Gabriel Roeder Smith & Company
Consultants & Actuaries

NEW YORK CITY RETIREMENT SYSTEMS

ACTUARIAL AUDIT OF EMPLOYER CONTRIBUTIONS FOR FISCAL YEAR 2014
(JUNE 30, 2012 LAG VALUATION)

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Background

Gabriel, Roeder, Smith & Company (GRS) was retained by the Comptroller to serve as Independent Actuary under Section 96 of the New York City Charter and provide other services related to the review of the funding of the following five actuarial pension funds (collectively NYCRS or the 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 Fire Department Pension Fund (FIRE)

GRS will conduct two consecutive biennial actuarial engagements, encompassing the following:

- Biennial Contribution Audits of the computed employer contributions for each System in NYCRS for fiscal years 2012 and 2014 (including an audit of actuarial accrued liabilities and actuarial valuation of assets);
- Biennial Experience Studies for the periods ending June 30, 2011 and June 30, 2013, for each System in NYCRS;
- Two Administrative Reviews of the data gathering and maintenance practices of the Office of the Actuary (OA) and each System in NYCRS (one review corresponding with each Contribution Audit); and
- Two Independent Actuarial Statements (one for each engagement); GRS, as the independent actuarial auditor, will submit a statement that will briefly describe the scope of the entire engagement, will review the entire engagement and comment on the financial condition and financing progress and policies of each System, and certify that the Systems are being funded on a sound actuarial, financial, and legal basis.

This report constitutes the deliverable with respect to the **Actuarial Audit of the Employer Contributions for Fiscal Year 2014 and the underlying derivations of valuation assets and liabilities.**

The purposes of this audit are to:

- verify that the employer contributions calculated by the OA are accurate, appropriate and reasonable;
- verify that the actuarial liabilities and actuarial values of assets have been computed using actuarial assumptions and methods that have been approved by each System's Board of Trustees and conform to applicable laws and generally accepted Actuarial Standards of Practice;
- verify that the actuarial software is operating accurately;
- review methods and assumptions for general reasonableness; and
- recommend changes that improve the annual valuation calculations.

EXECUTIVE SUMMARY (CONTINUED)

The Actuarial Contribution Audit provides an independent verification of the computation of employer pension contributions – including the methodologies used therein and their conformity to law and generally accepted actuarial principles – for the fiscal years 2012 and 2014. The Experience Studies review and comment on the continued appropriateness of the actuarial assumptions used in the computations of employer contributions and identify areas where assumptions may be improved. The Administrative Review evaluates the actuarial data gathering process to ensure that the data collection methods produce sufficiently accurate data for valuation and Experience Study purposes. Thus the three components of the assignment provide assurance that:

- Assets and liabilities are calculated accurately, using appropriate actuarial assumptions and methods, and are based on sufficient and accurate census data; and
- Employer contribution amounts are computed in conformity with all applicable financial, actuarial and statutory requirements.

Organization of this Report

This report is divided into the following sections:

Section A Executive Summary
Section B Discussion of Methods and Findings Related to all Systems
Section C GRS Replications and Findings by System

Actuarial Audit Process

The actuarial audits begin with the collection of member data, plan benefit provisions and financial information. After gathering and understanding all the relevant data, GRS then performed replication valuations to independently calculate valuation assets, liabilities and employer contributions. Once GRS had developed the base valuations, we then reviewed calculations for over 150 individual test lives. The review of the test lives helped identify those areas of the GRS valuation model that differed from the OA's valuation model. In the first engagement the test life reviews resulted in the identification of recommended changes (such as programming inconsistencies or assumptions that had not been updated in accordance with the 2012 A&M). During the second engagement, we used the test life review to determine if any of the recommendations from the first engagement had been implemented (or were still outstanding). As shown in the detail section for each System, many of the issues identified in test life review from the first engagement had not been implemented in the June 30, 2012 actuarial valuation and are included as recommendations in this engagement. For the second engagement GRS requested 300 – 400 test life cases (less than ½% of the entire group) in July 2014. Most were actives from NYCERS which has more than 100 different benefit plans. The OA provided test cases to GRS weekly over the next 7 months. In January 2015 the OA asked if they could stop sending test cases and GRS acquiesced, since the remaining issues did not have a material effect on our ability to replicate the valuation results. Those items indicated as "outstanding status unconfirmed" are items for which we did not receive test cases in order to determine if the issue was resolved.

EXECUTIVE SUMMARY (CONTINUED)

Once the GRS valuation model was completed, results were compared to the OA's and tested against pre-established tolerances. The comparisons of those tolerances are contained in the body of this report. The process can be summarized in the following steps:

1. Collect data:
    a. Member data used by the OA
    b. Summary of benefits valued by the OA
    c. Financial data used by the OA
2. Review plan benefit documentation to independently determine the plan benefits to be valued, including:
    a. Applicable laws
    b. Plan documents and benefit summaries developed by the Systems and posted on their websites
    c. Plan benefit summaries included in the Systems' CAFRs
3. Obtain the actuarial assumptions and methods used in the OA's valuation and independently confirm their applicability, validity and appropriateness
4. Perform independent valuations for each System using GRS' proprietary software and OA's data, assumptions and methods
5. Compare GRS' results with the OA's and identify and investigate areas of significant differences
6. Compare GRS' valuation of test cases with those of the OA's and identify and investigate areas of significant differences
7. Refine GRS' valuation model based on investigations of differences in results
8. Compare GRS valuation results to OA valuation results and test against tolerances
9. Recommend changes, as deemed appropriate by GRS

Results

This was the second actuarial audit since the implementation of the 2012 A&M (Actuarial Assumptions and Methods). One of the changes that was part of the 2012 A&M was a change in the actuarial cost method from the Frozen Initial Liability (FIL) Actuarial Cost Method to the Entry Age (EA) Actuarial Cost Method. As a result of this change in actuarial cost methods, there are more components in the actuarial audit of liabilities to replicate (as was the case with the first actuarial audit). The components reviewed include:

- the Present Value of Future Expected Benefits (PVFB)
- the Actuarial Value of Assets (AVA)
- the Present Value of Future Normal Cost (PVFNC)
- the Actuarial Accrued Liability (AAL)
- the Unfunded Actuarial Accrued Liability (UAAL)
- the amortization charges
- the Total Employer Contribution

EXECUTIVE SUMMARY (CONTINUED)

The "PVFB" represents the present value of all future benefits (those that have accrued and those that are expected to accrue in the future) to be paid from the Systems to current active plan members. Under the FIL Actuarial Cost Method, the PVFB less the assets less the frozen unfunded liability (for which there is a payment schedule) is spread over the future working lifetime of the current active population to develop a normal cost. The normal cost is then added to the payment for the unfunded liability and the expenses to develop the employer contributions. Therefore, prior actuarial audits focused on the calculations of the PVFB and the employer contributions.

Under the Entry Age Actuarial Cost Method, each individual member's PVFB at entry age is financed from entry age to exit from active service as a level percent of that member's expected pay (from entry age to exit from active service) to develop the Normal Costs. The Present Value of Future Normal Costs (PVFNC) on the valuation date is subtracted from the PVFB on the valuation date to determine the Actuarial Accrued Liability (AAL). The AAL can also be thought of as the present value of past normal costs (adjusted for survival and benefit payments). Therefore, under the EA Actuarial Cost Method, the PVFB again is the main result and the PVFNC and the AAL represent allocations of the PVFB between past and future costs. Different allocations between the PVFNC and the AAL may or may not result in different employer contributions, over the short term, depending on the relationship between the amortization periods for financing UAAL and the average career length of a new entrant. As a result, auditing tolerances are usually wider for the cost components other than the PVFB (cost components exclude the AVA). The following table shows a summary of the results of the actuarial audit relative to the PVFB and the employer contributions for FY 2014.

Comparison of OA and GRS Valuation Results ($ Millions)

System	Category	OA Results	GRS Results	Percent Difference	Tolerance Limit	Pass/ Fail
NYCERS	PVFB	$ 82,953	$ 81,989	1.18%	2.00%	Pass
	Employer Contribution	$ 3,114	$ 3,040	2.43%	5.00%	Pass
TRS	PVFB	$ 71,837	$ 71,133	0.99%	2.00%	Pass
	Employer Contribution	$ 2,999	$ 2,895	3.59%	5.00%	Pass
BERS	PVFB	$ 5,028	$ 5,023	0.10%	2.00%	Pass
	Employer Contribution	$ 215	$ 216	-0.46%	5.00%	Pass
POLICE	PVFB	$ 53,626	$ 53,363	0.49%	2.00%	Pass
	Employer Contribution	$ 2,321	$ 2,262	2.61%	5.00%	Pass
FIRE	PVFB	$ 20,966	$ 20,867	0.47%	2.00%	Pass
	Employer Contribution	$ 970	$ 963	0.73%	5.00%	Pass
Total	PVFB	$ 234,410	$ 232,375	0.88%		
	Employer Contribution	$ 9,619	$ 9,376	2.59%		

EXECUTIVE SUMMARY (CONTINUED)

Under the Entry Age Actuarial Cost Method, the PVFB is allocated between past and future service – Actuarial Accrued Liability (AAL) and Present Value of Future Normal Cost (PVFNC). GRS had difficulty replicating the OA's allocation between AAL and PVFNC for NYCERS, TRS and BERS during the first engagement. During the second engagement, it was determined (by looking closer at test case calculations and later confirmed by the OA) that the OA was leveling the member contributions over each member's entire career when determining the employer financed portion of the normal cost. This mainly affects the computation of the liabilities and normal costs of the civilian plans due to the shorter duration of member contributions. While this is an acceptable approach, we found no documentation describing this approach in the materials provided to us by the OA (or in the System CAFRs). We adjusted for this variation in the second engagement and our resulting computations of normal costs and accrued liabilities became much closer to the computations of the OA.

