

Kentucky Teachers' Retirement System

Full Scope Audit of the June 30, 2014

Actuarial Valuations



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October 28, 2015

Board of Trustees
Kentucky Teachers' Retirement System
479 Versailles Road
Frankfort, KY 40601

Re: **Actuarial Peer Review Audit of June 30, 2014 Actuarial Valuations**

Ladies and Gentlemen:

We are pleased to present the results of Segal's actuarial peer review audit of the June 30, 2014 valuations of the Kentucky Teachers' Retirement System. The purpose of this audit is to conduct a review of the actuarial methods, assumptions, and procedures employed by the Kentucky Teachers' Retirement System (KTRS) and the System's actuary, Cavanaugh Macdonald. This audit includes the following:

1. **Report review** – a review of the valuation reports to evaluate how they comply with actuarial standards, and whether they reflect appropriate disclosure information under required reporting and actuarial standards of practice.
2. **Methods and assumptions review** – an analysis of the actuarial assumptions and a review of the actuarial methods utilized in determining the funded status and accrued liability for compliance with generally accepted actuarial principles.
3. **Valuation results and data review** – an evaluation of the participant data and valuation results, with a detailed review of the findings. This includes reproducing the June 30, 2014 valuation results.

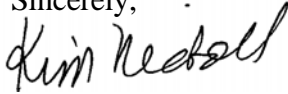
This review was conducted under the supervision of Kim Nicholl, a Fellow of the Society of Actuaries, a member of the American Academy of Actuaries, and an Enrolled Actuary under the Employee Retirement Income Security Act (ERISA), and Matthew Strom, a Fellow of the Society of Actuaries, a member of the American Academy of Actuaries, and an Enrolled Actuary under ERISA. This review was conducted in accordance with the standards of practice prescribed by the Actuarial Standards Board.

The assistance of KTRS staff and Cavanaugh Macdonald is gratefully acknowledged.

We appreciate the opportunity to serve as an independent actuarial advisor for KTRS and we are available to answer any questions you may have on this report.

Board of Trustees
Kentucky Teachers' Retirement System
October 28, 2015
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Sincerely,



Kim Nicholl, FSA, MAAA, EA
Senior Vice President and Actuary



Matthew A. Strom, FSA, MAAA, EA
Vice President and Actuary

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Kentucky Teachers' Retirement System

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Kentucky Teachers' Retirement System

I. Introduction

Statement of Project

The Kentucky Teachers' Retirement System (KTRS) retained Segal Consulting (Segal) to conduct an independent review of the System's current actuarial calculations, assumptions and methods. KTRS requested an independent review of the reasonableness, consistency and accuracy of:

- The methods, factors and assumptions used in the actuarial valuations;
- The compilation of the actuarial valuations; and
- The results and the actuarial assumptions generated from the experience study.

KTRS also asked for an evaluation of the data used in the performance of the valuations, including the degree to which data is sufficient to support the conclusions of the valuations and the use and appropriateness of any assumptions made regarding the data. KTRS requested a confirmation of the valuation results, an evaluation of the actuarial asset method, a determination of the accuracy of the funding computations, and verification of the appropriateness of the recommended employer and employee contribution rates. Finally, KTRS requested an assessment of whether the valuations appropriately reflect information required to be disclosed under required reporting standards (GASB Statements No. 45, 67 and 68).

We reviewed all information supplied to us. We also requested and reviewed additional information provided by the System's actuary Cavanaugh Macdonald. Finally, we considered the reasonableness of the actuarial assumptions and methods in the context of our own experience and those of other state and local pension systems.

Summary of Findings

This audit validates the findings of the actuarial valuations we studied. We believe the stated methods and assumptions were properly employed in determining the cost of the systems.

The data appears complete and we believe it is sufficient to support the conclusions reached in the valuation report. For the most part, we were able to match valuation results within an acceptable degree of accuracy. In general, the items identified in Section III of this report (regarding actuarial liability replication) are minor relative to the total liability of the System and do not have a significant impact on plan costs. All parameters and methods appear consistent with applicable GASB standards and generally accepted actuarial practices as promulgated in the various Actuarial Standards of Practice applicable to KTRS.

Kentucky Teachers' Retirement System

I. Introduction

Improvement Recommendations

As a result of our analysis, we would like to highlight the following issues, concerns, and recommendations:

- In our opinion, the post-retirement mortality table does not reflect sufficient margin for future improvement in mortality rates.
- We note some assumptions that were not stated or fully described in the valuation reports, and recommend that Cavanaugh Macdonald review the assumptions applied in their valuation software in comparison to those described in the report.
- We note some minor differences in the plan provisions described in the valuation reports and those applied in the valuation software, and recommend that Cavanaugh Macdonald review the calculations applicable to these discrepancies.

Each of these concerns, as well as additional comments and observations, are described more fully in this report.

