PROPOSED CHANGES IN ACTUARIAL ASSUMPTIONS AND METHODS FOR DETERMINING EMPLOYER CONTRIBUTIONS FOR FISCAL YEARS BEGINNING ON AND AFTER JULY 1, 2011 FOR THE NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

OFFICE OF THE ACTUARY

February 10, 2012

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ROBERT C. NORTH, JR.
CHIEF ACTUARY

February 10, 2012

Retirement Board
New York City Teachers'
Retirement System
55 Water Street, 16th Floor
New York, NY 10041

Re: Actuarial Assumptions and Methods

Dear Members:

This Report presents Proposed Changes in Actuarial Assumptions and Methods for Determining Employer Contributions for Fiscal Years Beginning on and After July 1, 2011 for the New York City Teachers' Retirement System.

I will be pleased to discuss this Report and answer any questions you may have with regard to these findings and proposals.

Respectfully Submitted,

Robert C. North, Jr., FSA, MAAA
Chief Actuary

RCN/bs

Att.

cc: Mr. J.R. Gibney
Mr. S.H. Rumley
Mr. N. Serrano

8205A&M-TRS:bs

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ACRONYMS

Following is a listing of acronyms used throughout this Report.

Actuarial Accrued Liability.....AAL

Actuarial Asset Valuation Method.....AAVM

Actuarial Asset Value.....AAV

Actuarial Cost Method.....ACM

Actuarial Interest Rate.....AIR

Actuarial Present Value.....APV

Actuarial Present Value of Benefits.....APVB

Actuarial Standard of Practice.....ASOP

Actuarial Standard of Practice Number 27.....ASOP27

Actuarially–Determined Contribution.....ADC

Administrative Code of the City of New York.....ACNY

American Statistical Association.....ASA

Annual Required Contribution.....ARC

Annuity Savings Fund.....ASF

City of New York.....City

Consumer Price Inflation.....CPI

Cost-of-Living Adjustments.....COLA

Economic Funded Ratio.....EFR

Employer Normal Contribution Rate.....ENCR

Entry Age Actuarial Cost Method.....EAACM

Expected Investment Returns.....EIR

ACRONYMS

Final Salary.....FS

Final Average Salary.....FAS

Frozen Initial Liability.....FIL

Gabriel, Roeder, Smith & Company.....GRS

General Wage Increases.....GWI

Governmental Accounting Standards Board.....GASB

Group Term Life Insurance.....GTLI

Increased-Take-Home-Pay.....ITHP

Increasing Dollar Payments.....IDP

KPMG Peat Marwick.....KPMG

Level Dollar Payments.....LDP

Market Value of Assets.....MVA

Market Value-related Accumulated Benefit Obligation....MVABO

National Bureau of Economic Research.....NBER

New York City Board of Education Retirement System.....BERS

New York City Employees’ Retirement System.....NYCERS

New York City Fire Department Pension Fund.....FIRE

ACRONYMS

New York City Police Pension Fund.....POLICE

New York City Retirement Systems.....NYCRS

New York City Teachers' Retirement System.....TRS

New York State and Local Retirement Systems.....NYSLRS

New York State Teachers' Retirement System.....NYSTRS

Office of the Actuary.....OA

One-Year Lag Methodology.....OYLM

Price/Earnings.....P/E

Public Employment Relations Board.....PERB

Public Employee Retirement Systems.....PERS

Society of Actuaries.....SOA

Standard and Poor's 500 Stock Index.....S&P 500

Statement of Actuarial Opinion.....SAO

The Hay Group.....Hay

The Segal Company.....Segal

Unexpected Investment Returns.....UIR

Unfunded Actuarial Accrued Liability.....UAAL

Variable Annuity Funds.....VAF

Watson Wyatt and Company.....Wyatt

World Trade Center.....WTC

PROPOSED CHANGES IN ACTUARIAL ASSUMPTIONS AND METHODS FOR DETERMINING EMPLOYER CONTRIBUTIONS FOR FISCAL YEARS BEGINNING ON AND AFTER JULY 1, 2011 FOR THE NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

SECTION I - EXECUTIVE SUMMARY

In accordance with the Administrative Code of the City of New York ("**ACNY**") and with appropriate practice, the Boards of Trustees of the five actuarially-funded New York City Retirement Systems ("**NYCRS**")[1] are to periodically review and adopt actuarial assumptions for use in the determination of employer contributions.

This Report proposes, as a **package**, changes to certain actuarial assumptions and methods to be used to determine employer contributions payable to the New York City Teachers' Retirement System ("**TRS**") for Fiscal Years beginning on and after July 1, 2011 (i.e., beginning Fiscal Year 2012).

[1] New York City Employees' Retirement System ("**NYCERS**")
New York City Teachers' Retirement System ("**TRS**")
New York City Board of Education Retirement System ("**BERS**")
New York City Police Pension Fund ("**POLICE**")
New York City Fire Department Pension Fund ("**FIRE**")

These proposals have been designed to provide for responsible financing of **TRS** reasonably consistent with the concepts of intergenerational equity. These proposals are appropriate for determining annual employer contributions to **TRS** but are not necessarily appropriate for determining the economic value of benefits, the value of benefit revisions or other purposes.

This Report reflects the best judgment of the Actuary regarding the appropriate financing of **TRS** and takes into account the two most recent actuarial experience studies and recommendations prepared by The Segal Company (**"Segal"**) in their Report dated November 2006 (**"Segal Report"**) and The Hay Group (**"Hay"**) in their Report dated December 2011 (**"Hay Report"**).

This Report also reflects the best judgment of the Actuary regarding the appropriate financing of the benefits provided under legislation associated with the September 11, 2011 attack on the World Trade Center (**"WTC"**) (i.e., Chapter 104 of the Laws of 2005 ("**Chapter 104/05**") as amended by Chapter 93 of the Laws of 2005 ("**Chapter 93/05**"), Chapter 445 of the Laws of 2006 (**"Chapter 445/06"**) as amended by Chapter 5 of the Laws of 2007 (**"Chapter 5/07"**) and Chapter 489 of the Laws of 2008 (**"Chapter 489/08"**)). Individually and collectively, as applicable, these laws are referred to in this Report as the "**WTC Laws**".

In developing this **package** of actuarial assumptions and methods the Actuary has given more weight to the **Hay Report** with respect to demographic and economic assumptions. This is due to the fact that **Hay** had four additional years of actuarial and economic experience to consider in developing their recommendations.

However, in reviewing the Actuarial Cost Method (**"ACM"**), the Actuary has given particular consideration to the **Segal** recommendation (i.e., applying the Entry Age Actuarial Cost Method (**"EAACM"**)) for determining annual employer contributions.

The Actuary generally agrees with most of the recommendations made by **Hay** on demographic and merit salary increase assumptions, but has refined those recommendations where the Actuary either believes that future experience may differ from that of the experience period or desires to smooth some of the recommended values.

The Actuary also generally agrees with the ranges recommended by **Hay** for the various economic assumptions. In particular, the Actuary notes that one of the most significant proposals to be made is that for the Actuarial Interest Rate (“**AIR**”) assumption.

In order to arrive at an appropriate **AIR** assumption for **TRS**, the Actuary has reviewed (1) recent, actual investment performance of all five actuarially-funded **NYCRS**, (2) longer-term historical performance of the U.S. capital markets, (3) likely expectations for future investment performance of the assets of **TRS** and (4) the relationships among the economic assumptions used for actuarial valuation purposes.

In summary, and subject to the qualifications and actions discussed later in this Section and to continued review of certain detailed accounting and technical requirements, the Actuary proposes the following actions with respect to the current actuarial assumptions and methods of **TRS** for determining employer contributions for Fiscal Years beginning on and after July 1, 2011 (i.e., Fiscal Year 2012).

Demographic Assumptions

The Actuary proposes the following actions with respect to demographic assumptions:

- Active Service Withdrawal: Revise the probabilities of active service Withdrawal to modestly increase the expected number of such withdrawals for members with less than five years of service based on the experience outlined in the **Hay Report** and to more closely reflect the experience expected by the Actuary.

- Active Service Ordinary Mortality: Retain the probabilities of active service Ordinary Mortality based on the experience outlined in the **Hay Report** and on the experience expected by the Actuary.

- Active Service Accidental Mortality: Retain the current probabilities of zero percent.

- Active Service Ordinary Disability: Revise the current probabilities of active service Ordinary Disability for males and females to generally reduce the expected number of such disabilities at younger ages and at older ages and to generally increase the number of such disabilities otherwise, based on the experience outlined in the **Hay Report** and on the experience expected by the Actuary.

- Active Service Accidental Disability: Revise the current probabilities of active service Accidental Disability to modestly increase the number of such disabilities at certain ages, based on the experience outlined in the **Hay Report** and on the experience expected by the Actuary.

- Service Retirement: For those members who do not elect an optional retirement program, revise the probabilities of Service Retirement in the first year of eligibility to generally increase the expected number of such retirements based on experience outlined in the **Hay Report** and to more closely reflect the experience expected by the Actuary.

  For those members who do not elect an optional retirement program, revise the probabilities of Service Retirement in the second year of eligibility to generally reduce the expected number of such retirements.

  For those members who do not elect an optional retirement program, revise the probabilities of Service Retirement after the second year of eligibility to generally reduce the expected number of such retirements in later years.

  For those members who elect an optional retirement program, revise the probabilities of Service Retirement in the first year of eligibility to decrease the expected number of such retirements at earlier ages and increase them at later ages based on experience outlined in the **Hay Report** and to more closely reflect the experience expected by the Actuary.

  For those members who elect an optional retirement program, revise the probabilities of Service Retirement in the second year of eligibility to generally reduce the expected number of such retirements.

For those members who elect an optional retirement program, revise the probabilities of Service Retirement after the second year of eligibility to generally reduce the expected number of such retirements in later years.

- Post-Retirement Mortality: Revise the existing Base Tables and Valuation Tables to reduce the probabilities of post-retirement mortality. The Base Tables reflect the experience outlined in the **Hay Report**, adjusted to Calendar Year 2010 expectations. The Valuation Tables are adjusted to reflect the impact of expected improvements in future mortality experience to Calendar Year 2025.

Economic Assumptions

The Actuary proposes the following economic assumptions:

- Consumer Price Inflation (“**CPI**”): Retain the current **CPI** assumption at 2.5% per year.

- General Wage Increases (“**GWI**”): Retain the current **GWI** component of the Salary Scale at 3.0% per year. This retains the current expected **real** wage growth assumption of .50% per year.

- Merit Salary Increases: Revise the current Merit Increase component of the service-based Salary Scale. The revised Merit Increase component of the Salary Scale would average approximately 3.56% per year over a 25-year career versus the current 3.11% per year.

- Actuarial Interest Rate (**"AIR"**) Assumption: Reduce the current **AIR** assumption from 8.0% per annum, gross of Investment Expenses (i.e., Investment Expenses are provided for and recovered separately), to 7.0% per annum, net of Investment Expenses.

Other Actuarial Assumptions and Methods

The Actuary proposes the following other components to the proposed **package** of actuarial assumptions and methods:

- Actuarial Cost Method (**"ACM"**): Replace the Frozen Initial Liability ("**FIL**") **ACM** utilizing the Initial Liability of $0 originally established as of June 30, 1999 with the Entry Age Actuarial Cost Method (**"EAACM"**).

- Amortize over 22 years using Increasing Dollar Payments (**"IDP"**) of 3.0% per year the Unfunded Actuarial Accrued Liability (**"UAAL"**) determined under the **EAACM** as of June 30, 2010 (i.e., Initial **UAAL**).

- Amortize over 15 years using Level Dollar Payments (**"LDP"**) any future **UAAL** attributable to actuarial gains and losses.

- Amortize over periods reasonably consistent with the working lifetimes remaining of those impacted using **LDP** any future **UAAL** attributable to benefit improvements.

- Amortize over 20 years using **LDP** any future **UAAL** attributable to changes in actuarial assumptions and methods.

- Conversions into Variable Annuities at Retirement: Retain the methodology for determining the actuarial losses sustained upon conversion at retirement of all or portions of member Annuity Savings Fund (**"ASF"**) account balances and Increased-Take-Home-Pay (**"ITHP"**) Reserves into variable annuities.

- Lag Valuation: Continue the use of a **"One-Year Lag"** methodology (**"OYLM"**) in the actuarial valuation process. Under this method the census data and asset information as of the June 30 second preceding a Fiscal Year would be used to determine the employer contribution for that Fiscal Year.

- Actuarial Asset Valuation Method (**"AAVM"**): Restart the **AAVM** (i.e., set the Actuarial Asset Value (**"AAV"**) equal to the Market Value of Assets (**"MVA"**)) as of June 30, 2011.

  Set the **AAV** as of June 30, 2010 equal to the June 30, 2011 **MVA**, discounted by the **AIR** assumption (adjusted for cash flow). This recognizes as of June 30, 2010 the investment performance of the Fund during Fiscal Year 2011.

For Fiscal Years 2012 and after, continue the current factors (i.e., 15%, 15%, 15%, 15%, 20% and 20%) used to phase Unexpected Investment Returns ("**UIR**") into the **AAV** over six years.

- Administrative Expenses: Continue to recover, with interest, the Administrative Expenses paid from the Fund.

  In conjunction with the **OYLM**, this requires recovering such expenses with two years' interest during the second Fiscal Year following expenditure.

- Investment Expenses: With the use of the **AIR** assumption of 7.0% per annum, net of Investment Expenses, no longer recover these expenses explicitly.

The Actuary also proposes that enabling legislation required to implement the proposed changes and actuarial assumptions and methods provide for certain other technical clarifications such as:

- Beginning with Fiscal Year 2013 employer contributions, explicitly requiring the payment of interest on late employer contributions (i.e., contributions made after the dates determined by the Actuary and communicated to the Retirement Board).

- Providing for the Actuary to establish **UAAL** and amortization schedules consistent with the **EAACM**, where such **UAAL** are appropriate but not provided in legislation.

- If required, authorizing the release to the Retirement System of any excess accounting reserves attributable to the Group Term Life Insurance (**"GTLI"**) obligations.

Financial Impact

All estimates of employer contributions and changes in employer contributions presented in this Report have been developed using estimated Fiscal Year 2012 employer contributions.

The overall impact of implementing the proposed actuarial assumptions and methods presented in this Report would increase Fiscal Year 2012 employer contributions to **TRS** by approximately $50 million (calculated comparing a June 30, 2010 actuarial valuation based on the proposed actuarial assumptions and methods with a June 30, 2010 actuarial valuation based on current actuarial assumptions and methods).

Note: Final Fiscal Year 2012 employer contributions could differ from those shown herein due to additional contract settlements, benefit changes and/or refinements in actuarial calculations and the possible introduction of alternative actuarial valuation software.

The following paragraphs present estimates of the financial impact of various components of the proposed **package** of changes in actuarial assumptions and methods presented in this Report.

Note: Ascribing financial impact to the individual changes in actuarial assumptions and methods is dependent upon the order in which the changes are considered. Thus, the amounts shown by source should not be relied upon to estimate the impact of alternative constructions.

Absent any other changes, the proposed change in the **AIR** assumption as of June 30, 2010 would increase Fiscal Year 2012 employer contributions to **TRS** by approximately $390 million compared with employer contributions computed using the current actuarial assumptions and methods.

Based on the **AIR** assumption of 7.0% per annum, the proposed changes in certain demographic and economic assumptions would increase Fiscal Year 2012 employer contributions to **TRS** by approximately $108 million compared with employer contributions computed using the current actuarial assumptions and methods except for the **AIR** assumption of 7.0% per annum.

In addition to the proposed changes in actuarial assumptions, the proposed change in the **AAVM** as of June 30, 2010 would decrease Fiscal Year 2012 employer contributions to **TRS** by approximately $122 million compared with employer contributions computed using the proposed actuarial assumptions and current actuarial methods, including the current **AAVM**.

In conjunction with proposed changes in actuarial assumptions and the **AAVM**, the proposed change to the **EAACM**, together with amortizing the Initial **UAAL** over 22 years using **IDP** would decrease Fiscal Year 2012 employer contributions to **TRS** by approximately $326 million compared with employer contributions computed using the proposed actuarial assumptions and **AAVM** under the current **FIL ACM**.

Overall, the proposed changes in actuarial assumptions and methods would increase Fiscal Year 2012 employer contributions to **TRS** by approximately $50 million compared with employer contributions computed using the current actuarial assumptions and methods.

Requisite Actions

The following actions are required and assumed to take place in advance of, or concurrent with, the adoption of these proposed changes in actuarial assumptions and methods:

- Benefits payable under **TRS** are not changed because of the changes in actuarial assumptions or methods (e.g., interest credited to Tier I and Tier II **ASF** account balances and **ITHP** Reserves continues to be based on a rate of 8.25% per annum).

  Note, however, that if these actuarial assumptions are adopted, then **ASF** account balances and **ITHP** Reserves would continue to be credited with interest at a rate greater than the expected earnings on the Fund. This fact should be given further consideration, although separately.

- The asset allocation of **TRS** continues to include a well-diversified portfolio including at least 60% in equity securities in the Fixed Benefit Program as defined in Section VI.

- The proposed changes presented in this Report are adopted as a **package** and that no changes be made to this **package** of actuarial assumptions and methods.

- The proposed changes in actuarial assumptions and methods are implemented expeditiously. As of the June 30, 2010 measurement date the Actuary is no longer able to issue unqualified Statements of Actuarial Opinion (**"SAO"**) based on the current actuarial assumptions and methods.

As noted, the Actuary has designed the actuarial assumptions and methods presented in this Report as a balanced **package**, designed **in combination** to provide a responsible and appropriate level of funding for **TRS**.

The consideration of a change to any individual component of this proposed **package** of actuarial assumptions and methods would require a review and possible revision to some or all of the other proposed actuarial assumptions and methods.

Legislation Required

Finally, it should be noted that the proposed change to the **AIR** assumption, the continuation of **OYLM**, the change to the **EAACM,** the establishment of **UAAL** and the establishment of amortization periods and methods require approval of the New York State Legislature and the Governor to become effective.

With respect to the **AIR** assumption, legislation must specify the period for which the proposed assumption is to be effective.

Following past practice, the Actuary proposes that legislation establish the **AIR** assumption to be used to determine employer contributions for the five-year period from July 1, 2011 to June 30, 2016 (i.e., Fiscal Years 2012 to 2016).

Such legislation would reduce the **AIR** assumption from 8.0% per annum (gross of Investment Expenses) that was originally established by Chapter 125 of the Laws of 2000 (“**Chapter 125/00**”) in conjunction with an overall review of actuarial assumptions and methods to 7.0% per annum (net of Investment Expenses).

