TEACHER RETIREMENT SYSTEM OF TEXAS

ACTUARIAL EXPERIENCE STUDY

AS OF AUGUST 31, 2014

Gabriel Roeder Smith & Company

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September 9, 2015

Board of Trustees
Teacher Retirement System of Texas
1000 Red River Street
Austin, TX 78701-2698

Dear Members of the Board:

Subject: Results of 2015 Experience Study

We are pleased to present our report on the results of the 2015 Experience Study for the Teacher Retirement System of Texas (TRS). It includes our recommendations for new actuarial assumptions to be effective for the August 31, 2015 actuarial valuation, and it describes the actuarial impact produced by these recommendations as though they had been effective for the August 31, 2014 actuarial valuation.

With the Board's approval of the recommendations in this report, we believe the actuarial condition of the System will be more accurately portrayed. The Board's decisions should be based on the appropriateness of each recommendation individually, not on their collective effect on the funding period or the unfunded liability.

This study was conducted in accordance with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board. The undersigned meet all of the Qualification Standards of the American Academy of Actuaries. In addition, both of the undersigned have extensive experience as retained public sector actuaries for several large, statewide public retirement systems.

We wish to thank the TRS staff for their assistance in providing data for this study.

Sincerely,

Lewis Ward
Consultant

Joseph P. Newton, FSA, EA, MAAA
Senior Consultant

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SECTION I

EXECUTIVE SUMMARY

Summary of Recommendations

Our recommended changes to the current actuarial assumptions may be summarized as follows:

Economic Assumptions

1. We recommend no change to the current nominal investment return assumption of 8.00%. Based on a blending of the current capital market assumptions from seventeen independent sources and the System's target asset allocation, an 8.00% investment return is very close to the median expected geometric return. Even though lowering the inflation assumption (see below) actually increases the assumed real rate of return assumption, there have been adjustments to the asset allocation as inflation has continued to decrease in order to increase the real return of the portfolio.

2. The current 8.00% assumption is based on earning the 8.00%, net of all investment *and* administrative expenses. This actually equates to a gross assumption in excess of 8.00%. We recommend adding an explicit charge for administrative expenses instead of netting the expenses against the investment return assumption by assuming administrative expenses will be 0.12% of covered payroll, and adding this expense to the required contribution rate. The 0.12% is based on the information from the most recent CAFR. This will mimic the approach used in determining the investment return assumption under the accounting rules so that one investment return assumption can be used for each purpose.

3. We recommend decreasing the inflation assumption from 3.00% to 2.50%. This will have an impact on projected wage growth.

4. We recommend an ultimate merit assumption for long-service employees of 1.00%. This means we will assume members with more than 25 years of service will receive increases equal to 3.50% per year. This is a net decrease of 0.75% per year compared to the current assumption set. This recommendation reflects a reduction in inflation as well as a reduction in the spread between inflation and salary increases experienced in the overall economy.

5. In accordance with the observed experience, we are recommending small adjustments in the service-based promotional/longevity component of the salary scale.

6. We recommend lowering the payroll growth assumption from 3.50% to 2.50%. This decrease is based on the sum of the 0.50% decrease in inflation, 0.25% from the salary scale plus another 0.25% to reflect the expected drag on overall payroll growth due to the retirements of the baby boomer generation over the next decade. As these members retire they will be replaced by new members with much lower salaries. The payroll growth assumption has no impact on the liabilities. This assumption is used to project amortization payments that will be received by

the System to amortize the UAAL and thus has a direct impact on the calculated funding period.

7. We currently assume there will be no cost of living increases or supplemental payments provided to retirees. At this time, we recommend no change to this assumption.

Mortality Assumptions

8. We recommend updating the post-retirement mortality tables for non-disabled retirees to reflect recent TRS member experience. We also recommend assuming mortality rates will continue to improve in the future using a fully generational approach and Scale BB.

9. We recommend updating post-retirement mortality tables for disabled retirees to reflect recent TRS member experience. We also recommend assuming mortality rates will continue to improve in the future using a fully generational approach and Scale BB.

10. We recommend updating the pre-retirement mortality tables for active employees to use 90% of the recently published RP-2014 mortality table for active employees. We also recommend assuming mortality rates will continue to improve in the future using a fully generational approach and Scale BB.

Other Demographic Assumptions

11. We recommend modifying who is counted as an active member in the valuation. Currently, members who contributed during the most recent fiscal year, but have not applied for a retirement, are considered to be active on the valuation date. We are not proposing any change for this group. However, we also assume 10% of any members who have contributed (been active) in the past 5 years to be an active member. This was an implicit rehire assumption because Teachers have historically had high incidence of terminating employment for a time and then returning to the workforce at a later date. We are modifying this methodology to add a more explicit valuation of the rehire incidence in the termination liabilities, and therefore recommend not counting this additional 10% as active employees. This will be a much cleaner approach to not only the valuation process (as the 10% required two sets of valuation runs for these members) but also in reporting demographic information because each member will be classified into one category (active, inactive, or in payment). This change will not have a material impact on the liabilities or cost calculations, but will make for a more efficient process.

12. We recommend adjustments to the termination patterns for members consistent with experience and future expectations. The termination patterns have been adjusted to reflect the rehire assumption. We will change the timing of the termination decrement from the middle of the year to the beginning of the year to mimic the actual pattern in the data.

13. We recommend small adjustments to the retirement patterns for members consistent with experience and future expectations. We recommend no change to the current assumption that

members will work a full year and then retire.

14. We recommend small adjustments to the disability patterns for members consistent with experience and future expectations. We are proposing two separate patterns based on whether the member has 10 years of service or more.

15. For members that become disabled in the future, we will assume 20% of them will choose a 100% joint and survivor annuity option.

16. We recommend no change to the current marriage assumption and spousal age difference.

Actuarial Methods and Policies

17. We recommend no change to the current process of estimating the valuation payroll for the upcoming fiscal year.

18. We recommend no change to the current asset smoothing method or the smoothing period. We do recommend removing the corridor around the market value of assets as simulations show the corridor is not needed in conjunction with the current method and period.

19. We recommend no change to the current funding method. The Entry Age Normal cost method (EAN) is the current funding method being used to allocate the actuarial costs of the System. The Entry Age Normal method will generally produce relatively level contribution amounts as a percentage of payroll from year to year, and allocates costs among various generations of taxpayers in a reasonable manner. It is by far the most commonly used actuarial cost method for large public retirement systems. In addition, we recommend continued use of the Ultimate Normal Cost variant of EAN because it produces a funding requirement as a percentage of payroll that is the most stable and predictable over time compared to all other funding methods and variants. Especially with a plan that receives its contribution as a fixed percent of payroll, this variant provides for a simple and straightforward calculation of the funding period. We continue to believe this is the most appropriate funding method. However, we will eliminate the use of a new entrant profile for determining the System's normal cost rate. Instead we will determine the normal cost of the current active group.

20. We recommend changing from using celled data in the valuation process to using individual data records. This will make for a cleaner and simpler valuation process and allow for better reporting of some items, such as actuarial gains and losses by source. However, the use of individual data will extend the computer run time dramatically. Thus, we will continue to use celled data in legislative analyses and adjust for any difference between the two data sets.

- ***Impact of all recommended changes:***

Item	2014 Valuation	Recommended Assumptions
(1)	(2)	(3)
Total Normal Cost %	10.43%	9.74%
Unfunded Actuarial Accrued Liability ($ in Billions)	$31.6	$32.8
Funded Ratio	80.2%	79.7%
Funding Period Based on Current Contribution Levels	29.8 years	33.4 years
30 Year ARC	8.66%	8.91%*

*Includes 12 basis point load for administrative expenses

SECTION II

INTRODUCTION

Introduction

A periodic review and selection of the actuarial assumptions is one of many important components of understanding and managing the financial aspects of the Teacher Retirement System of Texas (TRS). Use of outdated or inappropriate assumptions can result in understated costs which will lead to higher future contribution requirements or perhaps an inability to pay benefits when due; or, on the other hand, produce overstated costs which place an unnecessarily large burden on the current generation of members, employers, and taxpayers.

A single set of assumptions is typically not expected to be suitable forever. As the actual experience unfolds or the future expectations change, the assumptions should be reviewed and adjusted accordingly.

It is important to recognize that the impact from various outcomes and the ability to adjust from experience deviating from the assumptions are not symmetric. Due to compounding economic forces, legal limitations, and moral obligations outcomes from underestimating future liabilities are much more difficult to manage than outcomes of overestimates, and that un-symmetric risk should be considered when the assumption set, investment policy and funding policy are created. As such, the assumption set used in the valuation process needs to represent the best estimate of the future experience of the System and be at least as likely, if not more than likely, to overestimate the future liabilities versus underestimate them.

Using this strategic mindset, each assumption was analyzed compared to the actual experience of TRS and general experience of other large public employee retirement systems. Changes in certain assumptions and methods are suggested upon this comparison to remove any bias that may exist and to perhaps add in a slight margin for future adverse experience where appropriate. Next, the assumption set as a whole was analyzed for consistency and to ensure that the projection of liabilities was reasonable and consistent with historical trends.

The following report provides our recommended changes to the current actuarial assumptions.

Summary of Process

In determining liabilities and contribution rates for retirement plans, actuaries must make assumptions about the future. Among the assumptions that must be made include:

- Retirement rates
- Mortality rates
- Turnover rates
- Disability rates
- Investment return rate
- Salary increase rates
- Inflation rate

For some of these assumptions, such as the mortality rates, past experience provides important evidence about the future. For others, such as the investment return assumption, the link between past and future results is much weaker. In either case, actuaries should review the plan's assumptions periodically and determine whether these assumptions are consistent with actual past experience and with anticipated future experience.

The last such actuarial experience investigation was performed immediately following the August 31, 2010 actuarial valuation. For this experience study, we have added TRS' experience for the four-year period from August 31, 2010 through August 31, 2014 (FY 2011 – FY 2014).

In conducting experience studies, actuaries generally use data over a period of several years. This is necessary in order to gather enough data so that the results are statistically significant. In addition, if the study period is too short, the impact of the current economic conditions may lead to misleading results. It is known, for example, that the health of the general economy can impact salary increase rates and withdrawal rates. Using results gathered during a short-term boom or bust will not be representative of the long-term trends in these assumptions. Also, the adoption of legislation, such as plan improvements or changes in salary schedules, will sometimes cause a short-term distortion in the experience. For example, if an early retirement window was opened during the study period, we would usually see a short-term spike in the number of retirements followed by a dearth of retirements for the following two-to-four years. Using a longer period prevents giving too much weight to such short-term effects. On the other hand, using a much longer period could water down real changes that may be occurring, such as mortality improvement or a change in the ages at which members retire.

For this analysis, we used between three and twenty years of data, depending on the assumption being studied as follows:

Assumption	Data Used	Comment
Payroll/Population Growth	20 Years	Long term trends are needed, but more importantly, prospective changes must be considered
Individual Salary Increases	10 Years	Longer period will capture a longer economic cycle
Termination	10 Years	Longer period will capture a longer economic cycle
Post-Retirement Mortality	3 Years	This assumption reacts the quickest to changing trends and is best studied using an odd number of years for comparing to generational mortality tables. More years were used to analyze the rate of improvement over time.
All other	5 Years	The assumptions react quicker to changing trends and are less correlated with the economic cycle. 5 years provides more credibility to some of the assumptions that have smaller incidence, such as active mortality and disability

In an experience study, we first determine the number of deaths, retirements, etc. that occurred during the period. Then we determine the number expected to occur, based on the current actuarial assumptions. The number of "expected" decrements is determined by multiplying the probability of the occurrence at the given age, by the "exposures" at that same age. For example, let's look at a rate of retirement of 15% at age 55. The number of exposures can only be those members who are age 55 and eligible for retirement at that time. Thus they are considered "exposed" to that assumption. Finally, we calculate the A/E ratio, where "A" is the actual number (of retirements, for example) and "E" is the expected number. If the current assumptions were "perfect", the A/E ratio would be 100%. When it varies much from this figure, it is a sign that new assumptions may be needed. (However, in some cases we prefer to set our assumptions to produce an A/E ratio a little above or below 100%, in order to introduce some conservatism.) Of course we not only look at the assumptions as a whole, but we also review how well they fit the actual results by gender, by age, and by service.

If the data leads the actuary to conclude that new tables are needed, the actuary may "graduate" or smooth the results, since the raw results can be quite uneven from age to age or from service to service.

Please bear in mind that, while the recommended assumption set represents our best estimate, there are other reasonable assumptions sets that could be supported. Some reasonable assumption sets would show higher or lower liabilities or costs. For example, while our analysis concludes that an 8.00% investment return assumption is appropriate, others might argue that a different rate is also appropriate.

Organization of Report

Section III contains our findings and recommendations for each actuarial assumption. The impact of adopting our recommendations on liabilities and contribution rates is shown in Section IV. Section V summarizes the recommended changes. Section VI presents a summary of all the actuarial assumptions and methods, including the recommended changes. Finally, tables summarizing the analysis of the assumptions are in Section VII.

Section VII Exhibits

The exhibits in Section VII should generally be self-explanatory. For example, on page 60, we show an exhibit analyzing the termination rates for females with 10 or more years of service. The second column shows the total number of female members with at least 10 years of service who terminated during the study period. This excludes members who died, became disabled or retired. Column (3), labeled "Total Count" shows the total exposures of this group. This is the number of members who meet the criteria who could have terminated during any of the years. On this exhibit, the exposures exclude anyone eligible for unreduced retirement. A member is counted in each year they could have terminated, so the total shown is the total exposures for the ten-year period. Column (4) shows the probability of termination based on the raw data. That is, it is the result of dividing the actual number of terminations (col. 2) by the number exposed (col. 3). Column (5) shows the current termination rate and column (6) shows the new recommended termination rate.

Columns (7) and (8) show the expected numbers of terminations based on the current and proposed termination assumptions. Columns (9) and (10) show the Actual-to-Expected ratios under the current and proposed termination assumptions.

SECTION III

ANALYSIS OF EXPERIENCE AND RECOMMENDATIONS

Analysis of Experience and Recommendations

We will begin by discussing the economic assumptions: inflation, the investment return rate, the salary increase assumption, the cost-of-living increases, and the payroll growth rate. Then we will discuss the demographic assumptions: mortality, disability, termination and retirement. Finally we will discuss the actuarial methods used.

INFLATION AND INVESTMENT RETURN ASSUMPTIONS

Actuarial Standards of Practice (ASOP) No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, provides guidance to actuaries on giving advice on selecting economic assumptions for measuring obligations for defined benefit plans. ASOP No. 27 was revised and adopted by the Actuarial Standards Board (ASB) in September 2013.

As no one knows what the future holds, it is necessary for an actuary to estimate possible future economic outcomes. Recognizing that there is not one right answer, the current standard calls for an actuary to develop a reasonable economic assumption. A reasonable assumption is one that is:

1. appropriate for the purpose of the measurement,
2. reflects the actuary's professional judgment,
3. takes into account historical and current economic data that is relevant as of the measurement date,
4. is an estimate of future experience; an observation of market data; or a combination thereof,
5. and has no significant bias except when provisions for adverse deviation or plan provisions that are difficult to measure are included.