Kentucky Teachers' Retirement System

II. Actuarial Certification

This is to certify that Segal Consulting, a member of The Segal Group, Inc. (“Segal”) has replicated and reviewed the June 30, 2014, KTRS actuarial valuations in accordance with generally accepted actuarial principles and practices. The opinions presented in this report have been made on a basis consistent with our understanding of the applicable Actuarial Standards of Practice.

The actuarial valuation is based on the plan of benefits verified by KTRS. Segal did not audit the data provided by the Plan Administrator. The accuracy and comprehensiveness of the data is the responsibility of those supplying the data. To the extent we can, however, Segal does review the data for reasonableness and consistency. Based on our review of the data, we have no reason to doubt the substantial accuracy of the information on which we have based this report and we have no reason to believe there are facts or circumstances that would affect the validity of these results.

The actuarial computations made are for purposes of replication and review of the reports described above. Determinations for purposes other than as described here may be significantly different from the results reported here.

We are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein. To the best of our knowledge, this report is complete and accurate.



Kim Nicholl, FSA, MAAA, EA
Senior Vice President and Actuary



Matthew A. Strom, FSA, MAAA, EA
Vice President and Actuary

Kentucky Teachers' Retirement System

III (A). Actuarial Valuations: Data

In addition to the raw data files received from KTRS, we received census data from Cavanaugh Macdonald. These files consisted of the “scrubbed” data files that were used to perform the actuarial valuations. The head counts from each status matched those reported in the valuation reports. Typically, when aspects of the raw census data are incomplete or missing, the actuary relies on a series of assumptions and procedures to make the data whole. A description of the assumptions used by Cavanaugh Macdonald to adjust for missing data could be shown in the valuation reports.

Segal was not provided with a listing of non-vested inactive members, so we cannot verify the liability for this participant group. However, the liability for this group is very small compared to the aggregate liability of the System, so this omission has very little impact on our calculations.

In any event, we believe the data files provided are comprehensive enough to perform the actuarial valuations and develop conclusions from the results.

Kentucky Teachers' Retirement System

III (B). Actuarial Valuations: Replication and Comments

Comparison of Valuation Results

In replicating the results of the June 30, 2014, valuations, we found that overall, Cavanaugh Macdonald has a sound valuation process. We successfully matched most valuation statistics and liabilities within a tolerable range. Further, Segal reviewed and was able to match the calculation of the actuarial value of assets.

Comparison of Results: Pension Benefits

June 30, 2014	Cavanaugh Macdonald	Segal	Ratio of Segal/ Cavanaugh Macdonald
Participants			
Active contributing members	73,407	73,407	100.0%
Average age of active members	44.1	44.1	100.0%
Average years of service of active members	10.7	10.7	100.0%
Average pay	\$47,493	\$47,481	100.0%
Inactive members with deferred benefits	7,762	7,762	100.0%
Retired members and beneficiaries	<u>48,576</u>	<u>48,576</u>	100.0%
Total	129,745	129,745	100.0%
Inactive non-vested members due refunds*	27,689		
Projected covered payroll (\$000s)			
University	\$219,169	\$219,022	99.9%
Non-University	<u>3,267,158</u>	<u>3,266,434</u>	100.0%
Total	\$3,486,327	\$3,485,456	100.0%
Accrued Liability and Normal Cost (\$000s)			
Normal cost rate			
University	12.27%	12.30%	100.2%
Non-University	16.72%	16.33%	97.7%
Present value of future benefits			
Service Retirement Benefits	\$17,017,825	\$17,055,064	100.2%
Disability Retirement Benefits	716,654	719,641	100.4%
Death and Survivor Benefits	654,885	669,095	102.2%
Inactive members – vested	233,116	225,449	96.7%
Inactive members – nonvested*	53,792		
Active members	<u>16,977,258</u>	<u>16,713,936</u>	98.4%
Total	\$35,653,530	\$35,383,185	99.2%
Actuarial accrued liability	\$30,184,404	\$29,948,949	99.2%
Assets and Funding (\$000s)			
Actuarial value of assets	\$16,174,199	\$16,174,199	100.0%
Unfunded accrued liability	\$14,010,205	\$13,774,750	98.3%

*Data not provided

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III (B). Actuarial Valuations: Replication and Comments

Most data, assumptions, methods and plan provisions used to perform this actuarial valuation are described accurately in Cavanaugh Macdonald's valuation report, except as follows.

Page 5: It is unclear how the results of the valuation were adjusted to reflect inactive non-vested members and account for members with incomplete data.

Page 21: The annual salary increases applied in Cavanaugh Macdonald's software differ from the increases shown in the valuation report. In the software, the inflation assumption of 3.50% is multiplied by the assumed merit increase, whereas the report shows the total increase as the sum of the merit and inflation components. For example, the merit component for age 20 is 4.6%. The total increase shown in the report at this age is 8.1% (4.6% + 3.5%). In the software, the total increase for age 20 is 8.261% ($1.046 * 1.035 - 1$). We tested the impact of using the salary increase rates shown in the report, and the difference in the liabilities is negligible.

