Kentucky Retirement Systems

2018 Actuarial Experience Study
for the Period Ending June 30, 2018

GRS Retirement Consulting

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April 12, 2019

Board of Trustees
Kentucky Retirement Systems
Perimeter Park West
1260 Louisville Road
Frankfort, KY 40601

Dear Members of the Board:

Subject: Results of 2018 Experience Study

We are pleased to present our report of the 2018 Experience Investigation Study for the Kentucky Retirement Systems (i.e. Kentucky Employees Retirement System, County Employees Retirement System, and the State Police Retirement System) for the five-year period ending June 30, 2018. This report includes summaries and analysis of the experience data. Based on this analysis, we have recommendations for updates to certain actuarial assumptions and methods for use in the actuarial valuation, which will be first used in the June 30, 2019 actuarial valuation.

In addition, the report provides the estimated effect on the actuarial liabilities and the contribution requirements if these recommendations are adopted by the Board. Using the recommended set of actuarial assumptions should present a more accurate portrayal of the Systems' financial condition and should reduce the magnitude of future experience gains and losses.

This experience investigation study was conducted in accordance with generally accepted actuarial principles and practices, and in full compliance with the Actuarial Standards of Practice as issued by the Actuarial Standards Board. All of the undersigned are members of and meet the Qualification Standards of the American Academy of Actuaries and have experience with large public sector retirement systems.

We wish to thank the KRS staff for their assistance in this project.

Sincerely,

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Senior Consultant and Actuary

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Summary of Process

A periodic review and selection of the actuarial assumptions is one of many important components of understanding and managing the financial aspects of the Kentucky Retirement Systems. Use of outdated or inappropriate assumptions can result in understated costs which will lead to higher future contribution requirements or perhaps an inability to pay benefits when due. Also, a single set of assumptions is typically not expected to be suitable forever. As the actual experience of the plan changes, the assumptions should be reviewed and adjusted accordingly.

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

Changes in certain assumptions and methods are suggested upon this comparison to remove any bias that may exist, except to perhaps include some margin for future adverse experience where appropriate. Next, the assumption set as a whole was analyzed for consistency and to ensure that the projection of liabilities was reasonable and consistent.

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

SECTION I

INTRODUCTION

Introduction

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

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

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

In conducting experience studies, actuaries generally use data over a period of several years. This is necessary in order to gather enough data so that the results are statistically significant. In addition, if the study period is too short, the impact of the current economic conditions may lead to misleading results. It is known, for example, that the health of the general economy can impact salary increase rates and termination rates. Using results gathered during a short-term boom or bust will not be representative of the long-term trends in these assumptions. Also, the adoption of legislation, plan improvements or changes in salary schedules will sometimes cause a short-term distortion in the experience. For example, if an early retirement window was opened during the study period, we would usually see a short-term spike in the number of retirements. Using a longer period prevents giving too much weight to such short-term effects. On the other hand, using a much longer period increases the difficulty of identifying changes in behavior that may be occurring, such as mortality improvement or a change in the ages at which members retire. In our view, using a five-year period ending June 30, 2018 is generally reasonable. In the review of the demographic assumptions, we first determine the number of deaths, retirements, etc. that occurred during the period. Then we determine the number expected to occur, based on the current actuarial assumptions. The number “expected” is determined by multiplying the probability of the occurrence at the given age, by the “exposures” at that same age. For example, let’s assume there is a rate of retirement of 15% at age 55. The number of exposures can only be those members who are age 55 and eligible for retirement at that time. Thus they are considered “exposed” to that assumption. Finally, we calculate the A/E ratio, where "A" is the actual number (of retirements, for example) and "E" is the expected number. If the current assumptions were "perfect", the A/E ratio would be 100%. When it varies significantly from this figure, it is a sign that a new assumption may be needed. (However, in some cases we prefer to set our assumptions to produce an A/E ratio a little above or below 100%, in order to introduce some conservatism.) Of course we not only look at the assumptions as a whole, but we also review how well they fit the actual results by gender, by age, and by service.

In some instances we will compare the actual and expected experience based on headcount. However, there are other instances it is more appropriate to "weigh" the experience by benefit amount, liability, or salary, with the intention that our review and recommendations provide a better fit to the actual experience on a benefit basis which should result in smaller liability gains and losses prospectively.