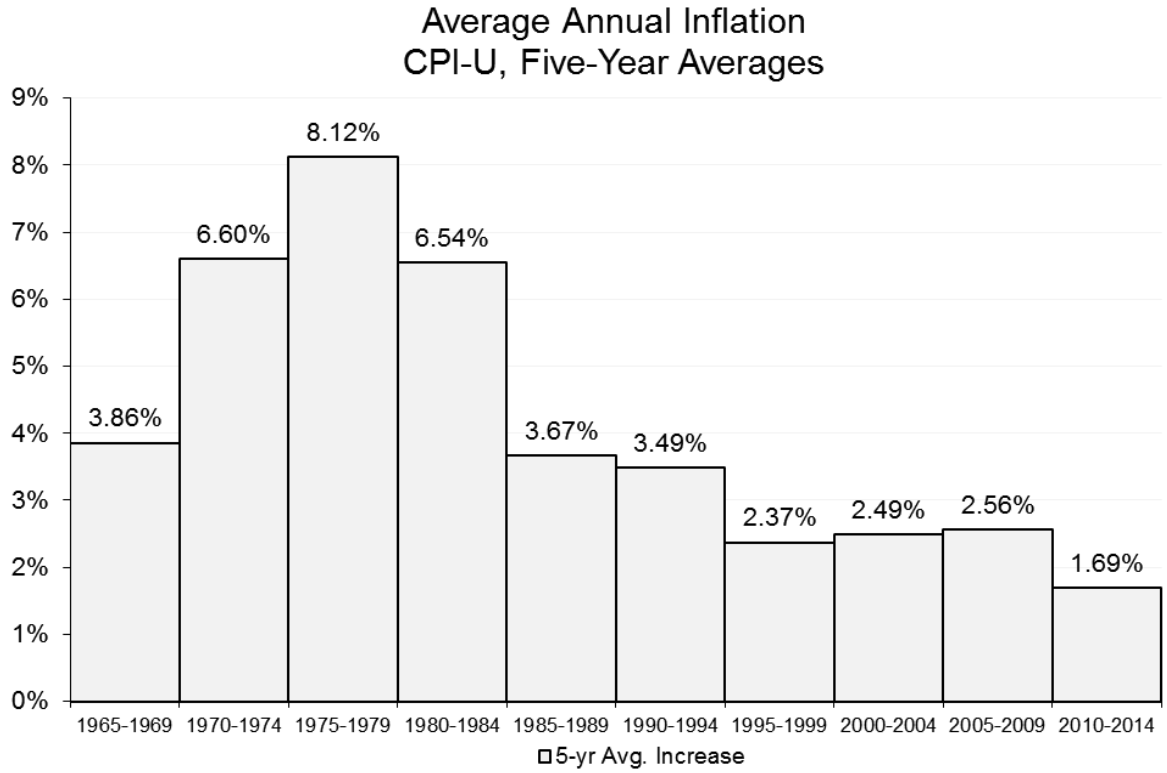
However, the standard explicitly advises an actuary not to give undue weight to recent experience.

Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period. Generally, the economic assumptions are much more subjective in nature than the demographic assumptions.

INFLATION ASSUMPTION

By "inflation," we mean price inflation, as measured by annual increases in the Consumer Price Index (CPI). This inflation assumption underlies most of the other economic assumptions. It impacts investment return, salary increases, payroll growth, and cost-of-living increases. The current annual inflation assumption is 3.00%.

The chart on the following page shows the average annual inflation, as measured by the increase in the Consumer Price Index (CPI-U) in each of the ten consecutive five-year periods over the last fifty years.



Source: Bureau of Labor Statistics, CPI-U, all items, not seasonally adjusted, Calendar Years

The table below shows the average inflation over various periods, ending December 2014.

Periods Ending Dec. 2014	Average Annual Increase in CPI-U
Last five (5) years	1.69%
Last ten (10) years	2.12%
Last fifteen (15) years	2.25%
Last twenty (20) years	2.28%
Last twenty-five (25) years	2.52%
Last thirty (30) years	2.71%
Since 1913 (first available year)	3.17%

Source: Bureau of Labor Statistics, CPI-U, all items, not seasonally adjusted

As you can see, inflation has been relatively low over the last twenty years. Even if we look back over a period of 30 years, inflation has averaged below 3% per year. It is hard to ignore the relatively steady inflation statistics over the last 25 years shown in the charts above.

All of the investment consulting firms in our survey, in setting their capital market assumptions, currently assume that inflation will be 2.50% or less. We examined the 2015 capital market assumption sets for seven investment consulting firms: BNY Mellon, Hewitt EnnisKnupp, JP Morgan, Mercer Consulting, Pension Consulting Alliance (PCA), New England Pension Consulting (NEPC), and RV Kuhns. The average assumption for inflation was 2.30%, with a range of 2.11% to 2.50%.

In the Social Security Administration's 2014 Trustees Report, the Office of the Chief Actuary is projecting a long-term average annual inflation rate of 2.70% under the intermediate cost assumption. (The low cost assumption was 2.00% and the high cost assumption was 3.40%.)

Another source of information about future inflation is the market for U.S. Treasury bonds. The December 31, 2014 yield for a 20-year inflation indexed Treasury bond (20-year TIPS) was 0.68% plus actual inflation. The yield for a 20-year non-indexed U.S. Treasury bond was 2.47%. This means the bond market was predicting that inflation over the next twenty years would average 1.78% = [(1 + 2.47%) / (1 + 0.68%) - 1] per year. One year earlier, as of December 31, 2013, the spread between the 20-year inflation protected and constant maturity bonds was noticeably higher, with a difference of 2.33%, so there has been a noticeable change in this expectation. The imputed 30-year inflation level is close to the 20-year level, being 1.90% and 2.28% at December 31, 2014 and December 31, 2013, respectively.

Also, the Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. Their most recent forecast (first quarter of 2015) predicts inflation over the next ten years will average 2.1% (2015 to 2024). The survey forecasts have also remained relatively stable over the last few years.

As a result, we recommend lowering the inflation assumption to 2.50%. While the 2.50% assumption is slightly higher than the expected rates of future inflation for many of the various sources above, including the bond market and the surveys of the Society of Professional Forecasters, it is within a reasonable range of acceptable assumptions and represents a large decrease from the current assumption.

INVESTMENT AND ADMINISTRATIVE EXPENSES

Since the trust fund pays expenses in addition to member benefits and refunds, we must make some assumption about these. Almost all actuaries treat investment expenses as an offset to the investment return assumption. That is, the investment return assumption represents expected return after payment of investment expenses.

In regards to investment expenses, investment consulting firms periodically issue reports that describe their capital market assumptions. The estimates for core investments (i.e., fixed income, equities, and real estate) are generally based on anticipated returns produced by passive index funds that are net of investment related fees. The investment return expectations for the alternative asset class such as private equity and hedge funds are also net of investment expenses. Therefore, we did not make any adjustments to account for investment related expenses. Some

retirement systems may also employ active management investment strategies that result in higher investment expenses compared to strategies that invest in passive index funds. We have assumed that active management strategies would result in the same returns, net of investment expenses, as passive management strategies.

On the other hand, there is a divergence of practice on the handling of administrative expenses. Some actuaries make an assumption that administrative expenses will be some fixed or increasing dollar amount. Others assume that the administrative expenses will be some percentage of the plan's actuarial liabilities or normal cost. And others treat administrative expenses like investment expenses, as an offset to the investment return assumption. For TRS, the practice has been to set the investment return assumption as the net return after payment of both investment and administrative expenses. However, the new accounting standards require administrative expenses to be separately accounted for, to produce an investment return assumption that is net of investment expenses, but not administrative expenses. To be consistent with this, we are recommending a change to our approach. The new approach would be to explicitly charge the administrative expenses as a percentage of payroll as an add-on to the required contribution. By changing our methodology for the funding valuation, we will be able to use the same investment return assumption and process for funding and accounting purposes. It will also reduce the burden placed on the investment return for funding future benefits.

Based on information from the 2014 CAFR, we are recommending an administrative load of 0.12% of payroll that will be added to the normal cost in the funding calculations.

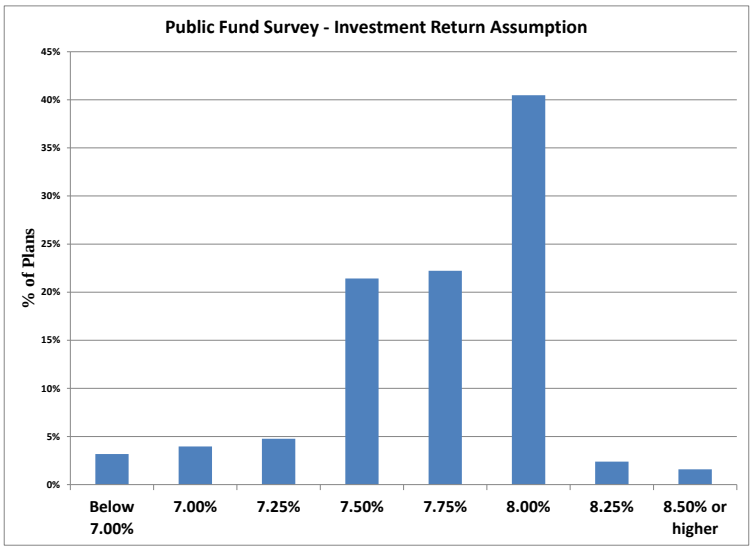
INVESTMENT RETURN RATE

The investment return assumption is one of the principal assumptions used in any actuarial valuation of a retirement plan. It is used to discount future expected benefit payments to the valuation date in order to determine the liabilities of the plans. Even a small change to this assumption can produce significant changes to the liabilities and contribution rates. Currently, it is assumed that future investment returns will average 8.00% per year, net of investment and administrative expenses.

Similar to the inflation assumption, past performance is not a reliable indicator of future performance, even when averaged over a long time period. Also, the actual asset allocation of the trust fund will significantly impact the overall performance, so returns achieved under a different allocation are not meaningful.

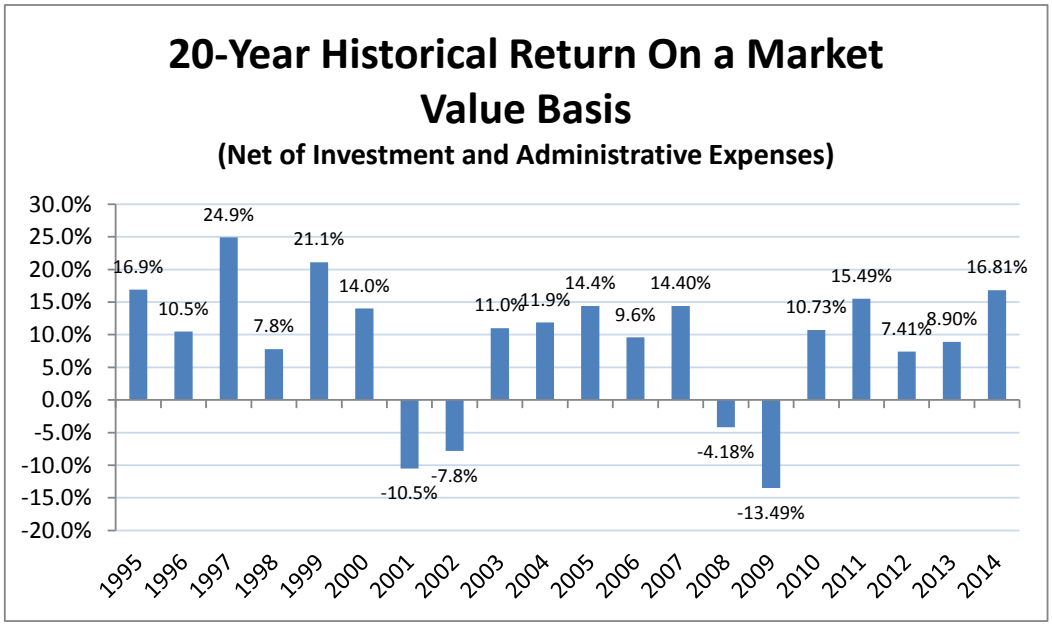
The Public Fund Survey (PFS) is a joint venture of the National Association of State Retirement Administrators (NASRA) and the National Council on Teacher Retirement (NCTR). More than 85% of all state and local government pension assets and members in the U.S. are represented in this survey. The latest PFS shows that the median investment return assumption for large public plans is 7.80%. The survey median has slightly decreased from 7.90% in the same survey conducted last year. Subtracting the rate of inflation assumed for each plan gives a median real rate of return of 4.50%, which is lower than the real rate of return assumption used by TRS. However, not all of the information supplied to the survey from peer systems is actually the inflation assumption, but instead the wage inflation assumption, making the comparable median higher than

4.50%. In addition, the TRS portfolio may have a materially different asset allocation than other funds which targets a higher real return. While we do not recommend the selection of an assumption based on prevalence information, it is still informative to identify where TRS is compared to its peers. Here is a chart showing the distribution of the investment return assumptions in the Public Fund Survey:



Source: Public Fund Survey (n=126). Median investment return assumption: 7.80% nominal return.

The chart below shows a twenty year history of TRS market returns through FY 2014.



The returns in the chart above are market returns, net of investment and administrative expenses, as reported in the actuarial valuations. TRS did exceed the expected 8.00% return assumption in fourteen of the last twenty years and the average market return during this period was 8.50%, which is more than the 8.00% assumption. On the other hand, over the last 10 years the plan's return has averaged 7.59%.

However, for this assumption, past performance, even averaged over a twenty-year period, is not a reliable indicator of future performance. The actual asset allocation of the trust fund will significantly impact the overall performance, so returns achieved under a different allocation are not meaningful. More importantly, the real rates of return for many asset classes, especially equities, vary so dramatically from year to year that even a twenty-year period is not long enough to provide reasonable guidance. There are strong reasons to believe the next twenty years will be different than the last twenty, in large part because current bond yields are significantly lower than they were 20 years ago.

Asset Allocation

We believe the most appropriate approach to selecting an investment return assumption is to identify expected returns given the funds' asset allocation mapped to forward-looking capital market assumptions. We view the investment return assumption as having two components: the assumed rate of (price) inflation plus the real return net of inflation. This "building block" approach is one explicitly permitted under ASOP 27. The inflation assumption has already been discussed, so we will proceed with the analysis of the real rate of return assumption.

To do this, we will examine the results of applying a set of capital market assumptions to the plan's target asset allocation. Because GRS is a benefits consulting firm and does not develop or maintain our own capital market assumptions, we typically will utilize the forward-looking return expectations developed by several investment consulting firms. In this instance, the Investment Management Division (IMD) of TRS has just recently (September of 2014) completed an asset allocation analysis during which they collected various longer term asset forecasts for their specific asset classes. We requested from the IMD the detail of their analysis. The following was a summary provided by the IMD.

Historically, TRS has relied on a survey solicited to external parties (SPNs, banks, etc.) as the key input into our long-term asset forecasting process. The 2014 Capital Market Expectations Survey continued this process due to several advantages this approach has relative to other estimation methods.

- *A broad-pool of market participants provides diversification across internal forecasting processes and "house views" as opposed to utilizing one organization's approach.*
- *Also, we reduce any estimation error that may be associated with the accuracy of a given forecasting process across periods as we are utilizing a diverse array of inputs and opinions.*
- *Finally, this approach provides us access to the smartest minds in the world of asset management and investing.*

The 2014 TRS Capital Market Expectations Survey request completed by 17 key TRS investment organizations and Strategic Partners to solicit their intermediate and long-term return estimates and volatility estimates of 50 separate asset classes.