In conjunction with another overall review of actuarial assumptions and methods, the **AIR** assumption of 8.0% per annum was continued by Chapter 152 of the Laws of 2006 (“**Chapter 152/06**”) and prescribed for determining employer contributions for Fiscal Years 2006 to 2009.

Chapter 211 of the Laws of 2009 (“**Chapter 211/09**”) extended for one year only the **AIR** assumption of 8.0% per annum to determine employer contributions for Fiscal Year 2010. Chapter 265 of the Laws of 2010 (“**Chapter 265/10**”) provided a similar extension of the **AIR** assumption of 8.0% per annum to determine employer contributions for Fiscal Year 2011.

Chapter 180 of the Laws of 2011 (“**Chapter 180/11**”) provided another extension of the **AIR** assumption of 8.0% per annum to determine employer contributions for Fiscal Year 2012 in anticipation of being replaced by the **AIR** assumption proposed in this Report.

In addition to the **AIR** assumption, legislation should also specify the interest rate (currently 8.25% per annum) to use in crediting Tier I and Tier II **ASF** account balances and **ITHP** Reserves, use of the **EAACM** to determine employer contributions and the amortization periods and methods for **UAAL** developed under the **EAACM**.

Since additional review of certain technical issues may identify alternative approaches that are preferable, the Actuary requests discretion to make minor adjustments during the legislative process to the extent necessary to better implement the intent of these proposed changes in actuarial assumptions and methods.

SECTION II - BACKGROUND AND INTRODUCTION

During November 2006 **Segal** presented their "New York City Retirement Systems Experience Study Report" for Fiscal Years Ending 1988–2005.

During December 2011 **Hay** presented their "City of New York - New York City Retirement Systems Final Experience Study Report – Second Engagement" for Fiscal Years Ending 1988-2009.

In accordance with the requirements of the **ACNY,** and taking into account the results of the **Segal Report** and the **Hay Report**, the Actuary has reviewed the current actuarial assumptions and methods used to determine employer contributions.

As a result of those reviews the Actuary has concluded that the actuarial assumptions and methods currently in effect should be modified.

The major components of the proposed changes in actuarial assumptions and methods are presented in this Report.

The Actuary respectfully requests the Retirement Board act expeditiously upon them.

These assumptions would first be employed in conjunction with a June 30, 2010 actuarial valuation date to determine Fiscal Year 2012 employer contributions.

This Report presents the changes proposed by the Actuary for certain actuarial assumptions and methods for **TRS**.

If supported by the Retirement Board and if enabling legislation is enacted, these proposals may be used to satisfy the requirements of **ACNY** Section 13-638.2 for Fiscal Years beginning on and after July 1, 2011 (i.e., Fiscal Year 2012).

Section III of this Report discusses a philosophy for developing an appropriate level of employer contributions.

Section IV discusses the findings and recommendations presented primarily in the **Hay Report** but also presented in the **Segal Report**.

Section V discusses the development of demographic assumptions.

Section VI reviews the economic assumptions, including the **AIR** assumption.

Section VII discusses other actuarial assumptions and methods, including the **OYLM**, the **ACM** and the **AAVM**.

Section VIII summarizes the financial impact of the proposed changes in actuarial assumptions and methods presented in this Report.

Section IX presents the findings and proposals of this Report.

Following the Sections of this Report, Appendix A presents the rates of investment return earned by the actuarially-funded **NYCRS** for Fiscal Year 1983 through Fiscal Year 2011.

Appendix B summarizes the economic assumptions used in the actuarial valuations of **TRS** since Fiscal Year 1981.

Appendix C discusses **AIR** assumptions used by Public Employee Retirement Systems (“**PERS**”).

Appendix D presents detailed tables of the proposed demographic and salary scale assumptions being proposed by the Actuary.

Appendix E presents, for informational purposes only, a discussion of financial economics, funding and disclosure noting some of the issues currently being debated in the actuarial, accounting and investment communities that may impact financing methodologies and financial reporting for the **NYCRS** in the future.

Appendix F contains a Statement of Actuarial Opinion acknowledging the qualification of the Actuary to render the opinion contained herein.

Appendix G acknowledges the input and assistance provided to the Actuary in preparing this Report.

SECTION III - PHILOSOPHY FOR DEVELOPING AN APPROPRIATE LEVEL OF EMPLOYER CONTRIBUTIONS

A major objective of actuarial methodologies used to determine annual employer contributions is to estimate the Actuarial Present Value (**"APV"**) of Benefits (**"APVB"**) to be received by participants of a retirement system and to allocate over time the financing of those benefits.

There is no single answer to the question of what is the correct level of employer contributions. Actuaries determine contribution levels by using a combination of: (1) actuarial assumptions, (2) Actuarial Cost Methods, (3) amortization methods and periods for paying off any Unfunded Actuarial Accrued Liabilities and (4) Actuarial Asset Valuation Methods. Each of these components exerts a significant impact on the calculated level of employer contributions.

For purposes of designing the proposals in this Report, a philosophic structure has been developed to provide guidance for developing an appropriate level of employer contributions.

The philosophic structure chosen is rooted in the principles of accrual accounting where a guiding concept is that expenses of an employer should be reflected on the books of that employer during the period that those expenses are incurred.

Most authorities would concur that pensions are earned over the working lifetime of employees, and, therefore, pension expense should also be allocated over the working lifetime of employees. This is the period of time during which public employees provide services to the taxpayers.

In the case of the five actuarially-funded **NYCRS**, as with most governmental entities, there are generally no material differences between the pension expense recorded on the employers' financial statements and the actual contributions made to the Funds. In this Report references to pension expense and contributions are used interchangeably.

Under the requirements of Governmental Accounting Standards Board (“**GASB**”) Statement Number 27 (“**GASB27**”) as amended by **GASB** Statement No. 50 (**“GASB50”**), an employer participating in a cost-sharing, multiple-employer Public Employee Retirement System (“**PERS**”) is deemed to have met its employer contribution obligations by paying its contractually-required contribution to that **PERS**. For employers participating in **TRS,** the contractually-required contribution is referred to as the Statutorily-Required Contribution or Statutory Contribution.

Since Fiscal Year 2001, the employers participating in **TRS** have reported pension expense on their Financial Statements equal to their actual, Statutory Contributions. However, for Fiscal Years 2001 through 2005, these Statutory Contributions were not equal to their Actuarially-Determined Contributions (“**ADC**”), or Annual Required Contributions (“**ARC**”) in **GASB27** terminology.

The difference between the Statutory Contributions and the **ADC** or **ARC** for **TRS** is the consequence of Chapter 125 of the Laws of 2000 (“**Chapter 125/00**”) as amended by Chapter 278 of the Laws of 2002 (“**Chapter 278/02**”). These laws phased-in over 5 years and 10 years, respectively, the **APVB** attributable to the additional benefits provided by **Chapter 125/00** (i.e., automatic Cost-of-Living Adjustments (“**COLA**”)).

The proposals presented in this Report attempt to follow a basic philosophy that pension expense and employer contributions attributable to current employees should be financed, in general, over the working lifetimes of those employees. Pension expense should not deliberately be deferred to future generations. This Report refers to this concept as “intergenerational equity”.

The Actuary believes that the combined effect of all of the proposed changes in actuarial assumptions and methods presented in this Report would develop annual employer contributions that are reasonably consistent with the philosophy of intergenerational equity and provide for responsible and orderly financing of the Retirement System, while also being sensitive to participating employer financial capacity.

SECTION IV - COMMENTS ON FINDINGS AND RECOMMENDATIONS PRESENTED IN DECEMBER 2011 HAY REPORT AND NOVEMBER 2006 SEGAL REPORT

In their final experience study reports both **Hay** and **Segal** present a review of the actuarial assumptions in use for the **NYCRS** and make recommendations for changes where they believe such changes are appropriate.

The Actuary has reviewed the **Hay** and **Segal** recommendations in detail and generally agrees with most of those recommendations. Taking into account greater familiarity with the **NYCRS** (such as the implications of the legislation enacted with respect to the attack on the World Trade Center on September 11, 2001), the implications of actuarial losses (particularly, investment losses) over the last ten years and changes in expectations for future investment returns, and making judgments regarding competing priorities for additional funding needs with participating employer financial capacity, the Actuary has refined the **Hay** and **Segal** recommendations and developed the proposals for actuarial assumptions and methods presented herein.

Section V of this Report develops the Actuary’s proposals on demographic assumptions for **TRS**.

Of particular note are the decreased probabilities for post-retirement mortality and the increased expected longevity of retirees.

Section VI of this Report reviews the economic assumptions for **TRS** including, in particular, reducing the **AIR** assumption from 8.0% per annum, gross of Investment Expenses (i.e., Investment Expenses are recovered separately) to 7.0% per annum, net of Investment Expenses.

Section VII of this Report includes a discussion of the **ACM** and the Actuary’s proposal to change from the **FIL ACM** to the **EAACM**.

SECTION V - DEVELOPMENT OF DEMOGRAPHIC ASSUMPTIONS

A. Decrements from Active Service

Members in active service are subject to the following types of decrements:

- Withdrawal
- Ordinary Mortality
- Accidental Mortality
- Ordinary Disability Retirement
- Accidental Disability Retirement
- Service Retirement

The **Hay** and **Segal Reports** provide comparisons of actual experience versus expected experience over the past few years for each of these decrements.

Based upon these comparisons and upon extensive actuarial analyses, **Hay** and/or **Segal** recommended changes in the decrements from active service on account of Withdrawal, Ordinary Mortality, Ordinary and Accidental Disability and Service Retirement.

Hay and **Segal** also recommended changes in post-retirement mortality.

Following is a discussion of each of the demographic assumptions.

Withdrawal

A review of Withdrawal experience from July 1, 1988 to June 30, 2009 indicates that there were approximately 5% more Withdrawals than expected over this 21-year period.

Over the 4-year period from July 1, 2005 to June 30, 2009, there were approximately 14% more Withdrawals than expected.

Review of this data suggested to **Hay** that it would be appropriate to revise the probabilities of Withdrwal from active service.

The Actuary generally agrees with this **Hay** recommendation but has further smoothed the probabilities of Withdrawal from active service.

The following Table IA compares the current and proposed probabilities of active service Withdrawal at selected years of service:

TABLE IA

COMPARISON OF ACTIVE SERVICE DECREMENTS

Years of Service	Probabilities of Withdrawal	
	Current*	**Proposed***
0	7.50%	9.00%
1	6.50%	8.00%
2	5.80%	7.00%
3	5.15%	6.00%
4	4.55%	5.00%
5	4.00%	4.00%
10	2.00%	2.00%
15	1.25%	1.25%
20	1.00%	1.00%

* Same probabilities are used for males and females.

Ordinary Mortality - Males

A review of male active service Ordinary Mortality experience from July 1, 1988 to June 30, 2009 indicates that there were approximately 46% more Ordinary Deaths than expected over this 21-year period.

Over the 4-year period from July 1, 2005 to June 30, 2009, there were approximately 20% more Ordinary Deaths than expected.

Review of this data suggested to **Hay** that it would be appropriate to increase the probabilities of male active service Ordinary Mortality.

After reviewing the experience data, the comments and recommendations of **Hay** and applying actuarial judgment, the Actuary proposes to retain the probabilities.

Ordinary Mortality - Females

A review of female active service Ordinary Mortality experience from July 1, 1988 to June 30, 2009 indicates that there were approximately 44% more Ordinary Deaths than expected over this 21-year period.

Over the 4-year period from July 1, 2005 to June 30, 2009, there were approximately 57% more Ordinary Deaths than expected.

Review of this data suggested to **Hay** that it would be appropriate to increase the probabilities of female active service Ordinary Mortality.

After reviewing the experience data, the comments and recommendations of **Hay** and applying actuarial judgment, the Actuary proposes to retain the probabilities.

Accidental Mortality

In the past, the Actuary has utilized a probability of zero percent for active service Accidental Mortality. Review of the experience data and judgment suggest to the Actuary that it would be appropriate to use same zero percent assumption for active service Accidental Mortality.

Hay did not recommend any changes in the probabilities of active service Accidental Mortality. As noted, the Actuary believes it is appropriate to use the current probabilities.

The following Table IB compares the current and proposed probabilities of decrement from active service at selected ages for Ordinary Mortality and Accidental Mortality:

TABLE IB

COMPARISON OF ACTIVE SERVICE DECREMENTS

	Probabilities of Decrement			
	Ordinary Mortality*		Accidental Mortality**	
Age	Current	Proposed	Current	Proposed
25	.040%/.020%	.040%/.020%	.00%	.00%
30	.040%/.020%	.040%/.020%	.00%	.00%
35	.050%/.025%	.050%/.025%	.00%	.00%
40	.060%/.030%	.060%/.030%	.00%	.00%
45	.110%/.055%	.110%/.055%	.00%	.00%
50	.160%/.080%	.160%/.080%	.00%	.00%
55	.210%/.105%	.210%/.105%	.00%	.00%
60	.260%/.130%	.260%/.130%	.00%	.00%

* Separate probabilities are used for males/females.

** The same probabilities are used for males and females.

Ordinary Disability

A review of Ordinary Disability experience from July 1, 1988 to June 30, 2009 indicates that there were approximately 58% more and 52% more Ordinary Disabilities than expected over this 21-year period for males and females, respectively.

Over the 4-year period from July 1, 2005 to June 30, 2009, there were approximately 31% and 32% more Ordinary Disabilities than expected for males and females, respectively.

Review of this data suggested to **Hay** that it would be appropriate to modestly increase the probabilities of male and female active service Ordinary Disability.

After reviewing the experience data, the comments and recommendations of **Hay** and applying actuarial judgment, the Actuary proposes to revise the probabilities of male and female active service Ordinary Disability.

Accidental Disability

A review of Accidental Disability experience from July 1, 1988 to June 30, 2009 indicates that there were approximately 10% fewer and 35% more Accidental Disabilities than expected over this 21-year period for males and females, respectively.

Over the 4-year period from July 1, 2005 to June 30, 2009, there were approximately 24% and 63% more Accidental Disabilities than expected for males and females, respectively.

Review of this data suggested to **Hay** that it would be appropriate to revise the probabilities of male and female active service Accidental Disability.

After reviewing the experience data, the comments and recommendations of **Hay** and applying actuarial judgment, the Actuary proposes to revise the probabilities of male and female active service Accidental Disability.

The following Table IC compares the current and proposed probabilities of decrement from active service at selected ages for Ordinary Disability and Accidental Disability:

TABLE IC

COMPARISON OF ACTIVE SERVICE DECREMENTS

Age	Probabilities of Decrement*			
	Ordinary Disability		Accidental Disability	
	Current	Proposed	Current	Proposed
25	0.020%/0.010%	0.010%/0.010%	0.000%/0.000%	0.000%/0.000%
30	0.020%/0.010%	0.010%/0.010%	0.010%/0.000%	0.000%/0.000%
35	0.030%/0.020%	0.060%/0.050%	0.010%/0.010%	0.010%/0.010%
40	0.040%/0.060%	0.100%/0.100%	0.010%/0.010%	0.020%/0.010%
45	0.050%/0.090%	0.150%/0.150%	0.020%/0.010%	0.030%/0.020%
50	0.070%/0.100%	0.150%/0.200%	0.030%/0.020%	0.030%/0.030%
55	0.120%/0.130%	0.150%/0.200%	0.040%/0.020%	0.040%/0.040%
60	0.170%/0.150%	0.150%/0.200%	0.050%/0.030%	0.040%/0.040%

* Separate probabilities are used for males/females.

Service Retirement

Hay and the Actuary have reviewed the actual experience of members who are eligible to decrement from active service on account of Service Retirement.

For those members who do not elect an Improved Retirement Program ("IRP") (i.e., Chapter 504 of the Laws of 2009), **Hay** has generally recommended increases in the Year One probabilities of Service Retirement and generally recommended decrease in the Year Two and Ultimate probabilities of Service Retirement.

The Actuary generally agrees with this **Hay** recommendation but has further smoothed the probabilities of Service Retirement.

For those members who elect an IRP (i.e., Chapter 19 of the Laws of 2008) the Actuary proposes to revise the Year One, Year Two and Ultimate probabilities of Service Retirement.

The following Table ID-1 and ID-2 present comparisons of the current probabilities of Service Retirement for those members who do not elect an IRP and for those who elect an IRP with those proposed by the Actuary:

TABLE ID-1

COMPARISON OF ACTIVE SERVICE DECREMENTS

FOR THOSE MEMBERS WHO DO NOT ELECT AN IMPROVED RETIREMENT PROGRAM*

Age	Probabilities of Service Retirement**					
	Year One		Year Two		Ultimate	
	Current	Proposed#	Current	Proposed#	Current	Proposed#
40	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%
45	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%
50	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%
55	12.0%/ 10.0%	20.0%/ 20.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%
60	12.0%/ 10.0%	20.0%/ 20.0%	10.0%/ 8.0%	15.0%/ 15.0%	10.0%/ 8.0%	15.0%/ 15.0%
65	30.0%/ 30.0%	30.0%/ 30.0%	30.0%/ 30.0%	20.0%/ 20.0%	30.0%/ 30.0%	20.0%/ 20.0%
70	100.0%/100.0%	100.0%/100.0%	100.0%/100.0%	100.0%/100.0%	100.0%/100.0%	100.0%/100.0%

* Probabilities are applicable only to members who either did not choose to participate in an IRP (i.e., Chapter 19 of the Laws of 2008) or who were mandated into an IRP (i.e., Chapter 504 of the Laws of 2009).

** Separate probabilities are used for males and females.

TABLE ID-2

COMPARISON OF ACTIVE SERVICE DECREMENTS

FOR THOSE MEMBERS WHO ELECT AN IMPROVED RETIREMENT PROGRAM*

	Probabilities of Service Retirement**					
	Year One		Year Two		Ultimate	
Age	Current	Proposed#	Current	Proposed#	Current	Proposed#
40	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%
45	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%
50	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%
55	40.0%/ 40.0%	30.0%/ 30.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%	0.0%/ 0.0%
60	40.0%/ 40.0%	30.0%/ 30.0%	30.0%/ 30.0%	20.0%/ 20.0%	20.0%/ 20.0%	20.0%/ 20.0%
65	30.0%/ 30.0%	40.0%/ 40.0%	30.0%/ 30.0%	30.0%/ 30.0%	30.0%/ 30.0%	30.0%/ 30.0%
70	100.0%/100.0%	100.0%/100.0%	100.0%/100.0%	100.0%/100.0%	100.0%/100.0%	100.0%/100.0%

* Probabilities are applicable only to members who voluntary elected to participate in an IRP (i.e., Chapter 19 of the Laws of 2008).

** Separate probabilities are used for males and females.

B. Mortality after Retirement

The probabilities of mortality for retires differ depending upon whether they are receiving Service Retirement benefits or Disability Retirement benefits.