Finally, if the data leads the actuary to conclude that new tables are needed, we will take into consideration the statistical credibility of the assumption as well as "graduate" or smooth the recommended assumption in instances where the experience has material variation age to age or from service year to service year.

Please bear in mind that, while the recommended assumption set represents our best estimate, there are other reasonable assumption sets that could be supported. Some reasonable assumption sets would show higher or lower liabilities or costs.

Organization of Report

Section II of this report summarizes our recommended changes and the fiscal impact if those assumptions are adopted. Section III contains our findings and a more detailed analysis of our recommendation for each actuarial assumption. The fiscal impact of adopting our recommendations on liabilities and contribution rates is shown in Section IV. Sections V through VII show a summary of the recommended assumptions for each System. Finally, Section VIII presents detailed summaries of the data and comparisons of the A/E ratios.

Section VIII Exhibits

The exhibits in Section VIII should generally be self-explanatory. For example, on page 83, we show the exhibit analyzing the service-based termination rates. The second column shows the total number of members who terminated during the study period. This excludes members who became disabled or retired. Column (3) shows the total exposures. This is the number of members who could have terminated during any of the years. In this exhibit, the exposures exclude anyone eligible for retirement. A member is counted in each year they could have terminated, so the total shown is the total exposures for the study period. Column (4) shows the probability of termination based on the raw data. That is, it is the result of dividing the actual number of terminations (col. 2) by the number exposed (col. 3). Column (5) shows the current termination rate and column (6) shows the new recommended termination rate. Columns (7) and (8) show the expected numbers of terminations based on the current and proposed termination assumptions. Columns (9) and (10) show the Actual-to-Expected ratios under the current and proposed termination assumptions.

SECTION II

SUMMARY OF RECOMMENDATIONS AND FISCAL IMPACTS

Summary of Recommendations KRS

Our recommendations to the actuarial assumptions used the actuarial valuation for KRS may be summarized as follows:

Economic Assumptions

1. Inflation Assumption: Recommend continued use of a 2.30% price inflation assumption.

2. Investment Return Assumption: Recommend continued use of a 5.25% investment return assumption for the KERS Non-Hazardous Retirement System and the State Police Retirement System. The current 6.25% investment return assumption for the CERS Retirement Systems (Non-Hazardous and Hazardous), KERS Hazardous Retirement System, and for all five health insurance plans remains reasonable. However, it would also be reasonable if the Board wanted to decrease the assumed rate of return from 6.25% to 6.00% for these systems.

3. Salary Increases for Individual Members: Recommend an overall increase to the salary increase assumption applicable to individual members and increasing the consistency in the assumptions for various groups. The recommended changes include an increase to some of the step-rate and promotional component of the salary increase assumption for shorter service employees as well as a recommended increase to the salary increase assumption for the CERS Hazardous and State Police Retirement System for those members with more than 10 years of service. However, we are also recommending a slight decrease to the rate of salary increase for long-service active members in the KERS Non-Hazardous System.

4. Payroll growth rate (used for amortizing the UAAL): Recommend no immediate change to the 0% payroll growth rate assumption for both KERS Systems (Non-Hazardous and Hazardous) and the State Police Retirement System. We also recommend no immediate change the current 2.0% payroll growth assumption for both CERS Systems (Non-Hazardous and Hazardous).

   Rather, we recommend that legislation be enacted to change the employers' method of making contributions to the System such that the dollar amount of the System's amortization cost be allocated to the participating employers based a fixed percentage of the total amortization cost and the employers only contribute the normal cost rate on covered payroll. If legislation is not enacted to redefine how the System collects contributions from the participating employers, then we recommend the Board monitor the emerging change in active membership count and change in covered payroll to identify if a reduction in the payroll growth assumption for any System is warranted.

Demographic Assumptions:

5. Mortality: Recommend replacing the base retiree mortality tables with a Kentucky Retirement Systems-specific mortality table developed using the actual mortality experience of non-disabled retirees in KERS, CERS, and SPRS. We also recommend replacing the current mortality tables for disabled retirees and active members with a variation of the Public Retirement Mortality Tables (PUB-2010 Tables) recently released by the Society of Actuaries. Finally, we also recommend using a generational mortality improvement assumption based on the ultimate rates of the published MP improvement scales ("MP-Ultimate") to explicitly project future improvement in life expectancy.

