New York City Retirement Systems

Replication Audit

March 12, 2018

BOLTON PARTNERS

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BOLTON PARTNERS

March 12, 2018

The Honorable Scott M. Stringer
New York City Comptroller
Office of the New York City Comptroller
One Centre Street
New York, NY 10007

Re: *Actuarial Audit of Employer Contributions for 2014 valuation*

Dear Comptroller Stringer:

Bolton Partners, Inc. is pleased to present this Contribution Replication Audit report, which is a key deliverable under our first biennial engagement to serve as Independent Actuary under Section 96 of the New York City Charter. Bolton Partners was hired by the Comptroller to perform an actuarial audit of the following five New York City Retirement Systems:

- New York City Employees' Retirement System (NYCERS)
- Teachers' Retirement System of the City of New York (TRS)
- Board of Education Retirement System of the City of New York (BERS)
- New York City Police Pension Fund (Police)
- New York City Fire Pension Fund (Fire)

This is Bolton Partners' report covering our full replication actuarial audit of the 2014 valuations. The primary purpose of the full replication work (which includes mathematical modeling and sample life analysis) is to validate the results, with emphasis on the actuarial liabilities, assets, and required contributions, of the June 30, 2014 actuarial valuations for the plans which determined the City's contribution needs for FY2016. We have finished our review of the five plans and we have closely matched the OA results based on their assumptions and methods. Many of our comments relate to either (1) questioning some of the methods used or (2) minor refinements in the valuation of the benefits. Our most significant comment relates to the liabilities associated with the Tax Deferred Annuity fixed rate investment return, which is provided by the TRS and BERS plans (see issue 1 below).

We also were asked to determine whether the actuarial valuation methods, assumptions and procedures used by the Office of the Actuary (OA) 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 the OA. We comment on these later in this report.

We want to thank Sherry Chan, Michael Samet and Anderson Huynh at the OA and their colleagues for their assistance in providing us the required data and sample life information, as well as promptly answering our questions regarding sample life calculations and other issues regarding plan provisions, funding methods and assumptions, participant data and practice.

We also want to thank the staffs at each System for providing documents and spending time answering our many questions. Their assistance was crucial to our work.

Sincerely,

BOLTON PARTNERS, INC.

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I. ACTUARIAL AUDIT PROCESS

The Replication (Contribution Rate) Audit for each System followed three main steps:

- Collect and validate all source information
- Produce independent models to verify computational and procedural accuracy
- Provide feedback on the OA model's weaknesses and recommendations for improvements

The OA provided us all source material including the "scrubbed" census data for the 2014 valuation. Summaries of the census information (summary statistics) were reviewed by the project manager for consistency with the reports produced by the OA. The following table provides select examples of summary statistics and validation parameters[1]:

Summary Statistic	Acceptable Tolerance
Number of participants — active, retired, various inactive categories	1.0%
Total salary and member contributions	1.0%
Age/Salary/Service grouping statistics	2.0%

The key purpose of the independent models is to audit the actuarial liabilities of the Systems and verify the Actuary's calculations of Employer Pension Contributions for each System. The successful validation of these items depended on a validation of the software used by the OA, the participant and asset data used by the OA, and the methods used to account for all benefits provided by the plan, including the Variable Supplements Fund (VSF) and Tax Deferred Annuity (TDA) programs. Some of this validation involved reviewing sample lives prepared by the OA and creating our own sample lives in Excel.

We created independent actuarial models of the Systems in ProVal and Excel. The purpose of these models was to calculate the actuarial assets and liabilities of each System and for the participating employers. These actuarial results were used to:

- Confirm that the actuarial assumptions and methods used by the Actuary are as adopted by each System's Board of Trustees and/or promulgated by the State legislature
- Verify the Actuary's calculations of Employer Pension Contributions for each System
- Validate the actuarial software used by the Actuary
- Review the financial impact of the VSFs on the NYCERS, Police, and Fire plans
- Review the financial impact of the TDA arrangements with TRS and BERS

[1] All information on acceptable tolerances in this report was taken from our proposal, which discussed the reasons for the various tolerance limits that we would apply in our work for the City of New York.

- Review the systems' progress in implementing the recommendations made by the preceding independent actuary

The models produced a comprehensive replication of the actuarial results that we compared to the detailed reports produced by the OA for each employee group and tier of each System. While we expected our results to be considerably closer to the OA's results than the acceptable tolerance shown below (in part because we also use ProVal, the system used by the OA to value system liabilities), the maximum tolerance we viewed as acceptable is shown below:

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%
Employer Contribution	5.0%

Our findings were expected to include comments on:

- Data limitations / reporting errors
- Computational errors or inefficiencies
- Inconsistencies between assumptions used by the Actuary and those set by the Boards and State legislature

Weaknesses were catalogued by the project manager and reviewed by the senior actuaries. We include comments on:

- The appropriateness of the actuarial asset valuation method used to calculate employer contributions
- The appropriateness of the actuarial cost method used to calculate employer contributions, including the one-year lag methodology used by the OA
- Recommended areas for additional improvement, inquiry or investigation by management

II. CONTRIBUTION REPLICATION

Summary of Results:

We have completed the replication of the present value of future benefits (PVFB), accrued liability, normal cost and employer contributions for each of the plans. A detailed comparison of results by plan can be found at the end of this section. The comparison of results uses the same tolerance methodology (except with different tolerance limits) as the prior report prepared by GRS – that is, for components with subcomponents, tolerance tests are completed on individual sub-components as a percentage of the subcomponent (labeled "Individual") and as a percentage of the total component (labeled "Total"). For instance, the Individual (*Total*) tolerance test for active PVFB is computed as the active PVFB produced by Bolton Partners minus the active PVFB produced by the OA, divided by the active (*Total*) PVFB produced by the OA.

Key values from the comparison are presented in the following table:

Comparison of OA and BP Results ($ Millions)

System	Category	OA Results	BP Results	Percentage Difference	Tolerance Limit	Pass / Fail
NYCERS	PVFB	$ 90,534	$ 90,850	0.35%	4.00%	Pass
	Employer Contribution	$ 3,365	$ 3,402	1.08%	5.00%	Pass
TRS	PVFB	$ 81,378	$ 80,878	-0.62%	4.00%	Pass
	Employer Contribution	$ 3,703	$ 3,619	-2.25%	5.00%	Pass
BERS	PVFB	$ 5,616	$ 5,631	0.27%	4.00%	Pass
	Employer Contribution	$ 266	$ 269	1.34%	5.00%	Pass
Police	PVFB	$ 58,258	$ 58,195	-0.11%	4.00%	Pass
	Employer Contribution	$ 2,394	$ 2,386	-0.32%	5.00%	Pass
Fire	PVFB	$ 22,764	$ 22,679	-0.37%	4.00%	Pass
	Employer Contribution	$ 1,054	$ 1,044	-0.98%	5.00%	Pass
Total	PVFB	$ 258,550	$ 258,233	-0.12%		
	Employer Contribution	$ 10,782	$ 10,720	-0.57%		

We have grouped the issues found during our replication work into the following categories:

1. Treatment of subsidized interest and annuity conversion factors for TRS and BERS
2. The overtime assumption for Police, Fire, and NYCERS
3. The coordination of the VSF payments and escalation for Police, Fire, and NYCERS
4. The Lag Method
5. The need for actuarial reports
6. The calculation of the employer normal cost
7. Conformance with ASOPs
8. Minor issues