Page 28: In some of the sample lives we reviewed, projected pre-retirement death benefits for members at decrement ages over age 55 with 27 years of service were calculated using the average of the highest five annual salaries rather than the highest three annual salaries. The impact on liabilities is negligible.

Page 29: We suggest disclosing the interest rate applied to member contribution balances in the summary of plan provisions.

Kentucky Teachers' Retirement System

III (B). Actuarial Valuations: Replication and Comments

Comparison of Results: Retiree Medical and Life Insurance Plans

RETIREE MEDICAL INSURANCE			
June 30, 2014	Cavanaugh Macdonald	Segal	Ratio of Segal/ Cavanaugh Macdonald
Participants			
Active members	73,407	68,613	93.5%
Inactive members with deferred benefits	5,188	5,138	99.0%
Retired members	37,275	37,275	100.0%
Spouses of retired members	7,031	7,031	100.0%
Total	122,901	118,057	96.1%
Projected covered payroll (\$000s)	\$3,486,327	\$3,485,456	100.0%
Accrued Liability and Normal Cost (\$000s)			
Normal cost rate	1.79%	2.00%	111.7%
Actuarial accrued liability			
Active members	\$1,422,834	\$1,416,568	99.6%
Inactive members with deferred benefits	24,301	23,337	96.0%
Retired members and spouses	1,747,554	1,748,790	100.1%
Total	\$3,194,689	\$3,188,695	99.8%
Assets and Funding (\$000s)			
Actuarial value of assets	\$508,913	\$508,913	100.0%
Unfunded accrued liability	\$2,685,776	\$2,679,782	99.8%

Included in the census are 4,794 rehired members who are being valued as retirees. Cavanaugh Macdonald includes these members in both the active and the retiree counts. The census also includes 50 records that are reported as both inactive members with deferred benefits and retirees. Segal's counts include these members only in the retiree counts.

In our review of the sample lives, the projected future contributions under a disability retirement appear to differ from the contributions described in the valuation for an active participant hired before 2002, with less than 20 years of service. Consistent with our understanding of the plan, if an active disables before becoming eligible for a service retirement, that future disabled retiree should be valued with five additional years of service earned under the disability allowance period. This additional five years should apply both when determining enrollment and the member's contribution amount. It appears that the additional five years of service was not applied to one of these calculations. This discrepancy does not appear in those sample lives hired after 2002.

Kentucky Teachers' Retirement System

III (B). Actuarial Valuations: Replication and Comments

LIFE INSURANCE			
June 30, 2014	Cavanaugh Macdonald	Segal	Ratio of Segal/ Cavanaugh Macdonald
Participants			
Active members	73,407	68,613	93.5%
Inactive members with deferred benefits	4,113	4,113	100.0%
Retired members	<u>44,855</u>	<u>44,855</u>	100.0%
Total	122,375	117,581	96.1%
Projected covered payroll (\$000s)	\$3,486,327	\$3,485,456	100.0%
Accrued Liability and Normal Cost (\$000s)			
Normal cost rate – year end June 30, 2017	0.03%	0.04%	133.3%
Actuarial accrued liability			
Active members	\$16,331	\$15,838	97.0%
Inactive members with deferred benefits	2,034	2,043	100.4%
Retired members and spouses	<u>78,989</u>	<u>78,937</u>	99.9%
Total	\$97,354	\$96,818	99.4%
Assets and Funding (\$000s)			
Actuarial value of assets	\$96,130	\$96,130	100.0%
Unfunded accrued liability	\$1,224	\$688	56.2%

Included in the census are 4,794 rehired members who are being valued as retirees. Cavanaugh Macdonald includes these members in both the active and the retiree counts. Segal's active count excludes these records.

While the census data for the Life Insurance Fund included all inactive vested participants eligible for a pension, only those with 5 or more years of KTRS service were included in the valuation. The report's plan summary states that service retirees and disabled retirees are eligible for the life insurance benefit. It appears that future retiree eligibility is based on eligibility service that includes KTRS service plus reciprocal service, rather than KTRS service alone. If this is accurate, an additional 3,495 inactive vested participants should be included in the Life Insurance Fund valuation.

It appears that the pre-retirement mortality rates were applied pre- and post-retirement to future inactive members with deferred benefits in Cavanaugh Macdonald's valuation. Segal's results above include the intended post-retirement mortality rates for future inactive members with deferred benefits.

Most data, assumptions, methods and plan provisions used to perform this actuarial valuation are described accurately in Cavanaugh Macdonald's valuation report, except as follows.

Page 5: It is unclear how the results of the valuation were adjusted to reflect inactive members and

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III (B). Actuarial Valuations: Replication and Comments

account for members with incomplete data.

Page 8: In contrast with the development of the actuarial value of assets on page 19, a full year of interest is accrued on “expected employer contributions”. Since employer contributions are a percentage of payroll, it is more reasonable to assume contributions are made in the middle of the year.

