

Request for Proposals: Actuarial Audit of the Ohio State Highway Patrol Retirement System

PREPARED FOR

Ohio Retirement Study Council

DUE BY

June 18, 2021

Prepared by:

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Employee Benefits, Actuarial & Investment Consulting

June 16, 2021

Bethany Rhodes
Director
Ohio Retirement Study Council
30 East Broad Street
2nd Floor
Columbus, Ohio 43215

Re: RFP for Actuarial Audit of the Ohio State Highway Patrol Retirement System

Dear Ms. Rhodes:

Bolton is pleased to present this response to the Ohio Retirement Study Council's RFP for an Actuarial Audit of the Ohio State Highway Patrol Retirement System. Our firm provides actuarial services for cities, counties, and states throughout the country and is well-qualified to provide all the of actuarial services described in your RFP. As demonstrated in this proposal, Bolton has the extensive experience and expertise necessary to provide the requested services in a timely manner with a commitment to the highest quality standards. Key advantages Bolton offers to the Ohio Retirement Study Council (ORSC) include:

- **Public sector audit experience:** We have completed several large and high-profile public sector audits in the past five years. These audits include the State of California pension and OPEB plans, the City of New York's five retirement systems, the State of Maryland, and the State of Texas.
- **Extensive public sector consulting expertise.** We have rich practical and theoretical experience with public sector pension valuations, experience studies, actuarial audits, and retirement consulting. The team that we are offering to you has done hundreds of actuarial valuations and is experienced in completing actuarial audits for both pension and OPEB programs.
- **Technical excellence.** Bolton's actuaries are nationally recognized experts in the design, funding, and management of public sector pension plans. We strive for perfection in our work. The quality and experience of our staff and the direct involvement of senior actuaries in all phases of a project ensure that we will deliver the highest quality of work. We have provided actuarial audit and review services to some of the largest public retirement systems in the U.S.
- **Accessible experts.** Our firm is just the right size to fit your needs: we have the experience and expertise of a large firm, with the personalized attention that smaller firms can offer. Bolton's Chief Actuary, Ellen Kleinstuber, will serve as the Lead Actuary for this engagement. She is also the President-Elect of the Conference of Consulting Actuaries, the actuarial organization that published seminal guidelines on public pension plan funding policies. Ellen resides in Lake County, OH and offers

the ORSC a local presence. Tom Vicente, your proposed Supporting Actuary, is a member of the Society of Actuaries' Social Insurance and Public Finance Section Council, which provides continuing education to actuaries and supports research that includes the evaluation and management of public pension plans. Tom Lowman, one of the country's foremost experts on public pension plans, will provide peer review support throughout the actuarial review. We design our project teams with built-in redundancy to ensure adequate coverage throughout the course of our work with our clients. This knowledge, flexibility, and availability will allow us to quickly meet your needs.

- **Clear communication.** We work with our clients to ensure our communication is comprehensive, understandable, and meets or exceeds their expectations. This includes the use of summary tables and graphs to illustrate trends in the data and valuation results and providing materials prior to meetings so that our clients have time to review and provide any feedback or requests for additions or clarifications.

Bolton is pleased to present this offer to provide the requested actuarial review services. We look forward to working with you and developing into a trusted partner. Please let us know if you have any questions regarding this proposal. You may contact Ellen Kleinstuber at (443) 573-3912 or Tom Vicente at (443) 573-3918.

Sincerely,

Bolton



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I. PROPOSAL SUMMARY

Each proposal shall provide a narrative summary of the proposal being submitted. This summary should identify all of the services and work products that are being offered in the proposal and should demonstrate the firm's understanding of the project. In addition to the summary, please provide all of the following general information:

- The firm's primary contact for ORSC staff use and, if different, for HPRS staff use during the audit, including the contact's address, telephone and e-mail address;
 - General ownership structure of the organization, including subsidiary and affiliated companies, and joint venture relationships;
 - Information regarding any material change in the firm's structure or ownership within the last eighteen months, or any material change in ownership, staff, or structure currently under review or being contemplated by the firm;
 - If available, a third-party assessment or report concerning client satisfaction and measures of the firm's strengths and weaknesses;
 - Any material litigation which has been threatened against the firm or to which the firm is currently a party;
 - A list and brief description of litigation brought against the firm by existing or former clients over the last five years; and
 - A list of any professional relationships involving the ORSC, the five Ohio public retirement systems, the State of Ohio, or its political subdivisions for the past five years, together with a statement explaining why such relationships do not constitute a conflict of interest relative to performing the proposed review. In the event that the firm has had any professional relationships involving the ORSC, the five Ohio public retirement systems, the State of Ohio, or its political subdivisions for the past five years, the firm shall provide a statement explaining why such relationships do not constitute a conflict of interest relative to performing the proposed review, or, if necessary, an explanation of the actions that will be taken to ensure an independent review.
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Summary of Proposal

Bolton's approach to is simple – we put our clients in the best position to succeed. We do this by delivering actuarial and consulting services with integrity, independence, and technical excellence. Bolton serves a national client base and has earned a reputation for providing the highest quality work and delivering understandable, insightful, and impactful solutions for our clients.

Bolton has completed numerous actuarial audits, including some of the largest retirement systems in the U.S., and has a proven, tested approach to validating that the valuations prepared by a system's consulting actuary are reasonable and appropriate. The team assigned to this engagement includes some of the most senior actuaries in our firm, each of whom is nationally known in the actuarial profession or the public plans community..

The Ohio Retirement Study Council (ORSC) was created by the Ohio General Assembly in 1968 to oversee Ohio's five state retirement systems. As part of its statutory duties, the ORSC is commissioning an independent actuarial audit of the most recent actuarial reports produced for the State Highway Patrol Retirement System (HPRS). Bolton understands that we would be providing the services and work products listed in Section II. Scope of Audit of the RFP. The requested work includes performing a full scope (GFOA Level One) actuarial audit for the primary purpose of independent verification and analysis of the assumptions, procedures, and methods used by the consulting actuary Foster & Foster (F&F) of HPRS for the following work products:

- HPRS annual pension actuarial valuation as of January 1, 2020;
- The five-year experience review for the period December 31, 2013 to December 31, 2018; and
- HPRS annual retiree health care actuarial valuation as of January 1, 2020, including GASB Statement disclosures.

As part of the independent verification analysis the actuarial audit will include the following elements and activities:

- **Data Validity** - Assessment of the validity, completeness, and appropriateness for HPRS's structure and funding objectives of the demographic and financial information used by the consulting actuary in the valuation of HPRS.
- **Actuarial Valuation Method and Procedures** - Assessment of whether the consulting actuary's valuation method and procedures are reasonable and consistent with generally accepted actuarial standards and practices appropriate for HPRS's structure and funding objectives and are applied as stated by the actuary. If deviations from accepted standards are found during the audit, Bolton will obtain the rationale for the deviations and determine their effects, including their monetary impact.
- **Actuarial Valuation Assumptions** - Assessment of whether the actuarial valuation assumptions are reasonable and consistent with generally accepted actuarial standards and practices; are reasonable based on HPRS's experience; and are appropriate for HPRS's structure and funding objectives. The assumptions evaluated should include both demographic and economic assumptions, such as mortality, retirement, separation rates, levels of pay adjustments, rates of investment return, and disability factors.
 - As part of this assessment, Bolton will consider and specifically address whether actual experience is appropriately evaluated in experience studies conducted by the consulting actuary at least every five years and whether recent changes in assumptions are appropriate, reasonable, and supported by the experience studies.
 - Bolton will also review the gain/loss analyses from the last four actuarial valuation reports.
- **Parallel Valuation** - Perform parallel valuations of both pension and retiree health care benefits as of January 1, 2020, using the validated member census data and the same actuarial assumptions.
- **Recommendations** - If Bolton recommends assumption adjustments to more accurately reflect present and future assets, liabilities, and costs of HPRS, Bolton will provide detailed rationale for our

recommendations and describe the general effect on HPRS's condition resulting from the proposed changes in assumptions.

- **Review of Health Care** - Assessment of whether the system appropriately and consistently determines retiree contributions to health care and whether the implementation of the HPRS's health care policies differ from those determinations.

Bolton's actuarial audit report will document our opinion of the demographic and financial information used, confirm the accuracy of the actuarial work and its relation to the actuarial standards, and provide a detailed description of each audit exception. We will include a glossary of key terms to support understanding, as well as an executive summary. Finally, the report will contain any recommendations for improvement for future reports and studies. Detailed and highly technical information will be included in appendices to assist the consulting actuary in understanding our findings will be included in a separate appendix document for their reference.

Each of the significant aspects of our Summary of Proposal response is discussed in further detail in the remainder of our proposal.

Primary Contacts

Your Lead Actuary, Ellen Kleinstuber, and Supporting Actuary, Thomas Vicente, will be the ORSC's primary contacts. Their contact information is below.

Ellen L. Kleinstuber, FSA, EA, FCA, MAAA, FSPA
Principal, Chief Actuary
ekleinstuber@boltonusa.com
(443) 573-3912

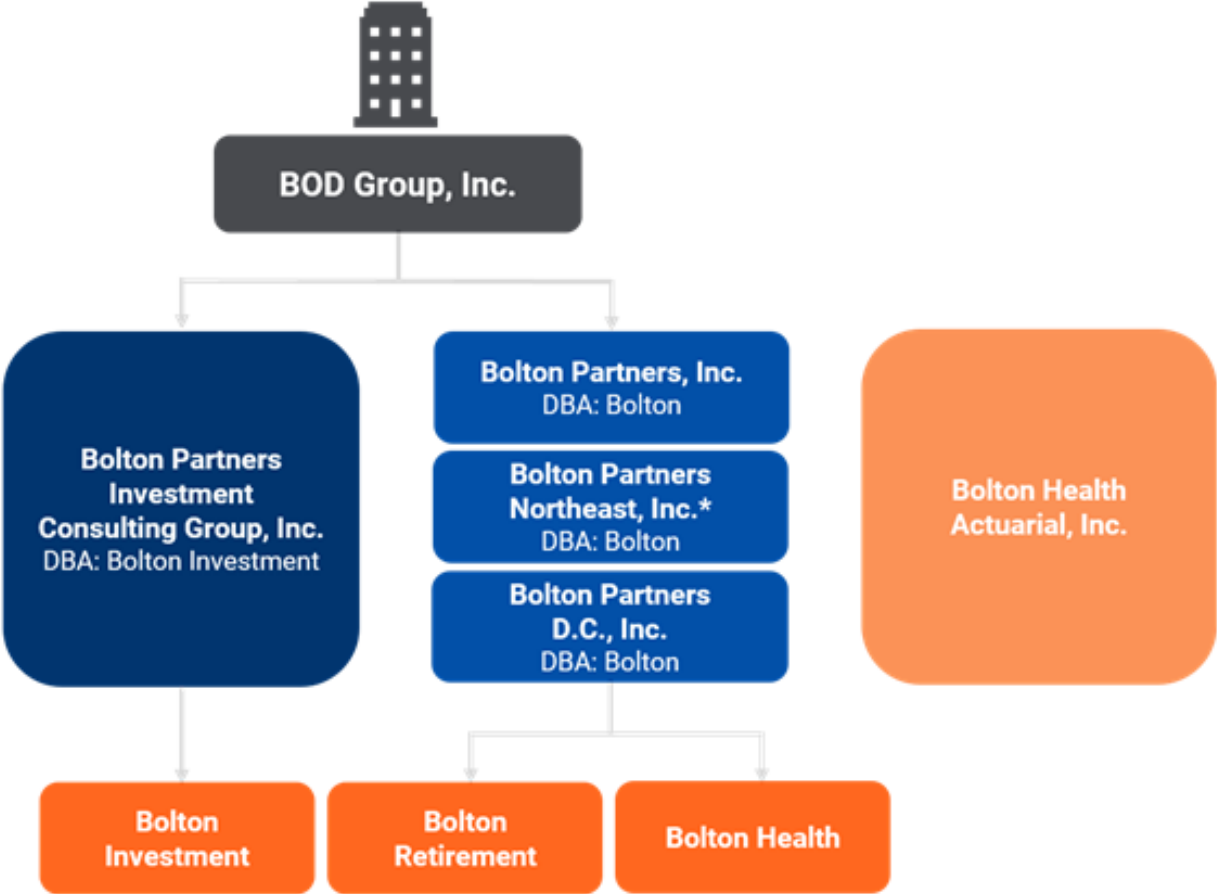
Thomas Vicente, FSA, EA, FCA, MAAA
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Bolton Ownership Structure

As an independent firm, we work solely on behalf of our clients and always in their best interest. Our firm's culture is based on an obsession with serving the needs of our clients without the bureaucracy often found at large national firms. Bolton's expertise is not limited by plan or employer size. Our client base represents a broad spectrum, from small cities to large counties to states, and are ideally suited to be more responsive and tailored to each and every client.

Headquartered in Baltimore, Maryland, we also maintain offices in Arlington, VA (Washington, D.C.); Mt. Laurel, NJ; Blue Bell (Philadelphia), PA; Atlanta, GA; and Denver, CO. Bolton's 100+ employees serve our clients throughout the United States. Although we do not maintain an official Bolton office in Ohio, our Chief Actuary Ellen Kleinstuber is an Ohio resident and works primarily from her home in Lake County.

We are part of BOD Group, Inc. and are a 100% employee-owned C corporation. Our private ownership allows us to put our clients ahead of everything else. We do not have shareholders that force us to focus on the next quarterly reporting. Instead, we can focus on what is best for our clients and provide truly unbiased consulting. We not only provide proactive consulting on what our clients should do, but we also provide our clients with recommendations on what they do not need to do, which results in efficient and cost-effective solutions for our clients. The ownership structure of our firm is depicted below.



*Bolton Partners Northeast, Inc. is a subsidiary of Bolton Partners, Inc.

Our most recent organizational change includes the rebranding of our organization from Bolton Partners, Inc. to Bolton. Along with the updated brand name, we completed an organizational realignment to clearly distinguish our three primary service lines: Bolton Health, Bolton Retirement, and Bolton Investment. The most recent changes in our ownership by percentage (effective January 1, 2021) are listed below. We do not anticipate any further, near-term changes in ownership or organization structure.

1/1/2021

Stockholder	Ownership
Robert G. Bolton	93.2%
Chris G. Bolton	2.0%
Mark L. Lynne	2.3%
James Downing	0.74%
Ellen Kleinstuber	1.02%
Geoff Adams	0.74%
	100.0%

Client Satisfaction

We are perhaps best known for providing the highest level of customer service to our clients, and our consultants are always engaged and accessible. If we are out of the office, we leave instructions on our email with contact information for our backup team member. When traveling and on client appointments, our consultants remain accessible by phone and email and make sure to stay in touch. Your Lead Actuary, Ellen Kleinstuber, is local and available to meet with HPRS and ORSC in person as needed.

We are willing to provide performance guarantees (and associated penalties) if we do not provide the level of customer service expected. We will guarantee response times on all written and phone communications and on specific phases of the actuarial audit project that are mutually acceptable to you and Bolton. We conduct annual “stewardship” meetings with our clients to ensure complete satisfaction with our overall relationship, identifying whether our promises have been kept, deadlines and milestones have been satisfied, and we are providing real financial value. We would welcome a conversation around creating key performance indicators (KPI) that you believe would be critical to successfully transitioning this important advisory relationship.

Litigation and Professional Relationships with the ORSC

There is no material litigation that has been threatened against Bolton or to which Bolton is currently a party.

No litigation has been brought against Bolton by existing or former clients over the last five years.

Integrity and independence are core values of our firm. These are reflected in everything we do to ensure that our clients’ interests are always first, front and center. Given our extensive work for the Pension Benefit Guaranty Corporation, it is imperative that we have a robust process in place for identifying potential conflicts of interest prior to accepting a client engagement. Bolton will not enter into a contract with an entity in which there could possibly be an identifiable conflict of interest. Our employees are educated about the importance of conflict-of-interest checks and independence in our employee handbook, through our COI policy. Our employees are also restricted from accepting outside employment without the approval of management to avoid the potential for any unidentifiable conflict to arise.

Bolton does not have and has not had any direct professional relationships involving the ORSC, the five Ohio public retirement systems, the State of Ohio, or its political subdivisions for the past five years. However, in 2017 Bolton was retained by the law firm representing the State Teachers Retirement System of Ohio (STRS) to serve as an expert witness for the defense in the matter Brian C. Clark, Ph.D. v. State Teachers Retirement System. The testifying expert in this matter has retired from the firm and is not part of the team assigned to our proposed team that would provide actuarial audit services to ORSC. Bolton is independent of ORSC and does not believe the litigation support in the STRS matter presents a conflict of interest with respect to our proposed engagement with ORSC. Should any such conflict arise in the future, we will notify you as soon as we become aware of it and will work with you to satisfactorily resolve the matter.


II. CAPABILITIES AND EXPERIENCE

Each proposal shall describe the firm’s capabilities and recent experience (at least during the last five years) in performing actuarial valuations, audits, or studies of public employee retirement systems. The response should include information on the types and sizes of public employee retirement systems for which past work has been performed, including whether the systems were defined benefit or defined contribution plans, the types and number of participating employers, number of participants, and other relevant indicators of plan type, size, and comparability to HPRS. You should include other information you believe may be relevant in demonstrating your capabilities in performing the actuarial audit, including other professional experience and data processing capabilities.

About Us

Bolton Partners, Inc. (DBA Bolton) is a full-service actuarial, employee benefits, and investment consulting firm with 40 years of experience providing consulting services to clients in the public and corporate sectors, nonprofit organizations, as well as for the Federal Government. Bolton was founded in 1981 by Mr. Robert G. Bolton as an independent actuarial and employee benefits consulting firm, and since our founding, actuarial services and benefit plan consulting have been our primary focus.

Our three consulting divisions provide pension and retirement, health and benefits, and investment consulting services for public sector, corporate, multi-employer plans, and non-profit organizations:

 RETIREMENT	 HEALTH	 INVESTMENT
<ul style="list-style-type: none">• Retirement Strategy and Plan Design• Actuarial Services• Administration and Compliance• Actuarial Audits• Asset/Liability Studies• Risk Management Consulting• Plan Terminations• Defined Contribution Consulting• Plan Compliance	<ul style="list-style-type: none">• Strategy and Plan Design• Plan Benchmarking and Performance• Health Actuarial Services• Wellbeing and Population Health• Brokerage and Exchange Services• Pharmacy Benefit Management• Group and Voluntary Benefits• Claim and Dependent Verification Audits• Vendor Evaluation and Selection• Compliance Support• Retiree Medical• Benefits Administration and Enrollment Services	<ul style="list-style-type: none">• Investment Policy Review and Deployment• Manager Evaluations and Searches• Performance Measurement, Modeling and Monitoring• Defined Contribution Consulting• Vendor Searches• Compliance Support• Plan Governance and Fiduciary Services• Asset Allocation Studies

Bolton serves a national client base and has earned a reputation for integrity and the highest quality of work. We build long-term partnerships with our clients by delivering understandable, insightful, and impactful solutions to complex benefits issues so that they can best manage future financial risks and provide valuable benefits to their employees.

Bolton is one of a select few firms with subject matter expertise in retirement consulting (both defined benefit and defined contribution), pension/OPEB actuarial services, retirement investment advisory services, health and welfare benefits, wellness and population health, healthcare actuarial services, and voluntary benefits. We also have a breadth and depth of experience working with public sector employers, with government plans constituting about 75% of our revenue. We are the actuaries for more than 85 public pension plans and over 150 OPEB plans.

Since our inception, Bolton has thrived in our industry and maintained our financial health and solvency. Our success over the last 40 years is due to the strength of our relationships with our clients, our technical knowledge, and our work product.

Actuarial Audit Experience

Bolton has the experience and qualifications to provide all work described in the scope of services. Bolton’s expertise is not limited by plan or employer size – our client base represents a broad spectrum, from small cities to large counties to states. We are ideally suited to be more responsive and tailored to each client. Our valuation software and reporting tools allow for flexibility in how we do our work, and our firm-wide commitment to integrity and technical excellence ensures that any modifications to our usual procedures will conform to the highest standards.

One of our particular areas of specialty is performing actuarial audit work, including for several of the largest public employer pension and OPEB plans in the country. In the last five years, we have completed several significant actuarial audits, including:

Entity	Plan Type	Year of Audit	Size (Participant Count/Asset Size)	Scope	Audit Type
State of Maryland	Defined Benefit	2019 (& 2014)	456,000 ppt/ \$56B	Six plans including State Police (4,000 ppt) plan	Full replication of valuation, review of experience study as well as audit of all methods and assumptions
State of California	Defined Benefit	2019 (& 2017)	640,000 ppt/ \$439B	Five plans including Highway Patrol (7,000 ppt) plan	Audit of methods and assumptions, review of experience study
State of California	OPEB	2019 (& 2018)	459,000 ppt/ \$874M	Covering all California employees including Highway Patrol	Audit of methods and assumptions including GASB allocations, review of experience study

Entity	Plan Type	Year of Audit	Size (Participant Count/Asset Size)	Scope	Audit Type
State of Texas	Defined Benefit	2017	359,000 ppt/ \$24B	Four plans including Law Enforcement (62,000 ppt)	GFOA Level 2 audit (sample tests and methods and assumptions review) and review of experience study
State of Texas	OPEB	2019 (& 2018)	1.4M ppt/ \$1.2B	Three plans (ERS, TRS, Texas A&M)	Audit of methods and assumptions and GASB statement 74 compliance, review of experience study
City of New York	Defined Benefit	2019 (& 2018 & 2017)	745,000 ppt/ \$153B	Five plans including Police Pension Fund (85,000 ppt)	Full replication of valuation, development of experience study as well as audit of all methods and assumptions
City of Denver	Defined Benefit, OPEB	2020 (& 2019)	25,000 ppt/ \$2B	Pension with OPEB embedded	Full replication of valuation as well as audit of all methods and assumptions
City of Austin	Defined Benefit	2019	21,600 ppt/ \$4B	Three plans including Police Plan (2,800 ppt)	Audit of methods and assumptions
Cherokee County GA	Defined Benefit	2020	2,800 ppt/ \$81M	One plan plus experience study	Full replication of valuation as well as audit of all methods and assumptions

We also perform annual audits of the actuarial valuations of the U.S. Department of State's pension plans, which span a wide variety of countries, including the United States. Many of the actuarial audits we have conducted for larger counties and states are for cost-sharing plans.

We are the valuation actuary for over 85 public sector defined benefit plans and over 100 public sector OPEB plans. We service many counties, cities and other public entities throughout the country. We are also the valuation actuary for most of the cities of West Virginia's police and fire pension plans through a contract with the West Virginia Municipal Pensions Oversight Board. Our clients include cost-sharing employers, agent plans, and single employer plans with most plans being single employer plans. Our average client has over 1,700 participants and \$350 million in liabilities, with our largest annual valuation client covering 18,000 participants and \$4.4 billion in liabilities.