Hay has recommended changes in the probabilities of mortality after Service Retirement and after Disability Retirement for both males and females.

The Actuary agrees with this recommendation based on a review of the experience of **TRS**.

However, the Actuary believes that the following discussion regarding mortality trends and tables is important.

Over the past 50 years, average life expectancy has increased approximately 4.4 years for males age 65 and approximately 4.1 years for females age 65.

Thus, it is reasonable to anticipate that mortality rates will continue to decline in the future.

There are two main methodologies employed to reflect future mortality improvements:

- Generational Mortality Tables which provide for probabilities of death that differ not just by age and gender, but also by Calendar Year or Fiscal Year.

- Reduced Probabilities of mortality that differ by age and gender, but not by year, and are intended to develop a weighted average impact on actuarial liabilities of anticipated mortality improvements.

The Actuary agreed when Watson Wyatt and Company (**“Wyatt”**) made recommendations in their 1999 Report (**“Wyatt Report”**) that Reduced Probabilities could be used as an appropriate method for implementing the impact of improving mortality for developing actuarial liabilities for the **NYCRS**.

Therefore, the Actuary proposed then and continues to propose that there be two types of post-retirement Mortality Tables:

- Base Tables – Do not reflect future mortality improvements.
- Valuation Tables – Reflect future mortality improvements.

The Valuation Tables would be used for determining **APVB** and to compute employer contributions.

The Base Tables would be used, as appropriate, for other purposes (e.g., development of option factors).

Wyatt recommended in 1999 the use of Valuation Tables with probabilities of mortality equal to between 93% and 97% of the Base Table probabilities and the Actuary proposed Valuation Tables as follows:

TABLE IIA

Post-Retirement Mortality Valuation Tables

Probabilities as a Percentage of Base Table Probabilities

Group	Percentage
Male	93%
Female	97%

Use of these Reduced Probabilities for the Valuation Tables allowed the Actuary to recognize the financial implications of improving mortality without the complexities of developing full Generational Mortality Tables.

Hay reported that the past pattern of gradual improvement in the mortality experience of men has continued. **Hay** also reported that the female experience base, while credible, is rather modest. **Hay** recommended creating new Base Tables for males and for females and new Valuation Tables for males and for females that reflect likely mortality improvement.

The Base Tables recommended by **Hay** were based upon a 10-year experience period with a mid-point of June 30, 2004 (i.e., experience for Fiscal Years 1999 to 2009). Where little or no experience data was available, RP-2000[2] probabilities of death were used. The probabilities were modified and projected to June 30, 2010 using **SOA** Projection Scale AA[3] to create the Base Tables.

The Valuation Tables recommended by **Hay** projected the Base Table probabilities to June 30, 2025 (i.e., 15 years) using **SOA** Projection Scale AA.

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[2] Developed by the Society of Actuaries (**"SOA"**) Retirement Plan Experience Committee in response to requirements of the Retirement Protection Act of 1994.

[3] Developed by **SOA** Group Annuity Table Task Force for projecting mortality improvement in conjunction with the 1994 Group Annuity Mortality Tables.

The Actuary agrees with the overall approach taken by **Hay**.

The probabilities shown in Appendix D are based primarily on the 10-year experience period developed by **Hay** with a June 30, 2004 mid-point. These starting probabilities were refined by the Actuary and then projected to June 30, 2010 using **SOA** Projection Scale AA to create the Base Tables. The Base Table probabilities were then projected to June 30, 2025 using **SOA** Projection Scale AA to produce the Valuation Tables.

The following Table IIB presents a comparison of the current probabilities of mortality for Service Retirees with those proposed by the Actuary:

The following Table IIB presents a comparison of the current probabilities of mortality for Service Retirees with those proposed by the Actuary.

Table IIB

COMPARISON OF PROBABILITIES OF MORTALITY AFTER SERVICE RETIREMENT

	Males				Females			
	Base Table		Valuation Table*		Base Table		Valuation Table*	
Age	Current	Proposed	Current	Proposed	Current	Proposed	Current	Proposed
40	0.124%	0.099%	0.115%	0.088%	0.067%	0.071%	0.065%	0.056%
50	0.283%	0.238%	0.263%	0.182%	0.159%	0.167%	0.154%	0.129%
60	0.663%	0.621%	0.616%	0.488%	0.395%	0.409%	0.383%	0.372%
70	1.985%	1.838%	1.846%	1.465%	1.114%	1.048%	1.080%	0.972%
80	5.045%	4.417%	4.692%	3.799%	3.175%	2.805%	3.080%	2.525%
90	13.874%	13.226%	12.903%	12.454%	10.700%	9.795%	10.379%	8.950%
100	32.471%	34.113%	30.198%	33.605%	29.519%	23.539%	28.633%	23.189%
110#	100.000%	100.000%	100.000%	100.000%	100.000%	100.000%	100.000%	100.000%

* Probabilities shown for the proposed Valuation Tables equal those of the Base Tables projected using **SOA** Projection Scale AA. These tables are used to determine **APVB** and compute employer contributions.

\# Tables end at age 110.

Hay also reviewed and recommended changing the probabilities of mortality after Disability Retirement.

The Actuary agrees and the following Table IIC presents a comparison of the current probabilities of mortality for Disability Retirees with those proposed by the Actuary:

Table IIC

COMPARISON OF PROBABILITIES OF MORTALITY AFTER SERVICE RETIREMENT

	Males				Females			
	Base Table		Valuation Table*		Base Table		Valuation Table*	
Age	Current	Proposed	Current	Proposed	Current	Proposed	Current	Proposed
40	0.624%	1.445%	1.510%	1.326%	3.015%	1.402%	2.925%	1.302%
50	1.985%	1.713%	1.846%	1.417%	2.641%	1.596%	2.562%	1.396%
60	2.401%	2.485%	2.233%	1.951%	1.542%	2.002%	1.496%	1.666%
70	3.370%	3.343%	3.134%	2.665%	1.988%	2.133%	1.929%	1.910%
80	6.518%	5.729%	6.062%	5.079%	4.963%	4.385%	4.814%	3.888%
90	13.931%	17.313%	12.955%	16.550%	11.797%	12.030%	11.443%	11.159%
100	32.471%	37.169%	30.198%	37.169%	29.519%	23.539%	28.633%	23.189%
110#	100.000%	100.000%	100.000%	100.00%	100.000%	100.000%	100.000%	100.000%

* Probabilities shown are those for the Valuation Tables used to determine **APVB** and to compute employer contributions and equal those of the Base Tables projected using **SOA** Projection Scale AA.

\# Tables end at age 110.

Currently, the Mortality Tables for beneficiaries of retired **TRS** members are used for beneficiaries of retired **TRS** members and the Actuary proposes to continue this practice.

Detailed tables of the demographic assumptions that are discussed in this Section, together with the Salary Scale assumptions discussed in Section VI, are presented in Appendix D.

SECTION VI - DEVELOPMENT OF ECONOMIC ASSUMPTIONS

A. Background Concepts

In accordance with Actuarial Standard of Practice ("**ASOP**") No. 27 ("**ASOP27**") and professional practice guidelines, the Actuary must justify the use of whatever economic assumptions are employed at each measurement date (e.g., the use of an **AIR** assumption of 8.0% per annum as of June 30, 2009).

The publication "Recommendations for Measuring Pension Obligations" developed by the Pension Committee of the Actuarial Standards Board and subsequently adopted by the American Academy of Actuaries states, in part, that "...while giving primary emphasis to the combined impact of all assumptions, the actuary should consider the reasonableness of each actuarial assumption independently on the basis of its own merits and its consistency with each other assumption."

Further, “...the actuary should consider the actual experience of the covered group but should emphasize expected long-term future trends rather than give undue weight to recent past experience.”

The construction of economic assumptions for actuarial valuations can be undertaken in multiple ways. The Actuary has considered several methodologies, but believes that the “Building Block” methodology of developing economic assumptions to be amongst the most robust.

The Building Block methodology develops total investment return by combining expected future inflation with an expected future **real** rate of return on assets.

Similarly, a **GWI** assumption is determined by combining expected future inflation with an expected future **real** growth in wages.

Overall, the Actuary is proposing to retain the current economic assumptions for inflation and **GWI,** and to reduce the **AIR** assumption.

When established effective as of June 30, 1999, the Actuary believed that these assumptions were appropriate, long-term economic expectations.

Between June 30, 1999 and June 30, 2011, the annual yield available on the 10-year U.S. Treasury Note declined from 5.81% to 3.18%, an arithmetic decline of 2.63% over a 12-year period. On June 30, 2010 the yield on the 10-year U.S. Treasury Note equaled 2.97%, an arithmetic decline of 2.84% over the 11-year period since June 30, 1999. On June 30, 2009 the yield on the 10-year U.S. Treasury Note equaled 3.53%, an arithmetic decline of 2.28% over the 10-year period since June 30, 1999.

The magnitude of these changes in yield since June 30, 1999 are significant but the Actuary does not believe that twelve years (i.e., June 30, 1999 to June 30, 2011) of experience necessarily constitutes a continuing long-term trend.

In addition, to some extent, the recent lesser yields reflect global risk aversion, the perceived safety of U.S. Treasury securities and attempts by the U.S. Federal Reserve to influence market interest rates.

Nevertheless, these reductions in yields do imply significant reductions in future return expectations and are important components for evaluating future expectations.

In addition to events in the bond markets, over the last decade the equity markets have experienced considerable volatility, including two extended periods of significant decline.

The compound average rate of return of 1.4% per year for the U.S. public equity markets (based on the **S&P 500**) for the decade ending December 31, 2010 was well below the historical compound average rate of return of approximately 9.9% per year since 1926. Thus, the preceding decade could be considered a statistical outlier.

Alternatively, this performance could also reflect the readjustment to (or at least be influenced by) other, macro trends such as:

- Increased globalization and competition.
- Increased debt burdens of developed countries and individuals.
- Growing emerging market economies with substantial savings growth.
- Aging demographics throughout the world.
- Increased taxation and regulatory burden expectations.

With this background, the Actuary has reviewed long-term and recent historical experience but placed most emphasis on future expectations including the implications of a changing economic environment.

As **Hay** noted in their Report, an **AIR** assumption of 8.0% per annum would not currently be considered within an acceptable range.

This observation is consistent with the changes in the economic environment since June 30, 1999, particularly the decrease in bond yields.

The Actuary agrees with **Hay** and believes that justification for continuing the **AIR** assumption at 8.0% per annum no longer exists.

In this Section of the Report, the components required for the Building Block methodology are developed and the proposal to continue the economic assumptions for inflation and **GWI** currently in use but to reduce the **AIR** assumption is described.

B. Consumer Price Inflation Assumption

In 1999, after considerable analysis and as the foundation of the Building Block methodology, the Actuary proposed that inflation be defined as **CPI** and that the expected future **CPI** assumption be set equal to 2.5% per year.

The Actuary believes that this assumption should be continued.

In developing this proposal, the Actuary reviewed and analyzed information from multiple sources as described hereafter.

Actuarial Auditor Recommendations

In October 1999 **Wyatt** recommended that the Actuary utilize a **CPI** assumption between 2.0% per year and 3.0% per year.

In October 2003 Gabriel, Roeder, Smith & Company (**"GRS"**) recommended that the Actuary utilize a **CPI** assumption between 2.5% per year and 3.5% per year.

In November 2006 **Segal** recommended that the Actuary utilize a **CPI** assumption of 3.0% per year.

In December 2011 **Hay** recommended that the Actuary utilize a **CPI** assumption of 3.0% per year within an acceptable range between 2.5% per year and 3.5% per year.

KPMG Peat Marwick (“**KPMG**”) Surveys

In their “1999 Survey of Economic and Capital Market Expectations,” **KPMG** presented their twenty-third annual survey of professionals “involved in developing economic forecasts or investment policies at sixty-one leading international financial institutions and investment organizations.” Amongst many of the statistics included in the **KPMG** Survey was an average annual growth rate in the **CPI** of 2.4% per year from Calendar Year 1999 through 2008 (i.e., the following 10 years).

In their “2004 Summary of Economic and Capital Market Expectations” the **KPMG** Survey shows an average expected growth rate in the **CPI** of 2.5% per year from Calendar Year 2004 through 2013 (i.e., the next 10 years).

The Actuary has not found any more recent, similar **KPMG** surveys but has found a comparable survey from Towers Watson.

Towers Watson Survey

In their "2011 Global Survey of Investment and Economic Expectations", Towers Watson presented Key Findings based on a survey of 141 investment managers. In the Towers Watson Survey, **CPI** in the U.S. was expected to average 2.6% per year from Calendar Year 2012 through Calendar Year 2021 (i.e., the following 10 years).

Survey of Professional Forecasters

On a quarterly basis the Federal Reserve Bank of Philadelphia publishes a Survey of Professional Forecasters.

This survey was formerly conducted by the American Statistical Association ("**ASA**") and the National Bureau of Economic Research ("**NBER**") and was known as the **ASA**/**NBER** survey. The survey began in 1968 and the Federal Reserve Bank of Philadelphia assumed responsibility for it beginning June 1990.

In the Fourth Quarter 1999 Survey, published November 19, 1999, the forecasters expected long-term inflation, as measured by the 10-year average rate of growth in the **CPI**, to equal 2.5% per year for the next 10 years.

In the Fourth Quarter 2003 Survey, published November 24, 2003, the forecasters expected long-term inflation, as measured by the 10-year average rate of growth in the **CPI**, to also equal 2.5% per year for the following 10 years.

In the Second Quarter 2005 Survey, published May 16, 2005, the forecasters expected long-term inflation, as measured by the 10-year average rate of growth in the **CPI**, to again equal 2.5% per year for the next 10 years.

In the Fourth Quarter 2011 Survey, published November 14, 2011, the forecasters expected long-term inflation, as measured by the 10-year average rate of growth in the **CPI**, to again equal 2.5% per year for the next 10 years.

Historical Average **CPI**

The compound average annual **CPI** over the 85-year period ending December 31, 2010 as reported by Ibbotson Associates, Inc. was approximately 3.0%.

Government Securities Yield Method – Historical Approach

The Government Securities Yield Method to estimate **CPI** argues that government bond investors establish the prices of their securities by seeking a total rate of return adequate to provide some **real** rate of return over **CPI**.

In the past, it was often assumed that government bond investors were seeking a **real** rate of return of approximately 3.0% per year for holding riskless, long-duration debt securities such as 30-year United States Treasury Bonds. Although this assumption may no longer be reasonable, using it provides one approach to analyzing the relationship between available bond yields and inflation.

If so, then the total yield on 30-year Treasury Bonds as of June 30, 1999 of approximately 6.0% per year would suggest that investors believed at that time that **CPI** would average approximately 2.9% per year (i.e., [(1.06 divided by 1.03) minus 1.00], rounded) over the 30 years from that point.

Assuming investor expectations of 3.0% per year **real** returns, the total yield on 30-year Treasury Bonds as of June 30, 2009, June 30, 2010 and June 30, 2011 of approximately 4.32% per year, 3.91% per year and 4.38% per year, respectively, suggest that investors believed that **CPI** would average approximately 1.3% per year, 0.9% per year and 1.3% per year, respectively, over the 30 years from these points.

Over a shorter time horizon, in the past intermediate-term government bond investors may have been seeking a **real** rate of return of approximately 2.5% per year for holding riskless, intermediate duration debt securities such as 10-year Treasury Notes. If so, then the total yield as of June 30, 1999 on 10-year Treasury Notes of approximately 5.8% per year would suggest that investors believed at that time that **CPI** would average approximately 3.2% per year (i.e., [(1.058 divided by 1.025) minus 1.0], rounded) over the 10 years from that point.

Assuming investor expectations of 2.5% per year **real** returns, the total yield on 10-year Treasury Notes as of June 30, 2009, June 30, 2010 and June 30, 2011 of approximately 3.53% per year, 2.97% per year and 3.18% per year, respectively, suggest that investors believed that **CPI** would average approximately 0.5%, 0.0% and 0.2% per year, respectively, over the 10 years from those points.

When reviewing these presumed, hypothetical 10-year and 30-year inflation expectations, it appears that either the expected **CPI** estimates are too low or the hypothetical **real** return expectations are too great.

That said, however, it should also be noted that over the past 85 years bond investors have almost never been correct in their expectations. The ex-post, implicit **real** rates of return that bond investors seem to have incorporated into the pricing of the government bonds they have held has varied from less than zero to over 10% per year.

For example, at the end of Calendar Year 1981, 10-year U.S. Treasury Notes were sold with a yield to maturity of approximately 14% per year, suggesting an expected **CPI** of at least 11% per year over the following 10 years. The actual **CPI** over those 10 years was approximately 3.9% per year.

The Actuary believes that long-term **real** return expectations have declined as evidenced by information in the following discussion of Inflation-Indexed Bonds.

Government Securities Yield Method – Inflation-Indexed Bonds

In January 1997 the United States Treasury began selling Inflation-Indexed Treasury Bonds of durations ranging from five to 30 years. Note: The Treasury ceased sales of 30-year bonds (nominal and inflation-indexed) during Calendar Year 2002 but resumed sales of 30-year bonds during Calendar Year 2006.

These bonds are sold to provide an estimated **real** rate of return by indexing to the rate of inflation the coupons and principal repayments.

Consequently, since the advent of Inflation-Indexed Treasury Bonds, it is possible to ascertain the inflation expectations of such bond investors. In particular, given that Inflation-Indexed Treasury Bonds are reported at an expected real-dollar yield, comparing this expected real-dollar yield with the nominal-dollar yield available on regular Treasury Bonds can provide an estimate of the expectations of inflation of these bond investors.

As of June 30, 1999 the yields available on Nominal-Yield and Inflation-Indexed Treasury Bonds suggested that inflation over the 5 to 30 years from that point would be less than 2.0% per year as shown in the following table:

TABLE IIIA

Comparison of Treasury Yields as of June 30, 1999

Duration	Yield on June 30, 1999		Estimated Inflation Expectation[#]
	Inflation-Indexed Bonds*	Nominal-Yield Bonds*	
5 years	3.97%	5.65%	1.62%
10 years	4.01%	5.81%	1.73%
30 years	3.94%	5.97%	1.95%

* Bond-equivalent rates as reported by Bloomberg.

[#] Equals [[(1.0 plus Nominal Bond Yield) divided by (1.0 plus Inflation-Indexed Bond Yield)] minus 1.0].

As of June 30, 2004 the yields available on Nominal-Yield and Inflation-Indexed Treasury Bonds suggested that inflation over the 5 to 30 years from that point would be less than 3.0% per year as shown in the following table:

TABLE IIIB

Comparison of Treasury Yields as of June 30, 2004

Duration	Yield on June 30, 2004		Estimated Inflation Expectation**
	Inflation-Indexed Bonds*	Nominal-Yield Bonds*	
5 years	1.38%	3.81%	2.40%
10 years	2.10%	4.62%	2.47%
30 years	2.37%#	5.41%	2.97%

* As reported by U.S. Treasury.