Based on these results, GRS has confirmed that the OA's calculations of the employer contributions for all Systems were reasonable and appropriate.

Summary of Recommendations/Findings

Applicable to all Systems:

1. Produce formal actuarial reports for all Systems
2. 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
3. Consider the use of a corridor around the market value in the development of the actuarial value of assets
4. Consider changes to the One Year Lag Methodology (OYLM)
5. Review the assumed benefit 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

EXECUTIVE SUMMARY (CONTINUED)

Summary of Recommendations/Findings (continued)

NYCERS:

6. Review administrative expenses in the development of the Actuarial Value of Assets (AVA)
7. Review programming for treatment of active members that are over 75 on the valuation date
8. 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)
9. Review the use of "default plan" provisions to value certain NYCERS members
10. Update the mortality for Transit beneficiaries to the tables adopted with the 2012 A&M (outstanding status unconfirmed)

TRS:

11. Review method of accounting for the TDA Fixed Funds in the development of the AVA
12. Review rounding of service for active members
13. Review programming of probabilities of termination on and after 20 years of service – rates shown in test life cases appear to indicate that these probabilities were rounded to the nearest 1%

BERS:

14. Review the amount of the assumed COLA in the first year after the valuation for members with $0 reported in the maximum allowance field
15. Review the allocation of the liabilities to the vested decrement for Tier I and Tier II
16. Continue to work with BERS to improve the reporting of valuation data related to part-time members

POLICE:

17. Review the assumed age of commencement for current deferred vested members
18. Review the development of the RASF (required member contributions) used in the entry age pass and reprogram accordingly

FIRE:

19. Review the assumed age of commencement for current deferred vested members
20. Value benefits (and liabilities) associated with "other service"
21. Review modeling of Auto COLA for certain beneficiaries

EXECUTIVE SUMMARY (CONCLUDED)

We would like to thank the OA for their cooperation.

James D. Anderson and Heidi G. Barry are Members of the American Academy of Actuaries (M.A.A.A) and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

Respectfully submitted,

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Date

SECTION B

DISCUSSION OF METHODS AND FINDINGS RELATED TO ALL SYSTEMS

DISCUSSION OF METHODS

General Comments

Each contribution audit begins with a replication of the valuation. However, a complete replication is not the end goal. The replication is performed to gain an understanding of the methods used by the OA and to verify that the independent auditing actuary can replicate results within reasonable tolerances based on the methods and assumptions described by the OA. Once the replication has been achieved, the auditing actuary must then evaluate the methods and assumptions to determine if the auditing actuary agrees with their use and/or recommends any changes.

Tolerances

While every valuation system will have some differences, these differences should generally be minor, especially in the aggregate. Replication of results within 2%-5% is generally viewed as a successful replication. However, different aspects of the replication may be farther away than others due to differences in valuation programs. For purposes of this audit, GRS has determined that a successful replication will occur if one of two tests is passed. The first test is an individual test. Using retirees and beneficiaries (R&B's) as an example: this test will be passed if the difference between the OA's computation of Present Value of Future Benefits (PVFB) for R&B's and the GRS' computation of the PVFB for R&B's is within a specified tolerance of the OA computation of PVFB for R&B's. The second test is an aggregate test. This test will be passed if the difference between the OA's computation of PVFB for R&B's and the GRS' computation of PVFB for R&B's is within a specified tolerance of the total PVFB for the entire System. The chart below illustrates the tolerances for this engagement:

Category	Individual Tolerance	Aggregate Tolerance
Present Value of Benefits by Category	2.0%	0.5% of Total Present Value of Benefits
Accrued Liability by Category	5.0%	5.0% of Total Accrued Liability
Normal Cost	5.0%	n/a
Computed Contribution	5.0%	5.0% of Total Contribution

It is not uncommon for the differences in actuarial accrued liabilities and normal costs to be in opposite directions (the auditing actuary's accrued liabilities are greater, but the normal costs are lower or vice-versa). This can happen due to minor differences in the way valuation systems allocate the present value of benefits between the past and the future. Because of this, the tolerance range on accrued liabilities is larger than on the present value of benefits. Such differences will frequently be offsetting, resulting in a computed contribution that differs by less than 5%.

Testing of Individual Member Calculations

As part of the process, the auditing actuary will also look at detailed calculations for specific individuals included in the valuations (known as test lives). There are no specific tolerances used by GRS in the comparison of test lives. Small differences in the rounding of ages or the treatment of

service can create large differences in test life results that could be offsetting when looking at aggregate results for the System (or even total results for all the test lives of the System). The test lives are useful for verifying that benefits are generally computed in the same manner and that assumptions are applied in the same manner. In general, when we identified substantial differences in test life results we attempted to spot differences in the intricate details of the valuation calculations. In the first engagement, these differences led to the identification of minor differences between what the OA identified as their valuation assumptions and what was used in the valuations in certain cases, such as retiree mortality tables being used to value beneficiaries in BERS and certain NYCERS groups and rounded probabilities of withdrawal used in the TRS valuation. In this (the second) engagement, the test lives were used to verify which of the issues identified in the first engagement were still outstanding and to confirm that no new issues arose.

Actuarial Value of Assets Method

Method Description

The actuarial value of asset method used in the valuations for all of the Systems is as follows:

Assumed investment return (currently 7%) is recognized immediately. Recognition of the difference between the assumed investment return and the actual investment return (on a market value basis) is phased into the actuarial value of assets. The schedule of recognition is 15% in the first year following the investment gain or loss, followed by recognition of 15%, 15%, 15%, 20% and 20% in the following five years. There is no corridor around the market value of assets within which the actuarial value must fall.

As part of the 2012 A&M, the actuarial value of assets was reset to the market value. However, the method was not changed and will continue to be used in future valuations, after the restart date. Due to the timing of the completion of the silver books and the valuations, the investment return results for FY 2011 were already known. The Actuary decided to reset the actuarial value of assets to the market value as of June 30, 2011.

Audit Comments

Most public sector plans use an asset smoothing period that ranges between 3 and 5 years. Some public sector pension plans use shorter periods, some plans use longer periods and a few plans use market values with no smoothing. Although the OA uses a longer period than is common in the public sector, we believe the method complies with the Actuarial Standard of Practice (ASOP) No. 44, which discusses the selection and use of asset valuation methods for pension valuations.

Section 3.3 of ASOP 44 states, in part:

> "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."

There are two common rationales for using an actuarial value of asset method to smooth market value fluctuations. One is that the market is volatile and that investment gains and losses should have their own smoothing where the smoothing period reflects the anticipated length of a market cycle. Under this rationale, many actuaries would argue that adding a corridor to the actuarial value of asset method will actually disrupt the smoothing because additional gains occurring after hitting the bottom of the corridor (or losses occurring after hitting the top of the corridor) are recognized immediately. Therefore, in a protracted downturn or a protracted upturn, the smoothing effect of the actuarial value of asset method could be temporarily lost.

The other rationale for using an actuarial value of asset method is a little more complex. Under some actuarial cost methods that develop an accrued liability, the accrued liability is essentially the theoretical value of the desired assets, given everything known on the valuation date and everything assumed after the valuation date. The value of the assets provides an actual measure. The Unfunded Actuarial Accrued Liability (UAAL) is then the difference between desired assets and actual assets. However, in order to make this determination you need to be able to assign a liquid value to your assets. In a portfolio with equities, this is done by multiplying the shares held by the value of those shares on the close of the market on the measurement date. Given that this date is in the past (relative to when the valuation is being performed), the fact that the shares were not sold, and that value of the shares likely changed at the very next market open, this method (known as the market value) is nothing more than a theoretical value. In addition, due to the large equity portfolios held by each of the Systems, it would not actually be physically possible to have liquidated the equity portfolios for

the closing values of the market, even if desired. Such liquidation would not only have taken a significant amount of time (which means that not all shares would have necessarily sold for the same price) but could actually influence the market pricing. As such, using a market value based on the closing market prices once every year is not only theoretical, but introduces fluctuations that many would consider to be "random noise." The actuarial value of assets therefore employs a smoothing technique in an attempt to smooth out the "random noise" while ascertaining the value of "where the plan is at, currently." Since no one can determine with 100% certainty what portion of the market value is random noise (even in hindsight), actuaries will use slightly different smoothing methods to fit the specific needs of the plan. Under this rationale, a true market correction (whether up or down) should be recognized immediately because it represents "where you are" on the measurement date. However, most large market fluctuations include both true market corrections and temporary "noise". Again, distinguishing between the two cannot be done with certainty (even in hindsight). Therefore, many actuaries employ a secondary process in the actuarial value of asset method to make that distinction. This secondary process is known as a corridor around the market value. If the corridor is hit, then all gains or losses beyond that corridor are treated like a market correction and recognized immediately in the valuation.