While most of our actuarial consulting is with traditional defined benefit plan sponsors, we also assist the Pension Benefit Guaranty Corporation (PBGC) with a wide variety of actuarial services, including:

- Auditing large plan terminations (such as the GM Salaried Plan) by reviewing the calculation of benefits and liabilities for sample participants

- Reviewing the funding levels of large corporate pension plans, such as GM, GE, IBM, Delta, American Airlines, that are engaging in corporate transactions or that have underfunded defined benefit plans under the single employer Early Warning Program
- Preparing valuations of pension benefits due to the participants in many large pension plans (such as the United Airlines plans and the 65,000 participants in the Delphi retirement plans), and
- Developing administrative systems to process future benefit calculations for trustee defined benefit plans

Ellen Kleinstuber, our Chief Actuary and the proposed Lead Actuary for this engagement, is an appointed member of the Board of Actuaries for the U.S. Civil Service Retirement System (CSRS). In this role, she works closely with the actuaries at the Office of Personnel Management (OPM) to review the periodic experience studies they prepare, provide advice on the interpretation of those studies, and approve the assumptions selected by the OPM actuaries for use in the annual valuation of the CSRS and the Federal Employees Retirement System (FERS). CSRS/FERS covers roughly 2.6 million participants and has \$1,97 trillion in actuarial liability.

These examples demonstrate that our firm and our senior actuaries are trusted to provide quality results in the public sector. Working with these large systems requires us to have best-in-class tools and procedures in place to support the services we provide. The variety of work we provide to public sector plan sponsors also requires us to be flexible and innovative in the work that we do. Some specific examples of actuarial audits we have performed are included below. We have also provided contact information for these clients in Section 3.

Maryland State Retirement and Pension System

Number of Participants: 456,000

Total Assets: \$56.3 billion

Type of Plan: Defined Benefit Cost-sharing with over 100 employers

Period of Engagement: July 2019-November 2019

Services Provided: Bolton was engaged to provide a level 1 full replication audit of the Maryland State Retirement and Pension System. We replicated the most recent actuarial valuation results and reviewed the multi-year cost projections from the actuary for the State Retirement and Pension System, including each component (Teachers, Employees, State Police, Judges, and Law Enforcement Officers' Pension System). From these baseline results, we validated such program aspects as employee contribution rates, benefit levels, employer contributions, salary increases, eligibility, past service credits for military service, and actuarial liabilities.

Results and Impact: Bolton validated that the actuarial valuation results prepared by the System actuary (GRS) for each of the five systems were reasonable and within the agreed-upon tolerances. As part of the audit, we identified opportunities to improve the methodology used to roll valuation results forward from the valuation date to the following fiscal year. Our review confirmed the assumptions from the 2019 experience

study were reasonable and were used appropriately for the 2019 valuation. A number of method changes were recommended to improve the process and outcome.

City of New York

Number of Participants: 745,000

Total Assets: \$152.6 billion

Type of Plan: Defined Benefit Cost-sharing with 11 participating employers

Period of Engagement: January 2017 – October 2020 (all deliverables provided by April 2019)

Services Provided: Bolton was engaged to (a) perform an actuarial audit of employer contributions for fiscal years 2016 and 2018, (b) prepare a study of actuarial experience to compare actual experience with the assumptions being used for the valuations, and (c) review the administrative processes for maintaining participant data, providing that data to the NYC actuary, and processing benefits calculations and payments. Our assignment covered the five major retirement systems sponsored by the City. The audit and experience study services include a comprehensive review of plan provisions to evaluate consistency with the benefits included in the valuation, reviewing economic and demographic assumptions and actuarial methods used, replicating the valuation results prepared by the actuary for the retirement systems and reconciling any differences between their results and ours, and preparing detailed documentation of our findings and recommendations to be reviewed with the City Comptroller and Chief Actuary. This project is now complete.

Results and Impact: Bolton validated that the actuarial valuation results prepared by the Office of the Actuary for each of the five systems were reasonable and within the agreed-upon tolerances and identified opportunities to improve the methodology used to roll valuation results forward from the valuation date to the following fiscal year. Our experience study confirmed the assumptions used for the 2014 valuation were reasonable and remain reasonable for the 2016 valuation, with potential updates for the 2018 valuation to be recommended based on a second biennial experience study. Some method changes were recommended to improve the process and outcome. Finally, the administrative audit validated that the data used in the valuations were reasonable and individual benefits were calculated accurately while suggesting an opportunity to potentially reduce plan liabilities by auditing the spousal data for current retirees to identify any who have predeceased the retiree.

State of California

Number of Participants: 640,000

Total Assets: \$439.0 billion

Type of Plan: Defined Benefit Agent Multiple and Cost-sharing with over 3,000 employers

Period of Engagement: 2017 and 2019

Services Provided: Bolton was engaged to assist the State Auditor in evaluating whether the actuarial valuations of the total defined benefit pension liability prepared by CalPERS are appropriate and consistent with the actuarial standard as well as with standards and guidance issued by GASB governing accounting and financial reporting for pensions. Bolton reviewed the following five pension plans for compliance with GASB 67/68 and relevant ASOPs: (1) State Miscellaneous, (2) State Peace Officers and Firefighters, (3) State Safety, (4) State Industrial, and (5) California Highway Patrol. We reviewed the actuarial reports for compliance with Actuarial Standards of Practice (ASOPs) 4 (measuring pension obligations), 23 (data quality), 27 (selection of economic assumptions in measuring pension obligations), 35 (selection of demographic and other non-economic assumptions for measuring pension obligations) and 41 (actuarial communications). We also reviewed the GASB 68 work for compliance with Chapter 13 (Defined Benefit Pension Plans (Plan & Employer Considerations)) of the AICPA's Audit & Accounting Guide for State and Local Governments.

Results and Impact: Bolton validated the roll forward method for providing GASB results for the June 30, 2017 Annual Financial Report. Bolton validated that the economic and demographic assumptions were consistent with the relevant ASOPs, including a detailed analysis of the discount rate assumption. We also provided detailed commentary on the amortization method and the impact on the contribution rates. Finally, Bolton recommended a reduction in the discount rate assumption.

Capabilities

Professional Staff

As an independent firm, we work solely on behalf of our clients and always in their best interest. Our firm's culture is based on an obsession with serving the needs of our clients without the bureaucracy often found at large national firms. Bolton's expertise is not limited by plan or employer size. Our client base represents a broad spectrum, from small cities to large counties to states, and unlike our larger competitors, we are ideally suited to be more responsive and tailored to each and every client.

Our staff, with its combined level of experience and expertise, is unique. Our senior consulting actuaries come from diverse backgrounds, benefiting from their work with a wide variety of plan sponsors in the public and private sectors and ensuring that our clients are provided with thoughtful, innovative advice on managing their retirement systems. Our actuaries take senior leadership positions within the U.S. actuarial organizations, affording us insights into the latest trends and developments that affect public pension plan sponsors. We also have consultants with experience on the plan sponsor side, providing a different perspective on how workforce dynamics may influence plan design and effective communication with members about their benefit programs.

We are proud of the fact that we have had little professional staff turnover (other than normal retirements) which gives our clients the opportunity to have long-term relationships and continuity in their service with our consultants.

Our professional staff includes:

Title	Count
Credentialed Actuaries*	28
Actuarial Assistants	35
Benefit Consultants	12
Administrators	3
Other	33
Total	111

*Includes 12 Fellows and 14 Associates of the Society of Actuaries, 9 Fellows of the Conference of Consulting Actuaries, 16 Members of the American Academy of Actuaries, and 20 Enrolled Actuaries

Bolton consultants are active participants in the actuarial and benefits community. We are members of the Society of Actuaries (SOA), the American Academy of Actuaries (AAA), the Conference of Consulting Actuaries (CCA), the International Foundation of Employee Benefit Plans (IFEFP), International Society of Certified Employee Benefit Specialists (ISCEBS), and Working in Employee Benefits (WEB). We take significant research and leadership roles with these organizations. For example:

- Tom Lowman, Vice President of Bolton, is the past vice-chairperson of the Conference of Consulting Actuaries Public Plans Community, the immediate past chairperson of the American Academy of Actuaries Public Plans Committee, and a former member of the Pension Committee of the Actuarial Standards Board.
- Ellen Kleinstuber, our Chief Actuary, is the current president elect of the Conference of Consulting Actuaries, co-chairperson of the Committee for the CCA Enrolled Actuaries Conference and the chairperson of the Conference of Consulting Actuaries Professionalism Committee, as well as the immediate past chairperson of the American Academy of Actuaries Pension Committee.
- Kevin Binder, our OPEB actuarial practice leader, is a former chairperson of the Society of Actuaries Retirement Section Research Team and has served on the project oversight group for the development of the RP-2000 mortality tables.
- Tom Vicente, Senior Consulting Actuary is Vice Chair of the Social Insurance and Public Finance section of the Society of Actuaries, and a member of the American Academy of Actuaries Public Plans Committee.

Our actuaries are frequent speakers at continuing education meetings of the various actuarial organizations and have presented to diverse audiences including the National Conference of Insurance Legislators, the Pension Rights Center, and the National Conference on Public Employee Retirement Systems.

With a staff of 115+, we have the resources available to fully meet the requirements of this project and will perform the services outlined in the RFP using only our present staff. We have a flat organizational structure, whereby even the most senior members of the firm are actively engaged in servicing clients. The quality and

experience of our staff and the direct involvement in the daily processing of tasks by senior actuaries ensure that we will deliver the highest quality work.

To ensure that we continue to have the necessary resources to provide exceptional service to our clients, on a monthly basis, we measure “capacity.” A capacity ratio of 100% is ideal, and our range has generally been between 95% and 105%. At 105% we hire more staff. No consultant has more than 30 clients, with the exception of our health care actuaries who do GASB 74/75 valuations (multiple small valuations).

Technological Resources

The software we use for our actuarial work is a combination of the programs in the Microsoft Office Suite (Excel, Word, PowerPoint, and Access) along with ProVal.

We have a library of Excel-usable add-in actuarial functions, which can be used with spreadsheet programs. These built-in functions are useful in an actuarial audit engagement as they allow us to create cost-effective independent Excel models to replicate sample life output from ProVal, adding to the quality control and efficiency of debugging our replication programming.

ProVal is an actuarial system widely used by consulting actuaries and the Federal government. ProVal is written in APL which is the ideal language for dealing with many of the emerging issues in actuarial work such as the use of yield curves and generational mortality. ProVal was developed and is supported externally. Dozens of actuarial firms use ProVal valuation software. ProVal includes a comprehensive database management system designed specifically to quickly and accurately prepare and summarize census data for the current year’s retirement plan valuations. ProVal links databases directly to valuations and projections, so we can know precisely what data underlies the results.

We use Citrix Sharefile for secure data sharing and storage. Clients have found this to be a user-friendly and safe way to transmit sensitive data to us, and they appreciate the ability to access files previously uploaded using a simple search mechanism.

We can also share data securely via Mimecast or via our sFTP server if this approach is more appealing to ORSC.

III. STAFF QUALIFICATIONS

Each proposal shall, at a minimum, describe the qualifications of all management and lead professional personnel who will participate in the audit. Each personnel description shall include: (1) a resume; (2) a summary of experience each has had in performing actuarial valuations, audits, or studies of public employee retirement systems; and (3) a management plan identifying the responsibilities each will have on the audit.

Each resume should include information on the current and past positions held with the firm, educational background, actuarial and other relevant credentials, and other relevant information to demonstrate the person's qualification.

The experience summaries should include information on the types and sizes of public employee retirement systems for which the designated staff have completed actuarial work, including whether the systems were defined benefit or defined contribution plans, the types and number of participating employers, number of participants, and other relevant indicators of plan type, size, and comparability to HPRS. You may reference, rather than repeat, duplicative information provided in Paragraph 4.2 Capabilities and Experience. The experience summaries also should describe the work performed and detail the roles and responsibilities that the individual staff had on the projects.

The management plan should specify the roles and responsibilities that each of the management and professional staff will have on the actuarial audit and include an estimated portion of the audit's time that will be spent by each on the audit.

Actuaries included on the project team should meet the following criteria:

- Be members of the American Academy of Actuaries;
- Be enrolled actuaries with experience in governmental plans;
- Be, at a minimum, associates with at least five years of experience in public practice, although preference will be given to actuaries that are Fellows of the Society of Actuaries; and
- Have performed an actuarial valuation, audit, or study of a public employee retirement system within the last two years.

Management Plan

At Bolton, we embrace a "build it together" service delivery model focused on alignment to the highest standards, continuous improvement, empowerment and accountability, and teamwork and collaboration. The driving theme of our consulting practice is to focus on solutions and results for our clients. That will put them in the best position to succeed.

Our client engagement teams are structured with the following qualities to effectively carry out project plans:

- **Accountability.** Your Lead and Supporting Actuaries will ensure that you are kept informed of important milestones and you will have direct access to them for any questions, issues, or concerns.
- **Redundancy.** To ensure that there is always continuity and accessibility, we have structured our teams to have redundancies at each level. In case of any absences, we will have the necessary backup leadership and support to continue to provide our services seamlessly.
- **Appropriate staffing.** Our staff is what makes our practice excellent. Our team members are experienced, knowledgeable, and devoted to providing the highest quality work to our clients.

We have assigned Bolton's Chief Actuary **Ellen Kleinstuber** as **Lead Actuary** and Senior Consulting Actuary **Tom Vicente** as **Supporting Actuary** for the actuarial valuation audit. Ellen and Tom will have ultimate responsibility for ensuring we deliver the proposed services on time and at the highest quality. They will have primary responsibility for preparation of our reports and formal presentation of the audit findings to you.

The **Project Manager, Jordan McClane**, with support from **Christy Yeager**, will supervise the work performed during the actuarial valuation audits. Jordan and Christy will be responsible for ensuring the project remains on schedule, maintaining a log of any issues that arise during our review that should be reviewed with ORSC, assigning tasks to the actuarial analysts, and identifying any need for additional resources to support our work. As an additional technical resource, they will be available to step in at any of the levels (primary actuary or programming support). Jordan and Christy have been involved with several of our large actuarial audit engagements, bringing additional depth of expertise to our project team.

Drew Freas will provide technical assistance as well as focus on reviewing the experience study and validating the gain and loss history of the plan over the last four years.

Janice Twardowicz, Alan Torroella, and Alex Newman will be the **Primary Actuarial Analysts** for the actuarial valuation audits. Janice has provided analyst support, including programming ProVal and sample life worksheets, for several of our recent, large actuarial audit engagements. Alan has also participated in recent full replication audits and is experienced in matching and analyzing results. Adam's and Alex's experience at Bolton has been exclusively supporting public pension plan sponsors, including preparation of all aspects of the annual actuarial valuation and GASB reporting.

To ensure proper quality control, we have assigned **Tom Lowman**, as the **Peer Review Actuary**. Tom will be involved throughout the project, including at the planning stage, to ensure Bolton's quality control procedures are implemented throughout the project and the final work product is given an independent actuarial review.

Employee	Area of Specialization	Actuarial Audit Experience	Years of Actuarial Experience	Percentage of Time to Be Spent on Audit
Ellen L. Kleinstuber, FSA, FCA, FSPA, EA, MAAA	Public and private sector defined benefit pension plan funding, accounting and administration issues, strategic consulting, practice standards and professionalism	City of Denver, International Association of Fire Fighters (private sector), U.S. Civil Service Retirement System (member of Board of Actuaries)	25+ years	10%
Tom Vicente, FSA, FCA, EA, MAAA	Public and private sector defined benefit pension plan funding, accounting and administration issues, strategic consulting, retiree medical (OPEB), and consulting services	State of California pension and OPEB audits (level 3) State of Maryland pension audit (level 1) Cherokee County (level 1) State Department (Level 2)	30+ years	12%
Christina H. Yeager, ASA, EA, MAAA	Public and private sector defined benefit and retiree medical actuarial and consulting services	State of California pension and OPEB audits (level 3)	20+ years	9%
Jordan McClane, FSA, EA	Public and private sector defined benefit actuarial and consulting services	State of Maryland pension audit (level 1) State Department (FSPS, FSRD, FSN – large pension plans) City of New York (level 1)	10 years	12%
Tom Lowman, FSA, FCA, EA, MAAA	Public and private sector pension plan funding, accounting and administration issues, peer review and quality control	State of Maryland pension audit (level 1) City of New York pension audit (level 1)	40+ years	1%
Janice Twardowicz	Public and private sector defined benefit and retiree medical actuarial and consulting services	State of California pension and OPEB audits (level 3) Cherokee County (level 1)	10+ years	15%
Drew Freas	Public and private sector defined benefit and retiree medical actuarial and consulting services, actuarial experience studies	State of Maryland pension audit (level 1)	10+ years	11%
Alan Torroella	Actuarial and pension consulting services	Cherokee County pension audit (level 1)	4 years	19%
Alex Newman	Actuarial and pension consulting services	Primarily valuation work for public pension plans	3 years	11%

Ellen L. Kleinstuber, FSA, FCA, FSPA, EA, MAAA

Lead Actuary

Ellen Kleinstuber is the Chief Actuary at Bolton with 29 years of actuarial experience. Ellen has worked with a wide variety of plan sponsors, ranging in size from 50 to 30,000 participants, including governmental entities, publicly traded and privately held companies, multinational corporations, and not-for-profit organizations, to deliver comprehensive employee benefit plan consulting, actuarial, and plan administration services.

Prior to joining Bolton, Ellen was Senior Vice President and Director of DB Plan Compliance with CBIZ for eight years and Vice President at Aon for 7 years.

Ellen's current responsibilities include consulting with plan sponsors, developing practice standards for quality control and peer review of actuarial, consulting and defined benefit administration services, and preparing external client communications on recent regulatory developments and emerging trends in actuarial practice. As a Principal of Bolton, Ellen is a member of the firm's Executive Leadership Council and manages the Bolton Retirement consulting division.

She is an active volunteer within the actuarial profession and has held several significant positions, including her current role as President-Elect of the Conference of Consulting Actuaries. Other significant volunteer roles include::

- Chairperson of the Pension Committee of the American Academy of Actuaries and a member of the Academy's Pension Practice Council (2011- 2018)
- Member of the Board of Directors and Vice President of Continuing Education for the Conference of Consulting Actuaries (2012 – 2018)
- Chairperson of the Joint Program Committee for the annual Enrolled Actuaries Meeting (2019)
- Chairperson of the Conference of Consulting Actuaries' Professionalism Committee

Ellen also serves as a member of the Board of Actuaries for the Civil Service Retirement System and Federal Employees Retirement System, which is responsible for selecting the key actuarial assumptions used for the annual valuation of those programs based on experience studies prepared by the actuaries at the Office of Personnel Management.

Ellen has been quoted by the New York Times, Reuters, CNBC, AARP, and Pensions & Investments on a wide range of topics related to defined benefit plan management and administration, and is a frequent speaker on pension-related topics; some recent and upcoming presentations include:

- Actuarial Audits of Pension and OPEB Plans – October 2021 (Georgia GFOA Annual Meeting)
- Stay in Your Lane: How Not to (Inadvertently) Become a Fiduciary – October 2020 (CCA Annual Meeting)
- Late Breaking Developments – October 2019 (CCA Annual Meeting)
- Actuarial Reports 101: Helping Non-Actuaries Understand Actuarial Reports – April 2019

- Evolving Our Practice: Addressing Actuarial Professionalism Issues – April 2018 (Enrolled Actuaries Meeting)
- Ethics – December 2016 (CCA webcast)
- Pension Risk Transfer from Different Perspectives – April 2016 (Enrolled Actuaries Meeting)
- Fiduciary Responsibility – April 2015 (Enrolled Actuaries Meeting)
- Advanced Benefit Administration – April 2015 (Enrolled Actuaries Meeting)
- Increasing Longevity: Impact on Pension Plan Sponsors and Participants – March 2014 (National Conference of Insurance Legislators)

In her role as Chief Actuary, Ellen serves as a general resource to all of Bolton's actuarial valuation and audit engagement teams, generally dealing with complex, non-routine issues or issues involving significant exercise of professional judgment. Ellen has been a part of the actuarial team assigned to our audit engagements for the Denver City/County Auditor and Cherokee County, GA. She currently has 13 clients:

- The International Association of Fire Fighters (please note that our engagement with IAFF began as an actuarial audit and has now become an ongoing actuarial engagement) – general actuarial services
- Vinton County (OH) National Bank – general actuarial services and pension risk transfer
- The Arc of Baltimore – general actuarial services and pension risk transfer
- Greater Baltimore Medical Center – general actuarial services and pension risk transfer
- Rosemore, Inc. – general actuarial services
- Peter & John Ministries – general actuarial services
- Other ad hoc/project-based clients – West Virginia Municipal Pension Oversight Board, Pension Benefit Guaranty Corporation, T Rowe Price, Leidos Biometric Research Institute, the Institute of Notre Dame, Annie E. Casey Foundation, Daiichi Sankyo

Ellen was recognized in 2012 as an outstanding volunteer by the Society of Actuaries for her role as the former chairperson of the Pension Section's Continuing Education Committee, by the American Academy of Actuaries in 2015 for her work on pension risk transfer issues, when she represented the Academy testifying before the National Conference of Insurance Legislators and the ERISA Advisory Council, and in 2019 by the Conference of Consulting Actuaries for her leadership as a member of the Board of Directors and chair of the Annual Enrolled Actuaries Meeting.

Ellen graduated from Elizabethtown College with a Bachelor of Science in mathematics (magna cum laude) in 1992. She is a Fellow of the Society of Actuaries, a Fellow of the Conference of Consulting Actuaries, a Fellow of the American Society of Enrolled Actuaries, a Member of the American Academy of Actuaries, and an Enrolled Actuary under ERISA.

While officially assigned to Bolton's corporate headquarters in Baltimore, Ellen resides in and typically works from her residence in Lake County, OH.

Thomas Vicente, FSA, FCA, EA, MAAA

Supporting Actuary

Tom Vicente is a Senior Consulting Actuary with Bolton. Tom has over 30 years of experience in actuarial, retiree medical and pension consulting services, as well as the administration and communication of retirement programs. He also has significant experience with design, benchmarking, and retirement adequacy studies for retirement programs, determining cost factors for union-negotiated programs, as well as with hybrid pension plans such as Cash Balance and Retirement Equity programs.

Tom has provided retirement consulting and actuarial services to many clients including:

- Governmental employers
- Not-for-profit employers
- For-profit employers (publicly and privately held)
- Church organizations
- Taft-Hartley multi-employer programs

Tom has been providing audits of large pension plans for more than a decade and has provided insight and guidance to large and small plans. He recently presented at the Georgia GFOA annual meeting on the different aspects of actuarial audits and why they are useful to plan sponsors. Some sample actuarial audit clients include the State of California (pension and OPEB audits), Cherokee County (pension audit), the US State Department (pension audit) and Maryland (pension audit).

