary assumption.

Experience Study Considerations

This assumption was not considered during the July 1, 2011 experience study.

Comments and Recommendations

Payroll growth was not considered during the experience study and is instead equal to the salary increase assumption.

According to ASOP 27 above, the payroll growth assumption is generally less than the salary increase assumption:

When a payroll growth assumption is needed, the actuary should use an assumption that is consistent with but typically not identical to the compensation increase assumption. One approach to setting the payroll growth assumption may be to reduce the compensation increase assumption by the effect of any assumed merit increases.

In the experience study's analysis of the salary increase assumption, the retained actuary specifically mentions:

This rate is intended to reflect both the across-the-board annual inflationary pay increases that may be granted from time to time as well as the individual step increases that may be realized by each employee over the course of his or her career.

By assuming that payroll growth equals salary increases, the retained actuary has not considered merit and promotion increases that exist within the salary increase assumption. As a result, the payroll growth assumption may be too high and is potentially inconsistent with the salary increase assumption. It may not accurately reflect the fact that older, higher-paid employees retire and are replaced by younger, lower-paid employees. As another consequence, if the payroll growth assumption were lower, the amortization of the UAAL component of ADC would be higher, resulting in higher plan contributions.

We recommend the payroll growth assumption be explicitly studied and be revised to be consistent with the salary increase and inflation assumptions.

Investment Return

The investment return assumption reflects anticipated returns on the plan's current and future assets. It is also used to calculate the present value of all plan liabilities and generally has the greatest impact of all assumptions reviewed in this report. The investment return assumption is generally evaluated using a building block approach in which the inflation assumption is added to the assumed real rate of return.

Applicable ASOPs

In selecting or recommending an investment return assumption, ASOP No. 27, Section 3.8 provides actuaries with guidance. The standard recommends the actuary review the investment data as follows.

ASOP No. 27, Section 3.6.1 — Data—*The actuary should review appropriate investment data. These data may include the following:*

- a. *current yields to maturity of fixed income securities such as government securities and corporate bonds;*

- b. forecasts of inflation, GDP growth, and total returns for each asset class;
- c. historical and current investment data including, but not limited to, real and nominal returns, the inflation and inflation risk components implicit in the yield of inflation-protected securities, dividend yields, earnings yields, and real estate capitalization rates; and
- d. historical plan performance.

The actuary may also consider historical and current statistical data showing standard deviations, correlations, and other statistical measures related to historical or future expected returns of each asset class and to inflation. Stochastic simulation models or other analyses may be used to develop expected investment returns from this statistical data.

The standards also state the actuary may adjust or customize the data above to reflect asset allocation, investment volatility and investment manager performance among other factors, and that combining estimated components of the investment return assumption and using multiple return rates in lieu of a single rate is also acceptable.

GE Fund

Retained Actuary's Assumption

The GE Fund uses an annual rate of investment return assumption of 7.25%, which consists of a 2.25% inflation assumption and a 5.00% real rate of return assumption (net of investment expenses).

Experience Study Considerations

In the experience study, the retained actuary considered several sources of information. First, they disclosed their target asset allocation of 50% domestic equity, 25% fixed income, 20% international equity, and 5% other (real estate, private equity, hedge funds). Secondly, they state that the current Callan estimated 10-year return with active management and 2.25% inflation is 6.75%, and if a 20-year return is considered instead the return could increase by 50 basis points.

Next, the retained actuary considered information on peers from a February 2017 NASRA Survey, which showed that out of 127 survey responders, the median is 7.50% with only 17% of responders having assumptions 8.00% or higher. Finally, the retained actuary considered information on peers within the State of Georgia, with returns ranging from 6.50% to 8.00% and the majority of peers using a 7.50% assumption.

Based on the above information, the retained actuary recommended that the investment return assumption be 7.25%, composed of an inflation rate of 2.25%, a real return of 5.00%.

Comments and Recommendations

The retained actuary's experience study contained significant benchmarking information from the Plan's peers, as well as plans from a NASRA Survey. The benchmarking did not consider the asset allocation of the peer systems. The experience study disclosed the Fund's target asset allocation and then noted the current Callan estimated 10-year forward-looking return of 6.75% with an additional 50 basis points for 20-year return. We assume that the Callan estimate is specific to the

Fund's target asset allocation, but this is not disclosed. Support for the additional 50 basis points is also not provided. There is also no comment on expected investment expenses. We recommend including a more robust forward-looking analysis based on the target asset allocation when reviewing the investment rate of return assumption in the future.

We have assessed the validity of the 2.25% inflation assumption above. In this section, we will assess the validity of the 5.00% real return assumption as of July 1, 2017 based on the provided target asset allocation. A survey released by Horizon Actuarial Services, LLC provides expected returns by asset classes. The survey provides capital market assumptions specific to projections over 10 years and 20 years. The investment return assumption, as noted by the SOA's Report of the Blue Ribbon Panel on Public Pension Plan Funding, should be using rates of return that can be achieved over the next 20 to 30-year period. Therefore, we selected the 20-year time horizon for our analysis.

Using the survey's expected returns by asset class for the 20-year horizon, the asset allocation modeled by the retained actuary, and adjusting for inflation differences and expenses, we have the following results:

| Asset Class | Target Allocation | Long-Term Expected Real Rate of Return (Horizon ¹) |
|--|-------------------|--|
| Domestic Equities | 50.00% | 6.68% |
| International Equities | 20.00% | 6.98% |
| Fixed Income | 25.00% | 2.15% |
| Other ² | 5.00% | 6.47% |
| Weighted Average Real Return | | 5.60% |
| Assumed Investment Expenses³ | | -0.37% |
| Real Return | | 5.33% |

¹Expected return for the 20-year time horizon for those consultants that responded to the survey, adjusted by the average inflation expectation of 2.44%, as noted in Exhibit 15 of the Horizon Actuarial 2017 Survey of Capital Market Assumptions.

²Real estate, private equity, hedge funds

³Based on the average pension investment expenses reported in the following study:
<http://jsg.legis.state.pa.us/resources/documents/ftp/act5/pdf/PPMAIRC-FINAL.pdf>

The expected real rate of return based on the target asset allocation is 5.33%. This is comparable to the 5.00% assumption used by the plan as of July 1, 2017.

While the investment return assumption was chosen using the underlying target asset allocation, we also compared the actual asset allocation with the target asset allocation. Page 9 of the Financial Statements report discloses the actual asset allocation as of June 30, 2017:

| Asset Class | Target Allocation | Actual June 30, 2017 Allocation ² |
|-----------------------------------|-------------------|--|
| Domestic and International Equity | 70.0% | 71.9% |
| Fixed Income | 25.0% | 22.3% |

| | | |
|--------------------------------|------|------|
| Other Investments ¹ | 5.0% | 5.8% |
|--------------------------------|------|------|

¹ Includes Real Estate, Private Equity, Hedge Funds, and cash and cash equivalents

² From the June 30, 2018 and 2017 Financial Statements and Supplemental Schedules

The actual allocation is comparable to the target allocation.

Based on the information above, the real rate of return assumption of 5.00% as well as the investment return of 7.25% are reasonable.

Police Officers' Fund

Retained Actuary's Assumption

7.50% per annum.

Experience Study Considerations

Historical investment performance was reviewed during the period January 1, 2008 through June 30, 2011. For years prior to 2008, consistent audited financial statements were not available, so those periods were ignored:

| Period | Market Value Return | Actuarial Value Return |
|---|---------------------|------------------------|
| January 1, 2008 through December 31, 2008 | -9.85% | -5.92% |
| January 1, 2009 through December 31, 2009 | 18.40% | 3.02% |
| January 1, 2010 through December 31, 2010 | 12.93% | 17.21% |
| January 1, 2011 through June 30, 2011 | 5.37% | 5.37% |
| Average Annualized Return for the Entire Period | 7.07% | 5.27% |

The retained actuary states the rate of return assumption should not be based on actual investment returns from historical data but based on the expected long-term future weighted return for each class of asset held by the fund. On this basis they recommend reducing the current investment assumption from 7.75% to 7.50%.

Comments and Recommendations

The investment return is the most significant assumption in valuing public pension plans. We strongly recommend that future experience studies contain significantly more analysis for selecting this assumption. We have several specific recommendations below:

- The retained actuary states the return should be based on an expected future return. We recommend the retained actuary provide analysis on the expected future return based on the target asset allocation.

- The experience study should disclose the target asset allocation used in the analysis.
- The retained actuary should consider benchmarking sources in their experience study (e.g., NASRA data).
- The retained actuary should consider evaluating the investment rate of based on building block approach, using the inflation assumption plus real rate of return less investment expenses.

As outlined in Section 3.6.1 of ASOP No. 27, the retained actuary should consider the following when selecting an investment assumption: current yields of fixed income securities, forecasts of inflation, GDP growth, and returns for each asset class, historical and current investment data, and historical plan performance. While the experience study report does consider historical plan performance, it does not consider any additional factors when determining the assumption. While 7.50% is generally an acceptable return based on industry information, there is not sufficient support for the selection of the assumption.

We have assessed the validity of the inflation assumption above. While it is not officially disclosed, we will assume it is equal to the COLA assumption of 3.00% for this analysis since the COLA is based on inflation with a 3% cap. In this section, we will assess the validity of the 4.50% real return assumption as of July 1, 2017 based on the target asset allocation disclosed in the GASB 67/68 Supplement Report as of June 30, 2017. A survey released by Horizon Actuarial Services, LLC provides expected returns by asset classes. The survey provides capital market assumptions specific to projections over 10 years and 20 years. The investment return assumption, as noted by the SOA's Report of the Blue Ribbon Panel on Public Pension Plan Funding, should be using rates of return that can be achieved over the next 20 to 30-year period. Therefore, we selected the 20-year time horizon for our analysis.

Using the survey's expected returns by asset class for the 20-year horizon, the target asset allocation disclosed in the GASB 67/68 Supplement Report as of June 30, 2017, and adjusting for inflation differences and expenses, produces the following results:

| Asset Class | Target Allocation | Long-Term Expected Real Rate of Return (Horizon ¹) |
|--|-------------------|--|
| Broad Equity Market | 7.00% | 7.29% |
| Domestic Large Cap Equity | 30.00% | 6.68% |
| Domestic Mid-Cap Equity | 15.00% | 7.89% |
| Domestic Small-Cap Equity | 9.00% | 7.89% |
| International Equity | 9.00% | 6.98% |
| Domestic Fixed Income | 25.00% | 2.15% |
| Alternative Investments ² | 5.00% | 6.47% |
| Weighted Average Real Return | | 5.90% |
| Assumed Investment Expenses³ | | -0.37% |
| Real Return | | 5.53% |

¹Expected return for the 20-year time horizon for those consultants that responded to the survey, adjusted by the average inflation expectation of 2.44%, as noted in Exhibit 15 of the Horizon Actuarial 2017 Survey of Capital Market Assumptions.

²Assumed to be an equal mix of real estate, private equity, hedge funds

³Based on the average pension investment expenses reported in the following study:
<http://jsg.legis.state.pa.us/resources/documents/ftp/act5/pdf/PPMAIRC-FINAL.pdf>

The expected real rate of return based on the target asset allocation is 5.53%. This is comparable to the 4.50% assumption used by the plan as of July 1, 2017.

Based on the information above, the real rate of return assumption of 4.50% as well as the investment return of 7.50% are reasonable.

Firefighters' Fund

Retained Actuary's Assumption

7.50% per annum.

Experience Study Considerations

Historical investment performance was reviewed during the period January 1, 2008 through June 30, 2011. For years prior to 2008, consistent audited financial statements were not available, so those periods were ignored:

| Period | Market Value Return | Actuarial Value Return |
|---|---------------------|------------------------|
| January 1, 2008 through December 31, 2008 | -17.86% | 19.54% |
| January 1, 2009 through December 31, 2009 | 23.77% | 3.28% |
| January 1, 2010 through December 31, 2010 | 16.33% | 16.00% |
| January 1, 2011 through June 30, 2011 | 6.52% | 6.52% |
| Average Annualized Return for the Entire Period | 6.82% | 12.82% |

The retained actuary states the rate of return assumption should not be based on actual investment returns from historical data but based on the expected long-term future weighted return for each class of asset held by the fund. On this basis they recommend reducing the current investment assumption from 7.75% to 7.50%.

Comments and Recommendations

The investment return is the most significant assumption in valuing public pension plans. We strongly recommend that the experience study contain significantly more analysis for selecting this assumption. We have several specific recommendations below:

- The retained actuary states the return should be based on an expected future return. We recommend the retained actuary provide analysis on the expected future return based on the target asset allocation.
- The experience study should disclose the target asset allocation used in the analysis.
- The retained actuary should consider benchmarking sources in their experience study (e.g., NASRA data).
- The retained actuary should consider evaluating the investment rate of based on building block approach, using the inflation assumption plus real rate of return less investment expenses.

As outlined in Section 3.6.1 of ASOP No. 27, the retained actuary should consider the following when selecting an investment assumption: current yields of fixed income securities, forecasts of inflation, GDP growth, and returns for each asset class, historical and current investment data, and historical plan performance. While the experience study report does consider historical plan performance, it does not consider any additional factors when determining the assumption. While 7.50% is generally an acceptable return based on industry information, there is not sufficient support for the selection of the assumption.

We have assessed the validity of the inflation assumption above. While it is not officially disclosed, we will assume it is equal to the COLA assumption of 3.00% for this analysis since the COLA is based on inflation with a 3% cap. In this section, we will assess the validity of the 4.50% real return assumption as of July 1, 2017 based on the target asset allocation disclosed in the GASB 67/68 Supplement Report as of June 30, 2017. A survey released by Horizon Actuarial Services, LLC provides alternate expected returns by asset classes. The survey provides capital market assumptions specific to projections over 10 years and 20 years. The investment return assumption, as noted by the SOA's Report of the Blue Ribbon Panel on Public Pension Plan Funding, should be using rates of return that can be achieved over the next 20 to 30-year period. Therefore, we selected the 20-year time horizon for our analysis.

Using the survey's expected returns by asset class for the 20-year horizon, the target asset allocation disclosed in the GASB 67/68 Supplement Report as of June 30, 2017, and adjusting for inflation differences and expenses, we have the following results:

| Asset Class | Target Allocation | Long-Term Expected Real Rate of Return (Horizon ¹) |
|--------------------------------------|-------------------|--|
| Broad Equity Market | 7.00% | 7.29% |
| Domestic Large Cap Equity | 30.00% | 6.68% |
| Domestic Mid-Cap Equity | 15.00% | 7.89% |
| Domestic Small-Cap Equity | 9.00% | 7.89% |
| International Equity | 9.00% | 6.98% |
| Domestic Fixed Income | 25.00% | 2.15% |
| Alternative Investments ² | 5.00% | 6.47% |

| | |
|--|---------------|
| Weighted Average Real Return | 5.90% |
| Assumed Investment Expenses³ | -0.37% |
| Real Return | 5.53% |

¹Expected return for the 20-year time horizon for those consultants that responded to the survey, adjusted by the average inflation expectation of 2.44%, as noted in Exhibit 15 of the Horizon Actuarial 2017 Survey of Capital Market Assumptions.

²Assumed to be an equal mix of real estate, private equity, hedge funds.

³Based on the average pension investment expenses reported in the following study:
<http://jsg.legis.state.pa.us/resources/documents/ftp/act5/pdf/PPMAIRC-FINAL.pdf>

The expected real rate of return based on the target asset allocation is 5.53%. This is comparable to the 4.50% assumption used by the plan as of July 1, 2017.

Based on the information above, the real rate of return assumption of 4.50% as well as the investment return of 7.50% are reasonable.

Salary Increase Rate

The salary increase assumption is used to project an employee's salary from the valuation date to the assumed termination date(s). It is comprised of inflation, real wage growth, and a merit scale. Inflation and real wage growth were already discussed above. This section focuses on the determination of the merit scale.

Applicable ASOPs

In selecting or recommending a total wage scale, ASOP No. 27, Section 3.10 provides actuaries with guidance. The standard recommends the actuary review the compensation data as follows.

ASOP No. 27, Section 3.10.1— Data—*The actuary should review available compensation data. These data may include the following:*

- a. *the plan sponsor's current compensation practice and any anticipated changes in this practice;*
- b. *current compensation distributions by age or service;*
- c. *historical compensation increases and practices of the plan sponsor and other plan sponsors in the same industry or geographic area; and*
- d. *historical national wage increases and productivity growth.*

The actuary should consider available plan-sponsor-specific compensation data, but the actuary should carefully weigh the credibility of these data when selecting the compensation increase assumption.

GE Fund

Retained Actuary's Assumption

The GE Fund uses the following age-based assumption for salary increases, which includes merit, promotion, and longevity increases as well as inflation and productivity increases:

| Age | Salary Scale |
|-----------|--------------|
| Under 25 | 14.75% |
| 25-29 | 11.75% |
| 30-34 | 8.75% |
| 35-39 | 6.75% |
| 40-44 | 5.75% |
| 45-49 | 5.00% |
| 50-54 | 4.25% |
| 55-59 | 3.75% |
| 60-64 | 3.25% |
| 65 & over | 3.00% |

These assumptions include the flat 3.00% “general” component which is composed of inflation and real wage growth.

Experience Study Considerations

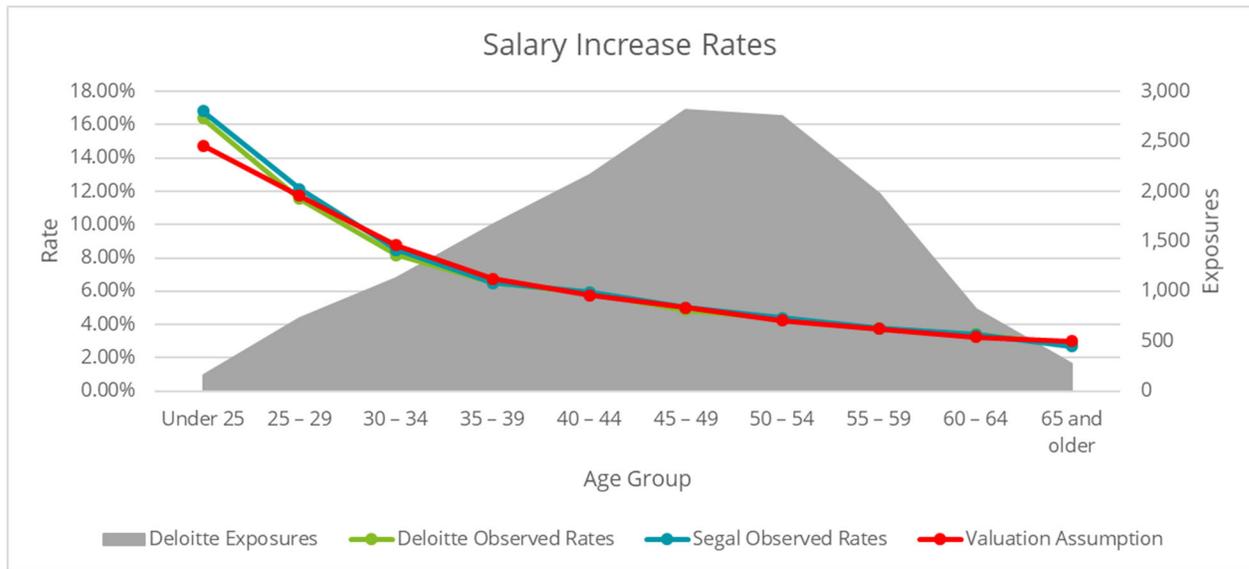
The actual salary experience was examined for a five-year period, including 2013 where salaries decreased by about 0.3%. Even factoring in 2013, the five-year actual salary increase was higher than assumed based on the previous assumption. Base on the findings from the study, the retained actuary revised their assumption as follows:

| Age | Prior Rates | Observed Rates | Proposed Rates with 2.25% Inflation |
|--------------|-------------|----------------|-------------------------------------|
| Under 25 | 7.25% | 16.81% | 14.75% |
| 25 – 29 | 7.25% | 12.13% | 11.75% |
| 30 – 34 | 5.25% | 8.47% | 8.75% |
| 35 – 39 | 5.25% | 6.49% | 6.75% |
| 40 – 44 | 4.25% | 5.95% | 5.75% |
| 45 – 49 | 4.25% | 5.02% | 5.00% |
| 50 – 54 | 3.75% | 4.39% | 4.25% |
| 55 – 59 | 3.75% | 3.78% | 3.75% |
| 60 – 64 | 3.50% | 3.41% | 3.25% |
| 65 and older | 3.50% | 2.70% | 3.00% |

Replication of Experience Study

Using experience study data provided by Segal from 7/1/2012 to 7/1/2016, we aggregated the year-over-year salary increases for continuing actives to replicate Segal's observed salary increase rates from the experience study.

| Annual Salary Increase | | | | |
|------------------------|--------------------|-------------------------|----------------------|----------------------|
| Age | Deloitte Exposures | Deloitte Observed Rates | Segal Observed Rates | Valuation Assumption |
| Under 25 | 166 | 16.39% | 16.81% | 14.75% |
| 25 – 29 | 731 | 11.56% | 12.13% | 11.75% |
| 30 – 34 | 1,128 | 8.17% | 8.47% | 8.75% |
| 35 – 39 | 1,674 | 6.49% | 6.49% | 6.75% |
| 40 – 44 | 2,160 | 5.91% | 5.95% | 5.75% |
| 45 – 49 | 2,818 | 4.87% | 5.02% | 5.00% |
| 50 – 54 | 2,755 | 4.35% | 4.39% | 4.25% |
| 55 – 59 | 1,981 | 3.75% | 3.78% | 3.75% |
| 60 – 64 | 824 | 3.43% | 3.41% | 3.25% |
| 65 and older | 277 | 2.80% | 2.70% | 3.00% |



As shown above, Deloitte’s observed rates are comparable to Segal’s observed rates.

The proposed salary increase rates used in the valuation reflect the observed rates, particularly for ages beyond 25. The retained actuary’s recommended salary increase rates are reasonable.

Comments and Recommendations

The retained actuary is appropriately using the building blocks approach, with the salary assumption equal to 2.25% inflation plus 0.75% real wage growth plus a merit/promotion/longevity scale for employees based on age.