The issue of using corridors is gaining more and more attention in the actuarial field. In 2014, two publications were circulated related to funding public sector plans:

1) The Society of Actuaries (SOA) "Report of the Blue Ribbon Panel on Public Pension Plan Funding"
2) A white paper developed by the Conference of Consulting Actuaries Public Plans Community (CCA PPC): "Actuarial Funding Policies and Practices for Public Pension Plans"

The recommendation from the Blue Ribbon Panel was to use an asset smoothing method over a period of less than or equal to five years. They neither recommended for nor against the use of a market corridor. The Panel's "Standardized Contribution Benchmark" does not use a corridor. However, in one footnote the Panel makes the statement:

> "While a corridor is typically recommended, the Panel does not use one in the standardized contribution because it is assuming no restart (resetting actuarial to market value of assets) and NO changes in amortization schedules for extraordinary gains or losses. This provides the most smoothness of assets."

The CCA PPC was more direct, indicating that using a smoothing period with no corridor was a "non-recommended practice".

In light of:

1) ASOP 44
2) the CCA PPC white paper
3) the SOA Blue Ribbon Commission
4) the fact that the smoothing period exceeds five years and the length used by most public retirement systems
5) the second rationale listed above for using an actuarial value of asset method

We recommend the use of a corridor around the market value to ensure that the actuarial value of assets "maintains a sufficiently narrow range around the market value" of assets. We recommend a corridor in the range of 25% to 30%. This range is within common practice. We note that the use of a corridor has been considered and rejected by the Actuary in the past.

We were able to reproduce the mathematical calculations used to determine the June 30, 2012 actuarial value of assets with the exception of the handling of expenses in the lag period for NYCERS. The difference was not material.

During the first engagement the OA pointed out that an issue arose with the TRS assets (and BERS assets, to a lesser extent) beginning with the June 30, 2011 valuation. The issue relates to the fact that the TDA (Tax Deferred Annuity) fixed funds and the QPP (Qualified Pension Plan) funds are comingled and that TDA gets a fixed interest allocation regardless of fund performance. This has the effect of amplifying (or leveraging) the gains and losses on the remainder of the assets. Consider the following three examples:

Example 1	Total Fund Rate of Return:		7%
	QPP	TDA	Total
Beginning of Year Asset Value	$1,000.00	$500.00	$1,500.00
Expenditures	300.00	10.00	310.00
Contributions	200.00	5.00	205.00
Investment Return	66.50	34.83	101.33
End of Year Asset Value	966.50	529.83	1,496.33
Rate of Return	7.00%	7.00%	7.00%

Example 2	Total Fund Rate of Return:		9%
	QPP	TDA	Total
Beginning of Year Asset Value	$1,000.00	$500.00	$1,500.00
Expenditures	300.00	10.00	310.00
Contributions	200.00	5.00	205.00
Investment Return	95.45	34.83	130.28
End of Year Asset Value	995.45	529.83	1,525.28
Rate of Return	10.05%	7.00%	9.00%

Example 3	Total Fund Rate of Return:		5%
	QPP	TDA	Total
Beginning of Year Asset Value	$1,000.00	$500.00	$1,500.00
Expenditures	300.00	10.00	310.00
Contributions	200.00	5.00	205.00
Investment Return	37.55	34.83	72.38
End of Year Asset Value	937.55	529.83	1,467.38
Rate of Return	3.95%	7.00%	5.00%

In example 1, each of the component funds earns the same investment rate of return as the total fund because the total rate of return was exactly 7%. In example 2, there is an investment gain because the total fund earns 9%. However, that gain is amplified for the QPP because the TDA gets exactly 7%. In example 3 there is an investment loss because the total fund earns 5%. However, that loss is amplified for the QPP because the TDA gets exactly 7%.

The OA asked us if we had ideas on how to mitigate the leveraging of asset gains and losses on the QPP. Below are two possibilities:

1) Run a Monte Carlo simulation on the asset returns to measure the relationship between the rate of return on the total portfolio compared to the rate of return on the QPP, given the fixed rate of return on the TDA. Modify the valuation assumption, if indicated.
2) Establish a contingency reserve during the years in which the total fund return equals or exceeds the fixed TDA rate of return (currently 7%). The amount of the reserve would equal all or a portion of the gain that arises in the QPP in those years attributable to the leveraging from the fixed rate of return on the TDA. Then in years when the total fund earns less than the rate credited to the TDA, portions of the contingency reserve can be released to mitigate the effect of the downward leveraging.

The OA also indicated that this issue created another issue with the development of the Actuarial Value of Assets. The issue, as we understand it, is that the transfer of investment income from the QPP to the TDA is treated like a benefit payment coming out of the QPP rather than investment income and therefore does not get smoothed in the same manner as investment income when it comes into the fund. The OA has indicated its suspicion that this treatment results in a bias in the Actuarial Value of Assets to be less than the Market Value of Assets, even when all assumptions are met. We recommend netting the TDA transfer from the investment income prior to smoothing the income, so that the TDA transfer is treated in the same manner as all other investment income.

Actuarial Cost Method

The Fiscal Year 2014 employer contributions are determined from the June 30, 2012 actuarial valuation. Thus, there is a 1-year lag between the valuation date and the period for which employer contributions are made. The June 30, 2012 valuations use the Entry Age Actuarial Cost Method (EAACM). This method was first employed for use in the June 30, 2010 NYCRS' actuarial valuations as part of the 2012 A&M. This is the most common actuarial cost method in use by public

employee retirement systems. In addition, the EAACM will now be required for accounting purposes under GASB Statements No. 67 and No. 68. We agree that this is an appropriate method for determining employer contributions for funding.

Initial unfunded actuarial accrued liabilities (determined as of June 30, 2010) are amortized as a level percent of pay over a 22-year closed period. Gains and losses occurring after the June 30, 2010 valuation are amortized as level dollar amounts over a 15-year closed period. These amortization periods are well within the common range of practice and we find them appropriate. The use of level percent amortization is well within the range of common practice. The use of level dollar amortization is well within the range of common practice. It is not within common practice to use level percent amortizations for certain components and level dollar amortizations for other components. While the use of either of these types of amortizations is acceptable, using both adds an unnecessary complication to an already complicated valuation process. We recommend the Actuary choose a single amortization method and use that method for all the types of UAAL.

<u>One-Year-Lag-Methodology (OYLM)</u>

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 OA verbally provided the following example to illustrate the OYLM under the EAACM: Consider a member with a 20 year career who was entitled to a lump sum of $19 at retirement. For simplicity, assume the member stays in employment for the entire 20 years and retires upon his 20th anniversary of employment. Also for simplicity, assume no mortality, no interest and no expenses. Then under the EAACM, the normal cost would be $0.95 for each of the 20 years of employment. This would accumulate to $19 ($0.95 x 20 years = $19) at the end of the 20 years of employment. Under the OYLM with EAACM, the normal cost would be $0 for the first year of employment and $1 for each of the following 19 years. This would also accumulate to $19.

While we understand and agree with this example, we do not agree that this example is representative of the implementation of the OYLM that the OA has employed. A general description of the OA's implementation of the OYLM under the EAACM follows:

- Actuarial results for Present Value of Future Benefits (PVFB), Actuarial Accrued Liability (AAL), Present Value of Future Normal Cost (PVFNC), and Present Value of Future Salary (PVFS) are first determined as of the valuation date under the individual EAACM and aggregated for the group.

- Total PVFS is then projected forward one year by accounting for the salaries expected to be paid during the first year following the valuation date.
- An Employer Normal Cost percentage is calculated by dividing the unadjusted Employer PVFNC by the projected PVFS.
    - This Employer Normal Cost percentage is then applied to payroll projected to the year starting one year after the valuation date.
- The unfunded liability on the valuation date is adjusted by Employer Normal Cost contributions that are expected to be made during the lag year (year starting on the valuation date).
- Administrative expenses paid during the year ending on the valuation date are funded by adding the amount of the expenses with two years of interest at 7% to the required contribution for the year starting one year after the valuation date.

The example on the following pages (Charts 1, 2 and 3) illustrate the EAACM, the EAACM with the theoretical (intended) OYLM and the EAACM with the OA implemented OYLM. They are based on the example verbally provided by the OA and described above.