Issues:

Issue #1: Funding of subsidized interest and annuity conversion factors for TRS and BERS TDA (403(b)) benefits

Employees can voluntarily contribute to a Tax Deferred Annuity (aka TDA or 403(b)) plan. One of the "investment options" is to earn a fixed rate of either 7% or 8.25% that is guaranteed by the primary plan (which pays the traditional retirement benefits). Whether the rate is 7% or 8.25% depends on the bargaining unit. Approximately 15% of TRS TDA Fixed Fund Balance amounts and about 67% of BERS TDA Fixed Fund Balance amounts earn 8.25%. Our primary concern is that if the plan is expecting to earn 7% but is paying 8.25% on some of the assets, there is a plan liability for guaranteeing this investment. We believe that the best practice is for the cost of this guaranteed interest rate be funded as part of the plan liabilities. The value of this additional benefit amount should be reflected in the contribution rate, either reflecting all future years the guaranty applies, or at least the value of this guarantee for the current year (also known as the "term cost" for the benefit.) Currently, no liability is reflected for the value of this subsidy in future years. Past subsidies are included as actuarial losses, and amortized over future years. At the end of this Issue #1 is some history related to previous loads that were included to reflect the subsidy.

We recommend that the cost of future interest rate subsidies be reflected in advance of the payment of the subsidy. The current approach of recognizing and amortizing an actuarial loss each year is not a good funding method. The question of how to best prefund this guarantee is complicated, however, because (1) these fixed TDA accounts continue to earn 7% or 8.25% even after termination of employment, until the employee or former employee withdraws the funds, (2) employee contribution levels vary, as the TDA contributions are voluntary and (3) investment allocations can be changed quarterly.

The OA should consider prefunding the difference between 8.25% and 7% instead of reflecting these amounts as an actuarial loss and amortizing the loss each year. Given that the current best estimate is that 15% of TRS and 67% of BERS Fixed TDA ASF funds are credited with 8.25% annually, the OA could implement an annual term cost, which for TRS could be approximated as 15% of the TRS Fixed ASF (15% x $17.3 billion), multiplied by the difference between the guaranteed rate and the valuation rate (8.25% - 7%), or about $32 million. Alternatively, we suggest including the liability for this above-market investment credit in the plan liabilities, reflecting both the subsidy earned this year and the expected subsidies to be earned in future years, including those years after retirement or termination.

Another issue is the treatment of the TDA accounts that are guaranteed to earn the 7% rate. GRS had commented on the leveraging impact which was resulting in amplified gains and losses. We note that if there were a requirement to disclose liabilities at bond rates (or some other rate below 7%), the value of the 7% guarantee should be reflected, and that value could be substantial. However, just because the 7% rate has a risk of increasing plan costs does not mean it has an expected cost using current assumptions. However, if the OA were to reduce the discount rate assumption, then this TDA guarantee should also be reflected as part of the cost of the plans, on the same basis as the 8.25% guarantee.

Also, members are allowed to convert TDA funds into an annuity at favorable rates, effectively purchasing an annuity from the plan. This option has not been elected by many employees, but does provide them a valuable option. In 2000, then Chief Actuary, Bob North, wrote a memo providing load factors to apply to valuation liabilities to reflect the employees' option to buy an annuity from the plan. While the subsidies were considerable, the election rates were low so the TDA loads were small. Still, it would be appropriate to review:

1. Whether the OA should also value a load for annuity conversions of the fixed investments (e.g. ASF TDA non-variable money),
2. Whether the OA should update the loads for the ASF TDA variable fund investments developed in 2000, and
3. Whether the OA should value a normal cost component for the potential annuity conversion cost (at least for amounts expected to be contributed in the year to the TDA).

The issue of loads for TDA annuities is not material to the results of the valuation given that members often leave their money in ASF TDA funds after they leave, and eventually elect one or more lump sum distributions. If this provision or the fixed ASF rates were to change, or if employees better understood the value of this option, the value of this annuity option could become more material.

Issues related to the TDA plan design and any related legal issues (e.g. how it might factor into 415 limits) and GASB accounting rules are beyond the scope of this project. Our audit reflects the plans' current provisions (e.g. the appropriateness of the mortality tables and interest rates used to convert the TDA balances into an annuity currently contained in the law are not a subject of this audit), so our focus is on seeing how existing provisions are funded.

The history of TDA interest credit cost, as we understand it, is as follows: Legislation in 2009 changed the interest crediting rate on some accounts from 8.25% to 7%. Prior to those changes, there was a 2.3% load on TDA Fixed assets to account for the extra 0.25%/year interest credit above the valuation discount rate assumption of 8%. When the interest crediting rate was lowered on most TDA fixed assets to 7%, the load was set to zero. It appears a "negative" load was not added because of the "risk" associated with earning 7% even though the expected return was 8% (i.e. no leveraging was assumed). For the 2010 actuarial valuation, the discount rate was lowered from 8% to 7%. The discount rate change eliminated any expected positive leveraging (for those TDA funds credited with 7%) and resulted in a scenario similar to the scenario prior to 2009, in which the guaranteed rate of return for all fixed TDA funds was greater than or equal to the valuation discount rate. Despite the lower discount rate, a load for the fixed TDA funds earning 8.25% was not created.

Issue #2: Overtime

For Police, Fire, and NYCERS, the compensation used for developing benefits in the valuation year includes the annualized June 30 rate of pay, assumed overtime, and an upward adjustment using half of the salary scale corresponding to the completed years of service as of the valuation date, in the valuation year.

The steps to develop the compensation used for benefits in the valuation year are outlined below.

- The 'Salary Base for Pension' field[2] provided in the active database is equal to the June 30, 2014 annualized rate of pay plus assumed overtime (which we will denote as Base OT_0) corresponding to the years of service as of the valuation date.
- Multiply the 'Salary Base for Pension' by $\left[1 + \frac{Salary\ Scale_0}{2}\right]$ to adjust salary from June 30, 2014 to December 31, 2014, the date of assumed decrements (other than 100% retirement) in the valuation year.
- Divide the result by [1 + *Base* OT_0] to back out the assumed baseline overtime assumption, which was presumably developed for the calendar year.
- Multiply the result by $\left[1 + \frac{Base\ OT_0 + Base\ OT_1}{2}\right]$ to incorporate an overtime assumption that is intended to correspond to the fiscal year (July 1, 2014 – June 30, 2015).

Most non-NYC plans use actual overtime for the valuation and may adjust expected future salaries to anticipate an increase in overtime when members near retirement. However, the OA does not use actual overtime except as part of the experience study process. Using the assumed versus actual overtime amount might have some benefit if department-wide overtime varies materially (and temporarily, such as the overtime following the events on September 11, 2001, or to address the more recent Riker's Island issues) from year to year, as may currently be the case with the Fire department due to the hiring freeze from 2006-2014. A reasonable overtime assumption will sometimes overstate and other times understate the actual overtime earnings, but in general, needs to provide an appropriate assumption in the aggregate for multiple lives over an extended period in order to be a useful replacement for using the actual overtime each year. Because it is unusual to replace actual overtime with assumed overtime, we believe that this process and the results of it should be clearly described in the methods and assumptions section of the actuarial reports.