The assumption at each age appears reasonable based on experience during the study period.

Based on the information above, the salary increase assumption is reasonable.

We recommend that the experience study also show exposed lives during the study period to add context for the sample size within each age group.

Police Officers’ Fund

Retained Actuary’s Assumption

The Police Officers’ Fund uses an annual salary increase assumption of 4.00%, unless actual compensation is known for a prior plan year.

Experience Study Considerations

The retained actuary considered the actual salary increases compared to the assumed increases during the period January 1, 2005 through June 30, 2011:

| Period | Actual Salary Increase |
|---|------------------------|
| January 1, 2005 through December 31, 2005 | 3.63% |
| January 1, 2006 through December 31, 2006 | 5.19% |
| January 1, 2007 through December 31, 2007 | 3.44% |
| January 1, 2008 through December 31, 2008 | 3.69% |
| January 1, 2009 through December 31, 2009 | 2.06% |
| January 1, 2010 through December 31, 2010 | 8.14% |
| January 1, 2011 through June 30, 2011 | -4.72% |
| Average Annualized Increase for the Entire Period | 3.23% |

The retained actuary recommended maintaining a flat salary increase assumption of 4.00%. This rate is intended to reflect both the across-the-board annual inflationary pay increases that may be granted from time to time as well as the individual step increases that may be realized by each employee over the course of his or her career.

Comments and Recommendations

Salary increases should be composed of inflation, real wage growth, and merit/promotional increases. Merit/promotional increases are generally higher for younger/shorter service employees and lower for older/longer service employees. We recommend the retained actuary consider an age and/or service-based merit/promotional increase table in combination with a flat inflation and real wage growth assumption.

The valuation report states that actual compensation for a prior year is used, if known. However, in response to a question from Deloitte, the retained actuary indicated:

We do not have historical salary data, so the entry age normal cost is based on current salary adjusted with the assumed salary increases applied to the past.

The retained actuary should clarify the language in the report for whether actual historical salary is used in determination of the Accrued Liability, Normal Cost, or Final Average Pay benefits for participants near retirement.

Firefighters' Fund

Retained Actuary's Assumption

The Firefighters' Fund uses an annual salary increase assumption of 4.00%, unless actual compensation is known for a prior plan year.

Experience Study Considerations

The retained actuary considered the actual salary increases compared to the assumed increases during the period January 1, 2005 through June 30, 2011:

| Period | Actual Salary Increase |
|---|------------------------|
| January 1, 2005 through December 31, 2005 | 6.50% |
| January 1, 2006 through December 31, 2006 | 8.42% |
| January 1, 2007 through December 31, 2007 | 1.60% |
| January 1, 2008 through December 31, 2008 | 1.81% |
| January 1, 2009 through December 31, 2009 | 7.92% |
| January 1, 2010 through December 31, 2010 | 7.42% |
| January 1, 2011 through June 30, 2011 | -3.41% |
| Average Annualized Increase for the Entire Period | 4.57% |

The retained actuary recommended maintaining a flat salary increase assumption of 4.00%. This rate is intended to reflect both the across-the-board annual inflationary pay increases that may be granted from time to time as well as the individual step increases that may be realized by each employee over the course of his or her career.

Comments and Recommendations

Salary increases should be composed of inflation, real wage growth, and merit/promotional increases. Merit/promotional increases are generally higher for younger/shorter service employees and lower for older/longer service employees. We recommend the retained actuary consider an age and/or service-based merit/promotional increase table in combination with a flat inflation and real wage growth assumption.

The valuation report states that actual compensation for a prior year is used, if known. However, in response to a question from Deloitte, the retained actuary indicated:

We do not have historical salary data, so the entry age normal cost is based on current salary adjusted with the assumed salary increases applied to the past.

The retained actuary should clarify the language in the report for whether actual historical salary is used in determination of the Accrued Liability, Normal Cost, or Final Average Pay benefits for participants near retirement.

Cost-of-Living Adjustment

The cost-of-living-adjustment (COLA) assumption is used to estimate the plan's future COLA adjustments for retirees, which are often based on an inflation index.

Applicable ASOPs

The section of ASOP No. 27 addressing COLA's provides the actuary with general guidance but is far from prescriptive:

ASOP No. 27, Section 3.11.2 — Cost-of-Living Adjustments — Plan benefits or limits affecting plan benefits (including the Internal Revenue Code (IRC) section 401(a)(17) compensation limit and section 415(b) maximum annuity) may be automatically adjusted for inflation or assumed to be adjusted for

inflation in some manner (for example, through regular plan amendments). However, for some purposes (such as qualified pension plan funding valuations), the actuary may be precluded by applicable laws or regulations from anticipating future plan amendments or future cost-of-living adjustments in certain IRC limits.

COLA Plan Provision

As described in Sections 6-2(d)(6)(iv) and 6-37(h) of the City Ordinance, an annual cost-of-living adjustment to the base pension benefit shall be made based on the ratio of the current average cost-of-living index as of January 1 to the adjusted pensioner index, where:

The current average cost-of-living index is the average of the monthly Consumer Price Index for the 12 month period from November 1 through October 31, prior to the annual adjustment date, as determined by the Bureau of Labor Statistics of the United States Department of Labor for all items and major groups, United States City average.

The adjusted pensioner index is the pensioner base index adjusted for all percentage adjustments made in benefits prior to the current annual adjustment date.

The pensioner base index is the average of the Consumer Price Index for the 12 month period ending two months prior to the date of adjustment.

The cost-of-living increase is limited to:

- 3% for those hired before October 31, 2011; or
- 1% for those hired after November 1, 2011

GE Fund

Retained Actuary's Assumption

Annual cost-of-living adjustments are assumed to occur on average at the rate of 2.25% per annum for hires before November 1, 2011, and 1.00% per annum for hires after October 31, 2011.

Experience Study Considerations

The experience study includes a description of the current COLA provisions and the recommendations from the retained actuary. The retained actuary recommends the assumption be set equal to the inflation assumption for those hired before 11/1/2011 and the assumption to be set to 1.00% for those hired after 10/31/2011. The experience study provides no further insight or analysis as to why the changes were recommended or what data was used to make the recommended changes. The prior assumption was 3.00% for those hired before 11/1/2011 and 1.00% for those hired after 10/31/2011.

Comments and Recommendations

Section 3.5.1 of ASOP 27 provides guidance on assumptions for plan provisions that are difficult to measure, such as a COLA with a maximum:

Depending on the purpose of the measurement, the actuary may determine that it is appropriate to adjust the economic assumptions to provide for considerations such as adverse deviation or plan provisions that are difficult to measure, as discussed in ASOP No. 4. Any such adjustment made should be disclosed in accordance with section 4.1.1.

For those hired before November 1, 2011, it is reasonable that the COLA assumption is the same as the inflation assumption – the maximum COLA of 3% is above the assumed inflation of 2.25%. For those hired after October 31, 2011, it is reasonable that the COLA assumption is equal to the maximum COLA of 1%. However, it would also be reasonable to consider slightly lower assumptions to reflect the volatility of inflation and the impact of the cap.

Based on the information above, the COLA assumption is reasonable. However, we recommend the retained actuary provide more context for the basis of the recommended assumption.

Police Officers' Fund

Retained Actuary's Assumption

Annual cost-of-living adjustments are assumed to occur at the rate of 3.00% per annum for all retirees.

Experience Study Considerations

This assumption was not considered during the July 1, 2011 experience study.

Comments and Recommendations

The assumption of 3.00% seems to have been selected based on the maximum COLA assumption of 3.00% for the participants who were hired before 11/1/2011. We have the following recommendations:

- As discussed above, the retained actuary should explicitly develop and disclose an inflation assumption. The COLA assumption should take the inflation assumption into consideration. If the inflation assumption were below 3.00%, a 3.00% COLA assumption would not be reasonable.
- The COLA assumption of 3.00% is not appropriate for participants hired after 10/31/2011. According to the City Ordinance mentioned above, participants hired after 10/31/2011 have a maximum COLA of 1.00%. The retained actuary should revise this assumption for post-2011 hires or provide additional support for this assumption. If the assumption for post 10/31/2011 hires already differs from 3.00%, it should be disclosed.
- It may be reasonable to consider COLA assumptions lower than the inflation assumption to reflect the volatility of inflation and the impact of the cap.

Firefighters' Fund

Retained Actuary's Assumption

Annual cost-of-living adjustments are assumed to occur at the rate of 3.00% per annum for all retirees.

Experience Study Considerations

This assumption was not considered during the July 1, 2011 experience study.

Comments and Recommendations

The assumption of 3.00% seems to have been selected based on the maximum COLA assumption of 3.00% for the participants who were hired before 11/1/2011. We have the following recommendations:

- As discussed above, the retained actuary should explicitly develop and disclose an inflation assumption. The COLA assumption should take the inflation assumption into consideration. If the inflation assumption were below 3.00%, a 3.00% COLA assumption would not be reasonable.
- The COLA assumption of 3.00% is not appropriate for participants hired after 10/31/2011. According to the City Ordinance mentioned above, participants hired after 10/31/2011 have a maximum COLA of 1.00%. The retained actuary should revise this assumption for post-2011 hires or provide additional support for this assumption. If the assumption for post 10/31/2011 hires already differs from 3.00%, it should be disclosed.
- It may be reasonable to consider COLA assumptions lower than the inflation assumption to reflect the volatility of inflation and the impact of the cap.

Comparison of Pension Funds

The experience study reports from Segal (GE Fund) and Southern Actuarial (Firefighters' and Police Officers' Funds) differed in format and comprehensiveness. While different actuarial firms have different approaches towards an experience study, we believe that the GE Fund's experience study was more complete than the Police Officers' and Firefighters' Funds experience studies. The GE Fund's experience study included thorough analysis of the inflation, investment return, salary scale, and COLA assumptions, while the Police Officers' and Firefighters' Funds experience studies either does not mention the assumption (inflation, payroll growth, COLA) or lacks sufficient detail (investment return).

We recommend that the Police Officers' and Firefighters' Funds work to enhance their data processes to improve the quality of the data so it can be relied upon for the experience study.

Additionally, it is generally a best practice to conduct an experience study every 3-5 years to reflect changes in the economy and the workforce. While the GE Fund appears to be conducting an experience study every 5 years, the last experience studies for the Police Officers' and Firefighters'

Funds were in 2011. We recommend that the Police Officers' and Firefighters' Funds' conduct more frequent experience studies, as required by the City Ordinance.

Regarding the individual assumptions themselves, it is generally reasonable for different plans to employ different assumptions. However, in several cases, the GE Fund's methodology is more consistent with "best practices" than the Police Officers' and Firefighters' Funds methodology. We have included commentary below:

- **Inflation:** The Police Officers' and Firefighters' Funds do not disclose this assumption. This assumption is a component of all other assumptions; therefore, it should be studied. It should also be consistent between all Funds.
- **Payroll Growth:** Payroll growth is generally chosen using a building block approach in which the inflation assumption is added to the assumed real wage growth. Real wage growth includes wage growth due to productivity, but excludes individual compensation increases above wage growth, also called "merit" increases. The GE Fund appropriately reflects the building block approach, while the Police Officers' and Firefighters' Funds Payroll Growth assumption equals the salary scale assumption and does not back out merit increases. A consequence of this is that if the payroll growth assumption were correctly lower than salary scale, the amortization of the UAAL component of ADC would be higher, resulting in higher plan contributions.
- **Salary Scale:** The Police Officers' and Firefighters' Funds flat salary scale of 4.00% is a simplified assumption. Salary scale should generally be determined using a building block approach of inflation, real wage growth, and merit/promotional increases, as the GE Fund is doing.
- **COLA:** The GE Fund's COLA assumption specifically addresses the plan provisions for pre and post-2011 hires. It also is consistent with the inflation assumption. The Police Officers' and Firefighters' Funds flat 3.00% assumption does not reflect the provisions of the plan, and since an inflation assumption is not disclosed, we cannot be sure if it is consistent with inflation. Again, better record keeping could make this assumption easier to set and study. This assumption should also be consistent between all Funds

We recommend that the Police Officers' and Firefighters' Funds consider a more robust set of analyses in their future assumption-setting practices.

Review of Demographic Assumptions

Actuarial assumptions used in the valuation of retirement benefits are generally broken into two categories: economic and demographic. This section of the report considers only those assumptions we have categorized as demographic, which include any non-economic assumption and generally include assumptions regarding the expected composition and behavior of the workforce.

This section determines if the demographic assumptions are reasonable and consistent with generally accepted actuarial practice and relevant ASOPs. To the extent that the experience studies (as of June 30, 2016 for the GE Fund and as of July 1, 2011 for the Police Officers' and Firefighters' Funds) included analysis on demographic assumptions, we include commentary on the experience study reports. For the GE Fund, we include a full replication of the experience study for these assumptions.

Applicable ASOPs

Actuarial Standard of Practice No. 35, *Selection of Demographic and other Noneconomic Assumptions for Measuring Pension Obligations*, provides guidance to actuaries in selecting demographic and other assumptions not covered by ASOP No. 27. ASOP No. 35 has been restated effective for any actuarial work product with a measurement date on or after June 30, 2015. Because the assumptions resulting from this experience study will be used in actuarial valuations with measurement dates after June 30, 2015, we consider this standard applicable.

As set forth by ASOP 35, the actuary should follow the process below for selecting demographic assumptions, as applicable:

- a. Identify the types of assumptions
- b. Consider the relevant assumption universe
- c. Consider assumption formats
- d. Select the specific assumptions
- e. Select a reasonable assumption

The standard defines a *reasonable* assumption as follows:

3.3.5 — Selecting a Reasonable Assumption—Each demographic assumption selected by the actuary should be reasonable. For this purpose, an assumption is reasonable if it has the following characteristics:

- 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.*

3.4 — Range of Reasonable Assumptions—The actuary should recognize the uncertain nature of the items for which assumptions are selected and, as a result, may consider several different assumptions equally reasonable for a given measurement. The actuary should also recognize that different actuaries will apply different professional judgment and may choose different reasonable assumptions. As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice.

The standard also discusses consistency among selection of demographic assumptions and requires the actuary to review the combined effect of all non-prescribed assumptions selected by the actuary (both demographic assumptions selected in accordance with this standard and economic assumptions selected in accordance with ASOP No. 27).

3.7 — Consistency among Demographic Assumptions Selected by the Actuary for a Particular Measurement—With respect to any particular measurement, each demographic assumption selected by the actuary should be consistent with the other assumptions selected by the actuary unless the assumption, considered individually, is not material (see section 3.10.2). For example, if an employer's business is in decline and the effect of that decline is reflected in the turnover assumption, it should also be reflected in the retirement assumption.

ASOP 35 provides assumption specific guidance for each of the assumptions below. The remainder of this section of our report presents our review of selected demographic assumptions to establish that the retained actuaries have followed the ASOP's general guidance and the assumption-specific guidance provided by the ASOP.

Mortality

The mortality assumption is used to determine when an active employee, retired employee, disabled employee or beneficiary will become deceased.

Applicable ASOPs

ASOP No. 35, Section 3.5.3 — Mortality and Mortality Improvement—*The actuary should take into account factors such as the following in the selection of mortality and mortality improvement assumptions:*

- a. *the possible use of different assumptions before and after retirement (for example, in some small plan cases a reasonable model for mortality may be to assume no mortality before retirement);*
- b. *the use of a different assumption for disabled lives, which in turn may depend on the plan's definition of disability and how it is administered; and*
- c. *the use of different assumptions for different participant subgroups and beneficiaries.*

The actuary should reflect the effect of mortality improvement both before and after the measurement date. With regard to mortality improvement, the actuary should do the following:

- i. adjust mortality rates to reflect mortality improvement before the measurement date. For example, if the actuary starts with a published mortality table, the mortality rates may need to be adjusted to reflect mortality improvement from the effective date of the table to the measurement date. Such an adjustment is not necessary if, in the actuary's professional judgment, the published mortality table reflects expected mortality rates as of the measurement date.*
- ii. include an assumption as to expected mortality improvement after the measurement date. This assumption should be disclosed in accordance with section 4.1.1, even if the actuary concludes that an assumption of zero future improvement is reasonable as described in section 3.3.5. Note that the existence of uncertainty about the occurrence or magnitude of future mortality improvement does not by itself mean that an assumption of zero future improvement is a reasonable assumption.*

Background on Recent National Mortality Studies

Credibility Theory

The Society of Actuaries ("SOA") released the "Credibility Educational Resource for Pension Actuaries" in August 2017. This report provides general guidance to pension actuaries in the application of the expanded ASOP No. 25 (Credibility Procedures) and the general goal of reducing future gains and losses due to different than anticipated mortality.

As described in ASOP 25, credibility procedure is a process that involves the evaluation of subject experience for potential use in setting assumptions without references to other data; or the identification of relevant experience and the selection and implementation of a method for blending the relevant experience with the subject experience. Subject experience is the actual experience the actuary is trying to estimate, whereas relevant experience is derived from other related sources and can be used to estimate the quantity of interest. In the case of the Pension Funds, subject experience is each of the Fund's direct past experience, relevant experience is that underlying the broader public sector data included in what is determined to be the most relevant SOA study, and the quantity of interest is each of the Fund's future experience. Subject experience is useful because it is directly related to the quantity of interest. Relevant experience is usually necessary because subject experience often lacks sufficient volume to provide the desired level of "accuracy." In many cases, direct past experience is robust enough to rely on partially, but not so much that it can be the sole source of credible experience. Therefore, the actuary must generally determine the most relevant experience and blend it with the plan's subject experience.

With more attention on mortality assumptions, there is also a growing awareness of the variability of mortality within different demographic groups and/or plan populations resulting in a desire for more customized assumptions. For example, evidence suggests that mortality varies by industry, geography and job type (i.e., collar). In addition, the size of pension benefit amounts can be a predictor of mortality, and certain plan provisions may lead to anti-selection, which affects future mortality (such as the ability of former plan members to elect a lump sum). This has led to a renewed interest in actuarial credibility theory as a means for adjusting standard tables to better fit specific pension plan populations in both the United States and Canada.

Additionally, in the U.S. context, the Bipartisan Budget Act of 2015 included a provision that required the IRS to issue guidance that would allow plans to reflect their own mortality experience rather than use the IRS-prescribed mortality tables in “accordance with established actuarial credibility theory.” Accordingly, in December 2016, the IRS issued Rev-Proc 2017-55 outlining the requirements a plan must meet to obtain IRS approval to use plan-specific mortality tables (which includes guidance on the use of credibility procedures) for purposes of pension plan valuations. This development, along with the expansion of ASOP No. 25 (Credibility Procedures) to cover pension work, has further increased the interest in credibility theory for U.S. pension actuaries.

Rev-Proc 2017-55, effective October 5, 2017, provides final guidance for Mortality Tables for Determining Present Value Under Defined Benefit Pension Plans. This ruling indicates that plans should determine if they have fully credible experience using predetermined formulas. Should they be determined to be below the fully credible threshold but have more than 100 deaths over the exposure period, an adjustment should be made to the best-fit mortality table to reflect this partial credibility.

The IRS guidance was developed for ERISA plans to reflect their plan experience in a manner that is reflective of current credibility theory and reviewable by the City of Atlanta. While the City of Atlanta’s plans are not subject to ERISA, Deloitte believes that the concepts prescribed in Rev-Proc 2017-55 should be applied where appropriate for the City of Atlanta’s plans in order to best comply with ASOP No. 25. Since the guidance is not prescribed for the City of Atlanta, the application process outlined in Rev-Proc 2017-55 does not apply.

Credibility Theory was not incorporated in the retained actuaries’ experience studies. We have included this content for consideration of future experience studies.

Base Mortality Tables

In October 2014, the Society of Actuaries (“SOA”) published several reports of the Retirement Plans Experience Committee (“RPEC”). The RP-2014 Mortality Tables Report¹ reflects observed data for single-employer defined benefit pension plans covering the years 2004 – 2008 (central year, 2006). The RPEC observed that this data was relatively consistent with the data underlying the RP 2000 mortality tables (that is, from 1990 – 1994, central year 1992) adjusted for longevity improvements using MP-2014². The rates in the RP-2014 tables were developed on a liability weighted basis (i.e. exposures and deaths were weighted by compensation for actives and by benefit amount for retirees).

As a supplement to the RP-2014 Mortality Tables Report, the Society of Actuaries also published the Supplement to the RP-2014 Mortality Tables Report, RPH-2014 Headcount-Weighted Tables³. The rates in these tables, denoted RPH-2014 (for Retirement Plans by Headcount), were calculated using

¹ RP-2014 Mortality Tables Report (<https://www.soa.org/Files/Research/Exp-Study/research-2014-rp-report.pdf>)

² Mortality Improvement Scale MP-2014 Report (<http://www.soa.org/Research/Experience-Study/pension/research-2014-mp.aspx>)

³ Supplement to the RP-2014 Mortality Tables Report (<https://www.soa.org/Files/Research/Exp-Study/research-2014-rp-supplement.pdf>)

the same underlying datasets and methods as those used in the development of the corresponding RP-2014 tables, but with exposures and deaths weighted by headcount rather than by amount.

As a result of comments received on the prior RP-2014 study, which included only data from private pension plans, the SOA and the RPEC initiated a mortality study of public pension plans in January 2015. The primary focus of this study was a comprehensive review of recent mortality experience of public retirement plans in the United States. The objectives of this study were the following:

1. Develop mortality tables based exclusively on public-sector pension plan experience.
2. Provide new insights into the composition of gender-specific pension mortality by factors such as job category (e.g., Teachers, Public Safety, General), salary/benefit amount, health status (i.e., healthy or disabled), geographic region and duration since event.

In October 2018 the Pub-2010 Public Retirement Plans Mortality Tables Report⁴ (“Pub-2010 Report”) was published, with job category-specific mortality base tables for Teachers, Public Safety, and General populations. Additional factors were considered, and subset mortality tables were released based on income level, with which they determined mortality had a strong correlation. Separate tables were also developed for contingent survivors, as their experience was determined to differ from that of other annuitants. We believe that this study is the most credible basis on which to base public sector mortality at this time.