Page 23: In the Statement of Actuarial Assumptions and Methods, we suggest disclosing the assumption that 0% of future retirees are assumed to be smokers.

Page 25: Current retiree medical plan participation election is described as being based on actual census data and current plan elections provided by the System. The data that was provided by Cavanaugh Macdonald did not include the plan elected by current retirees. The same percentages used for future retiree plan elections were used for current retirees.

Page 27: Like the pension valuation, the annual salary increases applied in Cavanaugh Macdonald’s software differ from the increases shown in the valuation report. In the software, the inflation assumption of 3.50% is multiplied by the assumed merit increase, whereas the report shows the total increase as the sum of the merit and inflation components. The effect on liabilities of this difference is negligible.

Page 29: In Schedule E, we suggest disclosing the retiree contribution rules for participants that disabled prior to January 1, 2002.

Kentucky Teachers' Retirement System

III (C). Actuarial Valuations: Review of Information for Financial Reporting Purposes

Information for Financial Reporting Purposes: Pension Benefits

Cavanaugh Macdonald prepared separate reports for financial statement purposes: a GASB 67 report that contains disclosure requirements for KTRS and a GASB 68 report that contains the accounting disclosure items for the employers/reporting entities that contribute to KTRS. All liability information was calculated using the June 30, 2013, valuation date and rolled forward to June 30, 2014, where it was disclosed at the June 30, 2015, reporting date. This timing follows the guidelines established within Statements 67 and 68.

The Municipal Bond Index Rates used as of June 30, 2013, and June 30, 2014, are 4.27% and 4.35%, respectively. These rates are reasonable when compared to our source data for similar rates. The resulting single equivalent, blended discount rates as of June 30, 2013, and June 30, 2014, are 5.16% and 5.23%, respectively. While the derivation of these single equivalent rates was not explicitly included in the GASB reports, the year that the plan's fiduciary net position was projected to be available to make benefit payments was disclosed (2036). Using this information and an estimated projection of future benefit payments, we were able to calculate single equivalent discount rates close enough to 5.16% and 5.23% to confirm their reasonability.

We note that the fiduciary net position as of June 30, 2014, is different by \$48,000 between the GASB 67 report dated December 11, 2014, and the GASB 68 report dated August 14, 2015, which is likely due to a minor asset restatement related to the financial audit. However, this difference was not addressed in the GASB 68 report, even to note that it is immaterial.

With respect to the collective pension expense, it is unclear why there is a "credit" of \$41,551,000 included in the calculation. In addition, Q&A 73 from the GASB 68 Implementation Guide clarifies that interest on service cost should be included in the amount reported as interest on the total pension liability; the Cavanaugh Macdonald disclosure includes the interest on normal cost in the service cost line.

With respect to the cost-sharing allocation of GASB 68 disclosure items, the proportionate share is determined based on contributions made, which is a reasonable basis. The schedules contained in the GASB 68 appear to be complete.

Information for Financial Reporting Purposes: Retiree Medical and Life Insurance Plans

For financial reporting purposes, GASB requires that two schedules be included in the footnotes to the financial statements. The first schedule is the "Schedule of Funding Progress," which includes a short history of the Accrued Liability, Actuarial Value of Assets, Unfunded Actuarial Obligation, Funded Ratio, Covered Payroll, and the Unfunded Accrued Liability, Funded Ratio, Member Payroll, and Unfunded Accrued Liability as a Percentage of Member Payroll. The second required schedule is the "Schedule of Employer Contributions," which shows a short history comparing the actual employer contributions made for a given fiscal year to the Annual Required Contribution (ARC) for that year. Typically, the ARC under GASB rules is an amount

Kentucky Teachers' Retirement System

III (C). Actuarial Valuations: Review of Information for Financial Reporting Purposes

equal to the Normal Cost for the year, plus the amortization of Unfunded Actuarial Obligation over a period not to exceed 30 years. The Unfunded Accrued Liability for this purpose can be either positive (i.e., when the Accrued Liability exceeds the Actuarial Value of Assets) or negative (i.e., when the Actuarial Value of Assets exceeds the Accrued Liability). There is flexibility in the method for determining the amortization component. For example, it can be computed either on a level dollar basis or as a level percent of payroll.

Both of the required schedules appear in the valuation reports, are consistent with the GASB requirements, and appropriately reflect the information required to be disclosed.

In addition to the two schedules required by GASB standards, we commonly see a table that outlines the actuarial methods and assumptions applicable to the amortization component of the ARC. This table is included valuation report.

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III (D). Actuarial Valuations: Format of Reports

Format of Reports

The current actuary provides KTRS with comprehensive actuarial valuation reports that contain a summary of the data, the actuarial funding results, development of the actuarial value of assets, a reconciliation of the actuarial gains/losses, accounting information, as well as various projections of contribution rates and funding ratios. These reports generally include enough information for an individual to gain a clear understanding of the financial picture of the Plan. Overall, the valuation reports communicate results with clarity, are complete, and follow the required actuarial standards of practice for actuarial communications.