6. Retirement: For members with a participation date prior to July 1, 2003, we are recommending an overall slight decrease in the rates of retirement for the KERS and CERS Systems. For members with a participation date on or after July 1, 2003, we recommend using retirement rates that are equal to 80% of the retirement rates applicable for the pre July 1, 2003 participants for ages below age 65. We are also recommending a decrease to the retirement rates for members in SPRS whose participation date is on or after July 1, 2003.

7. Termination/Withdrawal: We recommend increasing the termination rates for both KERS Systems (Non-Hazardous and Hazardous) as well as the CERS Non-Hazardous System, and decreasing the termination rates for CERS Hazardous and SPRS Systems.

8. Disability Incidence: Recommend increasing the rates of disability incidence for the KERS and CERS Systems (Non-Hazardous and Hazardous), and no change to the disability incidence assumption for SPRS.

9. Participation in the Retiree Health Insurance Plan: We recommend no change the current assumption regarding participation in the retiree health insurance plan.

Actuarial Methods and Policies

10. Asset Valuation Method: Recommend continued use of the five-year asset smoothing method with each year's investment losses based on the expected and actual investment earning determined on a market value of asset basis. However, for the purpose of increased transparency and comparability we recommend a modification to the presentation of the smoothing calculations in the report to be consistent with the format that is commonly used by other Systems. This modification will not have a cost impact.

11. Actuarial Cost Method: Continued use of the individual Entry Age Normal cost method (EAN) used to determine the actuarial accrued liability.

Summary of Recommendations

Our recommendations to the actuarial assumptions for use in the actuarial valuation may be summarized as follows:

	System				
	KERS		CERS		
Assumption	**Non-Haz**	**Haz**	**Non-Haz**	**Haz**	**SPRS**
(1)	(2)	(3)	(4)	(5)	(6)
Economic Assumptions					
1. Inflation	No Change	No Change	No Change	No Change	No Change
2. Investment Return (Pension / Ins)	No Change	No Change	No Change	No Change	No Change
3. Short-Service Salary Increase	Increase	Increase	Increase	Increase	Increase
4. Long-Service Salary Increase	Decrease	No Change	No Change	Increase	Increase
5. Payroll Growth Assumption	No Change[1]	No Change[1]	No Change	No Change	No Change
Demographic Assumptions					
6. Retiree Mortality	KRS Specific	KRS Specific	KRS Specific	KRS Specific	KRS Specific
7. Termination	Increase	Significant Increase	Slight Increase	Significant Decrease	Decrease
8. Retirement	Slight Decrease	Slight Decrease	Slight Decrease	Slight Decrease	Slight Decrease
9. Disability	Increase	Increase	Increase	Increase	No Change
10. Health Insurance Participation	No Change	No Change	No Change	No Change	No Change
Other Assumptions and Methods					
11. Asset Method	5-Year Smoothing	5-Year Smoothing	5-Year Smoothing	5-Year Smoothing	5-Year Smoothing

[1] We recommend legislative action to change method for allocating the required contribution to employers.

Summary of Financial Impact of Recommendations

($thousands)

The following tables highlight the impact of the recommended changes on the unfunded actuarial accrued liabilities (UAAL), funded ratio and employer contribution rates for the five systems for both the pension and insurance funds. Additional information on the financial impact on the Systems can be found in Section IV.

System	Pension		Insurance	
	Before Change	After Change	Before Change	After Change
KERS Non-Hazardous				
UAL	$ 13,655,954	$ 14,321,191	$ 1,548,384	$ 1,658,097
Funded Ratio	12.9%	12.4%	36.4%	34.9%
Employer Rate	74.5%	78.0%	10.7%	11.2%
KERS Hazardous				
UAL	$ 512,661	$ 559,986	$ (117,960)	$ (102,741)
Funded Ratio	55.5%	53.3%	130.0%	125.1%
Employer Rate	34.4%	37.2%	0.0%	0.0%
CERS Non-Hazardous				
UAL	$ 6,241,280	$ 6,902,382	$ 721,194	$ 882,018
Funded Ratio	52.7%	50.2%	76.7%	72.9%
Employer Rate	22.5%	25.4%	4.8%	5.4%
CERS Hazardous				
UAL	$ 2,470,827	$ 2,702,563	$ 427,722	$ 458,277
Funded Ratio	48.4%	46.2%	74.6%	73.3%
Employer Rate	37.0%	45.9%	9.5%	11.7%
SPRS				
UAL	$ 721,269	$ 761,380	$ 74,553	$ 79,973
Funded Ratio	27.1%	26.1%	71.6%	70.1%
Employer Rate	120.5%	131.7%	19.5%	21.3%

Note: Contribution rates shown for CERS are without regard to the phase-in provision.