** Equals [[(1.0 plus Nominal Bond Yield) divided by (1.0 plus Inflation-Indexed Bond Yield)] minus 1.0].

From U.S. Treasury estimate of Real Long-Term Rate Average for U.S. Treasury Securities of 10-plus year duration.

As of June 30, 2009 the yields available on Nominal-Yield and Inflation-Indexed Treasury Bonds suggested that inflation over the next 5 to 30 years from that point would be increasing but less than 2.2% per year as shown in the following table:

TABLE IIIC

Comparison of Treasury Yields as of June 30, 2009

Duration	Yield on June 30, 2009		Estimated Inflation Expectation**
	Inflation-Indexed Bonds*	Nominal-Yield Bonds*	
5 years	1.20%	2.54%	1.32%
10 years	1.78%	3.53%	1.72%
30 years	2.15%	4.32%	2.12%

* As reported by U.S. Treasury.

** Equals [[(1.0 plus Nominal Bond Yield) divided by (1.0 plus Inflation-Indexed Bond Yield)] minus 1.0].

As of June 30, 2010 the yields available on Nominal-Yield and Inflation-Indexed Treasury Bonds suggested that inflation over the next 5 to 30 years from that point would be increasing but less than 2.2% per year as shown in the following table:

TABLE IIID

Comparison of Treasury Yields as of June 30, 2010

Duration	Yield on June 30, 2010		Estimated Inflation Expectation**
	Inflation-Indexed Bonds*	Nominal-Yield Bonds*	
5 years	0.25%	1.79%	1.54%
10 years	1.15%	2.97%	1.80%
30 years	1.71%	3.91%	2.16%

* As reported by U.S. Treasury.

** Equals [[(1.0 plus Nominal Bond Yield) divided by (1.0 plus Inflation-Indexed Bond Yield)] minus 1.0].

As of June 30, 2011 the yields available on Nominal-Yield and Inflation-Indexed Treasury Bonds suggested that inflation over the next 5 to 30 years from that point would be less than 2.6% per year as shown in the following table:

TABLE IIIE

Comparison of Treasury Yields as of June 30, 2011

Duration	Yield on June 30, 2011		Estimated Inflation Expectation**
	Inflation-Indexed Bonds*	Nominal-Yield Bonds*	
5 years	-0.27%	1.76%	2.04%
10 years	0.75%	3.18%	2.41%
30 years	1.75%	4.38%	2.58%

* As reported by U.S. Treasury.

** Equals [[(1.0 plus Nominal Bond Yield) divided by (1.0 plus Inflation-Indexed Bond Yield)] minus 1.0].

Regression Analysis

Regression analysis has shown that one of the better predictors of one year’s **CPI** is the preceding year’s **CPI**.

In their analysis of historical **CPI** statistics, Ibbotson Associates, Inc. has reported that those statistics indicate that **CPI** tends to follow a trend as opposed to a random walk, which is consistent with the comments in the preceding paragraphs.

The following table presents the annual increases in the **CPI** from June 1990 to June 2011 on a Fiscal Year basis.

TABLE IV

RECENT CONSUMER PRICE INFLATION
FISCAL YEAR 1990 THROUGH FISCAL YEAR 2011

Fiscal Year*	CPI	3-Year Average CPI
1990	4.7%	4.6%
1991	4.7%	4.9%
1992	3.1%	4.2%
1993	3.0%	3.6%
1994	2.5%	2.9%
1995	3.0%	2.8%
1996	2.8%	2.8%
1997	2.3%	2.7%
1998	1.7%	2.3%
1999	2.0%	2.0%
2000	3.7%	2.5%
2001	3.2%	3.0%
2002	1.1%	2.7%
2003	2.1%	2.1%
2004	3.3%	2.2%
2005	2.5%	2.6%
2006	4.3%	3.4%
2007	2.7%	3.2%
2008	5.0%	4.0%
2009	-1.4%	2.1%
2010	1.1%	1.6%
2011	3.6%	1.1%

* From June of prior year to June of year shown (i.e., Fiscal Year).

As Table IV shows, **CPI** has been in a general downtrend over the last 20 years (generally consistent over the last 10 years with some leveling or slight increasing in the last couple of years) with the three-year average of **CPI** running at an annual rate of approximately 1.1% for the three years ending June 30, 2011.

Possible Misestimation in **CPI** Statistics

Just a few years ago, many economists, as well as Federal Reserve Chairman Alan Greenspan, believed that reported **CPI** figures were overstated by as much as 1.5% per year due to the delays in rebalancing the market basket of goods and failure to recognize substitution in the determination of **CPI**.

Since that time the Bureau of Labor Statistics has made changes in the market basket weights and in methodology that may have significantly reduced, but possibly not eliminated, the **CPI** overstatement. In fact, some economists now believe that the reported **CPI** figure could now be understated.

Combining Various Analyses

The Actuary believes that continuing an average **CPI** expectation of approximately 2.5% per year is reasonable based on a review of the following sources of information:

- 1999 **Wyatt Report** recommendation of between 2.0% per year and 3.0% per year.
- 2003 **GRS Report** recommendation of between 2.5% per year and 3.5% per year.
- 2006 **Segal Report** recommendation of 3.0% per year.
- 2011 **Hay Report** recommendation of 3.0% per year (within a range between 2.5% and 3.5% per year).
- 1999 and 2004 **KPMG** Survey forecasts of 2.4% and 2.5% per year, respectively.
- 2011 Towers Watson Survey forecast of 2.6% per year.

- Fall 1999, Fall 2003, Spring 2005 and Fall 2011 Surveys of Professional Forecasters long-term inflation expectations of approximately 2.5% per year in each summary.

- Historical average **CPI** of 3.0% per year.

- Recently-reported **CPI** running at a rate of approximately 3.6% per year for Fiscal Year 2011 and at an average of approximately 1.1% per year over the most recent three Fiscal Years.

- Possible, modest misstatement (either overstatement or understatement) in currently reported **CPI**.

- Long-term Treasury Bond investor expectations from June 30, 2009, June 30, 2010 and June 30, 2011 of:

  - 1.3% per year from June 30, 2009, 0.9% per year from June 30, 2010 and 1.3% per year from June 30, 2011 (based on assumed **real** yields of 3.0% per year).

  - 2.1% per year from June 30, 2009, 2.2% per year from June 30, 2010 and 2.6% per year from June 30, 2011 (based on the relationship between Nominal-Yield and Inflation-Indexed Yield Treasury Bonds).

Summary

The Actuary believes 2.5% per year remains a reasonable **CPI** assumption to use in the development of the other economic assumptions and proposes its continuation.

C. General Wage Increase Component of Salary Scale

The Actuary currently assumes a **GWI** of 3.0% per year for **TRS**, consisting of 2.5% per year for **CPI** and 0.5% per year for **real** wage growth. This assumption for **GWI** has been in effect since Fiscal Year 2000.

The **Hay Report** recommends that the **real** wage growth component of the **GWI** remain unchanged at .50% per year.

Although a **real** wage growth component of approximately 1.0% per year would be more consistent with expected nationwide trends, the Actuary believes this historical average may be more difficult to achieve in the future. In addition, the Actuary believes that **real** wage growth for active members of the five **NYCRS** may be less than the national and local, private industry averages.

In particular, the Actuary believes that **real** wage growth for New York City government workers may be restrained but is not likely to be much below the current assumption of .50% per year over the longer term. Therefore, the Actuary proposes continuing to use a **real** wage growth component of .50% per year.

Applying the Building Block methodology to develop an assumption for **GWI**, the Actuary proposes combining a **CPI** assumption of 2.5% per year and a **real** wage growth increase assumption of .50% per year to create a **GWI** assumption of 3.0% per year (i.e., [(1.025 times 1.005) minus 1.000], rounded).

D. Merit Increase Component of Salary Scale

Separate from the development of the **GWI** component of the Salary Scale, an estimate must be made of the Merit Increase component of the Salary Scale (i.e., that portion of the salary increase attributable to the individual's progression of age and service (e.g., longevity increases, promotion increases, step increases, performance increases, etc.)).

In their review, **Hay** recommends continuation of the existing service-related Merit Increase component of the Salary Scale for **TRS** with some adjustments.

In developing proposed changes in the Merit Salary Scale, the Actuary has reviewed the results of the **Hay Report**, distributions of average salaries by years of service as of June 30, 2010 and changes since 1999 to the labor agreements between the City of New York and the major unions representing TRS employees.

The Actuary is proposing changes in the Merit Salary Scale that generally increase expected salary increases over the earlier years and decreases them over the later years of anticipated career periods.

The following Table V presents at five-year intervals the Merit Increase component of the service-related Salary Scale proposed by the Actuary:

TABLE V

MERIT INCREASE COMPONENT OF SALARY SCALE*

Service	Current	Proposed
0	8.00%	10.00%
5	3.00%	5.00%
10	2.00%	1.00%
15	2.00%	1.00%
20	2.00%	1.00%
25	2.00%	1.00%
30	2.00%	1.00%
35	2.00%	1.00%
40	2.00%	1.00%

* Table is based on years of service. Percentages illustrated are those for year following service shown (i.e., service equal to five is the sixth year of employment). The same percentages are used for males and females. The total Salary Scale at each year of service is developed using arithmetic methodology and equals the Merit Increase component plus the **GWI** assumption of 3.0% per year.

It should be noted that the particular five-year intervals presented in Table V do not always provide an adequate overview of the pattern of the Merit Increase component of the Salary Scale. The entire range of year-by-year proposed Merit Increases is presented in Appendix D.

Overall, the Merit Increase component of the proposed Salary Scale averages 3.56% per year, compounded, when averaged from 0 to 25 years of service.

Combining the Merit Increase component of the Salary Scale with the **GWI** component of the Salary Scale creates the total expected rates of salary increase for each year of service.

A year-by-year detailed presentation of the proposed Merit Increase component of the Salary Scale and the total Salary Scale is provided in Appendix D.

It should be noted that the Actuary has chosen to develop year-by-year rates of salary increase in the proposed Salary Scale by adding the **GWI** and Merit Increase, rather than by using compounding methodology. The Actuary feels this makes it easier to understand the construction of the Salary Scale, is consistent with the development of the underlying experience data and does not materially impact the assumption.

E. Actuarial Interest Rate Assumption

The **AIR** assumption is used in the calculation of the Actuarial Present Values of Benefits and other actuarial values dependent upon the time value of money.

The **AIR** assumption is usually established based upon an expected rate of return on assets with a possible adjustment for adverse deviation.

To develop an appropriate **AIR** assumption, an expectation must be developed for the possible future rates of return on assets. Toward that end, and keeping in mind the guidelines of the Actuarial Standards Board, the Actuary has reviewed:

- The recent, actual investment performance of the assets of the five actuarially-funded **NYCRS**.
- The long-term performance of the U.S. capital markets.

- The expectations for future performance of the capital markets and, therefore, the expected investment returns for **TRS** taking into account anticipated asset allocation.

- The relationships in the actuarial valuation model among assumed **CPI**, **GWI**, individual salary increases and total rates of investment return.

Actual Investment Performance in Recent Years

Reviewing the investment performance for all five actuarially-funded **NYCRS** provides some insight into the impact of diversification of assets. **NYCERS**, **POLICE** and **FIRE** have included equities in their asset allocations since the 1970's, whereas the "Fixed Benefit Program" portions of **TRS** and **BERS** were invested entirely in fixed income securities prior to Fiscal Year 1991.

Appendix A shows that all five actuarially-funded **NYCRS** achieved compound annual rates of investment return on a market value basis over the 29 fiscal years ending June 30, 2011 in excess of the current **AIR** assumption of 8.0% per annum.

The best-performing fund was **POLICE**, which is well diversified and achieved a 29-year compound average annual rate of return of 10.54% (9.55% after the **"SKIM"** to the Variable Supplements Funds). **TRS** achieved a compound average annual rate of return of 9.52%.

Particularly impressive were the returns for Fiscal Years 1995 to 1999. The annual compound rates of return during this period averaged approximately 18% per year for the five **NYCRS**.

Just as impressive but, unfortunately, in the opposite direction, were the returns for **TRS** for Fiscal Years 2001 to 2003 and 2008 to 2009. The annual compounded rates of return during these periods were negative 4.3% per year for Fiscal Years 2001 to 2003 and negative 12.4% per year for Fiscal Years 2008 and 2009.

The returns received by equity and bond investors over the past 29 years (particularly, some of the recent periods) are not particularly representative of the levels of returns that have been obtained over similar time periods in the past.

In particular, investment returns in all assets classes have been influenced (usually positively) by the last 30 years having seen the greatest, long-term secular decline in interest rates (a.k.a. the greatest bond bull market) in history. During this period long-term corporate bonds earned a compound average annual rate of return of 10.2% (6.8% compound average annual **real** rate of return).

For this reason, consideration will also be given to the longer-term performance of the U.S. capital markets.

Longer-Term Historical Performance of U.S. Capital Markets

As noted earlier in this Report, recent investment performance of the actuarially-funded **NYCRS** has been favorable. However, this performance may not be sustainable. Therefore, a review of longer-term historical performance of the U.S. capital markets is appropriate.

Reviewing rate of return data on the U.S. capital markets for the period from 1926 to 2010, as compiled by Ibbotson Associates, Inc., shows that long-term government bonds returned a compound annual rate of return of 5.5% over the 85-year period ending December 31, 2010. Long-term corporate bonds, over the same period, returned a compound annual rate of return of 5.9%.

The **real** rate of return for an asset is defined as the excess of the rate of return on that asset over the rate of **CPI**.

The annualized rate of **CPI** for the 85-year period ending December 31, 2010 equaled approximately 3.0%.

Comparing the compound annual rate of return of approximately 5.9% for long-term corporate bonds with the annualized rate of **CPI** of approximately 3.0%, the long-term compound annual **real** rates of return for long-term government and corporate bonds are calculated to equal approximately 2.4% and 2.8%, respectively, over this period.

Large Capitalization U.S. equities, as represented by the Standard & Poor's 500 (**"S&P 500"**) Index, returned a compound annual rate of return of approximately 9.9% for the 85-year period ending December 31, 2010. Thus, equities have earned a compound annual **real** rate of return of approximately 6.7% over this period.

Over more recent periods, specifically the 10-year and 5-year periods ending December 31, 2010, **real** rates of return on bonds have been considerably greater. For example, the compound annual **real** rates of return on long-term corporate bonds have been approximately 5.2% for this 10-year period and approximately 3.6% for this 5-year period.

However, where bonds have performed well during recent periods, the compound annual **real** rates of return on U.S. large capitalization public market equities have been volatile and particularly unfavorable during the 10 calendar years ending December 31, 2010. Specifically, the corresponding compound annual **real** rate of return on the **S&P 500** Index was negative .9% for this 10-year period.

Real rates of return are volatile on a year-by-year basis. **Real** rates of return over periods of 5 years or 10 years vary significantly, reflecting the economic characteristics of the particular period selected.

Thus, **real** rates of return for any particular historical period may not provide reliable estimates of future performance.

Expectations for Future Performance of Capital Markets

If the past were a reasonable predictor of the future, then using the information on **real** rates of return measured over the 85 years ending December 31, 2010 could be used to help smooth out the distortions that can occur in measuring rates of return over shorter periods when either bull markets or bear markets may predominate.

However, even the 85-year period ending December 31, 2010 may be flawed as a predictor of future **real** rates of return. For example, the period since 1925 has been marked by recurring periods of inflation during which **real** rates of return were low or negative. In addition, U.S. Federal Reserve policy and U.S. global economic dominance influenced yields over much of the period.

The end point of this 85-year period also represents a time at which yields on U.S. Treasury securities were low, with **real** yields on shorter-duration U.S. Treasury securities having historically low expected **real** yields.

If the economic environment were not changing and an escalating inflationary environment were not predicted to recur in the future, **real** rates of return on bonds might reasonably be expected to be greater in the future than the 2.8% compound annual **real** rate of return computed for long-term corporate bonds for the 85-year period ending December 31, 2010.

However, impacting these expectations of possible expected **real** rates of return on bonds over time are the growth of large saver classes in the countries referred to as emerging markets plus significant debt overhang and expected paydowns in the developed countries (i.e., supply and demand relationship), the demographics of aging populations through the world (i.e., reduced economic growth and capital demands) and current **real** yields that are below long-term expectations.

In particular, given that interest rates are at historical lows and not consistent with a long-term actuarial inflation assumption of 2.5% per year, the existing **TRS** portfolio may be expected to incur some capital losses if economic conditions became more consistent with actuarial assumptions proposed.

With respect to equities, it may also be argued that the 6.7% compound annual **real** rate of return for equities for the 85-year period ending December 31, 2010 may be above long-term expectations since the period ending December 31, 2010 represents a point in time at which large capitalization U.S. equities (e.g., **S&P 500**) were still at a relatively high Cyclically Adjusted Price/Earnings (“**P/E**”)(“**CAPE**”)[4] ratio of approximately 23.0 versus a long-term average of approximately 16.4.

Based on the **CAPE** ratio of approximately 23.0 as of December 31, 2010 versus the historical **CAPE** ratio of approximately 16.4, the **S&P 500** would have to decline by approximately 29%.

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[4] The **CAPE** ratio is sometimes referred to as the Shiller **PE** Ratio or **PE10** and was popularized by Professor Robert Shiller. The **CAPE** ratio compares the price of equities with their trailing 10-year average inflation-adjusted earnings.

The inverse at the **CAPE** ratio may also be viewed as an approximation of future investor expectations of return. Using a **CAPE** ratio of 23.0 as of December 31, 2010, it may be reasonable to expect (with a wide variation of actual results) a future compound **real** rate of return of approximately 4.4% per year on the **S&P 500**.

In addition, the average dividend yield (i.e., ratio of annual dividend payout to current price) on the **S&P 500** has been near 2.0% for some time. This dividend yield is historically low and, when low in the past, the equity markets have tended to underperform the historical averages in following years.

Note: The further investment policy diversification since 2005 of **TRS** assets into private equities, real estate, opportunistic fixed income, hedge funds, etc., may offer somewhat greater expectations for portfolio investment return.

That said, such diversification may more smooth expected returns that increase them, although diversification with non-correlated assets does represent one of the only non-risk related ways to increase portfolio returns.

In addition, somewhat similar to the challenges for achieving future **real** rates of return on bonds comparable to those of the past, future **real** rates of return on equities are likely to be impacted by the initial, low dividend yields and lesser expected economic growth rates in the developed economies due to debt overhang and aging demographics.