We offer the following recommendations for adding useful information or improving the clarity of the reports.

Format of Report: Pension Benefits

Cover Letter: An executive summary that highlights the results of the valuation would be useful to the reader. Also, the actuary should consider disclosing the funding period based on the statutory contributions, or otherwise quantify the deficit between the statutory contributions and the actuarially determined required contributions.

Page 9: The bottom line figures in each table include the additional amount required to maintain a 30-year amortization; however, since these amounts are not paid as part of the statutory contributions, referring to them as the “Total Contribution to Pension Plan” could be misleading.

Page 11: The current wording of item 1 appears to contradict the statement in the cover letter that current contribution levels are insufficient to fund the benefits of the System. This item could be clarified to emphasize that, as stated in the cover letter, the current statutory contributions are not sufficient to cover the benefits of the System, but that the actuarially determined required contributions developed in the previous section would be sufficient. Similarly, item 2 could be either combined with item 1 or re-worded to emphasize that the realization of System’s funding goals depends on additional contributions.

Pages 11-12: In item 3, we suggest including a comment to indicate if the assets on loan to the medical insurance fund are included in the pension fund’s assets. A more detailed description of the table in item 4 might be useful to the reader. For example, the derivation of the projected payroll upon which the “Amount” column is based could be explained in the text or shown in the table.

Page 24: We suggest replacing the words “employer contribution” with “normal cost”.

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III (D). Actuarial Valuations: Format of Reports

Format of Report: Retiree Medical and Life Insurance Plans

Page 11: The current wording of item 1, stating that current contributions are insufficient to fund the benefits of the System, appears to contradict the Schedule of Employer Contributions on page 14 illustrating actual contributions for 2014 exceeding the “annual required contributions”. This item could be clarified to emphasize that, as stated in the cover letter, the current statutory contributions are not sufficient to cover the benefits of the System, but that the actuarially determined required contributions developed in the previous section would be sufficient. Similarly, item 2 could be either combined with item 1 or re-worded to emphasize that the realization of System’s funding goals depends on additional contributions.

Kentucky Teachers' Retirement System

III (E). Review of Assumptions and Experience Study Report

As part of our analysis, we have reviewed the principal assumptions used in the actuarial valuation report for the valuation as of June 30, 2014, for consistency, reasonableness and compatibility. In addition, we have reviewed the 2011 experience study report (that covered experience for the five-year period ending June 30, 2010), and have also compared the current set of economic assumptions to those used by a peer group of 126 systems covering state and local employees, the Public Fund Survey published by the National Association of State Retirement Administrators.

ECONOMIC ASSUMPTIONS

Inflation

In the 2011 Experience Study, the actuary recommended a 50 basis point reduction in the underlying price inflation assumption from 4.00% to 3.50%. The inflation assumption of 3.50% is at the high end of the range of 2.75% to 3.50% (based on valuations primarily covering fiscal years ending in 2013), but towards the middle of the range of 3.00% to 4.00% at the time the study was conducted. It should be noted that the U.S. Federal Reserve formally targets long-term inflation of 2%. The 3.50% assumption is reasonable for the June 30, 2014, actuarial valuation, however, it is possible that further reduction will be required in the next experience study.

Investment Return

The 7.50% assumption, when compared to the peer group, is also right in the middle of the range of 7.00% to 8.00%. This assumption is comprised of a 4.00% real rate of return (net of investment and administrative expenses), in addition to the 3.50% underlying price inflation assumption. The analysis from the 2011 Experience Study that outlines the basis of the 4.00% real return recommendation is sound and reasonable.

Segal's investment consulting group (Segal Rogerscasey) develops capital market assumptions that Segal actuaries use to assist with evaluating the investment return assumption. Using the KTRS target asset allocation reported in the 2011 Experience Study and 2014 Segal Rogerscasey model, we determined the reasonable range of the median real rate of return to be between 4.55%-4.95%. The Segal Rogerscasey assumptions are not net of investment fees or administrative fees, so applying the 0.22% assumption from the experience study, the adjusted median real rate of return range is 4.33%-4.73%. Including the inflation assumption of 3.50%, the median net investment return range is 7.83%-8.23%. On this basis, we believe the 7.50% assumption used in the 2014 actuarial valuation is reasonable.

The analysis presented in the 2011 Experience Study Report appears to be based on a single set of capital market assumptions. Another approach to consider for future experience studies would be to base the analysis on a composite of capital market assumptions from several investment consulting firms. This would provide a broader view of the universe of expectations.

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III (E). Review of Assumptions and Experience Study Report

Payroll Growth

The wage inflation assumption is used as the payroll growth assumption, which determines the unfunded liability amortization as a level percentage of payroll. An assumption of 4.00% was used in the June 30, 2014, actuarial valuation, which is comprised of the 3.50% inflation assumption, plus 0.50% real wage inflation.