- *The survey covered expectations across 50 asset classes including world equity and subclasses, private equity, world and US bonds, credit instruments, hedge funds, real assets and subclasses, inflation-linked assets, and commodities.*
- *Contributors included:*
- *Long and Intermediate Return*
    1. *AQR*
    2. *Blackrock*
    3. *Neuberger Berman*
    4. *Morgan Stanley*
    5. *Aon Hewitt*
    6. *Principal Global Investments*
- *Long Term Return Only*
    1. *JP Morgan*
    2. *Bridgewater*
    3. *Goldman Sachs*
    4. *PIMCO*
    5. *Towers Watson*
- *Intermediate Only*
    1. *Albourne*
    2. *GMO (7 year estimate, which we classify as intermediate return)*
- *Specific Asset Classes, Long and Intermediate Term*
    1. *Hamilton Lane (PE and ENR)*
    2. *Morgan Stanley Real Assets (RA)—only counted Morgan Stanley as 1 responder*
    3. *LaSalle (RE)*
    4. *Townsend (RA)*
    5. *Invesco (RE)*
- *Intermediate-term return expectations were defined as the next 3-5 years. TRS had responses from 13 providers.*
- *Long-term return expectations were defined as the next 10 or more years. TRS has responses from 16 providers*
- *The survey distinguished between arithmetic and geometric returns.*
    - *A formula was used to derive geometric returns if it wasn't provided (geometric return = arithmetic return – variance/2).*
- *For asset classes in which respondents did not already have an existing process to produce forward looking expectations, they were asked to leave the line blank.*
- *ENR forecasts are a 50/50 blend of forecasted returns for Real Assets and Private Equity*
- *Real Assets forecast reflects "Value Added" Real Estate, where specified, as the average blend of the underlying strategies reflected in this asset class*

In our opinion, the IMD's process met all of the requirements needed to use that as a basis for our analysis. The results were appropriate for the purpose of the measurement as the estimates were

longer term forecasts of market expectations, they took into account historical and current economic data that is relevant as of the measurement date, they represent an estimate of future experience and an observation of market data, and they had no significant bias (i.e., it is not significantly optimistic or pessimistic).

Below is a table with the plan's long-term target asset allocation and the development of the plan's expected nominal investment returns using capital market assumptions provided by TRS'IMD:

Asset Class	Long-Term Target Asset Allocation	Long-Term Expected Geometric Real Rate of Return	Expected Contribution to Long-Term Portfolio Returns
(1)	(2)	(3)	(4)
U.S. Equity	18%	4.6%	1.0%
Non-US Developed	13%	5.1%	0.8%
Emerging Markets	9%	5.9%	0.7%
Directional Hedge Funds	4%	3.2%	0.1%
Private Equity	13%	7.0%	1.1%
U.S. Treasuries	11%	0.7%	0.1%
Stable Value Hedge Funds	4%	3.0%	0.1%
Cash	1%	-0.2%	0.0%
Global Inflation Linked Bonds	3%	0.9%	0.0%
Real Assets	16%	5.1%	1.1%
Energy and Natural Resources	3%	6.6%	0.2%
Risk Parity	5%	6.7%	0.3%
Gross Real Return			**5.48%**
Actuary's Inflation Assumption			2.50%
Net Expected Nominal Investment Return			**7.98%**

As you can see, the expected return (geometric/compound) is very close to the current 8.00% assumption. In our professional judgement, we believe the 8.00% assumption meets the requirements under ASOP 27 for being a reasonable assumption.

We believe it is also important for the TRS Board to bear in mind the risk involved. You can see from the chart of annual returns shown earlier in this section that year-by-year returns can swing wildly. Only in seven of the last twenty years was the return within 3.00% (300 basis points) of the 8.00% assumption. The standard deviation of the investment returns is around 11.5%, depending on the particular set of capital market assumptions used. While the expected return of the portfolio is 8.00%, there is a 50% probability the return will be less than 8.00% over the longer term, and most short term projections are more pessimistic.

COST-OF-LIVING INCREASE ASSUMPTION

TRS does not provide automatic post-retirement cost of living adjustments (COLAs) to retired members. It has been past practice for the legislature to periodically grant ad hoc COLAs, when it is determined that the system can afford to absorb the cost. As we have seen over the last decade, the COLAs are certainly not automatic. We recommend continuing to assume no future COLAs in the annual valuations.

SALARY INCREASE RATES

In order to project future benefits, the actuary must project future salary increases. Salaries may increase for a variety of reasons:

- Across-the-board increases for all employees;
- Across-the-board increases for a given group of employees;
- Increases to a minimum salary schedule;
- Additional pay for additional duties;
- Step or service-related increases;
- Increases for acquisition of advanced degrees or specialized training;
- Promotions; or
- Merit increases, if available.

Our salary increase assumption is meant to reflect all of these types of increases.

The actuary should not look at the overall increases in payroll in setting this assumption, because payroll can grow at a rate different from the average pay increase for individual members. To analyze salary increases, we examine the actual increase in salary for each member who is active in two consecutive fiscal years.

Most actuaries recommend salary increase assumptions that include an element that depends on the member's age or service, especially for large, public retirement systems. It is typical to assume larger pay increases for younger or shorter-service employees. This is done in order to reflect pay increases that accompany step increases, changes in job responsibility, promotions, demonstrated merit, etc. The experience shows salaries have been more closely correlated to service (rather than age), as promotions and productivity increases tend to be greater in the first few years of a career, even if the new employee is older than the average new hire.

We analyzed the salary increases based on the change in the member's reported pay from one year to the next. That is, we looked at each member who appeared as an active member in two consecutive valuations individually, and measured his/her salary increase. Then we grouped the increases for all members with the same service, and determined their average increase.

The current assumption is composed of the wage inflation assumption plus a merit and promotion component that is based on the service of an individual. The current schedule ranges from 9.50% for new members to 4.25% for members with 25 or more years of service.

Salary increases for governmental employees can vary significantly from year to year. When the employer's tax revenues stall or increase slowly, salary increases often are small or nonexistent.

During good times, salary increases can be larger. Our experience across many governmental plans also shows several occasions in which salary increases will be low for a period of several years followed by a significant increase in one year. Therefore, for this assumption in particular, we prefer to use data over a longer period in establishing our assumptions. We used a ten-year period for this analysis (but also looked back at older studies). The average pay increases for members active in both valuations with more than one year of service are as follows:

Period	Increase	Inflation	Increase Above Inflation
FY 2004 to FY 2005	3.81%	3.11%	0.70%
FY 2005 to FY 2006	5.46%	3.90%	1.56%
FY 2006 to FY 2007	8.56%	2.29%	6.27%
FY 2007 to FY 2008	4.33%	4.26%	0.07%
FY 2008 to FY 2009	4.24%	0.19%	4.05%
FY 2009 to FY 2010	3.17%	1.38%	1.69%
FY 2010 to FY 2011	4.72%	2.29%	2.30%
FY 2011 to FY 2012	1.42%	4.26%	-1.15%
FY 2012 to FY 2013	2.57%	0.19%	0.87%
FY 2013 to FY 2014	4.72%	1.44%	3.29%
Average	4.28%	2.24%	2.04%

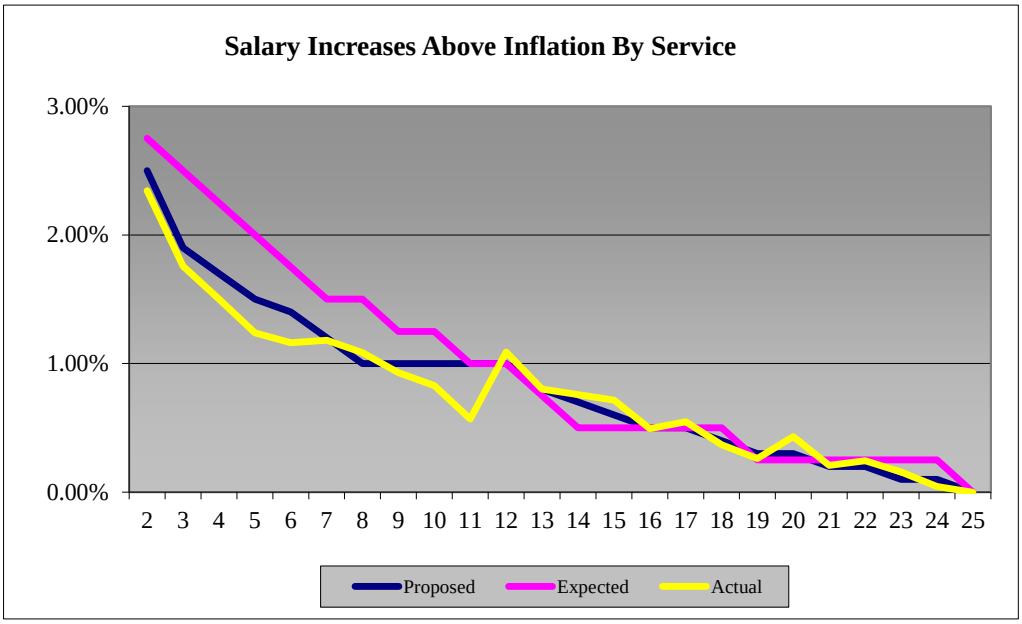
The average increase is 4.28%, or 2.04% above inflation. The expected increase above inflation was 2.52%, meaning the actual increases have been lower than expected, even on real terms when the difference in inflation has been removed.

To separate the steps, or promotional component of the schedule, we segregated out members with more than 25 years of service. These members should be past the promotional and step portions of their careers and therefore, only receive the general increases granted. The actual productivity increase during the ten year period was 0.53%, much lower than the assumed 1.25%, and close to national averages.

Period	Overall Increase for Long Service Members	Inflation	Increase Above Inflation
FY 2004 to FY 2005	2.64%	3.11%	-0.47%
FY 2005 to FY 2006	3.75%	3.90%	-0.16%
FY 2006 to FY 2007	6.62%	2.29%	4.34%
FY 2007 to FY 2008	3.00%	4.26%	-1.26%
FY 2008 to FY 2009	3.24%	0.19%	3.06%
FY 2009 to FY 2010	2.15%	1.38%	0.68%
FY 2010 to FY 2011	1.33%	2.29%	-1.10%
FY 2011 to FY 2012	0.99%	4.26%	-1.58%
FY 2012 to FY 2013	1.39%	0.19%	-0.31%
FY 2013 to FY 2014	2.74%	1.44%	1.30%
Average	2.77%	2.24%	0.53%

Based on this trend, we are recommending a change to the current assumption to lower the long term productivity assumption by 0.25% from 1.25% to 1.00%. While recent experience has been even lower, over the past 20 years long service members have had increases of 0.88%.

The net impact of lowering the inflation assumption from 3.00% to 2.50% and decreasing the long service real wage growth from 1.25% over inflation to 1.00% over inflation computes to a net decrease of 0.75% in the assumed salary increases for long service members. This change would decrease the projected liabilities of current active members and materially decrease the normal cost as a percentage of salaries.



The above exhibit models the portion of the salary increases for short term members that exceeded the salary increases for long term members based on the current assumptions, the actual experience, and a set of new proposed assumptions. You can see that the actual increases were lower than the current assumption, especially for lower years of service. Based on this experience, we are recommending a slight overall decrease to the salary increase assumptions.

Based on the new schedule, the cumulative increases from service 1 to 25 decreases approximately 3.5%, meaning for a new member, the projected salary at the end of 25 years is expected to be 3.5% lower under the new assumptions. This would create a decrease in the normal cost and unfunded liability.

PAYROLL GROWTH RATE

The salary increase rates discussed above are assumptions applied to individuals. They are used in projecting future benefits. We also use an overall payroll growth assumption, currently 3.50%, in determining the contributions needed to amortize the unfunded actuarial accrued liability. The amortization payments are calculated to be a level percentage of payroll, so as payroll increases

over time, these contributions do too. The amortization percentage is dependent on the rate at which payroll is assumed to increase.

Payroll can grow at a rate different from the average pay increases for individual members. When older, longer-service members terminate, retire or die, they are generally replaced with new members who have a lower salary. Because of this the growth in total payroll will be smaller than the average pay increase for members.

We have already lowered the ultimate salary scale by 0.75% (0.50% for inflation, 0.25% for real wage growth) and thus the 3.50% for this assumption should decrease to 2.75% accordingly. However, this assumption should also be adjusted for demographics if appropriate.

Another way to estimate this assumption is to produce an open projection assuming reasonable increases in the pay of the new entrants. Theoretically, over the long term the total payroll for a population of constant size should grow at about the rate that starting pays increase. These will generally rise with inflation, plus some adjustment for the excess of wage inflation over price inflation, plus an industry-specific adjustment.

We have performed open group projections that show payroll will grow over the next couple of decades at less than 2.75% per year as the baby boom generation reaches retirement. Therefore, we are recommending another 0.25% decrease in this assumption to a final recommendation of 2.50%.

This has no impact on the liabilities of TRS, but it does impact the amortization period, since we assume there will be fewer future contribution dollars that can be used to amortize the unfunded actuarial accrued liability.

DEMOGRAPHIC ASSUMPTIONS

Actuaries are guided by the Actuarial Standards of Practice (ASOP) adopted by the Actuarial Standards Board (ASB). One of these standards is ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*. This standard provides guidance to actuaries giving advice on selecting noneconomic assumptions for measuring obligations under defined benefit plans. We believe the recommended assumptions in this report were developed in compliance with this standard.

POST-RETIREMENT MORTALITY RATES

TRS' actuarial liabilities and retirement contribution rates depend in part on how long retirees live. If members live longer, benefits will be paid for a longer period of time and the liability and ultimate retirement contribution rates will be larger.

The issue of future mortality improvement is one that the governing bodies of our profession have increasingly become more focused on studying and ensuring that the actuarial profession remains on the forefront of this issue. This has resulted in recent changes to the relevant Actuarial Standard of Practice, ASOP 35, and published practice notes. This ASOP now requires pension actuaries to

make and disclose an assumption as to expected mortality improvement after the valuation date. The following are excerpts directly from the Standard:

"As mortality rates have continued to decline over time, concern has increased about the impact of potential future mortality improvements on the magnitude of pension commitments. Section 3.5.3 of current ASOP No. 35 lists "the likelihood and extent of mortality improvement in the future" as a factor for the actuary to consider in selecting a mortality assumption. In the view of many actuaries, the guidance regarding mortality assumptions should more explicitly recognize estimated future mortality improvement as a fundamental and necessary assumption, and the actuary's provision for such improvement should be disclosed explicitly and transparently."

*"**The resources reviewed by the Pension Committee showed that demographers generally expect that mortality will continue to improve**. These resources noted that some scientists argue that human life has biological limits, and that the rate of mortality improvement could slow as a result of obesity or other emerging health issues, but that such limits and countervailing factors do not alter the scientific consensus of likely continuing improvements in mortality."*

"The actuary should consider the effect of mortality improvement both prior to and subsequent to the measurement date. With regard to mortality improvement, the actuary should do the following:

i. ***adjust mortality rates to reflect mortality improvement prior to the measurement date**. For example, if the actuary starts with a published mortality table, the mortality rates may need to be adjusted to reflect mortality improvement from the effective date of the table to the measurement date. Such an adjustment is not necessary if, in the actuary's professional judgment, the published mortality table reflects expected mortality rates as of the measurement date.*

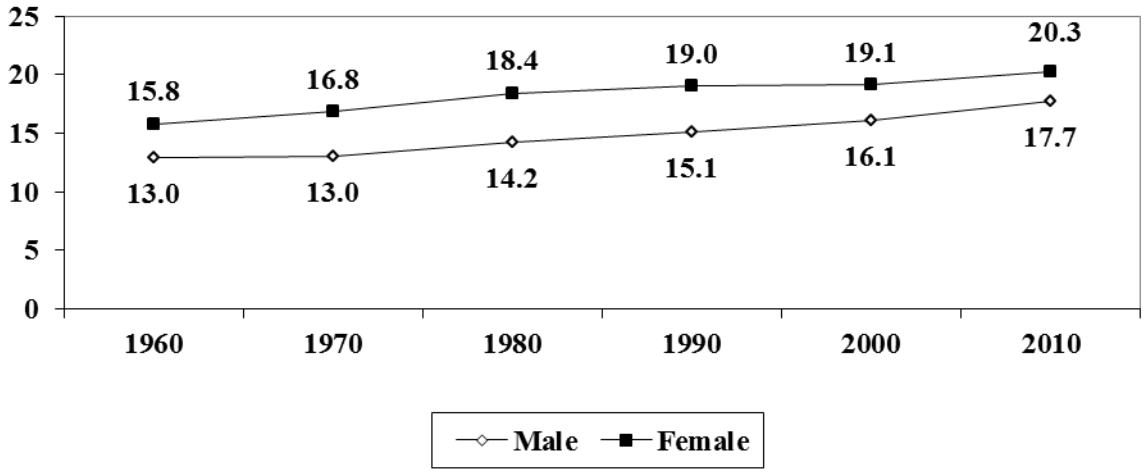
ii. ***include an assumption as to expected mortality improvement after the measurement date**. This assumption should be disclosed in accordance with Section 4.1.1, even if the actuary concludes that an assumption of zero future improvement is reasonable as described in Section 3.1. **Note that the existence of uncertainty about the occurrence or magnitude of future mortality improvement does not by itself mean that an assumption of zero future improvement is a reasonable assumption.**"*

As you will note, we have highlighted the above sentences we feel need to be emphasized. To meet this standard, a recent trend in actuarial models is to use mortality tables that explicitly incorporate projected mortality improvements over time. This type of table (or series of tables) is called "generational mortality." Historically, actuarial models have been constrained to static mortality tables due to two primary reasons: (1) a general belief that there was a limit on the ultimate longevity and (2) the added complexity of a generational mortality type model and limitations in computational power. A static mortality table would be used and updated with each experience study to reflect the most recent mortality. Historically, this would almost always result in adoption of lower mortality rates increasing the plan's normal cost and creating unfunded past service liabilities.