In summary, overall, as a consequence of reduced investment yield and expected lesser economic growth rates in the developed economies, particularly due to debt overhang and aging demographics, the Actuary believes future returns must be less than the historical averages.

For the purpose of establishing an **AIR** assumption, the objective is to develop a **real** rate of return that is attainable over the lifetimes of the current members of the retirement system, typically 30 to 50 years. This is the period of time during which most of the contributions are made, assets accumulate and benefits are disbursed for the current members of the retirement system who are included in the actuarial valuations.

Real Return Expectations

Taking into account recent and long-term historical investment performances and more importantly, reflecting future expectations, the Actuary believes that fixed income securities[5] comparable to those of the **NYCRS** can earn compound average annual **real** rates of return between 2.0% per year and 3.0% per year and that equities[6] comparable to those of the **NYCRS** can earn compound annual **real** rates of return between 4.0% per year and 5.0% per year from June 30, 2010.

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[5] The term fixed income securities as used henceforth in this Report is intended to refer to a well-diversified portfolio of capital preservation, income-generating securities. Such a portfolio could include government (nominal and inflation-protected) notes and bonds, high-quality corporate notes and bonds and high-quality asset-backed securities. To the extent of their characteristics, fixed income securities could also incorporate opportunistic high-quality fixed income strategies, certain low-volatility hedge funds, and related asset types.

[6] The term equities as used henceforth in this Report is intended to refer to a well-diversified portfolio of capital growth-oriented and related assets. For example, such a portfolio could include public market equities (domestic and global), private equity, equity real estate and equity-oriented hedge funds. To the extent of their characteristics, equities could also incorporate convertible bonds, high-yield bonds, opportunistic equity or high-yield bond strategies, the capital growth component of certain inflation-sensitive assets, and related asset types.

Relationship of Economic Components of Actuarial Assumptions and Development of an **AIR** Assumption

An **AIR** assumption can now be developed by relating this information on **real** rates of return to the other economic components of the actuarial assumptions.

The five actuarially-funded **NYCRS** may be considered as investing essentially in two broad asset classes: equities and fixed income securities as defined earlier. As such, a reasonable expectation for the long-term future performance of the **NYCRS** can be based upon the future, expected performance of equities and fixed income securities, applied in proportion to the percentages that these asset classes represent in the portfolios and adjusted for the diversification effect.

TRS currently has an Investment Policy establishing an asset allocation for the Fixed Benefit Program providing that approximately 63% of its investments be held in equities and approximately 37% in fixed income securities.

Assuming that the future expectations for compound average annual **real** rates of return for fixed income securities and equities are similar to those suggested earlier (i.e., between 2.0% and 3.0% per year for fixed income securities and between 4.0% and 5.0% per year for equities), and that **TRS** maintains an Investment Policy for its Fixed Income Program including at least 60% in equities, then the Actuary believes that an average annual **real** rate of return assumption range (net of expenses, and after adjustment to reflect the benefits of portfolio diversification) between approximately 3.4% and 4.4% per year is appropriate.

The upper end of this range of a compound average annual **real** rate of return expectation of approximately 4.4% reflects an assumed standard deviation of return for the entire portfolio of approximately 12% per year.

Note: This **real** rate of return exceeds the upper end of the implicit range recommended by **Hay** that equaled 4.0% per year (adjusted for estimated expenses and presented arithmetically in excess of inflation).

Consistent with the **Hay** comment that the current economic assumptions used for the **NYCRS** are at the “optimistic end of the range,” it should also be noted that few, major Public Employee Retirement Systems (other than the **NYCRS**), utilize a **real** rate of return assumption of 5.0% per year or greater. The current **NYCRS real** rate of return (computed on a simple arithmetic difference basis and net of expenses) is effectively 5.3% per year.

Note: Overall, the compound average annual **real** rate of return expectation for large **PERS** is approximately 4.5%, equal to the proposed compound average **real** rate of return presented herein.

When establishing an **AIR** assumption it is important to handle consistently the economic assumptions used in the actuarial valuation. In particular, the **AIR** assumption should be based upon the same underlying **CPI** assumption as that used in the assumption for salary increases.

As described earlier in this Section, the Actuary believes a long-term expectation for **CPI** of 2.5% per year is reasonable at this time. This figure is at the lower end of the range recommended by **Hay** (i.e., **Hay** recommended a **CPI** assumption of 3.0% per year (between 2.5% per year and 3.5% per year)).

By combining a **CPI** assumption of 2.5% per year with a compound **real** rate of return assumption of approximately 4.4% per year (the upper end of the Actuary's range) for a portfolio anticipated to be invested at least 60% in equities, the total expected compound rate of return on investments equals approximately 7.0% per year.

The Actuary does not plan to provide for any adverse deviation from the expected rates of return and proposes to treat Investment Expenses as offsets to the expected rate of return (i.e., Net of Investment Expenses). Taken together and using the upper end of the Actuary's range for expected investment returns, this analysis can support an **AIR** assumption of 7.0% per annum, net of Investment Expenses.

F. Investment Expenses

IMPORTANT: The current **AIR** assumption of 8.0% per annum was developed gross of Investment Expenses and assumed that those expenses paid from **TRS** would be recovered explicitly, with two years' interest, in the second following Fiscal Year.

The proposed **AIR** assumptions of 7.0% per annum, was developed assuming that Investment Expenses would not be recovered explicitly (i.e., the proposed **AIR** assumption is net of Investment Expenses).

SECTION VII - OTHER ACTUARIAL ASSUMPTIONS AND METHODS

A. Conversions into Variable Annuities at Retirement

The **Wyatt Report** recommended that calculations of actuarial liabilities for **TRS** include the impact of the actuarial losses that are sustained whenever members choose to convert at retirement all or portions of their **ASF** account balances or **ITHP** Reserves into variable annuities.

Hay did not explicitly discuss this methodology. The Actuary continues to agree with the appropriateness of recognizing actuarial losses that occur upon conversion of member **ASF** account balances and **ITHP** Reserves into variable annuities at retirement.

The Actuary has developed estimates of the financial impact of this issue upon **TRS** by reviewing the percentage of active member variable account balances that have been converted in the past and by estimating the actuarial loss per dollar of account balance converted.

B. Actuarial Cost Method and Unfunded Actuarial Accrued Liabilities

Actuarial Cost Method

The Actuary is proposing replacing the current Actuarial Cost Method (“**ACM**”), (i.e., the Frozen Initial Liability (“**FIL**”) **ACM**) with the Entry Age Actuarial Cost Method (“**EAACM**”).

The **EAACM** is a method under which the Actuarial Present Value (“**APV**”) of Benefits (“**APVB**”) of each individual included in the actuarial valuation is allocated on a level basis over the earnings (or service) of the individual between entry age and assumed exit age(s). The portion of this **APV** allocated to a valuation year is the Normal Cost. The portion of this **APV** not provided for at a valuation date by the **APV** of Future Normal Costs is the Actuarial Accrued Liability (“**AAL**”).

The excess, if any, of the **AAL** over the Actuarial Asset Value (“**AAV**”) is the Unfunded Actuarial Accrued Liability (“**UAAL**”).

Under this method actuarial gains (losses), as they occur, reduce (increase) the **UAAL** and are explicitly identified and amortized.

Increases (decreases) in obligations due to benefit changes, actuarial assumption changes and/or actuarial method changes are also explicitly identified and amortized.

Under the **FIL ACM**, the portion of the **APVB** attributable to various benefit changes, changes in assumptions and methods and actuarial gains/losses that would appear as explicit **UAAL** under the **EAACM** are financed implicitly through the Normal Cost (i.e., over the future working lifetimes of all active participants of the Plan).

In effect, under the **FIL ACM**, any potential **UAAL** are implicit and not distinguished in the financing calculations.

Under the **EAACM**, the explicit **UAAL** that are developed each year are generally financed over fixed periods. Ideally, these periods are reasonably consistent with the expected future working lifetimes of all active participants of the Plan.

One of the disadvantages of the **FIL ACM** is that the reported Employer Normal Contribution Rate ("**ENCR**") includes the impact of actuarial gains and losses.

Under the **EAACM**, the **ENCR** remains constant by individual and changes gradually over time for the entire Plan as the characteristics of the group changes (e.g., more **Chapter 504/09** active members decrease the average **ENCR**).

The **EAACM** is the most utilized **ACM** for funding Public Employee Retirement Systems ("**PERS**") in the United States.

Under the **EAACM**, since an explicit **UAAL** is developed, an explicit time period must be adopted for financing any **UAAL**.

The Actuary believes that the most appropriate period of financing actuarial liabilities, including any **UAAL**, is to allocate the costs over the future working lifetimes of active participants.

This approach adheres to the objective of intergenerational equity whereby the retirement benefits of Plan participants are financed over the time period during which those participants provide services to the citizens and taxpayers they serve.

To be consistent with the objective of intergenerational equity, the Actuary believes that the ideal time period for financing any Initial **UAAL** would be approximately 15 years as the amortization factor for a 15-year period compares reasonably with the implicit, salary-weighted amortization factor consistent with the average working lifetimes of active members of the Plan.

However, given the significant impact of the changes in actuarial assumptions being proposed and given the significant actuarial losses attributable to the last 10 years, including those attributable to poor investment performance, the Actuary is recommending a modest relaxation of this preferred approach.

Specifically, the Actuary is proposing the use of a 22-year amortization period for the Initial **UAAL** established under the **EAACM**.

The 22-year amortization period would begin on the date of establishment of the Initial **UAAL** (i.e., June 30, 2010) and would be fully paid by June 30, 2032 with payments over 21 years under the **OYLM**.

The Actuary recommends that the amortization factors for financing the Initial **UAAL** be developed using Increasing Dollar Payments (“**IDP**”) rather than Level Dollar Payments (“**LDP**”).

IDP amortization uses payments that increase each period, usually consistent with the rate of expected General Wage Increases (“**GWI**”), and is sometimes referred to as, or at least comparable to, Level Percentage of Payroll amortization. **LDP** amortization uses equal payments per period.

For all of the **NYCRS**, the Actuary is proposing the use of **IDP** amortization for the Initial **UAAL** where the increase in payments would be 3.0% per year, consistent with the proposed **GWI** assumption.

Note: Under these economic assumptions, use of **IDP** amortization periods of no more than 22 years (i.e., payments over 21 years under the **OYLM**) would result in the payment of all required interest on the Initial **UAAL** and the payment of some portion of principal on the Initial **UAAL**. The Actuary strongly advises paying at least interest each year on the Initial **UAAL**.

With respect to future **UAAL** that are determined each year due to Plan experience (i.e., benefit changes and actuarial gains and losses) and other actuarial assumption and/or method changes, the Actuary recommends amortizing:

- Benefit changes over the remaining working lifetimes of those impacted unless the amortization period is established by statute.

- Assumption and/or method changes over 20 years.

- Actuarial gains and losses over 15 years.

Note: Under **OYLM** the number of amortization payments would be one less than the number of years in the amortization period (e.g., 14 payments over a 15-year amortization period).

For future **UAAL** that are established (e.g., due to benefit changes and/or actuarial gains or losses) the Actuary recommends the use of **LDP** amortization.

C. **One-Year Lag** Methodology **(“OYLM”)**

The Actuary is proposing that the actuarial assumptions and methods presented herein be effective for determining Fiscal Year 2012 employer contributions based on a June 30, 2010 actuarial valuation date (i.e., continuing the use of “**One-Year Lag**” methodology or (“**OYLM**”)).

The **OYLM** uses a June 30, XX-2 actuarial valuation date to determine Fiscal Year XX employer contributions.

The primary benefit of the use of the **OYLM** is that it brings more certainty to the budgeting process of the employers participating in **TRS**.

Specifically, rather than contributing on an estimated basis throughout a Fiscal Year and then receiving (near the end of a Fiscal Year) a “true-up” letter with their final employer contribution for that Fiscal Year that could differ significantly from the estimate, under **OYLM** each employer would be provided with their expected employer contribution in advance of a Fiscal Year.

Except for changes due to legislative requirements and/or the impact of labor contract settlements with retroactive impact, that expected employer contributions would not change.

D. Actuarial Asset Valuation Method

The Actuary currently utilizes a Six-Year Average of Market Values **AAVM** to determine the Actuarial Asset Value (“**AAV**”) to be used in the actuarial valuations of **TRS** as of each June 30.

Under this methodology Expected Investment Returns (“**EIR**”) (i.e., investment returns equal to the amount that would be earned if the **AAV** earned the **AIR**) are recognized in the **AAV** immediately.

Unexpected Investment Return (“**UIR**”) (i.e., investment returns greater or less than the amount that would have been earned if the **AAV** earned the **AIR**) are phased into the **AAV** at a rate of 15%, 15%, 15%, 15%, 20% and 20% per year (i.e., cumulative rates of 15%, 30%, 45%, 60%, 80% and 100% over six years).

The purpose of an **AAVM** is to reduce the impact of short-term fluctuations in the value of assets used as of each June 30 actuarial valuation date and, consequently, the volatility in employer contributions for the following Fiscal Year.

As of June 30, 2011, as part of the **package** of proposed changes in actuarial assumptions and methods, the Actuary proposes to “Restart” the **AAVM** (i.e., set the June 30, 2011 **AAV** equal to the June 30, 2011 **MVA**).

The Actuary further proposes to set the June 30, 2010 **AAV** to recognize Fund performance during Fiscal Year 2011. The June 30, 2010 **AAV** would be defined as equal to the June 30, 2011 **MVA**, discounted to June 30, 2010 by the **AIR** assumption (adjusted for cash flow).

Finally, the Actuary proposes to retain the six-year phase-in factors of the current **AAVM** for Fiscal Year 2012 and later **UIR** (i.e., 15%, 15%, 15%, 15%, 20% and 20% (cumulatively, 15%, 30%, 45%, 60%, 80% and 100%) over six years).

Note: In conjunction with the **OYLM**, the six-year **AAVM** results in each Fiscal Year **UIR** being phased into the calculation of employer contributions over a total of seven Fiscal Years.

E. Administrative Expenses

The Actuary proposes continuing the current practice of recovering, with interest, any Administrative Expenses incurred by the Retirement System.

In conjunction with continuing the **OYLM**, Administrative Expenses for a Fiscal Year are recovered with two years' interest in the second following Fiscal Year (e.g., Fiscal Year 2010 expenses would be recovered during Fiscal Year 2012).

SECTION VIII - FINANCIAL IMPACT

The following Table VI presents the estimated financial impact on the Fiscal Year 2012 employer contributions of the proposals presented in this Report:

TABLE VI

ESTIMATED FINANCIAL IMPACT OF PROPOSED CHANGES IN ACTUARIAL ASSUMPTIONS AND METHODS

Estimated Fiscal Year 2012 Employer Contributions	**Amount ($ Millions)**	
Before Proposals*		$2,616
Changes on Account of Proposals:		
• Reduce **AIR Assumption** to 7.0% per annum		
·· Gross of Expenses	$ 533	
·· Investment Expenses	(143)	
·· Net of Expenses	$ 390	
• Revise **Demographic Assumptions**		
·· Post-Retirement Mortality	$ 170	
·· Other	(62)	
Subtotal	$ 108	
• Revise **AAVM**	$(122)	
• Change in **Actuarial Cost Method** and **Amortization Periods**	$(326)	
Total Proposals		$ 50
After Proposals#		$2,666

* Equals estimated employer contributions for Fiscal Year 2012 based upon the census data used for the June 30, 2010 actuarial valuation and on current actuarial assumptions and methods.

\# Equals estimated employer contributions for Fiscal Year 2012 based upon the census data used for the June 30, 2010 actuarial valuation and on proposed actuarial assumptions and methods.

It should be noted that the estimates of the total change in the Fiscal Year 2012 employer contribution may be fairly developed. However, the allocation of the total change to its component parts may not be particularly precise.

In addition, the final Fiscal Year 2012 employer contributions for **TRS** may differ somewhat from the estimates presented in Table VI.

For example, benefit provisions to be funded during Fiscal Year 2012 may change depending upon further actions of the New York State Legislature and the Governor. Salary adjustments for labor organizations may not follow the patterns expected. The Actuary may desire to refine certain actuarial methodologies used. Finally, the Office of the Actuary is currently introducing new actuarial valuation software that may (or may not) be implemented before the finalization of calculations for Fiscal Year 2012.

SECTION IX - FINDINGS AND PROPOSALS

As discussed earlier in this Report, the objective of actuarial methodology is to estimate the Actuarial Present Value of Benefits to be paid to participants and to allocate over time the financing of those benefits.

Actuaries develop contribution levels by using a combination of: (1) actuarial assumptions, (2) Actuarial Cost Methods, (3) amortization methods and periods for paying off any Unfunded Actuarial Accrued Liabilities and (4) Actuarial Asset Valuation Methods. Each of these components exerts a significant impact on the calculated level of employer contributions.

While attempting to follow a philosophy of financing benefits over the working lifetimes of the employees who earn them, (i.e., intergenerational equity), the Actuary has somewhat extended the period for **UAAL** amortization. The proposed actuarial assumptions and methods reflect an effort to balance responsible funding with employer financial capacity.

This Report also notes that guidelines of professional conduct for actuaries emphasize that in the development of actuarial assumptions, primary emphasis should be placed on the combined impact of all actuarial assumptions, but the reasonableness of each actuarial assumption should be considered independently.

With respect to the Actuarial Interest Rate assumption, the Actuary proposes that **TRS** reduce the current **AIR** assumption from 8.0% per annum (gross of Investment Expenses) to 7% per annum (net of Investment Expenses).

It is also intended that benefits payable to members not be affected by the proposed changes to actuarial assumptions and methods.

The Actuary proposes changes in certain demographic and economic assumptions and proposes changes in certain actuarial methods.

The Actuary proposes that the **FIL** Actuarial Cost Method be replaced with the **EAACM**.

The Actuary proposes that the **One-Year Lag** methodology be continued.

Further, the Actuary proposes to continue the six-year phase-in factors of the current **AAVM** for Fiscal Years 2012 and after for **UIR**, restarting the **AAVM** as of June 30, 2011 (i.e., setting **AAV** equal to the **MVA** as of June 30, 2011) and setting the **AAV** at June 30, 2010 to equal the June 30, 2011 **MVA**, discounted to June 30, 2010 by the **AIR** Assumption (adjusted for cash flow).

Since additional review of certain technical issues may identify alternative approaches that are preferable, the Actuary requests discretion to make minor adjustments during the legislative process to the extent necessary to better implement the intent of these proposed changes in actuarial assumptions and methods.

Legislation implementing any proposed changes in the **AIR** assumption must also specify the period for which the assumption will be used. Following past practice, five years (i.e., Fiscal Year 2012 to Fiscal Year 2016) is the proposed period of time to include in the legislation. This represents a reasonable period of time between planned reviews of this assumption.