Reviewing actual recent experience and based on our experience with other retirement systems, the 4.0% recommendation is aggressive. Actual increases in payroll for all KTRS active members, is approximately 1.4% for the five-year period ending June 30, 2014. During that same period, actual national price inflation was 2.02%. To the extent that actual payroll increases are lower than the assumption, contributions collected will be less than expected resulting in contribution losses.

Individual Salary Increases

For all members, the salary scale assumption is comprised of a merit and seniority component ranging from 0.00% to 4.10% for all members and a real wage inflation rate of 4.00% (reflecting 3.50% salary inflation and 0.50% productivity increases). The investment return and salary progression assumptions are internally consistent, and seem reasonable for the purpose of the actuarial valuation.

In the Experience Study Report, the salary increase analysis was performed using total salaries of active members in each year. We believe this method makes it difficult to assess the difference components of salary increases (inflationary increases versus merit and seniority increases). A better approach is to look at year-over-year increases, net of the actual inflation experienced in each year of the study period. In this way, the merit and seniority component can be studied independently from inflation. Actual salary increases over the period were relatively close to expected in aggregate, but without this separate analysis, it is difficult to understand how the merit and seniority component behaved over the study period. We note that inflation during this period was well under 3.5% and believe that, as a result, the merit and seniority component was greater than expected. Reflecting this difference would have likely resulted in a recommendation to increase the salary increase assumption.

DEMOGRAPHIC ASSUMPTIONS

Rates of Mortality

The rates of mortality for the period after service retirement are based on the RP-2000 Combined Mortality Table with static projection to 2020 using mortality improvement Scale AA set back 1 year for females. For the period after disability retirement, rates are based on the RP-2000 Disabled Mortality Table set back 7 years for males and set forward 5 years for females.

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III (E). Review of Assumptions and Experience Study Report

Mortality rates for active members are 50% of the rates applicable to healthy pensioners. Back when the experience analysis was conducted, the static projection of rates to 2020 resulted in actual to expected ratios of around 4% for post-retirement service pensions and 5% for disability retirements.

The actuary's guide for determining the reasonableness of demographic assumptions is Actuarial Standard of Practice (ASOP) No. 35. The following is an excerpt from this ASOP that provides guidance on setting the mortality assumptions. Note that the ASOP quoted below was modified in September 2010 and is applicable for actuarial valuations with measurement dates on or after June 30, 2011.

Excerpt from ASOP 35, Section 3.5.3 – Mortality and Mortality Improvement Assumptions:

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.*

Segal's internal policy regarding mortality improvement is that static projections should result in at least a 10% margin for healthy lives. Therefore, we believe that the 4% margin built into the table that was developed in the 2011 Experience Study is on the low end of reasonableness. Particularly, for the June 30, 2014, actuarial valuation, a portion of this 4% margin has likely already eroded away. We recommend that when mortality is studied with the next experience review, that a larger margin for future improvement be established, or that a fully generational approach be employed.

We do wish to point out an alternative (and probable improvement in methodology) that could be considered in the future. Rather than perform the actual versus expected analysis using headcounts (i.e., the number of retirees that died), another approach is to perform the analysis on

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III (E). Review of Assumptions and Experience Study Report

a benefits-weighted basis. This methodology takes into account the correlation, if any, between the health of the annuitants and their benefit size.

Rates of Service Retirement

Cavanaugh Macdonald uses retirement rates that vary by age, sex, reduced versus unreduced retirement, and first eligibility versus after first eligibility. Their analysis revealed a tendency for later retirement compared to the previous study and they recommended a change to the retirement rates accordingly. This is reasonable and consistent with other systems that we work with.

We would, however, point out that the previous and proposed rates included “bumps” in expected retirements at first eligibility for unreduced retirement with 27 years of service, which were not tabulated in the data shown in the experience study. We believe that Cavanaugh Macdonald could have commented on the observations that led to the changes in these first-eligibility retirement rate increases.

In addition, we note that according to the data from the experience study, less than 20% of members age 70 and older are retiring (relative to the assumption that all members age 70 and older on the valuation date will retire immediately). However, we believe the 100% retirement at age 70 assumption is reasonable and best practice, despite not being specifically addressed in the report.

Rates of Withdrawal

Cavanaugh Macdonald uses a series of termination rate tables based on gender and age and follows a select and ultimate approach based on service. The select period is ten years, split into two five-year periods. The actual termination experience during both select periods showed more terminations than expected, while termination experience for members with greater than 10 years of service showed fewer terminations than expected. As such, Cavanaugh Macdonald's recommendation was to revise the rates of withdrawal to reflect recent experience. Based on a review of the experience data shown in the report, we believe this recommendation is reasonable.