Tom also has considerable experience with programs covering police and safety groups, including valuing, The District of Columbia Police and Fire Pension Plan (pension valuation), and the State of New York- including SUNY entities (OPEB valuation), and police and fire pension plans at different towns and counties.

Tom's focus is on providing high value to clients through innovative solutions, strong communication, and high-quality, timely results. He has been a speaker for different groups including the Society of Actuaries recent webcast on public pension plan maturity metrics and the American Academy of Actuaries webcast on variable or risk sharing plan designs. He has also spoken at the Actuary's Club of Philadelphia and at local and national venues for training and continuing education purposes. Tom has published a white paper on the impact of accounting rules affecting governmental employers offering post-employment benefit programs and ways in which those employers could mitigate those costs. He has also published a paper on service purchase considerations for public sector pension plans. He is the Vice-Chair of the Social Insurance and Public Finance section of the Society of Actuaries and a member of the American Academy of Actuaries Public Plans Committee.

Tom received his B.S. in Mathematics from Drexel University. He is a Fellow in the Society of Actuaries and a Member of the American Academy of Actuaries. He has been certified by the Joint Board for the Enrollment of Actuaries to perform actuarial services under ERISA.

Christina H. Yeager, ASA, EA, MAAA

Supporting Actuary/Project Manager

Christy Yeager is a Consulting Actuary with Bolton. She has over 20 years of experience managing and reviewing valuations of retiree medical and defined benefit pension plans.

Immediately prior to joining Bolton in 2016, she worked at Aon Hewitt with primary responsibilities as an internal actuary for a large single-employer firm with numerous retiree medical plans, and as lead consultant and actuary for multiple small single-employer pension plans.

Christy has a strong background in both pension and OPEB actuarial services. Prior to joining Bolton, she supervised the group responsible for converting the firm's OPEB valuation coding from a proprietary valuation system to ProVal, the same actuarial valuation software package that Bolton uses for its actuarial valuations. She enhanced the coding for software features that were not available at the time of the original coding, to improve the quality and accuracy of the determination of valuation liabilities.

Christy has worked as a project manager on numerous large projects, including lump sum windows, EPCRS plan corrections, and actuarial audits. One notable project was Christy's development and management of a full benefit calculation audit for a client who discovered a component of compensation had been omitted from benefit calculations for two decades. The audit spanned two years and included not just the recalculations but also draft communications to the participants, coordination with ERISA counsel for necessary plan amendments and preparation VCP submission to the IRS reporting the operational errors, coordination with the trustee for make-up payments to affected retirees, incorporation to the actuarial valuation to determine the impact on annual and projected contribution requirements. Christy was also a key member of the Bolton team providing actuarial audit services to the California State Auditor.

She is a member of Bolton's Pension Benefit Guaranty Corporation (PBGC) consulting team, working with the actuaries in the PBGC's Policy and Research Actuarial Division and the Negotiating and Restructuring Division. Christy also devotes a significant amount of her time to annual valuation services for pension and OPEB plans, including:

- Annual preparation and review of funding and accounting valuations
- Annual presentation of actuarial results with Board and union representatives, including explanations of gain/loss and implications of regulatory changes
- Annual preparation and review of routine government forms, including assisting and coordinating the online submissions
- Ongoing preparation and review of individual benefit calculations and annual participant statements
- Preparation of actuarial experience studies and demographic assumption setting
- Ongoing consulting on benefit-related questions (death, disability, divorce, same-sex marriage, breaks in service, consequences of deferring commencement)

Christy has a BA in Mathematics and Economics from the University of Rochester.

Jordan McClane, FSA, EA

Project Manager

Jordan McClane is an actuary with ten years of experience. He is a Fellow of the Society of Actuaries, an Enrolled Actuary, a Fellow of the Conference of Consulting Actuaries, and a member of the American Academy of Actuaries. Jordan holds a Bachelor of Science in Actuarial Science from the Smeal College of Business at the Pennsylvania State University.

Jordan has completed a variety of projects for a broad spectrum of public sector clients from small counties to very large cities and states. He has been part of actuarial audits for the State of Maryland and the City of New York. He is a signing actuary and project manager for several counties and for all 53 municipal police and fire public pension plans under the oversight of the Municipal Pension Oversight Board of West Virginia. As a valuation actuary, Jordan helps clients understand the current health of their pension plans and assists them in achieving their pension plan goals.

Jordan's experience as a valuation actuary includes:

- Performing actuarial funding valuations and calculating actuarially determined contributions
- Producing actuarial exhibits for GASB 67/68
- Conducting experience studies to align assumptions with future expectations
- Estimating the impact on retirement systems from proposed changes to plan provisions and assumptions
- Designing projection models to estimate future funding levels
- Evaluating the cost of Deferred Retirement Option Programs (DROPs) through prospective and retrospective analyses
- Examining various risks to which pension plans are exposed

Furthermore, during this uncertain time of increased pressures on budgets and depressed state and local revenues resulting from the COVID-19 pandemic, Jordan has advised clients on strategies to minimize volatility of calculated contributions through the implementation of a level cost allocation model.

Beyond his valuation work, Jordan has been engaged in numerous other actuarial assignments, such as:

- Projecting the fiscal impact that proposal bills would have on the Maryland State Retirement and Pension System for the Maryland Department of Legislative
- Completing a full replication audit for the five New York City Retirement Systems and the Maryland State Retirement and Pension System, and
- Performing level two actuarial audit services for (1) five CalPERS plans for the California State Auditor's Office and (2) the City of Austin.

Jordan is also a signing actuary for some single employer pension plans. He has designed and implemented lump sum windows, developed plan termination feasibility studies, and performed pension asset-liability studies for both private and public sector employers.

Jordan's prior employment includes pension actuarial experience at Aon Hewitt in Baltimore and Towers Watson (now Willis Towers Watson) in New York City.

Thomas B. Lowman, FSA, FCA, EA, MAAA

Peer Review

Thomas B. Lowman is the Vice President of Bolton Retirement and served as Bolton's Chief Actuary from 1996 – 2018. . Tom has forty years of pension actuarial experience. He is a Fellow of the Society of Actuaries (1982), an Enrolled Actuary (1981), a member of the American Academy of Actuaries (1982), and a Fellow, Conference of Consulting Actuaries (2009). Tom is vice chair of the Conference of Consulting Actuaries (CCA) Public Plans Community and is the immediate past Chair of the American Academy of Actuaries Public Plans Committee.

Tom is recognized as one of the top national experts on public sector plans and is sought out as a resource in this area by the professional actuarial societies, GASB, and national journalists. His work with national actuarial organizations is extensive. Tom served a three-year elected term on the Society of Actuaries' Pension Section Council and served as Chair of the Society of Actuaries' Pension Section Research Committee. Tom also served on the Actuarial Standards Board Pension Committee and the Society of Actuaries Enterprise Risk Management Task Force on Pensions.

Tom's clients include the federal government (PBGC and Treasury), and pension valuation clients in Maryland, Virginia, and Delaware. In the past, Tom has worked on large plans including the State of New York Retirement plan and the Federal Civil Service and FERS plans. Tom recently completed the audits of the State of Texas Employees Retirement System and the New York City plans.

Tom helped draft the 2014 CCA White Paper on public pension plan funding which has become the leading authority on actuarial funding methods for public pension plans. He was interviewed by the SOA Blue Ribbon Panel on Public Plans and in April 2014 presented to the Actuarial Standards Board Pension Committee his thoughts on the difficulties of introducing the Panel's recommendations into actuarial standards of practice. Tom has been the Chair of several Society of Actuaries Project Oversight Groups. He was chair of the Pension Assumption and Method Project, studying how assumptions and methods vary depending on the type of plan/plan sponsor – ERISA single employer vs. state/local vs. Federal vs. Social Security. Tom wrote a paper on the issues with applying financial economic principals to public pension plans which he presented in 2009 and presented another paper to the 2010 Society of Actuaries' Retirement 2020 Symposium.

He has authored numerous papers that are considered primary actuarial reference documents including:

- DROP designs, co-authored with Robert Bolton
- Public Sector Gain Sharing designs for the Society of Actuaries, co-authored with Colin England and Ann Sturner

- Cash Balance Plans

Tom holds a mathematics degree from the University of Delaware in 1977.

Janice Twardowicz

Analyst

Janice Twardowicz is an Actuarial Consultant with over 30 years of consulting experience on defined benefit pension plans and retiree medical plans for both public sector and private sector sponsors. She has extensive experience with preparing pension valuations and studies on a wide variety of issues.

Examples of Janice's responsibilities and recent projects include:

- Preparation of actuarial valuations and for public sector and private sector single-employer plans
- Preparation of annual financial reporting valuations for both pension and retiree medical plans; including fiscal year-end disclosures, determination of annual expense and supplemental disclosures
- Calculation of benefits for plan participants
- Preparation of participant benefit statements
- Annual review of asset and demographic data
- Preparation of regulatory filings, certifications and notices
- Preparation of experience study cost results
- Preparation of union negotiation liabilities and cost changes
- Training staff members preparing pension plan related actuarial work mentioned above

Janice also provides extensive support to our engagements providing litigation support in various pension-related matters, including the replication of actuarial valuation results..

Janice worked with Aon and Mercer prior to joining Bolton in 2018.

Janice has a Bachelor of Science degree in Mathematics from the University of Maryland.

Drew Freas

Analyst

Drew Freas is a Senior Actuarial Consultant with 23 years of consulting experience on defined benefit pension plans and retiree medical plans for both public sector and private sector sponsors. He has extensive experience with preparing pension valuations and studies on a wide variety of issues.

Examples of Drew's responsibilities and recent projects include:

- Preparation of actuarial valuations and for single-employer, multiemployer, and public sector plans
- Assisting PBGC with on-site analysis of the expected underfunding of pension plans which may or are likely to terminate in the foreseeable future.
- Putting together over 1,000 pages of detailed calculations for an expert report written for the U.S. Department of Justice
- Calculation of withdrawal liability for multiemployer plans
- Assistance with plan terminations
- Calculation of benefits for plan participants
- Preparation of participant benefit statements
- Annual review of asset data
- Preparation of IRS Form 5500, PBGC Form 1, and Summary Annual Report
- Preparation of PPA certifications and Annual Funding Notices
- Supervising and training staff members preparing pension plan related actuarial work mentioned above
- Communication of benefit issues with clients.

Drew also provides extensive support to our engagement with the Maryland Department of Legislative Services. He leads the programming team that annually performs a full replication of the actuarial valuation prepared by the consulting actuary, which allows Bolton to provide cost impact analysis of proposed legislative changes impacting pension benefits under the Maryland state retirement system.

Drew is the Bolton Retirement Tools Leader. In this role, he is responsible for the development and documentation of our proprietary tools, managing the periodic updates to our actuarial valuation software, optimization of our software capabilities, and training of staff on the use of our various proprietary and licensed actuarial and plan administration software.

Drew worked with Aon and Buck prior to joining Bolton in 2001.

Drew has a B.S. in Mathematics with an Actuarial Science option from the Pennsylvania State University.

Alan Torroella

Analyst

Alan Torroella is an Actuarial Analyst with Bolton. Alan joined Bolton's Washington, D.C. office upon graduating from Johns Hopkins University in December 2016. He has worked under several contracts with the Pension Benefit Guarantee Corporation (PBGC). His work under PBGC involved calculating benefits, determining benefit entitlement, programming and testing their internal actuarial valuation system, and interpreting plan documents and amendments.

In January 2019, Alan began working in Bolton's Baltimore office and transitioned his focus from PBGC to public sector work. Alan currently works with 11 clients, including the Municipal Pensions Oversight Board of West Virginia, for whom he creates funding and accounting reports for each of their 53 municipalities. Alan strives for efficiency and quality in the valuation process for each of his clients.

Alan's experience includes:

- Proficient use of VBA, Excel, SQL, RStudio, MatLab, and Java
- Creating and executing pension valuations using the actuarial programming tool, ProVal
- Prospective and retrospective DROP analysis
- Data clean up and consolidation
- Performing cost impact studies on proposed plan changes
- Recreating and automating test lives

Alan holds a B.S. in Applied Mathematics and Statistics with a concentration in Optimization and Operations Research from Johns Hopkins University. He is currently pursuing his Associate of the Society of Actuaries (ASA) designation and expects to attain it in 2020.

Alex Newman

Analyst

Alex Newman is an Actuarial Analyst with Bolton. Alex joined Bolton upon graduating from Towson University in June of 2018.

At Bolton, Alex has been responsible for initiating all aspects of the pension valuation process, including data reconciliation, actuarial software programming, plan document review, drafting of valuation reports, and client communication. For each of the clients Alex works with, he has been improving the valuation process in terms of its organization, documentation, and reporting.

Alex's experience includes:

- Performing pension plan valuations
- Completing pension plan accounting and financial reports
- Conducting experience analysis studies
- Studying the cost impact of proposed changes in plan benefits and funding methodology
- Preparing benefit calculations
- Responding to auditors' requests

Alex holds a BS in Mathematics from Towson University with a concentration in Actuarial Science and Risk Management. Alex is currently working toward earning the Associate of the Society of Actuaries (ASA) designation.

IV. REFERENCES

You must include a list of organizations that may be used as references for your work on actuarial valuations, audits, or studies. Selected organizations may be contacted to determine the quality of the work performed, personnel assigned to the project, and contract adherence. The following should be included for the references listed:

- Date of the actuarial audit work or valuation;
 - Name and address of client;
 - Name and telephone number of individual in the client organization who is familiar with the actuarial work; and
 - Description of the work performed.
-

Maryland State Retirement and Pension System

Contact Name: Melody Countess, COO

Telephone Number: (410) 625-5650

E-mail Address: mcountess@sra.state.md.us

Mailing Address: 120 East Baltimore Street, Baltimore, MD 21202

Date of Engagement: July 2019 – November 2019

Description of Services: Bolton was engaged to provide a level 1 full replication audit of the 2019 actuarial valuation and employer contributions for fiscal 2021. We replicated the most recent actuarial valuation results and reviewed the multi-year cost projections from the actuary for the State Retirement and Pension System, including each component (Teachers, Employees, State Police, Judges, and Law Enforcement Officers' Pension System). From these results, we developed items such as employee contribution rates, employer contributions, and funded levels. We provided recommendations for potential improvements and ensured the most recent experience study was valid and being used appropriately.

City of New York

Contact Name: Rosa Charles, Senior Budget Analyst

Telephone Number: (212) 669-2495

E-mail Address: rcharle@comptroller.nyc.gov

Mailing Address: Office of the Comptroller, 1 Centre Street, Room 848, New York, NY 10007

Date of Engagement: January 2017 – October 2020 (all deliverables provided by April 2019)

Description of Services: Bolton was engaged to (a) perform an actuarial audit of employer contributions for fiscal years 2016 and 2018, (b) prepare a study of actuarial experience to compare actual experience with the assumptions being used for the valuations, and (c) review the administrative processes for maintaining participant data, providing that data to the NYC actuary, and processing benefits calculations and payments. Our assignment covered the five major retirement systems sponsored by the City. The audit and experience study services include a comprehensive review of plan provisions to evaluate consistency with the benefits included in the valuation, reviewing economic and demographic assumptions and actuarial methods used, replicating the valuation results prepared by the actuary for the retirement systems and reconciling any differences between their results and ours, and preparing detailed documentation of our findings and recommendations to be reviewed with the City Comptroller and Chief Actuary. This project is now complete.

Employees Pension Plan of Cherokee County

Contact Name: Steve Harshbarger, Strategy & Performance Manager

Telephone Number: (770) 721-7831

E-mail Address: seharshbarger@cherokeega.com

Mailing Address: Cherokee County Board of Commissioners 1130 Bluffs Parkway Canton, Georgia 30114

Date of Engagement: January 2020 – July 2020

Description of Services: Bolton was engaged to provide a level 1 full replication audit of the 2019 actuarial valuation and employer contributions for fiscal 2021. We replicated the most recent actuarial valuation results and reviewed the experience study used to set the plan assumptions. From these results, we developed items such as employee contribution rates, employer contributions, and funded levels. We provided recommendations for potential improvements including updates to the retirement age assumption and ensured the most recent experience study was valid and being used appropriately. We were also engaged to provide a supplemental sustainability analysis that resulted in recommendations for improving plan funding and benefit security.

California State Auditor's Office

Contact Name: Theresa Farmer, Auditor

Telephone Number: (916) 445-0255

Email Address: TheresaF@auditor.ca.gov

Mailing Address: 621 Capitol Mall, Sacramento, CA 95814

Date of Engagement: 2019

Description of Services: Bolton was engaged to assist the State Auditor in evaluating whether the actuarial valuations of the total defined benefit pension liability prepared by CalPERS are appropriate and consistent with the standards and guidance issued by GASB governing accounting and financial reporting for pensions. Bolton reviewed the following five pension plans for compliance with GASB 67/68 and relevant ASOPs: (1) State Miscellaneous, (2) State Peace Officers and Firefighters, (3) State Safety, (4) State Industrial, and (5) California Highway Patrol. We reviewed the actuarial reports for compliance with Actuarial Standards of Practice (ASOPs) 4 (measuring pension obligations), 23 (data quality), 27 (selection of economic assumptions in measuring pension obligations), 35 (selection of demographic and other non-economic assumptions for measuring pension obligations) and 41 (actuarial communications). We also reviewed the GASB 68 work for compliance with Chapter 13 (Defined Benefit Pension Plans (Plan & Employer Considerations)) of the AICPA's Audit & Accounting Guide for State and Local Governments. Bolton also audited the California state OPEB plan valuation prepared by F&F for compliance with GASB 74/75 and relevant ASOPs.

V. METHODOLOGY, WORK PRODUCT, AND TIMELINE

Each proposal shall describe the proposed methodology for each element of the components listed in Section II, Scope of Audit. The description should include specific techniques that will be used, including anticipated sampling techniques and sizes, and proposed sources of data and information. You may propose alternative ways of addressing the elements of the audit's scope.

In describing the proposed methodology, also identify the type and level of assistance that you anticipate will be needed from the staff of HPRS and the consulting actuary, including: assistance to understand the operations and records of HPRS; assistance to understand the actuarial assumptions, method, and procedures; and assistance to access, obtain, and analyze information needed for the audit. The description of the proposed methodology shall also identify meetings, interviews, programming support, space needs, etc., that you anticipate requiring from HPRS and the consulting actuary.

Each proposal shall also include one or more examples of work product(s) from actuarial valuations or audits that may help to illustrate the proposed methodology and final work product.

Each proposal shall provide an estimated date that the final report will be submitted and the projected timeline or the anticipated work requirements and milestone dates to reach that date.

ORSC has requested an audit that will review the 2020 annual valuation to assure that the results presented therein are actuarially sound, reasonable and consistent with industry standards and are appropriate for HPRS' structure and funding objectives. Our approach to providing these requested services is discussed in further detail below. We have included a sample of our work in **Section VI. Additional Information**.

Actuarial Valuation Audit

The services for the valuation review will follow a GFOA Level One audit. The processes for a Level One audit fall into the following categories.

- A review of the actuarial assumptions and methodology for compliance with the funding standards and appropriateness for HPRS' structure and funding objectives;
- A review of the appropriateness and internal consistency of the actuarial assumptions;
- Verification of demographic data; and
- Confirmation of the actuarial valuation results, including a determination of actuarial accrued liability, normal cost, expected employee contributions, and the effects of any recent legislation through a full replication of the actuarial valuation. This includes the review of the determination of retiree contributions and

- Recommend adjustments (if any) to more accurately reflect the program and provide the general effect

Our Actuarial Audit services include three tracks that run concurrently and together provide a comprehensive review of the accuracy and reasonableness of the actuarial valuation results and report:

Track	Tasks
Track One	Review of the actuarial assumptions and methodology for compliance with the funding standards and applicable actuarial standards of practice, and Review of the appropriateness and internal consistency of the actuarial assumptions
Track Two	Verification of demographic data including checks for reasonableness
Track Three	Validation of the actuarial valuation results, including a determination of actuarial accrued liability, normal cost, employer contribution rates through a full replication of these key valuation results

We will begin the Actuarial Audit by gathering the necessary source information from HPRS and F&F:

- Participant information
- Plan terms
- Recent plan investment information
- Relevant Board decisions or meeting minutes
- System’s funding policy
- Assumptions and methods set by the Board, or with their concurrence
- HPRS funding objectives and healthcare policies
- Actuarial Experience study and prior actuarial reports

We will require all information necessary to produce the actuarial results and employer contribution rates. The Lead Actuary and Supporting Actuary will provide outlines of the needed information, and the Project Manager will supervise the receipt and cataloging of information. Project analysts will maintain detailed listings of source information, including document source, date received, summary description, and validation status. If needed, the Lead Actuary and Supporting Actuary will conduct interviews with the F&F actuaries to gain a better understanding of any plan features, assumptions, and methods. We expect these interviews will be conducted virtually by phone or online.

As information is received and reviewed, the actuarial audit team will begin work on each track of the review.

Track One – Methods, Assumptions, Disclosures, and Communications

The work under Track One will start first and can run concurrently with the work under Track Two and Track Three.

Our review of the actuarial assumptions and methods used in the valuation begins with a review of the most recent experience study. The primary focus of the experience study review will be on the data and methodology, whereas the actuarial audit will focus on how the resulting assumptions are incorporated into the valuation.

The key steps in Track One are:

- Review of the most recent experience study to determine that the analysis of past experience is accurately reflected and reasonably represents likely future experience in the recommended changes to the actuarial assumptions and methods
- Review of the actuarial reports for compliance with the applicable Actuarial Standards of Practice (ASOPs) in effect on the measurement date for any areas of possible improvement
 - ASOP 4, Measuring Pension Plan Obligations and Determining Pension Plan Costs or Contributions,
 - ASOP 6, Measuring Retiree Group Benefits Obligations and Determining Retiree Group Benefits Plan Costs or Contributions,
 - ASOP 27, Selection of Economic Assumptions for Measuring Pension Obligations,
 - ASOP 35, Selection of Demographic Assumptions for Measuring Pension Obligations,
 - ASOP 41, Actuarial Communications,
 - ASOP 44, Selection and Use of Asset Valuation Methods for Pension Valuations,
 - ASOP 51, Assessment and Disclosure of Risks Associated with Measuring Pension Obligations and Determining Pension Plan Contributions
- Review of the actuarial reports in light of the newly implemented requirements of ASOP 56, *Modeling* and potential revisions to ASOPs 4, 27 and 35 that are being contemplated by the Actuarial Standards Board (to the extent those revisions are adopted by the time our work is performed)
- Review of correspondence (memoranda, letters, email) between HPRS and the actuary that include instructions and guidance regarding plan funding requirements, selection of actuarial assumptions and methods, and risk tolerance
- Review the determination of retiree healthcare contributions for appropriateness and consistency and assess whether the HPRS valuation methodology reflects the proper implementation of the premium determination
- Provide an evaluation of the valuation results and expressing an opinion regarding the reasonableness and accuracy of the actuarial assumptions, actuarial methods, funding projections, and general compliance with the ASOPs

- Recommend any revisions to the actuarial assumptions or methods, considering best practices and the Plan’s funding approach
- Review gain/loss analysis from prior four reports
- Recommend any revisions to improve the quality of the actuarial reports, as well as any additional projections or other analysis to better inform ORSC regarding the risks inherent in the funding approach
- Review optional form factors used by the System for reasonableness and accuracy

Track Two – Data

Track Two focuses on data quality. We will obtain and review the participant data for completeness and sufficiency to support the contribution and funding analysis prepared by the actuary, as required by ASOP 23, *Data Quality*.