The experience studies were performed by the prior actuaries before the release of the Pub-2010 Report. Therefore, we do not expect that these tables were considered in these experience studies. We have included this content for consideration of future experience studies.

Mortality Improvement Scale

The RPEC’s Mortality Improvement Scale MP-2014 Report⁵ reflects data from the Social Security Administration through 2009. As discussed in the report, the historical data was graduated and then projected from the resulting smoothed 2007 values to reach an ultimate rate of 1%⁶ after 20 years (from 2007⁷). As discussed in the RPEC’s Mortality Improvement Scale MP-2014 Report⁸, we believe this is a reasonable ultimate rate and convergence period.

The Society of Actuaries published the MP-2015 scale of longevity improvements in October 2015, the MP-2016 scale of longevity improvements in October 2016, the MP-2017 scale of longevity improvements in October 2017, and the MP-2018 scale of longevity improvements in October 2018. The MP-2015 scale reflected two additional years of Social Security data, the MP-2016 scale reflected

⁴ Pub-2010 Public Retirement Plans Mortality Tables Report (<https://www.soa.org/Files/resources/research-report/2019/pub-2010-mort-report.pdf>)

⁵ www.soa.org/Research/Experience-Study/pension/research-2014-mp.aspx

⁶ The ultimate rate is actually 1% at ages up to 85, then grading down to 0.85% at 95 and 0% at 110.

⁷ To avoid so-called edge effect distortions, the last two years of actual data (2008 and 2009) were replaced with the first two years of smoothed data.

⁸ www.soa.org/Research/Experience-Study/pension/research-2014-mp.aspx

an additional three⁹ years (beyond those reflected in MP-2015) of Social Security data, the MP-2017 scale reflected one additional year (beyond those reflected in MP-2016) of Social Security data and the MP-2018 scale reflected one additional year (beyond those reflected in MP-2017) of Social Security data.

GE Fund

Retained Actuary's Assumption

The following table shows the current mortality assumptions for each group of participants:

| Participant Group | Assumption |
|-------------------|---|
| Healthy Retirees | Approximate RP-2006 Blue Collar Healthy Annuitant Table, loaded by 25% with sex-distinct rates and projected generationally with scale SSA2016-2D |
| Disabled Lives | Approximate RP-2006 Disabled Retiree Mortality Table, loaded by 25% with sex-distinct rates and projected generationally with scale SSA2016-2D |
| Active Members | Approximate RP-2006 Blue Collar Employee Table, loaded by 25% with sex-distinct rates and projected generationally with scale SSA2016-2D |

Experience Study Considerations

The actual mortality experience was examined for disabled lives, healthy retirees, and pre-retirement participants, separately for males and females:

| Participant Group | Actual / Expected |
|-------------------|--|
| Healthy Retirees | Male: 125% (353 actual versus 283 expected) Female: 126% (309 actual versus 246 expected) |
| Disabled Lives* | Male: 96% Female: 121% |
| Active Members* | Male: 89% Female: 42% |

*Actual and expected deaths were not provided, only percentages

The retained actuary comments that the assumption for healthy retirees is the most important component of the mortality assumption. A graph of the actual, expected, and proposed assumption was provided for healthy retirees.

The retained actuary also provided background on the base tables and improvement scales. They state that the RP-2014 tables did not include public sector plans in the analysis, though they

⁹ SSA published data was used for 2012 and 2013, while preliminary data was used for 2014.

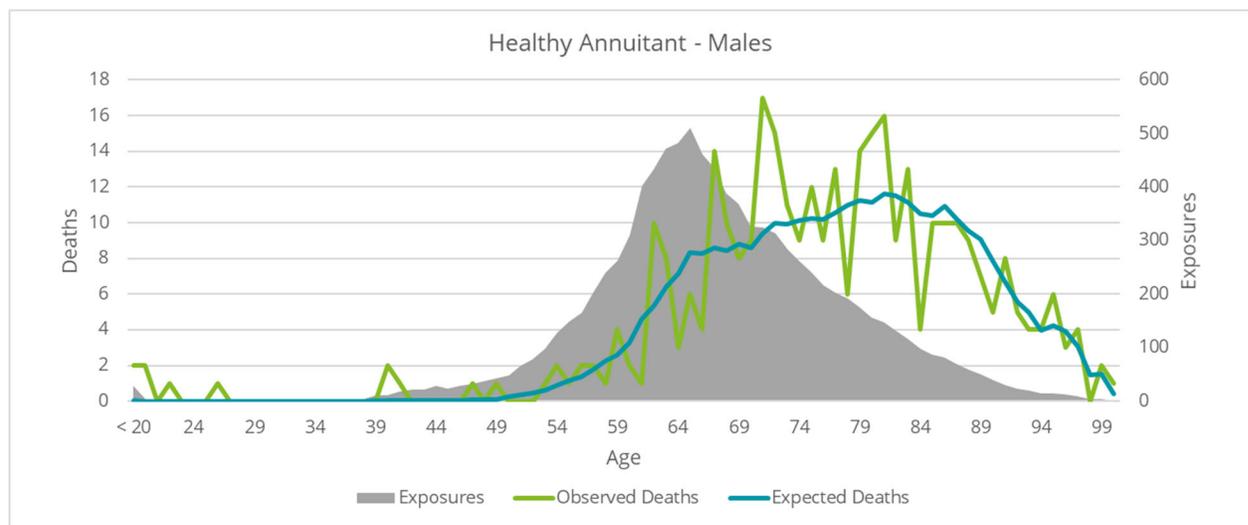
acknowledge that the Pub-2010 tables were being studied by the SOA at the time of publishing the experience study. They also state that the MP-2014 improvement scale was seen as too optimistic by many actuaries, and that other improvement scales were developed to be more modest.

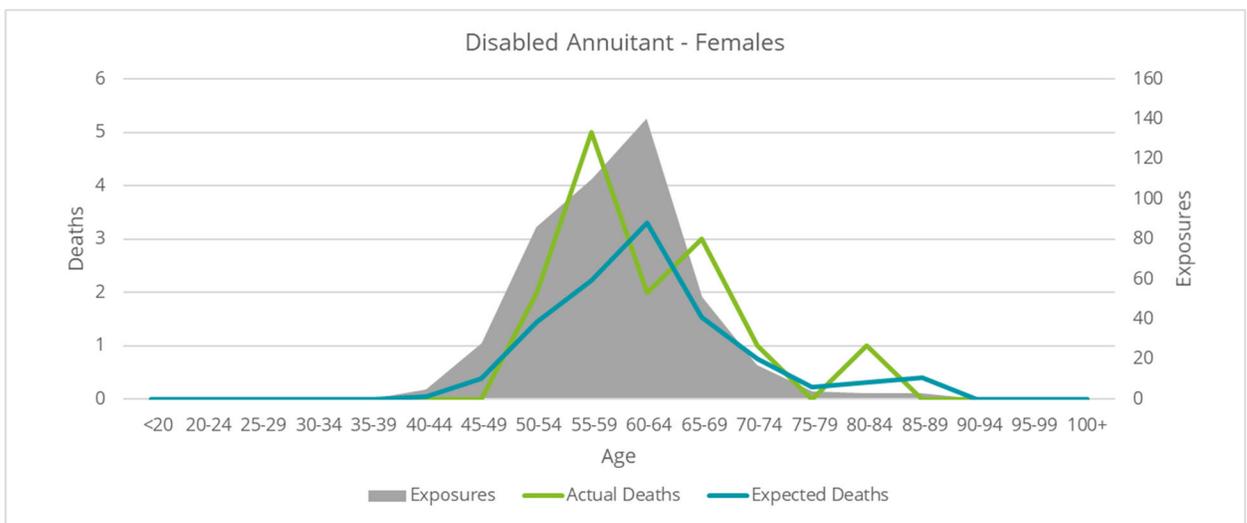
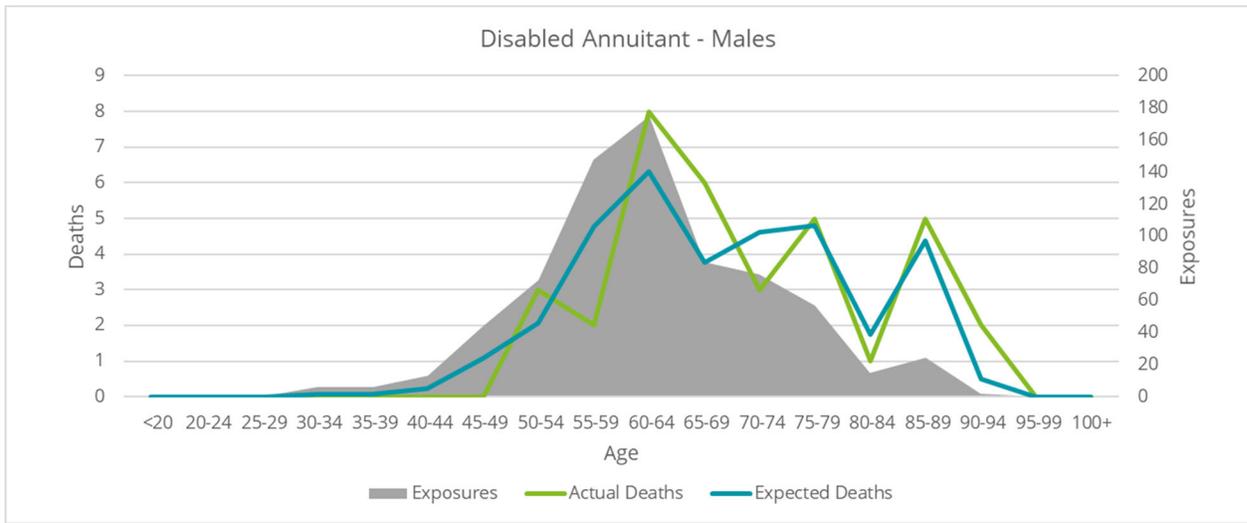
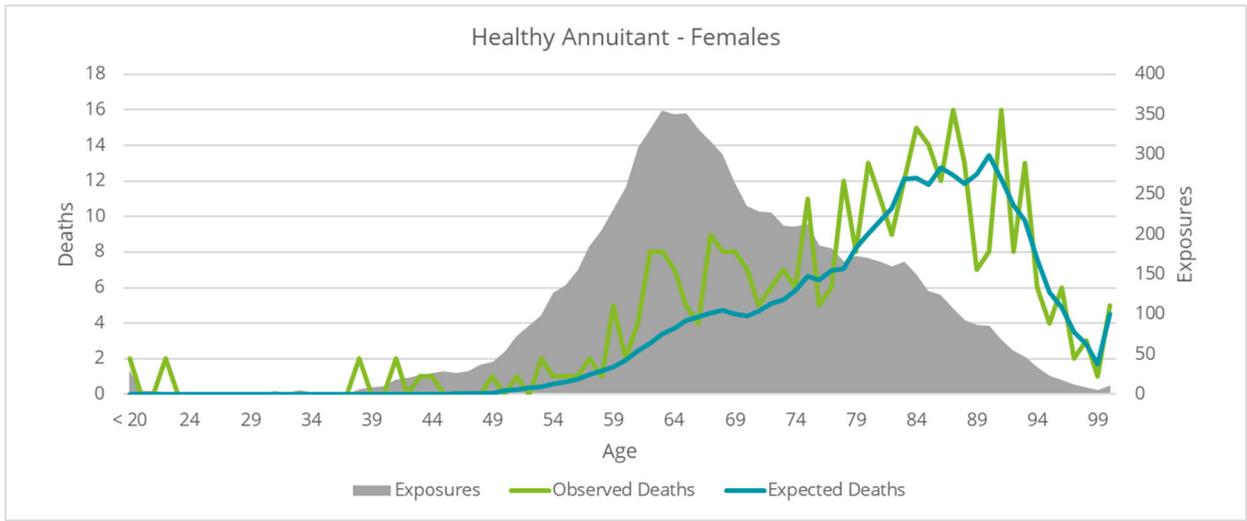
Ultimately, the retained actuary recommended updating to sex-distinct approximate RP-2006 Blue Collar mortality tables, with rates increased by 25%, and the SSA2016-2D sex-distinct improvement scale from the SSA. The healthy annuitant table was recommended for post-retirement mortality; the employee table was recommended for pre-retirement mortality; and the disabled retiree table was recommended for disabled life mortality.

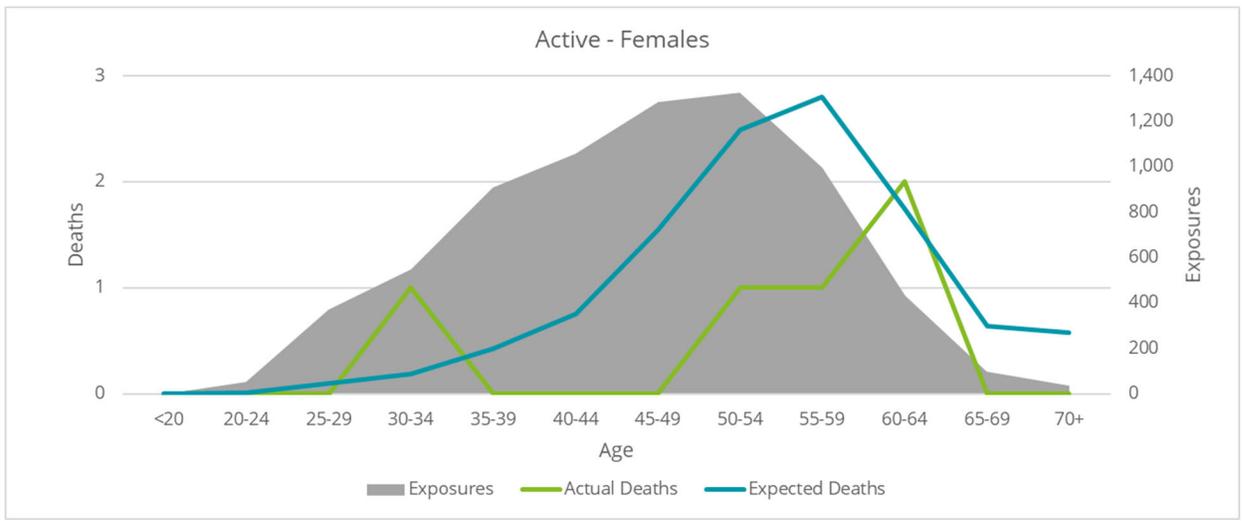
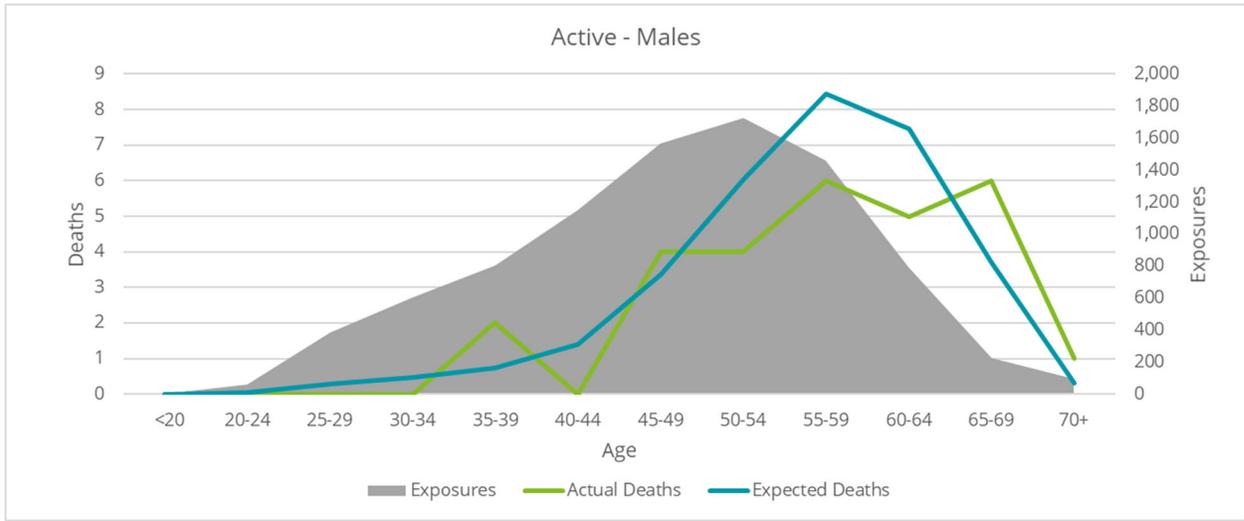
Replication of Experience Study

Using the experience study data provided by Segal from 7/1/2012 to 7/1/2016, Deloitte replicated Segal’s observed mortality rates for healthy annuitants, disabled annuitants, and active employees, separately for males and females.

In the graphs below, “Exposures” refers to the number of participants that meet the criteria of the population being studied. Using “Healthy Annuitant – Males” as an example, over the study period there were approximately 450 healthy male annuitants that were age 64 at some point during the study. Approximately 8 of them did not survive to age 65.







| Mortality - Summary | | | | |
|------------------------------|-------------------------|----------------------------|--|-------------------|
| Group | Observed Deaths - Segal | Observed Deaths - Deloitte | Expected Deaths (Valuation Assumption ¹) | Actual / Expected |
| Healthy Annuitant - Males | 353 | 350 | 332 | 1.05 |
| Healthy Annuitant - Females | 309 | 355 | 296 | 1.20 |
| Disabled Annuitant - Males | Not disclosed | 35 | 34 | 1.02 |
| Disabled Annuitant - Females | Not disclosed | 14 | 11 | 1.24 |
| Actives - Males | Not disclosed | 28 | 32 | 0.87 |
| Actives - Females | Not disclosed | 5 | 11 | 0.44 |

¹ With mortality projection applied to valuation date

Note that the mortality rates disclosed in Section 4 of Segal's 2017 actuarial valuation report do not include mortality projection to the valuation date. For purposes of determining the expected deaths, we applied mortality projections to each valuation year.

For Healthy Annuitants:

- For males, Deloitte is closely matching Segal's observed deaths. Deloitte's Actual / Expected ratio, comparing actual deaths to expected deaths based on the current valuation assumption, is 1.05, which is close to the target of 1.00. Additionally, the graph above shows the expected deaths in blue is a reasonable fit for the actual deaths in green. This implies that the assumed mortality table is a reasonable fit based on actual experience for males.
- For females, Deloitte is observing significantly more deaths than Segal. This is because in the experience study data there are 20-30 survivors (mostly female) who transitioned to a status of "non-participating" or disappeared from the data. We classified these as deaths, while Segal may have excluded them from the analysis. Since there are no benefit forms with an expiring payment period, the only way for an inactive to no longer be valued is death. We recommend the retained actuary investigate status transitions to non-participating, specifically as it applies to analyzing the mortality assumption and whether these participants should be included or excluded.
- For females, the Actual / Expected Ratio is 1.20, and per the graph above the expected deaths in blue appears to be too low compared to actual deaths in green, particularly at ages 59-74. This stems from the same issue as in the bullet above – Segal determined the assumption after observing a lower number of deaths than Deloitte, and therefore the assumed mortality rates are lower. The assumed mortality table may be a reasonable fit based on Segal's methodology, but based on Deloitte's methodology the assumed mortality rates appear lower than our target 1.00.

For Disabled Annuitants, Segal did not disclose the observed deaths. It appears that Segal recommended the same adjustment factor as for Healthy Annuitants. Due to the small number of actual deaths for disabled annuitants, it is reasonable that the retained actuary did not attempt to develop a separate adjustment factor for disabled lives, and instead used similar variations to the table as for healthy annuitants. For Males, the Actual / Expected was 1.02 (35 actual deaths versus 34 expected deaths). For Females, the Actual / Expected was 1.24 (14 actual deaths versus 11 expected deaths). These Actual / Expected ratios appear reasonable given variability due to the small sample size.

For Actives, Segal did not disclose the observed deaths. It appears that Segal recommended the same adjustment factor as for Healthy Annuitants. Due to the small number of actual deaths for actives, it is reasonable that the retained actuary did not attempt to develop a separate adjustment factor for active lives, and instead used similar variations to the table as for healthy annuitants. For Males, the Actual / Expected was 0.87 (28 actual deaths versus 32 expected deaths). For Females, the Actual / Expected was 0.44 (5 actual deaths versus 11 expected deaths). While these Actual / Expected ratios are far from 1.00, the sample size is not nearly large enough for the retained actuary to make any reasonable adjustment to the active mortality table. The assumption appears reasonable.

Overall, we find the mortality assumption to be reasonable for healthy annuitants, disabled annuitants, and actives.

Comments and Recommendations

We have several recommendations regarding the mortality assumption:

- We recommend the retained actuary investigate status transitions to non-participating, specifically as it applies to analyzing the mortality assumption and whether these participants should be included or excluded.
- We recommend the experience study include more detail disclosing the exposures and observed deaths for each of these three groups. Additionally, if the adjustment factors for the disabled and active table are chosen to be equal to the healthy annuitant table, this should be disclosed.
- We recommend that the next experience study discuss the basis for the selection of the Blue-Collar adjustment and the multiplier adjustment, including a credibility analysis. If experience is determined to not be fully or partially credible, we recommend using a standard published mortality table. More detail should be provided to justify any adjustments to the mortality table.
- We recommend that the retained actuary explain the rationale for the selection of the SSA2016-2D mortality improvement scale. While they mention that Scale MP-2014 may be too optimistic, subsequent annual updates of MP-2014 have “scaled back” the optimism. The retained actuary should specifically explain why SSA2016-2D is a better assumption than Scale MP.
- We recommend that the next experience study review the appropriateness of updating the base mortality table to the Pub-2010 mortality tables. The mortality base table assumption should be based on more recent tables and reflect the employee base covered under the GE Fund to the extent that such plan experience is credible. At the time of the experience study, the RP-2014 mortality tables were the most current basis available and were the recommended base table for the GE Fund. The subsequent release of the Pub-2010 tables should be considered and we recommend that the appropriateness of these tables be considered for this population.

