

June 23, 2010

Ms. Jill Bachus
Executive Director
Tennessee Consolidated Retirement System
502 Deaderick Street
Andrew Jackson Building, 10th Floor
Nashville, TN 37243-0201

Re: Tennessee Consolidated Retirement System (TCRS) Actuarial Audit

Dear Jill:

As requested, attached please find forty (40) copies of our Actuarial Review Report of the July 1, 2009 Actuarial Valuation for TCRS.

We appreciate the opportunity to have worked with you and staff and believe the draft / review / final report process adds value.

We stand ready to attend a meeting with the interested parties to present the highlights of our Report and respond to any questions or comments.

Thank you for allowing us to be of service on this important engagement.

Sincerest regards,



Lawrence F. Wilson, A.S.A.
Senior Consultant and Actuary

Enclosures

cc: Mr. Brian Murphy
Mr. Peter Strong

TENNESSEE CONSOLIDATED RETIREMENT SYSTEM

ACTUARIAL AUDIT OF THE JULY 1, 2009 ACTUARIAL VALUATION

ACTUARIAL AUDIT - JULY 1, 2009 ACTUARIAL VALUATION OF THE
TENNESSEE CONSOLIDATED RETIREMENT SYSTEM

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June 18, 2010

Board of Trustees
Tennessee Consolidated Retirement System
Tenth Floor
Andrew Jackson State Office Building
Nashville, Tennessee 37243-0230

Dear Board Members:

Gabriel, Roeder, Smith & Company (GRS) is pleased to present this Actuarial Audit of the July 1, 2009 Actuarial Valuation and Report of the Tennessee Consolidated Retirement System (TCRS). We are grateful to the staff of both the Tennessee Consolidated Retirement System and Bryan, Pendleton, Swats & McAllister, LLC (BPSM) for their cooperation throughout the Actuarial Audit process.

The Actuarial Audit has several related objectives:

- Review the reasonableness of the actuarial assumptions and methods,
- Review assumptions and methods for compliance with Professional Standards (generally accepted actuarial principles), State Law, and Board Regulations,
- Review the major economic assumptions (investment earnings, cost-of-living increases and salary) for reasonability and consistency,
- Determine whether the Teacher and General State employee groups are being funded on an adequate basis, and
- Validate the major valuation results.

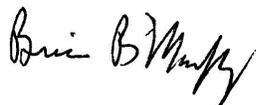
GRS is pleased to report to the Board, that in our professional opinion, the July 1, 2009 Actuarial Valuation and Report prepared by BPSM accurately represents the financial position of the Retirement System. We have identified several issues that we think the retained actuary needs to address going forward.

Throughout this report we make a number of suggestions for ways to improve the work product. We hope BPSM and the Board find these items helpful. Thank you for the opportunity to work on this assignment.

The undersigned are Members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,

Gabriel Roeder Smith & Company



Brian B. Murphy, F.S.A.



Lawrence F. Wilson, A.S.A.



Peter N. Strong, A.S.A.

SECTION I

EXECUTIVE SUMMARY

I. Executive Summary

We have reviewed the July 1, 2009 Actuarial Valuation Report prepared by Bryan, Pendleton, Swats & McAllister, LLC (BPSM) (The Tennessee Consolidated Retirement System retained actuaries). We find the actuarial assumptions and methods generally develop appropriate actuarial values for the Tennessee Consolidated Retirement System. We have also replicated the results of the July 1, 2009 Actuarial Valuation and find no material differences in the valuation results. The results of our replication of key financial results are shown in Section VI.

In reviewing actuarial assumptions and methods, it is important to recognize that there is not a single *correct* set of actuarial assumptions and methods. There is a range of reasonableness within which individual assumptions, methods and the entire valuation basis may fall. Assumptions may be characterized as conservative (producing relatively higher near term contributions) or aggressive (producing relatively lower near term contributions) within this range. Similarly, different acceptable actuarial methods will impact the incidence of required contributions.

In this light, we have the following comments on the July 1, 2009 Actuarial Valuation.

1. **Compliance with requirements of the Tennessee Statutes, government accounting standards and actuarial standards of practice:** The actuarial valuation is generally compliant with most of these requirements. Our suggestions for improvement are noted throughout this report and are summarized in comments (2) through (7) below.

2. **Use of generally accepted actuarial cost methods, bases for assumptions and reporting standards:** Generally, the Actuarial Valuation meets these requirements. Our primary suggestion for improvement concerns the funding method. The funding method described in the System actuary's valuation report provides for use of the Frozen Initial Liability funding method with a periodically reestablished UAL and a 20-year amortization of the UAL when the UAL is positive, and an automatic funding method change to the aggregate funding method when a negative UAL (or surplus) exists.

We understand use of this funding method is mandated by statute and by the Board of Trustees. The Board of Trustees has authority to decide when to reestablish the UAL. Reestablishment has generally occurred when significant changes in assumptions or System benefits have been made, or when actuarial experience has deviated significantly from expectations. We recommend the Board consider a more explicit basis be defined for reestablishment of the UAL. Further, we believe this funding method could result (indirectly) in a faster amortization of surpluses than deficiencies (unfunded accrued liabilities). Asymmetric treatment may not be beneficial to the System and may introduce volatility into the contribution rates when the System moves between an overfunded position and an underfunded position from one valuation to the next. In addition, we recommend the Board consider adding a floor to the contribution rate if the System becomes overfunded (for example, a floor equal to the normal cost under the Entry Age Normal funding method). Please see pages 12-13 for more detail.

3. **Adequate funding:** Generally, the current methods and assumptions have resulted in and should continue to result in adequate funding for the Teacher and General State employee groups. We note current funded percentages (based on the entry age normal accrued liability and the actuarial value of assets) are approximately 94% for the Teachers and 87% for the General State employees. Contribution rates for both groups include a normal cost component (for benefits being earned during the current year) and an amortization of the unfunded accrued liability (over a 20-year period). Assuming minimal future overall experience gains and losses, these contribution rates may slowly improve the accrued liability funded percentages and further secure benefits for the Teachers and the General State employees.