Our review will start by obtaining the “raw” data from HPRS and valuation data from F&F and reviewing the data for completeness and consistency with the various participation and benefit provisions. We will not trace the data back to the original source. The purpose here will be to determine if the data includes all necessary components to allow for an accurate valuation. Additionally, we will review the data for reasonableness (e.g., confirm dates of birth after 1/1/2000). Our report will document the steps we take and our findings regarding the appropriateness of the valuation data.

The Supporting Actuary and project analysts will work with F&F to resolve any discrepancies. Unresolved discrepancies will be described in the preliminary and final reports along with recommendations to improve the reporting process and reduce the opportunities for errors.

Track Three – Replication of Assets, Liabilities and Contribution Rates

This is the most complex and time-consuming portion of the actuarial audit. We will create independent actuarial models for the plan’s liabilities using ProVal, our actuarial valuation software, and Microsoft Excel. These actuarial results will then be used to:

- Confirm that the actuarial assumptions and methods used by the actuary are consistent with those adopted by HPRS and/or promulgated by the legislature
- Validate the actuarial software used by the actuary appropriately values the plan’s benefit provisions
- Verify the actuary’s calculations for the plan
- Verify the actuary’s gain/loss analysis

Our models will produce a comprehensive replication of the actuarial results and will be comparable to the detailed reports produced by the actuary. The actuarial models will be programmed by the lead actuarial programmer under the supervision of the Project Manager and Supporting Actuaries. As part of the process of testing our valuation programming we will compare sample life output from ProVal to independent, Excel-based sample life worksheets created by the actuarial analyst team. We select the number of sample lives to be reviewed based on the size of the plan and the complexity of the plan provisions. Our sample life

group always includes a mix of active, inactive, and retired participants that test the full range of plan provisions and actuarial assumptions reflected in the valuation software coding.

While we expect to be considerably closer than the acceptable tolerance shown, we recommend the following maximum tolerance for deviation for each key measure in the valuation.

Calculated Item	Acceptable Tolerance
Present value of pay; present value of member contributions	2.0%
Present value of future benefits	4.0%
Normal cost (gross)	4.0%
Actuarial value of assets	0.5%
Actuarial accrued liabilities	4.0%

We believe these thresholds provide a fair balance between accurately applying the actuarial assumptions and methods to the plan provisions and acknowledging reasonable differences in actuarial software and coding techniques. ORSC may request that we lower our acceptable tolerance levels to ensure an even closer match to those of the plan’s actuaries.

We will consider the following in the preparations of our parallel valuations:

- Any benefit changes since the prior valuation
- Applicable changes in the laws from the prior year
- Revisions in plain language or bargaining agreements
- Any applicable state or federal law changes
- Changes in administrative procedures, such as rules for calculating final average pay, or the definition of disability

Successful calculations and validations of each item/employee group will be summarized by the valuation programmers and reviewed by the Lead Actuary and Supporting Actuary and presented in biweekly progress reports to the executive directors of ORCS and HPRS. The progress reports will also include sources and resolutions of inconsistencies and the basis for any recommendations to be provided in the preliminary and final reports. The preliminary and final reports will include the validation results for each group and tier.

Any inconsistencies in the calculations, weaknesses in the models, or errors in the software programs used by the actuary will be included in the preliminary and final reports. We will provide any recommendations along with comments on best practices promulgated by professional organizations and will quantify the expected effects on plan funding.

Presentation of Results

Bolton will present the preliminary draft of the report jointly to the executive directors prior to its release. We will review the findings and the potential implications. We will meet with the Board of Trustees of HPRS and

the ORSC in separate briefings to review the report. The meetings can be in person or alternatively (and in light of the present uncertainty of the duration of COVID-19 protective measures), this meeting can be conducted by phone or Microsoft Teams to allow for face-to-face interaction. Finally, we will take part in an exit conference to answer any additional questions from the HPRS Board. Both the Lead Actuary and Supporting Actuary will attend these presentations and be available to respond to any questions.

Timeline

Below is a sample timeline for the audit. After meeting with you, we will revise the timeline as we have a better understanding of your schedule and the timing for availability of different materials we will request from the consulting actuary and HPRS staff.

Project Phase / Deliverable	Week(s)								
	1	2	3-5	6	7-10	11	12	13	TBD
Kickoff / Preliminary Project Plan	█								
Final Project Plan, Data Request		█							
Receive Data, Reports, Projections, Etc. for Valuation Review		█							
Review of Actuarial Assumptions, Methods, and Communications			█						
Complete Census Review and Submit Questions			█						
Receive Replies				█					
Valuation Replication Programming			█	█	█				
Develop Preliminary Audit Report					█				
Present and Receive Feedback on Preliminary Report						█			
Develop Updated Draft Audit Report							█		
Discussion / Feedback								█	

Project Phase / Deliverable	Week(s)								
	1	2	3-5	6	7-10	11	12	13	TBD
Final Report									
Presentation to Board of Trustees (TBD)									

Using the above timeline, we assume the project will be approved as of July 1, 2021. With that start date, we can commit to a project completion date of September 30, 2021. Note that delays in receiving information, answering questions and scheduling meetings can all contribute to adjustments to the timeline. If there are specific dates that ORSC is targeting, we can adjust the draft schedule as needed to meet an earlier deadline.

We will provide a comprehensive data request for both F&F and HPRS to respond to at the start of the engagement. The information requested is standard and should be readily available to all parties.

Other than scheduled progress reports we do not anticipate more than ten hours of time needed from HPRS staff. Similarly, we anticipate at most one two-hour discussion with F&F to discuss any aspects of the valuation that are not clear to us.

Our Consulting Approach

Bolton takes pride in the client relationships that we have established. Not only are we technical experts, but we also strive to be trusted advisors and partners with our clients. Typically, we begin any client engagement with a stewardship and planning meeting. This allows us to set very specific goals relative to our engagements. This is true for both actuarial audit and ongoing actuarial services engagements. We believe that success with our clients is defined by you, not by us.

Clients tell us that these characteristics are of value to them, and we work every day to make sure we meet and exceed these expectations:

- **Listen before we advise.** Each client and each organization has their own set of issues and challenges that need to be solved. We listen to what clients need and seek to understand what they define as a successful outcome.
- **Solve specific problems.** We will examine your data to understand your organization and benefit plans. This allows us to pinpoint problems that may arise during the engagement and leverage the appropriate resources on our team for each aspect of our work.
- **Garner trust and openness.** These characteristics are driven by honest, transparent personal relationships. We look for and encourage straight talk and work to earn your trust.
- **Be proactive.** We thoughtfully bring any reasonable idea and solution to the problems at hand and recognize that part of our value is to 'see the future' and lead with both innovative and proven solutions that will work.

- **Ensure compliance.** We ensure that our clients are aware of all applicable compliance and legislative requirements.

To ensure a successful partnership with ORSC, we view our interactions as a collaborative effort in which both parties must work together to identify common goals and proper expectations. We would work with your team to set specific tasks, activities, and expectations for program management throughout the audit.

Our teams are structured with the following qualities to effectively carry out project plans:

- **Accountability.** Your relationship manager will ensure that you, our client, are kept informed of important milestones and you will have direct access to them for any questions, issues, or concerns.
- **Redundancy.** To ensure that there is always continuity and accessibility, we have structured our teams to have redundancies at each level. In case of any absences, we will have the necessary backup leadership and support to continue to provide our services seamlessly.
- **Appropriate staffing.** Our staff is what makes our practice excellent. Our team members are experienced, knowledgeable, and devoted to providing the highest quality work to our clients.

Method of Managing the Required Services

As noted previously, we will start our engagement with ORSC with a stewardship and planning meeting where we work together with you to establish goals and objectives of the project and develop a detailed project plan.

- You will receive a clear, concise description of services that will be provided by us, including timing, before we begin any project.
- You will receive a specific project manager who will be responsible for making sure the project stays on track.
- You will receive constant communication from us so that you will never be surprised by any disruptions to the project timeline and you are aware of any issues that require your attention.

This approach will help you manage the project with us and will significantly reduce your burden for these projects.

To ensure continuity of service in the event a team member becomes unavailable, we have at least two people on the client team who are able to function in each team role. This allows us to quickly assign a backup team member to cover unexpected absences. We also have team members with expertise in both pension and OPEB plans, allowing for continuity and consistency of deliverables between the audit teams for these two valuation audits.

Data Security

Computer security is extremely important to us. We have state-of-the-art security measures and backup measures for our computer systems, and we have never had a breach of client data stored on our computers. We do everything we can to make sure it stays that way.

Participant data is always treated as confidential. For example, Bolton maintains contracts with the Pension Benefit Guaranty Corporation the Centers for Medicare & Medicaid Services and the U.S. State Department. Each of these agencies require the highest standards for data security, confidentiality, and privacy. Because of this, all of our clients benefit from the level of data security required by these relationships. We maintain this level of security by identifying it as a core value and by having our IT staff regularly participate in training and attend conferences to ensure our systems remain up to date.

Bolton uses Citrix ShareFile for secure file sharing. All communications and data sharing between Citrix ShareFile and the user are encrypted using either Secure Socket Layer (SSL) or Transport Layer Security (TLS) encryption protocols and up to AES 256-bit encryption. Files are also protected while at rest on Citrix Sharefile servers with AES 256-bit encryption.

Citrix Sharefile servers reside in SSAE 16 accredited datacenters with protective features that include hurricane-rated roofs and multiple redundant power sources. All data is automatically updated to servers in separate locations. Sharefile performs regular backups on all data, including off-site data backups, to protect against almost all disaster scenarios.

Data sharing with Citrix Sharefile is straightforward and simple. The URL can be saved as a favorite or easily accessed from our boltonusa.com website. Users can choose to be notified via email when files have been uploaded to or downloaded from the ShareFile site. Folders can be established within ShareFile to help organize shared data and can easily be reorganized at a later date as needs change. Files that are uploaded via Citrix Sharefile can be set to expire after a set timeframe or can be set to be retained indefinitely. With the option to retain uploaded files indefinitely, clients have the ability to retrieve files previously uploaded using a simple search mechanism. We can also share data securely via Mimecast or via our sFTP server if ORSC prefers.

Quality Assurance

Bolton is committed to providing consistent, high-quality work products through the implementation of quality control methods and procedures. Our internal quality assurance procedures include:

- **Do/Check/Review Process** – All work is independently checked by a second analyst or actuary to reduce the likelihood of errors. This also provides our clients with multiple contacts who are familiar with their plans and projects. Results are always reviewed by the project manager and/or lead consultant for accuracy, consistency, and clarity of communication.
- **Sample Life Review** – Actuarial software is like all other types of software – sometimes it isn't doing what you think it is. For all projects, we create independent models for sample participants that allow us to compare the results from the actuarial software with our expectations. Our staff's familiarity with these programs allows us to complete these samples for projects and scenarios.

- **Project Management Checklists and Logs** – We maintain project management checklists and logs to track the status of projects and staff accountability. This ensures that we are meeting our do/check/review process and are not missing deadlines.
- **Specialization in Public Sector Retirement and OPEB Plans** – The staff members assigned to ORSC all specialize in public sector retirement and/or OPEB plans. This reduces errors that are commonly made by (a) not being familiar with the features of public plans and (b) not being familiar with issues that are unique to OPEB.
- **Peer Review** – Work products are independently reviewed by a senior consultant for compliance with actuarial standards and client’s requirements, as well as the overall reasonableness of the results. Recommendations are also approved to ensure they reflect the firm’s judgment and best practices.

Requests for changes can be made to either the Lead or Supporting Actuary. If the request relates to a problem or a material change (such as in assumptions and methods), the lead consultant will be involved. Many changes are stylistic or emphasis changes. For example, clients may wish to highlight certain information that was not apparent in the original document.

We provide clients with draft documents to ensure they have a chance to review and determine if any information is inconsistent or unclear. We also provide our materials one week ahead of meetings to allow time for read-through. This helps our clients understand the information, create focused questions, and avoid surprises.

VI. ADDITIONAL INFORMATION

Each proposal shall include any additional information that might be helpful to gain an understanding of the proposal. This may include diagrams, excerpts from reports, or other explanatory documentation that would clarify and/or substantiate the proposal. Any material included here should be specifically referenced elsewhere in the proposal.

Each actuarial audit engagement is unique, and as such the report format must be tailored to the client and plan being audited. As stated on page 34, we have included a sample report to demonstrate our approach to providing the requested services in this section. We understand that ORSC and HPRS have specific requirements for the format and contents of the actuarial audit report, which we will comply with in our deliverables to you.

**Sample State Retirement and
Pension System
Audit of the 2019 Actuarial Valuations**

Bolton

Submitted by:

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Employee Benefits, Actuarial & Investment Consulting

November 13, 2019

Board of Trustees
Sample State Retirement and Pension System
100 Main Street
Sample City, Sample State 55555

Re: *Audit of the 2019 Actuarial Valuations for the Sample State Retirement and Pension System*

Dear Members of the Board:

Attached is Bolton Partners' actuarial audit of GRS's 2019 valuations of the Sample State Retirement and Pension System. This is a "Level one" full replication audit. The purpose of the audit is to:

- Validate the results of the June 30, 2019 actuarial valuations for the State and Municipal Pools, using appropriate mathematical modeling and review of the plan valuation to conclude if the actuarial liabilities and required contributions are valid
- Determine whether the actuarial valuation methods, assumptions and procedures used by the System's consulting actuary, Gabriel Roeder Smith & Company (GRS), are reasonable and consistent with all applicable laws, Board policies, generally accepted actuarial principles and practices, are appropriate for the plan structure and funding objectives and are applied as stated by GRS
- Assess whether the valuation results are complete and accurate, and the conclusions of the valuation reports accurately portray the actuarial status of the System and are properly reflected in the employer contribution rate
- Assess the financial effect of any errors or deviations from generally accepted actuarial principles and practices on the valuation results and employer contribution rates

The plan liabilities are the sum of the liabilities for all of the members. We audited the liability and normal cost calculations that are the heart of these valuations by replicating the results of the entire valuation. Our replication results are within our preestablished tolerances.

As part of our review of methods, we have commented on how the funding methods compare to the Government Finance Officers Association (GFOA) best practices and the guidance provided by the Conference of Consulting Actuaries (CCA) and we have provided recommendations for changes where appropriate. We recognize that some methods (e.g. the amortization periods) are set by legislation and not within the control of the Board.

We have also suggested studies that can help the Trustees and Sponsor understand the future funding needs and risks.

This audit report includes the following sections:

- I. *Executive Summary* – A summary of the key findings.
- II. *Purpose, Scope and Methodology of Audit* – A description of the purpose and limitations of the audit.
- III. *Replication of Actuarial Valuation Results* — A replication and comparison of key valuation results and developed contributions.
- IV. *Analysis of Methods and Assumptions* – An analysis and benchmarking of the actuarial assumptions, including a review of the most recent experience study, and a review of the actuarial methods utilized in determining the funded status and accrued liability as of July 1, 2019 for compliance with generally accepted actuarial principles.
- V. *Comments on proposed Actuarial Equivalence study* – This contains items to consider when the actuarial equivalence basis for administrative factors are studied in 2020.
- VI. *Recommendations* – Our conclusions and a discussion of potential changes and future studies that the Board should consider.

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

Respectfully submitted,

BOLTON PARTNERS, INC.


Thomas Vicente, FSA, EA


Thomas Lowman, FSA, EA



Jordan McClane, FSA, EA





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Section I. Executive Summary

The Sample State Retirement Agency (SSRA) retained Bolton Partners, Inc. to conduct an independent review of the System's 2019 actuarial reports' calculations, assumptions and methods. The State requested an assessment of whether the valuations were complete and accurate; that the methods and procedures used are reasonable, appropriate and correctly applied; that the conclusions of the valuation reports accurately portrayed the actuarial status of the plans; and, the effect of any errors or deviations on the results of these valuations. We also reviewed the validity of the data used in the valuation, provided our thoughts on the current funding methods and procedures, and commented on alternative methods that might be recommended. SSRA also requested a review of the actuarial reports and most recent experience analysis and to determine if there is consistency in the presentation of the actuarial results and whether they are consistent with professional standards (including the Actuarial Standards of Practice 4, 27, 35 and 41).

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

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

Statement of Key Findings

1. Validation of the Accuracy of the Valuation Results

We validated the accuracy of the valuation results by replicating the full valuation in a way that we believed provided a reasonable test of all key plan provisions and assumptions. We calculated the present value of future benefits, the actuarial liability, the normal cost, the actuarial value of assets, and the actuarially determined contribution and compared our results to those of GRS. The ranges of differences between our replication results and those prepared by GRS are shown below. All key metrics are within tolerance.



Section I. Executive Summary (cont.)

Statement of Key Findings (cont.)

Calculated Item	Difference Range	Tolerance
Present value of future benefits (PVFB)	-0.3% to +0.7%	4.0%
Actuarial accrued liabilities (AAL)	-1.1% to +0.3%	4.0%
Gross normal cost (NC)	-3.0% to +3.0%	4.0%
Actuarial value of assets (AVA)	0%	0.5%
Actuarially determined contribution (ADC)	-3.0% to +1.8%	4.0%

2. Rollforward Methodology Discussion

GRS uses a rollforward methodology to account for the difference in timing between the valuation date and the contribution period. Using a rollforward approach is reasonable and often preferred over not using a rollforward approach. GRS' methodology entails:

- Rolling forward the unfunded liability, and
- Developing a normal cost percentage that can be applied to a future payroll

We were able to use a common rollforward formula to match within approximately 1% of the rolled unfunded liability presented by GRS. We recommend that GRS show the development of the rolled unfunded liability as part of the valuation reports.

Additionally, we understand that the timing of contributions is different for some of the systems and generally between the State and Municipal plans due to ease of administration and past precedence. While the methods currently employed may be reasonable, we recommend that SSRA and GRS discuss the merits and drawbacks of using the existing approaches for all plans particularly how the cost percentages (either normal cost or actuarially determined contribution percentages) are reconstituted back into dollar values.

3. Assumptions and Methods are Reasonable, Appropriate and Appropriately Applied

We reviewed the methods and assumptions used in the valuations and concluded that the assumptions and methods are generally reasonable, appropriate for the valuations and appropriately applied in the actuarial models. Our recommendations include the following:

- We encourage the Board to continue to lower the discount rate and real rate of return assumption.
- We recommend that the plan see if the State's OPEB actuary might benefit from a separate set of retirement rates for members in plans with a DROP provision.



Section I. Executive Summary (cont.)

Statement of Key Findings (cont.)

- As in our last audit study, we recommend that the plan not phase in assumptions changes. This recommendation is largely to improve transparency. We understand that there are no current plans to lower the 7.4% assumption.

4. Funding Policy

Amortization Policy: The amortization periods are set by state legislation and are not under the direct control of the Board. We understand the Board has studied the amortization policy. However, as time passes, the amortization rules should be revised because the declining periods will result in substantial changes in the amortization of gains and losses. To the extent the Board can advise the State legislature, we recommend that GRS, the Board and the State develop a new amortization policy. We suggest considering the guidelines in the CCA White Paper on funding methods and the use of layered amortization bases.

Future risks to the System: Our prior audit recommended that the Board consider and measure the increase in future risks due to the continuing maturation of the plans. In this report, we note that GRS has included a new section on risk to comply with the new ASOP 51 standard. GRS discusses the possibility of doing additional quantitative risk assessments. We recommend that the Board approve some work in this area particularly related to issues around the future maturity of the plan.

5. Basis for Actuarial Equivalence Review in 2020

We have provided some thoughts on GRS's proposed review of assumptions used to determine benefit amounts under the various optional forms of payment. We have not been prescriptive in our recommendations but have provided general thoughts in this area.

Conclusions

Our audit validates the findings of the 2019 actuarial valuations.



Section II. Purpose, Scope and Methodology of the Audit

Purpose of the Audit

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

- Validate the results (liabilities, normal cost and contributions) of the June 30, 2019 valuation using a "level 1" audit (i.e. a full replication valuation to review the liability and normal cost calculations), as well as appropriate mathematical models.
- Determine whether the actuarial valuation methods and procedures used by GRS are:
 - Reasonable and consistent with all requirements
 - Appropriate for the plans' benefit structures and funding objectives
 - Applied consistently with the assumptions and methods specified in the actuarial valuation report prepared by GRS.
- Assess whether:
 - The actuarial valuation complies with all appropriate laws, policies, principals and practices
 - The conclusions of the valuation reports accurately portray the actuarial status of the System
 - The valuation reports properly determine the employer contribution rates.
- Assess the financial effect of any errors or deviations on the valuation results and the employer contribution rates.

Scope of the Audit

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



Section II. Purpose, Scope and Methodology of the Audit (cont.)

Scope of the Audit (cont.)

What this audit can provide is:

1. Assurance that appropriate benefits are being valued;
2. Confirmation that the valuation system is accurately calculating present value of benefits and appropriately dividing these present values into accrued liabilities and normal cost, by replicating the full results for each Plan;
3. Confirmation that the program is valuing benefits as described in the valuation report and consistent with applicable statutes;
4. A review of the demographic actuarial assumptions for consistency with generally accepted actuarial practices and the specific experience of the plans, as documented in the last experience study;
5. A measurement of economic actuarial assumptions against those used by other public plans and hence an assessment of their reasonableness;
6. A review of the reasonableness of actuarial funding and asset valuation methods;
7. An indication as to whether the liabilities and contribution rates shown are not reasonable or are incorrectly calculated; and
8. Recommendations for changes in procedures, methods, assumptions and forecasts of expectations.

Methodology of the Audit for the 2019 Actuarial Valuation

The purpose of this audit is to express an opinion regarding the reasonableness and accuracy of the actuarial assumptions, methods, and valuation results.