The abbreviation key for the charts is:

PVFS = Present Value of Future Salary
PVB = Present Value of Future Benefits
EA = Entry Age
PVFNC = Present Value of Future Normal Cost
EANC = Entry Age Normal Cost
AAL = Actuarial Accrued Liability
UAAL = Unfunded AAL
Val = Valuation

Chart 1
Illustration of EAACM with No Lag

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Val Date	Service on Val Date	Pay During Upcoming Year	PVFS at Val Date	PVB at Val Date	PVB at EA	NC%	PVFNC at Val Date	AAL at Val Date	Assets at Val Date	UAAL	Contribution During Year (15 year amort of UAAL)	Assets 1 year after Val Date
2010	0	10.00	200.00	19.00	19.00	9.50%	19.00	-	-	-	0.95	0.95
2011	1	10.00	190.00	19.00	19.00	9.50%	18.05	0.95	0.95	-	0.95	1.90
2012	2	10.00	180.00	19.00	19.00	9.50%	17.10	1.90	1.90	-	0.95	2.85
2013	3	10.00	170.00	19.00	19.00	9.50%	16.15	2.85	2.85	-	0.95	3.80
2014	4	10.00	160.00	19.00	19.00	9.50%	15.20	3.80	3.80	-	0.95	4.75
2015	5	10.00	150.00	19.00	19.00	9.50%	14.25	4.75	4.75	-	0.95	5.70
2016	6	10.00	140.00	19.00	19.00	9.50%	13.30	5.70	5.70	-	0.95	6.65
2017	7	10.00	130.00	19.00	19.00	9.50%	12.35	6.65	6.65	-	0.95	7.60
2018	8	10.00	120.00	19.00	19.00	9.50%	11.40	7.60	7.60	-	0.95	8.55
2019	9	10.00	110.00	19.00	19.00	9.50%	10.45	8.55	8.55	-	0.95	9.50
2020	10	10.00	100.00	19.00	19.00	9.50%	9.50	9.50	9.50	-	0.95	10.45
2021	11	10.00	90.00	19.00	19.00	9.50%	8.55	10.45	10.45	-	0.95	11.40
2022	12	10.00	80.00	19.00	19.00	9.50%	7.60	11.40	11.40	-	0.95	12.35
2023	13	10.00	70.00	19.00	19.00	9.50%	6.65	12.35	12.35	-	0.95	13.30
2024	14	10.00	60.00	19.00	19.00	9.50%	5.70	13.30	13.30	-	0.95	14.25
2025	15	10.00	50.00	19.00	19.00	9.50%	4.75	14.25	14.25	-	0.95	15.20
2026	16	10.00	40.00	19.00	19.00	9.50%	3.80	15.20	15.20	-	0.95	16.15
2027	17	10.00	30.00	19.00	19.00	9.50%	2.85	16.15	16.15	-	0.95	17.10
2028	18	10.00	20.00	19.00	19.00	9.50%	1.90	17.10	17.10	-	0.95	18.05
2029	19	10.00	10.00	19.00	19.00	9.50%	0.95	18.05	18.05	-	0.95	19.00
2030	20	-	-	19.00	19.00			19.00	19.00			

Chart 2
Illustration of EAACM with Theoretical OYLM Implementation

(1) Val Date	(2) Service on Val Date	(3) Pay During Upcoming Year	(4) PVFS at Val Date	(5) PVB at Val Date	(6) PVB at EA	(7) NC%	(8) PVFNC at Val Date	(9) AAL at Val Date	(10) Assets at Val Date	(11) UAAL	(12) During Year (15 year amort of UAAL)	(13) Assets 1 year after Val Date
2010	0	10.00	200.00	19.00	19.00	10.00%	*19.00*	-	-	-	-	-
2011	1	10.00	190.00	19.00	19.00	10.00%	19.00	-	-	-	1.00	1.00
2012	2	10.00	180.00	19.00	19.00	10.00%	18.00	1.00	1.00	-	1.00	2.00
2013	3	10.00	170.00	19.00	19.00	10.00%	17.00	2.00	2.00	-	1.00	3.00
2014	4	10.00	160.00	19.00	19.00	10.00%	16.00	3.00	3.00	-	1.00	4.00
2015	5	10.00	150.00	19.00	19.00	10.00%	15.00	4.00	4.00	-	1.00	5.00
2016	6	10.00	140.00	19.00	19.00	10.00%	14.00	5.00	5.00	-	1.00	6.00
2017	7	10.00	130.00	19.00	19.00	10.00%	13.00	6.00	6.00	-	1.00	7.00
2018	8	10.00	120.00	19.00	19.00	10.00%	12.00	7.00	7.00	-	1.00	8.00
2019	9	10.00	110.00	19.00	19.00	10.00%	11.00	8.00	8.00	-	1.00	9.00
2020	10	10.00	100.00	19.00	19.00	10.00%	10.00	9.00	9.00	-	1.00	10.00
2021	11	10.00	90.00	19.00	19.00	10.00%	9.00	10.00	10.00	-	1.00	11.00
2022	12	10.00	80.00	19.00	19.00	10.00%	8.00	11.00	11.00	-	1.00	12.00
2023	13	10.00	70.00	19.00	19.00	10.00%	7.00	12.00	12.00	-	1.00	13.00
2024	14	10.00	60.00	19.00	19.00	10.00%	6.00	13.00	13.00	-	1.00	14.00
2025	15	10.00	50.00	19.00	19.00	10.00%	5.00	14.00	14.00	-	1.00	15.00
2026	16	10.00	40.00	19.00	19.00	10.00%	4.00	15.00	15.00	-	1.00	16.00
2027	17	10.00	30.00	19.00	19.00	10.00%	3.00	16.00	16.00	-	1.00	17.00
2028	18	10.00	20.00	19.00	19.00	10.00%	2.00	17.00	17.00	-	1.00	18.00
2029	19	10.00	10.00	19.00	19.00	*10.00%*	1.00	18.00	18.00	-	1.00	19.00
2030	20	-	-	19.00	19.00			19.00	19.00			

= calculated, but not used

Chart 3
Illustration of EAACM with OA Implementation of OYLM

(1) Val Date	(2) Service on Val Date	(3) Pay During Upcoming Year	(4) PVFS at Val Date	(5) PVB at Val Date	(6) PVB at EA	(7) NC% -- before lag	(8) PVFNC at Val Date	(9) AAL at Val Date	(10) NC% -- after lag	(11) Assets at Val Date	(12) NC Dollars	(13) Projected Assets with Accrued NC	(14) Projected UAAL	(15) 15 year amort	(16) Assets Year End
2010	0	10.00	200.00	19.00	19.00	9.50%	19.00	-	10.00%	-		-			
2011	1	10.00	190.00	19.00	19.00	9.50%	18.05	0.95	10.03%	-	1.00	1.00	(0.05)	(0.00)	1.00
2012	2	10.00	180.00	19.00	19.00	9.50%	17.10	1.90	10.06%	1.00	1.00	2.00	(0.10)	(0.01)	1.99
2013	3	10.00	170.00	19.00	19.00	9.50%	16.15	2.85	10.09%	1.99	1.01	3.00	(0.15)	(0.01)	2.99
2014	4	10.00	160.00	19.00	19.00	9.50%	15.20	3.80	10.13%	2.99	1.01	4.00	(0.20)	(0.01)	3.98
2015	5	10.00	150.00	19.00	19.00	9.50%	14.25	4.75	10.18%	3.98	1.01	5.00	(0.25)	(0.02)	4.98
2016	6	10.00	140.00	19.00	19.00	9.50%	13.30	5.70	10.23%	4.98	1.02	6.00	(0.30)	(0.02)	5.98
2017	7	10.00	130.00	19.00	19.00	9.50%	12.35	6.65	10.29%	5.98	1.02	7.00	(0.35)	(0.02)	6.98
2018	8	10.00	120.00	19.00	19.00	9.50%	11.40	7.60	10.36%	6.98	1.03	8.01	(0.41)	(0.03)	7.98
2019	9	10.00	110.00	19.00	19.00	9.50%	10.45	8.55	10.45%	7.98	1.04	9.02	(0.47)	(0.03)	8.99
2020	10	10.00	100.00	19.00	19.00	9.50%	9.50	9.50	10.56%	8.99	1.05	10.03	(0.53)	(0.04)	10.00
2021	11	10.00	90.00	19.00	19.00	9.50%	8.55	10.45	10.69%	10.00	1.06	11.05	(0.60)	(0.04)	11.01
2022	12	10.00	80.00	19.00	19.00	9.50%	7.60	11.40	10.86%	11.01	1.07	12.08	(0.68)	(0.05)	12.03
2023	13	10.00	70.00	19.00	19.00	9.50%	6.65	12.35	11.08%	12.03	1.09	13.12	(0.77)	(0.05)	13.07
2024	14	10.00	60.00	19.00	19.00	9.50%	5.70	13.30	11.40%	13.07	1.11	14.18	(0.88)	(0.06)	14.12
2025	15	10.00	50.00	19.00	19.00	9.50%	4.75	14.25	11.88%	14.12	1.14	15.26	(1.01)	(0.07)	15.19
2026	16	10.00	40.00	19.00	19.00	9.50%	3.80	15.20	12.67%	15.19	1.19	16.38	(1.18)	(0.08)	16.30
2027	17	10.00	30.00	19.00	19.00	9.50%	2.85	16.15	14.25%	16.30	1.27	17.57	(1.42)	(0.09)	17.47
2028	18	10.00	20.00	19.00	19.00	9.50%	1.90	17.10	19.00%	17.47	1.43	18.90	(1.80)	(0.12)	18.78
2029	19	10.00	10.00	19.00	19.00	9.50%	0.95	18.05		18.78	1.90	20.68	(2.63)	(0.18)	20.50
2030	20	-	-	19.00	19.00			19.00		20.50	-	20.50			

Chart 1 shows how the assets would accumulate for this example under the EAACM without the one year lag. For this case, the normal cost is 9.5% of pay each and every year and produces a $0.95 contribution for 20 years that accumulates to $19 at the end of the 20 years. Under this illustration, there is no UAAL, since experience is exactly as expected.