The OA has both a baseline overtime assumption and a "dual" overtime assumption. The dual overtime assumption for service retirement includes higher expected overtime in the years prior to retirement, which is the result of members working additional hours of overtime in order to bolster their pay-related pension benefits. Recent experience for the Fire plan has indicated that the overtime assumption (baseline, dual service retirement, and dual disability) has been understating actual overtime by a material margin. To determine materiality in this context, we integrated the 4% threshold used to determine PVFB tolerance. While a generalization, if pay were 1% higher (due to additional overtime equal to 1% of pay), active liabilities might be 1% higher. The results could be more skewed depending on whether the differences were higher near retirement (the dual overtime group).

[2] For the 2014 valuation, the Police, Fire, and NYCERS databases contain a revised salary base for pension field which was used in place of the original field.

The following table, which is based on continuing active participants (those who did not decrement in the year indicated), shows the total compensation used for benefits if actual overtime were used instead of assumed baseline overtime, divided by the total compensation used for benefits (which includes assumed baseline overtime):

(Base+Actual OT) / (Base+Expected OT)					
Year	**Police**	**Fire**	**Year**	**Police**	**Fire**
2006	103.00%	106.82%	2011	102.26%	105.98%
2007	103.75%	104.34%	2012	103.27%	109.03%
2008	105.14%	103.25%	2013	103.86%	114.65%
2009	103.93%	100.92%	2014	102.25%	115.78%
2010	103.93%	103.99%	2015	105.14%	113.67%

Given the high actual overtime earnings for firefighters from 2011 to 2015, the review of the overtime assumption as part of the experience study, which is complicated by the Fire department's hiring freeze, has added importance. The OA could also decide to review the current methodology of using assumptions for both overtime and dual overtime vs. using actual overtime and an assumption for spiking near retirement.

We note that using assumed overtime has both advantages and disadvantages in smoothing the effect of unusual overtime patterns, such as has occurred in the recent years, at least in part due to the hiring freeze. Our recommendation is to continue to use the assumed overtime but to adjust the tables as part of the experience study.

Issue #3: Reducing VSF Payments by Escalation

The Police, Fire, and NYCERS corrections plans offer Variable Supplements Fund (VSF)[3] payments and offer Escalation[4] for members in the newer tiers. We understand that the VSF payments are reduced by COLA, but based on the language in the SPDs, they may not be reduced by Escalation. The Fire SPD states that "the VSF is reduced for any applicable **COLA [emphasis added]** offset" (page 38). Additionally, in the Frequently Asked Questions section at the end of the SPD, the answer to the question "What is COLA?" contains the following explanation "COLA payments to Service retirees are also subtracted from VSF payments until attainment of age 62, after which point the retiree will receive both the full COLA and full VSF payments" (page 48). However, the answer to the question "What is Escalation?" does not mention VSF payments, seemingly indicating that VSF payments are not reduced by Escalation. While the question as to whether VSF payments are reduced by Escalation currently represents a hypothetical scenario considering these tiers do not yet have any retirees, the answer to the question does impact the valuation of liabilities.

Contrary to our understanding of the SPDs, the OA's coding for the 2014 valuation assumes that VSF payments will be reduced by Escalation. When this question was posed to the Police and

[3] The VSF benefit generally provides an annual benefit of $12,000/year to certain eligible members.
[4] This is a post retirement benefit increase provision.

Fire systems for the administrative review, they responded that VSF payments will not be reduced by Escalation. In order for the valuation coding to match the plan provisions, as determined by the systems' intentions for administering the VSF payments, we believe that the OA and the systems should discuss the current inconsistency. If the systems' interpretation of the plans is that there should be no reduction in the VSF payments for Escalation, then the valuation coding should be updated accordingly.

We understand that it will be years before this issue will impact benefits.

Issue #4: Lag methodology used in the 2014 valuation for the FY16 contribution

Almost all public-sector valuations have a goal of creating an Actuarially Determined Contribution amount prior to when it is needed for budget purposes. For NYC, the June 30, 2014 valuation generated results for the FY16 budget. The OA used their "Lag" method to account for the delay between the calculation of the contribution and the payment of the contribution. While we do not believe this method is inappropriate, there are other methods which may be more consistent and which the OA could consider implementing for future valuations. Any method will have at least some minor issues often related to the time between the date of the valuation and the date the contribution is made.

We characterize the Lag methodology, for which the cost of year 1 is paid in year 2, as one specific case of a sub-class[5] to the primary funding method. The attributes of the Lag method that lead to this conclusion include:

- The Normal Cost for the FY16 contribution reflects only those hired by June 30, 2014
- The Normal Cost amount paid in FY15 is included as an asset for the June 30, 2014 valuation and is based on the June 30, 2013 valuation

While not discussed in common actuarial literature, funding methods can be divided into the following two sub-classes: (1) methods, such as the Lag method used by the OA, that produce a cost for a prior year and (2) methods that produce a cost using prior year results projected to the current year. All methods should adjust for the timing of payment a year later, which the Lag method does.

There is more than one calculation method for each of these two sub-classes. The first sub-class above contains other methods in addition to the Lag method. Some plans simply add the coming year's contribution to the assets (e.g. adding FY15 contributions to the June 30, 2014 assets) and add interest to the developed contribution from the valuation date to the date of payment (FY16).

Plans that employ methods within the other sub-class (those that produce a cost for the current year) tend to use some type of roll forward method to get results before the budget is prepared.

[5] We generally think of the overarching funding method as the way in which a plan allocates costs, and subsequently, funds those costs. Three common funding methods include Entry Age Normal, Projected Unit Credit and term cost funding. We consider the Lag method to be in a sub-class of funding methods as it delineates the timing of the primary funding method.

While GASB is not a funding method, GASB types of valuations are more like this sub-class of cost allocation methods. Usually these sub-class methods include:

- Rolling the unfunded liability forward a year (e.g. from June 30, 2014 to June 30, 2015) factoring in normal cost and contributions (e.g. for FY15). The rolled-forward unfunded liability is then amortized as of June 30, 2015. The Lag method looks something like this in terms of the unfunded liability payment calculation.

- Taking the Normal Cost from the June 30, 2014 valuation and moving it forward on some type of open group basis. This might be as simple as adding a projected salary growth percentage to the FY15 normal cost. This component is where sub-class (1) and the OA Lag method differ most from this sub-class (2) of methods.

Background and other thoughts on the Lag method:

The Lag method uses closed group payroll projections. We closely matched the four payroll values:

- Total Salary (VNCOMP)
- Salary Time = 0.5
- Salary Time = 1.0
- Salary Time = 1.5

We know that these salary values are for a closed group (those employed on June 30, 2014) and differences between these four values relate to salary scale increases and members decrementing out of the valuation (no replacements).