SECTION III

ANALYSIS OF EXPERIENCE AND RECOMMENDATIONS

Analysis of Experience and Recommendations

We will begin by discussing the economic assumptions: inflation, expenses, the investment return rate, the salary increase assumption, and the rate of payroll growth. Next are the demographic assumptions: mortality, disability, termination and retirement. Finally, we will discuss all of the actuarial methods used.

ECONOMIC ASSUMPTIONS

As no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment. The economic assumptions are much more subjective in nature than the demographic assumptions. The actuary should consider a number of factors, including the purpose and nature of the measurement, and appropriate historical and forward looking information.

Also, actuaries are guided by the Actuarial Standards of Practice (ASOP) adopted by the Actuarial Standards Board (ASB) and one of these standards is ASOP No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, which provides guidance to actuaries giving advice on selecting economic assumptions for measuring obligations under defined benefit plans.

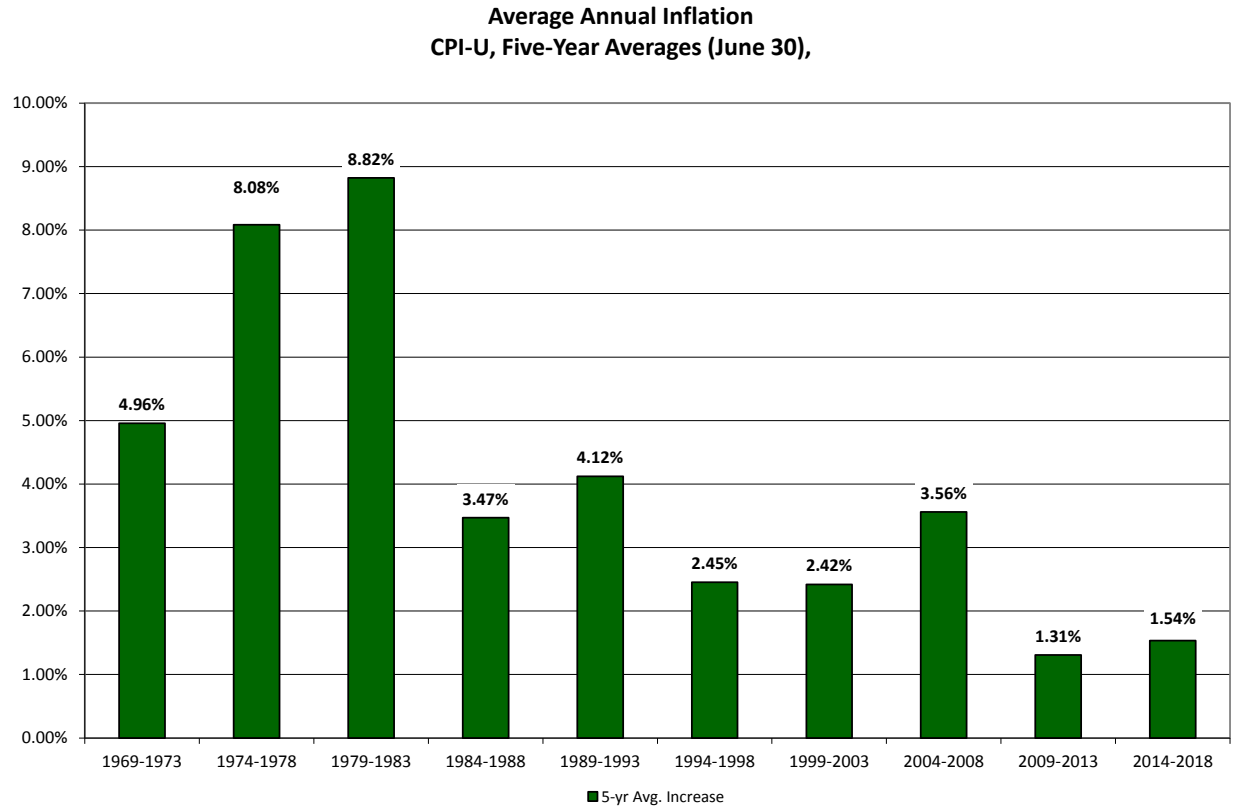
Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period. Nevertheless, the economic assumptions are much more subjective in nature than the demographic assumptions, which in itself can still create a difference in opinion among individuals in the actuarial profession and possibly stakeholders of the Retirement Systems.