Chart 2 shows how the assets would accumulate for this example under the EAACM and OYLM as we believe is intended by the OA. For this case, the normal cost is 10% of pay beginning in year 2 and continuing for 19 years. This produces a $0.00 contribution for 1 year and a $1.00 contribution for 19 years that accumulates to $19 at the end of the 20 years. Again, under this illustration there is no UAAL, since experience is exactly as expected.

Chart 3 shows how the assets would accumulate for this example under the EAACM and OYLM as implemented by the OA. Column 10 shows that the normal cost rate increases each year, starting at 10% of pay and ending at 19% of pay. This pattern of normal costs, by itself, will overfund the benefit. By the 20th year, the normal cost contributions would generate an asset of $21.45 (the sum of the Normal Cost in column 12). The OA also compares the assets with the next year of normal cost contributions to the accrued liabilities (which includes that next year of normal cost) to determine the UAAL. The UAAL is then amortized over 15 years in the example and added to the normal cost (the OA uses different amortization periods – 15 years is shown for simplicity). Under the example, the assets always differ from the accrued liabilities, even though there is no gain or loss. The amortization of this difference mitigates the overfunding, but does not eliminate it. The assets accumulate to $20.50 by the time the member retires.

It is important to note that due to the effect of interest, pay increases and decrement assumptions, it is not likely that the difference between the OA's implementation and the theoretical implementation will be as great as shown in these charts (and possibly in different directions in certain cases). What can be concluded from these charts is 1) that the normal cost is not a level percent of pay, as intended, and 2) that a UAAL can develop without a gain or loss under the OA's implementation.

The above charts were included in the first engagement report. One important aspect of these charts is that the normal cost is not necessarily level for an individual under the OA's implementation. However, the descriptions of the cost method contained in the POLICE report (starting on page 59) and the FIRE report (starting on page 60) imply that the method produces level normal cost for an individual. We recommend these descriptions be clarified.

<u>One-Year-Lag-Methodology (OYLM) – Employer Contributions versus Employee Contributions</u>

Since members begin contributing upon employment, there is no lag in their contributions. In the implementation of the OYLM, only the employer portion of the normal costs is adjusted for the one year lag.

<u>Loads</u>

Each of the Systems has loads included in liabilities for various reasons. GRS reviewed the calculations of these loads for reasonableness. We found all of the loads to be reasonable. None of the loads were of a magnitude that would warrant a more detailed analysis.

Valuation Report Content (Applies only to POLICE and FIRE)

There have been recent changes to the Actuarial Standards of Practice regarding report content. In accordance with these changes, we recommend the following additions to the valuation reports:

1. Disclose to what extent the mortality assumption provides a margin for future improvement.
2. Identify the principal for the actuarial valuation.
3. Add a development of the experience gain/loss.
4. Provide discussion of how actual experience during the prior year compared to actuarial assumptions.
5. Add a comment that indicates the measurement may not be appropriate for other purposes.
6. Provide a statement(s) indicating future measurements may differ significantly from those provided in the report.
7. State the extent of the actuary's reliance on data provided by others (e.g., the actuary is not responsible for data errors or omissions).
8. Discuss the independence of the actuary from the plan sponsor.
9. Describe assumptions for regular disability retirees' benefit amounts – i.e., members eligible to retire who decrement on disability are assumed to elect age and service benefits under service retirement rules in order to benefit from the VSF.

Summary of Comments on Actuarial Methods and Report Content

1. We believe the methods used by the OA in the June 30, 2012 (Lag) actuarial valuation are reasonable and comply with Actuarial Standards of Practice.
2. We recommend that the OA add a corridor around the market value in the development of the valuation assets (actuarial value of assets).
3. We recommend the OA reconsider the use of the OYLM to determine if a less complicated approach may achieve the OA's modeling goals.
4. If the OA decides to keep the OYLM then we recommend the OA apply the method at the individual level in a manner that is level for each member throughout their career.
5. Include additional disclosures in the valuation reports.

With regard to comment 4, GRS developed a modification to its programming of the June 30, 2010 actuarial valuations for NYCRS to implement the OYLM at the individual level. Under this modification, the present value of benefits, as of the valuation date, are computed in the same manner. However, the entry age normal cost is computed to be the present value of employer financed benefits at entry age divided by (the present value of future salary at entry age, less the expected pay during the first year of employment). This rate is then applied to the present value of future pay at attained age to determine the present value of future employer normal cost or applied to the expected pays for FY 2012 to determine the employer normal cost for FY 2012. Please see our first engagement Actuarial Audit of Employer Contributions report for further details.

SECTION C

GRS REPLICATIONS AND FINDINGS BY SYSTEM

REPLICATIONS AND FINDINGS BY SYSTEM

NYCERS

During the contribution audit for NYCERS, GRS was able to replicate the OA's computation of total present value of benefits, accrued liabilities, actuarial value of assets, unfunded actuarial accrued liabilities and employer contributions within tolerances. While a couple of items failed one of the two tests, no items failed both tests. This indicates that all items passed our tolerance tests.

GRS was also able to replicate the OA's computation of the employer contributions within tolerances, both in aggregate and by employer group for all obligors except the State Judiciary Group. We understand that details of the computations down to the obligors have been traditionally outside the scope of the contribution audits. However, the OC did request that we show our computation of the employer contributions by obligor for NYCERS. This is shown on the table on page C-3. The only group outside the tolerance was the State Judiciary. The reason was a difference in the present value of benefits for the retirees (all members of this group are retired) of 3%. Relative to total liabilities, GRS does not feel this is material. GRS has also reviewed the method the Actuary used to allocate contributions to the obligors and believes it to be reasonable and within the requirements of the New York City Administrative Code, Section 13-127. The method can briefly be described as follows:

Assets were initially allocated based on liabilities from the June 30, 2010 actuarial valuation and tracked by cash flow and investment return by the Obligor to the current valuation. In the current valuation, NYCERS is valued in total, as required by law. Then each Obligor is valued as a separate group and the individual Obligor results are then adjusted so that the sum of the Obligors matches the total NYCERS results.

We have the following findings for the NYCERS contribution audit (all of which were identified during the first engagement and are still outstanding):

1. Active members over age 75 on the valuation date appear to be valued as if they were exactly 75 on the valuation date. GRS recommends that members be valued at their actual age. This issue does not affect a significant number of members.
2. GRS recommends the OA review the modeling of future deferred members (current actives who are assumed to quit after vesting and before retirement eligibility). Future deferred members are assumed to commence benefits at first eligibility. However, current deferred members are assumed to commence benefits in accordance with the retirement pattern. We recommend these assumptions be unified.
3. In NYCERS there were a number of data test cases where the data seemed to indicate the member was entitled to one particular plan, but was valued under a different plan. We recommend that the OA document the rules relative to when a member should be valued under a plan different than indicated by the data and include such rules with the summary of benefits currently maintained. Discussions with the OA have suggested that some of these cases might be related to "default" plans that were used under the prior valuation system and are in the process of being converted under the ProVal valuation system.
4. The mortality table used for Transit beneficiaries does not appear to be updated to the 2012 A&M set of assumptions, based on our review of the test lives (outstanding status unconfirmed).

The charts on the following pages show the details of our replication, both in aggregate and by employer group.