4. **Review of economic assumptions for reasonability and consistency:** The economic assumptions are generally consistent, including recognition of anticipated inflation in the investment earnings assumption, the cost-of-living increase assumption and the salary increase assumption. We note the inflation assumption of 3.0% is within the range of reasonable long term inflation assumptions, although it may be somewhat on the lower end, based on historical experience. We also note the expected real rate of return on System assets of 4.5% (net of inflation and certain investment expenses) may be on the higher end of reasonable long-term real rate of return assumptions, depending on how System assets are invested.

The reduction in expected future COLAs to 2.5%, while historically reasonable, could result in extended periods of actuarial losses depending upon actual future CPI behavior. For this reason, a higher COLA assumption such as 2.75% could also be considered by the Board.

5. **Review of demographic assumptions for reasonability:** We commend your practice of having periodic experience studies to determine assumptions. The withdrawal rates include a three (3) year select period, which is shorter than the five (5) year vesting period. In addition, we note early retirement probabilities are included in the withdrawal rates – expected terminations eligible for early retirement are expected to commence payment of reduced benefit immediately upon termination. We recommend early retirement be distinguished from withdrawal and explicitly valued with its own assumption, such that early retirement rates are applied at each potential early retirement commencement age.

We were informed that the service retirement rates are applied differently in the valuation runs than the valuation report implies. The System actuary applies an algorithm to the data (based on the service retirement rates) that randomly assigns a discrete retirement age to each member before the valuation is run, rather than applying the retirement rates at each potential retirement date for each member as part of the valuation process. We recommend the Board consider having the System actuaries follow standard methodology by applying the disclosed retirement rates at each potential retirement date for each member.

With regard to the mortality assumption, we suggest the Board consider use of generational mortality tables, which reflect expected future improvements in mortality experience. Actuarial Standard of Practice (ASOP) Number 35 *Selection of Demographic and Other Noneconomic*

Assumptions for Measuring Pension Obligations, paragraph 3.5.3 provides the actuary should consider the likelihood and extent of mortality improvement in the future. Recently published mortality tables recommend usage of and include future mortality improvement scales. Generational tables, while not commonly in use by statewide public plans, are beginning to be used for retirement plan valuations – including public plans.

We were informed 100% of deaths and disabilities among active members are assumed to be *ordinary* (e.g., non-service incurred). We understand this assumption has been examined and determined to be reasonable. We suggest this assumption be disclosed in the valuation report.

6. **Assets:** We find almost no information on System assets in the valuation report. At a minimum, we recommend, as best practice, a section on System assets be added to the valuation report. This section should at least include a statement of assets showing the allocation of assets to major asset classes, a statement of net changes in assets showing receipts and disbursements, and an exhibit showing the development of the Actuarial Value of Assets. We believe this disclosure is mandated under ASOP No. 44 *Selection and Use of Asset Valuation Methods for Pension Valuations* – Section 4.

7. **Other aspects of the Valuation:** While most other aspects of the valuation are sufficient, we have the following recommendations for improvement:

- a. Addition of census statistics for vested terminated members.
- b. More consistent application of the disability decrement by either ceasing its application after attainment of normal retirement eligibility (earlier of age 60 or completion of 30 years of service) or continuing its application through the retirement rate pattern (until attainment of the assigned discrete retirement age).
- c. Inclusion of side-by-side (before and after) valuation results when major changes have been implemented (such as the assumption changes made as a result of the 2004-2008 experience study effective July 1, 2009).
- d. Modification of the valuation software utilized to produce standard sample life output detail. This is important on an ongoing basis for providing a consistent way to ensure that the valuation is correct, especially when benefit changes are being considered.
- e. Consider annual actuarial valuations. In times of rapidly changing contribution requirements, the delay in recognition of changing contribution requirements introduced by biennial valuation may add to contribution volatility. We understand the Board has selected biennial actuarial valuations and cost calculations are prepared in the interim.
- f. Review the option factors and service purchase factors in use by the System. It is our observation that the valuation assumes the System option factors and service purchase factors are cost neutral, as we find no adjustments in the actuarial work to account for either subsidized option factors or subsidized service purchase factors. It is important to keep the actuarial equivalence basis current so that options can be determined on a true cost neutral actuarial equivalent basis. We

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understand the actuarial equivalence basis is reviewed in coordination with the periodic experience studies. Notwithstanding the above, the System actuary states: *Another factor contributing to future contribution rates is the opportunity for rehired former participants to purchase prior service credits. This results in upward rate pressure for both the Teacher and the State groups.* We understand from TCRS staff the losses caused by the purchase of prior service credits are de minimus.

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SECTION II

INTRODUCTION

II. Introduction

The Board of Trustees for the Tennessee Consolidated Retirement System (TCRS) issued a Request For Proposal (RFP) for an actuarial audit of the July 1, 2009 Actuarial Valuation of the Tennessee Consolidated Retirement System performed by Bryan, Pendleton, Swats & McAllister, LLC (BPSM). Gabriel, Roeder, Smith & Company (GRS) responded to the RFP and was awarded the project. The project commenced February 2010.

An actuarial audit involves an in-depth review by an independent actuarial firm of the work completed by the System actuary. This actuarial audit involved the following components:

- GRS received data from both TCRS and from the System actuary - BPSM.
- BPSM supplied a detailed set of the actuarial assumptions used in the July 1, 2009 actuarial valuation.
- GRS loaded the data with respect to the Contributory Teachers and General State employees and the assumptions into our proprietary computer system and independently completed an actuarial valuation of the Tennessee Consolidated Retirement System as of July 1, 2009 for these groups. GRS and BPSM each use independently developed proprietary actuarial valuation software. As part of this actuarial audit, results of GRS software are compared with results of BPSM software, and differences are noted. Users of this report should bear in mind an actuarial valuation involves a large number of intricate calculations and many individual judgments regarding rather arcane items. Two independently written valuation programs will rarely agree to within more than 1% or so, except by coincidence. In this actuarial audit we concentrate on differences we believe are important. We do not pursue differences we believe are the result of minor judgment items or software technicalities.