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

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



Section II. Purpose, Scope and Methodology of the Audit (cont.)

Methodology of the Audit for the 2019 Actuarial Valuation (cont.)

Benefits Analysis

Critical to projecting future benefits is receiving complete and accurate data. We reviewed the data prepared by SSRA to be used in the actuarial valuation. We tested the data for completeness and compared it to the summary information found in the GRS reports.

We developed valuation results and Excel models that enabled us to compare our results with GRS's results. These models also allowed us to confirm that the GRS valuation projects benefits in a manner consistent with the Benefit Provisions summary in the prior valuation report (the current draft reports did not yet have the benefit summaries included and were not a part of the audit), and that the summary is consistent with state statutes applicable to the Sample State Retirement and Pension System. For purposes of this study, we regard differences of less than 3% to be immaterial for the Total Present Value of Benefits (PVFB) and 2% to be immaterial for the review of census data.

Assumptions Analysis

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

1. Reviewed the recent GRS Experience Study report finalized in 2019;
2. Benchmarked the economic assumptions against a survey of state and local employee retirement systems; and examined several individual test life calculations to make sure that the assumptions were properly applied.

Methods Analysis

The third component in assessing funding levels is the selection and application of the actuarial cost method (including the method for amortizing the unfunded actuarial accrued liability) and the asset valuation method (including smoothing techniques). This includes items unique to a particular system, such as SSRA's. We compared the funding methods used with best practices, based on the Conference of Consulting Actuary's (CCA)s "white paper" (included as an addendum to this report) as well as our own experience, as well as the overall funding goals of the Board and Legislature.



Section III. Replication of Actuarial Valuation Results

Summary

The scope of work for this engagement details a level one audit per the Government Finance Officers Association's (GFOA's) *Best Practices* guidelines for actuarial audits, and as such, this section contains the results of a full replication of the State and Municipal valuations in comparison to the key results generated by GRS and presented in their draft valuation reports dated October 11, 2019 and October 23, 2019. The prior audit, which was conducted in 2014 and was also performed by Bolton, was a level two audit that focused on individual sample lives within each of the systems to ensure appropriate coding of plan provisions and assumptions. Since that audit, plan provisions have not changed significantly, but actuarial assumptions have, due to the experience study conducted by GRS in 2019. There were few plan changes since the last audit, so the primary differences between our replication of the valuation results and those presented in the GRS draft valuation reports could be, among other things, the result of the incorrect application of the assumption changes. The sections below, however, depict a close match in the key valuation results. Given that we produced a close match in the aggregate for each of the plans, and that the actuary for the plan has remained the same since the prior audit, and due to the limited window to communicate with GRS prior to issuance of this report, we completed only a high level review of key valuation results for a select few sample lives and focused the majority of our efforts on replicating results in total for the plans.

Data Provided

In order for Bolton to perform the replication of the valuations necessary for a level one audit, the State Retirement Agency (SSRA) provided Bolton multiple files, notably the following:

- Active, deferred vested, and inactive census data
- Retired, disabled, and survivor census data
- Data layouts detailing the field names and descriptions of the fields contained in the above two census data files
- Tables containing decrement assumptions (withdraw rates, disability rates and retirement rates) and salary scale assumptions used by GRS for the valuations
- A system plan matrix detailing the eligibilities and provisions of the various plan codes within each of the systems
- The experience study report dated August 16, 2019

Although the two census data files contained the records from which GRS created a valuation data file to be imported into the GRS valuation system, we did not receive valuation data directly from GRS, and consequently, the following elements pertinent to valuing the pension benefits provided by these systems were not included and thus were estimated from the information available:



Section III. Replication of Actuarial Valuation Results (cont.)

Data Provided (cont.)

- The members who should be valued and the appropriate payment details associated with those individuals in pay. Although a status field and payment information were provided, some analysis/manipulation was required.
 - For instance, deciphering which “inactive” records with a status code of either “AI” or “I” were vested and due a pension benefit or not vested and due a refund of contributions. We matched the counts of terminated vested members due benefits in the GRS valuation reports by removing from the data those records with total service years fewer than the number of years required for vesting as provided in the “D-VEST-YR” field.
 - Additionally, the deferred benefit amounts for individuals with deferred vested benefits were not initially provided. The benefit amounts could have been computed using the information in the data had the final average compensation been provided for the individuals in this group. In the absence of this data, Bolton requested additional information and was ultimately provided with the final average compensation and deferred benefit amounts used by GRS. Understanding that these fields are not tracked by the SSRA, we validated the benefit amounts provided by GRS using the plan provisions applicable to each member, the service fields in the data, and the final average compensation provided by GRS. Based on our review, we believe that the benefit amounts valued by GRS are appropriate for the valuation.
- Whether a member should be valued in the State valuation or the Municipal valuation. A location field was provided in the census data and the data layout provided a categorization key (State location codes were codes less than 6500 or greater than 6500 “and 3rd and 4th position of the employer location = 07, 17 & 50”). However, we could not match the counts of participants using this key, and instead, used an amalgamation of the information in the census data, participating governmental unit (PGU) codes, and the State/Municipal flag provided by GRS via the SSRA.



Section III. Replication of Actuarial Valuation Results (cont.)

Established Tolerance

For this replication, we focused on the following key metrics of the valuation, using the tolerance thresholds for match differences as indicated below:

Calculated Item	Acceptable Tolerance
Present value of future benefits (PVFB)	4.0%
Actuarial accrued liabilities (AAL)	4.0%
Gross normal cost (NC)	4.0%
Actuarial value of assets (AVA)	0.5%
Present value of pay; present value of member contributions	2.0%

Present Value of Future Benefits

Generally, when performing a replication audit, we first focus on the present value of future benefits (PVFB), as it represents the estimated value, as of the valuation date and based on the plan provisions and valuation assumptions, of all future benefits that would be payable to the members in the plan as of the valuation date. Although the acceptable tolerance shown above is 4.0%, typically a closer match is produced if benefits, provisions, and assumptions are coded correctly. A match of the inactive (non-active members, including terminated vested members and in-pay individuals) liabilities indicates that the aggregate impact of mortality, cost of living, inflation and other assumptions is reasonable. A match of the active liabilities indicates that the plan provisions are in sync as well. As shown in the tables on page 12, the maximum absolute difference in active PVFB, inactive PVFB, and total PVFB, among all systems was less than 2.0%, less than 1.0%, and less than 1.0%, respectively.

Actuarial Accrued Liability

The PVFB is generally bifurcated into the value (referred to as the actuarial accrued liability, AAL) of benefits that have been “accrued” under the applicable actuarial cost method and the estimated value (referred to as the present value of future normal costs, PVFNC) of benefits that have not been but may be accrued in future years. Due to the intricacies of actuarial valuation software, the same benefits coded in different actuarial programs can generate slightly different splits of the PVFB into AAL and PVFNC. The accuracy of the match in the development of the AAL can be distorted if the inactive AAL is a significant portion of the overall AAL. As such, the tables on page 12 show both the active AAL and the inactive AAL. Although the difference in active AAL was larger for CORS Municipal than for other plans, it is still within tolerance and the maximum absolute difference, excluding CORS, in the active AAL and total AAL among all systems was approximately 2% and 1% respectively, further validating a strong replication match.



Section III. Replication of Actuarial Valuation Results (cont.)

Gross Normal Cost

Close matches in both the PVFB and the AAL do not necessarily equate to a close match in PVFNC due to the leveraging inherent in the division of the PVFB into its component units. This can be particularly true for mature plans, which include all plans within both the State and Municipal valuations, and, for this replication, is amplified by the fact that, generally, our generated results for PVFB are slightly greater, while our generated results for AAL are slightly smaller, than those produced by GRS. For mature plans, the PVFNC represents a small and declining portion of the PVFB, and therefore, small match differences in PVFB could translate into large differences in the PVFNC.

Since the PVFNC is essentially today's equivalent of the sum of all future normal costs, differences in the PVFNC may also be reflected in the normal cost (NC). For this replication, we evaluated the difference in gross (employer plus employee) normal cost. Rather than comparing the difference in dollar amounts, as was done for the PVFB and the AAL, the normal cost comparison was completed as a percentage of payroll, since contributions are developed as a percentage of payroll and the normal cost is one of the two primary components of the actuarially determined contribution, or ADC. Although match results for gross normal cost were not as closely replicated as the PVFB and AAL, the maximum absolute difference of approximately 3% was still within the established acceptable tolerance threshold.

Actuarially Determined Contribution

The ADC is generally comprised of: (1) the employer normal cost (as mentioned above) and (2) an amortization payment to recognize a portion of the unfunded AAL, or UAAL. If the matches for the AAL and the NC are within tolerance, then, often, the ADC is within tolerance assuming the calculation for amortizing the UAAL is performed correctly. For this replication, we used a tolerance threshold of 4.0% and the differences in ADC were all within approximately 3%.

Actuarial Value of Assets

In addition to liabilities and normal cost, we also reviewed the determination of the actuarial value of assets (AVA). The AVA, a smoothed market value of assets (MVA), is used to develop the ADC. The State and Municipal systems use a five-year smoothed AVA in which 20% of the difference between the actual and expected return on the beginning-of-period MVA is added to the expected end-of-period MVA. Based on the new AVA base developed in the June 30, 2019 valuations and the four prior bases displayed in the June 30, 2018 valuation reports, we were able to exactly match the AVA for all systems.



Section III. Replication of Actuarial Valuation Results (cont.)

Present Value of Pay and Present Value of Member Contributions

Generally, differences between the replication and valuation results for the present value of pay and/or the present value of member contributions may indicate that the actuarial assumption decrements or member contributions are not coded or applied appropriately. The present value of pay and the present value of member contributions were not provided in the draft valuation reports prepared by GRS, so we are not able to comment directly on our replication of those metrics.

Summary of Match Results

The tables on the following page display the key match results for the State and Municipal valuations. Please note that, for the Municipal valuation results, the AAL and the NC percentage displayed are before the impact of “pooling,” meaning that the percentages are based on the totals for the system and do not reflect the amounts that have been carved out for deficits, surpluses, and surcharges. A thorough review of these unfunded liability balances and normal cost surcharges was not conducted as we were not familiar with the historical plan provision decisions for each of the participating governmental units (PGUs). However, we confirmed that the amounts calculated were based on the payrolls and percentages as listed in the reports.



Section III. Replication of Actuarial Valuation Results (cont.)

Summary of Key Valuation Results

Table 1 – State Valuation Results

State (\$, millions)	TCS			ECS			SP			JRS			LEOPS		
	GRS	Bolton	% Diff	GRS	Bolton	% Diff	GRS	Bolton	% Diff	GRS	Bolton	% Diff	GRS	Bolton	% Diff
Active PVFB	25,315	25,564	1.0%	9,538	9,446	-1.0%	804	818	1.6%	290	295	1.6%	556	561	0.9%
Inactive PVFB	25,904	25,974	0.3%	14,268	14,326	0.4%	1,794	1,789	-0.2%	391	390	0.0%	799	798	-0.1%
Total PVFB	51,219	51,538	0.6%	23,806	23,772	-0.1%	2,598	2,607	0.3%	681	685	0.7%	1,354	1,359	0.3%
Active AAL	17,469	17,525	0.3%	7,015	6,948	-1.0%	507	503	-1.0%	170	166	-2.1%	341	339	-0.4%
Inactive AAL	25,904	25,974	0.3%	14,268	14,326	0.4%	1,794	1,789	-0.2%	391	390	0.0%	799	798	-0.1%
Total AAL	43,372	43,499	0.3%	21,283	21,274	0.0%	2,301	2,292	-0.4%	560	557	-0.6%	1,140	1,138	-0.2%
NC %	11.33%	11.00%	-2.9%	10.48%	10.17%	-3.0%	32.99%	33.98%	3.0%	37.39%	38.45%	2.8%	23.65%	23.68%	0.1%
ADC %	15.65%	15.45%	-1.3%	21.36%	21.57%	1.0%	79.03%	79.34%	0.4%	40.27%	40.99%	1.8%	43.93%	43.72%	-0.5%

Table 2 – Municipal Valuation Results

Municipal (\$, millions)	ECS			LEOPS			CORS		
	GRS	Bolton	% Diff	GRS	Bolton	% Diff	GRS	Bolton	% Diff
Active PVFB	2,953	2,945	-0.3%	336	338	0.7%	17	17	-1.3%
Inactive PVFB	3,204	3,215	0.3%	279	277	-0.6%	16	16	0.8%
Total PVFB	6,158	6,161	0.1%	615	616	0.1%	33	33	-0.3%
Active AAL	2,154	2,141	-0.6%	204	205	0.2%	12	12	-3.7%
Inactive AAL	3,204	3,215	0.3%	279	277	-0.6%	16	16	0.8%
Total AAL	5,358	5,356	0.0%	483	482	-0.3%	28	28	-1.1%
NC %	9.10%	8.97%	-1.4%	23.16%	23.06%	-0.4%	12.46%	12.54%	0.6%
ADC %	6.71%	6.51%	-3.0%	34.93%	34.53%	-1.1%	9.67%	9.46%	-2.2%



Section III. Replication of Actuarial Valuation Results (cont.)

Observations and Discussion Topics

Topic 1 – The NC Percentage

As mentioned previously, the PVFB is comprised of the AAL and the PVFNC and its division into these component units can vary slightly when using different valuation systems depending on the capabilities of the software and on the specifics of the coding. The results can be even more exaggerated when examining the employer, rather than gross, normal cost, since the employee contribution percentage for these plans often represents a large portion of the total normal cost. As a result, nearly all of the gross normal cost difference between our replication results and the results in the GRS valuation reports is passed through to the employer normal cost. For TCS¹, which has a gross NC percentage of around 11% and an employee contribution rate of 7%, even a 30 basis-point difference, which equates to less than a 3% difference, in the gross NC percentage, represents more than a 7% difference in employer NC.

Based on our discussions with GRS, we know that there are differences between how our system and GRS' system develops NC. For instance, GRS has indicated that their valuation software generates a NC as of the middle of the year, whereas our software generates a NC as of the beginning of the year. Other differences can be attributable to the salary used to create the NC percentage by spreading the PVFB over the working lifetime of the employee. Despite these differences, the NC percentage developed under different valuation systems should not vary drastically. Expressing the normal cost as a percentage, rather than a dollar amount, can mitigate some of the fluctuations associated with salary and timing differences.

To illustrate the mechanics of the NC development, let's consider a newly hired member. The PVFB for this member will be entirely PVFNC since the member has yet to accrue a benefit under the entry age normal funding method. The PVFNC will transfer to AAL proportionately to accumulated salaries from entry into the plan. The rate or payroll percentage used to accumulate these salaries is called the NC percentage, and due to the intentional design of the entry age normal level percentage of pay funding method, this rate will stay level throughout the employee's career if all assumptions are met and plan provisions remain unchanged. For these systems, the normal cost percentage is applied to payroll and the next section discusses how this is performed in practice.

The implications of the specific mechanics of the normal cost percentage development and application are somewhat technical, and perhaps, are more of an academic discussion than an area of concern. We have included it here because we noticed larger than anticipated differences in the employer NC contribution rate upon our first pass at coding the valuations. We recognize, as detailed above, that this is partly due to the leveraging in the NC rate where differences in gross normal cost are reflected almost entirely in the employer NC, rather than being distributed between both the employee and employer NC.

¹ See Appendix for the replication of the full contribution development for each of the systems



Section III. Replication of Actuarial Valuation Results (cont.)

Observations and Discussion Topics (cont.)

Topic 2 – Rollforward Methodology

Like the valuations for many public sector plans, the State and Municipal valuations for the Sample State Retirement and Pension System (SSRPS) develop a contribution for the fiscal year following the fiscal year beginning on the valuation date. For example, the June 30, 2019 valuation determines the contributions for FY 2021. This is common practice as employers need to know their contribution requirements before they set their FY 2021 budgets. The methodology used to adjust the 2019 results and generate FY 2021 contributions is often referred to as a rollforward methodology. Some methodologies are as simple as adding interest to the 2019 results. Others, such as the method employed for SSRPS, roll forward the UAAL from the valuation date to the beginning of the contribution fiscal year to create an expected UAAL. The UAAL rate that is developed from this rolled UAAL, along with the NC percentage, are applied to a future payroll to better align the contribution to the period in which it is made. No one rollforward method is perfect and often there is a balance between complexity and precision.

Although we were not able to match the exact UAAL rollforward methodology employed by GRS using only the information in the report, we were able to produce similar projected UAAL amounts using a common rollforward methodology:

$$(\text{UAAL at val date}) \times (1 + \text{DR}^2) - (\text{expected UAAL contribution during val year}) \times (1 + \text{DR})^{0.5}$$

Additionally, the draft Municipal report that we initially received did not show the rolled UAAL. However, GRS provided an updated Municipal valuation report to display, similar to the State valuation report, the rolled UAAL and we have validated the updated reports. We recommend that GRS consider showing the UAAL rollforward development. This could be accomplished by adding more rows to the tables in the contribution development pages or by adding a footnote to the rolled UAAL that explains the methodology or shows the formula used.

To develop the UAAL percentage for all plans except TCS, the dollar amortization payment is divided by the estimated payroll for the valuation year, (i.e. the payroll in the data) inflated with 1.5 years of the payroll growth assumption of 3.10%. GRS notes in the *Actuarial Assumptions and Methods* section of the report that the pay increase timing for all systems other than TCS is “middle of (Fiscal) year. This is equivalent to assuming that reported pays represent the annualized rate of pay at the beginning of the (Fiscal) year.” If that is the case, then we agree with GRS’ methodology of applying 1.5 years of payroll growth as doing so would align salaries with the contribution year.

For TCS, the pay increase timing is assumed to be “beginning of (Fiscal) year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.” If this is the case, then we would expect that the salary for TCS plan participants in the data would be inflated by 2.0 years of payroll growth. However, GRS applies only 1.0 year of payroll growth. This is based on past precedence where the actual amount contributed to the plan is based on salaries for the year prior to the contribution year.

² Discount rate



Section III. Replication of Actuarial Valuation Results (cont.)

Observations and Discussion Topics (cont.)

Topic 2 – Rollforward Methodology (cont.)

Generally, the ADC percentage is comprised of this UAAL percentage and the NC percentage. The Sample State Retirement Agency (SSRA) essentially has three different ways to reconstitute the ADC expressed as a percentage of payroll into dollar contributions for FY 2021.

- For State systems except TCS, the ADC percentage is applied to actual FY 2021 payroll and collected throughout FY 2021.
- For Municipal systems, the ADC percentage is applied to the actual June 30, 2020 annualized payroll and is collected in December 2020 (FY 2021).
- For TCS, the NC percentage is applied to the actual June 30, 2019 annualized payroll that has been inflated by the payroll growth assumption (3.1%) for one year.

We have the following comments about the methodologies employed by SSRA:

- When determining NC as a percentage of payroll, the payroll used was the “closed group” expected pay for FY 2020, factoring in expected exits during FY 2020. When applied to actual payroll in a future year, this has the benefit of collecting NC for members hired during the year of contribution (e.g. FY 2021). We like this approach.
- Since the NC percentage developed in the valuation reports depends on the mix of members in each of the benefit tiers at June 30, 2019, it will not reflect the actual mix of members in the year of contribution. This methodology is conservative and is not uncommon since reflecting the FY 2021 mix would require additional work.
- Perhaps the TCS NC should be increased by an additional 3.1% or applied to actual FY 2021 payroll to better align the contribution with the expected payroll.

Rollforward methods have gradually become more sophisticated over time, which occasionally makes them more complicated and harder to explain. Changes to certain items listed above would likely increase contributions while others would decrease contributions. Our goal is not to recommend specific changes but to suggest that GRS review what may be long-standing methods for aligning contributions with the periods in which they are made.

Topic 3 – Accidental Death Decrement for State Police and LEOPS

Page A-8 in the Appendix of the initial draft State valuation report provided a sample of accidental death mortality rates for the SP and LEOPS plans. The experience study notes that GRS recommends “rates equal to 30% of the non-duty retirement mortality assumption be used” for accidental death but the sample rates provided were equal to 9%, rather than 30%, of the non-duty retirement mortality assumption. GRS has since updated the sample rates displayed in the appendix to be equal to 30% of the non-duty retirement mortality assumption.



Section III. Replication of Actuarial Valuation Results (cont.)

Observations and Discussion Topics (cont.)

Topic 4 – Information on Non-Vested, Terminated Members

The absence of summary tables and language regarding non-vested terminated individuals due refunds of employee contributions makes it impossible for the reader to discern whether these refunds are included in the plan liabilities. If the employee contribution balances for members who terminated employment prior to vesting are included in the assets for the plan, they should also be included in the liabilities. Often the dollar value of the balances is added to the liabilities under the assumption that the balances will be returned to the individuals during the valuation year. If GRS is not valuing these employee contribution refunds in the liabilities, we recommend that the report be updated to appropriately reflect them. We also recommend that they be included as a separate line item in the demographic information count and the PVFB breakdown on the individual plan pages of the reports (Section II of the State valuation report and Section III of the Municipal valuation report) or that they be included in the “Terminated Vested Members” line item but with the label adjusted to detail as such; for instance, “Terminated Vested Members and Former Members Due Refunds of Employee Contributions.”

Full contribution development replication

Please see the Appendix for the replication of the full contribution development for each of the systems.

Conclusion

Given the close match in the key valuation results, we believe that the draft valuation reports, in general, accurately portray the actuarial status of the SSRPS and properly reflect the employer contribution rates and liabilities. We believe that none of the topics of discussion mentioned above would have a significant financial effect on the valuation results and the employer contribution rates.

Section IV. Analysis of Methods and Assumptions

Funding Methods

There are three key funding methods that are part of any plan's funding policy:

1. An **actuarial cost method**, which allocates the total present value of future benefits into three categories: all past years (Actuarial Accrued Liability or AAL), this year (Normal Cost), and future years (Present Value of Future Normal Cost).
2. An **amortization policy**, which determines the length of time and the structure of the increase or decrease in contributions required to systematically fund any Unfunded Actuarial Accrued Liability or UAAL. In the unusual situation where assets are in excess of the AAL, the policy should state how the surplus assets will be recognized.
3. An **asset smoothing method**, which reduces the effect of short-term market volatility while still tracking the overall movement of the market value of plan assets. This is discussed later in the "Asset Valuation Method" section.

In addition to providing our own opinion on the three methods used by the plans, we compared these methods to the opinions contained in the CCA White Paper on funding methods, as well as the Board's and Legislature's intentions to fund the plans. The CCA paper also contains rationale and objectives that we will sometimes refer to in this report.

We generally find that the funding methods chosen meet the Board's and Legislature's goals, and are consistent with appropriate funding practices, except as noted below.