NYCERS COMPARISON OF AGGREGATE RESULTS ($MILLIONS)

	Office of the Actuary		Gabriel, Roeder, Smith & Company		Tolerance Test	
	Liabilities	Count	Liabilities	Count	Individual	Total
1. Present Value of Benefits						
a. Actives	45,208	187,114	44,417	187,114	-1.75%	-0.95%
b. Inactives	845	16,353	864	16,353	2.22%	0.02%
c. Terminated Vested	625	8,880	638	8,880	2.02%	0.02%
d. Retirees	35,013	137,987	34,809	137,987	-0.58%	-0.25%
e. Loads	239		239		0.00%	0.00%
f. VSF	1,022		1,022		0.00%	0.00%
g. Total	82,953	350,334	81,989	350,334	-1.16%	-1.16%
2. Present Value of Future Salary	115,207		115,069		-0.12%	-0.12%
3. Present Value of Future Employee Contribution	2,826		2,824		-0.08%	-0.08%
4. Present Value of Future Employer Normal Costs						
a. Actives	12,516		12,380		-1.08%	-1.07%
b. VSF	156		156		0.00%	0.00%
c. Total	12,672		12,536		-1.07%	-1.07%
5. Actuarial Accrued Liability						
a. Actives (1.a. - 4.a.)	29,866		29,213		-2.19%	-0.97%
b. Inactives (1.b.)	845		864		2.22%	0.03%
c. Terminated Vested (1.c.)	625		638		2.02%	0.02%
d. Retirees (1.d.)	35,013		34,809		-0.58%	-0.30%
e. Loads (1.e.)	239		239		0.00%	0.00%
f. VSF (1.f. - 4.b.)	866		866		0.00%	0.00%
g. Total	67,455		66,629		-1.22%	-1.22%
h. Total - Net of Retirees	32,442		31,820		-1.92%	-0.92%
6. Development of Normal Cost						
a. Present Value Future NC ER	12,672		12,536		-1.07%	
b. Present Value Future Salary	115,207		115,069		-0.12%	
c. Salary - Time 0.5	12,277		12,270		-0.06%	
d. Projected Present Value Future Salary	103,338		103,207		-0.13%	
e. Normal Cost Percent	12.263%		12.147%		-0.95%	
f. Salary - Time 1.5	12,089		12,082		-0.06%	
g. Normal Cost (Unallocated)						
h. Normal Cost (Allocated)	1,482		1,468		-1.00%	
7. Assets						
a. Market Value of Assets	42,655		42,655		0.00%	0.00%
b. Actuarial Value of Assets	44,677		44,677		0.00%	0.00%
c. PV 1-Year Adj Employer Contrib	1,412		1,412		0.00%	0.00%
d. Administrative Expense	101		104		3.59%	0.01%
e. Valuation Assets (c. + d. + e.)	46,189		46,193		0.01%	0.01%
8. Assets (VSF)						
a. Market Value of Assets	36		36		0.00%	0.00%
b. Variable Assets	-		-			
c. Actuarial Value of Assets	38		38		0.00%	0.00%
9. Unfunded Actuarial Accrued Liability Bases						
a. Preliminary Unfunded June 30, 2012	21,228		20,398		-3.91%	-3.91%
b. 1. Experience (G)/L	(122)		(122)		0.00%	0.00%
2. Adjustment for ERI	21,105		20,276		-3.93%	-3.91%
3. Total Experience (G)/L	122		122		0.00%	0.00%
c. Experience (G)/L, June 30, 2012						
d. Total	21,228		20,398		-3.91%	-3.91%
10. Components of Contribution						
a. Entry Age Normal Cost	1,482		1,468		-1.00%	-0.48%
b. Initial UAAL Contribution	1,610		1,550		-3.72%	-1.93%
c. Subsequent UAAL Contribution	(35)		(34)			
d. Administrative Expenses	57		57		0.00%	0.00%
e. Total (Pension Expense)	3,114		3,040		-2.37%	-2.37%

NYCERS COMPARISON OF CONTRIBUTIONS BY OBLIGOR

Obligor	Computed FY 2014 Contribution		Difference
	OA Computation	GRS Computation	
New York City Transit Authority	729,092,823	696,873,603	-4.4%
New York City Housing Authority	156,387,455	153,335,585	-2.0%
New York City Health and Hospitals Corporation	435,677,527	421,406,363	-3.3%
Triborough Bridge and Tunnel Authority	33,936,105	32,683,550	-3.7%
New York City Off-Track Betting Corporation	10,725,157	10,683,464	-0.4%
New York City Housing Development Corporation	1,691,074	1,654,153	-2.2%
New York City School Contruction Authority	1,504,475	1,456,118	-3.2%
New York City Residential Mortgage Insurance Corporation	N/A	N/A	0.0%
State Judiciary Employees	1,060,813	991,321	-6.6%
New York City Municipal Water Authority	140,670	138,829	-1.3%
City University of New York Senior Colleges	35,855,239	34,699,558	-3.2%
All Others	1,707,996,818	1,686,487,332	-1.3%
Total	3,114,068,157	3,040,409,878	-2.4%

TRS

During the contribution audit for TRS, GRS was able to replicate the OA's computation of total present value of benefits, accrued liabilities, actuarial value of assets, unfunded actuarial accrued liabilities and employer contributions within tolerances. While a couple of items failed one of the two tests, no items failed both tests. This indicates that all items passed our tolerance tests.

We had two findings from the first engagement. The test lives we reviewed for the second engagement indicate that both of these findings are still outstanding.

1. Service for members appears to be rounded on the valuation data. We recommend using exact years and months of service. This affects the computation of entry age, as well as the computation of benefits.
2. Probabilities of termination for members with 20 or more years of service appear to be rounded to the nearest 1%. Probabilities of termination provided to GRS by the OA were less than 1%. GRS used the probabilities provided to the precision provided. This resulted in a significant difference between the present value of benefits for future deferred vested members (current actives, vested deferred decrement) between the OA computation and the GRS computation. We recommend the OA review the probabilities actually used in the valuation.

We have no additional findings from the second engagement, but have provided some suggestions in the Executive Summary for the OA to consider regarding the accounting of the TDA Fixed Funds in the development of the Actuarial Value of Assets.

The charts on the following pages show the details of our replication.

TRS COMPARISON OF RESULTS ($MILLIONS)

	Office of the Actuary		Gabriel, Roeder, Smith & Company		Tolerance Test	
	Liabilities	Count	Liabilities	Count	Individual	Total
Retirees Receiving Benefits						
Pension	33,073		32,825		-0.75%	-0.35%
Supplemental Benefits	2,502		2,513		0.44%	0.02%
Total Retirees Receiving Benefits Liability	35,575	76,359	35,338	76,350	-0.67%	-0.33%
Actives, Inactives and Terminated Vesteds						
Service Retirements	30,689		30,491		-0.64%	-0.28%
Ordinary Disability	650		639		-1.71%	-0.02%
Accidental Disability	185		183		-0.92%	0.00%
Ordinary Death	320		320		-0.06%	0.00%
Accidental Death	-		-		0.00%	0.00%
Vested & Deferred Retirements	1,328		1,099		-17.23%	-0.32%
Return of Contributions & Misc Liabilities	41		27		0.00%	-0.02%
Active Total	33,213	112,460	32,759	112,460	-1.37%	-0.63%
Inactives	363	9,689	353	9,689	-2.64%	-0.01%
Terminated Vested	672	9,868	668	9,868	-0.54%	-0.01%
Total Active/Inactive Liabilities without loads	34,248	132,017	33,781	132,017	-1.36%	-0.65%
Loads						
Coverages	35		35		0.00%	0.00%
Nager II Load	75		75		0.00%	0.00%
World Trade Center (WTC)	6		6		0.00%	0.00%
Reserve for Loan Insurance	1		1		0.00%	0.00%
Accum EE Cont Adj	115		115		0.00%	0.00%
Var Acct Balances	1,413		1,413		0.00%	0.00%
Annuitization of VFAB	369		369		0.00%	0.00%
Total	2,014		2,014		0.00%	0.00%
Total Present Value of Benefits	71,837		71,133		-0.98%	-0.98%
Actuarial Accrued Liability						
Actives	20,159		19,672		-2.42%	-0.83%
Inactives	363		353		-2.64%	-0.02%
Terminated Vested	672		668		-0.54%	-0.01%
Retirees	35,575		35,338		-0.67%	-0.40%
Loads	2,014		2,014		0.00%	0.00%
Total Actuarial Accrued Liability	58,783		58,046		-1.25%	-1.25%

TRS COMPARISON OF RESULTS ($MILLIONS)

	Office of the Actuary		Gabriel, Roeder, Smith & Company		Tolerance Test	
	Liabilities	Count	Liabilities	Count	Individual	Total
Development of Normal Cost						
Actives						
PresentValueFut EE Cont.	1,270		1,287		1.33%	
PresentValueFut N/C_Er	11,783		11,800		0.15%	
PresentValueFutureSalary	95,183		96,161		1.03%	
Salary - Time 0.5 (Expected Pay Paid)	7,961		7,964		0.03%	
Projected PresentValueFutureSalary	87,487		88,197		0.81%	
Normal Cost Percent (ER Only)	13.47%		13.38%		-0.67%	
Salary - Time 1.5 (projected ex pay paid)	7,968		7,968		0.00%	
Normal Cost - Actives	1,073		1,066		-0.67%	
Normal Cost - Total	1,073		1,066		-0.67%	
Assets						
Assets (Main Fund)						
AVA	33,871		33,871		0.00%	
PV 1 -Year Adj Employer Contributions	1,035		1,035		0.00%	
PV Administrative Expense Reimb	71		71			
Due to/from TDA	(305)		(305)		0.00%	
Total Main Fund Valuation Assets	34,672		34,672		0.00%	
Contribution Development						
Unfunded Actuarial Accrued Liability	24,111		23,374		-3.06%	
Amortization Factor						
Amortization UAAL Payment	1,887		1,829		-3.06%	-1.92%
Administrative Expenses	39		39		0.00%	0.00%
Entry Age Normal Cost	1,073		1,066		-0.67%	-0.24%
Total Contribution	2,999		2,895		-3.46%	-3.46%

BERS

During the contribution audit for BERS, GRS was able to replicate the OA's computation of total present value of benefits, accrued liabilities, actuarial value of assets, unfunded actuarial accrued liabilities and employer contributions within tolerances. While a couple of items failed one of the two tests, no items failed both tests. This indicates that all items passed our tolerance tests.