Page 49 of the Police valuation report accurately describes the One Year Lag Methodology (OYLM), so we have repeated it here:

> *One-Year Lag Methodology: One-Year Lag methodology uses a June 30, XX-2 valuation date to determine Fiscal Year XX employer contributions.*
>
> *This methodology requires technical adjustments to certain components used to determine Fiscal Year XX employer contributions as follows:*
>
> • *Present Value of Future Salary (PVFS)*
>
> *The PVFS at June 30, XX-2 is reduced by the value of salary projected to be paid during Fiscal Year XX-1.*
>
> • *Salary for Determining Employer Normal Contributions*
>
> *Salary used to determine the employer Normal Contribution is the salary projected to be paid during Fiscal Year XX to members on payroll at June 30, XX-2.*
>
> • *UAAL* [Unfunded Actuarial Accrued Liability] *Payments*

> *For determining the UAAL payments for Fiscal Year XX, and to be consistent with the OYLM, the UAAL as of June 30, XX-2 is adjusted by the discounted value of employer Normal Contributions paid during Fiscal Year XX-1 and the discounted value of Administrative Expenses reimbursed during Fiscal Years XX-1 and XX.*

After reading the valuation report description of the Lag method, we reread the GRS discussion of the lag methodology. GRS stated:

> *The One-Year-Lag-Methodology (OYLM) used in the valuation process (first used in the June 30, 2004 valuation to determine the FY 2006 contributions when valuations were performed using the Frozen Initial Liability actuarial cost method) reflects the fact that the employer contributions determined in a specific valuation will be contributed in the fiscal year that starts one year after the valuation date. Essentially, under the OYLM, the employer's cost of each new member's projected benefit is financed over a period starting with the second year of employment (entry age plus one) and ending on the expected year of retirement (retirement age). Currently, the OA starts the calculations using the individual level entry age actuarial cost method, which finances each member's projected benefit over the period from entry age to retirement age. However, the OA then modifies the entry age results in aggregate for the group, by financing the total future employer normal cost for the group over the future salaries of the group, starting one year after the valuation. Once the OA has made this adjustment, the normal cost is no longer level for each individual (based the OA's implementation). It may still be level for the group if the population stays relatively stable from year to year.*

The rest of the GRS explanation was a little hard to follow as GRS tried to show this as an individual member example even though the OA modifies the individual entry age results in the "aggregate for the group." The use of an aggregate method makes it difficult to convert this to an individual example. Certainly, the Normal Cost shown as a percent of pay is increased since the time to fund the benefit is shortened. The aggregate method also tends to have some type of asymptotic result when viewed between successive valuations.

One minor concern we have with the Lag method is that the funded ratio at June 30, 2014 would best be understood without including the 2013 Normal Cost paid in FY15. For GASB purposes, we would clearly not include the 2013 Normal Cost in the assets on June 30, 2014. Yet, we have done and seen similar things in the past for other plans using this type of sub-class methodology.

Issue #5: Production of actuarial valuation reports and additional disclosures in the valuation reports

We fully support the OA's plan to provide annual actuarial reports for all five plans (currently these exist for only the Fire and Police plans) in addition to information shown in the CAFR. We believe that, for all five plans, there is value to disclose details on assumptions, methods and data in the same document. The Actuarial Standards of Practice (ASOPs)[6] contain lists of the

[6] Common pension ASOPs that apply most often include ASOPs 4, 27, 35 and 44, as well as ASOP 41 which describes communication requirements.

disclosure requirements. Trying to decide what is material or not material given plans with this level of benefit and valuation methodology complexities is difficult. We have a few suggestions:

1. The fact that actual overtime pay is not used in determining valuation liabilities should be disclosed. We also suggest the disclosure of the difference between the prior years' overtime and the assumed overtime in each valuation, perhaps in a table showing the ratio of actual/assumed overtime in the prior 10 years.
2. The application of the salary scale components with mid-year decrements is not easily understood without reviewing sample lives. While complicated, we don't think the details need to be in the annual report, but some additional explanations would be helpful.
3. The funding of the BERS and TRS TDA subsidies should be described in the QPP valuation reports, as well as how these subsidies are reflected in the valuation results. We also suggest including a liability reflecting the valuation assumptions, actuarial liability methodology, and appropriate distribution assumptions.
4. Explanation of the loads used to estimate various liabilities.
5. There are some items, such as negative ARF TDA asset values, that don't impact the contribution calculation but should be explained or the asset values changed.

Issue #6: Calculation of Employer Normal Cost

The OA calculates the employer normal cost for the five plans as a level percentage of pay. However, employee contributions are not made over an employee's career, but rather over a period of time (e.g. first 20 years for Police and Fire and 10 years for TRS and BERS), resulting in a higher total normal cost as a percent of pay in the early years and lower total normal cost in the later years (that is, the years after the employee "normal cost" or contributions end). We believe that keeping the employer normal cost level and not keeping the total normal cost level is a good method for funding these plans.

Because the method used by the OA is not typical (just as ending employee contributions after 10 years is not typical), we suggest that this be disclosed in the description of the funding method. For most non-NYC plans, the employee contributions, gross normal cost and employer normal cost are all level over a member's career. GRS also commented on this in their review in 2013.

Issue #7: Conformance with Actuarial Standards of Practice (ASOPs)

There are many standards the plan's actuary must follow in order to say: "To the best of my knowledge, the results contained herein have been prepared in accordance with generally accepted actuarial principals and procedures and with the Actuarial Standards of Practice issued by the Actuarial Standards Board."[7] Many of these are in the nature of disclosures. We can find things in the OA's reports such as disclosure of the purpose of the report, the date liabilities and assets are measured as of and a summary of the plan provisions. Normally we look in the Actuarial Valuation Reports (AVRs) for this information. Since only two plans had AVRs, we

[7] From page three of the OA 2014 actuarial valuation report for the Police Plan.

looked at the actuarial sections of the CAFRs for the other three plans. The ASOP requirements can be met through a combination of reports (e.g. AVR/CAFR, employer contribution letters, "Silver Book" about assumptions and methods and "Orange Book" about data). While potentially awkward for a user to look through all of these reports, using multiple reports can make the AVRs shorter. Generally, we would like to see more in the AVRs.

Below are some suggested changes:

1. One example of using multiple reports is that employee information is usually summarized in the AVR using a traditional "age and service" matrix broken down into five-year age and service grouping. However, we understand that such summaries are contained in other reports (e.g. the Orange report). Reference should be made in the AVR to such reports and where those reports can be found.
2. There is a requirement to provide a rationale for key assumptions. The AVRs refer to reports containing assumption studies. It would be good to simply add that the rationale for certain key assumptions come from these studies.
3. The use of assumed and not actual overtime compensation should be disclosed.
4. The AVR should identify who provided the plan asset information.
5. We recommend that the various loads should be stated and not just noted that they exist. We recognize that many are not material.
6. While it is generally understood that valuations are based on assumptions, there should be some disclosure that future events can change results. Section 4.1r of ASOP 4 suggests the following language be included: "Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law." Page A-13 of the "Employer contribution letter" contains some of these points.
7. It should be noted that the funded status measure shown in the report is not appropriate "for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations." See ASOP 4 section 4.1q.
8. Unless the actuary judges it inappropriate, the actuary issuing an actuarial communication should also indicate the extent to which the actuary is available to provide supplementary information and explanation.

Issue #8: Other minor observations

Below is a list of comments, noted during the development of our replication valuation coding and review of sample lives, which we would like to mention, as each topic's methodology differs from our expectation based on the SPDs and valuation reports for the plans. Although their impact to liability and contributions may be minor, we consider them to be substantial enough to warrant review by the OA.