With advances in computing power, it has become a more mainstream practice to incorporate generational mortality models. The idea behind adopting a generational mortality model is to avoid the experience study "correction" factor. While minor adjustments may need to be made in the future, the constant bias towards needing to reduce mortality rates is avoided.

The expectation of continued increases in longevity is supported by national trends. The following graph provides the expected remaining lifetime in years for a 65 year old retiree measured beginning in 1960. Notice the recent uptrend in female longevity after almost two decades of relatively minimal improvement. This significant change in pattern (most of which has occurred since 2004) has led most of the actuarial profession to agree that future improvements will likely continue.

Life Expectancy in Years, Current Age 65



National Vital Statistics Reports, Vol 58, No 21, June 2010

National Vital Statistics Reports, Vol 60, No 4, January 2011

The most current mortality tables and improvement assumptions have recently been published in a report by the Society of Actuaries' Retirement Plans Experience Committee's (RPEC) in October of 2014. The following are excerpts from the Society of Actuaries Report on their mortality improvement scale, referred to as MP-2014:

"In late 2009, RPEC initiated a comprehensive analysis of pension plan mortality experience in the United States. At an early stage of its analysis, the Mortality Improvement subcommittee of RPEC noticed that mortality improvement experience in the United States since 2000 was clearly different from that anticipated by Scale AA. In particular, there was a noticeable degree of mismatch between the Scale AA rates and actual mortality experience for ages under 50, and the Scale AA rates were lower than the actual mortality improvement rates for most ages over 55. Given that the full Pension Mortality Study was still many months from completion at that time, the SOA decided to publish interim mortality improvement Scale BB, which provided pension actuaries with a more up-to-date alternative to Scale AA for the projection of base mortality rates beyond calendar year 2000."

RPEC recognizes that there is a wide range of opinion with respect to future levels of mortality and that the assumptions underlying mortality improvement reflect some degree of subjectivity. RPEC characterized the assumptions that underpin Generational Scale BB (including a 1.0% long-term rate of mortality improvement and limited cohort effects) as a temporary projection scale to overcome perceived short-comings of Scale AA (noted above) until RPEC could finalize an updated generational mortality assumption, which they now refer to as MP-2014.

Based on the recent strengthening of the Standards of Practice, GRS has been increasingly recommending our clients use a fully generational approach for mortality assumptions. By doing this, future mortality rates will be projected to continually decrease each year. Therefore, the life expectancy at age 60 for someone reaching 60 now will not be as long as the life expectancy for someone reaching 60 in 2020, and their life expectancy will not be as long as someone reaching 60 in 2040, etc. The following table provides the life expectancy for individuals retiring in future years, based on the Retirement Pensioners 2000 mortality table (RP-2000) with full generational projection using the Society of Actuaries mortality improvement scale BB.

Proposed Life Expectancy for an Age 60 Retiree in Years					
Gender	**Year of Retirement**				
	2010	2015	2020	2025	2030
Male	23.1	23.7	24.3	24.8	25.4
Female	26.4	26.9	27.4	27.9	28.4

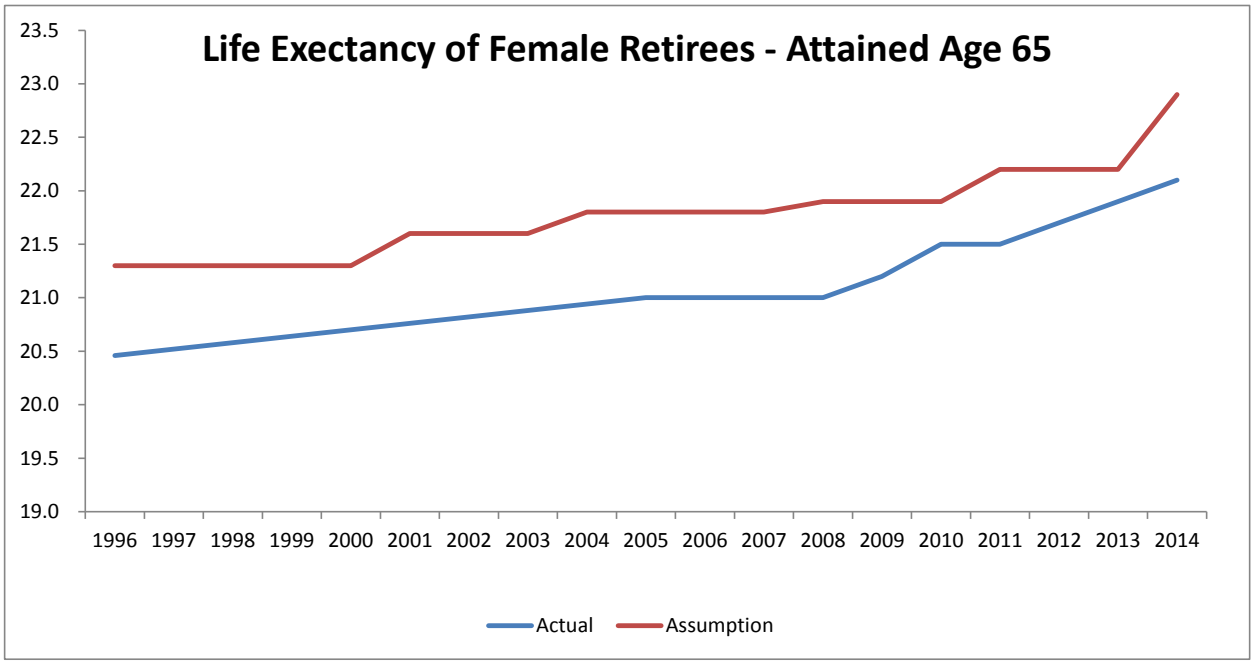
Because of this assumption of continuous improvement, life expectancies for today's younger active members are expected to be materially longer than those of today's retirees. By utilizing generational mortality, the improvement over time is built into the contributions for individual members.

TRS SPECIFIC ANALYSIS

The mortality table currently being used for non-disabled retirees and for beneficiaries receiving benefits is a client specific table created in the 2007 Experience Study. The table has separate rates for males and females. The rates are then adjusted by using an 80% load factor to reflect anticipated future increases in life expectancy. The tables have separate rates for males and females. The current application is what we refer to as a "static" table. The mortality rate for a 65-year-old male is projected to be the same in 30 years as it is today, with no accommodations for *continued* mortality improvements expected over time.

The following graph shows the life expectancy of the female population of TRS retirees in comparison to the assumption used in the historical actuarial valuations. Clearly, there have been substantial increases in longevity in the TRS population. In conjunction with the 2014 valuation, we recommended and the Board approved a temporary increase in the longevity assumption.

However, based on recent trends, the margin in the current assumption will likely be overtaken within 5-10 years.



When choosing an appropriate mortality assumption, actuaries typically use standard mortality tables, unlike when choosing other demographic assumptions. They may choose to adjust these standard mortality tables, however, to reflect various characteristics of the covered group, and to provide for expectations of future mortality improvement (both up to and after the measurement date). If the plan population has sufficient credibility to justify its own mortality table, then the use of such a table also could be appropriate. Factors that may be considered in selecting and/or adjusting a mortality table include the demographics of the covered group, the size of the group, the statistical credibility of its experience, and the anticipated rate of future mortality improvement.

We first measured the credibility of the dataset to determine whether standard, unadjusted tables should be used or if statistical analysis of TRS specific data was warranted. Based on a practice note issued by the American Academy of Actuaries in the fall of 2011, a dataset needs 96 expected deaths for each gender to be within +/- 20% of the actual pattern with 95% confidence. We believe +/- 20% is a rather large range to be considered fully credible. Other sources state higher requirements, such as 1,000 deaths per gender. The following table gives the number of deaths needed by gender to have a given level of confidence that the data is +/- X% of the actual pattern.

Standard Score	Confidence	99% – 101%	97% – 103%	95% – 105%	90% – 110%	80% – 120%
0.674	75%	4,543	505	182	45	11
1.282	80%	16,435	1,826	657	164	41
1.645	90%	27,060	3,007	1,082	271	68
1.96	95%	38,416	4,268	1,537	384	96
2.576	99%	66,358	7,373	2,654	664	166

Using this information, 1,082 deaths are needed by gender to have 90% confidence that the data is within +/- 5% of the actual pattern. Just in 2013, TRS experienced 4,519 female deaths, clearly indicating it is a fully credible group.

For this analysis, we have weighted the analysis by the amount of the member's monthly annuity. This is consistent with the development of all national tables as data shows a clear correlation between income and longevity. By weighting the data by annuity values, we are giving more weight to members who have larger annuities (and thus have larger liabilities).

We begin by determining the expected number of deaths in each year at each age for males and females. Then we compare the actual number to the expected number. The ratio of the actual deaths to the expected deaths (the A/E ratio) tells us whether the assumptions are reasonable. When using a static mortality table, an A/E ratio between 110% and 120% has traditionally been desired for conservatism and includes a margin for continued future improvements in mortality rates. However, when using a generational approach for mortality improvement, an A/E of 100% is targeted. We will discuss this in two parts, the recommended base mortality assumption, and the recommended mortality improvement assumption.

Recommended Base Mortality Assumption

Since TRS has enough experience to credibly model post-retirement mortality, we have developed and recommended base mortality assumptions that are specific to TRS.

The proposed base mortality assumptions are based on TRS's experience for the three-year period ending August 31, 2014. We intentionally used a three-year period for developing a morality assumption because this is the most recent experience and reflects the most recent improvements in longevity. Using a larger experience period would temper real changes that have occurred in the mortality assumption due to real changes, or improvements, observed in this assumption.

To develop the recommended mortality assumptions, mortality rates for ages after 60 are based on the System's experience, using an exponential model to provide a smooth fit to the experience. Mortality rates for ages under 50, are equal to the most recently published RP-2014 mortality assumptions (adjusted back to the central point of the experience period). Finally, the mortality rates for the transitional age ranges, ages 50 to 59, were developed using a cubic spine method to orderly transition between the mortality rates between the core and outlier age ranges.

The final step in the creation of the base mortality assumption was to project the preliminary table from the center point of the analysis period (i.e., 2013) to the year 2014 using the recommended projection scale below.

Recommended Mortality Improvement Assumption

There are currently three commonly discussed mortality improvement assumptions used by pension actuaries for valuating pension plan liabilities, each released by the Society of Actuaries. These mortality improvement assumptions include: Scale AA, Scale BB, and Scale MP-2014.

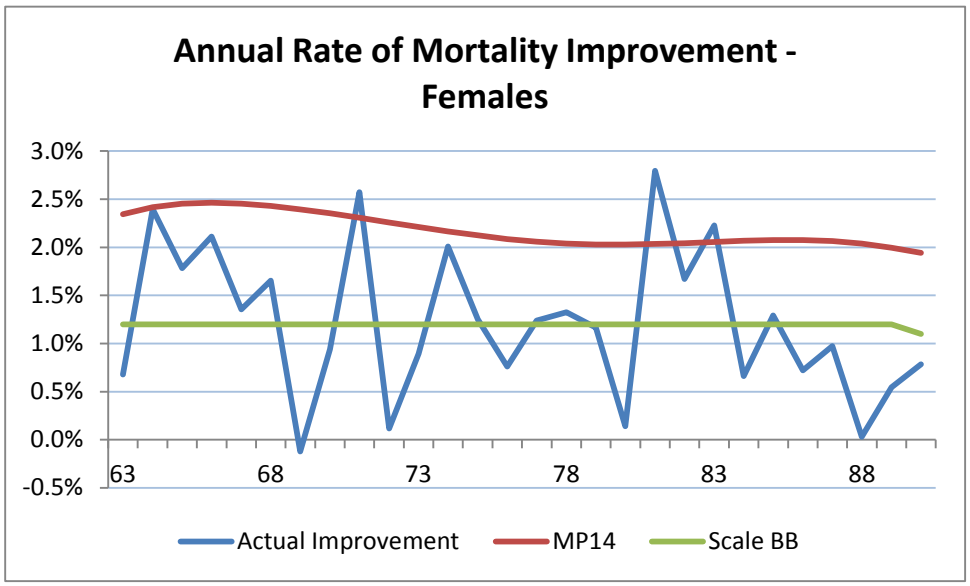
Scale AA is based upon a blend of mortality improvement trends among Civil Service Retirement System (CSRS) and Social Security Administration participants between 1977 and 1993. Since its official release in 1995, it has become the most widely adopted improvement scale for use by both public and private institutions within the United States.

The Society of Actuaries' Retirement Plans Experience Committee (RPEC) initiated a pension mortality study in 2010. At an early stage of its analysis, RPEC noticed that mortality experience since 2000 has improved at a faster rate than anticipated by Scale AA. As a result, RPEC issued another mortality improvement scale, Scale BB, in the year 2012 as an alternative mortality improvement assumption for pension actuaries to use.

In October 2014, RPEC issued final reports of the mortality study that was originally initiated in 2010. These final reports included the release of another mortality improvement assumption, Scale MP-2014, which represents the Committee's current best estimate of future mortality improvement in the United States.

In our opinion, mortality improvement assumptions Scale BB and Scale MP-2014 are preferable over Scale AA since they are based on more current data (Scale BB and MP-2014 are based on the same historical data) and more consistently model actual historical experience. A significant difference between improvement Scale MP-2014 and Scale BB is Scale MP-2014 is a two-dimensional improvement assumption that is a function of the age and calendar year, whereas Scale BB is only a function of age.

The graph on the next page compares the rate of mortality improvement actually experienced by TRS to the mortality improvement assumptions Scale BB and Scale MP-2014. To identify the rate of mortality improvement experienced by TRS, we compared the crude mortality rates for the years 2004 through 2006 (i.e., a midpoint year of 2005) to the crude mortality rates for the years 2012 through 2014 (i.e., a midpoint year of 2013).



As the table shows, the actual rate of mortality improvement for females was reasonably close to the Scale BB improvement assumption.

For these reasons, we recommend use of the mortality improvement Scale BB. This change will increase the UAAL, decrease the funded ratio, and increase the funding period of TRS and is the most material change recommended in this analysis. That said, this change should reduce the impact of the "correction factor" in future experience studies as continuous future improvement is now included in the liability projections.