Police Officers’ Fund

Retained Actuary’s Assumption

The following table shows the current mortality assumptions for each group of participants:

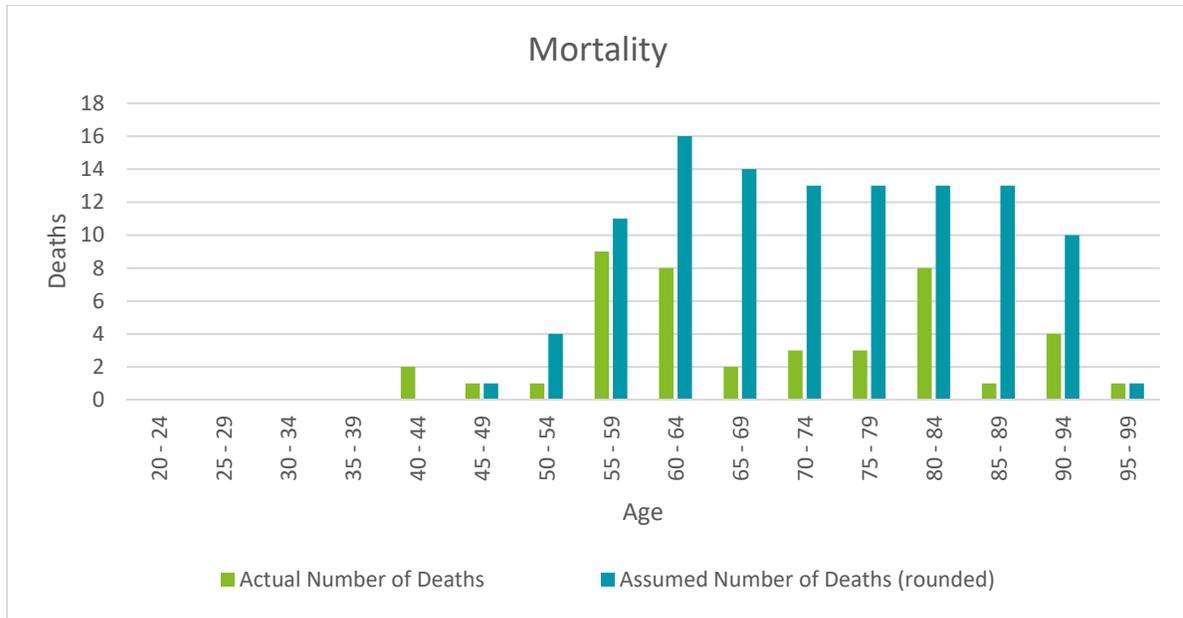
| Participant Group | Assumption |
|-------------------|---|
| Healthy Retirees | Sex-distinct rates set forth in RP-2000 Blue Collar Mortality Table, with full generational improvements in mortality using Scale AA. |

| | |
|----------------|---|
| Active Members | Sex-distinct rates set forth in RP-2000 Blue Collar Mortality Table, with full generational improvements in mortality using Scale AA; deaths prior to retirement are assumed not to be service connected. |
|----------------|---|

Experience Study Considerations

When the experience study was conducted, the mortality assumption was the RP-2000 Mortality Table for annuitants and non-annuitants projected to 2007 by Scale AA, as published by the Internal Revenue Service (IRS) for purposes of Internal Revenue Code (IRC) section 430. The following table shows the accumulated difference in expected retiree deaths to actual retiree deaths during the period January 1, 2003 through July 1, 2011:

| Age Group | Actual Number of Deaths | Assumed Number of Deaths (rounded) | Actual Deaths / Expected |
|-----------|-------------------------|------------------------------------|--------------------------|
| 20 - 24 | 0 | 0 | 0% |
| 25 - 29 | 0 | 0 | 0% |
| 30 - 34 | 0 | 0 | 0% |
| 35 - 39 | 0 | 0 | 0% |
| 40 - 44 | 2 | 0 | 0% |
| 45 - 49 | 1 | 1 | 100% |
| 50 - 54 | 1 | 4 | 25% |
| 55 - 59 | 9 | 11 | 82% |
| 60 - 64 | 8 | 16 | 50% |
| 65 - 69 | 2 | 14 | 14% |
| 70 - 74 | 3 | 13 | 23% |
| 75 - 79 | 3 | 13 | 23% |
| 80 - 84 | 8 | 13 | 62% |
| 85 - 89 | 1 | 13 | 8% |
| 90 - 94 | 4 | 10 | 40% |
| 95 - 99 | 1 | 1 | 100% |



The retained actuary mentioned several caveats with this data:

1. Because they do not collect information regarding actual retiree deaths each year, they assumed that retirees who disappear each year from the data file have died. It is possible that a small number of these retirees have returned to work or have had their monthly benefit payment stopped for some other reason.
2. Some retiree deaths may not be included since some beneficiaries in the valuation data may use the retiree's social security number and other participants may be marked as a beneficiary, making it impossible to know for certain whether all retiree deaths have been included in the study.

The retained actuary states that the results of the experience study above should not be the basis for selecting the next mortality assumption, due to the caveats outlined above as well as the small sample size.

The retained actuary concluded that the data was of insufficient quality to support an assumption change.

Effective July 1, 2013, the mortality basis was changed from the RP-2000 Mortality Table, projected to 2007 by Scale AA, to the RP-2000 Mortality Table, projected to 2015 by Scale AA, both as published by the Internal Revenue Service (IRS) for purposes of Internal Revenue Code (IRC) section 430.

Effective July 1, 2017, the mortality improvement scale was changed from Scale AA, projected to 2015, to Scale AA with generational projections.

Comments and Recommendations

We have several recommendations regarding the mortality assumption:

- We recommend that the retained actuary and the City consider a data clean-up effort to enhance the data collection and data transformation process to be able to rely on plan experience.
- We recommend the experience study make a clear recommendation for the mortality assumption, or clearly state that they are proposing no change to the assumption.
- We recommend that the next experience study contain more analysis on industry-standard tables. The retained actuary states that the experience study data cannot be relied upon for selecting the assumption. If that is the case, the retained actuary should provide a much more detailed analysis on industry-standard tables available, such as the RP-2014 tables or the Pub-2010 tables.
- We recommend the retained actuary consider credibility analysis to support the selection of their assumption.
- We recommend that the mortality assumption be based on more recently published tables and reflect the employee base covered under the Police Officers' Fund to the extent that such plan experience is credible. The RP-2000 tables were published in 2000 and based on data from 1990 to 1994. For mortality base tables, the most recently available tables are not necessarily the best fit for the plan if the plan has at least partially credible data and can prove otherwise. However, the subsequent release of the Pub-2010 tables should be considered and we recommend that the appropriateness of these tables be considered for this population.
- The valuation report states that the mortality assumption was changed effective July 1, 2013, and again at July 1, 2017. We recommend that the valuation report provide an explanation of the rationale for the current assumption.
- We recommend updating the improvement scale to a more recently published table or provide a rationale for the selection of the scale being used. Improvement Scale AA was published in 1995 and is based on data from the Social Security Administration through 1993. Updated versions of improvement scale MP are published each year.

Firefighters' Fund

Retained Actuary's Assumption

The following table shows the current mortality assumptions for each group of participants:

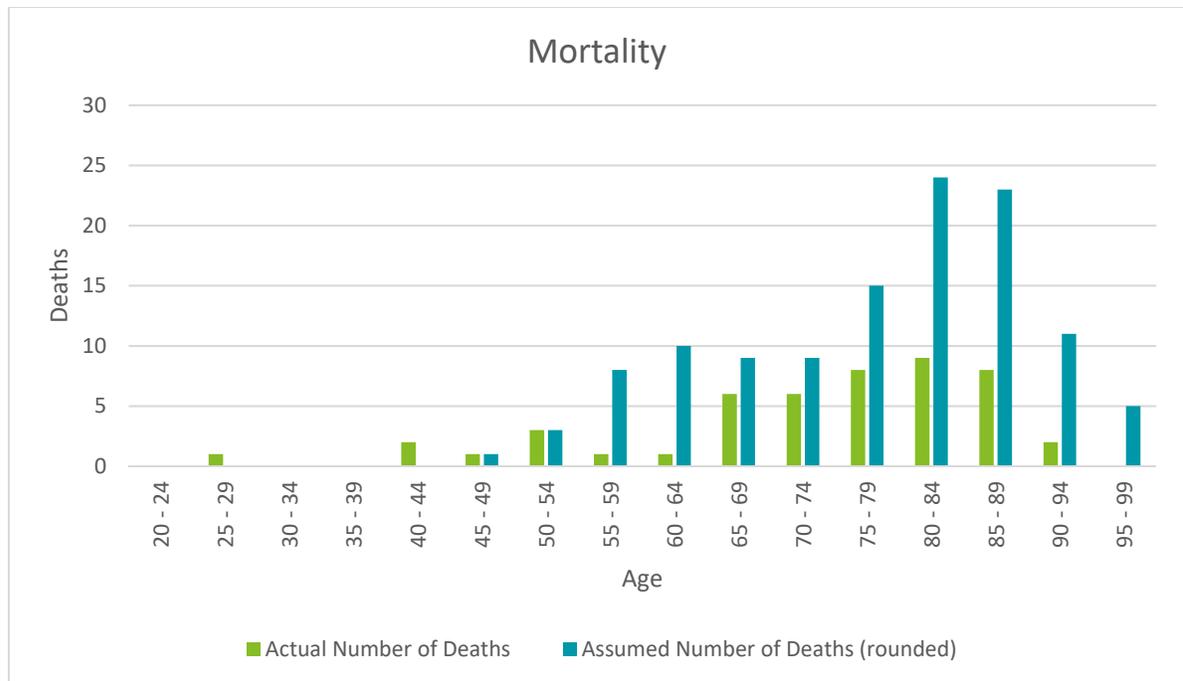
| Participant Group | Assumption |
|-------------------|---|
| Healthy Retirees | Sex-distinct rates set forth in RP-2000 Blue Collar Mortality Table, with full generational improvements in mortality using Scale AA. |
| Active Members | Sex-distinct rates set forth in RP-2000 Blue Collar Mortality Table, with full generational improvements in |

| | |
|--|---|
| | mortality using Scale AA; deaths prior to retirement are assumed not to be service connected. |
|--|---|

Experience Study Considerations

When the experience study was conducted, the mortality assumption was the RP-2000 Mortality Table for annuitants and non-annuitants projected to 2007 by Scale AA, as published by the Internal Revenue Service (IRS) for purposes of Internal Revenue Code (IRC) section 430. The following table shows the accumulated difference in expected retiree deaths to actual retiree deaths during the period January 1, 2003 through July 1, 2011:

| Age Group | Actual Number of Deaths | Assumed Number of Deaths (rounded) | Actual Deaths / Expected |
|-----------|-------------------------|------------------------------------|--------------------------|
| 20 – 24 | 0 | 0 | 0% |
| 25 – 29 | 1 | 0 | 0% |
| 30 – 34 | 0 | 0 | 0% |
| 35 – 39 | 0 | 0 | 0% |
| 40 – 44 | 2 | 0 | 0% |
| 45 – 49 | 1 | 1 | 100% |
| 50 – 54 | 3 | 3 | 100% |
| 55 – 59 | 1 | 8 | 13% |
| 60 – 64 | 1 | 10 | 10% |
| 65 – 69 | 6 | 9 | 67% |
| 70 – 74 | 6 | 9 | 67% |
| 75 – 79 | 8 | 15 | 53% |
| 80 – 84 | 9 | 24 | 38% |
| 85 – 89 | 8 | 23 | 35% |
| 90 – 94 | 2 | 11 | 18% |
| 95 – 99 | 0 | 5 | 0% |



The retained actuary mentioned several caveats with this data:

1. Because they do not collect information regarding actual retiree deaths each year, they assumed that retirees who disappear each year from the data file have died. It is possible that a small number of these retirees have returned to work or have had their monthly benefit payment stopped for some other reason.
2. Some retiree deaths may not be included since some beneficiaries in the valuation data may use the retiree's social security number and other participants may be marked as a beneficiary, making it impossible to know for certain whether all retiree deaths have been included in the study.

The retained actuary warns the reader that the results of the experience study above should not be the basis for selecting the next mortality assumption, due to the caveats outlined above as well as the small sample size.

The retained actuary does not make a recommendation in the experience study.

Effective July 1, 2013, the mortality basis was changed from the RP-2000 Mortality Table, projected to 2007 by Scale AA, to the RP-2000 Mortality Table, projected to 2015 by Scale AA, both as published by the Internal Revenue Service (IRS) for purposes of Internal Revenue Code (IRC) section 430.

Effective July 1, 2017, the mortality improvement scale was changed from Scale AA, projected to 2015, to Scale AA with generational projections.

Comments and Recommendations

We have several recommendations regarding the mortality assumption:

- We recommend that the retained actuary and the City consider a data clean-up effort to enhance the data collection and data transformation process to be able to rely on plan experience.
- We recommend the experience study make a clear recommendation for the mortality assumption, or clearly state that they are proposing no change to the assumption.
- We recommend that the experience study contain more analysis on industry-standard tables. The retained actuary states that the experience study data cannot be relied upon for selecting the assumption. If that is the case, the retained actuary should provide a much more detailed analysis on industry-standard tables available, such as the RP-2014 tables or the Pub-2010 tables.
- We recommend the retained actuary consider credibility analysis to support the selection of their assumption.
- We recommend that the mortality assumption be based on more recently published tables and reflect the employee base covered under the Firefighters' Fund to the extent that such plan experience is credible. The RP-2000 tables were published in 2000 and based on data from 1990 to 1994. For mortality base tables, the most recently available tables are not necessarily the best fit for the plan if the plan has at least partially credible data and can prove otherwise. However, the subsequent release of the Pub-2010 tables should be considered and we recommend that the appropriateness of these tables be considered for this population.
- The valuation report states that the mortality assumption was changed effective July 1, 2013, and again at July 1, 2017. We recommend that the valuation report provide an explanation of the rationale for the current assumption.
- We recommend updating the improvement scale to a more recently published table or provide a rationale for the selection of the scale being used. Improvement Scale AA was published in 1995 and is based on data from the Social Security Administration through 1993. Updated versions of improvement scale MP are published each year.

Retirement

The retirement assumption is used to determine when an employee is expected to commence benefits.

Actuarial Standards

ASOP No. 35, Section 3.5.1 — Retirement—*The actuary should take into account factors such as the following:*

- a. *employer-specific or job-related factors such as occupation, employment policies, work environment, unionization, hazardous conditions, and location of employment;*
- b. *the plan design, where specific incentives may influence when participants retire;*
- c. *the design of, and date of anticipated payment from, social insurance programs (for example, Social Security or Medicare); and*
- d. *the availability of other employer-sponsored postretirement benefit programs (for example, postretirement health coverage or savings plan).*

GE Fund

Retained Actuary's Assumption

The plan uses a separate retirement assumption for members with less than or greater than 30 years of service:

| Less than 30 Years of Service Rate | | 30 or More Years of Service Rate | |
|------------------------------------|------|----------------------------------|------|
| Age | Rate | Age | Rate |
| 50-52 | 2% | 50-52 | 30% |
| 53-54 | 3% | 53-54 | 30% |
| 55 | 5% | 55 | 30% |
| 56 | 6% | 56 | 30% |
| 57 | 6% | 57 | 35% |
| 58-59 | 7% | 58-59 | 35% |
| 60 | 20% | 60 | 35% |
| 61-64 | 15% | 61-64 | 20% |
| 65-66 | 25% | 65-66 | 25% |
| 67-68 | 15% | 67-68 | 25% |
| 69 | 25% | 69 | 25% |
| 70 | 100% | 70 | 100% |

Members retiring from inactive status are assumed to retire uniformly at age 60.

Experience Study Considerations

The retained actuary considered data over the study period to evaluate the retirement assumption. Participants over age 70 were ignored. Rates were considered separately for those with less than 30 years of service and greater than 30 years of service because those hired prior to November 1, 2011 are eligible for unreduced early retirement at 30 years of service. The results of the study are as follows:

| Service | Actual | Expected | Percent of Expected |
|--------------------|--------|----------|---------------------|
| Less than 30 Years | 407 | 393 | 104% |
| 30 or More Years | 97 | 125 | 78% |

The retained actuary also included graphs showing the actual versus expected retirement rates by age, separated for those with less than and greater than 30 years of service. For those with under 30 years of experience, actual rates matched expected rates quite well, and no change was proposed. For those with greater than 30 years of experience, the retained actuary recommended decreasing the rates between ages 53 and 64 to more closely match the observed experience.

Additionally, the retained actuary noted that new plan provisions were effective for participants hired after October 31, 2011, which may impact future retirement patterns. These participants were not included in the analysis or contemplated in the proposed assumptions.

Replication of Experience Study

Using the experience study data provided by Segal from 7/1/2012 to 7/1/2016, we replicated Segal's observed retirement rates for active participants who have less than 30 years of service and those who have more than 30 years of service.

The results of our analysis are as follows:

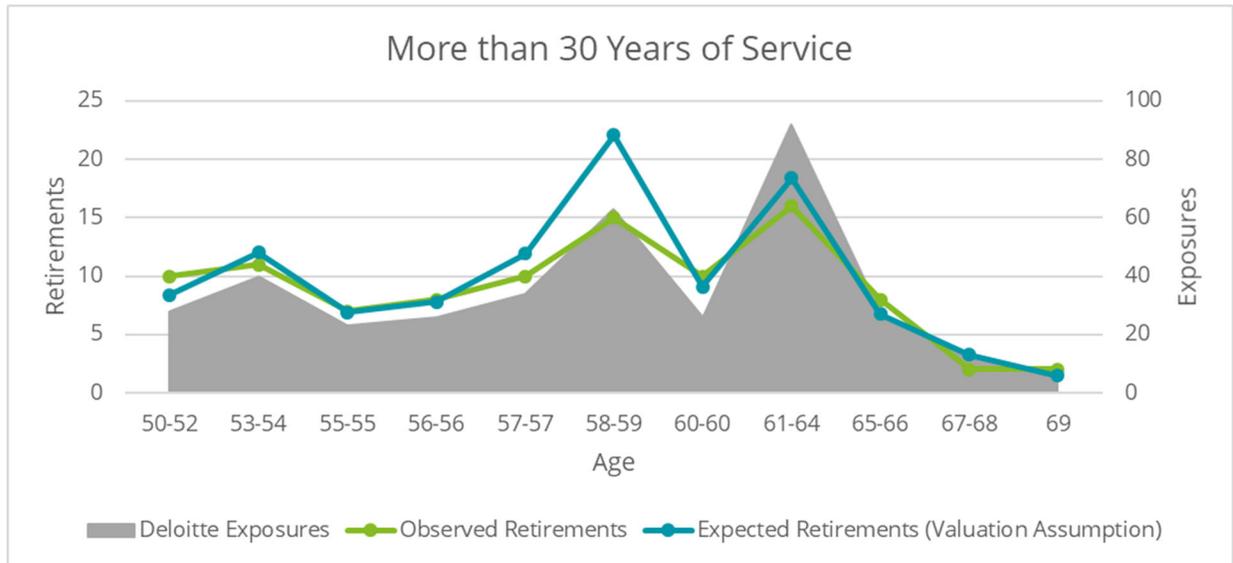
| Less than 30 years of Service | | | | | | |
|-------------------------------|--------------------|----------------------|--------------------------|----------------------|---|-----------------|
| Age | Deloitte Exposures | Observed Retirements | Observed Retirement Rate | Valuation Assumption | Expected Retirements (Valuation Assumption) | Actual/Expected |
| <50 ¹ | 3,140 | 100 | 3.2% | 0.0% | 0 | N/A |
| 50-52 | 1,258 | 58 | 4.6% | 2.0% | 25 | 2.31 |
| 53-54 | 768 | 46 | 6.0% | 3.0% | 23 | 2.00 |
| 55-55 | 370 | 23 | 6.2% | 5.0% | 19 | 1.24 |
| 56-56 | 341 | 19 | 5.6% | 6.0% | 20 | 0.93 |
| 57-57 | 321 | 27 | 8.4% | 6.0% | 19 | 1.40 |
| 58-59 | 569 | 53 | 9.3% | 7.0% | 40 | 1.33 |
| 60-60 | 235 | 56 | 23.8% | 20.0% | 47 | 1.19 |
| 61-64 | 511 | 94 | 18.4% | 15.0% | 77 | 1.23 |
| 65-66 | 117 | 29 | 24.8% | 25.0% | 29 | 0.99 |
| 67-68 | 60 | 10 | 16.7% | 15.0% | 9 | 1.11 |
| 69 | 27 | 5 | 18.5% | 25.0% | 7 | 0.74 |
| Subtotal | 4,577 | 420 | 9.2% | 6.9% | 315 | 1.33 |
| 70+ ¹ | 84 | 14 | 16.7% | 100.0% | 84 | 0.17 |

¹ Segal did not consider these ages in the experience study



| More than 30 years of Service | | | | | | |
|-------------------------------|--------------------|----------------------|--------------------------|----------------------|---|-----------------|
| Age | Deloitte Exposures | Observed Retirements | Observed Retirement Rate | Valuation Assumption | Expected Retirements (Valuation Assumption) | Actual/Expected |
| <50 ¹ | 4 | 1 | 25.0% | 0.0% | 0 | N/A |
| 50-52 | 28 | 10 | 35.7% | 30.0% | 8 | 1.19 |
| 53-54 | 40 | 11 | 27.5% | 30.0% | 12 | 0.92 |
| 55-55 | 23 | 7 | 30.4% | 30.0% | 7 | 1.01 |
| 56-56 | 26 | 8 | 30.8% | 30.0% | 8 | 1.03 |
| 57-57 | 34 | 10 | 29.4% | 35.0% | 12 | 0.84 |
| 58-59 | 63 | 15 | 23.8% | 35.0% | 22 | 0.68 |
| 60-60 | 26 | 10 | 38.5% | 35.0% | 9 | 1.10 |
| 61-64 | 92 | 16 | 17.4% | 20.0% | 18 | 0.87 |
| 65-66 | 27 | 8 | 29.6% | 25.0% | 7 | 1.19 |
| 67-68 | 13 | 2 | 15.4% | 25.0% | 3 | 0.62 |
| 69 | 6 | 2 | 33.3% | 25.0% | 2 | 1.33 |
| Subtotal | 378 | 99 | 26.2% | 28.6% | 108 | 0.92 |
| 70+ ¹ | 26 | 3 | 11.5% | 100.0% | 26 | 0.12 |

¹ Segal did not consider these ages in the experience study



For purposes of determining a retirement exposure and an observed retirement, we relied the participant's age and service during the exposure year. If the participant was retirement eligible based on age, service, and benefit tier, they counted as a retirement exposure. If a retirement-eligible participant transitioned from active to inactive, they counted as an observed retirement, regardless of whether their inactive status code was "Retiree" or an alternative status. This methodology may differ from that which Segal used, resulting in actual and expected retirements differing as well.