Also, as part of the actuarial audit, GRS actuaries have reviewed and commented on the reasonability and consistency of the economic assumptions and the reasonability and appropriateness of the demographic assumptions and actuarial cost methods. Once again, different individuals coming from different experience backgrounds often come to different conclusions when looking at the same data.

SECTION III

REVIEW OF ECONOMIC ASSUMPTIONS

III. Review of Economic Assumptions

Process for Assumption Setting: The principles set forth in Actuarial Standards of Practice (ASOP) No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations* guide the proper selection of **economic assumptions**. In particular, they prescribe that the actuary should develop a best estimate range for each economic assumption, and then recommend a specific point within that range. After completing the assumption process, the actuary should review the set of economic assumptions for consistency.

The economic assumptions seem reasonable and appropriate. We note the inflation assumption (3.0%) is within the range of reasonable long term inflation assumptions, although it may be somewhat on the lower end of the range, based on historical experience. Over the last twenty (20) years, the average rate of inflation has been about 2.7%, which is in line with the inflation assumption. However, over the last thirty (30) and fifty (50) years, the average rate of inflation has been about 3.5% and 4.1%, respectively (please see table on page 7).

The expected long-term investment earnings assumption (7.5%) implies a long-term *real rate of return* (in excess of inflation and net of certain investment expenses) of 4.5%. We note this real return assumption may be at the higher end of the range of reasonable long-term real rate of return assumptions, depending on how the underlying investments are invested. A typical investment allocation of 60% equities and 40% fixed income investments may support this real rate of return assumption, based on the average real rates of return for this type of portfolio (please see table on page 8). While the assumed spread over inflation is mainstream by comparative standards, we see a trend toward reduction of assumed spreads beginning to emerge. The breakdown of assets by investment class was not included in the July 1, 2009 actuarial valuation report.

The cost-of-living increase assumption was changed from 3.0% to 2.5% as of July 1, 2009, while the inflation assumption remained at 3.0%, implying that assumed future cost-of-living increases are 50 basis points below inflation over the long term. The reduction in expected future COLAs to 2.5%, while historically reasonable, could result in extended periods of actuarial losses. For example, had the assumption been in effect for the period 1966 to 1985, it would have produced a loss every year. Consequently, some actuaries would make a higher COLA assumption, such as 2.75% (or even 3.0%), given the same data. We understand the Board decided to lower the COLA assumption to 2.5%. The historical experience of actual average cost-of-living increases supports the change, as shown on the next page.

The salary increase assumption varies by age, with higher salary increases assumed at younger ages and lower salary increases assumed at older ages. This assumption follows the general trend we see as younger, shorter service employees tend to receive higher salary increases as a percentage of pay as they gain experience and knowledge and receive promotions throughout the first half of their careers. We note the salary increase assumption is greater than the inflation

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assumption across all ages, such that merit and productivity increases are expected at all ages. The salary increase assumption appears reasonable and consistent with the inflation assumption.

Another assumption commonly used in determining public plan contribution requirements is a payroll growth assumption. The payroll growth assumption represents the best estimate of future covered payroll for active members. The payroll growth assumption is then used to determine the amortization payment for unfunded liabilities. Initially, this amortization as a level percent of increasing payroll is lower in dollar amount and is scheduled to increase in tandem with the expected payroll increase.

Use of a payroll growth assumption is expected to produce more level contribution requirements as a percentage of increasing payroll.

The System uses a level dollar amortization (versus a level percentage of payroll amortization). No payroll growth assumption is being used. We understand the System previously used a level percentage of payroll amortization and by Board decision switched to the more conservative level dollar amortization in phases in 1983 and 1985.

HISTORICAL INFLATION VERSUS CAPPED COST-OF-LIVING INCREASES

Year	Inflation (CPI)	Est. COL Increase	Year	Inflation (CPI)	Est. COL Increase	Year	Inflation (CPI)	Est. COL Increase
1960	1.4%	1.4%	1978	9.0%	3.0%	1996	3.3%	3.0%
1961	0.7%	0.7%	1979	13.3%	3.0%	1997	1.7%	1.7%
1962	1.3%	1.3%	1980	12.5%	3.0%	1998	1.6%	1.6%
1963	1.6%	1.6%	1981	8.9%	3.0%	1999	2.7%	2.7%
1964	1.0%	1.0%	1982	3.8%	3.0%	2000	3.4%	3.0%
1965	1.9%	1.9%	1983	3.8%	3.0%	2001	1.6%	1.6%
1966	3.5%	3.0%	1984	3.9%	3.0%	2002	2.4%	2.4%
1967	3.0%	3.0%	1985	3.8%	3.0%	2003	1.9%	1.9%
1968	4.7%	3.0%	1986	1.1%	1.1%	2004	3.3%	3.0%
1969	6.2%	3.0%	1987	4.4%	3.0%	2005	3.4%	3.0%
1970	5.6%	3.0%	1988	4.4%	3.0%	2006	2.5%	2.5%
1971	3.3%	3.0%	1989	4.6%	3.0%	2007	4.1%	3.0%
1972	3.4%	3.0%	1990	6.1%	3.0%	2008	0.1%	0.1%
1973	8.7%	3.0%	1991	3.1%	3.0%	2009	2.7%	2.7%
1974	12.3%	3.0%	1992	2.9%	2.9%			
1975	6.9%	3.0%	1993	2.7%	2.7%	20-Yr Avg	2.73%	2.45%
1976	4.9%	3.0%	1994	2.7%	2.7%	30-Yr Avg	3.51%	2.57%
1977	6.7%	3.0%	1995	2.5%	2.5%	50-Yr Avg	4.07%	2.54%