- There were three problems with the 2014 BERS or TRS valuations that were corrected in future valuations. One was $71 million in BERS TDA assets that were later attributed to the BERS QPP. We have used the original asset valuations in our replication work. The other two problems were minor coding issues with TRS involving the use of the wrong mortality tables for some benefits and the wrong retirement decrements and eligibility for Tier 6.

- Based on the sample lives we received, it appears that the OA is not limiting the salary used in the calculation of the Final Average Salary (FAS). Generally, each year's salary used in the calculation of the FAS should be limited to:

    - For employees in Tier 2, 120% of the prior year salary.
    - For employees in Tier 3 or Tier 4, 110% of the average of the salaries for the prior two years.
    - For employees in Tier 6, 110% of the average of the salaries for the prior four years.

- For TRS and BERS, loads are calculated for the expected loss resulting from the potential annuitization of TDA *variable* funds. Although the percentage of members who elect to annuitize is likely much smaller for the fixed fund than the variable funds, the OA should also consider adding a load for the expected loss from annuitization of the *fixed* TDA funds.

- Similar to the annuitization loads applied to the TDA, loads are calculated for the expected loss resulting from the potential annuitization of variable funds consisting of Tier 1 and 2 contributions (both employee and employer ITHP). The OA should consider adding a load for the expected loss from annuitization of the fixed ASF and ASAF funds as well.

- For TRS, the net impact of the TDA is presented as a negative asset. The OA should consider valuing the net impact of the TDA as a liability, rather than a negative asset, since this is a benefit obligation of the QPP.

- The discount rate for variable annuities in pay should be 4.074% instead of 4% since the change in the unit values is the fund return minus the increase in units (4%/12 each month). We recognize that the impact of this adjustment is very minor.

- Some of the liability (e.g. about 1.6% for TRS and BERS but much less for Police and Fire) is for "inactive" members who are neither employees nor retirees. It is important to keep some liability for this group not in a permanent status. We recommend that the OA consider a study or gain/loss analysis for TRS and BERS to determine the reasonableness of valuing the ABO liability for 'inactive' members for the first 5 or 7 years of inactivity.

- The BERS QPP liability for commitments to the TDA ARF fund is very small. However, the 2014 AVR could not account for the exact net liability. This should be improved.

- The methodology for allocating the normal cost between non-VSF and VSF for NYCERS differs from the methodology used for the Police and Fire worksheets. For Police and Fire, all portions (total, non-VSF, and VSF) of the present value of future employer normal costs (PVFERNC) were divided by the present value of total salary, whereas, for NYCERS, the non-VSF PVFERNC is divided by the present value of *total* salary but the VSF PVFERNC is divided by the present value of *VSF* salary. Thus, the non-VSF ERNC and VSF ERNC do not

sum to the total ERNC. Despite the discrepancy, the development of the total contribution correctly uses the total ERNC. The OA says they have corrected this in future valuations.

Comments on Prior GRS Recommendations/Findings

In addition to replicating the 2014 valuation results, we reviewed the recommendations and findings of GRS in this area. Our responses are shown in *italics*.

Applicable to all Systems:

- Produce formal actuarial reports for all Systems
  - *The OA now has actuarial valuation reports (AVRs) for both the Police and Fire plans and plans to prepare reports for the other plans.*
  - *We agree with the GRS recommendation.*
- Describe the leveling of member contributions (over each member's career) in the determination of the employer normal cost in any description of the actuarial cost method
  - *We agree with the disclosure recommendation and have no problem with the method in use.*
- Consider the use of a corridor around the market value in the development of the actuarial value of assets (*There was no corridor in the 2014 valuation*)
  - *We agree with the GRS recommendation and support the OA's adoption of a limit on the difference between the market value and actuarial value of assets.*
- Consider changes to the One Year Lag Methodology (OYLM)
  - *See Issue 4 above.*
- Review the assumed commencement date for deferred vested members for consistency between the valuation of the vested decrement for current active members (who are assumed to become deferred vested in the future) and the valuation of the current deferred vested members
  - *Assumed commencement age is now the same for active members who terminate and current deferred vested members.*

NYCERS:

- Review administrative expenses in the development of the Actuarial Value of Assets (AVA)
  - *We believe that the OA appropriately adds to the assets expected reimbursements of expenses paid in the past.*
- Review programming for treatment of active members that are over 75 on the valuation date
  - *We did not receive any samples lives for active members who are age 75 or older on the valuation date, but given that these active members make up less than 1% of the active population, we believe this issue is immaterial.*
- Review calculations of liabilities for the vesting decrement for active members (liabilities for current active members assumed to quit with deferred benefits in the future)
  - *We did not find any issues with the vesting decrement liabilities for active members.*

- Review the use of "default plan" provisions to value certain NYCERS members
  - *The OA provided Bolton with the mapping and count of participants to plans, which addresses GRS' "default plan" provision recommendation.*
  - *We recommend that the OA disclose this mapping methodology.*
- Update the mortality for Transit beneficiaries to the tables adopted with the 2012 A&M
  - *We did not receive any sample lives for Transit beneficiaries so we could not verify whether the correct mortality tables were used for this group.*

TRS:

- Review method of accounting for the TDA Fixed Funds in the development of the AVA
  - *We agree with this recommendation and have the following observations:*
    - *The smoothing method should continue to exclude QPP Tier 1-2 ASF funds that are variable funds and TDA money likewise should continue to exclude any variable benefit funds (ASF or ARF) for the same reason (i.e. employer has no investment risk). The smoothing should continue to include money in the fixed TDA ASF and fixed TDA ARF.*
    - *While it seems natural to split QPP and TDA assets, the purpose of asset smoothing is to reduce the effect of short term market volatility in an unbiased fashion. This second condition (unbiased fashion) is why this method should be on the equivalent of a combined QPP and TDA basis.*
    - *While some TDA funds credit 8.25%, the plan has an expected rate of return assumption which is 7% and not really a blend of 7% and 8.25%. The OA is considering moving to term cost funding (or some other approach) for the difference between 8.25% and 7% on certain TDA funds. Previously (when the valuation discount rate as 8.0%) there was a load to reflect that the 8.25% crediting rate was higher than the assumption. The investment smoothing to determine the actuarial value of assets should be based on an expected return of 7% and not some weighting of 7% and 8.25%. Crediting 8.25% on some TDA funds is really a benefit provision and not an assumption.*
- Review rounding of service for active members
  - *The rounding of service for the sample lives we received seems reasonable. All systems, including TRS, use either rounded or truncated service as of the valuation date. We are unsure why GRS only made this comment for TRS. Using exact years of service, rather than integer years, would likely not have a material impact on valuation results.*
- Review programming of probabilities of termination on and after 20 years of service – rates shown on the test life cases appear to indicate that these probabilities were rounded to the nearest 1%
  - *Per a June 23, 2017 email from Anderson Huynh (OA), the rates have been fixed for the valuations subsequent to June 30, 2014.*

BERS:

- Review the amount of the assumed COLA in the first year after the valuation for members with $0 reported in the maximum allowance field
  - *In the BERS section of the report, GRS expanded on this topic: "If the maximum allowance field is zero, the OA appears to base the first year COLA amount solely on the Supplementation field. We recommend that for these cases, the first year COLA Amount be based on the sum of the Pension, Annuity and Supplementation fields, similar to the Auto COLA (used for all future years except first year)." We did not receive any sample lives that had a zero maximum allowance field and a first year COLA so we are unable to comment on whether GRS' recommendation has been implemented.*
- Review the allocation of the liabilities to the vested decrement for Tier I and Tier II
  - *In the BERS section of the report, GRS expanded on this topic: "Tier II 55/25 optional plan members are valued using the old retirement pattern (pre-2012 A&M)." We did not receive any Tier II 55/25 optional plan sample lives but believe this issue is immaterial as there are very few (less than 15) actives in the Tier II 55/25 optional plan as of the valuation date.*
- Continue to work with BERS to improve the reporting of valuation data related to part-time members
  - *Our understanding, as discussed in the Administrative Review portion of our report, is that BERS made substantial changes both in historical data and in the data now being made available to the OA, as of June 30, 2017. While we have not reviewed this information, we anticipate substantial improvement in the data.*

Police:

- Review the assumed age of commencement for current deferred vested members
  - *Assumed commencement age is now the same for active members who terminate and current deferred vested members.*
- Review development of the RASF (required member contributions) used in the entry age pass and reprogram accordingly
  - *The final GRS report contained the following explanation "A detailed analysis of the test lives indicated that the required contribution field (RASF) read in from the data file was used at each and every age of the entry age pass. This means that a deficit or addition to the formula benefit is valued due to an artificial difference between the actual and required employee contributions." Although it is not frequently used, ProVal has the functionality to develop two separate present value of future benefits (PVFB) calculations. The standard calculation of PVFB (which we will denote as $PVFB_S$) is used to determine the accrued liability for the entry age normal (EAN) method and is coded in the benefit definition. If "Use alternative formula for EAN Normal Cost" is selected, a separate PVFB calculation (which we will denote as $PVFB_A$) can be coded to develop the EAN normal cost rate (equal to $PVFB_A$ divided by the present value of future salary from entry age) and the EAN present value of future normal costs (equal to normal cost rate multiplied by the present value of future salaries at the valuation date). We interpret GRS' comment to mean*

that GRS had concluded that the RASF component used to develop $PVFB_A$ was the same for all years (i.e. the RASF amount at the age of entry and every age thereafter was equal to the amount provided in the data). This no longer appears to be true as the RASF balance for calculating $PVFB_A$ is an expected amount (increasing from entry age through 20 years of service with contributions and interest) calculated by ProVal and is not based on the field provided in the data. The RASF field in the data is used for calculating $PVFB_S$.

Fire:

- Review the assumed age of commencement for current deferred vested members
  - *Assumed commencement age is now the same for active members who terminate and current deferred vested members.*
- Value benefits (and liabilities) associated with "other service"
  - *We agree with the GRS recommendation. Neither the Police nor the Fire valuation uses "other" (non-uniform) service. Of the 10,319 actives in the 2014 Fire data, 474 of them had other service greater than 0. For these 474 participants, other service as a percentage of total service (with total service = Service for Standard Benefits plus Service for Other Benefits), ranges from 0.5% to over 50%. Half of the 474 participants had other service as a percentage of total service of at least 20%. Given the materiality for the Fire plan in both the count of members with other service and the percentage of total service attributed to other service, we recommend that the OA consider valuing other service in future valuations.*
- Review modeling of Auto COLA for certain beneficiaries.
  - *Spouse beneficiaries and all beneficiaries (even non-spouse) of members deceased due to accidental death are entitled to COLAs. Per a June 29, 2017 email, the OA believes that GRS' use of the term "certain beneficiaries" refers to non-spouse beneficiaries. We did not request enough sample lives to determine whether non-spouse beneficiaries only get a COLA if the corresponding member death was categorized as accidental. If this issue is in fact present in the coding, then the total impact on results would be minimal given that there are very few (approximately 20) non-spouse beneficiaries who are receiving benefits as a result of a member decrement other than accidental death.*

NYCERS Comparison of Results

	Office of the Actuary		Bolton Partners		Tolerance Test	
	Liabilities	Count	Liabilities	Count	Individual	Total
1. Present Value of Benefits						
a. Actives						
Retirement	42,507		42,433		-0.17%	-0.08%
Disability	3,228		3,260		0.99%	0.04%
Ordinary Death	900		895		-0.52%	-0.01%
Accidental Death	25		25		0.03%	0.00%
Deferred Vested	1,444		1,447		0.26%	0.00%
Non-Vested Return of Contributions	46		49		4.80%	0.00%
Total	48,151	184,762	48,110	184,762	-0.09%	-0.05%
b. Inactives	908	16,527	937	16,527	3.15%	0.03%
c. Terminated Vesteds	747	9,674	763	9,674	2.23%	0.02%
d. Retirees	38,663	142,095	38,959	142,095	0.76%	0.33%
e. Loads	512		512		0.00%	0.00%
f. VSFs	1,554		1,570		1.04%	0.02%
g. Total	90,534	353,058	90,850	353,058	0.35%	0.35%
2. Present Value of Future Salary	116,470		117,368		0.77%	
3. Present Value of Future Employee Contributions	3,153		3,094		-1.87%	
4. Present Value of Future Employer Normal Costs						
a. Actives	12,842		12,963		0.94%	0.93%
b. VSFs	184		170		-7.57%	-0.11%
c. Total	13,026		13,133		0.82%	0.82%
5. Actuarial Accrued Liability						
a. Actives (1.a. - 3. - 4.a.)	32,156		32,053		-0.32%	-0.14%
b. Inactives (1.b.)	908		937		3.15%	0.04%
c. Terminated Vesteds (1.c.)	747		763		2.23%	0.02%
d. Retirees (1.d.)	38,663		38,959		0.76%	0.40%
e. Loads (1.e.)	512		512		0.00%	0.00%
f. VSFs (1.f. - 4.b.)	1,370		1,400		2.20%	0.04%
g. Total	74,355		74,623		0.36%	0.36%
6. Development of Employer Normal Cost						
a. Present Value of Future Employer Normal Costs	13,026		13,133		0.82%	
b. Present Value of Future Salary	116,470		117,368		0.77%	
c. Salary - Time 0.5	12,444		12,471		0.22%	
d. Projected Present Value of Future Salary	104,440		105,312		0.84%	
e. Normal Cost Percent	12.472%		12.471%		-0.01%	
f. Salary - Time 1.5	12,230		12,267		0.31%	
g. Employer Normal Cost	1,525		1,530		0.30%	
7. Assets (Main Fund)						
a. Market Value of Assets	54,422		54,422		0.00%	
b. Actuarial Value of Assets	50,506		50,506		0.00%	
c. PV 1-Year Adj Employer Normal Cost	1,425		1,425		0.00%	
d. PV Administrative Expense 6/30/xx Reimb	50		50		0.00%	
e. PV Administrative Expense 6/30/xx-1 Reimb	52		52		0.00%	
f. Total Main Fund Valuation Assets (b.+ c.+ d. + e.)	52,033		52,033		0.00%	
8. Assets (VSFs)						
a. Market Value of Assets	226		226		0.00%	
b. Actuarial Value of Assets	232		232		0.00%	
9. Unfunded Actuarial Accrued Liability Bases	22,091		22,359		1.21%	
10. Components of Contribution						
a. Employer Normal Cost	1,525		1,530		0.30%	0.13%
b. UAAL Contribution	1,762		1,793		1.80%	0.94%
c. Administrative Expenses	55		55		0.00%	0.00%
d. Interest on Late Employer Contribution	23		23		0.00%	0.00%
e. Total (Pension Expense)	3,365		3,402		1.08%	1.08%