For participants with under 30 years of service, the Actual/Expected Ratio is 1.33:

- Deloitte's observed actual retirements of 420 closely aligns to Segal's observed retirements of 407.
- The retained actuary recommended no change to the assumption in the experience study. Therefore, we would expect Deloitte's expected retirements (based on the current valuation assumption) to match the 397 expected retirements shown in the experience study report. However, Deloitte only observed 315 expected retirements. We are not certain of the retained actuary's methodology, but the reason for this difference is likely due to the difference in methodology for determining retirement eligibility as described above. For example, the retained actuary states that "withdrawal rates do not apply at or beyond the later of eligibility for early retirement or age 55". They could be including all actives over age 55 in the "retirement bucket", even if not eligible for retirement, which could explain the higher number of expected retirements from the retained actuary.
- Because Deloitte has significantly fewer expected retirements than Segal, our Actual/Expected ratio is 1.33, which is quite high.
- There is more than one reasonable way to assess and determine a retirement assumption. Segal's assumption is not necessarily unreasonable. However, we recommend they review their methodology for determining expected retirements, taking into consideration the plan provisions for retirement eligibility.

For participants with over 30 years of service, the Actual/Expected ratio is 0.92:

- Deloitte's observed actual retirements of 108 aligns relatively closely to Segal's observed retirements of 97.
- Unlike for under 30 years of service, the retained actuary did recommend a change to the assumption in the experience study, so the expected retirements from the experience study are not relevant since they are based on the prior assumption. The Actual/Expected ratio of 0.92 shown above compares plan experience over the study period to the current valuation assumption.
- Again, the same differences in methodology as described above apply here – Deloitte is determining retirement eligibility strictly based on age, service, and benefit tier, while Segal might be doing something different. However, the differences here are not as significant, as participants with over 30 years of service are very likely to be retirement eligible, so there will not be as much (if any) ambiguity between the retirement and withdrawal groups. This explains why the Actual/Expected ratio is closer to 1.00.

Comments and Recommendations

We have several recommendations regarding the retirement assumption:

- We recommend that Segal reviews their methodology for determining expected retirements, taking into consideration the plan provisions for retirement eligibility.
- We recommend the experience study include more detail, such as the exposures and observed retirements by age group and service level. We recommend the experience study include a more detailed breakout, such as what is shown in our tables above.
- We recommend that the retained actuary consider studying the retirement behavior of deferred vested participants.
- We recommend that the retained actuary develop a retirement assumption for those hired after October 31, 2011 and provide detail in the valuation on the basis for the selection of these assumptions. While there may not be sufficient experience to analyze their retirement behavior until they begin to retire, based on the changes in the benefits and retirement criteria, we would expect these employees to generally work longer.
- We recommend that the next experience study consider whether the use of liability-weighted retirement may provide a better fit for the valuation than headcount-weighted retirement.

Police Officers' Fund

Retained Actuary's Assumption

Retirement is assumed to occur at normal retirement age.

Experience Study Considerations

This assumption was not considered during the July 1, 2011 experience study.

Comments and Recommendations

Retirement is a significant assumption for pension plans, especially considering potential early retirement subsidies. Assuming retirement at a single age may be appropriate when the early retirement is not subsidized however it is not as accurate as an age or service-based mortality table, especially for projecting benefit payments.

We recommend that the retained actuary study the retirement assumption and consider an age and/or service-based assumption. An Actual/Expected analysis should be performed to assist in developing an appropriate assumption. Additionally, specific plan provisions should be taken into account, such as eligibility for unreduced retirement (as is considered for the GE Fund).

Firefighters' Fund**Retained Actuary's Assumption**

Retirement is assumed to occur at normal retirement age.

Experience Study Considerations

This assumption was not considered during the July 1, 2011 experience study.

Comments and Recommendations

Retirement is a significant assumption for pension plans, especially considering potential early retirement subsidies. Assuming retirement at a single age may be appropriate when the early retirement is not subsidized however it is not as accurate as an age or service-based mortality table, especially for projecting benefit payments.

We recommend that the retained actuary study the retirement assumption and consider an age and/or service-based assumption. An Actual/Expected analysis should be performed to assist in developing an appropriate assumption. Additionally, specific plan provisions should be taken into account, such as eligibility for unreduced retirement (as is considered for the GE Fund).

Withdrawal

The withdrawal assumption is used to determine when an employee who is not eligible for retirement will terminate employment.

Actuarial Standards

ASOP No. 35, Section 3.5.2 — Termination of Employment—The actuary should take into account factors such as the following:

- a. *employer-specific or job-related factors such as occupation, employment policies, work environment, unionization, hazardous conditions, and location of employment; and*
- b. *plan provisions, such as early retirement benefits, vesting schedule, or payout options.*

GE Fund

Retained Actuary's Assumption

The plan uses service-based withdrawal rates as follows:

| Years of Service | Rate | Years of Service | Rate |
|------------------|--------|------------------|-------|
| Less than 1 | 18.00% | 8 | 6.50% |
| 1 | 15.00% | 9 | 5.50% |
| 2 | 12.00% | 10 | 5.00% |
| 3 | 11.00% | 11 | 4.50% |
| 4 | 10.00% | 12 | 4.00% |
| 5 | 9.00% | 13 | 3.50% |
| 6 | 7.00% | 14 | 3.00% |
| 7 | 7.00% | 15 or more | 2.50% |

Withdrawal rates do not apply for members eligible for retirement or who have reached age 55.

Experience Study Considerations

The retained actuary considered data over the study period to evaluate the withdrawal assumption. The retained actuary found that actual withdrawals were lower than expected for participants with less than two years of service and were in line with expected for those with two or more years of service. The retained actuary also found that there were no major differences between males and females. The following table summarizes the withdrawal experience:

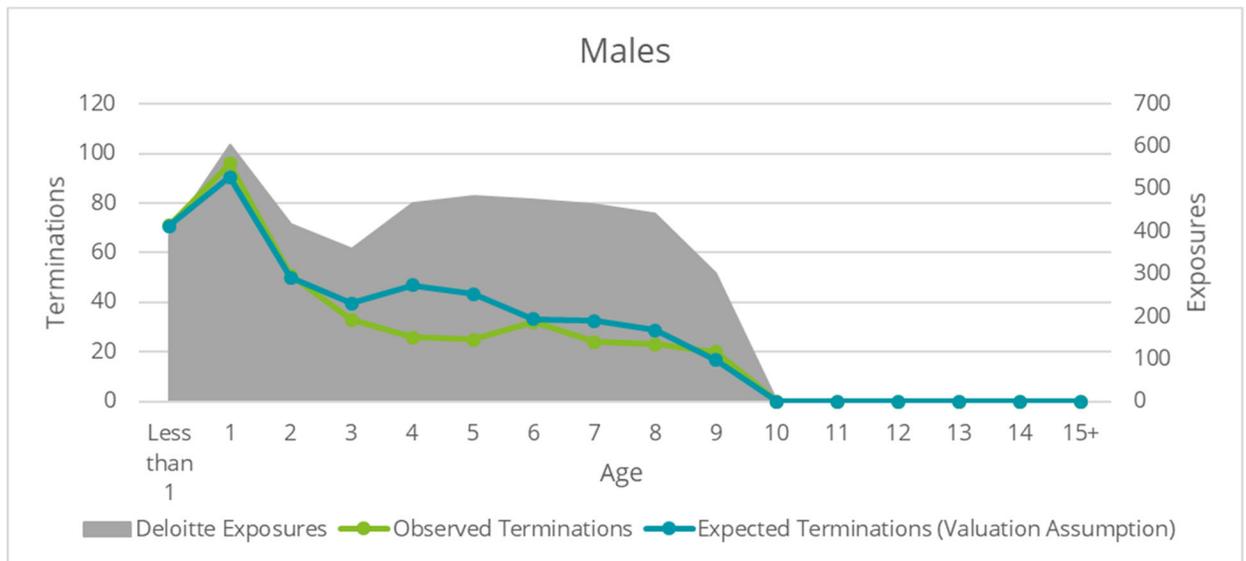
| Group | Less than 2 Years | | 2 or More Years | | Total | | % of Expected |
|---------|-------------------|----------|-----------------|----------|--------|----------|---------------|
| | Actual | Expected | Actual | Expected | Actual | Expected | |
| Total | 301 | 429 | 526 | 529 | 827 | 958 | 86% |
| Males | 167 | 230 | 276 | 288 | 443 | 518 | 86% |
| Females | 134 | 199 | 250 | 241 | 384 | 440 | 87% |

Based on the results of the experience study the retained actuary maintained a service-based table with no difference in rates by gender and decreased the rates for participants with less than two years of service.

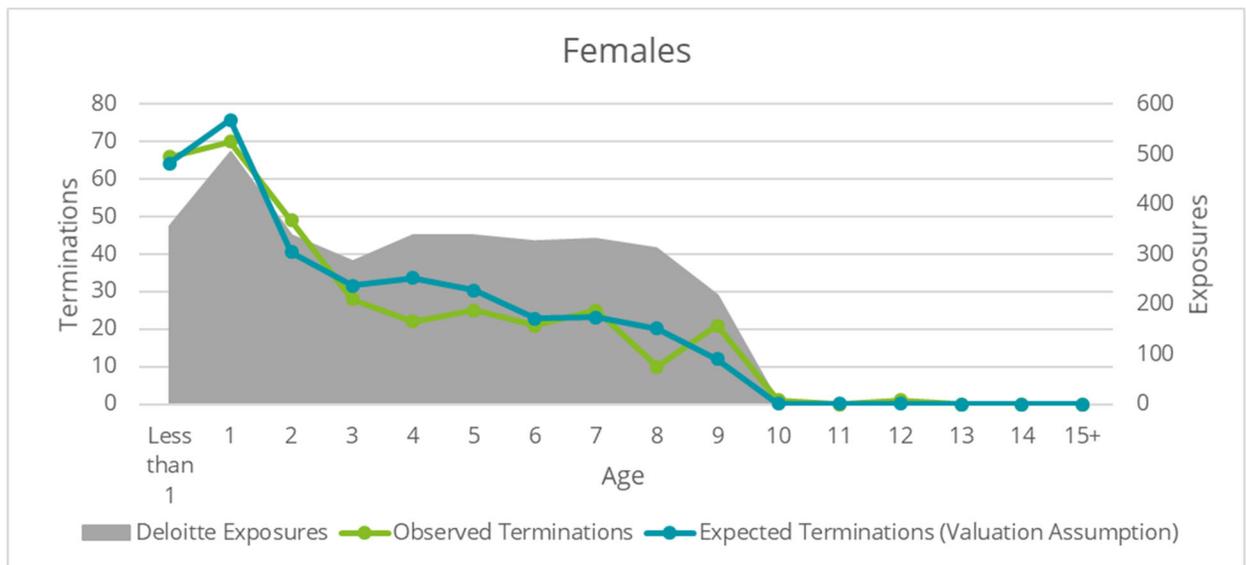
Replication of Experience Study

Using the experience study data provided by Segal from 7/1/2012 to 7/1/2016, we replicated Segal's observed termination rates for active participants, broken out by less than or greater than 2 years of service and gender.

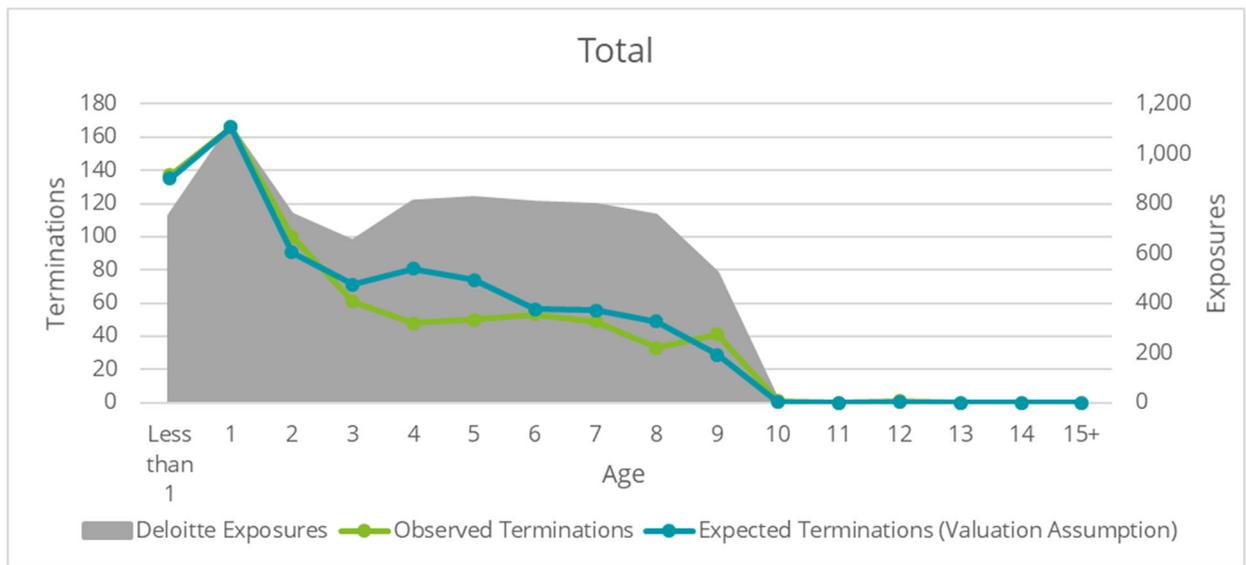
| Males | | | | | | |
|------------------------|--------------------|-----------------------|---------------------------|----------------------|--|-----------------|
| Years of Service | Deloitte Exposures | Observed Terminations | Observed Termination Rate | Valuation Assumption | Expected Terminations (Valuation Assumption) | Actual/Expected |
| Less than 1 | 393 | 71 | 18.1% | 18.0% | 71 | 1.00 |
| 1 | 603 | 96 | 15.9% | 15.0% | 90 | 1.06 |
| Less than 2 (Subtotal) | 996 | 167 | 16.8% | 16.2% | 161 | 1.04 |
| 2 | 416 | 51 | 12.3% | 12.0% | 50 | 1.02 |
| 3 | 359 | 33 | 9.2% | 11.0% | 39 | 0.84 |
| 4 | 468 | 26 | 5.6% | 10.0% | 47 | 0.56 |
| 5 | 482 | 25 | 5.2% | 9.0% | 43 | 0.58 |
| 6 | 476 | 32 | 6.7% | 7.0% | 33 | 0.96 |
| 7 | 464 | 24 | 5.2% | 7.0% | 32 | 0.74 |
| 8 | 441 | 23 | 5.2% | 6.5% | 29 | 0.80 |
| 9 | 303 | 20 | 6.6% | 5.5% | 17 | 1.20 |
| 10 | 1 | 0 | 0.0% | 5.0% | 0 | 0.00 |
| 11 | 0 | 0 | 0.0% | 4.5% | 0 | 0.00 |
| 12 | 2 | 0 | 0.0% | 4.0% | 0 | 0.00 |
| 13 | 2 | 0 | 0.0% | 3.5% | 0 | 0.00 |
| 14 | 2 | 0 | 0.0% | 3.0% | 0 | 0.00 |
| 15+ | 0 | 0 | 0.0% | 2.5% | 0 | 0.00 |
| 2 or More (Subtotal) | 3,416 | 234 | 6.9% | 8.5% | 291 | 0.80 |
| Total | 4,412 | 401 | 9.1% | 10.2% | 452 | 0.89 |



| Females | | | | | | |
|------------------------|--------------------|-----------------------|---------------------------|----------------------|--|-----------------|
| Years of Service | Deloitte Exposures | Observed Terminations | Observed Termination Rate | Valuation Assumption | Expected Terminations (Valuation Assumption) | Actual/Expected |
| Less than 1 | 357 | 66 | 18.5% | 18.0% | 64 | 1.03 |
| 1 | 505 | 70 | 13.9% | 15.0% | 76 | 0.92 |
| Less than 2 (Subtotal) | 862 | 136 | 15.8% | 16.2% | 140 | 0.97 |
| 2 | 338 | 49 | 14.5% | 12.0% | 41 | 1.21 |
| 3 | 287 | 28 | 9.8% | 11.0% | 32 | 0.89 |
| 4 | 337 | 22 | 6.5% | 10.0% | 34 | 0.65 |
| 5 | 338 | 25 | 7.4% | 9.0% | 30 | 0.82 |
| 6 | 327 | 21 | 6.4% | 7.0% | 23 | 0.92 |
| 7 | 331 | 25 | 7.6% | 7.0% | 23 | 1.08 |
| 8 | 311 | 10 | 3.2% | 6.5% | 20 | 0.49 |
| 9 | 218 | 21 | 9.6% | 5.5% | 12 | 1.75 |
| 10 | 1 | 1 | 100.0% | 5.0% | 0 | 20.00 |
| 11 | 1 | 0 | 0.0% | 4.5% | 0 | 0.00 |
| 12 | 1 | 1 | 100.0% | 4.0% | 0 | 25.00 |
| 13 | 0 | 0 | 0.0% | 3.5% | 0 | 0.00 |
| 14 | 0 | 0 | 0.0% | 3.0% | 0 | 0.00 |
| 15+ | 0 | 0 | 0.0% | 2.5% | 0 | 0.00 |
| 2 or More (Subtotal) | 2,490 | 203 | 8.2% | 8.6% | 215 | 0.95 |
| Total | 3,352 | 339 | 10.1% | 10.6% | 355 | 0.96 |



| Total | | | | | | |
|------------------------|--------------------|-----------------------|---------------------------|----------------------|--|-----------------|
| Years of Service | Deloitte Exposures | Observed Terminations | Observed Termination Rate | Valuation Assumption | Expected Terminations (Valuation Assumption) | Actual/Expected |
| Less than 1 | 750 | 137 | 18.3% | 18.0% | 135 | 1.01 |
| 1 | 1,108 | 166 | 15.0% | 15.0% | 166 | 1.00 |
| Less than 2 (Subtotal) | 1,858 | 303 | 16.3% | 16.2% | 301 | 1.01 |
| 2 | 754 | 100 | 13.3% | 12.0% | 90 | 1.11 |
| 3 | 646 | 61 | 9.4% | 11.0% | 71 | 0.86 |
| 4 | 805 | 48 | 6.0% | 10.0% | 81 | 0.60 |
| 5 | 820 | 50 | 6.1% | 9.0% | 74 | 0.68 |
| 6 | 803 | 53 | 6.6% | 7.0% | 56 | 0.94 |
| 7 | 795 | 49 | 6.2% | 7.0% | 56 | 0.88 |
| 8 | 752 | 33 | 4.4% | 6.5% | 49 | 0.68 |
| 9 | 521 | 41 | 7.9% | 5.5% | 29 | 1.43 |
| 10 | 2 | 1 | 50.0% | 5.0% | 0 | 10.00 |
| 11 | 1 | 0 | 0.0% | 4.5% | 0 | 0.00 |
| 12 | 3 | 1 | 33.3% | 4.0% | 0 | 8.33 |
| 13 | 2 | 0 | 0.0% | 3.5% | 0 | 0.00 |
| 14 | 2 | 0 | 0.0% | 3.0% | 0 | 0.00 |
| 15+ | 0 | 0 | 0.0% | 2.5% | 0 | 0.00 |
| 2 or More (Subtotal) | 5,906 | 437 | 7.4% | 8.6% | 506 | 0.86 |
| Total | 9,622 | 1,043 | 10.8% | 11.5% | 1,108 | 0.94 |



Similar to the retirement assumption, we relied on the participant’s age and service during the exposure year to determine whether they were retirement eligible. If the participant was retirement eligible based on age, service, and benefit tier, they counted as a retirement exposure. If not, they counted as a termination exposure. This methodology may differ from what the retained actuary used. The table below shows the actual terminations observed by Deloitte compared to Segal:

| Observed Terminations | | | | | | |
|-----------------------|------------------------------|----------|----------------------------|----------|-------|----------|
| Group | Less than 2 Years of Service | | 2 or More Years of Service | | Total | |
| | Segal | Deloitte | Segal | Deloitte | Segal | Deloitte |
| Male | 167 | 167 | 276 | 234 | 443 | 401 |
| Female | 134 | 136 | 250 | 203 | 384 | 339 |
| Total | 301 | 303 | 526 | 437 | 827 | 740 |

For participants with less than 2 Years of Service, we match Segal quite closely. However, for participants with 2 or more Years of Service, Deloitte is showing significantly fewer observed terminations than Segal. This is because if an active who meets the age and service criteria for retirement eligibility transitions to inactive status, Deloitte classifies them as a retirement, thereby excluding them from the termination exposure count, whereas Segal may classify them as a termination based on their methodology.

In the experience study report, Segal proposed modifying the assumption for less than 2 years of service. We see above that for males and females combined, the Actual/Expected is 1.01 for less than two years of service (comparing actual experience to the valuation assumption). Therefore, we find Segal's proposed adjustment to the assumption for those with less than 2 years of service reasonable.

Segal did not propose modifying the assumption for those with 2 or more years of service because based on their methodology, the Actual / Expected was reasonable using the prior assumption. However, using Deloitte's methodology, the Actual/Expected ratio is 0.86. Similar to the retirement assumption, we recommend the retained actuary review their methodology for determining expected and actual retirements versus terminations, taking into consideration the plan provisions for retirement eligibility. The difference in methodology between Deloitte and Segal is likely causing the Actual/Expected ratio to be on the low side.

Additionally, as seen in the graphs above, based on Deloitte's methodology, Females show consistently higher termination rates for 2 or more years of service. We recommend the retained actuary consider applying a gender-specific table.

Comments and Recommendations

The withdrawal assumption is based on years of service. This is a robust basis for the assumption because it reflects the general tendency of shorter-tenured employees to incur higher rates of turnover. The assumed rates reflect higher expected turnover within the first several years of service, which is not uncommon. Based on the information provided, the withdrawal assumption appears reasonable.