We had six findings from the first engagement. The test lives we reviewed for the second engagement indicate that the following findings are still outstanding.

1. 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).
2. Tier II 55/25 optional plan members are valued using the old retirement pattern (pre-2012 A&M). We recommend the retirement pattern be updated for these members.
3. The OA does not believe the service information is reliable due to the number of part time members and the inability of BERS to provide complete information regarding part time members. Therefore the OA assigns one year of service for each plan year that the member is reported as active. Membership dates are contained on the file. GRS used the membership date to test the reasonability of the integral service used by the OA and determined that the integral service used by the OA was reasonably reflective of the elapsed time between membership date and valuation date. Although the benefit is based on actual service and annualized pay, the OA models benefits in the valuation using annualized service and actual (part time) pay due to the reliability of reported service. We agree that this process provides a reasonable approximation. We recommend the OA continue to work with BERS to obtain better data for part time members.

BERS COMPARISON OF RESULTS ($MILLIONS)

	Office of the Actuary		Gabriel, Roeder, Smith & Company		Tolerance Test	
	Liabilities	**Count**	**Liabilities**	**Count**	**Individual**	**Total**
Retirees Receiving Benefits						
Total Pension	1,593	14,874	1,586	14,874	-0.43%	-0.14%
Total Supplemental Benefits	211		216		1.99%	0.08%
Taxed Deferred Annuities						
Total Retirees Receiving Benefits Liability	1,805		1,802		-0.14%	-0.05%
Actives, Inactives and Terminated Vesteds						
Service Retirements	2,695		2,689		-0.22%	-0.12%
Ordinary Disability	200		196		-1.75%	-0.07%
Accidental Disability	12		12		-1.69%	0.00%
Ordinary Death	67		65		-3.30%	-0.04%
Accidental Death	-		-		0.00%	0.00%
Vested & Deferred Retirements	127		135		6.54%	0.17%
Return of Contributions & Misc Liabilities	7		8		0.00%	0.02%
Active Total	3,107	27,840	3,105	27,840	-0.08%	-0.05%
Inactives	86	3,305	87	3,305	0.81%	0.01%
Terminated Vested	11	184	11	184	-2.63%	-0.01%
Total Active/Inactive Liabilities without loads	3,205	31,329	3,203	31,329	-0.07%	-0.04%
Loads						
World Trade Center (WTC)	1		1		0.00%	0.00%
Reserve for Loan Insurance	0		0		0.00%	0.00%
Accumulated EE Contribution Adjustment	15		15		0.00%	0.00%
Variable Account Balances	2		2		0.00%	0.00%
Annuitization of VFAB	-		-			
Total	18		18		0.00%	0.00%
Total Present Value of Benefits	5,028		5,023		-0.09%	-0.09%
Actuarial Accrued Liability						
Actives	1,842		1,811		-1.70%	-0.83%
Inactives	86		87		0.81%	0.02%
Terminated Vested	11		11		-2.63%	-0.01%
Retirees	1,805		1,802		-0.14%	-0.07%
Loads	18		18		0.00%	0.00%
Total Actuarial Accrued Liability	3,763		3,730		-0.89%	-0.89%

BERS COMPARISON OF RESULTS ($MILLIONS)

	Office of the Actuary		Gabriel, Roeder, Smith & Company		Tolerance Test	
	Liabilities	Count	Liabilities	Count	Individual	Total
Development of Normal Cost						
Actives						
PresentValueFut EE Cont.	224		226		0.67%	
PresentValueFut N/C_Er	1,041		1,068		2.62%	
PresentValueFutureSalary	9,685		9,701		0.17%	
Salary - Time 0.5 (Expected Pay Paid)	996		997		0.08%	
Projected PresentValueFutureSalary	8,721		8,704		-0.19%	
Normal Cost Percent (ER Only)	11.93%		12.27%		2.82%	
Salary - Time 1.5 (projected ex pay paid)	982		982		0.00%	
Normal Cost - Total	117		121		2.83%	
Assets						
AVA	2,372		2,372		0.00%	
PV 1 -Year Adj Employer Contributions	103		103		0.00%	
Admin Expenses	19		19			
Due (To)/From TDA	28		28			
Total Valuation Assets	2,521		2,521		0.00%	
Contribution Development						
Unfunded Actuarial Accrued Liability	1,242		1,209		-2.70%	
Amortization Factor						
Amortization UAAL Payment	87		85		-2.63%	-1.07%
Administrative Expenses	10		10		0.00%	0.00%
Entry Age Normal Cost	117		121		2.83%	1.54%
Total Contribution	215		216		0.47%	0.47%

POLICE

During the contribution audit for POLICE, GRS was able to replicate the OA's computation of total present value of benefits, normal costs and accrued liabilities within tolerances. GRS was also able to replicate the OA's computation of the employer contributions within tolerances. No area failed both the individual and the aggregate tolerance test.

Although GRS replicated the OA's computation of normal costs within tolerances, we did have some difficulty with this component. 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.

We have the following findings for the POLICE contribution audit (all of which were identified during the first engagement and are still outstanding):

1. Review the method for determining liabilities for deferred vested members. For members already terminated, the OA assumes that benefit commencement will occur in accordance with the retirement pattern for active members. However, for future deferred members, the OA assumes that benefits will commence upon first eligibility. Under the OA's methods, if deferred vested experience matches the actuarial assumptions in a particular year, the valuation calculations will show a gain even though no gain occurred. We recommend the OA make the assumed commencement of benefits the same for current deferred members and future deferred members.
2. It has been GRS' experience that uniformed members who quit before retirement eligibility typically commence benefits upon first eligibility. Absent POLICE definitive experience to the contrary, we recommend the OA assume deferred benefits will commence upon first eligibility. The GRS calculation for deferred members was based on commencement of benefits upon first eligibility.
3. We recommend the OA review the development of the RASF (required member contribution) used on the entry age pass and update accordingly.

POLICE COMPARISON OF RESULTS ($MILLIONS)

	Office of the Actuary		Gabriel, Roeder, Smith & Company		Tolerance Test	
	Liabilities	Count	Liabilities	Count	Individual	Total
Retirees Receiving Benefits						
SubChapter Two	$20,840	46,441	$20,831	46,441	-0.04%	-0.02%
SubChapter One	1	197	1	197	0.00%	0.00%
Total Pension	20,841	46,638	20,832	46,638	-0.04%	-0.02%
SubChapter Two Supplemental	2,339		2,307		-1.37%	-0.06%
SubChapter One Supplemental	2		2		0.00%	0.00%
Total Supplemental Benefits	2,341		2,309		-1.37%	-0.06%
Total Retirees Receiving Benefits Liability	23,182		23,141		-0.18%	-0.08%
Actives, Inactives and Terminated Vesteds						
Service Retirements	15,931		15,894		-0.23%	-0.07%
Ordinary Disability	596		603		1.17%	0.01%
Accidental Disability	7,048		6,902		-2.07%	-0.27%
Ordinary Death	131		136		3.82%	0.01%
Accidental Death	55		53		-3.64%	0.00%
Vested & Deferred Retirements	287		273		-4.88%	-0.03%
Return of Contributions & Misc Liabilities	2		2		0.00%	0.00%
Active Total	24,050	34,240	23,863	34,240	-0.78%	-0.35%
Inactives	89	1,358	86	1,358	-3.37%	-0.01%
Terminated Vested	94	746	100	746	6.38%	0.01%
Total Active/Inactive Liabilities without loads	24,233	36,344	24,049	36,344	-0.76%	-0.34%
VSFs						
Active	2,391		2,411		0.84%	0.04%
Retired	3,585		3,527		-1.62%	-0.11%
Total	5,976		5,938		-0.64%	-0.07%
Loads						
World Trade Center (WTC)	209		209		0.00%	0.00%
Transfer	-		-		0.00%	0.00%
Reserve for Loan Insurance	4		4		0.00%	0.00%
RITHP Fix	-		-			
Accum EE Cont Adj	22		22		0.00%	0.00%
Total	235		235		0.00%	0.00%
Total Present Value of Benefits	53,626		53,363		-0.49%	-0.49%
Actuarial Accrued Liability						
Actives	14,006		13,761		-1.75%	-0.57%
Inactives	89		86		-3.37%	-0.01%
Terminated Vested	94		100		6.38%	0.01%
Retirees	23,182		23,141		-0.18%	-0.10%
Loads	235		235		0.00%	0.00%
VSF Active	1,622		1,613		-0.55%	-0.02%
VSF Retired	3,585		3,527		-1.62%	-0.14%
Total VSF	5,207		5,140		-1.29%	-0.16%
Total Actuarial Accrued Liability	42,813		42,463		-0.82%	-0.82%