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HISTORICAL PATTERNS OF INVESTMENT RETURN, PAY INCREASES & INFLATION

Calendar Year Period	Gross Market Returns			Stocks (S&P 500)	Price Inflation (CPI)	Sample Balanced Fund*	
	Bonds (Long)		Cash Equiv. (T Bills)			Total Return (I)	Spread: I - CPI - e
	U.S. Treasury	Corp. (20yr AA)					
1960-1969	1.4%	1.7%	3.9%	7.8%	2.5%	5.4%	2.4%
1970-1979	5.5%	6.2%	6.3%	5.9%	7.4%	6.0%	-1.9%
1980-1989	12.6%	13.0%	8.9%	17.5%	5.1%	15.6%	10.0%
1990-1999	8.8%	8.4%	4.9%	18.2%	2.9%	14.2%	10.8%
2000-2009	7.7%	7.6%	2.8%	-0.9%	2.5%	2.4%	-0.6%
Last 20 Yrs	8.2%	8.0%	3.8%	8.2%	2.7%	8.1%	4.9%
Last 30 Yrs	9.7%	9.6%	5.5%	11.2%	3.5%	10.5%	6.5%
Last 50 Yrs	7.1%	7.3%	5.3%	9.4%	4.1%	8.5%	3.9%

* Sample Balanced Fund	
Equities	60%
Bonds - Government	9%
- Corporate	29%
Cash Equivalents	2%
Total	100%
Fund expenses (e) @	0.5%

@ Generally includes fund administrative, manager fees and transaction costs.

SECTION IV

**REVIEW OF OTHER ASSUMPTIONS AND
ACTUARIAL METHODS**

IV. Review of Other Assumptions and Actuarial Methods

The principles set forth in ASOP No. 35, Selection of Demographic and Other **Noneconomic Actuarial Assumptions** for Measuring Pension Obligations guide the proper selection of the remaining actuarial assumptions. In particular, they prescribe the actuary to use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the System that is the subject of the measurement. A reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

Our comments regarding our review of the reasonability of the demographic assumptions and their presentation in the valuation report are as follows:

1. **Withdrawal / early retirement rates** – Withdrawal and early retirement rates are combined. The ultimate annual rates of combined withdrawal for Teachers and General State employees decrease through age 45, and then increase from ages 45 to 60. It is unclear from the valuation report whether those who leave employment according to the withdrawal rates and who are eligible for an immediate reduced early retirement benefit are assumed to immediately begin receiving reduced benefits or to defer commencement of benefits until age 60 (at which point they would be eligible to receive unreduced benefits). Upon discussion with the System actuary, we were informed if a member withdraws according to the assumed withdrawal rates eligible for an immediate reduced early retirement benefit, the member is assumed to immediately commence receiving the reduced early retirement benefit. We recommend the System consider valuing early retirement benefits separately from withdrawal benefits – develop separate early retirement rates based on early retirement experience. The early retirement rates developed would be applied at each potential early retirement commencement age.

The withdrawal rates reflect three (3) year select and ultimate rates. We often observe higher employee turnover during the early years of employment. The use of select and ultimate withdrawal rates is generally reasonable. We note it may be more common for the select period for withdrawal rates to coincide with the vesting period (five (5) years vs. three (3) years). However, the select period should coincide with observed experience in the experience study.

The report includes footnotes under each table of withdrawal rates, stating a rate of either 12.5% (for Teachers) or 7.5% (for General State employees) is added to the service retirement rate at the age when an employee first becomes eligible for unreduced retirement benefits. Given that the service retirement rates are provided separately on subsequent pages, and that these additional rates (12.5% or 7.5% in the first year of eligibility for unreduced benefits) are provided there, we believe it may be unnecessary to include them as footnotes under the withdrawal rate tables.

Rates of withdrawal / early retirement appear to be reasonable and appropriate.

2. ***Service retirement rates*** – The valuation report states service retirement rates are applied at ages at which members are eligible for unreduced retirement benefits (age 60 with at least five (5) years of service or after completion of 30 years of service at any age).

Rates are increased by 12.5% for Teachers and 7.5% for General State employees in the first year in which members are eligible for unreduced retirement benefits prior to age 60. In addition, rates are increased by 8.0% for Teachers and 2.0% for General State employees on or after age 60 with 15 or more years of service.

These service retirement rates appear to be reasonable, and they appear to appropriately reflect the trend towards later retirement, as observed in the 2004-2008 experience study.

Upon discussion of the service retirement assumption with the System's actuary (BPSM), we were informed the service retirement rates are not applied in the valuation runs in the same manner as the valuation report seems to imply. The valuation report implies service retirement rates apply at each age at which a member is eligible for an unreduced service retirement benefit, in the same manner to all members. Traditionally, this means each rate is applied to the liability of the member's projected retirement benefit payable at each respective potential retirement age, and the overall liability (the weighted average over all potential retirement dates) is determined for each member.

However, retirement rates are applied differently in the TCRS actuarial valuation. The System actuary uses an algorithm in conjunction with the service retirement rates to randomly assign a discrete retirement age (e.g., exactly age 68) to each member. In the aggregate, BPSM argues the resulting total liabilities are not materially different under these two methods of applying the service retirement rates. However, the liabilities for individual members are, in many cases, quite different. These differences could result in incorrect evaluation of certain types of legislative proposals such as service credit purchases or early retirement windows. For example, the weighted average expected retirement age for a specific member using the service retirement rates may be 60.7, whereas the algorithm employed by the System actuary may randomly assign a discrete expected retirement age of 68 to the same member, which may result in a significantly different liability for that member.

We determined System liabilities using both methods (applying the disclosed service retirement rates individually to each member / assuming each member retires at the discrete retirement age assigned by BPSM). In the aggregate, the total liabilities are very similar (different by 0.27%). However, some of the individual member liabilities are different by as much as 30% to 40% or more.

We recommend the Board consider following industry standard procedure for retirement rates.

3. **Inactive mortality and disabled mortality rates** – The inactive mortality rates (separate male and female rates) were updated as of July 1, 2009 to reflect improved mortality experience (observed mortality rates lower than expected) for both Teachers and General State employees during the 2004-2008 experience study period.