We recommend adding a separate withdrawal assumption for employees hired after November 1, 2011. As their benefits are less valuable, withdrawal rates may increase as participants are less likely to remain with the City to preserve their pension benefits. Unlike the retirement assumption, which will take 20-30 years to develop meaningful experience, termination rates, especially for early years of service, can be immediately studied.

We recommend the experience study include more detail, such as the exposures and observed terminations for each year of service. We recommend the experience study include a more detailed breakout, such as what is shown in our tables above.

We recommend that Segal review their methodology for determining expected and actual retirements versus terminations, taking into consideration the plan provisions for retirement eligibility.

We also recommend that the next experience study consider the use of liability weighted withdrawal as opposed to headcount weighted withdrawal, as level of salary can influence termination behavior.

Police Officers' Fund

Retained Actuary's Assumption

Withdrawal rates were derived from a study of actual plan experience covering the period 1982 through 1986. A sample of the withdrawal rates is set forth in the following table:

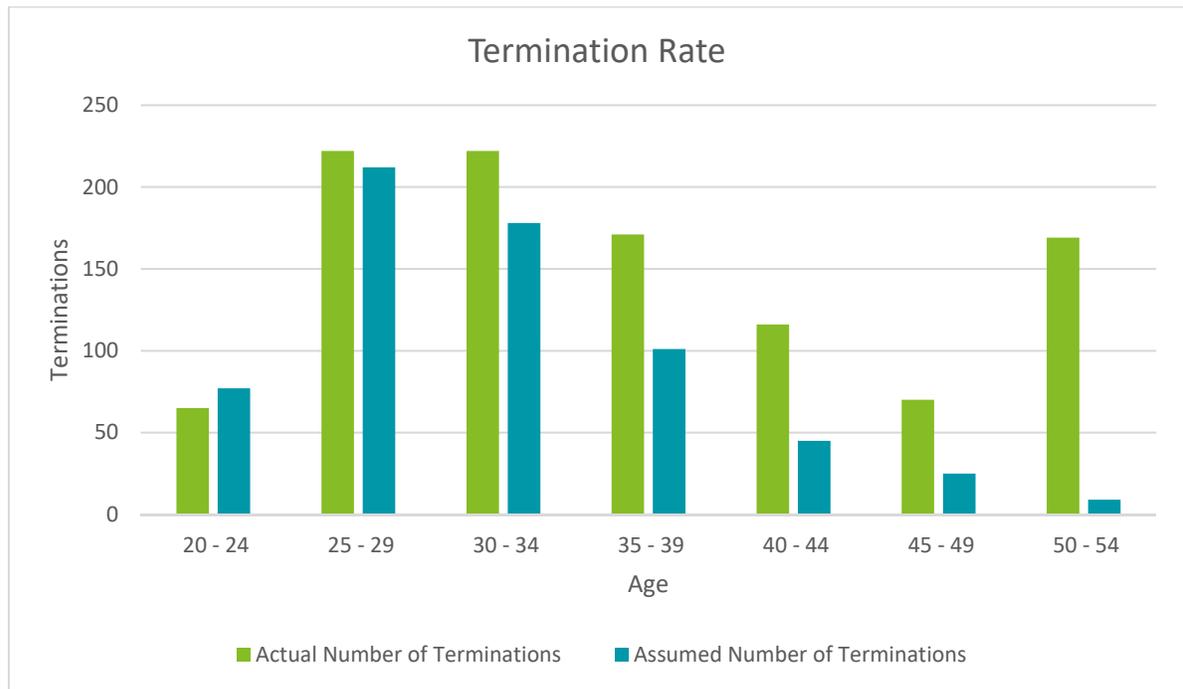
| Age | Rate |
|-----|--------|
| 20 | 15.00% |
| 25 | 11.40% |
| 30 | 7.80% |
| 35 | 4.90% |
| 40 | 2.30% |
| 45 | 1.35% |
| 50 | 0.96% |
| 55 | 0.00% |

Experience Study Considerations

The retained actuary considered the actual withdrawal rates compared to the assumed rates during the period January 1, 2003 through June 30, 2011.

| Age Group | Actual Number of Terminations | Assumed Number of Terminations (rounded) | Actual / Expected |
|-----------|-------------------------------|--|-------------------|
| 20 - 24 | 65 | 77 | 84% |
| 25 - 29 | 222 | 212 | 105% |
| 30 - 34 | 222 | 178 | 125% |
| 35 - 39 | 171 | 101 | 169% |
| 40 - 44 | 116 | 45 | 258% |
| 45 - 49 | 70 | 25 | 280% |

| | | | |
|---------|-----|---|-------|
| 50 - 54 | 169 | 9 | 1878% |
|---------|-----|---|-------|



The retained actuary caveats this data:

1. The retained actuary does not know the reason that an active employee disappears from the active database. For example, some of the participants shown above as being terminated may have retired or died.
2. The retained actuary believes the sample size is too small to provide reasonable and reliable results.

The retained actuary notes that the actual number of terminations exceeds the expected number and suggests that the Pension Board increase the termination assumption. However, they recommend using an industry-standard table instead of basing the assumption on observed experience.

Ultimately, the assumption was not changed, and the July 1, 2017 assumption is still based on plan experience from 1982 to 1986.

Comments and Recommendations

The withdrawal assumption is based on age. This is a robust basis for the assumption because it reflects the general tendency of younger employees to incur higher rates of turnover. The assumed rates reflect higher expected turnover for younger employees, which is not uncommon. Based on the information provided however the assumption that older employees will terminate at a lower rate should be looked at more thoroughly.

The retained actuary mentions that they cannot be sure that an active's disappearance from the database corresponds to a termination. As a result, the retained actuary did not advise basing the withdrawal assumption on the plan's experience. We recommend that the retained actuary and the City consider a data clean-up effort to enhance the data collection and data transformation process to be able to rely on plan experience more fully.

The retained actuary also mentions that the sample size is too small to provide reasonable and reliable results. However, assuming the actual terminations in the table above are really terminations, despite the data limitations, the number of decrements is high enough at each age band to achieve partial credibility. If the retained actuary has confidence in the accuracy of their data, we recommend they consider basing the withdrawal assumption on actual experience, or a blending of plan experience with an industry standard table.

In the experience study report, the retained actuary discloses that the current withdrawal assumption will overstate the liabilities. If the retained actuary is intentionally using this conservative assumption, we recommend that it be disclosed in the valuations.

Firefighters' Fund

Retained Actuary's Assumption

Withdrawal rates were derived from a study of actual plan experience covering the period 1982 through 1986. A sample of the withdrawal rates is set forth in the following table:

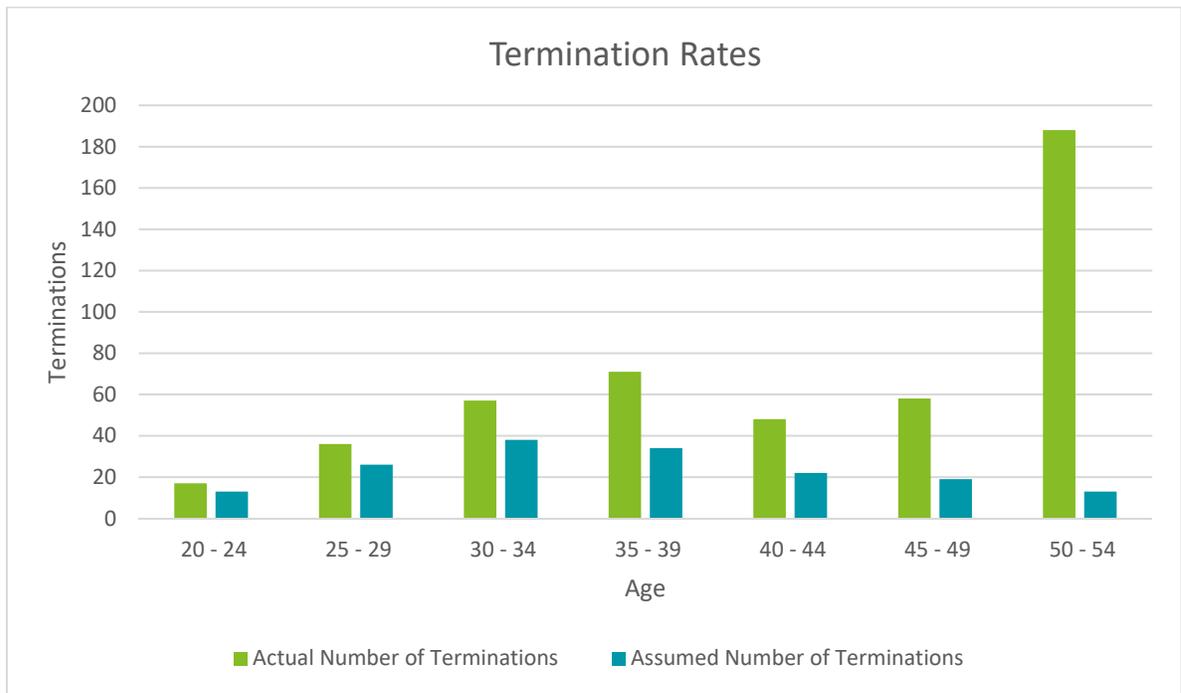
| Age | Rate |
|-----|-------|
| 20 | 5.45% |
| 25 | 4.22% |
| 30 | 3.62% |
| 35 | 2.87% |
| 40 | 1.80% |
| 45 | 1.31% |
| 50 | 1.21% |
| 55 | 0.00% |

Experience Study Considerations

The retained actuary considered the actual withdrawal rates compared to the assumed rates during the period January 1, 2003 through June 30, 2011.

| Age Group | Actual Number of Terminations | Assumed Number of Terminations (rounded) | Actual / Expected |
|-----------|-------------------------------|--|-------------------|
| 20 - 24 | 17 | 13 | 131% |
| 25 - 29 | 36 | 26 | 138% |
| 30 - 34 | 57 | 38 | 150% |
| 35 - 39 | 71 | 34 | 209% |

| | | | |
|---------|-----|----|-------|
| 40 - 44 | 48 | 22 | 218% |
| 45 - 49 | 58 | 19 | 305% |
| 50 - 54 | 188 | 13 | 1446% |



The retained actuary caveats this data:

1. The retained actuary does not know the reason that an active employee disappears from the active database. For example, some of the participants shown above as being terminated may have retired or died.
2. The retained actuary believes the sample size is too small to provide reasonable and reliable results.

The retained actuary notes that the actual number of terminations exceeds the expected number and suggests that the Pension Board increase the termination assumption. However, they recommend using an industry-standard table instead of basing the assumption on observed experience.

Ultimately, the assumption was not changed, and the July 1, 2017 assumption is still based on plan experience from 1982 to 1986.

Comments and Recommendations

The withdrawal assumption is based on age. This is a robust basis for the assumption because it reflects the general tendency of younger employees to incur higher rates of turnover. The assumed

rates reflect higher expected turnover for younger employees, which is not uncommon. Based on the information provided however the assumption that older employees will terminate at a lower rate should be looked at more thoroughly.

The retained actuary mentions that they cannot be sure that an active's disappearance from the database corresponds to a termination. As a result, the retained actuary did not advise basing the withdrawal assumption on the plan's experience. We recommend that the retained actuary and the City consider a data clean-up effort to enhance the data collection and data transformation process to be able to rely on plan experience more fully.

The retained actuary also mentions that the sample size is too small to provide reasonable and reliable results. However, assuming the actual terminations in the table above are really terminations, despite the data limitations, the number of decrements is high enough at each age band to achieve partial credibility. If the retained actuary has confidence in the fidelity of their data, we recommend they consider basing the withdrawal assumption on actual experience, or a blending of plan experience with an industry standard table.

In the experience study report, the retained actuary discloses that the current withdrawal assumption will overstate the liabilities. If the retained actuary is intentionally using this conservative assumption, we recommend that it be disclosed in the valuations.

Disability

The disability assumption is used to determine when an employee becomes disabled and qualifies for disability benefits.

Actuarial Standards

ASOP No. 35, Section 3.5.4 — Disability and Disability Recovery—*The actuary should take into account factors such as the following:*

- a. *the plan's definition of disability (for example, whether the disabled person is eligible for Social Security benefits); and*
- b. *the potential for recovery. For example, if the plan requires continued disability monitoring and if the plan's definition of disability is very liberal, an assumption for rates of recovery may be appropriate. Alternatively, the probability of recovery may be reflected by assuming a lower incidence of disability than the actuary might otherwise assume.*

GE Fund

Retained Actuary's Assumption

The plan uses a disability incidence table with separate rates for males and females, and separate rates for ordinary and occupational disability. Sample rates for ordinary disability are as follows:

| Age | Rate - Male | Rate - Female |
|-----|-------------|---------------|
| 20 | 0.00% | 0.00% |
| 25 | 0.00% | 0.00% |

| | | |
|----|-------|-------|
| 30 | 0.00% | 0.00% |
| 35 | 0.09% | 0.09% |
| 40 | 0.14% | 0.13% |
| 45 | 0.22% | 0.20% |
| 50 | 0.37% | 0.32% |
| 55 | 0.64% | 0.54% |
| 60 | 0.95% | 0.66% |

Occupational disability rates are 10% of the ordinary disability rates.

Experience Study Considerations

There were 49 members approved for a disability benefit during the five-year study period ending June 30, 2016, producing A/E ratios shown in the table below:

| | Actual Disablements | Expected Disablements | Ratio A/E |
|--------------|------------------------|--------------------------|------------|
| Male | 30 | 44 | 68% |
| Female | 19 | 25 | 76% |
| Total | 49 | 69 | 71% |

Based on the experience observed, the retained actuary recommended decreasing the assumption to 80% of the previous rates.

The retained actuary recommended continuing the assumption that the occupational disability rate is 10% of ordinary disability rates.

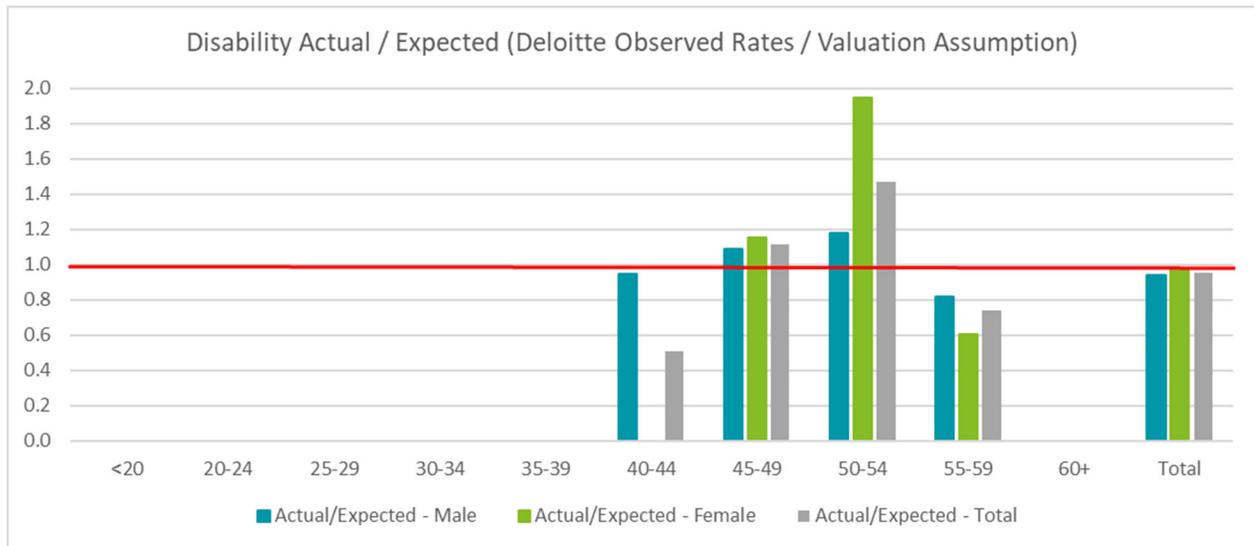
Replication of Experience Study

Using the experience study data provided by Segal from 7/1/2012 to 7/1/2016, we replicated Segal's observed gender-specific disability rates for active participants.

| Male | | | | | |
|-------|-----------------------|--------------------------|-----------------------------|-------------------------|---------------------------|
| Age | Deloitte Exposures | Observed Disablements | Observed Disability Rate | Valuation Assumption | Actual/Expected - Male |
| <20 | 0 | 0 | 0.00% | 0.00% | 0.00 |
| 20-24 | 59 | 0 | 0.00% | 0.00% | 0.00 |
| 25-29 | 384 | 1 | 0.26% | 0.00% | 0.00 |
| 30-34 | 604 | 1 | 0.17% | 0.00% | 0.00 |
| 35-39 | 805 | 0 | 0.00% | 0.12% | 0.00 |
| 40-44 | 1,150 | 2 | 0.17% | 0.18% | 0.94 |
| 45-49 | 1,564 | 5 | 0.32% | 0.29% | 1.09 |
| 50-54 | 1,728 | 11 | 0.64% | 0.54% | 1.18 |
| 55-59 | 1,457 | 10 | 0.69% | 0.84% | 0.82 |
| 60+ | 1,120 | 0 | 0.00% | 0.24% | 0.00 |
| Total | 8,871 | 30 | 0.34% | 0.36% | 0.94 |

| Female | | | | | |
|--------|--------------------|-----------------------|--------------------------|----------------------|--------------------------|
| Age | Deloitte Exposures | Observed Disablements | Observed Disability Rate | Valuation Assumption | Actual/Expected - Female |
| <20 | 0 | 0 | 0.00% | 0.00% | 0.00 |
| 20-24 | 50 | 0 | 0.00% | 0.00% | 0.00 |
| 25-29 | 371 | 0 | 0.00% | 0.00% | 0.00 |
| 30-34 | 550 | 0 | 0.00% | 0.00% | 0.00 |
| 35-39 | 906 | 0 | 0.00% | 0.12% | 0.00 |
| 40-44 | 1,055 | 0 | 0.00% | 0.17% | 0.00 |
| 45-49 | 1,283 | 4 | 0.31% | 0.27% | 1.15 |
| 50-54 | 1,327 | 11 | 0.83% | 0.43% | 1.95 |
| 55-59 | 993 | 4 | 0.40% | 0.67% | 0.60 |
| 60+ | 567 | 0 | 0.00% | 0.15% | 0.00 |
| Total | 7,102 | 19 | 0.27% | 0.27% | 0.97 |

| Total | | | | | |
|-------|--------------------|-----------------------|--------------------------|----------------------|-------------------------|
| Age | Deloitte Exposures | Observed Disablements | Observed Disability Rate | Valuation Assumption | Actual/Expected - Total |
| <20 | 0 | 0 | 0.00% | 0.00% | 0.00 |
| 20-24 | 109 | 0 | 0.00% | 0.00% | 0.00 |
| 25-29 | 755 | 1 | 0.13% | 0.00% | 0.00 |
| 30-34 | 1,154 | 1 | 0.09% | 0.00% | 0.00 |
| 35-39 | 1,711 | 0 | 0.00% | 0.12% | 0.00 |
| 40-44 | 2,205 | 2 | 0.09% | 0.18% | 0.51 |
| 45-49 | 2,847 | 9 | 0.32% | 0.28% | 1.12 |
| 50-54 | 3,055 | 22 | 0.72% | 0.49% | 1.47 |
| 55-59 | 2,450 | 14 | 0.57% | 0.77% | 0.74 |
| 60+ | 1,687 | 0 | 0.00% | 0.21% | 0.00 |
| Total | 15,973 | 49 | 0.31% | 0.32% | 0.95 |



Deloitte's observed disablements (30 for males, 19 for females) match Segal. Additionally, Deloitte's observed disability rates compared to the valuation assumption (as shown in the graph above) align to the valuation assumption. The actual / expected for all ages is 94% for males, 97% for females, and 95% for males/females combined. Since these ratios are close to 100%, we believe the disability assumption is reasonable for males and females. Due to the small sample size for disability incidence, it is not unreasonable for there to be volatility in the actual / expected for specific age groups.

Comments and Recommendations

The disability rates appear reasonable and consistent with the experience reviewed.

The retained actuary did not review the assumption that occupational disability rates are 10% of ordinary disability rates. We recommended that the retained actuary also consider this assumption in the next experience study. Additionally, we recommend that the report clarify how the occupational disability rates are applied; the retained actuary should disclose what percentage of disabilities are assumed to be occupational.

Due to the small sample size, we recommend supplementing historical data with industry-standard data for disability incidence for similar job types to develop a more credible assumption.

The experience study report lacked additional detail, such as the exposures and observed disabilities by age group and gender. We recommend the experience study include a more detailed breakout, such as what is shown in our tables above.

Police Officers' Fund

Retained Actuary's Assumption

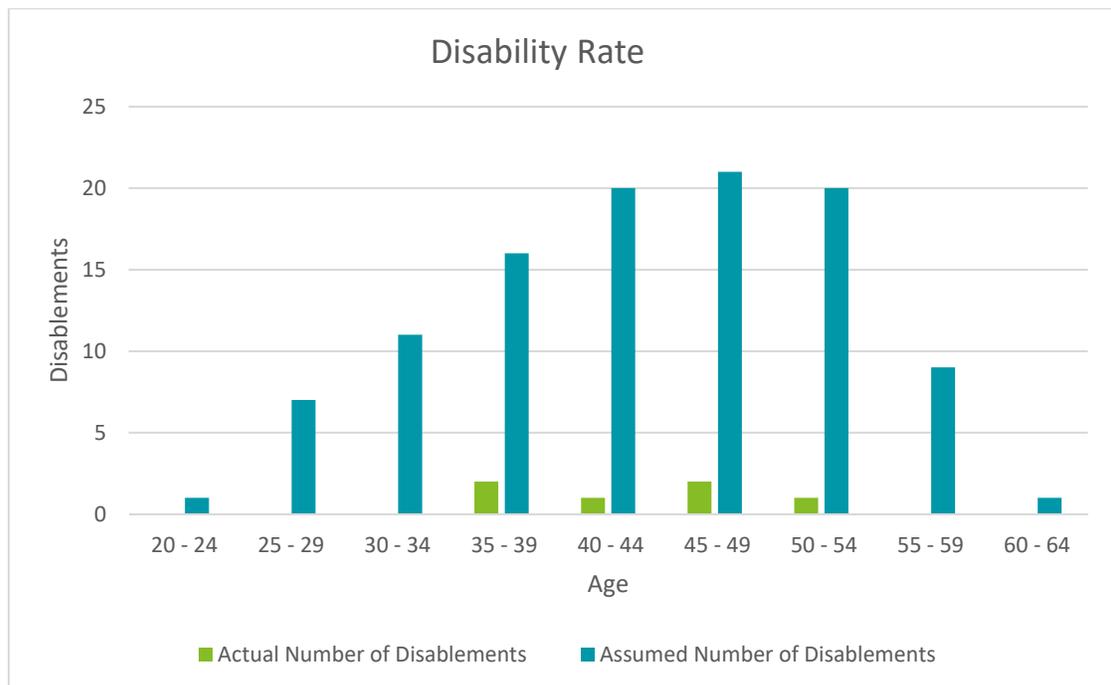
Sex-distinct rates set forth in the Wyatt 1985 Disability Study (Class 4).