DISABLED MORTALITY RATES

This is a minor assumption, and it has little impact on the liabilities of TRS. The experience produced A/E ratios of 99% and 95% for males and females, respectively, which are reasonable matches in total. However, when separated between pre and post normal retirement age, the fit was not as good. We are recommending a change to assume members that live past normal retirement age will use the same table as healthy retirees, with a 3-year set-forward, meaning a disabled member age 70 will use the same mortality rate as a healthy member age 73. For ages prior to normal retirement age, we will assume the same 3-year set forward, but we are applying a minimum rate of 4% for males and 2% for females to reflect impaired mortality during those ages.

ACTIVE MORTALITY RATES

A separate mortality table is used for active members. It is typical for active mortality to be much lower than the retiree mortality. The current mortality rates assume lower mortality than the retiree mortality table but clearly still higher mortality than is actually occurring. We are recommending updating this assumption to the new RP-2014 mortality table for active employees, and applying a 90% multiplier. This assumption has basically no impact.

DISABILITY RATES

Disability is also a minor assumption, but we are separating this assumption between members who have achieved 10 years of service and thus are eligible for a lifetime annuity and those with less than 10 years who would only receive a temporary annuity. We have developed new tables using data only from members with more than 10 years of service, which in general have higher incidence of disability than the previous assumption. However, members with less than 10 years of service appear to become disabled at about 20% the rate of the other group, and we have reflected that in their expectations. This change has very minor impact on the results.

RETIREMENT RATES

We currently use retirement rates that vary by age, sex, reduced versus unreduced retirement, and first eligibility versus after first eligibility. When we examine the core retirement ages (55 – 70), there were 16,069 male retirements during the four-year period, and there were 48,367 female retirements. This is pretty much in line with current expectations.

However, in general, earlier ages appears to have fewer retirements than expected and later ages more. Therefore, we are recommending new tables with lower probabilities at younger ages and higher probabilities for older ages. We have also simplified the assumption by removing the bump at first eligibility as the data shows this is not needed. This change will slightly lower the liabilities and contribution requirements. For more detail, please see Section IV.

TERMINATION RATES

Termination rates reflect members who leave for any reason other than death, disability or service retirement. They apply whether the termination is voluntary or involuntary, and whether the member takes a refund or keeps his/her account balance on deposit in TRS. The current termination rates are composed of two distinct assumptions, one for the first ten years of service called the "select" period and a separate assumption for terminations after the ten year period called the "ultimate." The select assumption reflects the member's age, service and sex, and we want to continue this practice. The ultimate assumption is based on the member's time from retirement eligibility and service, and we would also like to continue that practice. We have analyzed the two assumption periods separately.

For this assumption, we used 10-years of data. In addition, we have weighted the experience by salary, meaning instead of counting members and the number of members that terminate, we have counted payrolls and the portion of the payroll that terminates. A higher paid member has more liability than a lower paid member, and thus the termination pattern for the higher paid member will have more impact on the future liabilities of the plan. Also, in school districts, higher paid members are hired in to positions that have lower turnover (teachers, school administrators, etc) versus lower paid members (support staff, teacher aids, etc).

For the select period, the current assumptions produce an A/E ratio for males of 73% and an A/E ratio for females of 90%. For this assumption, A/E ratios over 100% are conservative. As anticipated, the weighting by salary had an impact on the results, showing less turnover when based on payroll. Also, the data showed that a complex grid based on age and service was not needed and

a simpler assumption only based on service would suffice. We are recommending new assumptions based on service only for the select period.

For the ultimate period, the current assumptions produce an A/E ratio for males of 104% and an A/E ratio for females of 102%, both close to expected. However, we have tweaked the slope of the assumption to better match experience.

The results are shown below ($ in millions of payroll):

Termination Rates – Males					
		Current Assumptions		Recommended Assumptions	
Service Years	Actual terms	Expected Terms	A/E ratio	Expected Terms	A/E ratio
0	$1,082	$1,248	87%	$1,081	100%
1-4	2,157	3,258	66%	2,157	100%
5-9	898	1,183	76%	898	100%
≥ 10	588	567	104%	587	100%
Totals	$4,725	$6,256	76%	4,723	100%

Termination Rates – Females					
		Current Assumptions		Recommended Assumptions	
Service Years	Actual terms	Expected Terms	A/E ratio	Expected Terms	A/E ratio
0	$2,126	$2,541	84%	$2,127	100%
1-4	4,929	5,523	89%	4,929	100%
5-9	2,527	2,623	96%	2,527	100%
≥ 10	1,597	1,566	102%	1,596	100%
Totals	$4,725	$6,256	91%	4,723	100%

RE-EMPLOYMENT

As with all multi-employer, state-wide, teacher populations, TRS has a material number of members who terminate employment and then become re-employed at either the same or another school district at a later date. Members who transfer from one school district to another during one summer would not fall into this category as they would not show as a termination. This is specifically dealing with members who are active in one valuation, then inactive in the next, and then will return to active in a later year.

We currently reflect this in the liabilities by assuming 10% of current inactive members (members not contributing in the last fiscal year) will return to active service immediately. 90% of these members are counted and valued as inactives while 10% are counted and valued as an

active. This requires two separate valuation runs for this group, makes it complicated to determine the population counts, and makes year to year reconciliation more difficult. In addition, the current normal cost rate does not anticipate this pattern of reemployment in the termination assumption.

In the last 10 years, there have been 166,293 female members and 55,578 male members terminated from service between the ages of 35 and 50. In addition, during the same time period, there were 17,760 female members and 4,397 male members hired into that age range that had prior service at the time of hire. So, in effect, 10.7% of female and 7.9% of male terminations were replaced by members with prior service.

To reflect this pattern, we are recommending reducing our rates of termination by 11% for females and 8% for males. This is to say we assume 11% of female members who terminate service will re-establish active service at some point in the future, likewise 8% of male members. The tables in Section V are net of the rehire assumption.

For current inactives, we will no longer count them as partially active and partially inactive. Instead, we will count any member who contributed in the last fiscal year as active and all others as an inactive. This way, each member only gets counted once in the population data.

This change increases the normal cost.

OTHER ASSUMPTIONS AND REFUNDS

There are other assumptions made in the course of a valuation, such as the percentage of members who are married, the age difference between husbands and wives, the likelihood that a terminating employee will take a refund, etc. We reviewed these, and believe these are generally realistic or conservative, so we decided to recommend no changes to these other assumptions.

ACTUARIAL METHODS

We have reviewed the actuarial cost method being used—the Entry Age Normal cost method—and we continue to believe that this is the method of choice for this plan, since this method does the best job of keeping costs level as a percentage of payroll.

The version of the Entry Age cost method that is being used for TRS uses a hypothetical group of new members to determine the normal cost. This methodology was implemented in the early 1990's when it was clear that the demographic profile of the TRS population was changing to include more males and more mid-career hires. The use of the profile reflected this change in the normal cost sooner and thus gave a better long term cost than other methods. TRS has now reached a point where most of the population has been hired during this shift and the current demographic makeup is likely a reasonable representation of the future demographics. We believe the additional complexity of using the profile is no longer advantageous or needed, and thus we recommend no longer using that methodology and instead basing the normal cost on the current active population as a whole. This change has no impact on the total projected liabilities of the System.

In addition, we recommend continued use of the Ultimate Normal Cost variant of EAN because it produces a funding requirement as a percentage of payroll that is the most stable and predictable over time compared to all other funding methods and variants. Especially with a plan that receives its contribution as a fixed percent of payroll, this variant provides for a simple and straightforward calculation of the funding period. We continue to believe this is the most appropriate funding method.

We recommend no change to the current asset smoothing method or the smoothing period. We do recommend removing the corridor around the market value of assets as simulations show the corridor is not needed in conjunction with the current method and period.

We recommend changing from using celled data in the valuation process to using individual data records. This will make for a cleaner and simpler valuation process and allow for better reporting of some items, such as actuarial gains and losses by source. However, the use of individual data will extend the computer run time dramatically. Thus, we will continue to use celled data in legislative analysis and adjust for any difference between the two data sets.

SECTION IV

ACTUARIAL IMPACT OF RECOMMENDATIONS

Actuarial Impact of Recommendations

Based on the Current 8.00% Investment Return Assumption

	Valuation Results as of 8/31/14		Change	
Item	Current Assumptions	Recommended Assumptions	Amount	Percent
(1)	(2)	(3)	(4)	(5)
1. Normal cost %	10.43%	9.74%	(0.69%)	(6.6%)
2. Present value of future benefits for retired members	$78.5	$78.8	$0.3	0.4%
3. Present value of future benefits for active members	$117.4	$111.7	($5.7)	(4.9%)
4. Total present value of future benefits	$195.9	$190.5	($5.4)	(2.8%)
5. Actuarial accrued liability	$160.0	$161.2	$1.2	0.8%
6. Actuarial value of assets	$128.4	$128.4	$0.0	0.0%
7. Unfunded actuarial accrued liability	$31.6	$32.8	$1.2	3.8%
8. Funding period	29.8 years	33.4 years	3.6 years	12.1%
9. Funded ratio	80.2%	79.7%	(0.5%)	(0.6%)
10. 30-Year contribution requirement	8.66%	8.91%*	0.25%	2.9%

All dollar amount in $ billions

Funding period is based on increased member, employer, and state contribution rates for fiscal year 2015 and beyond as specified by statute.

*Includes 12 basis points load for administrative expenses

SECTION V

SUMMARY OF ASSUMPTIONS AND METHODS INCORPORATING THE RECOMMENDED ASSUMPTIONS

Summary of Assumptions and Methods Incorporating the Recommended Assumptions

1. Investment Return Rate — 8.00% per annum, compounded annually, composed of an assumed 2.50% inflation rate and a 5.50% real rate of return, net of investment expenses

2. Active Mortality, Withdrawal, Disability Retirement, and Service Retirement Rates:

   Rates and scales developed in the actuarial investigation as August 31, 2014, with values at specimen ages shown in the tables below:

   a. Active Mortality: RP-2014 Employee Mortality Tables for male and female multiplied by 90%, with full generational projection using Scale BB. Below are the samples rates for 2014 and 2044.

	2014 Mortality Rates	
Age	**Male**	**Female**
20	0.000365	0.000146
30	0.000407	0.000196
40	0.000565	0.000356
50	0.001517	0.000992
60	0.004219	0.002198
70	0.012469	0.005678
80	0.034930	0.016542
90	0.123749	0.092945

	2044 Mortality Rates	
Age	**Male**	**Female**
20	0.000334	0.000133
30	0.000372	0.000179
40	0.000516	0.000326
50	0.001387	0.000906
60	0.003417	0.001626
70	0.007923	0.003953
80	0.022196	0.011516
90	0.088804	0.066698

b. Rates of Termination (net of applying rehire assumption)

Years of Service	Probability of Decrement Due to Withdrawal: Male	Female
1	0.149027	0.143098
2	0.119756	0.117329
3	0.096637	0.097896
4	0.072275	0.076765
5	0.062453	0.068443
6	0.055556	0.060368
7	0.047176	0.049631
8	0.041464	0.043108
9	0.036978	0.038477
10	0.033777	0.035264

The following table is used for all years after the first ten years of employment.

Years from NR	Probability of Decrement Due to Withdrawal Based on Years from Normal Retirement: Male	Female	Years from NR	Male	Female
1	0.012140	0.009500	**17**	0.024208	0.027793
2	0.014373	0.012353	**18**	0.024547	0.028402
3	0.015865	0.014405	**19**	0.024873	0.028990
4	0.017017	0.016064	**20**	0.025185	0.029559
5	0.017968	0.017481	**21**	0.025487	0.030110
6	0.018783	0.018731	**22**	0.025777	0.030646
7	0.019502	0.019858	**23**	0.026058	0.031166
8	0.020147	0.020888	**24**	0.026329	0.031673
9	0.020733	0.021842	**25**	0.026592	0.032166
10	0.021273	0.022731	**26**	0.026848	0.032648
11	0.021772	0.023567	**27**	0.027096	0.033118
12	0.022239	0.024357	**28**	0.027337	0.033578
13	0.022676	0.025107	**29**	0.027571	0.034027
14	0.023090	0.025822	**30**	0.027800	0.034467
15	0.023481	0.026506	**31**	0.028023	0.034898
16	0.023853	0.027162	**32**	0.028241	0.035320

c. Rates of Disability Retirement

Probability of Decrement Due to Disability

	For Service >= 10		For Service < 10	
Age	**Male**	**Female**	**Male**	**Female**
20	0.000184	0.000276	0.000037	0.000055
30	0.000184	0.000276	0.000037	0.000055
40	0.000430	0.000469	0.000086	0.000094
50	0.001993	0.001817	0.000399	0.000363
60	0.003505	0.002754	0.000701	0.000551

d. Rates of Retirement

Age	Normal Retirement		Age	Early Retirement	
	Male	Female		Male	Female
50	0.1300	0.3000	**45**	0.0100	0.0100
51	0.1300	0.1200	**46**	0.0100	0.0100
52	0.1300	0.1300	**47**	0.0100	0.0200
53	0.1300	0.1400	**48**	0.0200	0.0300
54	0.1400	0.1500	**49**	0.0300	0.0400
55	0.1500	0.1600	**50**	0.0100	0.0100
56	0.1600	0.1700	**51**	0.0100	0.0100
57	0.1700	0.1800	**52**	0.0100	0.0100
58	0.1800	0.1900	**53**	0.0100	0.0100
59	0.1800	0.2000	**54**	0.0100	0.0100
60	0.2200	0.2100	**55**	0.0100	0.0100
61	0.2000	0.2200	**56**	0.0100	0.0100
62	0.2400	0.2300	**57**	0.0100	0.0100
63	0.2000	0.2300	**58**	0.0100	0.0100
64	0.2000	0.2300	**59**	0.0100	0.0200
65	0.2200	0.2300	**60**	0.0200	0.0200
66	0.2200	0.2300	**61**	0.0200	0.0200
67	0.2200	0.2300	**62**	0.0500	0.0400
68	0.2200	0.2300	**63**	0.0500	0.0500
69	0.2200	0.2300	**64**	0.0600	0.0600
70	0.2200	0.2300	**65**	0.0500	0.0500
71	0.2200	0.2300			
72	0.2200	0.2300			
73	0.2200	0.2300			
74	0.2200	0.2300			
75	1.0000	1.0000			

For members hired after August 31, 2007 and who are vested as of August 31, 2014, the retirement rates for members once they reach unreduced retirement eligibility at age 60 are increased 10% for each year the member is beyond the Rule of 80 (i.e. if the member reached the Rule of 80 at age 58 then the probability of retirement at age 60 is 120% of the rate shown above).

For members hired after August 31, 2007 and who are not vested as of August 31, 2014, or, for members hired after August 31, 2014, the retirement rates for members once they reach

unreduced retirement eligibility at age 62 are increased 10% for each year the member is beyond the Rule of 80 (i.e. if the member reached the Rule of 80 at age 58 then the probability of retirement at age 62 is 140% of the rate shown above).

The rates of retirement for normal retirement benefits for members who are not TRS-Care grandfathered as of August 31, 2014 are 85% of the rates described above prior to age 62 and an increased rate at age 62 by adding 5%.

Non-grandfathered members who receive a reduced benefit upon attaining rule of 80 but prior to normal retirement age, have a 1% probability of retirement.