INFLATION ASSUMPTION

By "inflation," we mean price inflation as measured by annual increases in the Consumer Price Index (CPI). This inflation assumption underlies most of the other economic assumptions. It impacts investment return, salary increases, and the rate of payroll growth for amortizing the unfunded actuarial accrued liability. The current annual inflation assumption is 2.30%.

Actual Change in CPI-U

The chart below shows the average annual inflation in each of the ten consecutive five-year periods over the last fifty years:



The following table shows the average inflation over various periods, ending June 30, 2018:

Periods Ending June 30, 2018	Average Annual Increase in CPI-U
Last five (5) years	1.54%
Last ten (10) years	1.42%
Last fifteen (15) years	2.13%
Last twenty (20) years	2.20%
Last twenty-five (25) years	2.25%
Last thirty (30) years	2.56%
Since 1913 (first available year)	3.12%

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

As you can see, inflation has been relatively low over the last thirty years.

Forward-Looking Expectations Developed by Investment Consulting Firms

Most investment consulting firms, in setting their capital market assumptions, make a price inflation assumption as a building block for developing forward-looking return expectations. Based on a 2018 survey of capital market assumptions of eleven investment consulting firms, the average expected price inflation for the next ten years is 2.20%. Of those firms, three of them develop longer-term assumptions (20 years or more) and have an average expected rate of inflation of 2.4%.

Expectations Implied in the Bond Market

Another source of information about future inflation is the market for US Treasury bonds. For example, the June 30, 2018 yield for 20-year inflation indexed Treasury bonds was 0.84% plus actual inflation. The yield for 20-year non-indexed US Treasury bonds was 2.61%. Simplistically, this means that on that day the bond market was predicting that inflation over the next twenty years would average 1.76% [(1 + 2.61%) / (1 + 0.84%) - 1] per year. The difference in yield for 30-year bonds implies 1.83% inflation over the next 30 years. This is consistent with most forecasts of inflation and overall economic growth being lower over the next decade. However, this analysis is known to be imperfect as it ignores the inflation risk premium that buyers of US Treasury bonds often demand as well as possible differences in liquidity between US Treasury bonds and TIPS.

Forecasts from Social Security Administration

In the Social Security Administration's 2018 Trustees Report, the Office of the Chief Actuary is projecting a long-term average annual inflation rate of 2.6% under the intermediate cost assumption. The Chief Actuary for the Social Security Administration kept this assumption unchanged from the prior year and the low cost and high cost scenarios are 2.0% and 3.2%, respectively.

Survey of Professional Forecasters and Fed Policy

The Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. Their forecast for the fourth quarter of 2018 was for inflation over the next ten years (2019 to 2028) to average 2.21%. Additionally, the Fed has openly stated that they have a target 2.00% inflation rate.

Recommendation

Using these sources, we recommend continued use of a 2.30% assumption.

Investment Return Assumption

The investment return assumption is one of the principal assumptions used in any actuarial valuation of a retirement plan. It is used to discount future expected benefit payments to the valuation date in order to determine the liabilities of the plans. Even a small change to this assumption can produce significant changes to the liabilities and contribution rates.

KRS maintains five retirement and five health insurance plans. Due to differences in external liquidity requirements of the systems, there are differences in how plan assets are invested. Furthermore, the differences in the investment policies are material enough to warrant the use of different investment return assumptions. Specifically, the current investment return assumption is 6.25% for the CERS retirement system (non-hazardous and hazardous), KERS retirement hazardous system, and all five health insurance plans. On the other hand, the investment return assumption for the KERS Non-Hazardous retirement system and SPRS is 5.25%.

Investment and Administrative Expenses

The trust fund pays expenses in addition to member benefits and refunds; we must make some assumption about these. Currently an explicit administrative expense assumption is included in the normal cost rate. This assumption is updated on an annual basis and is equal to the prior year's administrative expense divided by covered payroll. We recommend no change to this process.

Actual Investment Performance

Below is a table with the actual annualized investment return performance on a market value of asset basis.