Finally, it should be emphasized that the proposed changes in actuarial assumptions and methods presented in this Report are an interconnected **package**, the individual components of which may not be revised without consideration of and probable revision to other components.

APPENDIX A – RECENT HISTORY OF INVESTMENT RETURNS

The following table presents by Retirement System information on rates of investment return earned by the five actuarially-funded **NYCRS** during the past 29 years.

TABLE VII

NEW YORK CITY RETIREMENT SYSTEMS

RATES OF INVESTMENT RETURN BASED ON MARKET VALUE*
FISCAL YEAR 1983 THROUGH FISCAL YEAR 2011

YEAR ENDED	NYCERS**	TRS	BERS	POLICE**	FIRE**
6/30/83	31.09%	25.33%	27.20%	36.28/33.21	33.55/30.34
6/30/84	-1.85	2.20	2.20	-1.49	-2.49
6/30/85	27.08	20.89	18.74	26.00/25.20	23.07/23.07
6/30/86	22.70	17.89	16.77	26.10/15.76	23.70/13.77
6/30/87	11.10	4.43	5.46	13.80/8.51	13.40/8.32
6/30/88	3.60	7.70	8.26	1.80	2.50
6/30/89	15.90	12.92	13.22	16.00	15.90
6/30/90	10.00/9.95	7.40	6.90	10.70/10.38	11.30/10.08
6/30/91	8.80	12.80	10.70	8.30	8.40
6/30/92	14.70/14.57	14.00	14.90	14.30/13.58	13.40/12.80
6/30/93	15.30/15.04	14.20	14.10	14.00/12.48	14.30/10.15
6/30/94	1.80	0.30	0.80	1.00	1.20
6/30/95	19.20	17.70	18.60	18.30/13.80	18.40/14.66
6/30/96	17.94	15.00	16.60	17.76/13.54	17.46/16.09
6/30/97	22.37	20.42	20.84	22.23	22.49
6/30/98	21.29	19.66	19.13	19.96	19.17
6/30/99	13.47	12.97	13.94	12.68	12.63
6/30/00	9.43/9.19	9.92	9.52	9.30	8.30
6/30/01	-8.30	-8.20	-8.61	-8.24	-8.00
6/30/02	-8.64	-8.05	-7.64	-7.87	-8.53
6/30/03	3.94	4.01	4.39	2.99	4.11
6/30/04	16.30	15.87	16.35	17.04	16.93
6/30/05	9.22	10.63	10.20	10.28	10.88
6/30/06	9.83	9.95	10.45	10.65	10.35
6/30/07	18.40	17.46	18.76	18.88	18.29
6/30/08	-4.96	-6.21	-5.30	-4.83	-5.15
6/30/09	-18.18	-18.12	-18.20	-18.63	-18.78
6/30/10	14.09	14.38	15.04	13.74	14.76
6/30/11	23.12	23.28	24.19	23.26	23.15
29-Year Compound Average Return	10.38/10.36	9.50	9.75	10.54/9.55	10.24/9.29

* Annual and compound performance figures for Fiscal Years ending June 30, 1983 through June 30, 1989 were taken from the October 1989 Report on **AIR** by Buck Consultants, Inc. Figures for Fiscal Years ending June 30, 1990 through June 30, 2011 were taken from Reports issued by the Office of the Comptroller of the City of New York.

** Figures shown are before and after **SKIM** to Variable Supplements Funds during years in which there were such **SKIM** payments of material amounts.

APPENDIX B - RECENT HISTORY OF ECONOMIC ASSUMPTIONS USED IN ACTUARIAL VALUATIONS

The economic assumptions used in the actuarial valuations for determining employer contributions of **TRS** over the past 31 fiscal years are illustrated in the following table:

TABLE VIII

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM
ECONOMIC ASSUMPTIONS USED IN ACTUARIAL VALUATIONS
FOR DETERMINING EMPLOYER CONTRIBUTIONS

Actuarial Valuation		Actuarial Interest Rate	General Wage Increase*
As of June 30	For Fiscal Years		
1980-1981	1981-1982	7.50%	6.00%
1982-1984	1983-1985	8.00%	6.50%
1985-1987	1986-1988	8.00%	5.50%
1988-1989	1989-1990	8.25%	5.50%
1990-1994	1991-1995	9.00%	5.50%
1995-1998	1996-1999	8.75%	4.00%
1999-2009#	2000-2011	8.00%	3.00%
2010-2014 Proposed	2012-2016 Proposed	7.00%	3.00%

* In addition to the **GWI** shown, the total Salary Scale includes an additional Merit Increase component.

Due to **One-Year Lag** methodology, there were two actuarial valuations as of June 30, 2004.

In terms of recent legislation, these **AIR** assumptions were established in several New York State Chapter Laws.

Chapter 948 of the Laws of 1990 and Chapters 607, 608 and 610 of the Laws of 1991 increased from 8.25% per annum to 9.00% per annum (8.50% per annum for **POLICE** and **FIRE**) the statutory rate of interest to be used by the Actuary for Fiscal Years 1991 through 1995 (for use in the actuarial valuations as of June 30, 1990 through June 30, 1994) in valuing pension liabilities to compute employer contributions to the five actuarially-funded **NYCRS**.

Chapter 249 of the Laws of 1996 updated the **AIR** assumption to 8.75% per annum for all of **NYCRS** except **POLICE**. Chapter 598 of the Laws of 1996 extended for Fiscal Year 1996 the use of an **AIR** assumption of 8.50% per annum for **POLICE**. Chapter 157 of the Laws of 1997 established the **AIR** assumption for **POLICE** at 8.75% per annum for Fiscal Years 1997 to 2000.

Chapter 85 of the Laws of 2000 superseded (for Fiscal Year 2000) Chapter 249 of the Laws of 1996 and Chapter 157 of the Laws of 1997 and established an **AIR** assumption of 8.0% per annum for all the **NYCRS** effective for Fiscal Years 2000 to 2004.

Chapter 133 of the Laws of 2004 extended to Fiscal Year 2005 the **AIR** assumption of 8.0% per annum for all of the **NYCRS**.

Chapter 133 of the Laws of 2005 further extended to Fiscal Year 2006 the **AIR** assumption of 8.0% per annum for all of the **NYCRS**.

Chapter 152 of the Laws of 2006 re-established the **AIR** assumption of 8.0% per annum for all of the **NYCRS** for Fiscal Years 2006 to 2009. Chapter 211 of the Laws of 2009 extended to Fiscal Year 2010 the **AIR** assumption of 8.0% per annum for all of the **NYCRS**. Chapter 265 of the Laws of 2010 extended to Fiscal Year 2011 the **AIR** assumption of 8.0% per annum for all of the **NYCRS**.

Chapter 180 of the Laws of 2011 extended to Fiscal Year 2012 the **AIR** assumption of 8.0% per annum for all of the **NYCRS** in anticipation of being replaced by the **AIR** assumption proposed in this Report.

With respect to the future, pursuant to Section 13-638.2(e) of the **ACNY**, the Boards of Trustees of the actuarially-funded **NYCRS** are charged with submitting to the Governor, Leaders of the New York State Legislature, Superintendent of Insurance, Chairman of the Permanent Pension Commission (which no longer exists), Mayor of the City of New York and the Council of the City of New York written recommendations as to the **AIR** assumption and the period for which it shall be effective.

ACNY Section 13-638.2 as currently written requires these recommendations be provided for the Fiscal Year beginning July 1, 2011 (i.e., Fiscal Year 2012).

The proposals in this Report would meet these requirements and would also be effective for determining the employer contributions for Fiscal Year 2012.

APPENDIX C - ACTUARIAL INTEREST RATE ASSUMPTIONS USED BY PUBLIC EMPLOYEE RETIREMENT SYSTEMS

As noted earlier in this Report, the appropriateness of any individual actuarial assumption should be evaluated in relation to the actuarial assumptions in the aggregate.

The determination of employer contributions depends upon the combined effect of the actuarial assumptions, the Actuarial Cost Method, the period of time and method chosen to amortize any Unfunded Actuarial Accrued Liabilities and the **AAVM**.

How the individual **AIR** assumption for one pension plan compares with the average **AIR** used by all pension plans is an interesting but not necessarily important or useful fact for determining the appropriateness of that individual assumption for any individual pension plan.

Nevertheless, knowing how the proposed **AIR** assumption compares with the averages does provide a certain perspective.

In its October 2011 Issue Brief: "Public Pension Plan Investment Returns", the National Association of State Retirement Administrators ("**NASRA**") reported a median **AIR** assumption of 8.0% per annum.

NASRA also reported that the median inflation assumption was 3.5% per year and the median **real** investment rate of return assumption was 4.5% per year.

For the **NYCRS**, the Actuary is proposing continuing a lesser inflation assumption of 2.5% per year and reducing the assumption for the **real** rate of return on investments to 4.5% per year (measured comparably).

Thus, while the Actuary proposes to continue an inflation assumption less than that of most other **PERS**, the Actuary is also proposing to reduce the assumption for the **real** rate of return on investments to be more consistent with other **PERS**.

Thus, the use of an **AIR** assumption of 7.0% per annum would place **TRS** below the median assumption for Public Employee Retirement Systems.

With respect to other **PERS** within New York State, it may be noted that the New York State Teachers' Retirement System ("**NYSTRS**") has continued its use of an **AIR** assumption of 8.0% per annum.

The New York State and Local Retirement System ("**NYSLRS**"), which includes both the New York State and Local Employees' Retirement System and the New York State Police and Fire Retirement System, has recently reduced its **AIR** assumption from 8.0% per annum to 7.5% per annum.

APPENDIX D - TABLES OF PROPOSED DEMOGRAPHIC AND SALARY SCALE ASSUMPTIONS

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

PROBABILITIES OF MORTALITY AFTER SERVICE RETIREMENT
RECOMMENDED BY THE ACTUARY

BASE TABLES*

Age	Males	Females	Age	Males	Females
19	0.0273%	0.0160%	65	1.0992%	0.6383%
20	0.0285%	0.0161%	66	1.2626%	0.7145%
21	0.0298%	0.0162%	67	1.4165%	0.7934%
22	0.0308%	0.0163%	68	1.5578%	0.9013%
23	0.0321%	0.0168%	69	1.7049%	0.9607%
24	0.0330%	0.0173%	70	1.8378%	1.0482%
25	0.0340%	0.0180%	71	2.0254%	1.1649%
26	0.0356%	0.0190%	72	2.2094%	1.2889%
27	0.0363%	0.0198%	73	2.3895%	1.4034%
28	0.0374%	0.0208%	74	2.5658%	1.5227%
29	0.0392%	0.0220%	75	2.7551%	1.6272%
30	0.0422%	0.0239%	76	3.0710%	1.8629%
31	0.0480%	0.0295%	77	3.4008%	2.1114%
32	0.0540%	0.0344%	78	3.7279%	2.3469%
33	0.0599%	0.0389%	79	4.0521%	2.5788%
34	0.0656%	0.0430%	80	4.4173%	2.8051%
35	0.0717%	0.0472%	81	5.0692%	3.3395%
36	0.0762%	0.0509%	82	5.7288%	3.8845%
37	0.0807%	0.0550%	83	6.3577%	4.4173%
38	0.0852%	0.0594%	84	7.0290%	5.0061%
39	0.0910%	0.0645%	85	7.6617%	5.6164%
40	0.0987%	0.0707%	86	8.6894%	6.3577%
41	0.1120%	0.0762%	87	9.7950%	7.0290%
42	0.1253%	0.0826%	88	10.9326%	7.6617%
43	0.1388%	0.0900%	89	12.0301%	8.6894%
44	0.1524%	0.0982%	90	13.2260%	9.7950%
45	0.1660%	0.1072%	91	15.1926%	10.9326%
46	0.1798%	0.1173%	92	17.3126%	12.0301%
47	0.1936%	0.1283%	93	19.3716%	13.2260%
48	0.2077%	0.1406%	94	21.4865%	15.1926%
49	0.2218%	0.1533%	95	23.8265%	17.3126%
50	0.2383%	0.1671%	96	25.9842%	19.3716%
51	0.2664%	0.1816%	97	28.0792%	21.4865%
52	0.2946%	0.1981%	98	30.4289%	23.1180%
53	0.3249%	0.2157%	99	32.4226%	23.5189%
54	0.3559%	0.2349%	100	34.1126%	23.5389%
55	0.3898%	0.2563%	101	35.8628%	24.4834%
56	0.4350%	0.2854%	102	37.1685%	25.4498%
57	0.4814%	0.3154%	103	38.3040%	26.6044%
58	0.5291%	0.3455%	104	39.2003%	27.9055%
59	0.5748%	0.3767%	105	39.7886%	29.3116%
60	0.6210%	0.4090%	106	40.0000%	30.7811%
61	0.7190%	0.4526%	107	40.0000%	32.2725%
62	0.8148%	0.4974%	108	40.0000%	33.7441%
63	0.9179%	0.5434%	109	40.0000%	35.1544%
64	1.0173%	0.5905%	110	100.0000%	100.0000%

* Probabilities before adjustment for post-2010 mortality improvements.

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

PROBABILITIES OF MORTALITY AFTER DISABILITY RETIREMENT
RECOMMENDED BY THE ACTUARY

BASE TABLES*

Age	Males	Females	Age	Males	Females
19	0.9446%	0.6100%	65	2.8302%	2.0650%
20	0.9493%	0.6150%	66	2.9042%	2.0782%
21	0.9540%	0.6200%	67	2.9910%	2.0916%
22	0.9734%	0.6276%	68	3.0923%	2.1052%
23	1.0086%	0.6340%	69	3.2091%	2.1190%
24	1.0451%	0.6405%	70	3.3432%	2.1330%
25	1.0828%	0.6470%	71	3.4438%	2.1964%
26	1.1390%	0.6603%	72	3.6144%	2.3713%
27	1.1623%	0.6603%	73	3.7490%	2.5557%
28	1.1860%	0.6603%	74	3.9592%	2.7790%
29	1.2103%	0.6603%	75	4.1295%	3.0084%
30	1.2731%	0.6738%	76	4.3825%	3.2469%
31	1.3391%	0.8724%	77	4.7311%	3.5238%
32	1.3664%	1.0628%	78	5.0382%	3.7969%
33	1.3733%	1.2493%	79	5.3708%	4.0846%
34	1.3804%	1.3391%	80	5.7288%	4.3848%
35	1.3875%	1.3664%	81	6.3577%	4.8982%
36	1.3947%	1.3733%	82	7.0290%	5.3708%
37	1.4021%	1.3804%	83	7.6617%	5.7288%
38	1.4097%	1.3875%	84	8.6894%	6.3577%
39	1.4175%	1.3947%	85	9.7950%	7.0290%
40	1.4445%	1.4021%	86	10.9326%	7.6617%
41	1.4741%	1.4126%	87	12.0301%	8.6894%
42	1.5042%	1.4210%	88	13.2260%	9.7950%
43	1.5349%	1.4445%	89	15.1926%	10.9326%
44	1.5664%	1.4741%	90	17.3126%	12.0301%
45	1.5754%	1.5042%	91	19.3716%	13.2260%
46	1.5846%	1.5349%	92	21.4865%	14.7501%
47	1.5940%	1.5664%	93	23.8265%	16.1382%
48	1.6225%	1.5760%	94	25.9842%	17.6379%
49	1.6548%	1.5858%	95	28.0792%	19.0648%
50	1.7130%	1.5958%	96	30.4289%	20.7814%
51	1.7724%	1.6225%	97	32.4226%	22.2790%
52	1.8613%	1.6548%	98	34.1126%	23.1180%
53	1.9552%	1.7130%	99	35.8628%	23.5189%
54	2.0533%	1.7724%	100	37.1685%	23.5389%
55	2.1559%	1.8613%	101	38.3040%	24.4834%
56	2.2634%	1.9552%	102	39.2003%	25.4498%
57	2.3410%	1.9666%	103	39.7886%	26.6044%
58	2.3861%	1.9782%	104	40.0000%	27.9055%
59	2.4338%	1.9900%	105	40.0000%	29.3116%
60	2.4851%	2.0020%	106	40.0000%	30.7811%
61	2.5406%	2.0142%	107	40.0000%	32.2725%
62	2.6015%	2.0266%	108	40.0000%	33.7441%
63	2.6688%	2.0392%	109	40.0000%	35.1544%
64	2.7444%	2.0520%	110	100.0000%	100.0000%

* Probabilities before adjustment for post-2010 mortality improvements.

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

PROBABILITIES OF MORTALITY FOR BENEFICIARIES RECOMMENDED BY THE ACTUARY

BASE TABLES*

Age	Males	Females	Age	Males	Females
19	0.0273%	0.0160%	65	1.0992%	0.6383%
20	0.0285%	0.0161%	66	1.2626%	0.7145%
21	0.0298%	0.0162%	67	1.4165%	0.7934%
22	0.0308%	0.0163%	68	1.5578%	0.9013%
23	0.0321%	0.0168%	69	1.7049%	0.9607%
24	0.0330%	0.0173%	70	1.8378%	1.0482%
25	0.0340%	0.0180%	71	2.0254%	1.1649%
26	0.0356%	0.0190%	72	2.2094%	1.2889%
27	0.0363%	0.0198%	73	2.3895%	1.4034%
28	0.0374%	0.0208%	74	2.5658%	1.5227%
29	0.0392%	0.0220%	75	2.7551%	1.6272%
30	0.0422%	0.0239%	76	3.0710%	1.8629%
31	0.0480%	0.0295%	77	3.4008%	2.1114%
32	0.0540%	0.0344%	78	3.7279%	2.3469%
33	0.0599%	0.0389%	79	4.0521%	2.5788%
34	0.0656%	0.0430%	80	4.4173%	2.8051%
35	0.0717%	0.0472%	81	5.0692%	3.3395%
36	0.0762%	0.0509%	82	5.7288%	3.8845%
37	0.0807%	0.0550%	83	6.3577%	4.4173%
38	0.0852%	0.0594%	84	7.0290%	5.0061%
39	0.0910%	0.0645%	85	7.6617%	5.6164%
40	0.0987%	0.0707%	86	8.6894%	6.3577%
41	0.1120%	0.0762%	87	9.7950%	7.0290%
42	0.1253%	0.0826%	88	10.9326%	7.6617%
43	0.1388%	0.0900%	89	12.0301%	8.6894%
44	0.1524%	0.0982%	90	13.2260%	9.7950%
45	0.1660%	0.1072%	91	15.1926%	10.9326%
46	0.1798%	0.1173%	92	17.3126%	12.0301%
47	0.1936%	0.1283%	93	19.3716%	13.2260%
48	0.2077%	0.1406%	94	21.4865%	15.1926%
49	0.2218%	0.1533%	95	23.8265%	17.3126%
50	0.2383%	0.1671%	96	25.9842%	19.3716%
51	0.2664%	0.1816%	97	28.0792%	21.4865%
52	0.2946%	0.1981%	98	30.4289%	23.1180%
53	0.3249%	0.2157%	99	32.4226%	23.5189%
54	0.3559%	0.2349%	100	34.1126%	23.5389%
55	0.3898%	0.2563%	101	35.8628%	24.4834%
56	0.4350%	0.2854%	102	37.1685%	25.4498%
57	0.4814%	0.3154%	103	38.3040%	26.6044%
58	0.5291%	0.3455%	104	39.2003%	27.9055%
59	0.5748%	0.3767%	105	39.7886%	29.3116%
60	0.6210%	0.4090%	106	40.0000%	30.7811%
61	0.7190%	0.4526%	107	40.0000%	32.2725%
62	0.8148%	0.4974%	108	40.0000%	33.7441%
63	0.9179%	0.5434%	109	40.0000%	35.1544%
64	1.0173%	0.5905%	110	100.0000%	100.0000%

* Probabilities before adjustment for post-2010 mortality improvements.