TRS Comparison of Results

	Office of the Actuary		Bolton Partners		Tolerance Test	
	Liabilities	Count	Liabilities	Count	Individual	Total
1. Present Value of Benefits						
a. Actives						
Retirement	32,669		33,125		1.39%	0.56%
Ordinary Disability	723		743		2.74%	0.02%
Accidental Disability	204		207		1.50%	0.00%
Ordinary Death	342		355		3.95%	0.02%
Accidental Death	0		0		N/A	N/A
Deferred Vested	1,437		1,178		-18.02%	-0.32%
Non-Vested Return of Contributions	76		76		-0.11%	0.00%
Total	35,451	111,726	35,684	111,726	0.66%	0.29%
b. Inactives	1,282	8,702	1,285	8,699	0.26%	0.00%
c. Terminated Vesteds	810	12,349	799	12,349	-1.26%	-0.01%
d. Retirees and Designated Annuitants	40,753	80,419	40,026	80,516	-1.78%	-0.89%
e. Loads	3,083		3,083		0.00%	0.00%
f. Total	81,378	213,196	80,878	213,290	-0.62%	-0.62%
2. Present Value of Future Salary	101,382		102,569		1.17%	
3. Present Value of Future Employee Contributions	1,799		1,850		2.80%	
4. Present Value of Future Employer Normal Costs	12,269		12,453		1.50%	
5. Actuarial Accrued Liability						
a. Actives (1.a. - 3. - 4.)	21,383		21,382		0.00%	0.00%
b. Inactives (1.b.)	1,282		1,285		0.26%	0.00%
c. Terminated Vesteds (1.c.)	810		799		-1.26%	-0.02%
d. Retirees (1.d.)	40,753		40,026		-1.78%	-1.08%
e. Loads (1.e.)	3,083		3,083		0.00%	0.00%
g. Total	67,310		66,575		-1.09%	-1.09%
6. Development of Employer Normal Cost						
a. Present Value of Future Employer Normal Cost	12,269		12,453		1.50%	
b. Present Value of Future Salary	101,382		102,569		1.17%	
c. Salary - Time 0.5	8,238		8,243		0.06%	
d. Projected Present Value of Future Salary	93,418		94,600		1.27%	
e. Normal Cost Percent	13.134%		13.164%		0.23%	
f. Salary - Time 1.5	8,274		8,282		0.09%	
g. Employer Normal Cost	1,087		1,090		0.32%	
7. Assets						
a. Market Value of Assets - Fixed	41,200		41,200		0.00%	
b. Market Value of Assets - Variable	3,290		3,290		0.00%	
c. Actuarial Value of Assets	37,521		37,521		0.00%	
d. Administrative Expense	38		38		0.00%	
e. PV 1-Year Adj Employer Normal Cost	1,016		1,016		0.00%	
f. PV Future Administrative Expense Reimbursement	39		39		0.00%	
g. Administrative Expense Reimbursement 6/30/xx-1	37		37		0.00%	
h. Due (To)/From TDA	-465		-465		0.00%	
i. Total Valuation Assets (c. + e. + f. + g. + h.)	38,149		38,149		0.00%	
8. Unfunded Actuarial Accrued Liability Bases	29,161		28,426		-2.52%	-2.52%
9. Components of Contribution						
a. Employer Normal Cost	1,087		1,090		0.32%	0.09%
b. UAAL Contribution	2,573		2,486		-3.38%	-2.35%
c. Administrative Expenses	43		43			
d. Total (Pension Expense)	3,703		3,619		-2.25%	-2.25%

BERS Comparison of Results

	Office of the Actuary		Bolton Partners		Tolerance Test	
	Liabilities	Count	Liabilities	Count	Individual	Total
1. Present Value of Benefits						
a. Actives						
Retirement	2,972		2,990		0.62%	0.33%
Ordinary Disability	214		211		-1.73%	-0.07%
Accidental Disability	12		12		-1.08%	0.00%
Ordinary Death	68		69		0.60%	0.01%
Accidental Death	0		0		N/A	N/A
Deferred Vested	131		136		3.85%	0.09%
Non-Vested Return of Contributions	8		7		-9.94%	-0.01%
Total	3,405	25,182	3,424	25,182	0.57%	0.34%
b. Inactives	90	4,005	90	4,005	0.90%	0.01%
c. Terminated Vesteds	14	195	13	195	-3.91%	-0.01%
d. Retirees and Designated Annuitants	2,080	15,995	2,076	15,994	-0.22%	-0.08%
e. Loads	27		27		0.00%	0.00%
f. Total	5,616	45,377	5,631	45,376	0.27%	0.27%
2. Present Value of Future Salary	9,542		9,478		-0.67%	
3. Present Value of Future Employee Contributions	225		219		-2.68%	
4. Present Value of Future Employer Normal Costs	1,055		1,063		0.76%	
5. Actuarial Accrued Liability						
a. Actives (1.a. - 3. - 4.)	2,125		2,143		0.82%	0.40%
b. Inactives (1.b.)	90		90		0.90%	0.02%
c. Terminated Vesteds (1.c.)	14		13		-3.91%	-0.01%
d. Retirees (1.d.)	2,080		2,076		-0.22%	-0.11%
e. Loads (1.e.)	27		27		0.00%	0.00%
g. Total	4,336		4,349		0.30%	0.30%
6. Development of Employer Normal Cost						
a. Present Value of Future Employer Normal Cost	1,055		1,063		0.76%	
b. Present Value of Future Salary	9,542		9,478		-0.67%	
c. Salary - Time 0.5	1,018		1,020		0.17%	
d. Projected Present Value of Future Salary	8,557		8,492		-0.76%	
e. Normal Cost Percent	12.330%		12.519%		1.53%	
f. Salary - Time 1.5	998		999		0.12%	
g. Employer Normal Cost	123		125		1.65%	
7. Assets						
a. Market Value of Assets - Fixed	3,232		3,232		0.00%	
b. Market Value of Assets - Variable	48		48		0.00%	
c. Actuarial Value of Assets	2,633		2,633		0.00%	
d. Administrative Expense	10		10		0.00%	
e. PV 1-Year Adj Employer Normal Cost	115		115		0.00%	
f. PV Future Administrative Expense Reimbursement	10		10		0.00%	
g. Administrative Expense Reimbursement 6/30/xx-1	10		10		0.00%	
h. Due (To)/From TDA	2		2		0.00%	
i. Total Valuation Assets (c. + e. + f. + g. + h.)	2,770		2,770		0.00%	
8. Unfunded Actuarial Accrued Liability Bases	1,566		1,579		0.83%	
9. Components of Contribution						
a. Employer Normal Cost	123		125		1.65%	0.77%
b. UAAL Contribution	131		133		1.17%	0.58%
c. Administrative Expenses	11		11		0.00%	0.00%
d. Interest on Late Employer Contribution	0		0		0.00%	0.00%
e. Total (Pension Expense)	266		269		1.34%	1.34%