	Historical Average Annual Return			
System	**FY 2018**	**3-Year**	**5-Year**	**10-Year**
KERS Non-Hazardous	7.50%	6.17%	7.19%	5.96%
KERS Hazardous	8.68%	7.14%	7.70%	6.21%
CERS Non-Hazardous	8.75%	7.18%	7.71%	6.22%
CERS Hazardous	8.77%	7.21%	7.73%	6.23%
SPRS	7.65%	6.06%	7.04%	5.89%

Source: Comprehensive Annualized Financial Report for the fiscal year ending June 30, 2018.

However, past performance is not a reliable indicator of future investment performance, even when returns are averaged over a long time (e.g. twenty-year period or more). The actual asset allocation of the trust fund will significantly impact the overall performance, so returns achieved under a different allocation are not meaningful.

Forward-Looking Return Expectations

We believe the most appropriate approach to identifying an appropriate investment return assumption is to identify expected returns developed by mapping the KRS's asset allocation policy to forward-looking capital market assumptions that are developed by professional investment consulting firms.

Wilshire Associates (KRS's Investment Consultant) provided a recommended asset allocation policy in their June 7, 2018 Board material that had the following objectives. For the severely underfunded systems (i.e. the KERS Non-Hazardous and SPRS Retirement Systems), they recommended an allocation that has approximately a 60% likelihood of achieving an assumed rate of return of 5.25%, while decreasing short-term volatility by 10% and lowering the portfolio's sensitivity to the economic growth cycle by about 14%. Wilshire Associates also recommended a different asset allocation policy for the other systems maintained by KRS (i.e. the KERS Hazardous, CERS Non-Hazardous and Hazardous

Retirement Systems, and all five Retiree Health Insurance Systems) that has approximately a 50% likelihood of achieving a 6.25% rate of return, while increasing projected liquidity and maintaining a similar investment risk profile as the prior allocation.

Both these asset allocation policies were adopted by the Board in June 2018 and used in our analysis. The following table provides a summary of these two asset allocation policies.

Asset Class	KERS Non-Haz and SPRS Retirement	Other KRS Systems
US Equity	18.75%	15.75%
Non-US Equity	18.75%	15.75%
Private Equity	10.00%	7.00%
High Yield / Credit Fixed Inc.	15.00%	15.00%
Core Fixed Income	13.50%	20.50%
Cash	1.00%	3.00%
Real Estate	5.00%	5.00%
Hedge Funds / Opportunistic	3.00%	3.00%
Real Return	15.00%	15.00%
Total	**100.00%**	**100.00%**

It's our understanding that the Board slightly modified these target allocations in December 2018, but the changes were insignificant for this analysis.

GRS is a benefits consulting firm and does not provide investment consulting advice, we do not develop or maintain our own forecasts of capital market expectations. Instead, we utilized 2018 forward-looking capital market return expectations developed by KRS's investment consultant, Wilshire Associates, as well as other investment consulting firms that are listed below. The primary purpose of performing this analysis using multiple investment consulting firms is to quantify possible differences in forward looking return expectations within the professional investment community.

- Aon (10-Year and 30-Year)
- Callan
- Marquette
- NEPC (7-Year and 30-Year)
- RV Kuhns
- Wilshire (KRS's Investment Consultant)
- BNY Mellon
- JP Morgan
- Mercer (10-Year and 20-Year)
- PCA
- Summit

Each of these investment consultants provided forward-looking return expectations for next 7 to 10 years. Additionally, three of these firms (Aon, Mercer, and NEPC) develop return expectations over a longer, 20- to 30-year period.

KRS theoretically has an indefinite life span which may result in some stakeholders believing that emphasis should be placed solely on long-term expectations, even if short-term expectations are materially different. While KRS is expected to have an indefinite life span, this system is relatively mature with material shorter-term liability attributable to current retirees. For example, as of the last actuarial

valuation $11.4 billion of the $15.7 billion total actuarial accrued liability in the KERS Non-Hazardous System is attributable to members who are currently receiving a retirement benefit (i.e. 72% of the total liability). Similarly, $7.8 billion of the $13.2 billion total actuarial accrued liability in the CERS Non-Hazardous System is attributable to members who are currently receiving a retirement benefit (i.e. 59% of the total liability). Due to the Systems' maturity, we believe an appropriate return assumption for these Systems should account for short-term expectations.

The tables below provide the 40th, 50th, and 60th percentiles of the geometric average of the expected nominal return, as well as the probability of exceeding the current investment return assumption.