3. Rates of Salary Increase

Inflation rate of 2.50%, plus productivity component of 1.00%, plus step-rate/promotional component as shown:

Years of Service	Merit, Promotion, Longevity		General		Total
1	6.00	%	3.50	%	9.50
2	2.50		3.50		6.00
3	1.90		3.50		5.40
4	1.70		3.50		5.20
5	1.50		3.50		5.00
6	1.40		3.50		4.90
7	1.20		3.50		4.70
8	1.00		3.50		4.50
9	1.00		3.50		4.50
10	1.00		3.50		4.50
11	1.00		3.50		4.50
12	1.00		3.50		4.50
13	0.80		3.50		4.30
14	0.70		3.50		4.20
15	0.60		3.50		4.10
16	0.50		3.50		4.00
17	0.50		3.50		4.00
18	0.40		3.50		3.90
19	0.30		3.50		3.80
20	0.30		3.50		3.80
21	0.20		3.50		3.70
22	0.20		3.50		3.70
23	0.10		3.50		3.60
24	0.10		3.50		3.60
25 & up	0.00		3.50		3.50

4. Post-retirement Mortality: Client specific tables, with full generational projection using scale BB, used for service retirement annuitants, beneficiaries and survivors. These tables are developed based on the experience in the actuarial investigation as of August 31, 2014. Below are sample rates for 2014 and projected rates for 2044.

	2014 Mortality Rates	
Age	**Male**	**Female**
40	0.001938	0.001585
50	0.004247	0.002791
60	0.005584	0.003882
70	0.015547	0.009613
80	0.053691	0.035591
90	0.162983	0.133727
100	0.407509	0.284047
110	0.500000	0.467915

	2044 Mortality Rates	
Age	**Male**	**Female**
40	0.001771	0.001448
50	0.003881	0.002550
60	0.004523	0.002872
70	0.009879	0.006692
80	0.034118	0.024777
90	0.116958	0.095964
100	0.372385	0.259564
110	0.500000	0.467915

For disabled retirees, a three-year set forward of the above tables are used, with a minimum mortality rates of 0.0200 for female and 0.0400 for male.

	2014 Mortality Rates	
Age	**Male**	**Female**
40	0.040000	0.020000
50	0.040000	0.020000
60	0.040000	0.020000
70	0.040000	0.020000
80	0.076501	0.054133
90	0.218673	0.181404
100	0.500000	0.340356
110	1.000000	0.500000

	2044 Mortality Rates	
Age	**Male**	**Female**
40	0.040000	0.020000
50	0.040000	0.020000
60	0.040000	0.020000
70	0.040000	0.020000
80	0.048613	0.037685
90	0.156922	0.130177
100	0.456904	0.311020
110	1.000000	0.500000

HANDLING OF ACTIVE DATA WITH MISSING INFORMATION:

As of the close of each fiscal year there is a large number of records for whom no statistical data has been received. The only information TRS has is social security number and initial contributions. Any of these records that were in the prior year's data are treated as non-vested terminated members. The remaining records are treated as new entrants. These records are added to the count of active members, but have no liability.

There are other records provided by TRS that have missing gender and/or missing date of births. These records are handled as follows:

1. 80% of records with missing gender are assumed to be female. The overall male/female ratio of the active membership is used to set this assumption.

2. Records with missing dates of birth are assigned a date of birth that produces an entry age equal to the average entry age for the overall active population, based on the member's actual service.

ASSUMPTION FOR DROP PARTICIPATION

It is assumed that no members will enter DROP.

BENEFIT ELECTION OF VESTED TERMINATING MEMBERS:

In determining the liabilities developed for future terminating vested members, it is assumed that the member elects either a refund or a deferred vested benefit, whichever is more valuable. The deferred benefit is assumed to commence at the earliest age the member is eligible for unreduced retirement.

ELECTION RATES FOR ACTIVE MEMBER DEATH BENEFITS:

It is assumed that the beneficiary will elect the death benefit option with the greatest value.

BENEFIT OPTION ELECTIONS:

It is assumed that future healthy retirees will select the normal form of payment. For disabled members, 80% are assumed to select the normal form of payment and 20% to select the 100% joint and survivor option.

CLASSIFICATION OF WHO ARE ACTIVE MEMBERS:

Members who contributed during the just-completed plan year but did not retire before the August 31st are considered active.

AVERAGE SURVIVOR BENEFIT LIABILITY:

One of the options on the death of an active member, a disabled member, or a retired member is a survivor benefit. To determine the liability for this benefit the following average values are used.

		Males	Females
1.	Active member	$62,200	$59,000
2.	Disabled member	$13,000	$11,000
3.	Retired member	$12,000	$12,000

ACTUARIAL VALUE OF ASSETS:

A. The actuarial value of assets is equal to the market value of assets less a five-year phase in of the excess (shortfall) between expected investment return and actual income. The actual calculation is based on the difference between actual market value and the expected actuarial value of assets each year, and recognizes the cumulative excess return (or shortfall) over at a minimum rate of 20% per year. Each year a base is set up to reflect this difference. If the current year's base is of opposite sign to the deferred bases then it is offset dollar for dollar against the deferred bases. Any remaining bases are then recognized over the remaining period for the base (5 less the number of years between the bases year and the valuation year). This is intended to ensure the smoothed value of assets will converge towards the market value in a reasonable amount of time.

B. Expected earnings are determined using the assumed investment return rate and the beginning of year actuarial value of assets (adjusted for receipts and disbursements during the year). The returns are computed net of investment expenses.

PAYROLL GROWTH FOR FUNDING OF UNFUNDED ACTUARIAL ACCRUED LIABILITY:

1. Total payroll growth rate: 2.50%.

2. Portion attributable to inflation: 2.50%.

3. Portion attributable to active member growth: No growth.

ACTUARIAL COST METHOD:

The funding period required to amortize the unfunded actuarial accrued liability (UAAL) is determined using the Entry Age Actuarial Cost Method. This method assigns the plan's total unfunded liabilities (the actuarial present value of future benefits less the actuarial value of assets) to various periods. The unfunded actuarial accrued liability is assigned to years prior to the valuation, and the normal cost is assigned to the year following the valuation. The remaining costs are assigned to future years.

The normal cost is determined using the "ultimate entry age normal" method. Under this cost method, a calculation is made to determine the average uniform and constant percentage rate of employer contribution which, if applied to the compensation of each participant during the entire period of his/her anticipated covered service, would be required to meet the cost of all benefits payable on his behalf based on the benefits provisions for new employees hired on or after August 31, 2014.

The actuarial accrued liability (AAL) for each member is the difference between their present value of future benefits (PVFB), based on the tier of benefits that apply to the member, and their present value of future normal costs determined using the normal cost rate described above. For inactive and retired members their AAL is equal to their PVFB.

The unfunded actuarial accrued liability (UAAL) is the excess of the actuarial accrued liability over the actuarial value of assets.

Since the State statutes governing the System establish the current employee and State contribution rates, the actuarial valuation determines the number of years required to amortize (or fund) the UAAL on a level percentage of payroll basis, taking into account the payroll growth assumption and the normal cost expressed as a percent of pay.

Because of this amortization procedure, any change in the unfunded actuarial accrued liability due to (i) actuarial gains and losses, (ii) changes in actuarial assumptions, or (iii) amendments, affects the funding period. The statutory goal is that the State contribution rate be sufficient to keep the funding period below 31 years.

PROJECTED PAYROLL FOR CONTRIBUTIONS:

The aggregate projected payroll for the fiscal year following the valuation date is calculated by increasing the actual payroll paid during the previous fiscal year by the payroll growth rate and multiplying by the ratio of current active members to the average number of active members during the previous fiscal year.

USE OF CELLED DATA:

For valuation purposes, every record in the census is valued individually.

For legislative purposes, the active valuation data is celled by benefit tier, gender, years of service, month and year of birth. The individual cell is valued using the sum of the salary and account balances of the members in the cell. Every year we test this approach against using the individual records and the results are consistently less than 0.02% different in total present value of benefits.

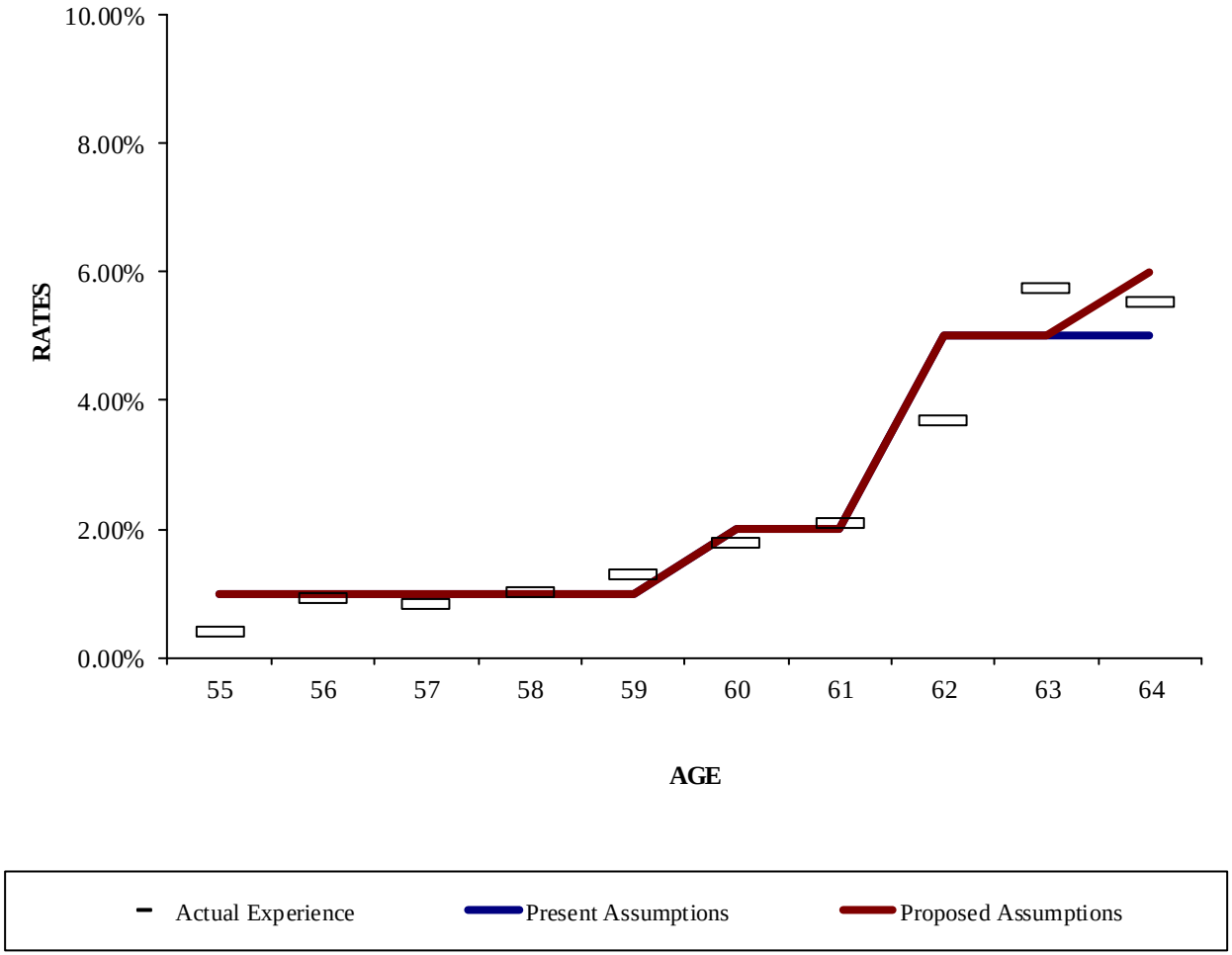
SECTION VI

SUMMARY OF DATA AND EXPERIENCE

TEACHER RETIREMENT SYSTEM OF TEXAS
MALE RETIREMENT EXPERIENCE - AGE BASED
Early Retirement

				Assumed Rate		Expected Retirement		Actual/Expected	
Age	Actual Retirement	Total Count	Actual Rate	Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
45	-	-	N\A	17%	1%	-	-	N/A	N/A
46	-	1	0.000	17%	1%	-	-	N/A	N/A
47	1	8	0.125	17%	1%	1	-	100%	N/A
48	3	57	0.053	17%	2%	10	1	30%	300%
49	4	135	0.030	17%	3%	23	4	17%	100%
50	-	-	N\A	17%	1%	-	-	N/A	N/A
51	-	-	N\A	17%	1%	-	-	N/A	N/A
52	-	-	N\A	17%	1%	-	-	N/A	N/A
53	-	-	N\A	17%	1%	-	-	N/A	N/A
54	-	-	N\A	17%	1%	-	-	N/A	N/A
55	56	13,004	0.004	1%	1%	130	130	43%	43%
56	113	12,162	0.009	1%	1%	122	122	93%	93%
57	99	11,566	0.009	1%	1%	116	116	85%	85%
58	112	10,751	0.010	1%	1%	108	108	104%	104%
59	131	9,996	0.013	1%	1%	100	100	131%	131%
60	165	9,169	0.018	2%	2%	183	183	90%	90%
61	176	8,289	0.021	2%	2%	166	166	106%	106%
62	272	7,331	0.037	5%	5%	367	367	74%	74%
63	359	6,233	0.058	5%	5%	312	312	115%	115%
64	291	5,236	0.056	5%	6%	262	314	111%	93%
Total	1,782	93,938	0.019			1,900	1,923	94%	93%

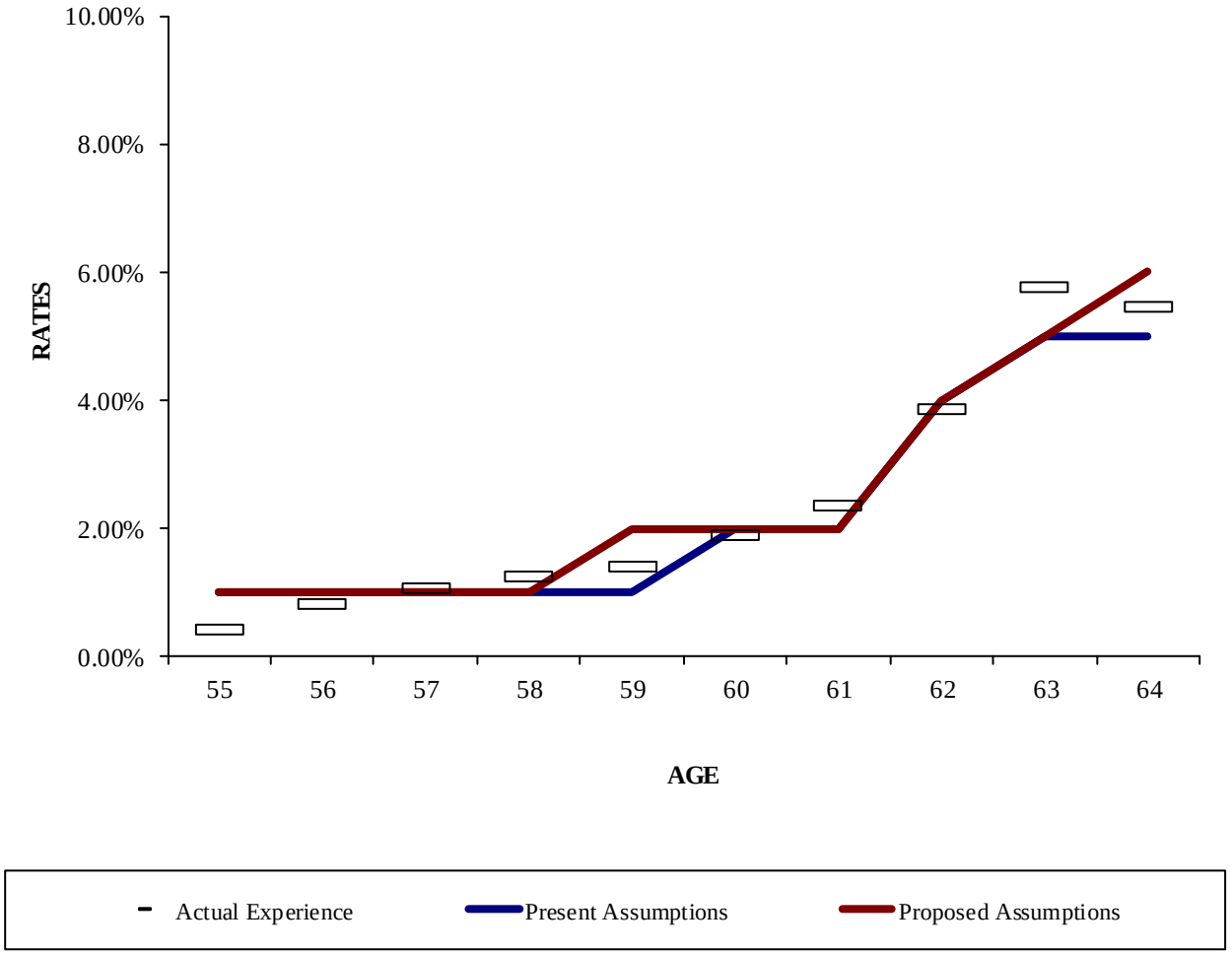
MALE RETIREMENT EXPERIENCE - AGE BASED
Early Retirement