We note a general trend has emerged of continuous increases in life expectancy and improvements in observed mortality experience over the past several decades. As a result, many practitioners have begun to use generational mortality tables, which incorporate projected future improvements in mortality rates. Frequently actuaries have added a margin to observed mortality to account for anticipated mortality improvement. Effective in 2008, generational tables have become the standard for ongoing corporate pension plans subject to ERISA. Actuaries are beginning to use this type of mortality table in public plans. We think this is a reasonable alternative to building in an explicit margin. We believe, while not currently in widespread use by statewide systems, generational tables are becoming more common.

Actuarial Standard of Practice (ASOP) Number 35 - *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*, paragraph 3.5.3 provides the actuary should consider the likelihood and extent of mortality improvement in the future. Recently published mortality tables recommend usage of and include future mortality improvement scales.

We recommend the System consider the use of generational mortality tables in the valuation of its liabilities to address future anticipated mortality improvements.

4. **Active mortality rates** – The active mortality rates (separate male and female rates) were updated as of July 1, 2009 to reflect improved mortality experience (observed mortality rates lower than expected) for both Teachers and General State employees during the 2004-2008 experience study period. We note active mortality rates are lower than inactive mortality rates for members of the same age, which is typical and expected.

5. **Duty versus Non-Duty active mortality and disability rates** – Benefits payable under the System for ordinary death and disability (non-service related) differ from the benefits payable for accidental death and disability (service related). However, the percentages of deaths and disabilities that are assumed to be ordinary (non-service related) versus the percentages that are assumed to be accidental (service related) are not disclosed in the actuarial valuation report. Upon discussion with the System actuary, we were informed that 100% of deaths and disabilities are assumed to be *ordinary* (non-service related). While this assumption may be somewhat aggressive, the liability for accidental (service-related) death and disability may be small enough to be deemed immaterial, as the accidental disability benefit only applies to members who joined the System prior to July 1, 1997. Upon further discussion with TCRS staff, we were informed this assumption has been thoroughly reviewed, is consistent with System experience and has

been determined to be reasonable. Hazardous positions, such as police officers and firefighters (who would be more impacted by line-of-duty / accidental death and disability), were not the focus of this audit.

We recommend the assumption that 100% of deaths and disabilities among active members are assumed to be *ordinary* (non-service related) be disclosed in the actuarial assumptions section of the valuation report.

Actuarial Cost (Funding) Method: An actuarial cost method is a set of techniques for conversion of the actuarial present values of benefits into contribution requirements. Actuarial methods are characterized by:

1. Normal Cost – the *current year's* cost of the System.
2. Actuarial Accrued Liability – the assets which would have accumulated to date had contributions been made at the level of the normal cost since the date of the first benefit accrual, all actuarial assumptions had been exactly realized and there had been no benefit changes.

The total contribution produced by an actuarial cost method is the total of the normal cost and an amount to amortize any unfunded actuarial accrued liability.

The method used in the valuation of the Tennessee Consolidated Retirement System is the Frozen Initial Liability funding method with an unfunded accrued liability which is reestablished periodically. The System's Board has authority to decide when to reestablish the UAL. Reestablishment has generally occurred when significant changes in assumptions or System benefits have been made, or when actuarial experience has deviated significantly from expectations. We recommend the Board consider a more explicit basis be defined for reestablishment of the UAL.

If the reestablished unfunded accrued liability is positive, then it is amortized over a period of twenty (20) years. If it is negative, then no amortization is recognized and the Aggregate funding method is used to develop only a Normal Cost. In essence, this means when the unfunded liability is negative (when a surplus exists), the surplus is amortized over the expected average future working lifetimes of current active members, which is most likely in the ten (10) to fifteen (15) year range - much shorter than the twenty (20) year period used when the unfunded liability is positive. This tends to make the contribution go down faster when experience is good, adding to the volatility of contribution rates over time and resulting in reduced funding.

The Government Accounting Standards Board (GASB) promulgates accounting standards for public entities. GASB Statements 25 and 27 generally set out expense and disclosure requirements for retirement systems.

Under GASB standards, the expense / contribution should include provisions for amortizing the total unfunded actuarial liability (UAL), whether the UAL is positive or negative. Consequently, when a positive UAL is being amortized as part of a plan's funding method, then a negative unfunded accrued liability (surplus) is also required to be amortized (Please see Guide to Implementation of GASB Statements 25, 26 and 27 on Pension Reporting and Disclosure by State and Local Government Plans and Employers - Question 40, and GASB Statement 27 - Footnote 10).

In general, the maximum amortization period is 30 years (Please see Guide to Implementation of GASB Statements 25, 26 and 27 on Pension Reporting and Disclosure by State and Local Government Plans and Employers - Question 41, and GASB Statement 27 - Paragraph 10.f.1.). Twenty (20) years falls within the range of reasonable amortization periods, and would be expected to keep the System in a better funded position over time.

Paragraph 148 of GASB Statement 25 reads *The Board also believes that, when components of the total unfunded actuarial liability are separately amortized, gains and losses of a similar type ... should be amortized over similar periods; that is, it would not be appropriate to recognize all gains immediately or over very short periods and spread all losses over longer periods. The Board recognizes that a required minimum period may not always be appropriate. For example, in some circumstances, the immediate recognition of a gain to offset a loss may help to reduce volatility in the ARC.* Note that paragraph 148 is included in the *Basis for Conclusions* section rather than in the formal statement section. Consequently, it may represent GASB's preference, but not a formal requirement.

We are not aware of any additional GASB pronouncements that deal definitively with the amortization of a surplus; however, we understand GASB has a consistent and clear preference for treating overfunded and underfunded liabilities in the same manner. If TCRS wishes a more definitive determination of GASB's position on whether or not to use a 20-year amortization when a surplus exists, we suggest that GASB be contacted directly.