Actuarial Cost Method:

The actuarial cost method for the Sample State plans is the individual entry age normal method. This is a reasonable and common funding method, used by well more than half of all public plans. The individual entry age normal method (EAN) is attractive to public sector employers because the EAN Normal Cost is developed to be level with respect to salary. In other words, the EAN Normal Cost increases at the same rate as salary. Most public sector pension plan sponsors prefer to state their pension contribution as percent of active payroll. Thus, the entry age normal cost method is a natural fit for public sector plans.

We support GRS' current use of the individual entry age normal method.

Amortization of Unfunded Actuarial Accrued Liability (UAAL)

The Plans' UAAL amortization policy has changed over time. The current policy includes these characteristics:

1. The UAAL is amortized as a level percentage of payroll,
2. The UAAL is amortized over a single "closed" amortization period.
3. For the State Retirement and Pension System, as of 6/30/2019, there are 19 years remaining in the amortization period. The amortization period ends 6/30/2039 (p.A-1).



Section IV. Analysis of Methods and Assumptions (cont.)

Funding Methods (cont.)

Amortization of Unfunded Actuarial Accrued Liability (UAAL) (cont.)

For the Municipal plan, the amortization period depends on the group as shown below (2019 report, p.B-15).

Group	Amortization period ends	Amortization period
Employees' Combined System (ECS)	6/30/2043	100 years in 2016, down to 20 years for 2022; 30 years for 2019 valuation ³ .
LEOPS	6/30/2040	20 years as of 6/30/2019
CORS	6/30/2047	27 years as of 6/30/2019

We believe that each of the three key amortization components listed below should be considered separately and not in the aggregate:

- The level percent of payroll method is the CCA LCAM Model Practice. We see no reason to change this practice, the amortization period for the State plans is down to 19 years so the temporary negative amortization⁴ that sometimes results from using this method period is past.
- “Closed” amortization period is the CCA LCAM Model Practice. We see no reason to change this practice. Sample State uses a single closed amortization period for its plans. We recommend that the Trustees look into a layered amortization approach; and that the Trustees recommend this to the legislature. At some point in the future this change will become even more important.
- Amortization periods of more than 25 years is generally not a CCA LCAM Model Practice unless used as a transition to shorter amortization periods (and even for transition we recommend this be limited to 30 years). A 25-year closed layered period falls into the CCA category of “Acceptable Practices, with Conditions” (p.27). We support reducing the amortization period for ECS down to 20 years for 2022.

As we mentioned in our 2014 audit of Sample State plans, we point to two quotes from the 2014 CCA paper and suggest changes in future practices:

1. The problem of having a single fixed amortization approach becomes obvious as time goes on and the end of the amortization period draws near. The CCA paper expresses this as: “Single layer, fixed period amortization is not a stable policy, since period would have to be restarted when remaining period gets too short” (p.22). At some point the current approach will be abandoned. Sample State may wish to make changes based on good policy goals before there is added pressure to increase the amortization period to avoid a contribution spike.

³ From “Actuarial Valuation Board Summary”, slide 27; also 2019 valuation report, p.3.

⁴ Negative amortization refers to the condition where in the first few years, the amortization payments do not cover the interest on the UAAL. The result is a temporary increase in the UAAL. The outstanding UAAL begins to decrease once the amortization payments are large enough to more than cover the interest on the UAAL.



Section IV. Analysis of Methods and Assumptions (cont.)

Funding Methods (cont.)

Amortization of Unfunded Actuarial Accrued Liability (UAAL) (cont.)

2. CCA Model practice is “30-year amortization of surplus” (p.24). Having a surplus may seem like a distant future event. However, we note that there was a surplus in 2000 and it was amortized over 20 years. The longer 25-year amortization of losses which occurred after the establishment of the surplus, eliminated the surplus, creating the need to combine bases in 2013. When the plans again achieve a surplus (i.e., a negative unfunded liability), a 30-year amortization period for the surplus should be considered.

The presentation of 2019 valuation results prepared by GRS states that the State amortization method needs to be reconsidered to control volatility once the period falls below 10-15 years (*slide 27*). Our recommendation is that the SRPS study and implement a replacement methodology now. An approach that is known to have impending flaws cannot be regarded as a sound practice.

Asset Valuation Method

Assets in the Trust are valued using the common 5-year smoothing period. This method smooths investment gains and losses (that is, investment returns above or below the assumed investment return) for each fiscal year by recognizing these gains and losses evenly over a five-year period. The State’s method also imposes a collar of 80%/120% that places limits on the spread between actuarial value of assets (AVA) and market value of assets (MVA).

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

The Actuarial Standard of Practice (ASOP) No. 44 (Selection and Use of Asset Valuation Methods for Pension Valuations) gives guidance for determining the reasonableness of an asset smoothing method. The following is an excerpt from ASOP 44 that establishes the qualities a reasonable asset smoothing method must exhibit.

From the Actuarial Standard of Practice No. 44

Section IV. Analysis of Methods and Assumptions (cont.)

Funding Methods (cont.)

Asset Valuation Method (cont.)

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

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

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

To summarize ASOP 44, an acceptable asset smoothing method must create asset values that fall within a reasonable range around market value; and differences between the actuarial value of assets (AVA) and market value of assets (MVA) must be recognized in a reasonable period of time. In lieu of satisfying both principles, a smoothing method could satisfy the requirements if, in the actuary's professional judgment, the range around market value is sufficiently narrow or the differences are recognized in a sufficiently short period.

Bolton's policy, consistent with others in the actuarial community, is that 80%/120% corridor is a reasonable range around MVA; and five years is a sufficiently short period for recognizing difference between the AVA and MVA. Therefore, in our opinion the method utilized by SSRA is reasonable.



Section IV. Analysis of Methods and Assumptions (cont.)

Actuarial Assumptions

We reviewed the principal assumptions used in the actuarial valuation in light of the recent GRS experience study report dated August 16, 2019. For this purpose, we have reviewed the assumptions for reasonableness. We also compared (1) the current set of economic assumptions to the NASRA (National Association of State Retirement Plan Administrators) survey covering other state plans and (2) Meketa's expectations with survey data from the Horizon actuarial firm. We found the assumptions reasonable but would continue to encourage the lowering of the discount rate and real rate of return.

Investment Return

The long-term investment return assumption (also called the discount rate) is one of the most impactful assumptions in an actuarial valuation. A pension is a promise of future payments. In an actuarial valuation, we provide an estimate of how much these promises are worth on the valuation date. This is done by calculating the accrued and future plan payouts and discounting the plan payouts to the valuation date using the investment return/discount rate assumption.

The June 30, 2019 assumed long term rate of return rate is 7.40%. The long-term rate of return 7.40% is comprised of 2.60% price inflation plus 4.80% real return on assets. This is the rate adopted by the Sample State Retirement Board. Based on both the GRS experience study and our analysis below, we think it will be difficult to earn a 4.8% real rate of return in the next 10 years.

Section 3.8 of ASOP 27 (Selection of Economic Assumptions for Measuring Pension Obligations) lists a series of considerations when determining the investment return assumption, such as inflation, illiquidity, credit risk, macroeconomic conditions, investment volatility, investment manager performance, expenses, and others. Many of these considerations can be reviewed through an analysis of the expected return and volatility of returns for the plan's assets based on a target allocation of investments, which is often stated in the plan's investment policy.

In the 2014-2018 experience study, GRS recommends that the discount rate be in the range 7.25%-7.40% (p.1-5). To arrive at this conclusion, GRS began with the capital market assumptions (CMAs) of 14 different investment firms. Using the CMAs, and the Plan's Target Asset allocation, first GRS computed the expected (arithmetic) nominal return and standard deviation for the Plan under each CMA. To make the comparison more apples to apples, the expected nominal return was computed using each CMA's expected real return and adding the Meketa inflation assumption of 2.15%. Meketa is SSRPS' investment consultant.

Next, GRS determined a "consensus" geometric return for the Plan. The median (or 50th percentile) geometric return for each CMA was computed. The average of the 14 medians is 6.77%. The 7.40% return ultimately adopted by SSRPS is at the 44th percentile as determined by GRS.

Section IV. Analysis of Methods and Assumptions (cont.)

Actuarial Assumptions (cont.)

Investment Return (cont.)

The GRS approach uses capital market assumptions for a 10-year investment horizon. Some public sector plans develop their return assumptions using a longer horizon, such as 20 years, due to the long-term nature of the pension obligations. However, the SSRPS plans are fairly mature given the ratio of in-pay liabilities to active liabilities, and therefore, the duration of the plans may be shorter than an average plan. Given the maturity of the plans and that long-term return assumptions contain a non-inconsequential degree of speculation, the consideration of 10-year returns is not unreasonable. Additionally, the experience study mentions in a footnote on *p.II-10* that only 6 out of the 14 investment consultants provided CMAs over a period of 20 or 30 years.

As mentioned on *p.II-11* of the experience study, Meketa, the investment consultant for SSRPS, expects a 7.68% 10-year geometric return (based on inflation assumptions of 2.15%) and a 8.26% average 20-year geometric return (based on inflation assumption of 2.60%). These seem to be higher than assumed by many of their peers. It should be noted that this implies the portfolio geometric return is 8.84% during years 11 through 20.

As an independent review, Bolton used the CMAs provided in Horizon Actuarial Services' Survey of Capital Market Assumptions (2019 Edition) to develop an expected portfolio geometric return. This survey was developed for Taft-Hartley plans, but generally the long-term investment approach and size of the investment firms providing information is consistent with that of GRS' survey and includes considerable overlap including all but one of the firms used by GRS. The Horizon survey shows the average CMAs from 34 survey participants for the 10-year investment horizon figures and 16 survey participants for the 20-year investment horizon figures. The report presents separately the 10-year return assumptions and the 20-year return assumptions.



Section IV. Analysis of Methods and Assumptions (cont.)

Actuarial Assumptions (cont.)

Investment Return (cont.)

The table below summarizes SSRPS' target asset allocation and how SSRPS' asset classes were mapped to Horizon survey's asset classes. Because different advisors sometimes use different asset classes to express the target asset allocation, there could be other valid mappings between SSRPS' asset classes and Horizon survey's asset classes. For the asset mapping, we relied on the asset allocation shown in the GRS 2018 Experience Review report (p.11-8).

SSRPS asset class	Target asset allocation	Horizon survey asset class
US Equity	16%	60% Large Cap 40% Small/Mid Cap
International Developed Equity	10%	Non-US Equity Developed
International Emerging Markets	11%	Non-US Equity Emerging
Private Equity	13%	Private Equity
Long-term Government Bonds	10%	US Treasuries (Cash Equivalents)
Securitized and Corporate bonds	5%	US Corporate Bonds – Core
Inflation Linked Bonds	4%	TIPS
High Yield Bonds and Bank Loans	7%	US Corp Bonds – High Yield
Emerging Market Debt	2%	Non-US Debt - Emerging
Real Estate	10%	Real Estate
Natural resources and Infrastructure	4%	Infrastructure
Absolute Return	8%	Hedge Funds

Generally, evaluating both short-term and long-term return assumptions is a prudent exercise. Accordingly, we calculated SSRPS' expected geometric return based on SSRPS' target allocation and the Horizon 10-year and 20-year average CMAs. Using this method and the inflation assumption of 2.29% contained in the Horizon report, we estimate SSRPS' geometric return is between 6.63% (10-year investment horizon) and 7.56% (20-year investment horizon). The June 30, 2019 discount rate assumption of 7.40% falls within this range, further confirming the reasonableness of the discount return assumption.



Section IV. Analysis of Methods and Assumptions (cont.)

Actuarial Assumptions (cont.)

Investment Return (cont.)

The table below summarizes Horizon's CMAs and our derivation of SSRPS' portfolio return. In our calculations, to convert between the portfolio arithmetic (A) and geometric (G) return, we used the formula (mentioned in ASOP 27) $G \approx A - V/2$, where V is the portfolio variance. We also show the 10-year average figures for comparison.

Horizon Asset Class	Target Allocation	Arithmetic Return		St. Dev
		20 Year	10 Year	
US Equity - Large Cap	9.60%	8.34%	7.26%	16.17%
US Equity - Small/Mid Cap	6.40%	9.52%	8.45%	20.15%
Non-US Equity - Developed	10.00%	9.30%	8.40%	18.23%
Non-US Equity - Emerging	11.00%	11.67%	10.62%	24.73%
US Corp Bonds - Core	5.00%	4.46%	3.74%	5.47%
US Corp Bonds - High Yield	7.00%	6.38%	5.60%	10.06%
Non-US Debt - Emerging	2.00%	6.76%	6.19%	11.31%
US Treasuries (Cash Equivalent)	10.00%	3.07%	2.71%	2.31%
TIPS (Inflation-Protected)	4.00%	3.69%	3.29%	6.11%
Real Estate	10.00%	7.94%	6.95%	15.03%
Hedge Funds	8.00%	6.61%	5.63%	8.38%
Infrastructure	4.00%	8.46%	7.79%	14.39%
Private Equity	13.00%	12.82%	11.34%	22.05%
Total				
Portfolio Arithmetic Return		8.21%	7.28%	
Portfolio Variance				1.30%
Portfolio Standard Deviation				11.40%
Portfolio Geometric Return (net of expenses)		7.56%	6.63%	

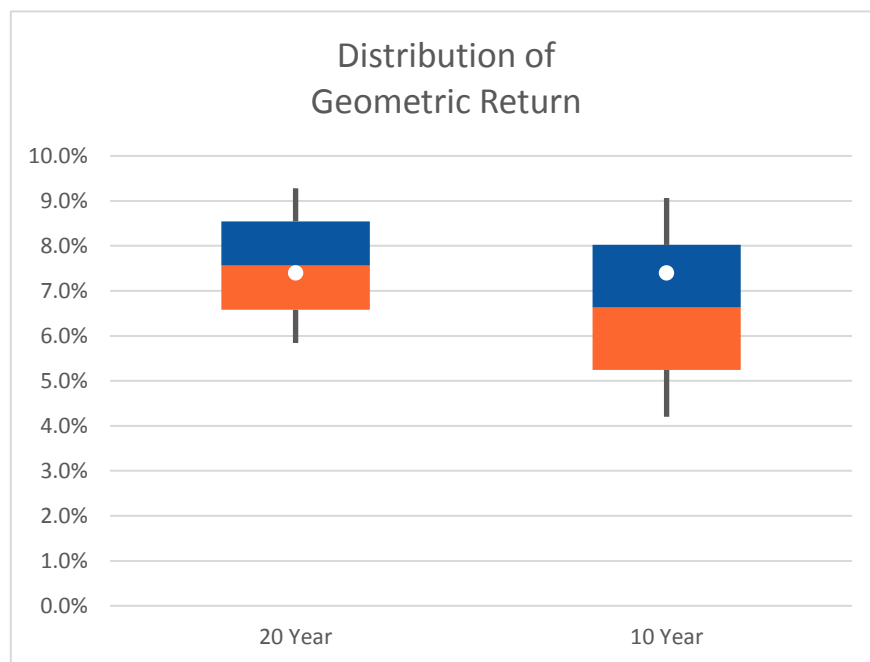
Given that much of the liabilities will be paid out in the next 10 years and the 20-year numbers are more speculative than the 10-year numbers, the lower 10-year expectations of return should be given some extra consideration.

Section IV. Analysis of Methods and Assumptions (cont.)

Actuarial Assumptions (cont.)

Investment Return (cont.)

Using Horizon’s CAPM assumptions, we estimated the 25th, 35th, 50th, 65th, and 75th percentiles for the portfolio geometric return for both the 20-year and 10-year investment horizons. The chart below compares the rate of return (7.40%) to these percentiles. This graph assumes that the portfolio geometric return is normally distributed with standard deviation equal to the portfolio standard deviation divided by square root of the investment time horizon (20 years and 10 years respectively).



Percentile	20 Year	10 Year
75th	9.28%	9.06%
65th	8.54%	8.02%
50th	7.56%	6.63%
35th	6.58%	5.24%
25th	5.84%	4.20%

Consequently, both the expected geometric return of 7.56% over 20 years and 6.63% over 10 years, plus the percentiles we compute using the Horizon survey results - show that Sample State’s assumption of 7.40% is with the range of reasonable assumptions. But the Board should continue to explore lowering the rate and the real rate of return.



Section IV. Analysis of Methods and Assumptions (cont.)

Actuarial Assumptions (cont.)

Investment Return (cont.)

We also compared Sample State's investment return assumption with the investment return assumption for the six most populous states. We show below the return assumption for *funding purposes* because this is usually the expected long-term return on assets.

State	Plan	Net Return Assumption
California	The 5 state plans	7.00 % ⁵
Texas	Texas ERS	7.50 %
Florida	Florida RS	7.40 %
New York	NY State and Local ERS ⁶	7.00 %
Pennsylvania	Pennsylvania State ERS	7.25 %
Illinois	Illinois SERS	7.00 %

The table above shows that Sample State's assumption of 7.40% is the same as Florida's assumption. It is near the upper end of the assumption used by the six most populous states but not terribly out of the ordinary.

We also compared Sample State's investment return assumption with the investment return assumption for other states. The *NASRA Issue Brief: Public Pension Plan Investment Return Assumptions (updated February 2019)* survey reflects a median rate of 7.25%, with a long-term trend of decreasing investment return assumptions.

As shown on the attached NASRA chart, investment return assumptions have been declining nationwide. This coincides with declining return expectations of many investment advisors. When compared to the peer group, the 7.40% investment return assumption is at the top of the median of the range. We expect in the future, the survey results will continue to show declines.

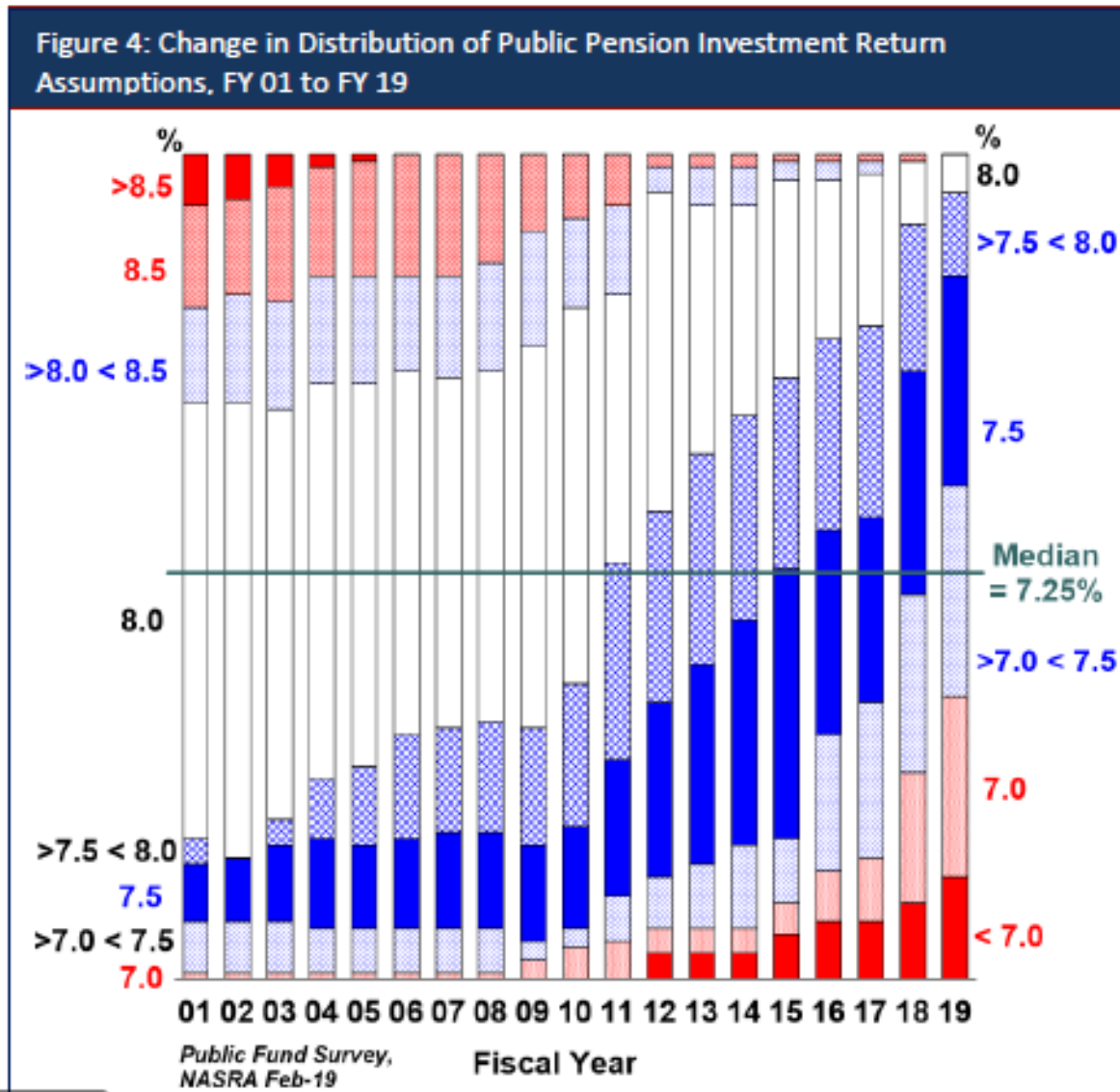
⁵ For the 6/30/2017 funding valuation, 7.25% (compounded annually) as of 6/30/2017 and 7.00% (compounded annually) as of 6/30/2018 and thereafter.

⁶ For New York, we show the investment return assumption as shown in NY State and Local ERS' 2018 CAFR.

Section IV. Analysis of Methods and Assumptions (cont.)

Actuarial Assumptions (cont.)

Investment Return (cont.)



In summary, the investment return assumption used for the SSRPS in this audit is consistent with the rates used by other large, public sector plans and can be supported using either the Horizon CMAs (our independent calculation), NASRA Survey, or the 2019 GRS model CMAs.

Section IV. Analysis of Methods and Assumptions (cont.)

Actuarial Assumptions (cont.)

Investment Return (cont.)

ASOP 27 (Selection of Economic Assumptions for Measuring Pension Obligations), paragraph 3.6.2 states:

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.

In general, we believe that GRS’ policy of developing consensus CMAs based on the input from various investment advisors and GRS’ methodology of determining a blended return assumption are both reasonable. Thus, we find the 7.40% investment return assumption acceptable in light of ASOP 27. However, the Board should be prepared for further declines in the discount rate in the future as investment professionals’ expectations for the discount rate continues to decline.

Phase in of Assumption Changes vs. Direct Rate Smoothing

As shown in the table below, the discount rate assumption decreased by 0.05% each of the last three years.