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

PROBABILITIES OF MORTALITY AFTER SERVICE RETIREMENT
RECOMMENDED BY THE ACTUARY

VALUATION TABLES*

Age	Males	Females	Age	Males	Females
19	0.0205%	0.0123%	65	0.8897%	0.5921%
20	0.0214%	0.0124%	66	1.0376%	0.6627%
21	0.0227%	0.0125%	67	1.1641%	0.7359%
22	0.0238%	0.0126%	68	1.2609%	0.8360%
23	0.0256%	0.0132%	69	1.3799%	0.8911%
24	0.0271%	0.0138%	70	1.4650%	0.9723%
25	0.0292%	0.0146%	71	1.6146%	1.0643%
26	0.0325%	0.0158%	72	1.7612%	1.1776%
27	0.0337%	0.0165%	73	1.9048%	1.2630%
28	0.0347%	0.0174%	74	2.0453%	1.3704%
29	0.0363%	0.0183%	75	2.2299%	1.4425%
30	0.0392%	0.0205%	76	2.4856%	1.6514%
31	0.0445%	0.0262%	77	2.7947%	1.9002%
32	0.0500%	0.0305%	78	3.1104%	2.1122%
33	0.0556%	0.0340%	79	3.4326%	2.3209%
34	0.0608%	0.0370%	80	3.7991%	2.5246%
35	0.0665%	0.0400%	81	4.4263%	3.0055%
36	0.0707%	0.0424%	82	5.0785%	3.4326%
37	0.0748%	0.0452%	83	5.6361%	3.7991%
38	0.0779%	0.0481%	84	6.3260%	4.4263%
39	0.0818%	0.0514%	85	6.8955%	5.0785%
40	0.0875%	0.0564%	86	7.8204%	5.6361%
41	0.0978%	0.0607%	87	8.9495%	6.3260%
42	0.1078%	0.0658%	88	10.1407%	6.8955%
43	0.1176%	0.0717%	89	11.1587%	7.8204%
44	0.1272%	0.0783%	90	12.4543%	8.9495%
45	0.1364%	0.0842%	91	14.3062%	10.1407%
46	0.1455%	0.0907%	92	16.5497%	11.1587%
47	0.1543%	0.0977%	93	18.5179%	12.4543%
48	0.1631%	0.1071%	94	20.5396%	14.3062%
49	0.1715%	0.1167%	95	23.1217%	16.5497%
50	0.1815%	0.1292%	96	25.2155%	18.5179%
51	0.1998%	0.1426%	97	27.2485%	20.5396%
52	0.2176%	0.1603%	98	29.9756%	22.7737%
53	0.2400%	0.1800%	99	31.9397%	23.1685%
54	0.2629%	0.1998%	100	33.6045%	23.1885%
55	0.2923%	0.2176%	101	35.8628%	24.4834%
56	0.3313%	0.2400%	102	37.1685%	25.4498%
57	0.3722%	0.2629%	103	38.3040%	26.6044%
58	0.4154%	0.2923%	104	39.2003%	27.9055%
59	0.4513%	0.3313%	105	39.7886%	29.3116%
60	0.4875%	0.3722%	106	40.0000%	30.7811%
61	0.5732%	0.4154%	107	40.0000%	32.2725%
62	0.6495%	0.4513%	108	40.0000%	33.7441%
63	0.7429%	0.4875%	109	40.0000%	35.1544%
64	0.8234%	0.5477%	110	100.0000%	100.0000%

* Probabilities after adjustment for post-2010 mortality improvements.

Note: Assumptions are for use in actuarial valuations on and after June 30, 2010 in conjunction with One-Year Lag methodology to determine Fiscal Year 2012 and later employer contributions.

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

PROBABILITIES OF MORTALITY AFTER DISABILITY RETIREMENT
RECOMMENDED BY THE ACTUARY

VALUATION TABLES*

Age	Males	Females	Age	Males	Females
19	0.7084%	0.4500%	65	2.2907%	1.7289%
20	0.7124%	0.4600%	66	2.3866%	1.7421%
21	0.7265%	0.4725%	67	2.4580%	1.7555%
22	0.7527%	0.4853%	68	2.5029%	1.7691%
23	0.8040%	0.4978%	69	2.5974%	1.7918%
24	0.8588%	0.5106%	70	2.6651%	1.9096%
25	0.9313%	0.5237%	71	2.7452%	2.0068%
26	1.0407%	0.5509%	72	2.8812%	2.1666%
27	1.0781%	0.5509%	73	2.9885%	2.3001%
28	1.1001%	0.5509%	74	3.1561%	2.5011%
29	1.1226%	0.5509%	75	3.3423%	2.6669%
30	1.1809%	0.5795%	76	3.5471%	2.8784%
31	1.2421%	0.7734%	77	3.8879%	3.1561%
32	1.2674%	0.9422%	78	4.2037%	3.3423%
33	1.2740%	1.0909%	79	4.5497%	3.5471%
34	1.2808%	1.2381%	80	5.0785%	3.8879%
35	1.2878%	1.2674%	81	5.6361%	4.2037%
36	1.2950%	1.2740%	82	6.3260%	4.5497%
37	1.3024%	1.2808%	83	6.8955%	5.0785%
38	1.3100%	1.2878%	84	7.8204%	5.6361%
39	1.3178%	1.2950%	85	8.9495%	6.3260%
40	1.3258%	1.3024%	86	10.1407%	6.8955%
41	1.3340%	1.3136%	87	11.1587%	7.8204%
42	1.3424%	1.3220%	88	12.4543%	8.9495%
43	1.3510%	1.3306%	89	14.3062%	10.1407%
44	1.3598%	1.3394%	90	16.5497%	11.1587%
45	1.3688%	1.3484%	91	18.5179%	12.4543%
46	1.3780%	1.3576%	92	20.5396%	14.1002%
47	1.3874%	1.3670%	93	23.1217%	15.6608%
48	1.3970%	1.3766%	94	25.2155%	17.1161%
49	1.4068%	1.3864%	95	27.2485%	18.5008%
50	1.4168%	1.3964%	96	29.9756%	20.1666%
51	1.4270%	1.4066%	97	31.9397%	21.9471%
52	1.4374%	1.4170%	98	33.6045%	22.7737%
53	1.4480%	1.4276%	99	35.8628%	23.1685%
54	1.5165%	1.4384%	100	37.1685%	23.1885%
55	1.6168%	1.4494%	101	38.3040%	24.4834%
56	1.7236%	1.4606%	102	39.2003%	25.4498%
57	1.8101%	1.5165%	103	39.7886%	26.6044%
58	1.8733%	1.6168%	104	40.0000%	27.9055%
59	1.9108%	1.6539%	105	40.0000%	29.3116%
60	1.9511%	1.6659%	106	40.0000%	30.7811%
61	2.0253%	1.6781%	107	40.0000%	32.2725%
62	2.0738%	1.6905%	108	40.0000%	33.7441%
63	2.1601%	1.7031%	109	40.0000%	35.1544%
64	2.2213%	1.7159%	110	100.0000%	100.0000%

* Probabilities after adjustment for post-2010 mortality improvements.

Note: Assumptions are for use in actuarial valuations on and after June 30, 2010 in conjunction with One-Year Lag methodology to determine Fiscal Year 2012 and later employer contributions.

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

PROBABILITIES OF MORTALITY FOR BENEFICIARIES RECOMMENDED BY THE ACTUARY

VALUATION TABLES*

Age	Males	Females	Age	Males	Females
19	0.0205%	0.0123%	65	0.8897%	0.5921%
20	0.0214%	0.0124%	66	1.0376%	0.6627%
21	0.0227%	0.0125%	67	1.1641%	0.7359%
22	0.0238%	0.0126%	68	1.2609%	0.8360%
23	0.0256%	0.0132%	69	1.3799%	0.8911%
24	0.0271%	0.0138%	70	1.4650%	0.9723%
25	0.0292%	0.0146%	71	1.6146%	1.0643%
26	0.0325%	0.0158%	72	1.7612%	1.1776%
27	0.0337%	0.0165%	73	1.9048%	1.2630%
28	0.0347%	0.0174%	74	2.0453%	1.3704%
29	0.0363%	0.0183%	75	2.2299%	1.4425%
30	0.0392%	0.0205%	76	2.4856%	1.6514%
31	0.0445%	0.0262%	77	2.7947%	1.9002%
32	0.0500%	0.0305%	78	3.1104%	2.1122%
33	0.0556%	0.0340%	79	3.4326%	2.3209%
34	0.0608%	0.0370%	80	3.7991%	2.5246%
35	0.0665%	0.0400%	81	4.4263%	3.0055%
36	0.0707%	0.0424%	82	5.0785%	3.4326%
37	0.0748%	0.0452%	83	5.6361%	3.7991%
38	0.0779%	0.0481%	84	6.3260%	4.4263%
39	0.0818%	0.0514%	85	6.8955%	5.0785%
40	0.0875%	0.0564%	86	7.8204%	5.6361%
41	0.0978%	0.0607%	87	8.9495%	6.3260%
42	0.1078%	0.0658%	88	10.1407%	6.8955%
43	0.1176%	0.0717%	89	11.1587%	7.8204%
44	0.1272%	0.0783%	90	12.4543%	8.9495%
45	0.1364%	0.0842%	91	14.3062%	10.1407%
46	0.1455%	0.0907%	92	16.5497%	11.1587%
47	0.1543%	0.0977%	93	18.5179%	12.4543%
48	0.1631%	0.1071%	94	20.5396%	14.3062%
49	0.1715%	0.1167%	95	23.1217%	16.5497%
50	0.1815%	0.1292%	96	25.2155%	18.5179%
51	0.1998%	0.1426%	97	27.2485%	20.5396%
52	0.2176%	0.1603%	98	29.9756%	22.7737%
53	0.2400%	0.1800%	99	31.9397%	23.1685%
54	0.2629%	0.1998%	100	33.6045%	23.1885%
55	0.2923%	0.2176%	101	35.8628%	24.4834%
56	0.3313%	0.2400%	102	37.1685%	25.4498%
57	0.3722%	0.2629%	103	38.3040%	26.6044%
58	0.4154%	0.2923%	104	39.2003%	27.9055%
59	0.4513%	0.3313%	105	39.7886%	29.3116%
60	0.4875%	0.3722%	106	40.0000%	30.7811%
61	0.5732%	0.4154%	107	40.0000%	32.2725%
62	0.6495%	0.4513%	108	40.0000%	33.7441%
63	0.7429%	0.4875%	109	40.0000%	35.1544%
64	0.8234%	0.5477%	110	100.0000%	100.0000%

* Probabilities after adjustment for post-2010 mortality improvements.

Note: Assumptions are for use in actuarial valuations on and after June 30, 2010 in conjunction with One-Year Lag methodology to determine Fiscal Year 2012 and later employer contributions.

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

AGE-RELATED PROBABILITIES OF DECREMENT FROM ACTIVE SERVICE
RECOMMENDED BY THE ACTUARY
MEMBERS WHO DO NOT ELECT AN IMPROVED RETIREMENT PROGRAM*

MALES

Age	Ordinary Death	Accidental Death	Ordinary Disability	Accidental Disability	Reduced Svc Ret	******** Service Retirement ******** Year 1	Year 2	Ultimate
19	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
20	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
21	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
22	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
23	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
24	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
25	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
26	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
27	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
28	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
29	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
30	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
31	0.042%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%
32	0.044%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
33	0.046%	0.00%	0.04%	0.01%	0.00%	0.00%	0.00%	0.00%
34	0.048%	0.00%	0.05%	0.01%	0.00%	0.00%	0.00%	0.00%
35	0.050%	0.00%	0.06%	0.01%	0.00%	0.00%	0.00%	0.00%
36	0.052%	0.00%	0.07%	0.01%	0.00%	0.00%	0.00%	0.00%
37	0.054%	0.00%	0.08%	0.01%	0.00%	0.00%	0.00%	0.00%
38	0.056%	0.00%	0.08%	0.02%	0.00%	0.00%	0.00%	0.00%
39	0.058%	0.00%	0.09%	0.02%	0.00%	0.00%	0.00%	0.00%
40	0.060%	0.00%	0.10%	0.02%	0.00%	0.00%	0.00%	0.00%
41	0.070%	0.00%	0.11%	0.02%	0.00%	0.00%	0.00%	0.00%
42	0.080%	0.00%	0.12%	0.02%	0.00%	0.00%	0.00%	0.00%
43	0.090%	0.00%	0.13%	0.02%	0.00%	0.00%	0.00%	0.00%
44	0.100%	0.00%	0.14%	0.02%	0.00%	0.00%	0.00%	0.00%
45	0.110%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
46	0.120%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
47	0.130%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
48	0.140%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
49	0.150%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
50	0.160%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
51	0.170%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
52	0.180%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
53	0.190%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
54	0.200%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
55	0.210%	0.00%	0.15%	0.04%	2.00%	20.00%	0.00%	0.00%
56	0.220%	0.00%	0.15%	0.04%	2.00%	20.00%	15.00%	0.00%
57	0.230%	0.00%	0.15%	0.04%	2.00%	20.00%	15.00%	15.00%
58	0.240%	0.00%	0.15%	0.04%	2.00%	20.00%	15.00%	15.00%
59	0.250%	0.00%	0.15%	0.04%	3.00%	20.00%	15.00%	15.00%
60	0.260%	0.00%	0.15%	0.04%	4.00%	20.00%	15.00%	15.00%
61	0.270%	0.00%	0.15%	0.04%	5.00%	20.00%	15.00%	15.00%
62	0.280%	0.00%	0.15%	0.04%	0.00%	30.00%	20.00%	20.00%
63	0.290%	0.00%	0.15%	0.04%	0.00%	20.00%	15.00%	15.00%
64	0.300%	0.00%	0.15%	0.04%	0.00%	20.00%	15.00%	15.00%
65	0.320%	0.00%	0.15%	0.04%	0.00%	30.00%	20.00%	20.00%
66	0.350%	0.00%	0.15%	0.04%	0.00%	20.00%	15.00%	15.00%
67	0.390%	0.00%	0.15%	0.04%	0.00%	20.00%	15.00%	15.00%
68	0.440%	0.00%	0.15%	0.04%	0.00%	20.00%	15.00%	15.00%
69	0.500%	0.00%	0.15%	0.04%	0.00%	20.00%	15.00%	15.00%
70	NA	NA	NA	NA	NA	100.00%	100.00%	100.00%

* Applies to members who did not voluntarily elect to participate in the 55/25 plan enacted under Chapter 19 of the Laws of 2008 and to members mandated into the 55/27 plan.

Note: All probabilities are rounded as shown and apply to males only at age/service when member is eligible. Assumptions are for use in actuarial valuations on and after June 30, 2010 in conjunction with One-Year Lag methodology to determine Fiscal Year 2012 and later employer contributions.

NA: Not Applicable as members age 70 and greater are assumed to leave active employment immediately.

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

AGE-RELATED PROBABILITIES OF DECREMENT FROM ACTIVE SERVICE
RECOMMENDED BY THE ACTUARY
MEMBERS WHO DO NOT ELECT AN IMPROVED RETIREMENT PROGRAM*

FEMALES

Age	Ordinary Death	Accidental Death	Ordinary Disability	Accidental Disability	Reduced Svc Ret	******** Service Retirement ******** Year 1	Year 2	Ultimate
19	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
20	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
21	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
22	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
23	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
24	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
25	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
26	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
27	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
28	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
29	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
30	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
31	0.021%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
32	0.022%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%
33	0.023%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
34	0.024%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%
35	0.025%	0.00%	0.05%	0.01%	0.00%	0.00%	0.00%	0.00%
36	0.026%	0.00%	0.06%	0.01%	0.00%	0.00%	0.00%	0.00%
37	0.027%	0.00%	0.07%	0.01%	0.00%	0.00%	0.00%	0.00%
38	0.028%	0.00%	0.08%	0.01%	0.00%	0.00%	0.00%	0.00%
39	0.029%	0.00%	0.09%	0.01%	0.00%	0.00%	0.00%	0.00%
40	0.030%	0.00%	0.10%	0.01%	0.00%	0.00%	0.00%	0.00%
41	0.035%	0.00%	0.11%	0.01%	0.00%	0.00%	0.00%	0.00%
42	0.040%	0.00%	0.12%	0.01%	0.00%	0.00%	0.00%	0.00%
43	0.045%	0.00%	0.13%	0.02%	0.00%	0.00%	0.00%	0.00%
44	0.050%	0.00%	0.14%	0.02%	0.00%	0.00%	0.00%	0.00%
45	0.055%	0.00%	0.15%	0.02%	0.00%	0.00%	0.00%	0.00%
46	0.060%	0.00%	0.16%	0.02%	0.00%	0.00%	0.00%	0.00%
47	0.065%	0.00%	0.17%	0.02%	0.00%	0.00%	0.00%	0.00%
48	0.070%	0.00%	0.18%	0.03%	0.00%	0.00%	0.00%	0.00%
49	0.075%	0.00%	0.19%	0.03%	0.00%	0.00%	0.00%	0.00%
50	0.080%	0.00%	0.20%	0.03%	0.00%	0.00%	0.00%	0.00%
51	0.085%	0.00%	0.20%	0.03%	0.00%	0.00%	0.00%	0.00%
52	0.090%	0.00%	0.20%	0.03%	0.00%	0.00%	0.00%	0.00%
53	0.095%	0.00%	0.20%	0.03%	0.00%	0.00%	0.00%	0.00%
54	0.100%	0.00%	0.20%	0.03%	0.00%	0.00%	0.00%	0.00%
55	0.105%	0.00%	0.20%	0.04%	2.00%	20.00%	0.00%	0.00%
56	0.110%	0.00%	0.20%	0.04%	2.00%	20.00%	15.00%	0.00%
57	0.115%	0.00%	0.20%	0.04%	2.00%	20.00%	15.00%	15.00%
58	0.120%	0.00%	0.20%	0.04%	2.00%	20.00%	15.00%	15.00%
59	0.125%	0.00%	0.20%	0.04%	3.00%	20.00%	15.00%	15.00%
60	0.130%	0.00%	0.20%	0.04%	4.00%	20.00%	15.00%	15.00%
61	0.135%	0.00%	0.20%	0.04%	5.00%	20.00%	15.00%	15.00%
62	0.140%	0.00%	0.20%	0.04%	0.00%	30.00%	20.00%	20.00%
63	0.145%	0.00%	0.20%	0.04%	0.00%	20.00%	15.00%	15.00%
64	0.150%	0.00%	0.20%	0.04%	0.00%	20.00%	15.00%	15.00%
65	0.160%	0.00%	0.20%	0.04%	0.00%	30.00%	20.00%	20.00%
66	0.175%	0.00%	0.20%	0.04%	0.00%	20.00%	15.00%	15.00%
67	0.195%	0.00%	0.20%	0.04%	0.00%	20.00%	15.00%	15.00%
68	0.220%	0.00%	0.20%	0.04%	0.00%	20.00%	15.00%	15.00%
69	0.250%	0.00%	0.20%	0.04%	0.00%	20.00%	15.00%	15.00%
70	NA	NA	NA	NA	NA	100.00%	100.00%	100.00%

* Applies to members who did not voluntarily elect to participate in the 55/25 plan enacted under Chapter 19 of the Laws of 2008 and to members mandated into the 55/27 plan.