The financial results of the actuarial valuation are impacted by the assumption of when during the year certain future events (i.e. retirement, death, etc) are expected to occur. We understand the System actuary assumes future unreduced retirements occur at the beginning of the fiscal year and all other future events occur in the middle of the year. This assumption varies among actuaries. Most actuaries would use middle of year event timing for groups other than teachers.

For the most part, the System actuaries use generally accepted actuarial cost methods, reasonable actuarial assumptions and reporting standards.

SECTION V

**REVIEW OF OTHER ASPECTS OF THE ACTUARIAL
VALUATION REPORT**

V. Review of Other Aspects of the Actuarial Valuation and Report

Most other aspects of the System's actuary's work and report are sufficient. However, we do have a few additional suggestions / recommendations for improvement:

1. We recommend an asset section be included in the valuation report, including an exhibit showing how the Actuarial Value of Assets (AVA) is developed. In addition to being required, this section would be useful for readers of the report to see the amount of prior years' market value asset gains and losses that have yet to be phased in to the current Actuarial Value of Assets, so the current level of System funding may be evaluated in light of known asset gains and losses that have yet to be recognized. The asset section should also include a statement of assets showing a breakdown of fund investments by asset class / category, a statement of net changes in fund assets showing receipts and disbursements, and a history of investment performance (on both a market value and an actuarial value basis). These exhibits could be useful in justifying the assumed investment earnings rate of 7.5%.

We believe inclusion of an exhibit showing the development of the Actuarial Value of Assets (AVA) is mandated by *Actuarial Standard of Practice (ASOP) Number 44 – Selection and Use of Asset Valuation Methods for Pension Valuations*, Section 4.1.

2. Census statistics were not included for vested terminated members. Sufficient statistical information has been included for active members and members currently receiving benefits. Similar statistical information should be included for vested terminated members.
3. Upon review, we note an anomaly in the application of the disability decrement for purposes of actuarial valuation. Normal retirement (eligibility to commence unreduced benefits) is defined as the earlier of age 60 with five (5) years of service or any age with 30 years of service. As discussed on pages 10-11 in Section IV (Review of Other Assumptions and Actuarial Methods) of this report, discrete retirement ages are assigned to each member. This discrete retirement age is for the most part after the age the member is projected to first reach eligibility for normal retirement.

The disability decrement is applied to age 60 (without regard to when the member attains 30 years of service) - many members will not reach their assigned discrete expected retirement age until after age 60. By contrast, the withdrawal decrement and the post termination death decrement cease at the earlier of attainment of age 60 or 30 years of service. The active mortality decrement continues to apply until the discrete retirement age is reached.

We agree with application of the active mortality decrement at all ages during which the member is expected to continue employment. We also agree that the withdrawal

decrement should cease to apply once the member is eligible for unreduced normal retirement benefits (at which point, the retirement rates take over). Some actuaries cease application of the disability decrement once a member becomes eligible for unreduced retirement (and assume that any disability after that time would result in an immediate retirement). Others prefer to continue application of the disability decrement through the retirement pattern. However, it seems inconsistent to apply the disability decrement beyond attainment of 30 years of service (one of the conditions for unreduced retirement) and not beyond age 60 (the other condition for unreduced retirement).

4. Several actuarial assumptions were changed effective July 1, 2009 in order to reflect the findings of the 2004-2008 experience study. When major changes in assumptions, methods or plan provisions are made, such as this year for TCRS, it is beneficial and general practice to disclose side-by-side (before and after) valuation results. The impact of the assumption changes can be seen in aggregate. The valuation results prior to the assumption changes can be directly compared to the previous valuation results.
5. We recommend the System actuary consider modification of their software to produce more detailed sample life output. In the process of completing our audit, we requested details of valuation calculations for individual sample lives. We were informed the System actuaries' valuation software did not produce this type of detailed output. We believe having this type of output available is important on an ongoing basis to provide a consistent internal checking of the software's calculations and to ensure the actuarial valuation is correct. This information is especially important when benefit changes are being considered or assumption changes are being made.
6. We believe the System might be better served by annual actuarial valuations. In times of rapidly changing contribution requirements, the delay in recognition of changing contribution requirements introduced by biennial valuation may add to contribution volatility. We understand the decision to prepare biennial actuarial valuations was made by the Board of Trustees and cost calculations are prepared in the interim.
7. The valuation report assumes System option factors and service purchase factors are cost neutral. We find no adjustments in the actuarial work to account for either subsidized option factors or subsidized service purchase factors. It is important to keep the actuarial equivalence basis current so that options can be determined on a true cost neutral actuarial equivalent basis. We understand from TCRS staff the actuarial equivalence basis is reviewed in coordination with the periodic experience studies. Notwithstanding the above, the valuation report states: *Another factor contributing to future contribution rates is the opportunity for rehired former participants to purchase prior service credits. This results in upward rate pressure for both the Teacher and the State groups.* We understand from TCRS staff the losses caused by the purchase of prior service credits are de minimus.

SECTION VI

REPLICATION OF JULY 1, 2009 ACTUARIAL
VALUATION RESULTS

VI. Replication of key financial results of the July 1, 2009 Actuarial Valuation

In this phase of the review, GRS reviewed the calculated values (present value of benefits) supplied by the System actuaries, subdivided by Class (Teachers versus General State employees) and type of benefit for active members (e.g., service retirement, vesting and early retirement, ordinary and service disability, ordinary and service death, and refunds of contributions) and pensioners by category (retirees and terminated vesteds) separately by Class. In addition, we reviewed the calculation of the present values of future salaries separately by Class.

The following tables compare the results of the System actuaries and GRS calculations of present value of benefits and future compensation for each Class. GRS results are shown using two different methods for application of the service retirement rates: (1) applying the service retirement rates to each member individually, as disclosed in the valuation report, and (2) assuming each member retires at the exact discrete retirement age assigned by the System actuary.