TEACHER RETIREMENT SYSTEM OF TEXAS
FEMALE RETIREMENT EXPERIENCE - AGE BASED
Early Retirement

				Assumed Rate		Expected Retirement		Actual/Expected	
Age	Actual Retirement	Total Count	Actual Rate	Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
45	-	-	N\A	17%	1%	-	-	N\A	N\A
46	-	3	0.000	17%	1%	1	-	0%	N\A
47	-	9	0.000	17%	2%	2	-	0%	N\A
48	2	80	0.025	17%	3%	14	2	14%	100%
49	5	156	0.032	17%	4%	27	6	19%	83%
50	-	-	N\A	17%	1%	-	-	N\A	N\A
51	-	-	N\A	17%	1%	-	-	N\A	N\A
52	-	-	N\A	17%	1%	-	-	N\A	N\A
53	-	-	N\A	17%	1%	-	-	N\A	N\A
54	-	-	N\A	17%	1%	-	-	N\A	N\A
55	196	45,320	0.004	1%	1%	453	453	43%	43%
56	348	42,042	0.008	1%	1%	420	420	83%	83%
57	413	38,173	0.011	1%	1%	382	382	108%	108%
58	425	33,772	0.013	1%	1%	338	338	126%	126%
59	415	29,511	0.014	1%	2%	295	590	141%	70%
60	478	25,102	0.019	2%	2%	502	502	95%	95%
61	496	20,794	0.024	2%	2%	416	416	119%	119%
62	650	16,724	0.039	4%	4%	669	669	97%	97%
63	764	13,187	0.058	5%	5%	659	659	116%	116%
64	556	10,153	0.055	5%	6%	508	609	109%	91%
Total	4,748	275,026	0.017			4,686	5,046	101%	94%

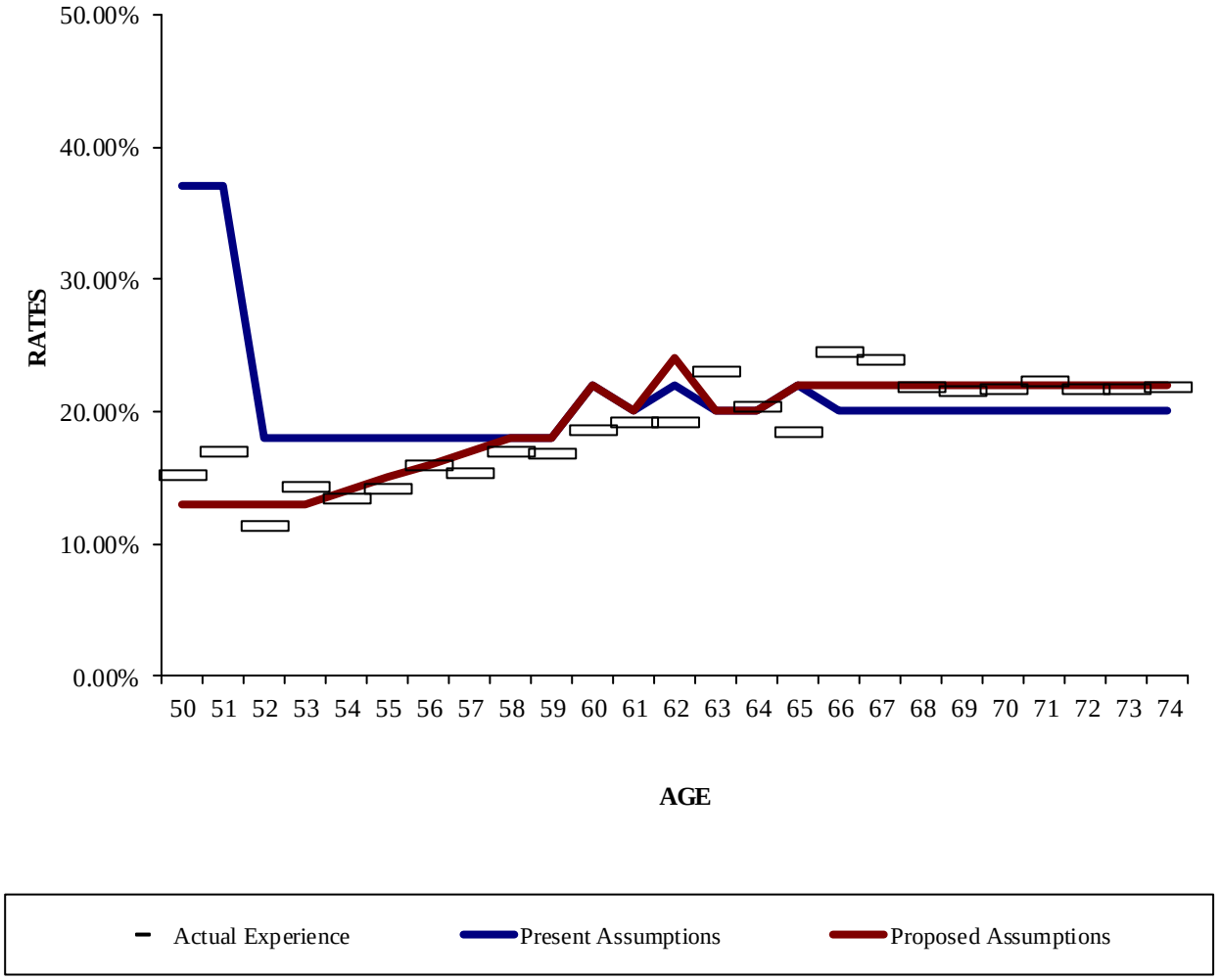
FEMALE RETIREMENT EXPERIENCE - AGE BASED
Early Retirement



TEACHER RETIREMENT SYSTEM OF TEXAS
MALE RETIREMENT EXPERIENCE - AGE BASED
Unreduced Retirement

				Assumed Rate		Expected Retirement		Actual/Expected	
Age	Actual Retirement	Total Count	Actual Rate	Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 50	41	76	0.539	37%	13%	28	10	146%	410%
50	57	375	0.152	37%	13%	139	49	41%	116%
51	146	858	0.170	37%	13%	317	112	46%	130%
52	261	2,281	0.114	18%	13%	411	297	64%	88%
53	493	3,435	0.144	18%	13%	618	447	80%	110%
54	541	4,027	0.134	18%	14%	725	564	75%	96%
55	638	4,475	0.143	18%	15%	806	671	79%	95%
56	785	4,884	0.161	18%	16%	879	781	89%	101%
57	786	5,090	0.154	18%	17%	916	865	86%	91%
58	902	5,275	0.171	18%	18%	950	950	95%	95%
59	914	5,397	0.169	18%	18%	971	971	94%	94%
60	1,010	5,406	0.187	22%	22%	1,189	1,189	85%	85%
61	1,007	5,233	0.192	20%	20%	1,047	1,047	96%	96%
62	989	5,120	0.193	22%	24%	1,126	1,229	88%	80%
63	1,134	4,912	0.231	20%	20%	982	982	115%	115%
64	926	4,531	0.204	20%	20%	906	906	102%	102%
65	1,718	9,298	0.185	22%	22%	2,046	2,046	84%	84%
66	1,731	7,034	0.246	20%	22%	1,407	1,547	123%	112%
67	1,295	5,409	0.239	20%	22%	1,082	1,190	120%	109%
68	920	4,205	0.219	20%	22%	841	925	109%	99%
69	719	3,327	0.216	20%	22%	665	732	108%	98%
70	595	2,742	0.217	20%	22%	548	603	109%	99%
71	510	2,280	0.224	20%	22%	456	502	112%	102%
72	401	1,839	0.218	20%	22%	368	405	109%	99%
73	311	1,433	0.217	20%	22%	287	315	108%	99%
74	320	1,463	0.219	20%	22%	293	322	109%	99%
75 & Over	1,226	5,021	0.244	100%	100%	5,021	5,021	24%	24%

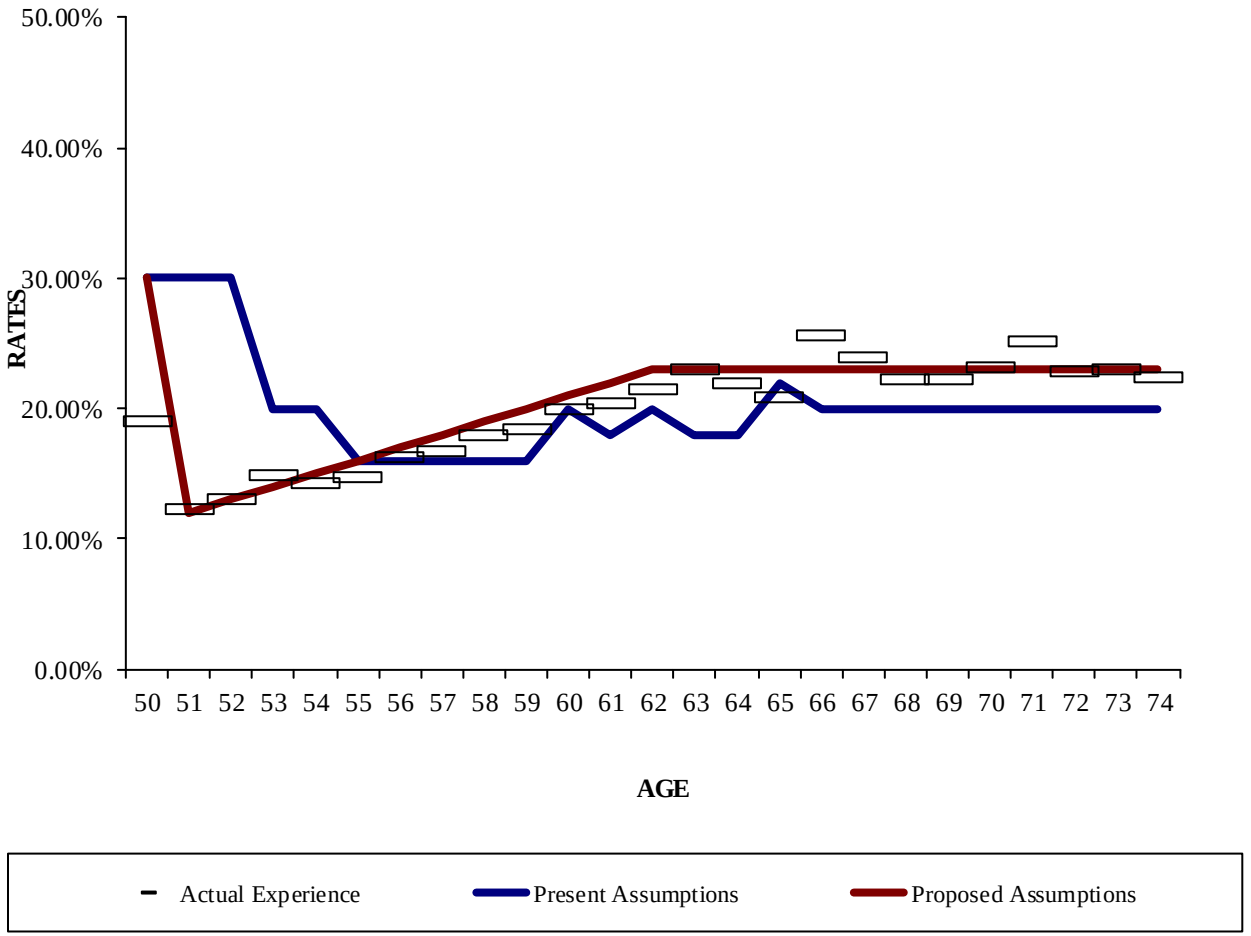
MALE RETIREMENT EXPERIENCE - AGE BASED
Unreduced Retirement



TEACHER RETIREMENT SYSTEM OF TEXAS
FEMALE RETIREMENT EXPERIENCE - AGE BASED
Unreduced Retirement

				Assumed Rate		Expected Retirement		Actual/Expected	
Age	Actual Retirement	Total Count	Actual Rate	Current	Proposed	Current (3) * (5)	Proposed (3) * (6)	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 50	188	624	0.301	30%	30%	187	187	101%	101%
50	100	523	0.191	30%	30%	157	157	64%	64%
51	345	2,780	0.124	30%	12%	834	334	41%	103%
52	1,006	7,641	0.132	30%	13%	2,292	993	44%	101%
53	1,516	10,145	0.149	20%	14%	2,029	1,420	75%	107%
54	1,685	11,747	0.143	20%	15%	2,349	1,762	72%	96%
55	1,970	13,346	0.148	16%	16%	2,135	2,135	92%	92%
56	2,442	14,923	0.164	16%	17%	2,388	2,537	102%	96%
57	2,781	16,528	0.168	16%	18%	2,644	2,975	105%	93%
58	3,239	18,036	0.180	16%	19%	2,886	3,427	112%	95%
59	3,533	19,140	0.185	16%	20%	3,062	3,828	115%	92%
60	3,940	19,741	0.200	20%	21%	3,948	4,146	100%	95%
61	4,025	19,707	0.204	18%	22%	3,547	4,336	113%	93%
62	4,027	18,662	0.216	20%	23%	3,732	4,292	108%	94%
63	3,865	16,747	0.231	18%	23%	3,014	3,852	128%	100%
64	3,241	14,704	0.220	18%	23%	2,647	3,382	122%	96%
65	4,623	22,033	0.210	22%	23%	4,847	5,068	95%	91%
66	3,905	15,209	0.257	20%	23%	3,042	3,498	128%	112%
67	2,634	10,996	0.240	20%	23%	2,199	2,529	120%	104%
68	1,784	7,987	0.223	20%	23%	1,597	1,837	112%	97%
69	1,317	5,912	0.223	20%	23%	1,182	1,360	111%	97%
70	1,041	4,470	0.233	20%	23%	894	1,028	116%	101%
71	834	3,306	0.252	20%	23%	661	760	126%	110%
72	557	2,437	0.229	20%	23%	487	561	114%	99%
73	426	1,846	0.231	20%	23%	369	425	115%	100%