Valuation date	Discount rate
6/30/2019	7.40%
6/30/2018	7.45%
6/30/2017	7.50%
6/30/2016	7.55%
6/30/2015	7.55%

The repetitive, annual 0.05% decrease in the discount rate takes on the appearance of a phase in of a lower ultimate rate. We recommend against using this gradual phase down of the discount rate (or of any assumption or method change) in the future. The problem with this approach is the lack of transparency regarding the plans’ actual funding levels. This approach artificially understates the unfunded liabilities during the phase-in period and further implies that the discount rate is not based on expected returns. The practice of phasing in the assumption change is not rare, but it should be.

We suggest that, if necessary to meet budget imperatives, the impact of the full assumption change on the Actuarially Determined Contribution (ADC) be phased in rather than phasing in the full assumption.

The CCA White Paper discusses two types of direct rate smoothing. One type phases in “certain changes in contribution rates, specifically, phasing-in the effect of assumption changes element over short period, consistent with the frequency of experience analyses” (p.28). Direct rate smoothing is not a traditional funding method, but it overlaps with assumption setting. The concept is that if the investment return assumption needs to decline from 7.55% (the rate for the



Section IV. Analysis of Methods and Assumptions (cont.)

Actuarial Assumptions (cont.)

Phase in of Assumption Changes vs. Direct Rate Smoothing (cont.)

6/30/2016 valuation) to an ultimate rate, under a direct rate smoothing method the investment return change is made immediately (fully impacting the liability calculations). However, the impact of the change on the contribution rate is phased in over time (e.g. 4 years). Direct rate smoothing is not a CCA LCAM Model Practice (it is an “Acceptable” practice).

We recommend using direct rate smoothing rather than phasing in the assumption changes. While the Board and elected officials may prefer being able to say they asked for and/or funded 100% of the actuarially determined contribution by phasing in the assumptions and not the contribution rate, there are difficult questions that need to be answered if phasing-in assumption changes, such as:

1. Is the current assumption the most reasonable assumption?
2. What would the liabilities, underfunding and contributions be if the ultimate interest rate (or other assumption being phased-in) is used?
3. Is using a rate higher than the ultimate rate creating a lack of transparency?

Inflation assumptions

The 6/30/2019 7.40% discount rate assumption is comprised of a price inflation assumption of 2.60%, plus a real rate of return assumption (net of investment expenses) of 4.80% (*Appendix A-1 of 2019 valuation report*). This inflation assumption is greater than the maximum inflation assumption observed in the GRS survey. This inflation assumption is about equal to the maximum inflation assumption observed in the 2019 Horizon survey (both 10-year and 20-year time horizon). Social Security Administration’s 2018 Annual Report uses intermediate ultimate CPI assumption of 2.60%⁷. GRS recommends a price inflation rate of 2.40% to 2.60%.

It appears the 2.60% inflation assumption (which affects the COLA and wage inflation assumption) is somewhat higher than the consensus opinion among investment managers regarding future inflation. However, using a high inflation assumption will yield higher plan liability (all other things being equal and discount rate remains constant). In our opinion, the 2.60% is within the reasonable range of possibilities.

Cost of living adjustment (COLA) assumption

Every pension system offered by the Sample State offers annual cost of living adjustments (COLAs). The concept is the buying power of each retiree’s pension benefit is roughly kept constant in time by increasing the pension benefit yearly by the same percent as general inflation. For many Sample State pension system participants, the annual COLA is the smaller of 3.0% and actual inflation and compounded. The cap on the COLA depends on the System, Plan, and whether the benefit is attributable to reformed service (service earned after 7/1/2011).

⁷ From SSA website, https://www.ssa.gov/OACT/TR/2019/V_B_econ.html#292722.



Section IV. Analysis of Methods and Assumptions (cont.)

Actuarial Assumptions (cont.)

Cost of living adjustment (COLA) assumption

For the experience study, GRS performed simulation of inflation and developed a table showing the type of COLA provision versus the proposed COLA assumption for the valuation (p.11-6, X-1). For this work the inflation assumption is 2.60%, normally distributed with standard deviation of 1.49%. The 1.49% standard deviation is approximately equal to the standard deviation of inflation for the 20-year period ending June 30, 2018. The proposed COLA assumption equals the observed mean of simulated results.

COLA provision	Proposed assumption for 2019 valuation
Unlimited	2.60%
3% COLA cap	2.19%
5% COLA cap	2.57%
Reformed	1.42%

In the 2019 valuation report, the cost of living adjustment assumption is summarized in a slightly different manner. On page *Appendix A-1* it states:

- 2.19% - 3.10% for service prior to July 1, 2011
- 1.42% - 3.10% for service after June 30, 2011

The 3.10% level is for the Legislative and Judicial where benefit increases are tied to the assumed wage inflation.

The COLA assumption can significantly impact a plan’s liabilities. The proposed COLA assumption appears reasonable to us.

We reviewed the other assumptions and the 2018 Experience Study:

Selecting Rates Between Prior Assumptions and Current Experience

GRS’ recommended assumptions are often in between the prior assumptions and current experience. This is a common practice. However, the Board should be prepared to again adjust assumptions like employee turnover and retirement rates after the next experience study if actual plan experience in the future is similar to the plan’s recent experience.

Mortality

Mortality assumptions are made up of a combination of “base” tables and mortality improvement scales. These two assumptions are combined to quantify future longevity. GRS used the Pub-2010 mortality tables as the basis for the base mortality table. This is a recently published set of mortality tables that were developed using the experience of participants in public sector pension plans and contains different mortality base tables by job category (e.g. Teachers, Safety and General), health status (e.g. healthy or disabled), amount (salary or pension benefit), and geographical region.

Section IV. Analysis of Methods and Assumptions (cont.)

Actuarial Assumptions (cont.)

Mortality (cont.)

There are three different types of mortality assumptions used in a pension valuation: healthy annuitant, disabled annuitant, and pre-retirement mortality (the probability of a participant dying before commencing benefits under the plan). We discuss each type of mortality below.

Healthy annuitant

All healthy annuitant mortality tables recommended by GRS are on a benefits-weighted basis. We believe this is appropriate. As mentioned in section 12.5 of the “Pub-2010 Public Retirement Plans Mortality Tables Report” by the Society of Actuaries:

The reason for using a weighted version of a mortality table—either amount-weighted or headcount-weighted—is to obtain the most appropriate result for the particular application at hand. For the measurement of most pension obligations, tables weighted by amount (salary for active employees and benefit amount for those in payment status) generally produce the most appropriate results. On the other hand, headcount-weighted tables might be more appropriate for applications such as the measurement of obligations for retirement programs with benefit structures uncorrelated with income, such as many retiree medical or retiree life insurance programs.

We will use these acronyms for the Sample State plans.

Plan	Acronym
Teachers’ Contributory System	TCS
Employees’ Contributory System	ECS
Correctional Officers’ Retirement System	CORS
Law Enforcement Officers’ Pension System	LEOPS

The GRS recommended base mortality table for each plan is summarized below:

Plan	Recommended Pub-2010 table
TCS	Teachers
ECS (excluding CORS)	General
State police, LEOPS, and CORS	Safety
Judges	General, above median

For each healthy post-retirement mortality table, GRS developed a scaling factor to take into account any credible deviations the Sample State plan may have from the Pub-2010 tables. The scaling factors depend upon plan, gender, healthy/disabled. Note that the credibility (called Z factor in the experience report) of the data for the female judges and combined female safety groups was very low (12% and 14% respectively). The scaled mortality tables for the healthy annuitants appear reasonable. As a future update, for the next experience study, perhaps eight years of data could be used to increase credibility.



Section IV. Analysis of Methods and Assumptions (cont.)

Actuarial Assumptions (cont.)

Mortality (cont.)

Disabled mortality

For disabled mortality assumptions, GRS followed a similar process, but the analysis was done on a headcount weighted basis (p.IV-2). There is no explanation in the experience report why headcount weighted (or “population-weighted”) disabled mortality was examined.

For each plan, GRS recommends using the corresponding (benefits weighted) disabled Pub-2010 mortality table (Teachers, General, Safety) as shown above. The one exception is the Judges group. For disabled judges, GRS recommends using the same mortality as healthy judges. The 6/30/2019 valuation report shows there are only 4 disabled judges (p.B-12).

Similar to healthy mortality, for each plan, GRS developed a scaling factor for the disabled mortality table, by gender, to take into account any credible deviations the Sample State plan may have from the Pub-2010 tables. The factors appear reasonable to us.

We recommend analyzing disabled mortality on a benefits-weighted basis. Although there are very few disabled judges, we recommend using the disabled mortality for disabled judges. (This change will have a minimal impact on the plan’s liability). We support using the corresponding disabled mortality for the other groups. Also, we are unable to replicate the columns “Actual/Expected”, “Assumed Rate”, “Proposed Rate”. There may be some calculation error in these tables (p.IV-16, IV-18).

Pre-retirement mortality

For each plan, GRS recommends the corresponding Pub-2010 Employee mortality table for the pre-retirement mortality. This was based on actuarial judgement as there was insufficient data and credibility to develop specific pre-retirement mortality tables.

The mortality tables for the active groups are reasonable. *We recommend perhaps giving a little more rationale why GRS recommends the rate of line of duty mortality (for Safety) should be equal to 30% of non-duty pre-retirement mortality assumption (p.IV-2).*

Mortality improvement scale

ASOP 35 (Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations), section 3.5.3, states the actuary should “include an assumption as to expected mortality improvement after the measurement date.” GRS recommends the SOA mortality improvement scale, MP-2018, which quantifies how much mortality will improve in the future. The improvement scale is applied on a generational basis, which means there is mortality improvement in each future year. (Mortality improvement never stops.) The SOA has released a mortality improvement scale once a year, every year, since 2014. The MP-2018 scale is the most recent scale available.

The mortality improvement scale and its application are reasonable and reflect current best practices.



Section IV. Analysis of Methods and Assumptions (cont.)

Actuarial Assumptions (cont.)

Employee Retirement Assumption

As mentioned in the experience report, the retirement assumption “is a major component in cost calculations. Note that higher rates of retirement at earlier retirement ages or years of service upon attaining retirement eligibility generally result in higher actuarially determined contributions, and vice versa.” (p.V-1) GRS’ recommended assumptions are usually in between the prior assumptions and current experience. In other words, for the Systems where actual retirements were greater than expected (using old assumptions), the proposed retirement rates are higher than the old retirement rates but the expected number of retirements using proposed assumptions is slightly below actual number of retirements. Similarly, for the Systems where actual retirements are fewer than expected (using old assumptions), the proposed retirement rates are lower than the old retirement rates but the expected number of retirements using proposed assumptions is slightly higher than actual number of retirements.

It is important to balance – on the one hand the assumptions need to be tied to actual plan experience. On the other hand, pensions are long term obligations and it is prudent to not make changes to assumptions quickly.

While not impacting the pension valuation, we offer one comment about DROP retirement rates. For pension funding purposes GRS assumes members are “retired” when they enter DROP. However, the State’s OPEB valuation needs to use DROP exit ages as the age when members retire (and start OPEB benefits). Often the pension actuary is in the best position to provide separate OPEB retirement rates to be used in the OPEB valuation for those limited groups with a DROP.

Employee Termination (Turnover) Assumption

We examined the turnover assumption. A turnover assumption that is too high will understate the plan costs. GRS reviewed the turnover experience in two ways, using a headcount basis versus a more theoretically correct “liability weighted” basis. The liability weighted results showed consistently lower turnover than headcount weighted results. According to the experience study, “Liability weighted was often unreliable” (p.I-5). As a result, the recommended assumptions are based upon the headcount weighted results. The turnover assumption was reduced for the TCS, CORS and LEOPS groups and increased for the ECS and State Police groups.

Overall, we find the GRS recommendations for retirement and termination are appropriate. We believe that GRS was correct in recommending rates that are between the prior assumption and recent experiences.

Overall, the economic and demographic actuarial assumptions adopted by the System are reasonable and consistent with generally accepted actuarial standards and practices contained in Actuarial Standard of Practice No. 27 covering economic assumptions and Actuarial Standard of Practice No. 35 covering demographic and non-economic assumptions.

Section V. Comments on Proposed Actuarial Equivalence Study

The GRS experience study recommended that the plan's actuarial equivalence factors be reviewed in 2020. Such factors are commonly used to reduce the monthly pension benefits when a member selects an annuity option that provides additional benefits to their beneficiary. Such a review seems like a good idea. We have some general suggestions about such a study covering the following topics.

- Impact on valuation results
- Three key assumptions used to determine Actuarial Equivalence factors:
 - Discount Rate
 - COLA assumption
 - Mortality assumption
- Frequency of review

While not required, we suggest that the 2020 study include rationale in each area (discussed more below). This will help with future reviews. We have not spent the time to see how much might have been done in the past.

Impact of Valuation Results:

While not always a consideration in selecting assumptions for this purpose, the plan actuary should consider if there are any subsidies or margins created when members elect optional forms of payment in the future. Many actuaries prefer to assume that future retirees will elect the normal form of payment and not a reduced form of payment. Some actuaries will include assumptions about how many future retirees will select which optional forms. GRS in their valuation report says: "It was assumed optional forms of payment were actuarially equivalent to the normal form of payment." This is acceptable (and common) but should be kept in mind as we discuss the other two topics (assumptions and frequency).

Key Assumptions:

Discount rate: In our practice we often see three types of discount rates being used: (1) old (often high) assumptions based on interest rates from several decades ago (that may be out of date), (2) rates close to the current valuation funding assumption and (3) rates close to current bond market rates. The discount rate used by the System for this purpose currently is 5.85% and was based on the investment return level that was expected to be exceeded 75% of the time using a set of capital market assumptions. This likely falls between common practices (2) and (3) above. Since we would be comfortable with either (2) or (3), we are comfortable with this practice. Using lower discount rates almost always means larger reductions and creates some room for conservatism or an anti-selection margin in terms of the impact on future funding valuations. There may be additional uses other than determining option form reductions where this might not be true (an example would be a plan that pays lump sums). It would be good to document the rationale for selecting the 75% result. Certainly, the gradual reduction in the funding assumption makes using 7.4% as the rate more difficult.

Section V. Comments on Proposed Actuarial Equivalence Study (cont.)

Key Assumptions (cont.):

COLA assumption: Having COLAs increases the value of Joint and Survivor benefits more than single life annuity benefits since benefit payments are expected to be spread further out into the future when COLAs have maximum value. Our understanding is that assumptions are made about future COLAs and used to determine the reduction factors. For example, for ECS/CORS currently there are assumptions of 2.29% COLA pre-reform, 1.49% COLA post-reform. We think it is important to continue factoring in COLAs. **Mortality tables:** Mortality tables used for funding need to be modified for the Actuarial Equivalent basis. One key reason for this is that the benefits (factors) cannot vary by gender while for funding we do consider gender. Currently the factors are based on RP 2014 Combined Annuitant Mortality and blend the male and female tables assuming either 50% or 85% are male depending on the system.

The funding mortality tables are generational (factor in future mortality improvements). This would be difficult and unusual to use as a basis for actuarial equivalents. Since the factors do change from time-to-time, the key seems to be to include enough mortality improvement to cover members retiring during the expected period between the dates of updates (effectively targeting an average age of members retiring during the review period.) For example, if the changes are expected to be made in FY21 and reviewed again in FY31, one possibility is to base factors after imputing mortality improvements to the middle of the period (FY 26 in this example). This is just an example. We don't want to get too specific and recognize that factoring in less mortality improvement is often conservative from a funding perspective. Perhaps not using any future mortality improvement is appropriate. This is an area where providing rationale might be helpful.

Frequency of Review:

Certainly, changes can be made every five years when experience studies update funding assumptions (which appears to be plan practice). Frequent changes create administrative cost and members might have seen estimates based on old assumptions. While very subjective, we suggest that once every 10 years would be sufficient absent any subsequent events. The Board should consider adopting a policy specific to the frequency of updating factors if there is not already one.

Along with a policy of frequency of change, we would expect that any change would apply to any retirement after a specific effective date if this passes legal review. There may be times when the optional form of benefit reduction could be larger based on new rates but these often are not material.



Section VI. Recommendations

This full replication audit reviewed the data used, the benefits valued, and the actuarial methods and assumptions employed in the June 30, 2019 actuarial valuation. The full replication audit gives us confidence in the results of the 2019 actuarial valuation report. A few test lives were sampled which also demonstrate the application of the actuarial assumptions to the benefits as stated in the valuation report. The actuarial assumptions, methods, and procedures are reasonable and reflect the benefit promises made to SSRA members.

Below we summarize our recommendations for your consideration:

- **Data**
 1. The data would be improved if the system calculated the benefits for all terminated vested members and if GRS had more information on refunds owed. These former members represent only a small fraction of total liabilities. We recognize that this type of data collection/calculation delay is a common problem (and ongoing project) for most large plans. There was a similar comment in our 2015 audit.
- **Valuation Report/Risk Disclosures**
 1. Ask GRS to provide a quantitative risk projection of the plan as it matures in the future. A similar recommendation was made in 2015. We now have a new actuarial standard on risk disclosure (ASOP 51) focused mostly of qualitative assessments and GRS has met those standards and also provided some quantitative risk assessments. GRS has suggested in their valuation that other quantitative projections could be performed. We are suggesting one specific area (Risk growth as the plan matures) be looked at by GRS as we believe it will be beneficial to the plan.
- **Assumptions**
 1. Continue to look at lowering the discount rate and real rate of return. Ideally this would be without phasing in assumption changes.
 2. See if the actuary for the State's OPEB plans could benefit from a separate set of retirement rates (for groups that have a DROP) tied to DROP exit ages instead of entry ages.
 3. There are some other small considerations about assumptions in this report, but they are minor enough that we are leaving them out of this section.



Section VI. Recommendations (cont.)

- **Funding Methods**
 1. Adopt layered amortization for all plans and a plan to manage the layers following guidelines in 2014 CCA White Paper contained in our prior audit report. This was also a recommendation in 2015 and we realize that it may take legislation to change the amortization policy.
 2. Take a fresh look at the three methods that take dollar values (e.g. Normal Cost), turn them into percentages of pay and reconstitute them into dollar contribution amounts. You may decide to reaffirm the existing methods.

- **Expected 2020 study of Actuarial factors used for plan administration**
 1. We have provided ideas to consider when you look at updating actuarial factors (a project recommended in the recent GRS experience study). This is a hot topic for corporate plans and less so for public plans like MSRS.

The plan's actuary appears to have reasonably valued the expected liability of the System. They have applied the methodology consistently and their report conforms to accepted actuarial principle and practices. We are available to discuss any aspect of our review with System staff or the System's actuary.



Appendix – Replication of Full Contribution Results

2019 State Valuation - TCS	GRS	Bolton	% Difference
A. Demographic Info			
1. Active Number Count	107,782	107,782	0.00%
2. Retired Member and Beneficiary Count	79,151	79,151	0.00%
3. Vested Former Member Count	<u>24,474</u>	<u>24,474</u>	0.00%
4. Total Number Count	211,407	211,407	0.00%
5. Active Payroll	7,153,063,434	7,153,063,434	0.00%
6. Annual Benefits for Retired Members	2,287,252,060	2,287,252,060	0.00%
B. Actuarial Results			
1. Present Value of Projected Benefits Attributable to:			
a. Retired and Disabled Members, and Beneficiaries	24,800,000,941	24,922,086,635	0.49%
b. Terminated Vested Members	1,103,856,547	1,051,793,632	-4.72%
c. Active Members	<u>25,315,356,005</u>	<u>25,563,644,142</u>	0.98%
d. Total Present Value	51,219,213,493	51,537,524,409	0.62%
2. Less Present Value Total Future Normal Costs	<u>7,846,776,249</u>	<u>8,038,786,391</u>	2.45%
3. Actuarial Accrued Liability (1d - 2)	43,372,437,244	43,498,738,018	0.29%
4. Less Actuarial Value of Assets	<u>33,060,345,745</u>	<u>33,060,345,745</u>	0.00%
5. Unfunded Actuarial Accrued Liability (UAAL) (3-4)	10,312,091,499	10,438,392,273	1.22%
6. Funded Ratio	76.22%	76.00%	-0.29%
7. Employer Normal Cost	319,329,204	294,992,336	-7.62%
8. Total Projected Payroll	7,374,808,400	7,374,808,400	0.00%
9. Total Normal Cost Rate	11.33%	11.00%	-2.91%
10. Employee Contribution Rate	7.00%	7.00%	0.00%
11. Employers' Normal Cost Rate	4.33%	4.00%	-7.62%
12. UAAL Projected to Contribution Period	10,197,296,733	10,327,203,260	1.27%
13. Amortization Payment	783,649,581	793,632,736	1.27%
14. UAAL Amortization Rate	10.63%	10.76%	1.22%
15. Total Actuarial Employer Contribution Rate (11 + 14)	14.96%	14.76%	-1.34%
16. Estimated Employer Rate after Reinvestment of Savings	15.65%	15.45%	-1.28%



Appendix – Replication of Full Contribution Results (cont.)

2019 State Valuation - ECS	GRS	Bolton	% Difference
A. Demographic Info			
1. Active Number Count	56,432	56,432	0.00%
2. Retired Member and Beneficiary Count	61,972	61,972	0.00%
3. Vested Former Member Count	<u>18,961</u>	<u>18,961</u>	0.00%
4. Total Number Count	137,365	137,365	0.00%
5. Active Payroll	3,232,027,368	3,232,027,368	0.00%
6. Annual Benefits for Retired Members	1,179,587,395	1,179,587,395	0.00%
B. Actuarial Results			
1. Present Value of Projected Benefits Attributable to:			
a. Retired and Disabled Members, and Beneficiaries	13,410,448,332	13,486,307,321	0.57%
b. Terminated Vested Members	857,923,385	839,693,168	-2.12%
c. Active Members	<u>9,537,761,424</u>	<u>9,445,505,632</u>	-0.97%
d. Total Present Value	23,806,133,141	23,771,506,121	-0.15%
2. Less Present Value Total Future Normal Costs	<u>2,523,034,512</u>	<u>2,497,427,925</u>	-1.01%
3. Actuarial Accrued Liability (1d - 2)	21,283,098,629	21,274,078,196	-0.04%
4. Less Actuarial Value of Assets	<u>13,796,352,071</u>	<u>13,796,352,071</u>	0.00%
5. Unfunded Actuarial Accrued Liability (UAAL) (3-4)	7,486,746,558	7,477,726,125	-0.12%
a. Less Present Value of Special Liability Payments	<u>7,025,988</u>	<u>7,025,988</u>	0.00%
b. State Portion of UAAL (5-6)	7,479,720,570	7,470,700,137	-0.12%
6. Funded Ratio	64.82%	64.85%	0.04%
7. Employer Normal Cost	122,737,130	112,235,558	-8.56%
8. Total Projected Payroll	3,281,741,449	3,281,741,449	0.00%
9. Total Normal Cost Rate	10.48%	10.17%	-2.96%
10. Employee Contribution Rate	6.74%	6.75%	0.15%
11. Employers' Normal Cost Rate	3.74%	3.42%	-8.56%
12. UAAL Projected to Contribution Period	7,472,361,856	7,475,222,347	0.04%
13. Amortization Payment	574,241,722	574,461,547	0.04%
14. UAAL Amortization Rate	16.97%	17.50%	3.12%
15. Total Actuarial Employer Contribution Rate (11 + 14)	20.71%	20.92%	1.01%
16. Estimated Employer Rate after Reinvestment of Savings	21.36%	21.57%	0.98%



Appendix – Replication of Full Contribution Results (cont.)