GRS established quantitative measures to determine whether, on a present value line by line basis (e.g., retired members, beneficiaries, active retirement, death, disability, etc.), results calculated separately by GRS and the System actuaries agreed with each other to within reasonable tolerances. Measure One of our quantitative tests is the ratio of the line present value calculated by GRS to the line present value calculated by the System actuaries. To PASS this test requires a difference not in excess of 5.0%.

Measure Two of our quantitative test is the ratio of the difference between the line present value calculation of the System actuaries and the GRS line present value calculation divided by the total liability calculated by the System actuaries. To PASS this test requires a ratio within 0.5%. Essentially Measure Two permits a wider variation of items with minor effect. A PASS is assigned to each line present value only if Measure One or Measure Two is passed.

Every line liability PASSES for both Classes and in our opinion our results have verified the calculations of the System's actuaries. Our results should not replace the results of the System actuaries. Our calculations are sufficient only for the purpose intended (actuarial audit) and are not suitable for any other purpose.

TENNESSEE CONSOLIDATED RETIREMENT SYSTEM

Group I - Contributory Teachers

Actual Rates of Retirement

(\$ 000)

	<u>BPS&M</u>	<u>GRS</u>	<u>Liability Ratio</u>		<u>Liability Test</u>		
			<u>Individual</u>	<u>Total</u>	<u>Individual</u> <u>5%</u>	<u>PVFB</u> <u>0.5%</u>	<u>Composite</u>
<u>Active PVFB</u>							
Withdrawal / Early Retirement	\$ 1,502,614	\$ 1,490,608	(0.0080)	(0.0006)	Pass	Pass	Pass
Retirement	10,486,946	10,600,638	0.0108	0.0054	Pass	Fail	Pass
Death	153,773	185,179	0.2042	0.0015	Fail	Pass	Pass
Disability	124,409	125,628	0.0098	0.0001	Pass	Pass	Pass
Total Active PVFB	\$ 12,267,742	\$ 12,402,053	0.0109	0.0064	Pass	N/A	Pass
Count	73,590	73,590	0.0000	N/A	Pass	N/A	Pass
Active PVF Salary	\$ 35,054,684	\$ 34,333,668	(0.0206)	N/A	Pass	N/A	Pass
<u>Inactive PVFB</u>							
Retirees	\$ 8,359,990	\$ 8,330,584	(0.0035)	(0.0014)	Pass	Pass	Pass
Terminated Vesteds	261,236	259,039	(0.0084)	(0.0001)	Pass	Pass	Pass
Total Inactive PVFB	\$ 8,621,226	\$ 8,589,623	(0.0037)	(0.0015)	Pass	N/A	Pass
Count	37,337	37,337	0.0000	N/A	Pass	N/A	Pass
Total	\$ 20,888,968	\$ 20,991,676	0.0049	0.0049	Pass	N/A	Pass

TENNESSEE CONSOLIDATED RETIREMENT SYSTEM Group I - General State Employees

(\$ 000)

Actual Rates of Retirement

	BPS&M	GRS	Liability Ratio		Liability Test		
			Individual	Total	Individual	PVFB	
			5%	0.5%	Composite		
<u>Active PVFB</u>							
Withdrawal / Early Retirement	\$ 802,015	\$ 829,545	0.0343	0.0022	Pass	Pass	Pass
Retirement	6,316,663	6,156,490	(0.0254)	(0.0125)	Pass	Fail	Pass
Death	180,833	224,338	0.2406	0.0034	Fail	Pass	Pass
Disability	<u>130,479</u>	<u>133,957</u>	0.0267	0.0003	Pass	Pass	Pass
Total Active PVFB	\$ 7,429,990	\$ 7,344,330	(0.0115)	(0.0067)	Pass	N/A	Pass
Count	61,425	61,425	0.0000	N/A	Pass	N/A	Pass
Active PVF Salary	\$ 22,075,000	\$ 21,332,682	(0.0336)	N/A	Pass	N/A	Pass
<u>Inactive PVFB</u>							
Retirees	\$ 4,971,965	\$ 4,971,103	(0.0002)	(0.0001)	Pass	Pass	Pass
Terminated Vesteds	<u>367,608</u>	<u>378,979</u>	0.0309	0.0009	Pass	Pass	Pass
Total Inactive PVFB	\$ 5,339,573	\$ 5,350,082	0.0020	0.0008	Pass	N/A	Pass
Count	36,525	36,525	0.0000	N/A	Pass	N/A	Pass
Total	\$ 12,769,563	\$ 12,694,412	(0.0059)	(0.0059)	Pass	N/A	Pass

TENNESSEE CONSOLIDATED RETIREMENT SYSTEM

(\$ 000)

			Grand Total		Actual Rates of Retirement		
			Liability Ratio		Liability Test		
			Individual	Total	Individual	PVFB	Composite
<u>Active PVFB</u>	<u>BPS&M</u>	<u>GRS</u>	<u>Individual</u>	<u>Total</u>	<u>5%</u>	<u>0.5%</u>	<u>Composite</u>
Withdrawal / Early Retirement	\$ 2,304,629	\$ 2,320,153	0.0067	0.0005	Pass	Pass	Pass
Retirement	16,803,609	16,757,128	(0.0028)	(0.0014)	Pass	Pass	Pass
Death	334,606	409,517	0.2239	0.0022	Fail	Pass	Pass
Disability	<u>254,888</u>	<u>259,585</u>	0.0184	0.0001	Pass	Pass	Pass
Total Active PVFB	\$ 19,697,732	\$ 19,746,383	0.0025	0.0014	Pass	N/A	Pass
Count	135,015	135,015	0.0000	N/A	Pass	N/A	Pass
Active PVF Salary	\$ 57,129,684	\$ 55,666,350	(0.0256)	N/A	Pass	N/A	Pass
<u>Inactive PVFB</u>							
Retirees	\$ 13,331,955	\$ 13,301,687	(0.0023)	(0.0009)	Pass	Pass	Pass
Terminated Vesteds	<u>628,844</u>	<u>638,018</u>	0.0146	0.0003	Pass	Pass	Pass
Total Inactive PVFB	\$ 13,960,799	\$ 13,939,705	(0.0015)	(0.0006)	Pass	N/A	Pass
Count	73,862	73,862	0.0000	N/A	Pass	N/A	Pass
Total	\$ 33,658,531	\$ 33,686,088	0.0008	0.0008	Pass	N/A	Pass