Police Comparison of Results

	Office of the Actuary		Bolton Partners		Tolerance Test	
	Liabilities	Count	Liabilities	Count	Individual	Total
1. Present Value of Benefits						
a. Actives						
Retirement	17,099		17,032		-0.39%	-0.11%
Ordinary Disability	692		689		-0.37%	0.00%
Accidental Disability	6,955		6,934		-0.31%	-0.04%
Ordinary Death	145		147		1.35%	0.00%
Accidental Death	57		57		-0.09%	0.00%
Deferred Vested	290		291		0.17%	0.00%
Non-Vested Return of Contributions	2		2		-0.95%	0.00%
Total	25,241	34,402	25,153	34,402	-0.35%	-0.15%
b. Inactives	86	1,369	85	1,369	-1.13%	0.00%
c. Terminated Vesteds	74	572	74	572	0.14%	0.00%
d. Retirees	25,911	48,212	25,935	48,212	0.09%	0.04%
e. Loads	685		685		0.00%	0.00%
f. VSFs	6,261		6,265		0.06%	0.01%
g. Total	58,258	84,555	58,195	84,555	-0.11%	-0.11%
2. Present Value of Future Salary	32,762		32,783		0.06%	
3. Present Value of Future Employee Contributions	607		608		0.06%	
4. Present Value of Future Employer Normal Costs						
a. Actives	9,801		9,840		0.40%	0.37%
b. VSFs	792		771		-2.67%	-0.20%
c. Total	10,593		10,611		0.17%	0.17%
5. Actuarial Accrued Liability						
a. Actives (1.a. - 3. - 4.a.)	14,833		14,705		-0.86%	-0.27%
b. Inactives (1.b.)	86		85		-1.13%	0.00%
c. Terminated Vesteds (1.c.)	74		74		0.14%	0.00%
d. Retirees (1.d.)	25,911		25,935		0.09%	0.05%
e. Loads (1.e.)	685		685		0.00%	0.00%
f. VSFs (1.f. - 4.b.)	5,469		5,494		0.45%	0.05%
g. Total	47,058		46,977		-0.17%	-0.17%
6. Development of Employer Normal Cost						
a. Present Value of Future Employer Normal Costs	10,593		10,611		0.17%	
b. Present Value of Future Salary	32,762		32,783		0.06%	
c. Salary - Time 0.5	3,579		3,579		0.01%	
d. Projected Present Value of Future Salary	29,303		29,323		0.07%	
e. Normal Cost Percent	36.149%		36.187%		0.11%	
f. Salary - Time 1.5	3,502		3,503		0.04%	
g. Employer Normal Cost	1,266		1,268		0.15%	
7. Assets (Main Fund)						
a. Market Value of Assets	31,751		31,751		0.00%	
b. Actuarial Value of Assets	29,213		29,213		0.00%	
c. PV 1-Year Adj Employer Normal Cost	1,217		1,217		0.00%	
d. PV Future Admin Expense Reimbursement	37		37		0.00%	
e. Total Main Fund Valuation Assets (b.+ c.+ d.)	30,467		30,467		0.00%	
8. Assets (VSFs)						
a. Market Value of Assets	2,705		2,705		0.00%	
b. Actuarial Value of Assets	2,674		2,674		0.00%	
9. Unfunded Actuarial Accrued Liability Bases	13,917		13,836		-0.58%	-0.58%
10. Components of Contribution						
a. Employer Normal Cost	1,266		1,268		0.15%	0.08%
b. UAAL Contribution	1,108		1,098		-0.86%	-0.40%
c. Administrative Expenses	20		20		0.00%	0.00%
d. Total (Pension Expense)	2,394		2,386		-0.32%	-0.32%

Fire Comparison of Results

	Office of the Actuary		Bolton Partners		Tolerance Test	
	Liabilities	Count	Liabilities	Count	Individual	Total
1. Present Value of Benefits						
a. Actives						
Retirement	3,133		3,117		-0.53%	-0.07%
Ordinary Disability	747		742		-0.61%	-0.02%
Accidental Disability	6,421		6,338		-1.29%	-0.36%
Ordinary Death	100		101		0.91%	0.00%
Accidental Death	102		99		-2.61%	-0.01%
Deferred Vested	29		29		0.13%	0.00%
Non-Vested Return of Contributions	0		0		-0.87%	0.00%
Total	10,532	10,319	10,426	10,319	-1.00%	-0.46%
b. Inactives	6	16	6	16	-3.20%	0.00%
c. Terminated Vesteds	7	40	7	40	0.69%	0.00%
d. Retirees	11,034	16,763	11,035	16,763	0.01%	0.00%
e. Loads	115		115		0.00%	0.00%
f. VSFs	1,071		1,091		1.87%	0.09%
g. Total	22,764	27,138	22,679	27,138	-0.37%	-0.37%
2. Present Value of Future Salary	11,256		11,256		0.00%	
3. Present Value of Future Employee Contributions	123		123		0.13%	
4. Present Value of Future Employer Normal Costs						
a. Actives	3,657		3,683		0.73%	0.70%
b. VSFs	159		163		2.26%	0.09%
c. Total	3,816		3,846		0.79%	0.79%
5. Actuarial Accrued Liability						
a. Actives (1.a. - 3. - 4.a.)	6,752		6,620		-1.96%	-0.70%
b. Inactives (1.b.)	6		6		-3.20%	0.00%
c. Terminated Vesteds (1.c.)	7		7		0.69%	0.00%
d. Retirees (1.d.)	11,034		11,035		0.01%	0.01%
e. Loads (1.e.)	115		115		0.00%	0.00%
f. VSFs (1.f. - 4.b.)	912		928		1.80%	0.09%
g. Total	18,825		18,710		-0.61%	-0.61%
6. Development of Employer Normal Cost						
a. Present Value of Future Employer Normal Costs	3,816		3,846		0.79%	
b. Present Value of Future Salary	11,256		11,256		0.00%	
c. Salary - Time 0.5	1,138		1,138		-0.03%	
d. Projected Present Value of Future Salary	10,156		10,156		0.00%	
e. Normal Cost Percent	37.577%		37.873%		0.79%	
f. Salary - Time 1.5	1,121		1,121		-0.02%	
g. Employer Normal Cost	421		424		0.77%	
7. Assets (Main Fund)						
a. Market Value of Assets	10,596		10,596		0.00%	
b. Actuarial Value of Assets	9,809		9,809		0.00%	
c. PV 1-Year Adj Employer Normal Cost	402		402		0.00%	
d. PV Future Admin Expense Reimbursement	NA		NA			
e. Total Main Fund Valuation Assets (b.+ c.+ d.)	10,211		10,211		0.00%	
8. Assets (VSFs)						
a. Market Value of Assets	863		863		0.00%	
b. Actuarial Value of Assets	797		797		0.00%	
9. Unfunded Actuarial Accrued Liability Bases	7,818		7,703		-1.47%	-1.47%
10. Components of Contribution						
a. Employer Normal Cost	421		424		0.77%	0.31%
b. UAAL Contribution	633		620		-2.15%	-1.29%
c. Administrative Expenses	N/A		N/A			
d. Total (Pension Expense)	1,054		1,044		-0.98%	-0.98%