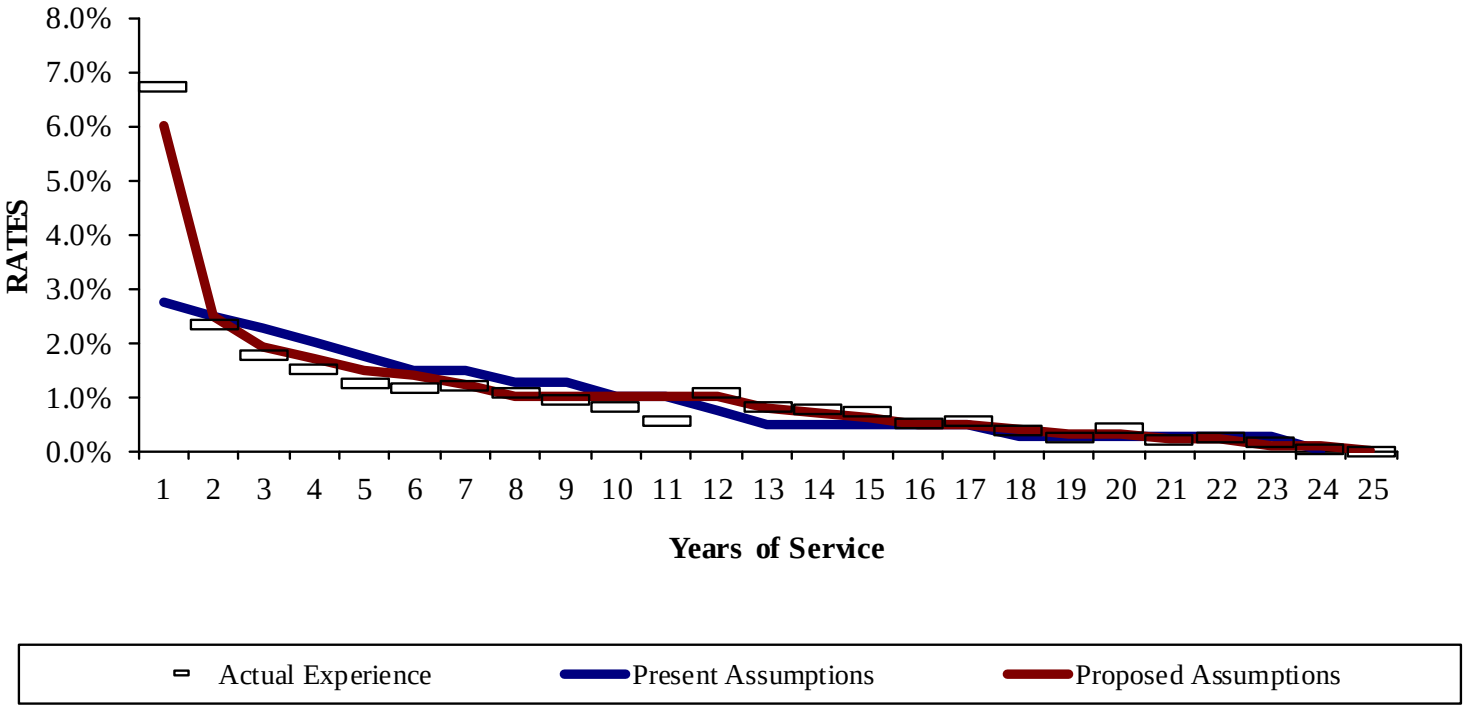
FEMALE RETIREMENT EXPERIENCE - AGE BASED
Unreduced Retirement



TEACHER RETIREMENT SYSTEM OF TEXAS
Service-Based Salary Rates

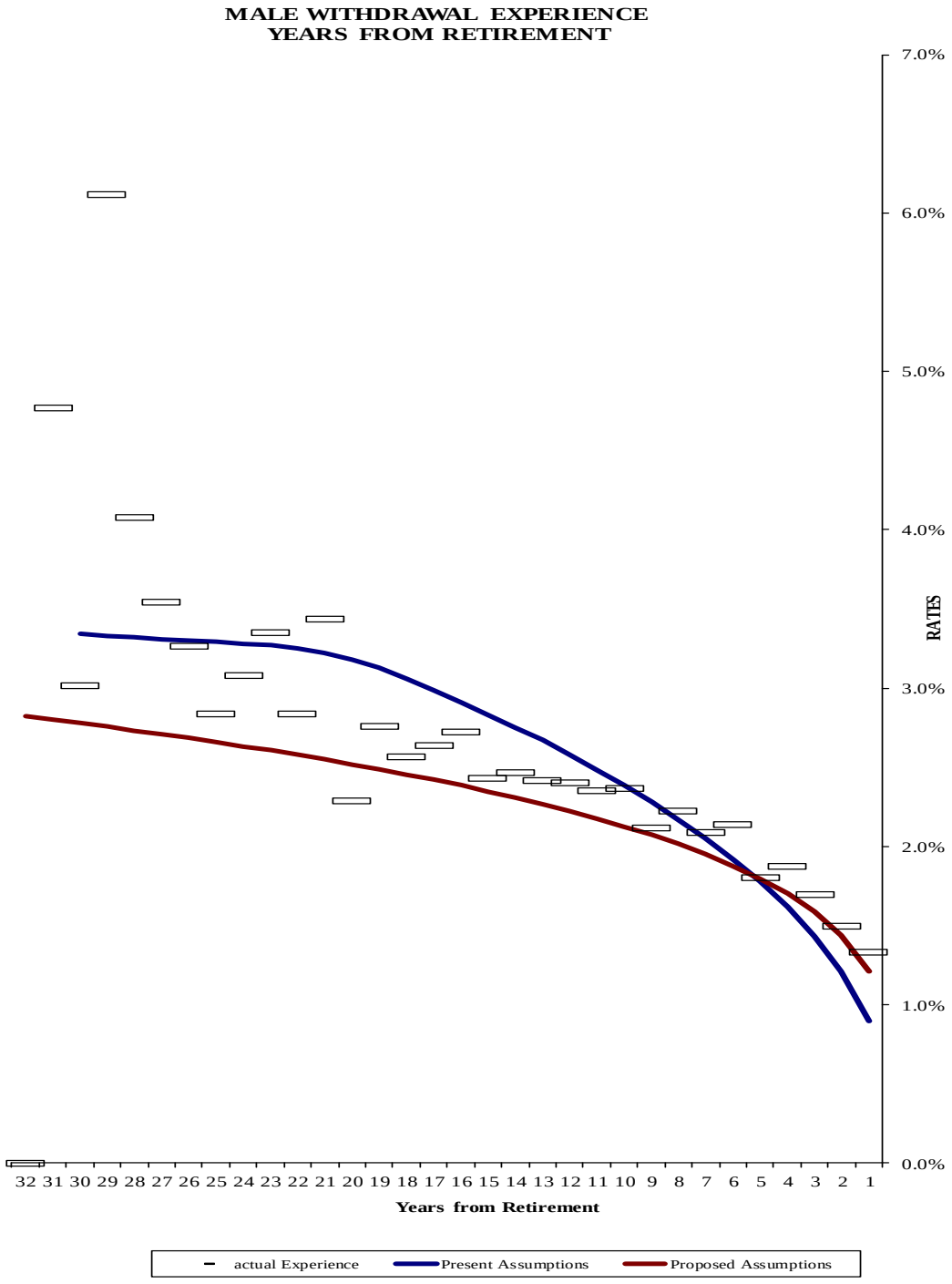
	Current Salary Scale		2004/2014 Actual Experience			Proposed Salary Scale	
Years of Service	Total	Step Rate/ Promotional	Total	Above Inflation	Step Rate/ Promotional	Total	Step Rate/ Promotional
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	7.25%	3.00%	**9.47%**	7.23%	6.70%	**9.50%**	6.00%
2	7.00%	2.75%	**5.11%**	2.87%	2.34%	**6.00%**	2.50%
3	6.75%	2.50%	**4.53%**	2.28%	1.75%	**5.40%**	1.90%
4	6.50%	2.25%	**4.27%**	2.03%	1.49%	**5.20%**	1.70%
5	6.25%	2.00%	**4.01%**	1.76%	1.23%	**5.00%**	1.50%
6	6.00%	1.75%	**3.93%**	1.69%	1.16%	**4.90%**	1.40%
7	5.75%	1.50%	**3.95%**	1.71%	1.18%	**4.70%**	1.20%
8	5.75%	1.50%	**3.85%**	1.61%	1.08%	**4.50%**	1.00%
9	5.50%	1.25%	**3.70%**	1.45%	0.92%	**4.50%**	1.00%
10	5.50%	1.25%	**3.60%**	1.35%	0.82%	**4.50%**	1.00%
11	5.25%	1.00%	**3.34%**	1.09%	0.56%	**4.50%**	1.00%
12	5.25%	1.00%	**3.86%**	1.61%	1.08%	**4.50%**	1.00%
13	5.00%	0.75%	**3.57%**	1.33%	0.80%	**4.30%**	0.80%
14	4.75%	0.50%	**3.53%**	1.28%	0.75%	**4.20%**	0.70%
15	4.75%	0.50%	**3.48%**	1.24%	0.71%	**4.10%**	0.60%
16	4.75%	0.50%	**3.26%**	1.02%	0.49%	**4.00%**	0.50%
17	4.75%	0.50%	**3.32%**	1.07%	0.54%	**4.00%**	0.50%
18	4.75%	0.50%	**3.14%**	0.89%	0.36%	**3.90%**	0.40%
19	4.50%	0.25%	**3.03%**	0.79%	0.26%	**3.80%**	0.30%
20	4.50%	0.25%	**3.20%**	0.96%	0.43%	**3.80%**	0.30%
21	4.50%	0.25%	**2.98%**	0.73%	0.20%	**3.70%**	0.20%
22	4.50%	0.25%	**3.01%**	0.77%	0.24%	**3.70%**	0.20%
23	4.50%	0.25%	**2.92%**	0.68%	0.15%	**3.60%**	0.10%
24	4.50%	0.25%	**2.81%**	0.57%	0.04%	**3.60%**	0.10%
25	4.25%	0.00%	**2.77%**	0.53%	0.00%	**3.50%**	0.00%

Service-Based Salary Rates



TEACHER RETIREMENT SYSTEM OF TEXAS
MALE WITHDRAWAL EXPERIENCE - YEARS FROM RETIREMENT

				Assumed Rate		Expected Withdrawal		Actual/Expected	
Years from Retirement	Actual Withdrawal	Total Salary	Actual Rate	Current	Proposed	Current	Proposed	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	26	1,958	0.0134	0.0090	0.0121	22	24	118%	110%
2	30	2,018	0.0150	0.0121	0.0144	27	29	113%	104%
3	35	2,067	0.0170	0.0143	0.0159	31	33	114%	107%
4	39	2,095	0.0188	0.0162	0.0170	34	36	116%	110%
5	37	2,039	0.0181	0.0178	0.0180	36	37	104%	101%
6	42	1,972	0.0214	0.0192	0.0188	37	37	115%	114%
7	39	1,878	0.0209	0.0205	0.0195	37	37	106%	107%
8	40	1,787	0.0222	0.0217	0.0201	37	36	106%	110%
9	36	1,713	0.0212	0.0228	0.0207	38	36	96%	102%
10	39	1,643	0.0237	0.0239	0.0213	38	35	103%	111%
11	37	1,584	0.0235	0.0248	0.0218	38	34	99%	108%
12	36	1,478	0.0240	0.0258	0.0222	37	33	97%	108%
13	33	1,359	0.0242	0.0267	0.0227	35	31	95%	107%
14	30	1,206	0.0247	0.0275	0.0231	32	28	93%	107%
15	24	1,002	0.0244	0.0283	0.0235	28	24	89%	104%
16	20	740	0.0273	0.0291	0.0239	21	18	96%	114%
17	10	381	0.0264	0.0299	0.0242	11	9	94%	109%
18	5	203	0.0257	0.0306	0.0245	5	5	99%	105%
19	5	179	0.0277	0.0313	0.0249	5	4	107%	111%
20	3	146	0.0229	0.0318	0.0252	4	4	90%	91%
21	4	127	0.0344	0.0322	0.0255	3	3	131%	135%
22	3	117	0.0284	0.0325	0.0258	3	3	106%	110%
23	4	108	0.0335	0.0327	0.0261	3	3	122%	129%
24	3	94	0.0309	0.0328	0.0263	3	2	110%	117%
25	2	76	0.0284	0.0329	0.0266	2	2	99%	107%
26	2	59	0.0327	0.0330	0.0268	2	2	112%	122%
27	1	34	0.0355	0.0331	0.0271	1	1	119%	131%
28	1	14	0.0408	0.0332	0.0273	0	0	136%	149%
29	0	6	0.0612	0.0333	0.0276	0	0	201%	222%
30	0	4	0.0302	0.0334	0.0278	0	0	98%	109%
31	0	2	0.0477	0.0335	0.0280	0	0	153%	170%
32	0	0	0.0000	0.0336	0.0282	0	0	0%	0%
Totals	589	28,088				567	544	104%	108%


MALE WITHDRAWAL EXPERIENCE
YEARS FROM RETIREMENT
7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
RATES
32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
Years from Retirement
actual Experience
Present Assumptions
Proposed Assumptions

TEACHER RETIREMENT SYSTEM OF TEXAS
FEMALE WITHDRAWAL EXPERIENCE - YEARS FROM RETIREMENT

				Assumed Rate		Expected Withdrawal		Actual/Expected	
Years from Retirement	Actual Withdrawal	Total Count	Actual Rate	Current	Proposed	Current	Proposed	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	63	5,438	0.0116	0.0068	0.0095	56	52	113%	122%
2	76	5,617	0.0135	0.0101	0.0124	70	69	108%	109%
3	88	5,729	0.0154	0.0127	0.0144	82	83	108%	107%
4	101	5,813	0.0174	0.0149	0.0161	92	93	109%	108%
5	105	5,689	0.0185	0.0169	0.0175	99	99	106%	106%
6	118	5,540	0.0213	0.0187	0.0187	104	104	113%	114%
7	114	5,253	0.0216	0.0204	0.0199	106	104	107%	109%
8	113	4,957	0.0229	0.0220	0.0209	106	104	106%	110%
9	106	4,601	0.0230	0.0235	0.0218	105	100	101%	105%
10	99	4,233	0.0234	0.0250	0.0227	101	96	98%	103%
11	94	3,859	0.0243	0.0264	0.0236	99	91	95%	103%
12	96	3,368	0.0284	0.0277	0.0244	97	82	99%	117%
13	83	3,123	0.0265	0.0290	0.0251	93	78	89%	105%
14	81	2,646	0.0306	0.0302	0.0258	87	68	93%	118%
15	72	2,126	0.0337	0.0314	0.0265	79	56	91%	127%
16	62	1,530	0.0407	0.0326	0.0272	64	42	97%	150%
17	37	1,064	0.0350	0.0337	0.0278	37	30	100%	126%
18	12	484	0.0250	0.0348	0.0284	13	14	91%	88%
19	11	424	0.0248	0.0359	0.0290	11	12	92%	86%
20	10	372	0.0264	0.0369	0.0296	10	11	97%	89%
21	8	331	0.0243	0.0378	0.0301	9	10	86%	81%
22	9	305	0.0302	0.0386	0.0306	9	9	103%	98%
23	9	290	0.0306	0.0393	0.0312	9	9	101%	98%
24	9	253	0.0368	0.0399	0.0317	8	8	119%	116%
25	8	220	0.0360	0.0404	0.0322	7	7	113%	112%
26	6	177	0.0352	0.0408	0.0326	6	6	107%	108%
27	4	110	0.0397	0.0411	0.0331	4	4	118%	120%
28	2	49	0.0505	0.0413	0.0336	2	2	149%	150%
29	1	15	0.0527	0.0414	0.0340	1	0	152%	155%
30	0	7	0.0347	0.0415	0.0345	0	0	99%	101%
31	0	4	0.0418	0.0416	0.0349	0	0	116%	120%
32	0	1	0.0549	0.0417	0.0353	0	0	153%	155%
Totals	1,597	73,627				1,566	1,444	102%	111%

FEMALE WITHDRAWAL EXPERIENCE
YEARS FROM RETIREMENT