TENNESSEE CONSOLIDATED RETIREMENT SYSTEM

Group I - Contributory Teachers

Discrete Rates of Retirement

(\$ 000)

	<u>BPS&M</u>	<u>GRS</u>	<u>Liability Ratio</u>		<u>Liability Test</u>		
			<u>Individual</u>	<u>Total</u>	<u>Individual</u> <u>5%</u>	<u>PVFB</u> <u>0.5%</u>	<u>Composite</u>
<u>Active PVFB</u>							
Withdrawal / Early Retirement	\$ 1,502,614	\$ 1,476,153	(0.0176)	(0.0013)	Pass	Pass	Pass
Retirement	10,486,946	10,576,621	0.0086	0.0043	Pass	Pass	Pass
Death	153,773	148,598	(0.0337)	(0.0002)	Pass	Pass	Pass
Disability	<u>124,409</u>	<u>122,670</u>	(0.0140)	(0.0001)	Pass	Pass	Pass
Total Active PVFB	\$ 12,267,742	\$ 12,324,042	0.0046	0.0027	Pass	N/A	Pass
Count	73,590	73,590	0.0000	N/A	Pass	N/A	Pass
Active PVF Salary	\$ 35,054,684	\$ 34,641,234	(0.0118)	N/A	Pass	N/A	Pass
<u>Inactive PVFB</u>							
Retirees	\$ 8,359,990	\$ 8,330,584	(0.0035)	(0.0014)	Pass	Pass	Pass
Terminated Vesteds	<u>261,236</u>	<u>259,039</u>	(0.0084)	(0.0001)	Pass	Pass	Pass
Total Inactive PVFB	\$ 8,621,226	\$ 8,589,623	(0.0037)	(0.0015)	Pass	N/A	Pass
Count	37,337	37,337	0.0000	N/A	Pass	N/A	Pass
Total	\$ 20,888,968	\$ 20,913,665	0.0012	0.0012	Pass	N/A	Pass

TENNESSEE CONSOLIDATED RETIREMENT SYSTEM Group I - General State Employees

(\$ 000)

Discrete Rates of Retirement

	<u>BPS&M</u>	<u>GRS</u>	<u>Liability Ratio</u>		<u>Liability Test</u>		
			<u>Individual</u>	<u>Total</u>	<u>Individual</u> <u>5%</u>	<u>PVFB</u> <u>0.5%</u>	<u>Composite</u>
<u>Active PVFB</u>							
Withdrawal / Early Retirement	\$ 802,015	\$ 822,571	0.0256	0.0016	Pass	Pass	Pass
Retirement	6,316,663	6,174,987	(0.0224)	(0.0111)	Pass	Fail	Pass
Death	180,833	201,934	0.1167	0.0017	Fail	Pass	Pass
Disability	130,479	131,958	0.0113	0.0001	Pass	Pass	Pass
Total Active PVFB	\$ 7,429,990	\$ 7,331,450	(0.0133)	(0.0077)	Pass	N/A	Pass
Count	61,425	61,425	0.0000	N/A	Pass	N/A	Pass
Active PVF Salary	\$ 22,075,000	\$ 21,516,829	(0.0253)	N/A	Pass	N/A	Pass
<u>Inactive PVFB</u>							
Retirees	\$ 4,971,965	\$ 4,971,103	(0.0002)	(0.0001)	Pass	Pass	Pass
Terminated Vesteds	367,608	378,979	0.0309	0.0009	Pass	Pass	Pass
Total Inactive PVFB	\$ 5,339,573	\$ 5,350,082	0.0020	0.0008	Pass	N/A	Pass
Count	36,525	36,525	0.0000	N/A	Pass	N/A	Pass
Total	\$ 12,769,563	\$ 12,681,532	(0.0069)	(0.0069)	Pass	N/A	Pass

TENNESSEE CONSOLIDATED RETIREMENT SYSTEM

(\$ 000)

			Grand Total		Discrete Rates of Retirement		
			Liability Ratio		Liability Test		
			Individual	Total	Individual	PVFB	Composite
<u>Active PVFB</u>	<u>BPS&M</u>	<u>GRS</u>	<u>Individual</u>	<u>Total</u>	<u>5%</u>	<u>0.5%</u>	<u>Composite</u>
Withdrawal / Early Retirement	\$ 2,304,629	\$ 2,298,724	(0.0026)	(0.0002)	Pass	Pass	Pass
Retirement	16,803,609	16,751,608	(0.0031)	(0.0015)	Pass	Pass	Pass
Death	334,606	350,532	0.0476	0.0005	Pass	Pass	Pass
Disability	<u>254,888</u>	<u>254,628</u>	(0.0010)	0.0000	Pass	Pass	Pass
Total Active PVFB	\$ 19,697,732	\$ 19,655,492	(0.0021)	(0.0013)	Pass	N/A	Pass
Count	135,015	135,015	0.0000	N/A	Pass	N/A	Pass
Active PVF Salary	\$ 57,129,684	\$ 56,158,063	(0.0170)	N/A	Pass	N/A	Pass
<u>Inactive PVFB</u>							
Retirees	\$ 13,331,955	\$ 13,301,687	(0.0023)	(0.0009)	Pass	Pass	Pass
Terminated Vesteds	<u>628,844</u>	<u>638,018</u>	0.0146	0.0003	Pass	Pass	Pass
Total Inactive PVFB	\$ 13,960,799	\$ 13,939,705	(0.0015)	(0.0006)	Pass	N/A	Pass
Count	73,862	73,862	0.0000	N/A	Pass	N/A	Pass
Total	\$ 33,658,531	\$ 33,595,197	(0.0019)	(0.0019)	Pass	N/A	Pass