Table 1. CERS, KERS Hazardous, and All Health Insurance Funds

Expected Annual Geometric Returns and Return Probabilities

	Investment Consultant	Distribution of 20-Year Average Geometric Net Nominal Return			Probability of exceeding
		40th	50th	60th	6.25%
	(1)	(2)	(3)	(4)	(5)
7 to 10 Year Expectations	1	4.87%	5.37%	5.88%	33.1%
	2	5.01%	5.51%	6.02%	35.7%
	3	4.64%	5.31%	5.98%	36.1%
	4	5.25%	5.78%	6.32%	41.3%
	5	5.04%	5.66%	6.28%	40.5%
	6	5.28%	5.87%	6.46%	43.5%
	7	5.19%	5.91%	6.63%	45.3%
	8	5.50%	6.07%	6.65%	46.9%
	9	5.56%	6.37%	7.19%	51.5%
	10	6.15%	6.75%	7.35%	58.3%
	11	6.56%	7.09%	7.62%	65.7%
20-30 Year	1	5.86%	6.47%	7.08%	53.6%
	2	6.01%	6.63%	7.25%	56.1%
	3	6.10%	6.69%	7.28%	57.5%
	Average	5.50%	6.11%	6.71%	47.5%

Source: GRS

Table 2. KERS Non-Hazardous, and SPRS Retirement Funds
Expected Annual Geometric Returns and Return Probabilities

	Investment Consultant	Distribution of 20-Year Average Geometric Net Nominal Return 40th	50th	60th	Probability of exceeding 5.25%
	(1)	(2)	(3)	(4)	(5)
7 to 10 Year Expectations	1	4.43%	5.01%	5.59%	45.8%
	2	4.63%	5.05%	5.48%	45.4%
	3	4.73%	5.16%	5.59%	47.8%
	4	4.72%	5.26%	5.80%	50.1%
	5	5.01%	5.45%	5.89%	54.5%
	6	4.99%	5.49%	5.99%	54.9%
	7	4.90%	5.50%	6.11%	54.2%
	8	5.14%	5.62%	6.11%	57.7%
	9	5.37%	6.09%	6.81%	61.7%
	10	5.83%	6.35%	6.87%	70.5%
	11	6.07%	6.53%	6.99%	76.1%
20-30 Year	1	5.80%	6.30%	6.80%	70.4%
	2	5.63%	6.17%	6.72%	66.8%
	3	5.52%	6.04%	6.57%	64.9%
	Average	5.20%	5.72%	6.24%	58.6%

Source: GRS

When developing the expected return for each assumption set we normalized the expected portfolio return for any difference between the investment consultant's price inflation assumption and the 2.30% price inflation assumption used in the actuarial valuation.

Recommendation

CERS (Non-Hazardous and Hazardous), KERS Hazardous Retirement, and All Insurance Funds

Based on our broader survey, the average of the 50th percentile return expectations of all assumption sets is 6.11%. This is reasonably close to the current 6.25% assumption and the results provided by Wilshire, and as a result, we find the current assumption reasonable. However, only three of the eleven

short-term assumptions result in a greater than 50% probability of exceeding the current 6.25% return assumption. Thus, if the Board is uncomfortable with a lower than 50% probability of achieving the assumption over the next decade, they may want to consider lowering the assumption to 6.00%..

KERS Non-Hazardous and SPRS Retirement Funds

These two retirement funds are invested differently than the other systems maintained by KRS because they require increased liquidity to have funds available to provide the benefit payments due to current retirees. Specifically, as of the last actuarial valuation the funded ratio of the KERS Non-Hazardous and SPRS Retirement funds were 12.8% and 27.1%, respectively.

As the results in Table 2 shows, the average 50th percentile is 5.72% and the average probability of exceeding the current 5.25% return assumption is 58.6%. In absolute terms, this may result in a conclusion that the current return assumption may be too conservative. However, given the very low funded ratios of the systems where this assumption is used, it is more prudent to use an investment return assumption that has a greater than 50% probability of emerging experience being greater than expected. Therefore, we also recommend no change the current 5.25% return assumption for these systems.

Salary Increase Rates

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

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

Our salary increase assumption is meant to reflect all of these types of increases, since all of these affect the salaries used in benefit calculations and upon which contributions are made.