POLICE COMPARISON OF RESULTS ($MILLIONS)

	Office of the Actuary		Gabriel, Roeder, Smith & Company		Tolerance Test	
	Liabilities	Count	Liabilities	Count	Individual	Total
Development of Normal Cost						
Actives						
PresentValueFut N/C_Er	9,519		9,033		-5.11%	
PresentValueFutureSalary	30,671		30,248		-1.38%	
Salary - Time 0.5 (Expected Pay Paid)	3,453		3,451		-0.06%	
Projected PresentValueFutureSalary	27,333		26,797		-1.96%	
Normal Cost Percent (ER Only)	34.83%		33.71%		-3.21%	
Salary - Time 1.5 (projected ex pay paid)	3,387		3,385		-0.06%	
Normal Cost - Actives	1,180		1,141.05		-3.26%	
VSF						
PresentValueFutN/C_Er	769		797		3.64%	
PresentValueFutureSalary	30,671		30,248		-1.38%	
Salary - Time 0.5	3,453		3,451		-0.06%	
Projected PresentValueFutureSalary	27,333		26,797		-1.96%	
Normal Cost Percent	2.81%		2.97%		5.71%	
Salary - Time 1.5	3,387		3,385		-0.06%	
Normal Cost - VSF	95		101		5.65%	
Normal Cost - Total	1,275		1,242		-2.60%	
Assets						
Assets (Main Fund)						
AVA	26,777		26,777		0.00%	
PV 1 -Year Adj Employer Contributions	1,306		1,306		0.00%	
PV AdminExp Reimb in Future	35		35		0.00%	
Total Main Fund Valuation Assets	28,118		28,118		0.00%	
Assets (VSFs)						
PSOVSF	222		222		0.00%	
POVSF	575		575		0.00%	
Total Actuarial Value of VSF Fund	797		797		0.00%	
Contribution Development						
Unfunded Actuarial Accrued Liability	13,898		13,548		-2.52%	
Amortization Factor						
Amortization UAAL Payment	1,027		1,001		-2.52%	-1.11%
Admin	19		19		0.00%	0.00%
Entry Age Normal Cost	1,275		1,242		-2.60%	-1.43%
Total Contribution	2,321		2,262		-2.54%	-2.54%

FIRE

During the contribution audit for FIRE, GRS was able to replicate the OA valuation results well within our tolerances. We matched the OA results within our aggregate tolerances in every category. In addition, we matched the OA results within our individual tolerances in all but three categories.

The chart on the following page shows the details of this replication.

GRS has found no material issues in the FIRE contribution audit. Most of the differences between the OA calculations and the GRS calculations are attributable to differences in how age and service were rounded within the calculations. These differences were mostly offsetting in aggregate, but they result in material differences in some of the test case lives we reviewed. The difference in the rounding of service can be seen in test life comparisons predominately in the vesting decrement.

We have the following recommendations specific to FIRE (all of which were identified during the first engagement and are still outstanding):

1. Review the method for determining liabilities for deferred vested members. For members already terminated, the OA assumes that benefit commencement will occur in accordance with the retirement pattern for active members. However, for future deferred members, the OA assumes that benefits will commence upon first eligibility. Under the OA's methods, if deferred vested experience matches the actuarial assumption in a particular year, the valuation calculations will show a gain even though no gain occurred. We recommend the OA make the assumed commencement of benefits the same for current deferred members and future deferred members.
2. It has been GRS' experience that uniformed members who quit before retirement eligibility typically commence benefits upon first eligibility. We recommend the OA assume deferred benefits will commence upon first eligibility. The GRS calculation for deferred members was based on commencement of benefits upon first eligibility. GRS' calculation of liabilities for current deferred members was approximately 16% higher than the OA's as a result of the differences in assumed commencement date.
3. We recommend the OA include the liabilities for "other service." This service is currently reported on the data file. Although there are not a significant number of members with this service, it does not add any significant complications to the valuation model and is fairly simple to model.
4. We recommend that the OA review the modeling of the Auto COLA for certain beneficiaries. We identified some modeling of the Auto COLA in the test lives that differed from our expectations.

FIRE COMPARISON OF RESULTS ($MILLIONS)

	Office of the Actuary		Gabriel, Roeder, Smith & Company		Tolerance Test	
	Liabilities	Count	Liabilities	Count	Individual	Total
Retirees Receiving Benefits						
SubChapter Two	$9,355	16,454	$9,359	16,454	0.04%	0.02%
SubChapter One	5	463	5	463	0.00%	0.00%
Total Pension	9,360	16,917	9,364	16,917	0.04%	0.02%
SubChapter Two Supplemental	903		886		-1.88%	-0.08%
SubChapter One Supplemental	7		7		0.00%	0.00%
Total Supplemental Benefits	910		893		-1.87%	-0.08%
Total Retirees Receiving Benefits Liability	10,270		10,257		-0.13%	-0.06%
Actives, Inactives and Terminated Vesteds						
Service Retirements	2,750		2,740		-0.38%	-0.05%
Ordinary Disability	663		657		-0.97%	-0.03%
Accidental Disability	6,082		6,004		-1.28%	-0.37%
Ordinary Death	93		96		2.46%	0.01%
Accidental Death	90		87		-3.99%	-0.02%
Vested & Deferred Retirements	29		29		-0.69%	0.00%
Return of Contributions & Misc Liabilities	-		-		0.00%	0.00%
Active Total	9,708	10,267	9,612	10,267	-0.99%	-0.46%
Inactives	4	12	5	12	9.52%	0.00%
Terminated Vested	4	30	5	30	23.81%	0.00%
Total Active/Inactive Liabilities without loads	9,716	10,309	9,622	10,309	-0.98%	-0.45%
VSFs						
Active	465		469		0.95%	0.02%
Retired	579		584		0.83%	0.02%
Total	1,044		1,053		0.88%	0.04%
Loads						
World Trade Center (WTC)	36		36		0.00%	0.00%
Transfer	-		-		0.00%	0.00%
Reserve for Loan Insurance	1		1		0.00%	0.00%
Accum EE Cont Adj	(102)		(102)		0.00%	0.00%
Total	(65)		(65)		0.00%	0.00%
Total Present Value of Benefits	20,966		20,867		-0.47%	-0.47%
Actuarial Accrued Liability						
Actives	5,967		5,927		-0.67%	-0.23%
Inactives	4		5		9.52%	0.00%
Terminated Vested	4		5		23.81%	0.01%
Retirees	10,270		10,257		-0.13%	-0.08%
Loads	(65)		(65)		0.00%	0.00%
VSF Active	315		313		-0.57%	-0.01%
VSF Retired	579		584		0.83%	0.03%
Total VSF	894		897		0.34%	0.02%
Total Actuarial Accrued Liability	17,075		17,026		-0.28%	-0.28%

FIRE COMPARISON OF RESULTS ($MILLIONS)

	Office of the Actuary		Gabriel, Roeder, Smith & Company		Tolerance Test	
	Liabilities	Count	Liabilities	Count	Individual	Total
Development of Normal Cost						
Actives						
PresentValueFut N/C_Er	3,629		3,563		-1.82%	
PresentValueFutureSalary	10,940		10,885		-0.50%	
Salary - Time 0.5 (Expected Pay Paid)	1,105		1,103		-0.18%	
Projected PresentValueFutureSalary	9,872		9,782		-0.91%	
Normal Cost Percent (ER Only)	36.76%		36.42%		-0.92%	
Salary - Time 1.5 (projected ex pay paid)	1,100		1,098		-0.18%	
Normal Cost - Actives	404		400		-1.10%	
VSF						
PresentValueFutN/C_Er	150		157		4.67%	
PresentValueFutureSalary	10,940		10,885		-0.50%	
Salary - Time 0.5	1,105		1,103		-0.18%	
Projected PresentValueFutureSalary	9,872		9,782		-0.91%	
Normal Cost Percent	1.52%		1.60%		5.63%	
Salary - Time 1.5	1,100		1,098		-0.18%	
Normal Cost - VSF	17		18		5.44%	
Normal Cost - Total	421		418		-0.84%	
Assets						
Assets (Main Fund)						
AVA	8,521		8,521		0.00%	
PV 1 -Year Adj Employer Contributions	419		419		0.00%	
Total Main Fund Valuation Assets	8,940		8,940		0.00%	
Assets (VSFs)						
FOVSF	277		277		0.00%	
FFVSF	439		439		0.00%	
Total Actuarial Value of VSF Fund	716		716		0.00%	
Contribution Development						
Unfunded Actuarial Accrued Liability	7,419		7,370		-0.66%	
Amortization Factor						
Amortization UAAL Payment	549		545		-0.66%	-0.37%
Entry Age Normal Cost	421		418		-0.84%	-0.36%
Total Contribution	970		963		-0.73%	-0.73%