75% of disabilities are assumed to be service-connected.

Experience Study Considerations

The retained actuary considered the actual disability rates compared to the assumed rates during the period January 1, 2003 through June 30, 2011:

| Age Group | Actual Number of Disablements | Assumed Number of Disablements | Actual Disablements/ Expected |
|-----------|-------------------------------|--------------------------------|-------------------------------|
| 20 - 24 | 0 | 1 | 0% |
| 25 - 29 | 0 | 7 | 0% |
| 30 - 34 | 0 | 11 | 0% |
| 35 - 39 | 2 | 16 | 13% |
| 40 - 44 | 1 | 20 | 5% |
| 45 - 49 | 2 | 21 | 10% |
| 50 - 54 | 1 | 20 | 5% |
| 55 - 59 | 0 | 9 | 0% |
| 60 - 64 | 0 | 1 | 0% |



The retained actuary caveats this data:

1. The retained actuary does not know if the data contains all the disabilities that have occurred. For example, some of the retired participants may be disabled retirees and may not be reflected as disabled.

2. The retained actuary believes the sample size is too small to provide reasonable and reliable results. However, they recommend using an industry-standard table instead of basing the assumption on observed experience.

Ultimately, the assumption was not changed, and the July 1, 2017 assumption is still based on the Wyatt 1985 Disability Study (Class 4) for males and females.

Comments and Recommendations

Similar to withdrawal, we recommend that the retained actuary and the City consider a data clean-up effort to enhance the data collection and data transformation process to be able to rely on plan experience more fully. It seems very unlikely that there would only be six disabilities in an 8-year span.

In the experience study report, the retained actuary discloses that the current disability assumption will overstate the liabilities. If the retained actuary is intentionally using this conservative assumption, we recommend that it be disclosed in the valuations.

We agree that the sample size is too small, and the data is too unreliable to establish a disability assumption. Using an industry standard table is acceptable for the disability assumption.

Firefighters' Fund

Retained Actuary's Assumption

Sex-distinct rates set forth in the Wyatt 1985 Disability Study (Class 4).

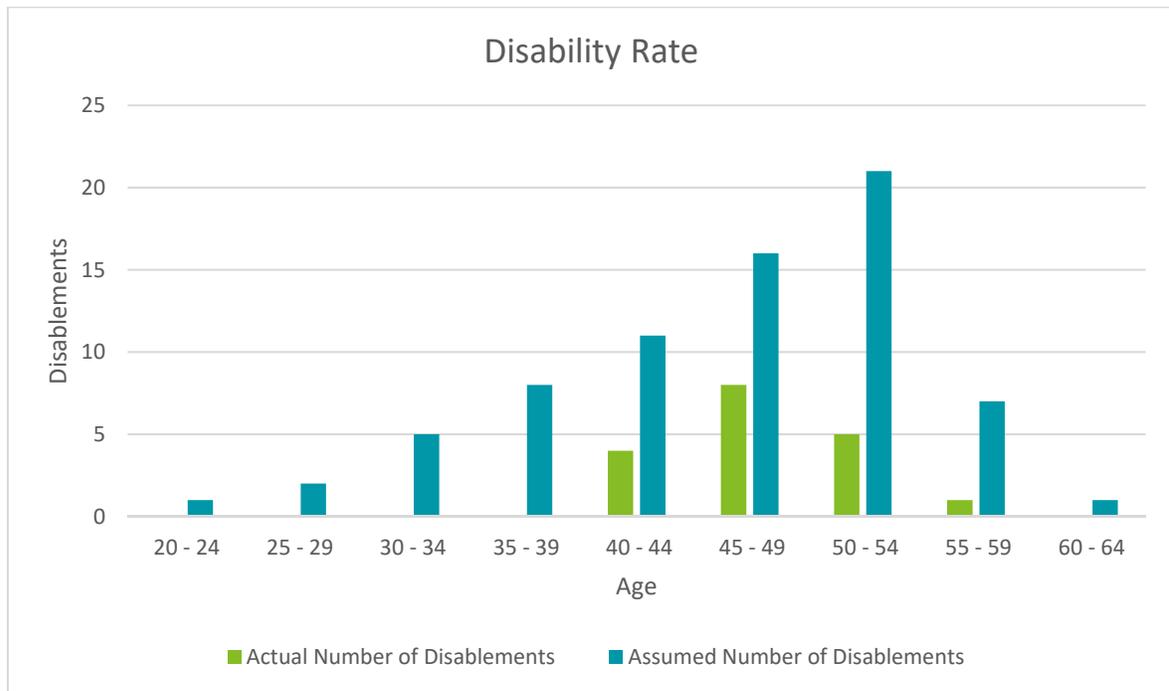
67% of disabilities are assumed to be service-connected.

Experience Study Considerations

The retained actuary considered the actual disability rates compared to the assumed rates during the period January 1, 2003 through June 30, 2011:

| Age Group | Actual Number of Disablements | Assumed Number of Disablements | Actual Disablements/ Expected |
|-----------|-------------------------------|--------------------------------|-------------------------------|
| 20 - 24 | 0 | 1 | 0% |
| 25 - 29 | 0 | 2 | 0% |
| 30 - 34 | 0 | 5 | 0% |
| 35 - 39 | 0 | 8 | 0% |
| 40 - 44 | 4 | 11 | 36% |
| 45 - 49 | 8 | 16 | 50% |
| 50 - 54 | 5 | 21 | 24% |

| | | | |
|---------|---|---|-----|
| 55 - 59 | 1 | 7 | 14% |
| 60 - 64 | 0 | 1 | 0% |



The retained actuary caveats this data:

1. The retained actuary does not know if the data contains all the disabilities that have occurred. For example, some of the retired participants may be disabled retirees and may not be reflected as disabled.
2. The retained actuary believes the sample size is too small to provide reasonable and reliable results. However, they recommend using an industry-standard table instead of basing the assumption on observed experience.

Ultimately, the assumption was not changed, and the July 1, 2017 assumption is still based off the Wyatt 1985 Disability Study (Class 4) for males and females.

Comments and Recommendations

Similar to withdrawal, we recommend that the retained actuary and the City consider a data clean-up effort to enhance the data collection and data transformation process to be able to rely on plan experience more fully. It seems very unlikely that there would only be 18 disabilities in an 8-year span.

In the experience study report, the retained actuary discloses that the current disability assumption will overstate the liabilities. If the retained actuary is intentionally using this conservative assumption, we recommend that it be disclosed in the valuations.

We agree that the sample size is too small, and the data is too unreliable to establish a disability assumption. Using an industry standard table is acceptable for the disability assumption.

Marital Status and Form of Payment

In cases where participants receive no subsidy among payment forms and valuation actuarial equivalence matches that of optional payment forms, this assumption is not necessary. However, because participants receive subsidized optional forms of payment, this assumption impacts liabilities.

It is common for actuaries to make an assumption regarding the marital status of plan participants for use in assuming future benefit eligibility and election. Like the inflation assumption, the marital status assumption is often a component of several other assumptions.

Actuarial Standards

ASOP No. 35, Section 3.5.5 — Optional Form of Benefit Assumption—*The actuary should consider factors such as the following:*

- a. *the benefit forms and benefit commencement dates available under the plan being valued;*
- b. *the historical or expected experience of elections under the plan being valued and similar plans; and*
- c. *the degree to which particular benefit forms may be subsidized.*
- d. *cost projections, including those made in conjunction with establishing or modifying the plan's design; and*
- e. *determinations of actuarial present values.*

ASOP No. 35, Section 3.6.3 — Marriage, Divorce, and Remarriage—*The actuary should consider whether marriage, divorce, or remarriage affects the payment of benefits, the amount or type of benefits, or the continuation of benefit payments. If such an assumption is selected, it may also be necessary to make an assumption regarding beneficiary ages.*

GE Fund

Retained Actuary's Assumption

75% of members are assumed to be married. For members hired before November 1, 2011, the plan provides an unreduced Joint-and-75% Survivor Annuity. Married members are assumed to elect the Joint-and-75% Survivor Annuity, while non-married members are assumed to elect a Single Life Annuity. Members hired after October 31, 2011 are assumed to elect a Single Life Annuity.

Additionally, with respect to refunds of contributions, 75% of terminated vested members hired before November 1, 2011 are assumed to elect a refund of their employee contribution balances.

100% of members hired after October 31, 2011 are assumed to elect a refund of their employee contribution balances.

Experience Study Considerations

The review of actual retirements showed that over half of all annuitants retired with a joint and survivor annuity. The retained actuary recommended maintaining the assumed marriage percentage of 75% based on fully subsidized J&S benefits for hires prior to November 1, 2011.

For the refund of contributions, during this period of study 78% of the participants hired before November 1, 2011 elected a refund of their employee contributions while 97% of participants hired after October 31, 2011 elected a refund of their contributions. The retained actuary recommended increasing the refund of contributions percentage from 50% to 75% for participants hired before November 1, 2011 and maintain the assumption of 100% for participants hired after October 31, 2011.

Replication of Experience Study

Form of Payment

Using the experience study data provided by Segal from 7/1/2012 to 7/1/2016, Deloitte replicated Segal's observed forms of payment election experience.

| Selection | Male | Female | Total |
|--|------|--------|-------|
| Joint & Survivor Annuity | 160 | 65 | 225 |
| Life Annuity | 75 | 97 | 172 |
| Percentage Electing Joint & Survivor Annuity | 68% | 40% | 57% |

Deloitte's observed rates align to the retained actuary's statement that "over half of all annuitants retired with a joint and survivor annuity". However, the experience study report did not contain detail beyond this. As seen above, the data shows that election experience varies for males and females, and that an assumption of 75% may be too high. We recommend the experience study report contain more detail for observed election experience, and we recommend the retained actuary consider applying a gender-specific assumption.

Refund Assumption

Using experience study data provided by Segal from 7/1/2012 to 7/1/2016, we replicated Segal's observed refund election experience.

| Terminating Participants not Eligible for Retirement | Hired before November 1, 2011 | Hired after October 31, 2011 |
|--|-------------------------------|------------------------------|
| Elected Refund | 321 | 48 |
| Declined Refund | 100 | 0 |
| Deloitte Observed Refund Election Percentage | 76% | 100% |

| | | |
|---|-----|------|
| Segal Observed Refund Election Percentage | 78% | 97% |
| Valuation Assumption | 75% | 100% |

As shown above, Deloitte's observed refund election percentage is quite comparable to the retained actuary's observed experience and the valuation assumption. The refund assumption is reasonable. However, we recommend the experience study include more detail for the development of this assumption.

Comments and Recommendations

Pre-2011 hires receive an unreduced joint-and-75% annuity upon retirement, so it is reasonable to assume that the proportion electing the joint and survivor benefit is equal to the proportion married. As post-2011 hires begin to retire, we recommend excluding them from future experience analysis – since they receive an actuarially reduced joint-and-75% annuity some married members may elect the life annuity which would distort the assumption for pre-2011 hires.

We recommend that the experience study more explicitly state the actual and expected annuitants electing a joint and survivor benefit.

The assumption that 100% of members hired after 2011 will elect a Single Life Annuity is reasonable since the joint and survivor benefit is actuarially reduced. Therefore, there will generally be minimal gain or loss if a post-2011 hire elects a joint and survivor benefit (depending on the degree of difference between actuarial equivalence factors and valuation interest and mortality). Generally, assuming all members elect a Single Life Annuity is an appropriate simplification. However, we recommend that the valuation report disclose the actuarial equivalence assumption for calculating the Joint and 75% annuity.

Police Officers' Fund

Retained Actuary's Assumption

Active participants making an additional 1% contribution are assumed to provide a survivor benefit to their beneficiary and are assumed to have one surviving beneficiary of the opposite sex.

The retained actuary does not disclose the assumption used for refunds of employee contributions.

Experience Study Considerations

These assumptions were not considered during the July 1, 2011 experience study.

Comments and Recommendations

The purpose of the percent married assumption is to estimate the percentage of retirees which will receive the joint and survivor benefit. According to the plan provisions, participants with an eligible beneficiary must make an additional 1% of contributions throughout their career to receive the joint and survivor benefit. However, participants hired after August 31, 2011 are not required to make an additional 1% contribution, because the joint and survivor benefit is actuarially reduced.

Therefore, it's appropriate to assume that active participants making an additional 1% contribution are married for pre-2011 hires. For post-2011 hires, we assume that the retained actuary is valuing all participants as receiving a life annuity (similar to GE Fund). If this is the case, we recommend that this assumption is explicitly disclosed in the valuation report. There will generally be minimal gain or loss if a post-2011 hire elects a joint and survivor benefit (depending on the degree of difference between actuarial equivalence factors and valuation interest and mortality). Generally, assuming all members elect a Single Life Annuity is an appropriate simplification. However, we recommend that the valuation report disclose the actuarial equivalence assumption for calculating the Joint and 75% annuity.

We recommend that the refund of contribution behavior of terminated vested participants be studied in the next experience study.

Firefighters' Fund

Retained Actuary's Assumption

Active participant making an additional 1% contribution to provide a survivor benefit to their beneficiary are assumed to have one surviving beneficiary of the opposite sex.

Experience Study Considerations

These assumptions were not considered during the July 1, 2011 experience study.

Comments and Recommendations

The purpose of the percent married assumption is to estimate the percentage of retirees which will receive the joint and survivor benefit. According to the plan provisions, participants with an eligible beneficiary must make an additional 1% of contributions throughout their career to receive the joint and survivor benefit. However, participants hired after August 31, 2011 are not required to make an additional 1% contribution, because the joint and survivor benefit is actuarially reduced.

Therefore, it's appropriate to assume that active participants making an additional 1% contribution are married for pre-2011 hires. For post-2011 hires, we assume that the retained actuary is valuing all participants as receiving a life annuity (similar to GE Fund). If this is the case, we recommend that this assumption is explicitly disclosed in the valuation report. There will generally be minimal gain or loss if a post-2011 hire elects a joint and survivor benefit (depending on the degree of difference between actuarial equivalence factors and valuation interest and mortality). Generally, assuming all members elect a Single Life Annuity is an appropriate simplification. However, we recommend that the valuation report disclose the actuarial equivalence assumption for calculating the Joint and 75% annuity.

We recommend that the refund of contribution behavior of terminated vested participants be studied in the next experience study.

Age of Survivor

Future Joint & Survivor annuity payment amounts are based in part on the age of the survivor. Because valuation mortality and interest rates are not equal to those used to calculate optional forms of payment, the age of survivors impacts liability amounts.

Actuarial Standards

ASOP No. 35, Section 3.6.7 — Missing or Incomplete Data— *At times, the actuary may find that the data provided are incomplete due to missing elements such as birth dates or hire dates. Provided that the actuary has determined, in accordance with ASOP No. 23, Data Quality, that the overall data are of sufficient quality to complete the assignment, the actuary may need to make reasonable assumptions for the missing data elements. In making such assumptions, the actuary should consider the relevant data actually supplied. For example, it may be appropriate to assume a missing birth date is equal to the average birth date for other participants who have complete data and who have the same service credits as the participant whose date of birth is missing.*

GE Fund

Retained Actuary's Assumption

The female spouse is assumed to be 3 years younger than the male spouse.

Experience Study Considerations

During the study period, beneficiaries of male participants were about 3 years younger and beneficiaries of female participants were about 3 years older. The retained actuary recommended no change to the assumption of a 3-year age difference for both male and female members.

Replication of Experience Study

Segal's data provided did not include the spouse's date of birth. We are unable to verify the retained actuary's age of survivor assumption.

Comments and Recommendations

This assumption appears reasonable. The assumption that males are three years older than female spouses is an industry-standard assumption used for many pension plans. However, we recommend the retained actuary continue to monitor this assumption to confirm that the plan's population conforms with the industry-standard.

We recommend the experience study more explicitly state the observed data, including the number of lives and the actual versus expected age difference. Since spousal dates of birth were not provided in the experience study data, we recommend the retained actuary specifically clarify where they received this information.

Police Officers' Fund

Retained Actuary's Assumption

The female spouse is assumed to be 3 years younger than the male spouse.

Experience Study Considerations

This assumption was not considered during the July 1, 2011 experience study.

Comments and Recommendations

This assumption appears reasonable. The assumption that males are three years older than female spouses is an industry-standard assumption used for many pension plans. However, we recommend the retained actuary continue to monitor this assumption, as recent studies show a decreasing gap between ages. We recommend this assumption be analyzed in the next experience study.

Firefighters' Fund

Retained Actuary's Assumption

The female spouse is assumed to be 3 years younger than the male spouse.

Experience Study Considerations

This assumption was not considered during the July 1, 2011 experience study.

Comments and Recommendations

This assumption appears reasonable. The assumption that males are three years older than female spouses is an industry-standard assumption used for many pension plans. However, we recommend the retained actuary continue to monitor this assumption, as recent studies show a decreasing gap between ages. We recommend this assumption be analyzed in the next experience study.

Comparison of Pension Funds

The experience study reports from Segal (GE Fund) and Southern Actuarial (Firefighters' and Police Officers' Fund) differed in format and quality. While different actuarial firms have different approaches towards an experience study, we believe that GE Fund's experience study was much more complete than the Police Officer's and Firefighters' Funds experience study. The GE Fund's experience study included thorough analysis of the demographic assumptions, while the Police Officers' and Firefighters' Funds experience study generally lacks sufficient detail. We recommend that the Police Officers' and Firefighters' Funds work to enhance the detail and scope of their experience study. A large challenge in their experience studies was the lack of trustworthy data. The retained actuary did not believe the data was of sufficient quality to permit the experience study to be the basis for any demographic assumption. Meanwhile, GE Fund's underlying data was of

sufficient quality to perform the analysis. We recommend that the Police Officers' and Firefighters' Funds work with the City to enhance its data process to improve the quality of the data.

Regarding the individual assumptions themselves, it is generally reasonable for different plans to employ different assumptions. However, in several cases, the GE Fund's methodology is more of a "best practice" than the Police Officers' and Firefighters' Funds experience study. We have included commentary below:

- **Mortality:** The GE Fund is using RP-2006 base tables with SSA2016-2D mortality improvements, which reflect current industry-accepted standards. The Police Officers' and Firefighters' Funds are using the RP-2000 table with improvement Scale AA. This assumption should be updated to use a more current table.
- **Retirement:** The GE Fund is using an age-based assumption, with separate rates for those with less than or greater than 30 years to reflect eligibility for unreduced early retirement. The Police Officers' and Firefighters' Funds are assuming that all participants retire at their normal retirement age. An age or service based assumption would be more accurate.
- **Withdrawal and Disability:** The GE Fund's assumption is based on observed experience. As discussed above, the Police Officers' and Firefighters' Funds did not find their data to be trustworthy enough to form the basis for the assumption and therefore are using outdated assumptions from the 1980s.

We recommend that the Police Officers' and Firefighters' Funds consider a more robust set of analyses in their future assumption-setting practices.

Validation of Actuarial Valuation Results

This section will validate the retained actuary's calculation of several key items in the valuation report, including AAL, PVFB, Normal Cost (NC), ADC and AVA.

Summary of Replication

In order to validate the accuracy of valuation results calculated by the retained actuaries, we replicated the results for the Pension Funds as of July 1, 2017. Our intention was not to seek an absolute match on every metric from the retained actuaries. An absolute match is not feasible nor practical considering that different actuaries use different methods and valuation software and can apply different assumptions for missing or incomplete data. We sought to match key metrics within reasonable thresholds.

Applicable ASOPs

Actuarial Standard of Practice No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*, provides guidance in Section 3.9 for measuring the value of accrued or vested benefits. We used the relevant components of this ASOP as a guideline to verify that this measurement considered the following:

- relevant plan provisions and applicable law;
- the contingencies upon which benefits become payable, which may differ for ongoing-basis and termination-basis measurements;
- the extent to which participants have satisfied relevant eligibility requirements for accrued or vested benefits and the extent to which future service or advancement in age may satisfy those requirements;
- whether or the extent to which death, disability, or other ancillary benefits are accrued or vested;
- whether the plan provisions regarding accrued benefits provide an appropriate attribution pattern for the purpose of the measurement (for example, following the attribution pattern of the plan provisions may not be appropriate if the plan's benefit accruals are significantly back-loaded)

Comments and Recommendations

The following sections present the results of our replication of the July 1, 2017 valuation reports, including the AAL, PVFB, and NC.