Note: All probabilities are rounded as shown and apply to females only at age/service when member is eligible. Assumptions are for use in actuarial valuations on and after June 30, 2010 in conjunction with One-Year Lag methodology to determine Fiscal Year 2012 and later employer contributions.

NA: Not Applicable as members age 70 and greater are assumed to leave active employment immediately.

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

AGE-RELATED PROBABILITIES OF DECREMENT FROM ACTIVE SERVICE
RECOMMENDED BY THE ACTUARY
MEMBERS WHO ELECTED AN IMPROVED RETIREMENT PROGRAM*

MALES

Age	Ordinary Death	Accidental Death	Ordinary Disability	Accidental Disability	Reduced Svc Ret	******** Service Retirement ******** Year 1	Year 2	Ultimate
19	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
20	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
21	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
22	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
23	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
24	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
25	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
26	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
27	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
28	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
29	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
30	0.040%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
31	0.042%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%
32	0.044%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
33	0.046%	0.00%	0.04%	0.01%	0.00%	0.00%	0.00%	0.00%
34	0.048%	0.00%	0.05%	0.01%	0.00%	0.00%	0.00%	0.00%
35	0.050%	0.00%	0.06%	0.01%	0.00%	0.00%	0.00%	0.00%
36	0.052%	0.00%	0.07%	0.01%	0.00%	0.00%	0.00%	0.00%
37	0.054%	0.00%	0.08%	0.01%	0.00%	0.00%	0.00%	0.00%
38	0.056%	0.00%	0.08%	0.02%	0.00%	0.00%	0.00%	0.00%
39	0.058%	0.00%	0.09%	0.02%	0.00%	0.00%	0.00%	0.00%
40	0.060%	0.00%	0.10%	0.02%	0.00%	0.00%	0.00%	0.00%
41	0.070%	0.00%	0.11%	0.02%	0.00%	0.00%	0.00%	0.00%
42	0.080%	0.00%	0.12%	0.02%	0.00%	0.00%	0.00%	0.00%
43	0.090%	0.00%	0.13%	0.02%	0.00%	0.00%	0.00%	0.00%
44	0.100%	0.00%	0.14%	0.02%	0.00%	0.00%	0.00%	0.00%
45	0.110%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
46	0.120%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
47	0.130%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
48	0.140%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
49	0.150%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
50	0.160%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
51	0.170%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
52	0.180%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
53	0.190%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
54	0.200%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.00%
55	0.210%	0.00%	0.15%	0.04%	2.00%	30.00%	0.00%	0.00%
56	0.220%	0.00%	0.15%	0.04%	2.00%	30.00%	20.00%	0.00%
57	0.230%	0.00%	0.15%	0.04%	2.00%	30.00%	20.00%	20.00%
58	0.240%	0.00%	0.15%	0.04%	2.00%	30.00%	20.00%	20.00%
59	0.250%	0.00%	0.15%	0.04%	3.00%	30.00%	20.00%	20.00%
60	0.260%	0.00%	0.15%	0.04%	4.00%	30.00%	20.00%	20.00%
61	0.270%	0.00%	0.15%	0.04%	5.00%	30.00%	20.00%	20.00%
62	0.280%	0.00%	0.15%	0.04%	0.00%	40.00%	30.00%	30.00%
63	0.290%	0.00%	0.15%	0.04%	0.00%	30.00%	20.00%	20.00%
64	0.300%	0.00%	0.15%	0.04%	0.00%	30.00%	20.00%	20.00%
65	0.320%	0.00%	0.15%	0.04%	0.00%	40.00%	30.00%	30.00%
66	0.350%	0.00%	0.15%	0.04%	0.00%	30.00%	20.00%	20.00%
67	0.390%	0.00%	0.15%	0.04%	0.00%	30.00%	20.00%	20.00%
68	0.440%	0.00%	0.15%	0.04%	0.00%	30.00%	20.00%	20.00%
69	0.500%	0.00%	0.15%	0.04%	0.00%	30.00%	20.00%	20.00%
70	NA	NA	NA	NA	NA	100.00%	100.00%	100.00%

* Applies to members who voluntarily elected to participate in the 55/25 plan enacted under Chapter 19 of the Laws of 2008.

Note: All probabilities are rounded as shown and apply to males only at age/service when member is eligible. Assumptions are for use in actuarial valuations on and after June 30, 2010 in conjunction with One-Year Lag methodology to determine Fiscal Year 2012 and later employer contributions.

NA: Not Applicable as members age 70 and greater are assumed to leave active employment immediately.

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

AGE-RELATED PROBABILITIES OF DECREMENT FROM ACTIVE SERVICE
RECOMMENDED BY THE ACTUARY
MEMBERS WHO ELECTED AN IMPROVED RETIREMENT PROGRAM*

FEMALES

Age	Ordinary Death	Accidental Death	Ordinary Disability	Accidental Disability	Reduced Svc Ret	******** Service Retirement ******** Year 1	Year 2	Ultimate
19	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
20	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
21	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
22	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
23	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
24	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
25	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
26	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
27	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
28	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
29	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
30	0.020%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
31	0.021%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
32	0.022%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%
33	0.023%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
34	0.024%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%
35	0.025%	0.00%	0.05%	0.01%	0.00%	0.00%	0.00%	0.00%
36	0.026%	0.00%	0.06%	0.01%	0.00%	0.00%	0.00%	0.00%
37	0.027%	0.00%	0.07%	0.01%	0.00%	0.00%	0.00%	0.00%
38	0.028%	0.00%	0.08%	0.01%	0.00%	0.00%	0.00%	0.00%
39	0.029%	0.00%	0.09%	0.01%	0.00%	0.00%	0.00%	0.00%
40	0.030%	0.00%	0.10%	0.01%	0.00%	0.00%	0.00%	0.00%
41	0.035%	0.00%	0.11%	0.01%	0.00%	0.00%	0.00%	0.00%
42	0.040%	0.00%	0.12%	0.01%	0.00%	0.00%	0.00%	0.00%
43	0.045%	0.00%	0.13%	0.02%	0.00%	0.00%	0.00%	0.00%
44	0.050%	0.00%	0.14%	0.02%	0.00%	0.00%	0.00%	0.00%
45	0.055%	0.00%	0.15%	0.02%	0.00%	0.00%	0.00%	0.00%
46	0.060%	0.00%	0.16%	0.02%	0.00%	0.00%	0.00%	0.00%
47	0.065%	0.00%	0.17%	0.02%	0.00%	0.00%	0.00%	0.00%
48	0.070%	0.00%	0.18%	0.03%	0.00%	0.00%	0.00%	0.00%
49	0.075%	0.00%	0.19%	0.03%	0.00%	0.00%	0.00%	0.00%
50	0.080%	0.00%	0.20%	0.03%	0.00%	0.00%	0.00%	0.00%
51	0.085%	0.00%	0.20%	0.03%	0.00%	0.00%	0.00%	0.00%
52	0.090%	0.00%	0.20%	0.03%	0.00%	0.00%	0.00%	0.00%
53	0.095%	0.00%	0.20%	0.03%	0.00%	0.00%	0.00%	0.00%
54	0.100%	0.00%	0.20%	0.03%	0.00%	0.00%	0.00%	0.00%
55	0.105%	0.00%	0.20%	0.04%	2.00%	30.00%	0.00%	0.00%
56	0.110%	0.00%	0.20%	0.04%	2.00%	30.00%	20.00%	0.00%
57	0.115%	0.00%	0.20%	0.04%	2.00%	30.00%	20.00%	20.00%
58	0.120%	0.00%	0.20%	0.04%	2.00%	30.00%	20.00%	20.00%
59	0.125%	0.00%	0.20%	0.04%	3.00%	30.00%	20.00%	20.00%
60	0.130%	0.00%	0.20%	0.04%	4.00%	30.00%	20.00%	20.00%
61	0.135%	0.00%	0.20%	0.04%	5.00%	30.00%	20.00%	20.00%
62	0.140%	0.00%	0.20%	0.04%	0.00%	40.00%	30.00%	30.00%
63	0.145%	0.00%	0.20%	0.04%	0.00%	30.00%	20.00%	20.00%
64	0.150%	0.00%	0.20%	0.04%	0.00%	30.00%	20.00%	20.00%
65	0.160%	0.00%	0.20%	0.04%	0.00%	40.00%	30.00%	30.00%
66	0.175%	0.00%	0.20%	0.04%	0.00%	30.00%	20.00%	20.00%
67	0.195%	0.00%	0.20%	0.04%	0.00%	30.00%	20.00%	20.00%
68	0.220%	0.00%	0.20%	0.04%	0.00%	30.00%	20.00%	20.00%
69	0.250%	0.00%	0.20%	0.04%	0.00%	30.00%	20.00%	20.00%
70	NA	NA	NA	NA	NA	100.00%	100.00%	100.00%

* Applies to members who voluntarily elected to participate in the 55/25 plan enacted under Chapter 19 of the Laws of 2008.

Note: All probabilities are rounded as shown and apply to females only at age/service when member is eligible. Assumptions are for use in actuarial valuations on and after June 30, 2010 in conjunction with One-Year Lag methodology to determine Fiscal Year 2012 and later employer contributions.

NA: Not Applicable as members age 70 and greater are assumed to leave active employment immediately.

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

SERVICE-RELATED PROBABILITIES OF DECREMENT FROM ACTIVE SERVICE RECOMMENDED BY THE ACTUARY

Years of Service	Withdrawal
0	9.00%
1	8.00%
2	7.00%
3	6.00%
4	5.00%
5	4.00%
6	3.50%
7	3.05%
8	2.65%
9	2.30%
10	2.00%
11	1.75%
12	1.55%
13	1.40%
14	1.30%
15	1.25%
16	1.20%
17	1.15%
18	1.10%
19	1.05%
20	1.00%
21	0.90%
22	0.80%
23	0.70%
24	0.60%
25	0.50%
26	0.50%
27	0.50%
28	0.50%
29	0.50%
30	0.50%
31	0.50%
32	0.50%
33	0.50%
34	0.50%
35	0.50%

Note: All probabilities are rounded as shown and apply to both males and females only until members are eligible for retirement. Assumptions are for use in actuarial valuations on and after June 30, 2010 in conjunction with One-Year Lag methodology to determine Fiscal Year 2012 and later employer contributions.

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

ANNUAL RATES OF SALARY INCREASE
RECOMMENDED BY THE ACTUARY

Years of Service	Merit Increase	Salary Scale*
0	10.00%	13.00%
1	8.00%	11.00%
2	6.00%	9.00%
3	5.00%	8.00%
4	6.00%	9.00%
5	5.00%	8.00%
6	5.00%	8.00%
7	4.00%	7.00%
8	2.00%	5.00%
9	5.00%	8.00%
10	1.00%	4.00%
11	1.00%	4.00%
12	3.00%	6.00%
13	1.00%	4.00%
14	5.00%	8.00%
15	1.00%	4.00%
16	1.00%	4.00%
17	2.00%	5.00%
18	1.00%	4.00%
19	9.00%	12.00%
20	1.00%	4.00%
21	5.00%	8.00%
22	1.00%	4.00%
23	1.00%	4.00%
24	1.00%	4.00%
25	1.00%	4.00%
26	1.00%	4.00%
27	1.00%	4.00%
28	1.00%	4.00%
29	1.00%	4.00%
30	1.00%	4.00%
31	1.00%	4.00%
32	1.00%	4.00%
33	1.00%	4.00%
34	1.00%	4.00%
35	1.00%	4.00%
36	1.00%	4.00%
37	1.00%	4.00%
38	1.00%	4.00%
39	1.00%	4.00%
40	1.00%	4.00%
41	1.00%	4.00%
42	1.00%	4.00%
43	1.00%	4.00%
44	1.00%	4.00%
45	1.00%	4.00%
46	1.00%	4.00%
47	1.00%	4.00%
48	1.00%	4.00%
49	1.00%	4.00%
50	1.00%	4.00%

* Includes General Wage Increases of 3.0% per year.

Note: Assumptions are for use in actuarial valuations on and after June 30, 2010 in conjuction with One-Year Lag methodology to determine Fiscal Year 2012 and later employer contributions.

APPENDIX E - DISCUSSION OF FINANCIAL ECONOMICS, FUNDING AND DISCLOSURE

As noted in Section VI of this Report, the economic assumptions proposed herein have been developed in accordance with the current requirements of Actuarial Standard of Practice Number 27 which is the prevailing guidance on this issue for professional actuaries in the United States.

The economic assumptions proposed herein were also developed in conjunction with the other actuarial assumptions and methods to provide an overall **package** of actuarial assumptions and methods that is designed to, as well as possible, meet the goals of providing security for plan participants while establishing an expected pattern of employer contributions that should be less volatile, more predictable and reasonably consistent with the principles of intergenerational equity.

However, Trustees should be aware that changes are being discussed with respect to the requirements of **ASOP27** and accounting practice. In addition, investor expectations are expanding with respect to disclosure of information on the financial condition of pension funds.

These changes are unfolding most rapidly with respect to private sector pension plans and are generally described as intended to provide more transparency to the relationship between pension fund assets and liabilities or as “marking-to-market” the assets and liabilities of the pension funds.

The impact of these changes on the requirements for funding for public sector pension plans is not likely to occur soon or to be as direct or dramatic as for private sector pension plans.

However, change is underway in the public sector that may well impact taxpayer and investor perception of public sector pension plans in the near future and possibly impact financing of such plans thereafter.

With an eye to that future, since June 30, 2003, the Actuarial Section of the Comprehensive Annual Financial Report for **TRS** has included a subsection called “Additional Discussion of Plan Funding and “Other Measures of Funded Status”.

One of those Other Measures of Funded Status is a Funded Ratio calculated as the Market Value of Assets (“**MVA**”) divided by a liability measure referred to as the Market Value-related Accumulated Benefit Obligation (“**MVABO**”). This Funded Ratio will be referred to hereafter as the Economic Funded Ratio (“**EFR**”).

The **EFR** is a measure of funded status where:

- Assets are determined at Market Value without any smoothing.

- Liabilities are determined using assumptions that are independent of the asset allocation of the Fund and exclusive of any advance recognition of expected asset risk premia (e.g., equity risk premium).

The **EFR** provides an estimate of the financial status of **TRS** that meets the criteria of economic transparency and that is consistent with anticipated changes to disclosure requirements for private sector pension plans and, at some point, for public sector pension plans.

To the extent that the liabilities of a pension plan are bond-like instruments, a review of the **EFR** over a period of years highlights the overall economic relationship, and whatever mismatch may exist, between the assets and liabilities of a pension fund.

In the case of an asset allocation that is at least 60% equities, it is to be expected that the **EFR** would be volatile.

Depending upon the goals and objectives of a pension fund, such volatility is not necessarily a cause for concern but it should be monitored. In fact, eliminating such volatility could only be achieved by investing the assets of a fund in duration-matched, bond-like securities.

Doing so, however, would result in less expected investment return for a fund based on currently–available bond yields. As a consequence of the fundamental rule of pension funding (i.e., contributions plus investment income pay for benefits plus expenses), a full match between the assets and liabilities of a fund could significantly increase employer contributions to that fund.

The proposals in this Report for the ongoing funding of **TRS** are intended to strike the appropriate balance amongst participant security, contribution stability and predictability, and intergenerational equity and employer financial capacity.

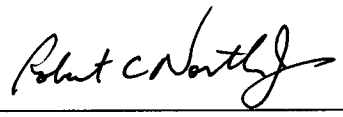
The disclosure of Other Measures of Funded Status is intended to provide users with a more robust understanding of the economic status of the Fund at each valuation date. These additional disclosures also illustrate the implications and dynamics of the funding and investment policies employed to finance the Fund.

APPENDIX F - STATEMENT OF ACTUARIAL OPINION

PROPOSED CHANGES IN ACTUARIAL ASSUMPTIONS AND METHODS FOR DETERMINING EMPLOYER CONTRIBUTIONS FOR FISCAL YEARS BEGINNING ON AND AFTER JULY 1, 2011 FOR THE NEW YORK CITY TEACHERS' RETIREMENT SYSTEM

ACKNOWLEDGEMENT OF QUALIFICATION

I, Robert C. North, Jr., am the Chief Actuary for the New York City Retirement Systems. I am a Fellow of the Society of Actuaries and a Member of the American Academy of Actuaries. I meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.



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Chief Actuary
New York City Retirement Systems
February 10, 2012

APPENDIX G - ACKNOWLEDGEMENTS

The Actuary acknowledges and expresses appreciation to **Hay** and to **Segal** whose Reports formed the basis for several of the Actuary's proposals.

The Actuary also thanks the staff of the Office of the Actuary who offered suggestions, prepared computations, developed supporting information and worked tirelessly to help produce this Report.

The Actuary further wishes to express appreciation to the many members of the Boards of Trustees of the five actuarially-funded **NYCRS** and representative of their participating employers who provided valuable viewpoints.

Finally, the Actuary wishes to thank the members of the Retirement Board of **TRS** whose ongoing support has made much easier the professional challenge of developing these proposals.