Rates of Disability Retirement

Cavanaugh Macdonald uses a series of disability retirement rates based on gender and age. The actual experience showed fewer disability retirements than expected at most ages for both males and females. As such, Cavanaugh Macdonald's recommendation was to revise the rates of disability to reflect recent experience. Based on a review of the experience data shown in the report, we believe this recommendation is reasonable.

FUNDING METHOD FOR LIABILITIES

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The 2011 Experience Study included a recommendation to change from the Projected Unit Credit cost method to the Entry Age Normal method. The Entry Age Normal actuarial cost method and is the same method used by more than three-quarters of the plans in the Public Funds Survey. We believe that the current method to be reasonable.

ASSET VALUATION METHOD

The June 30, 2014 actuarial valuation uses an “actuarial” value of assets for purposes of establishing the required employer contributions. The current method smoothes investment gains and losses for each fiscal year by recognizing these gains and losses evenly over a five-year period. This method does not impose a corridor, which would place a limit on the spread between actuarial value of assets (AVA) and market value of assets (MVA).

An essential part of the public sector budgeting process is that material budget items, including pension contributions, should have a level cost pattern from year to year to the extent possible. Segal recognizes the importance of this requirement and assists clients in establishing reasonable methodologies for recognizing investment gains and losses and limiting the potential volatility that may result in increased contributions due to investment results.

The actuary's guide for determining the reasonableness of an asset smoothing method is ASOP No. 44. The following is an excerpt from this ASOP that establishes the qualities a reasonable asset smoothing method must exhibit.

Excerpt from ASOP 44, Section 3.3 – Selecting Methods Other Than Market Value:

If the considerations in section 3.2 have led the actuary to conclude that an asset valuation method other than market value may be appropriate, the actuary should select an asset valuation method that is designed to produce actuarial values of assets that bear a reasonable relationship to the corresponding market values. The qualities of such an asset valuation method include the following:

- a. The asset valuation method is likely to produce actuarial values of assets that are sometimes greater than and sometimes less than the corresponding market values.*
- b. The asset valuation method is likely to produce actuarial values of assets that, in the actuary's professional judgment, satisfy both of the following:*
 - 1. The asset values fall within a reasonable range around the corresponding market values. For example, there might be a corridor centered at market value, outside of which the actuarial value of assets may not fall, in order to assure that the difference from market value is not greater than the actuary deems reasonable.*
 - 2. Any differences between the actuarial value of assets and the market value are recognized within a reasonable period of time. For example, the actuary might use a*

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method where the actuarial value of assets converges toward market value at a pace that the actuary deems reasonable, if the investment return assumption is realized in future periods.

In lieu of satisfying both (1) and (2) above, an asset valuation method could satisfy section 3.3(b) if, in the actuary's professional judgment, the asset valuation method either (i) produces values within a sufficiently narrow range around market value or (ii) recognizes differences from market value in a sufficiently short period.

Two key principles arise from ASOP 44. These are that acceptable asset smoothing must create asset values that fall within a reasonable range around market value and are recognized in a reasonable period of time. In lieu of satisfying both of these principles, a smoothing method could satisfy the requirements if, in the actuary's professional judgment, the range around market value is sufficiently narrow or the differences are recognized in a sufficiently short period.

Segal has established an internal policy, which is consistent with others in the actuarial community, that five years is a sufficiently short period to constitute a reasonable asset smoothing method even if no corridor is used. Therefore, it is our opinion that the method utilized by KTRS is reasonable.

FUNDING POLICY CONTRIBUTION

Effective with the June 30, 2014, actuarial valuation, the Board adopted a funding policy, which is outlined in the valuation report. The policy states that the "legacy unfunded liability" as of June 30, 2014, will be amortized over a closed 30 year period. New sources of unfunded liability arising each year after June 30, 2014, will be amortized over closed 20 year periods. We believe this funding policy is sufficient and provides a reasonable contribution rate schedule for adequately funding KTRS.

OPEB ASSUMPTIONS

Discount Rates

In accordance with GASB 45, if the employers' funding policy is expected to consistently contribute an amount equal to or greater than the ARC, then the discount rate used for determining the actuarial present value of total projected benefits should be the estimated long-term yield on plan assets.

The plan assets for the Medical Insurance Fund, Life Insurance Fund and Pension Fund are comingled. While an assumed discount rate of 8.00% for the Medical Insurance Fund is not unreasonable, we would expect that the investment return used for all three Funds would be the same, rather than 8.00% for the Medical Insurance Fund, 7.50% for the Life Insurance Fund and 7.50% for the Pension Fund.

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Health Care Trend Rates

Trend is a measure of the rate of change, over time, of the per capita health care rates. It includes factors such as medical inflation, utilization, plan design, and technology improvements. The trend rates used are reasonable and produce results consistent with trend rates used for other similar plans.

Age-Related Morbidity

Morbidity or aging factors are used to estimate variation in per capita health care costs by age for the benefits being modeled.

The age-65 and older aging factors used by CMC are reasonable and appropriate for the valuation. No aging factors are applied to the pre-65 per capita health care costs. While some in the actuarial community believe that age-related morbidity should always be applied when developing per capita claims, ASOP No. 6 provides some exceptions.