GE Fund

| <i>(in \$1,000s)</i> | Deloitte | Segal | Difference | Comments |
|---|--------------------|--------------------|------------|-----------------------------------|
| Present Value of Future Benefits | | | | |
| Active Members | \$699,580 | \$697,639 | 0.3% | Match within reasonable threshold |
| Inactive Members | <u>\$1,279,350</u> | <u>\$1,279,259</u> | 0.0% | |
| Total | \$1,978,930 | \$1,976,898 | 0.1% | |
| Normal Cost | \$22,215 | \$22,117 | 0.4% | Match within reasonable threshold |
| Actuarial Accrued Liability | | | | |
| Active Members | \$516,930 | \$530,102 | -2.5% | Match within reasonable threshold |
| Inactive Members | <u>\$1,279,350</u> | <u>\$1,279,259</u> | 0.0% | |
| Total | \$1,796,280 | \$1,809,361 | -0.7% | |

Police Officers' Fund

| <i>(in \$1,000s)</i> | Deloitte | Southern Actuarial | Difference | Comments |
|---|------------------|--------------------|------------|---|
| Present Value of Future Benefits | | | | |
| Active Members | \$632,445 | \$617,891 | 2.4% | Match within reasonable threshold |
| Inactive Members | <u>\$872,359</u> | <u>\$883,882</u> | -1.3% | |
| Total | \$1,504,804 | \$1,501,773 | 0.2% | |
| Normal Cost | \$18,765 | \$20,741 | -9.5% | Difference is primarily due to differences in methodology between Deloitte and Southern Actuarial, as discussed below |
| Actuarial Accrued Liability | | | | |
| Active Members | \$491,229 | \$481,507 | 2.0% | Match within reasonable threshold |
| Inactive Members | <u>\$872,359</u> | <u>\$883,882</u> | -1.3% | |
| Total | \$1,363,588 | \$1,365,389 | -0.1% | |

Firefighters' Fund

| (in \$1,000s) | Deloitte | Southern Actuarial | Difference | Comments |
|--|------------------|--------------------|------------|---|
| <u>Present Value of Future Benefits</u> | | | | |
| Active Members | \$354,443 | \$347,930 | 1.9% | Match within reasonable threshold |
| Inactive Members | <u>\$616,198</u> | <u>\$624,944</u> | -1.4% | |
| Total | \$970,641 | \$972,874 | -0.2% | |
| <u>Normal Cost</u> | \$10,145 | \$11,655 | -13.0% | Difference is primarily due to differences in methodology between Deloitte and Southern Actuarial, as discussed below |
| <u>Actuarial Accrued Liability</u> | | | | |
| Active Members | \$276,257 | \$270,805 | 2.0% | Match within reasonable threshold |
| Inactive Members | <u>\$616,198</u> | <u>\$624,944</u> | -1.4% | |
| Total | \$892,455 | \$895,749 | -0.4% | |

Comparison of Pension Funds

For each of the three pension plans, we were able to match results within a reasonable threshold. For the GE Fund, we were able to match PVFB, AAL, and NC very closely. For the Police Officers' and Firefighters' Funds, we were able to match PVFB and AAL very closely, but were not as close for NC. Actuarial firms have differing methods for the determination of Normal Cost, so it is not uncommon or unreasonable for our NC results to differ by this extent. Please refer to the *Review of Actuarial Methods – Actuarial Cost Method* section for discussion on the NC method used by Southern Actuarial, where we conclude that their methodology leads to higher NC than the “typical” method, which explains why Southern Actuarial’s NC is roughly 10% higher than Deloitte’s.

Verification of Actuarially Determined Contribution

In order to verify the ADC calculated by the retained actuaries, we relied on the liability values as stated in the report as a basis for the calculation. We independently verified the mathematical calculation using this basis.

Applicable ASOPs

Actuarial Standard of Practice No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*, provides guidance in Section 3.20 for calculating a reasonable actuarially determined contribution for funding valuations that do not include a prescribed method set by law. Since the method is set by law for the Pension Funds, the actuary should calculate as prescribed by City Ordinance.

Comments and Recommendations

GE Fund

The contribution policies are discussed in detail in the *Review of Actuarial Methods* section of this report. The purpose of this section will be to verify the retained actuary's calculation of the ADC on page 25 of the valuation report.

Deloitte requested clarification from the retained actuary for the line item described as "Adjustment for Timing". Segal indicated that this item adjusts for interest and payroll growth. Deloitte calculates the ADC in the following manner:

1. Calculate the 7/1/2018 ADC
2. Adjust the 7/1/2018 ADC for half-year of interest
3. Determine the contribution percentage using this calculated ADC, and the 7/1/2018 payroll
4. Apply the calculated contribution percentage to expected 7/1/2018 payroll

While the steps as outlined by the retained actuary differ in description, Deloitte verified that the resulting calculation is consistent with our approach.

| (In \$'s) | | Segal | Deloitte ¹ |
|-----------|---|---------------------|-----------------------|
| | | FY 2018/2019 | FY 2018/2019 |
| 1 | UAAL | 596,508,570 | |
| 2 | Payment to Amortize UAAL over 23 Years | 39,042,767 | 39,042,767 |
| 3 | Employer Normal Cost² | 5,225,714 | |
| | <u>Deloitte Methodology</u> | | |
| 4 | Interest to Mid-Year | | 1,576,656 |
| 5 | Preliminary ADC [(2) + (3) + (4)] | | 45,845,137 |
| 6 | Current Year Payroll | | 167,902,833 |
| 7 | Contribution Rate [(5) / (6)] | | 27.30% |
| 8 | Projected Payroll | | 172,939,918 |
| 9 | Final ADC [(7) x (8)] | | 47,220,491 |
| | <u>Segal Methodology</u> | | |
| 10 | Adjustment for Timing³ | 2,952,010 | |
| 11 | Projected Payroll | 172,939,918 | |
| 12 | Final ADC [(2) + (3) + (4) + (10)] | 47,220,491 | |
| 13 | Contribution Rate [(12) / (11)] | 27.30% | |
| | Compare ADC | 47,220,491 | 47,220,491 |
| | % Delta | | 0.00% |

¹ Relies on the UAAL, NC, and administrative expenses calculated by the retained actuary

² Includes Administrative Expenses

³ Actuary clarified that this includes payroll growth and interest to mid-year

We agree with the ADC as calculated by the retained actuary. We recommend that the retained actuary provide a description of the components of row 10, as well as clarify whether actual payroll will be substituted for the projected payroll for the final contribution amount.

Police Officers' Fund

The contribution policies are discussed in detail in the *Review of Actuarial Methods* section of this report. The purpose of this section will be to verify the retained actuary's calculation of the ADC on page I-1 of the valuation report.

Based on the information provided, including the UAAL, Normal Cost, and Administrative Expenses, we were able to verify the ADC as shown below.

| (In \$'s) | | Southern Actuarial | Deloitte ¹ |
|--|--|--------------------|-----------------------|
| | | FY 2018/2019 | FY 2018/2019 |
| 1 | UAAL | 313,717,871 | |
| 2 | Payment to Amortize UAAL over 24 Years | 18,633,810 | 18,633,810 |
| 3 | Employer Normal Cost ² | 11,472,962 | |
| <i>Deloitte Methodology</i> | | | |
| 4 | Interest to Mid-Year | | 1,108,594 |
| 5 | Preliminary ADC [(2) + (3) + (4)] | | 31,215,365 |
| 6 | Current Year Payroll (6/30/2017) | | 90,947,614 |
| 7 | Contribution Rate [(5) / (6)] | | 34.32% |
| 8 | Projected Payroll | | 94,585,519 |
| 9 | Final ADC [(7) x (8)] | | 32,463,980 |
| <i>Southern Actuarial Methodology</i> | | | |
| 10 | Adjustment to Reflect Semi-Monthly Employer Contributions ³ | 1,148,861 | |
| 11 | Interest on "True-up" Payment | -24,103 | |
| 12 | Projected Payroll | 94,585,519 | |
| 13 | Final ADC [(2) + (3) + (4) + (10) + (11)] | 31,231,530 | |
| 14 | Contribution Rate [(13) / (12)] | 33.02% | |
| Compare ADC | | 31,231,530 | 32,463,980 |
| % Delta | | | 3.95% |

¹ Relies on the UAAL, NC, and administrative expenses calculated by the retained actuary

² Includes Administrative Expenses

³ Actuarially determined contributions are assumed to be paid at the middle of every year

Deloitte's calculated ADC differs from the retained actuary's calculation by **\$1,232,450**. This difference is due to two items:

- The difference between the retained actuary's calculation and Deloitte's preliminary calculation is only \$16,615. The retained actuary is accounting for the lag between the ADC calculation and the actual contribution with a "true-up" methodology that adds interest on the difference between actual and expected ADC, however, we do not believe that this methodology properly accounts for this lag.
- The retained actuary includes a line item called "Semi-Monthly Employer Contributions". There is not a disclosed description of the methodology behind this calculation.

To resolve these item, we recommend that page I-1 of the report include disclosure of the UAAL to support the determination of the ADC as well as a review of the current approach to determine if the lag in contribution timing is being properly accounted for.

The retained actuary discloses several different payroll figures:

| | Payroll Figure | Amount | Source |
|---|---------------------------------|---------------|---|
| 1 | Covered Payroll – FYE 6/30/2017 | \$104,788,049 | GASB 67/68 Supplement as of June 30, 2017 |

| | | | |
|---|--|--------------|--|
| 2 | Total Annualized Compensation for the Prior Year | \$91,328,879 | Actuarial Valuation as of July 1, 2017 Page III-2 |
| 3 | Total Expected Compensation for the Current Year | \$90,947,614 | Actuarial Valuation as of July 1, 2017 Page III-2 |
| 4 | Expected Payroll for the 2018/19 Fiscal Year | \$94,585,519 | Actuarial Valuation as of July 1, 2017 Page I-1 |

In response to Deloitte's question, the retained actuary indicated that:

- (1) is the actual payroll for FYE 6/30/2017
- (3) is the expected payroll for FYE 6/30/2018, which is based on (1) but adjusted to reflect assumed salary scale and expected decrements
- (4) is the expected payroll for FYE 6/30/2019, which is item (3) with 4.00% payroll growth. This is what is used to calculate the ADC above.
- (2) is just a summary statistic which is not used to calculate contributions.

We recommend the valuation report include enhanced descriptions of the basis for these payroll figures, such as the census data from which the figure was developed, and the assumptions applied to determine each figure.

Firefighters' Fund

The contribution policies are discussed in detail in the *Review of Actuarial Methods* section of this report. The purpose of this section will be to verify the retained actuary's calculation of the ADC on page I-1 of the valuation report.

Based on the information provided, including the UAAL, Normal Cost, and Administrative Expenses, we were able to verify the ADC as shown below.

| (In \$'s) | | Southern Actuarial | Deloitte ¹ |
|-----------|--|---------------------|-----------------------|
| | | FY 2018/2019 | FY 2018/2019 |
| 1 | UAAL | 226,240,745 | |
| 2 | Payment to Amortize UAAL over 24 Years | 13,437,956 | 13,437,956 |
| 3 | Employer Normal Cost ² | 7,034,444 | |
| | <i>Deloitte Methodology</i> | | |
| 4 | Interest to Mid-Year | | 753,836 |
| 5 | Preliminary ADC [(2) + (3) + (4)] | | 21,226,236 |
| 6 | Current Year Payroll (6/30/2017) | | 46,961,912 |
| 7 | Contribution Rate [(5) / (6)] | | 45.20% |
| 8 | Projected Payroll | | 48,840,388 |
| 9 | Final ADC [(7) x (8)] | | 22,075,286 |
| | <i>Southern Actuarial Methodology</i> | | |
| 10 | Adjustment to Reflect Semi-Monthly Employer Contributions ³ | 781,217 | |
| 11 | Interest on "True-up" Payment | -59,625 | |
| 12 | Projected Payroll | 48,840,388 | |
| 13 | Final ADC [(2) + (3) + (4) + (10) + (11)] | 21,193,992 | |
| 14 | Contribution Rate [(13) / (12)] | 43.39% | |
| | Compare ADC | 21,193,992 | 22,075,286 |
| | % Delta | | 4.16% |

¹ Relies on the UAAL, NC, and administrative expenses calculated by the retained actuary

² Includes Administrative Expenses

³ Actuarially determined contributions are assumed to be paid at the middle of every year

Deloitte's calculated ADC differs from the retained actuary's calculation by **\$881,294**. This difference is due to two items:

- The difference between the retained actuary's calculation and Deloitte's preliminary calculation is only \$32,244. The retained actuary is accounting for the lag between the ADC calculation and the actual contribution with a "true-up" methodology that adds interest on the difference between actual and expected ADC, however, we do not believe that this methodology properly accounts for this lag.
- The retained actuary includes a line item called "Semi-Monthly Employer Contributions". There is not a disclosed description of the methodology behind this calculation.

To resolve this item, we recommend that page I-1 of the report include disclosure of the UAAL to support the determination of the ADC as well as a review of the current approach to determine if the lag in contribution timing is being properly accounted for.

The retained actuary discloses several different payroll figures:

| Payroll Figure | Amount | Source |
|----------------|--------|--------|
|----------------|--------|--------|

| | | | |
|---|--|--------------|--|
| 1 | Covered Payroll – FYE 6/30/2017 | \$47,478,900 | GASB 67/68 Supplement as of June 30, 2017 |
| 2 | Total Annualized Compensation for the Prior Year | \$47,196,423 | Actuarial Valuation as of July 1, 2017 Page III-2 |
| 3 | Total Expected Compensation for the Current Year | \$46,961,912 | Actuarial Valuation as of July 1, 2017 Page III-2 |
| 4 | Expected Payroll for the 2018/19 Fiscal Year | \$48,840,388 | Actuarial Valuation as of July 1, 2017 Page I-1 |

In response to Deloitte’s question, the retained actuary indicated that:

- (1) is the actual payroll for FYE 6/30/2017
- (3) is the expected payroll for FYE 6/30/2018, which is based on (1) but adjusted to reflect assumed salary scale and expected decrements
- (4) is the expected payroll for FYE 6/30/2019, which is item (3) with 4.00% payroll growth. This is what is used to calculate the ADC above.
- (2) is just a summary statistic which is not used to calculate contributions.

We recommend the valuation report include enhanced descriptions of the basis for these payroll figures, such as the census data from which the figure was developed, and the assumptions applied to determine each figure.

Comparison of Pension Funds

Each of the three Pension Funds is calculating the ADC in accordance with the City Ordinance, but use different a different interpretation of the application of this method. Segal includes a year of payroll growth in the calculation of the ADC to account for the one-year lag in the payment of the ADC, whereas Southern Actuarial does not include a proper adjustment for this timing delay. Southern Actuarial uses a true-up methodology where, if applied differently, may result in the same result. However, as it is currently disclosed, the results will differ between actuaries.

Segal’s approach results in a higher ADC to account for the fact that the payroll is expected to grow in between the time that the ADC is disclosed and when it will be contributed in the following fiscal year. We recommend that the three Funds apply the same method for calculating interest and payroll growth as components of ADC for consistency and that they disclose the approach for transparency.

Verification of Actuarial Value of Assets

Applicable ASOPs

Actuarial Standard of Practice No. 44, *Selection and Use of Asset Valuation Methods for Pension Valuations*, governs the asset valuation method for pension valuations, which is used to develop the actuarial value of assets (AVA).

See the *Actuarial Asset Valuation Method* under *Review of Actuarial Methods* for more information on the compliance of the asset valuation method with this ASOP. This section will review the Pension Funds' compliance with their stated asset valuation method.

Comments and Recommendations

GE Fund

The components of the GE Fund's AVA are the Market Value of Assets (MVA) as of the Valuation Date, as well as the excess (shortfall) between expected investment return and actual investment income for each of the five previous years.

We were able to replicate the retained actuary's calculation of the AVA as summarized below:

| (In \$'s) | | Segal | | Deloitte | |
|-----------|---|-------------------|-----------------------------------|-----------------------------------|---------------|
| 1 | MVA | | 6/30/2017 1,229,420,000 | 6/30/2017 1,229,420,000 | |
| 2 | Calculation of Unrecognized Return | Original Amount | Percent Deferred | Percent Deferred | |
| a | FYE 2017 | 68,568,900 | 80% 54,855,120 | 80% | 54,855,120 |
| b | FYE 2016 | -79,572,275 | 60% -47,743,365 | 60% | -47,743,365 |
| c | FYE 2015 | -29,016,925 | 40% -11,606,770 | 40% | -11,606,770 |
| d | FYE 2014 | 105,310,725 | 20% 21,062,145 | 20% | 21,062,145 |
| e | FYE 2013 | <u>74,330,440</u> | 0% - | 0% | - |
| f | Total unrecognized return | | 16,567,130 | | 16,567,130 |
| 3 | Preliminary actuarial value | | 1,212,852,870 | | 1,212,852,870 |
| 4 | Corridor adjustment | | 0 | | 0 |
| a | MVA + 20% | | | | 1,475,304,000 |
| b | MVA - 20% | | | | 983,536,000 |
| 5 | Final AVA | | 1,212,852,870 | | 1,212,852,870 |

Police Officers' Fund

The AVA for the Police Officers' Fund is equal to the MVA.

Firefighters' Fund

The AVA for the Firefighters' Fund is equal to the MVA.

Comparison of Pension Funds

The calculation methodologies differ between the three Pension Funds due to the different policies. These differences are evaluated in the *Review of Actuarial Methods* section of this report.

Review of Required Disclosures and Presentation

In this section, we review the content of the actuarial report for required disclosures and report presentations.

Applicable ASOPs

Actuarial Standard of Practice No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*, provides guidance regarding nearly all aspects of the actuarial valuation method, including several cross-references to other ASOPs cited in this review.

Actuarial Standard of Practice No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*, states in Section 4.1.2., *Rationale for Assumptions*, that the actuary should disclose the information and analysis used in selecting each assumption that has a significant effect on the measurement. There are several approaches to meeting this requirement offered in the ASOP, including specific approaches used, sources of external advice, or how the past experience and future expectations were considered.

Actuarial Standard of Practice No. 41, *Actuarial Communications*, provides guidance for any written, electronic, or oral communication issued by an actuary with respect to actuarial services. The standard specifically identifies disclosures that must be made within Actuarial Reports like the annual valuations and experience studies provided by the retained actuaries.

Generally, an actuarial report should:

- Accurately and fairly represent the financial condition of the System
- Be written so that it can be reasonably understood by the intended audience
- State the actuarial findings, and identify the methods, procedures, assumptions, and data used by the actuary with sufficient clarity that another actuary qualified in the same practice area could make an objective appraisal of the reasonableness of the actuary's work as presented in the actuarial report
- Disclose uncertainty or risk, conflicts of interest, reliance on other sources for data, and responsibility for assumptions and methods.

The standards above identify what must be reported within the reviewed valuations and experience studies. We have recommended additional disclosure where we judged its value to be worth the effort of production.

Actuarial Standard of Practice No. 51, *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions*, provides guidance for actuaries when calculating an actuarially determined contribution. Funding reports should include the following:

- Identification of key risks facing the plan
- Assessment of these risks either quantitatively or descriptively
- Calculation of plan maturity measures
- Historical information of key plan metrics and demographic information.

This standard is intended to supplement ASOP 4 and is effective for any actuarial work product with a measurement date on or after November 1, 2018. **Note that this ASOP is not effective for these valuations, but it will apply for subsequent valuations.** We have provided recommendations to proactively provide the required information, where appropriate.

Comments and Recommendations

GE Fund

It is our opinion that the actuarial valuation report meets applicable actuarial standards of practice and appears to accurately represent the funded status of the plan. Additionally, while ASOP 51 was not effective for this report, the report includes ASOP 51-type content such as historical information and an identification and assessment of key risks facing the plan.

Deloitte confirmed with the retained actuary that the presentation dated June 7, 2017 was the only communication delivered to the City as part of the experience study. For this reason, this document is considered an Actuarial Report as defined by ASOP 41. We do not believe that the experience study report meets the applicable actuarial standards of practice in terms of the appropriate disclosures. While Deloitte was able to verify the selected assumption through a replication of the study, section 3.2 of ASOP 41 states that “In the actuarial report, the actuary should state the actuarial findings, and identify the methods, procedures, assumptions, and data used by the actuary with sufficient clarity that another actuary qualified in the same practice area could make an objective appraisal of the reasonableness of the actuary’s work as presented in the actuarial report.” Without access to the data underlying the report, Deloitte does not believe sufficient detail was provided in the actuarial communication to make an objective appraisal of the reasonableness of the actuary’s work.

We recommend making the following additions to the reports:

- Disclose the undiscounted cash flows, a beneficial tool for understanding the plan’s financial obligation. This could be for a 10 to 20 year period, showing current and future retirees separately.
- Provide a rationale for any assumptions that are changed subsequent to the most recent experience study.

- Include a description of how closely current actual and target asset allocations align with the target asset allocation used to select the investment return assumption in the most recent experience study.
- Add the required disclosures under section 3.3 of ASOP 41 to address “Uncertainty or Risk” and “Conflict of Interest”.
- Increase the level of detail provided in the experience study such that another qualified actuary could make an objective appraisal of the reasonableness of the actuary’s work.
- Consider adding a signature page to future experience study reports.

Police Officers’ Fund

The actuarial report and experience study report meets applicable actuarial standards of practice; the actuarial report appears to accurately represent the funded status of the plan. Additionally, while ASOP 51 was not effective for this report, the report includes ASOP 51-type content such as historical information for key plan metrics and demographic information. However, for future reports when ASOP 51 is effective, we would expect to see more ASOP 51-type content including identification and assessment of key risks facing the plan.

While ASOP 51 is not effective until November 1, 2018, we would expect future valuation reports for the Police Officers’ and Firefighters’ Funds to include additional assessment of risk.

We recommend that the valuation report include appropriate disclosure of rationale for each assumption determined to have significant impact on the measurement, as described in ASOP 35.

Firefighters’ Fund

The actuarial report and experience study report meets applicable actuarial standards of practice; the actuarial report appears to accurately represent the funded status of the plan. Additionally, while ASOP 51 was not effective for this report, the report includes ASOP 51-type content such as historical information for key plan metrics and demographic information. However, for future reports when ASOP 51 is effective, we would expect to see more ASOP 51-type content including identification and assessment of key risks facing the plan.

While ASOP 51 is not effective until November 1, 2018, we would expect future valuation reports for the Police Officers’ and Firefighters’ Funds to include additional assessment of risk.

We recommend that the valuation report include appropriate disclosure of rationale for each assumption determined to have significant impact on the measurement, as described in ASOP 35.

Comparison of Pension Funds

While we have disclosed several recommendations throughout this report that will improve transparency for these disclosures, it is our opinion that the presentation of the required disclosures for the Pension Funds satisfy the applicable ASOPs.