2019 State Valuation - SP	GRS	Bolton	% Difference
A. Demographic Info			
1. Active Number Count	1,364	1,364	0.00%
2. Retired Member and Beneficiary Count	2,505	2,505	0.00%
3. Vested Former Member Count	<u>89</u>	<u>89</u>	0.00%
4. Total Number Count	3,958	3,958	0.00%
5. Active Payroll	106,977,874	106,977,874	0.00%
6. Annual Benefits for Retired Members	128,577,798	128,577,798	0.00%
B. Actuarial Results			
1. Present Value of Projected Benefits Attributable to:			
a. Retired and Disabled Members, and Beneficiaries	1,780,278,894	1,775,954,743	-0.24%
b. Terminated Vested Members	13,238,270	13,360,364	0.92%
c. Active Members	<u>804,310,830</u>	<u>817,539,796</u>	1.64%
d. Total Present Value	2,597,827,994	2,606,854,904	0.35%
2. Less Present Value Total Future Normal Costs	<u>296,895,264</u>	<u>314,977,235</u>	6.09%
3. Actuarial Accrued Liability (1d - 2)	2,300,932,730	2,291,877,669	-0.39%
4. Less Actuarial Value of Assets	<u>1,522,238,564</u>	<u>1,522,238,564</u>	0.00%
5. Unfunded Actuarial Accrued Liability (UAAL) (3-4)	778,694,166	769,639,105	-1.16%
6. Funded Ratio	66.16%	66.42%	0.40%
7. Employer Normal Cost	27,144,982	28,220,353	3.96%
8. Total Projected Payroll	108,623,376	108,623,376	0.00%
9. Total Normal Cost Rate	32.99%	33.98%	3.00%
10. Employee Contribution Rate	8.00%	8.00%	0.00%
11. Employers' Normal Cost Rate	24.99%	25.98%	3.96%
12. UAAL Projected to Contribution Period	773,776,809	763,909,091	-1.28%
13. Amortization Payment	59,463,786	58,705,464	-1.28%
14. UAAL Amortization Rate	53.10%	52.42%	-1.28%
15. Total Actuarial Employer Contribution Rate (11 + 14)	78.09%	78.40%	0.40%
16. Estimated Employer Rate after Reinvestment of Savings	79.03%	79.34%	0.39%



Appendix – Replication of Full Contribution Results (cont.)

2019 State Valuation - JRS	GRS	Bolton	% Difference
A. Demographic Info			
1. Active Number Count	315	315	0.00%
2. Retired Member and Beneficiary Count	431	431	0.00%
3. Vested Former Member Count	<u>8</u>	<u>8</u>	0.00%
4. Total Number Count	754	754	0.00%
5. Active Payroll	48,934,800	48,934,800	0.00%
6. Annual Benefits for Retired Members	35,371,231	35,371,231	0.00%
B. Actuarial Results			
1. Present Value of Projected Benefits Attributable to:			
a. Retired and Disabled Members, and Beneficiaries	387,332,181	387,296,639	-0.01%
b. Terminated Vested Members	3,211,949	3,198,202	-0.43%
c. Active Members	<u>290,025,633</u>	<u>294,716,203</u>	1.62%
d. Total Present Value	680,569,763	685,211,044	0.68%
2. Less Present Value Total Future Normal Costs	<u>120,259,332</u>	<u>128,523,269</u>	6.87%
3. Actuarial Accrued Liability (1d - 2)	560,310,431	556,687,775	-0.65%
4. Less Actuarial Value of Assets	<u>494,038,020</u>	<u>494,038,020</u>	0.00%
5. Unfunded Actuarial Accrued Liability (UAAL) (3-4)	66,272,411	62,649,755	-5.47%
6. Funded Ratio	88.17%	88.75%	0.65%
7. Employer Normal Cost	15,234,188	15,805,594	3.75%
8. Total Projected Payroll	49,687,500	49,687,500	0.00%
9. Total Normal Cost Rate	37.39%	38.45%	2.83%
10. Employee Contribution Rate	6.73%	6.64%	-1.34%
11. Employers' Normal Cost Rate	30.66%	31.81%	3.75%
12. UAAL Projected to Contribution Period	64,080,816	61,225,624	-4.46%
13. Amortization Payment	4,924,531	4,705,113	-4.46%
14. UAAL Amortization Rate	9.61%	9.18%	-4.47%
15. Total Actuarial Employer Contribution Rate (11 + 14)	40.27%	40.99%	1.79%
16. Estimated Employer Rate after Reinvestment of Savings	40.27%	40.99%	1.79%



Appendix – Replication of Full Contribution Results (cont.)

2019 State Valuation - LEOPS	GRS	Bolton	% Difference
A. Demographic Info			
1. Active Number Count	1,615	1,615	0.00%
2. Retired Member and Beneficiary Count	1,583	1,585	0.13%
3. Vested Former Member Count	<u>188</u>	<u>188</u>	0.00%
4. Total Number Count	3,386	3,388	0.06%
5. Active Payroll	113,981,595	113,981,595	0.00%
6. Annual Benefits for Retired Members	56,691,749	56,775,096	0.15%
B. Actuarial Results			
1. Present Value of Projected Benefits Attributable to:			
a. Retired and Disabled Members, and Beneficiaries	776,664,359	775,875,994	-0.10%
b. Terminated Vested Members	22,141,821	22,289,484	0.67%
c. Active Members	<u>555,675,344</u>	<u>560,556,057</u>	0.88%
d. Total Present Value	1,354,481,524	1,358,721,535	0.31%
2. Less Present Value Total Future Normal Costs	<u>214,847,355</u>	<u>221,219,017</u>	2.97%
3. Actuarial Accrued Liability (1d - 2)	1,139,634,169	1,137,502,519	-0.19%
4. Less Actuarial Value of Assets	<u>730,534,135</u>	<u>730,534,135</u>	0.00%
5. Unfunded Actuarial Accrued Liability (UAAL) (3-4)	409,100,034	406,968,384	-0.52%
6. Funded Ratio	64.10%	64.22%	0.19%
7. Employer Normal Cost	19,269,849	19,304,569	0.18%
8. Total Projected Payroll	115,734,826	115,734,826	0.00%
9. Total Normal Cost Rate	23.65%	23.68%	0.13%
10. Employee Contribution Rate	7.00%	7.00%	0.00%
11. Employers' Normal Cost Rate	16.65%	16.68%	0.18%
12. UAAL Projected to Contribution Period	408,524,638	404,800,850	-0.91%
13. Amortization Payment	31,394,611	31,108,442	-0.91%
14. UAAL Amortization Rate	26.31%	26.07%	-0.91%
15. Total Actuarial Employer Contribution Rate (11 + 14)	42.96%	42.75%	-0.49%
16. Estimated Employer Rate after Reinvestment of Savings	43.93%	43.72%	-0.48%



Appendix – Replication of Full Contribution Results (cont.)

2019 Municipal Valuation - ECS	GRS	Bolton	% Difference
A. Demographic Info			
Number of:			
Active Members	24,785	24,785	0.00%
Retired Members and Beneficiaries	18,740	18,740	0.00%
Vested Deferred Members	<u>6,400</u>	<u>6,400</u>	0.00%
Total	49,925	49,925	0.00%
Annual Salaries of Active Members	1,177,913,393	1,177,913,393	0.00%
Annual Benefits for Retirees and Beneficiaries	275,298,462	275,298,462	0.00%
B. Actuarial Results			
1. Entry Age Actuarial Accrued Liability	5,358,268,576	5,356,092,082	-0.04%
2. Actuarial Value of Assets	<u>4,411,058,371</u>	<u>4,411,058,371</u>	0.00%
3. Unfunded Actuarial Accrued Liability (UAAL) (1-2)	947,210,205	945,033,711	-0.23%
4. Funded Ratio	82.3%	82.4%	0.04%
5. Assigned Liability			
a. Deficit Balances	22,620,847	22,620,847	0.00%
b. Surplus Balances	-851,617	-851,617	0.00%
c. New Entrant Liability Balances	1,778,480	1,778,480	0.00%
d. UAL Portion of CPB Surcharge	12,758,797	12,758,797	0.00%
e. UAL Portion of CPB to ACPS Surcharge	130,677,082	130,677,082	0.00%
f. UAL Portion of Noncontributory to ACPS Surcharge	<u>5,830,049</u>	<u>5,830,049</u>	0.00%
g. Total Assigned Liability Balances	172,813,638	172,813,638	0.00%
6. Pooled Unfunded Actuarial Accrued Liability (3 - 5g)	774,396,567	772,220,073	-0.28%
7. Outstanding Balance of Previously Amortized Bases	<u>0</u>	<u>0</u>	N/A
8. Current Year Amortization Base (6 - 7)	774,396,567	772,220,073	-0.28%
9. UAAL Projected to Contribution Period	795,384,705	794,162,696	-0.15%
10. Pooled Unfunded Amortization Payments	46,713,360	45,352,889	-2.91%
11. UAL Amortization Rate	3.79%	3.68%	-2.90%
12. Total Projected Payroll	1,196,031,705	1,196,031,705	0.00%
13. Employer Normal Cost			
a. Pension System Employer Normal Cost	40,166,847	39,106,725	-2.64%
b. Retirement System Normal Cost	135,843	135,843	0.00%
c. CPB Normal Cost Surcharge	9,311,583	9,311,583	0.00%
d. CPB to ACPS Normal Cost Surcharge	-3,705,890	-3,705,890	0.00%
e. Noncontributory to ACPS Normal Cost Surcharge	<u>54,749</u>	<u>54,749</u>	0.00%
f. Employer Normal Cost After Adjustment (a - b - c - d - e)	34,370,562	33,310,440	-3.08%
14. Employer Normal Cost Adjusted for Timing	34,899,240	33,822,811	-3.08%
15. Employer Normal Cost Rate	2.92%	2.83%	-3.08%
16. Basic Employer Cost Rate (12 + 15)	6.71%	6.51%	-2.98%



Appendix – Replication of Full Contribution Results (cont.)

2019 Municipal Valuation - LEOPS	GRS	Bolton	% Difference
A. Demographic Info			
Number of:			
Active Members	1,068	1,068	0.00%
Retired Members and Beneficiaries	470	471	0.21%
Vested Deferred Members	<u>123</u>	<u>123</u>	0.00%
Total	1,661	1,662	0.06%
Annual Salaries of Active Members	66,981,482	66,981,482	0.00%
Annual Benefits for Retirees and Beneficiaries	17,994,374	18,039,759	0.25%
B. Actuarial Results			
1. Entry Age Actuarial Accrued Liability	483,498,858	482,185,433	-0.27%
2. Actuarial Value of Assets	<u>321,670,508</u>	<u>321,670,508</u>	0.00%
3. Funded Ratio	66.53%	66.71%	0.27%
4. Unfunded Actuarial Accrued Liability (UAAL) (1-2)	161,828,350	160,514,925	-0.81%
5. New Entrant Liability Balances	<u>-13,623,515</u>	<u>-13,623,515</u>	0.00%
6. Pooled Unfunded Actuarial Accrued Liability (4 - 5)	175,451,865	174,138,440	-0.75%
7. UAAL Projected to Contribution Period	177,115,685	174,267,208	-1.61%
8. Amortization Factors	13.456519	13.456519	0.00%
9. Unfunded Amortization Payment	13,162,073	12,950,393	-1.61%
10. UAL Amortization Rate	18.77%	18.47%	-1.60%
11. Total Projected Payroll	68,011,771	68,011,771	0.00%
12. Employer Normal Cost	10,824,207	10,757,226	-0.62%
13. Employer Normal Cost Adjusted for Timing	10,990,702	10,922,690	-0.62%
14. Employer Normal Cost Rate	16.16%	16.06%	-0.62%
15. Basic Employer Cost Rate (10 + 14)	34.93%	34.53%	-1.15%

2019 Municipal Valuation - CORS	GRS	Bolton	% Difference
A. Demographic Info			
Number of:			
Active Members	97	97	0.00%
Retired Members and Beneficiaries	40	40	0.00%
Vested Deferred Members	<u>3</u>	<u>3</u>	0.00%
Total	140	140	0.00%
Annual Salaries of Active Members	5,583,279	5,583,279	0.00%
Annual Benefits for Retirees and Beneficiaries	1,069,529	1,069,529	0.00%
B. Actuarial Results			
1. Entry Age Actuarial Accrued Liability	27,819,644	27,500,470	-1.15%
2. Actuarial Value of Assets	<u>25,731,728</u>	<u>25,731,728</u>	0.00%
3. Funded Ratio	92.49%	93.57%	1.16%
4. Unfunded Actuarial Accrued Liability (UAAL) (1-2)	2,087,916	1,768,742	-15.29%
5. New Entrant Liability Balances	<u>0</u>	<u>0</u>	N/A
6. Pooled Unfunded Actuarial Accrued Liability (4 - 5)	2,087,916	1,768,742	-15.29%
7. UAAL Projected to Contribution Period	2,077,917	1,803,864	-13.19%
8. Amortization Factors	16.104385	16.104385	0.00%
9. Unfunded Amortization Payment	129,028	112,011	-13.19%
10. UAL Amortization Rate	2.21%	1.92%	-13.12%
11. Total Projected Payroll	5,669,159	5,669,159	0.00%
12. Employer Normal Cost	416,513	420,979	1.07%
13. Employer Normal Cost Adjusted for Timing	422,919	427,455	1.07%
14. Employer Normal Cost Rate	7.46%	7.54%	1.07%
15. Basic Employer Cost Rate (10 + 14)	9.67%	9.46%	-2.17%

VII. GLOSSARY

Each proposal shall provide a glossary of all abbreviations, acronyms, and technical terms used to describe the services or products proposed. This glossary should be provided even if the terms are described or defined when first used in the proposal response.

Actuarial Accrued Liability

The portion of the actuarial present value of future benefits attributed to prior service by the chosen actuarial cost method.

Actuarially Determined Contribution

A target or recommended contribution to a defined benefit pension plan for the reporting period, determined in conformity with Actuarial Standards of Practice based on the most recent measurement available when the contribution for the reporting period was adopted.

AICPA

American Institute of Certified Public Accountants

ASOP

Actuarial Standard of Practice

AFR

Annual Financial Report also known as the Comprehensive Annual Financial Report

COI

Conflict of interest

Demographic Assumption

Assumptions regarding the future population of pension participants, including retirement, termination, disability and mortality assumptions.

EA

Enrolled Actuary

Economic Assumption

Assumptions regarding future economic factors, including COLA, salary improvement, change in average wages, changes in Social Security benefits and investment returns.

Employer's Contributions

Contributions made in relation to the actuarially determined contributions of the employer (ADC). An employer has made a contribution in relation to the ADC if the employer has (a) made payments of benefits directly to or on behalf of a retiree or beneficiary, (b) made premium payments to an insurer, or (c) irrevocably transferred assets to a trust, or an equivalent arrangement, in which plan assets are dedicated to providing benefits to retirees and their beneficiaries in accordance with the terms of the plan and are legally protected from creditors of the employer(s) or plan administrator.

Expenses

Plan expenses paid by the plan are divided into administrative and investment related expenses.

F&F

Foster & Foster

FCA

Fellow of the Conference of Consulting Actuaries

FSA

Fellow of the Society of Actuaries

FSPA

Fellow of the American Society of Enrolled Actuaries

GASB

Government Accounting Standards Board

GASB No. 67 and GASB No. 68

These are the government standards that replace GASB 25 and 27 for pension plans. They are effective for plan years beginning after June 14, 2013 and employer fiscal years beginning after June 14, 2014.

GASB No. 74 and GASB No. 75

These are the government standards that replace GASB 43 and 45 for OPEB plans.

GFOA

Government Finance Officers Association

HPRS

State Highway Patrol Retirement System

Investment Return Assumption or Investment Rate of Return (Discount Rate)

The rate used to adjust a series of future payments to reflect the time value of money.

MAAA

Member of the American Academy of Actuaries

Normal Cost or Normal Actuarial Cost

That portion of the Actuarial Present Value of pension plan benefits and expenses which is allocated to a valuation year by the Actuarial Cost Method.

OPEB

Other Post-Employment Benefits

ORSC

Ohio Retirement Study Council

PBGC

Pension Benefit Guaranty Corporation

Plan Liabilities

Obligations payable by the plan at the reporting date, including, primarily, benefits and refunds due and payable to plan members and beneficiaries, and accrued investment and administrative expenses. Plan liabilities do not include actuarial accrued liabilities for benefits that are not due and payable at the reporting date.

Plan Members or Plan Participants

The individuals covered by the terms of a Pension or OPEB plan. The plan membership generally includes employees in active service, terminated employees who have accumulated benefits but are not yet receiving them, and retired employees and beneficiaries currently receiving benefits.

Post-Employment

The period between termination of employment and retirement as well as the period after retirement.

Roll-forward

A technique for estimating liabilities or assets into the future by taking into account the expected causes of increases and decreases. The expected increases for the liability are generally normal cost and interest and the expected decrease is benefit payments. The expected increases for assets are employee and employer contributions and investment return and the expected decrease is benefit payments.

Salary Scale

An actuarial assumption regarding the increase in employees' salaries, reflecting cost-of-living, merit and longevity increases.

Unfunded Actuarial Accrued Liabilities

The excess of the present value of prospective pension benefits, as of the date of a pension plan valuation, over the sum of (1) the actuarial value of the assets of the plan and (2) the present value of future normal costs determined by any of several actuarial cost methods. For plans that define an accrued liability, this amount equals the excess of the accrued liability over plan assets.

VIII. COST INFORMATION

The pricing summary should include a breakdown of costs per element listed in Section II, Scope of Audit, including: personnel costs (including hourly rates and estimated hours for professional and clerical staff assigned to the audit), travel and lodging, data processing costs, materials, and any other potential costs. The cost estimates in the pricing summary must include all necessary charges to conduct the audit and must include a “not to exceed” figure.

The cost for the audit as described above will be a fixed fee equal to \$75,000. This is a firm fixed fee and no costs will be billed above that level.

Our fixed fee is derived from the below analysis of the work required for the project. Note that some of the tasks are done as part of the overall process and are broken out here for display purposes but are not actually able to be separated from the body of the project (e.g., project management, biweekly calls, etc.).

Personnel	Data Validity		
	Hourly Rate	Hours	Cost
Ellen Kleinstuber	\$530	1	\$530
Tom Vicente	\$515	1	\$515
Christy Yeager	\$470	1	\$470
Jordan McClane	\$375	1	\$375
Drew Freas	\$340	0	\$0
Janice Twardowicz	\$330	0	\$0
Alan Torroella	\$185	15	\$2,775
Alex Newman	\$235	10	\$2,350
Tom Lowman	\$530	0	\$0
Other*		0	\$0
Total		29	\$7,015

Actuarial Valuation Method and Procedures			
Personnel	Hourly Rate	Hours	Cost
Ellen Kleinstuber	\$530	4	\$2,120
Tom Vicente	\$515	4	\$2,060
Christy Yeager	\$470	5	\$2,350
Jordan McClane	\$375	5	\$1,875
Drew Freas	\$340	5	\$1,700
Janice Twardowicz	\$330	3	\$990
Alan Torroella	\$185	0	\$0
Alex Newman	\$235	0	\$0
Tom Lowman	\$530	1	\$530
Other*		0	\$0
Total		27	\$11,625

Actuarial Valuation Assumptions			
Personnel	Hourly Rate	Hours	Cost
Ellen Kleinstuber	\$530	5	\$2,650
Tom Vicente	\$515	8	\$4,120
Christy Yeager	\$470	4	\$1,880
Jordan McClane	\$375	4	\$1,500
Drew Freas	\$340	5	\$1,700
Janice Twardowicz	\$330	5	\$1,650
Alan Torroella	\$185	0	\$0
Alex Newman	\$235	3	\$705
Tom Lowman	\$530	0	\$0
Other*		0	\$0
Total		34	\$14,205

Parallel Valuation			
Personnel	Hourly Rate	Hours	Cost
Ellen Kleinstuber	\$530	5	\$2,650
Tom Vicente	\$515	5	\$2,575
Christy Yeager	\$470	8	\$3,760
Jordan McClane	\$375	8	\$3,000
Drew Freas	\$340	8	\$2,720
Janice Twardowicz	\$330	10	\$3,300
Alan Torroella	\$185	25	\$4,625
Alex Newman	\$235	0	\$0
Tom Lowman	\$530	0	\$0
Other*		0	\$0
Total		69	\$22,630

Recommendations			
Personnel	Hourly Rate	Hours	Cost
Ellen Kleinstuber	\$530	5	\$2,650
Tom Vicente	\$515	5	\$2,575
Christy Yeager	\$470	0	\$0
Jordan McClane	\$375	7	\$2,625
Drew Freas	\$340	4	\$1,360
Janice Twardowicz	\$330	4	\$1,320
Alan Torroella	\$185	0	\$0
Alex Newman	\$235	0	\$0
Tom Lowman	\$530	2	\$1,060
Other*		0	\$0
Total		27	11,590

Review of Healthcare			
Personnel	Hourly Rate	Hours	Cost
Ellen Kleinstuber	\$530	1	\$530
Tom Vicente	\$515	3	\$1,545
Christy Yeager	\$470	0	\$0
Jordan McClane	\$375	0	\$0
Drew Freas	\$340	0	\$0
Janice Twardowicz	\$330	10	\$3,300
Alan Torroella	\$185	0	\$0
Alex Newman	\$235	10	\$2,350
Tom Lowman	\$530	0	\$0
Other*		0	\$0
Total		24	\$7,725

Total			
Personnel	Hourly Rate	Hours	Cost
Ellen Kleinstuber	\$530	21	\$11,130
Tom Vicente	\$515	26	\$13,390
Christy Yeager	\$470	18	\$8,460
Jordan McClane	\$375	25	\$9,375
Drew Freas	\$340	22	\$7,480
Janice Twardowicz	\$330	32	\$10,560
Alan Torroella	\$185	40	\$7,400
Alex Newman	\$235	23	\$5,405
Tom Lowman	\$530	3	\$1,590
Other*		0	\$0
Total		210	\$74,790

*Travel, materials, data costs etc.