ASOP No. 6 is the actuary's guide for determining the reasonableness of per capita health costs. The following is an excerpt from ASOP No. 6 that describes situations in which it may be appropriate to use premiums without adjustment for age.

Excerpt from ASOP 6, Section 3.7.7.c – Possible Exceptions:

*In some very limited cases, the use of the **pooled health plan's premium** may be appropriate without regard to adjustments for age. The factors that an actuary should evaluate in determining whether the **premium** may be appropriate without regard to adjustments for age include:*

*4. whether the **pooled health plan** and its **premium** structure are sustainable over the **measurement period**, even if other groups or active **participants** cease to participate. The use of a **premium** without regard to adjustment for age is generally inappropriate if the **pooled health plan** and its **premium** structure are not sustainable over the **measurement period** if other groups or active **participants** cease to participate.*

A key principle from ASOP 6 Section 3.7.7 is that it's acceptable to use an unadjusted premium if the premium structure would remain unchanged even if it were independently developed for only those being valued. We believe this to be true for pre-65 retirees, and it is reasonable to use unadjusted premiums for this group.

Retiree Medical Plan Participation

The participation assumption is used to project what percentage of members elect retiree health care coverage upon retirement.

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Assumed participation is based on retiree contribution percentage, which is based on service at retirement. This approach is reasonable and appropriate for the valuation. Since this assumption was not included in the Experience Study, we have no experience upon which to evaluate the appropriateness of the rates being used.

Retiree Medical Plan Elections

Assumed medical plan elections are based on elections among current retirees. This approach is reasonable and appropriate for the valuation. Since this assumption was not included in the Experience Study, we have no experience upon which to evaluate the appropriateness of the assumption being used.

Kentucky Teachers' Retirement System

IV. Conclusions and Recommendations

This full scope audit reviewed the data used, the benefits valued, and the actuarial methods and assumptions employed in the June 30, 2014, actuarial valuations. The test lives provided by the actuary reflect the plan provisions of KTRS as stated in the 2014 actuarial valuation report. These test lives also demonstrate the application of the actuarial assumptions to the benefits as stated in the valuation report. The actuarial assumptions, methods, and procedures are reasonable and reflect the benefit promises made to KTRS members. All parameters and methods appear consistent with generally accepted actuarial practices.

Below we summarize our recommendations for your consideration:

A. Valuation Reports

1. State the interest crediting rate applied to member contribution balances.
2. Consider counting rehired members who are valued as retirees only as actives or only as retirees, but not in both places.
3. Identify the nature of the pension expense “credit” of \$41.6 million shown in the GASB 68 report.
4. Change the service cost line item of pension expense such that it does not include interest to the end of the year; as noted in the Statement 68 Implementation Guide Q&A 73, interest on service cost should be included in the amount reported as interest on the total pension liability.
5. Clarify and/or add certain information or assumptions as noted in Section III(D) of this report.

B. Projected Benefits/Valuation Calculations

1. Fix the individual salary increase assumption so that the calculations are consistent with the description in the report.
2. Change the average salary calculation for pre-retirement death benefits for members at decrement ages over age 55 with 27 years of service so that it is based on a 3-year average rather than 5-year.
3. For pre-2002 hires, future disability retirees should be valued with five additional years of service earned under the disability allowance period.
4. Assuming that eligibility service for Life Insurance Fund benefits includes reciprocal service (as stated in the report's plan summary), an additional 3,495 inactive vested participants should be included in the Life Insurance Fund valuation.

Kentucky Teachers' Retirement System

IV. Conclusions and Recommendations

5. It appears that the pre-retirement mortality rates were applied pre- and post-retirement to future inactive members with deferred benefits in Cavanaugh Macdonald's valuation.
6. Consider using middle of the year interest timing for "expected employer contributions", if appropriate.

C. Assumptions and Methods

1. Consider a broader set of capital market assumptions when evaluating the recommended real rate of return.
2. Study the individual salary increase assumption by netting out actual inflation experienced during the study period to determine a more accurate analysis of merit and inflationary pay increases.
3. If using a post-retirement table with a static projection, consider at least a 10% margin for future improvement in mortality. Or, preferably, use a fully generational table.
4. Consider studying base mortality experience on a benefits-weighted basis rather than by headcounts only.
5. Use a single discount rate for all three of the Medical Insurance Fund, Life Insurance Fund, and Pension Fund. Or, disclose the rationale for using a higher discount rate for the Medical Insurance Fund.

To reiterate our summary from Section 1, the System's actuary appears to have reasonably valued the expected liability of the System. They have applied the methodology consistently and their report generally conforms to accepted actuarial principle and practices. In this report, we have noted areas that we believe will improve the usefulness and clarity of the KTRS annual actuarial valuation. We are available to discuss any aspect of our review with KTRS staff or the System's actuary.