An actuary should not look at the overall increases in payroll when setting this assumption, because total payroll can increase at a rate different from the average pay increase for individual members. There are two reasons for this. First, when older, longer-service employees terminate, retire or die, they are generally replaced with new employees who have a lower salary. This causes the growth in total payroll to be smaller than the average pay increase for individual employees. Second, total payroll can change due to an increase or decrease in the size of the employee group. Rather we examine the actual compensation increases on an individual basis.

We analyzed the salary increases based on the change in each member's reported pay from one year to the next. That is, we looked at each member who appeared as an active member in two consecutive valuations—these are called continuing active members—and measured his/her salary increase.

Below is a table showing the average increase given to continuing members by year for members in various groups:

Fiscal Year Ending	KERS Non-Hazardous	KERS Hazardous	CERS Non-Hazardous	CERS Hazardous	SPRS
2014	2.9%	3.1%	3.5%	5.0%	3.3%
2015	4.0%	6.5%	4.3%	4.3%	3.0%
2016	4.9%	18.3%*	5.1%	5.9%	6.4%
2017	4.4%	11.1%	4.3%	9.0%	9.8%
2018	4.5%	6.1%	4.1%	5.5%	7.0%
Average	4.1%	8.9%	4.3%	5.9%	5.9%

* Includes a one-time payroll adjustment.

It is typical to assume larger pay increases for younger or shorter-service employees as promotions and productivity increases tend to be greater in the first few years of a career, even if the new employee is older than the average new hire.

The current assumptions follow this pattern for all employee groups. Therefore, we divide the task of setting the salary increase into two pieces:

1. Determining the assumption for long-service employees

2. Determining the additional increases to be applied to shorter-service employees

The next two subsections will discuss these components of the salary assumption.

Salary Increase Assumptions for Long-Service Employees

Many of the sources of pay increases have diminished importance for longer-service employees. Step or service-related increases are usually smaller and promotions occur with less frequency. Additional training or acquisition of advanced degrees usually occurs early in the career. Thus, our salary increase assumption has an ultimate level when members are assumed to receive increases equal to wage inflation plus smaller increases for merit, promotion, and longevity.

The data suggests the patterns level off at around 10 years for the hazardous duty groups, 11 years for the KERS Non-Hazardous and 15 years for the CERS Non-Hazardous and those are the lengths of service used to classify someone as a Long Service Employee. The relatively high average salary increase for the KERS Hazardous employees is due to the one-time pay adjustment in fiscal year 2015/2016. As a result, the average salary increase is not representative of the prospective expected average increase.

We are proposing the new assumption set has the same increases applied to members in similar job classifications. In summary, the assumed rate of annual salary increases for long-service employees will be 1.00% per year over inflation for Non-Hazardous members and 1.25% per year over inflation for the members in the Hazardous and State Police Systems.

Salary Increase Assumption for Shorter-Service Employees

To analyze the service-related salary assumption, we looked at the excess in the average increases for shorter service employees over the average for longer-service employees. For example, CERS non-hazardous members with four years of service received an average increase of 4.64%, which was 1.84% more than the average increase of 2.80% for the same type of employee with fifteen or more years of service. This component of the salary scale assumption behaves more like a demographic assumption than an economic assumption, and therefore, the historical experience has a high level of creditability for purposes of establishing future expectations. Step-rate assumptions were generally increased for all five Systems. Details of our analysis are shown in Section VIII beginning on page 74.

Salary Increases – Combined Effect

The table below shows the average expected increase in compensation for continuing members for the last five years, reconciling the changes from the current to proposed assumptions:

Summary of Actual Salary Experience Compared to Current and Recommended Salary Assumption for All Employees

System	Actual Nominal Increase	Actual Inflation	Salary Increase over Price Inflation		
			Actual[1]	Current Assumption[2]	Proposed Assumption[3]
KERS Non-Hazardous	4.1%	1.5%	2.6%	1.9%	2.1%
KERS Hazardous	8.9%	1.5%	7.4%	2.3%	2.4%
CERS Non-Hazardous	4.3%	1.5%	2.8%	1.7%	2.0%
CERS Hazardous	5.9%	1.5%	4.4%	1.4%	2.2%
SPRS	5.9%	1.5%	4.4%	1.8%	2.2%

[1] The actual salary increase in excess of actual inflation for all continuing active members during the five-year observation period.
[2] The expected average increase in salary in excess of the 2.30% assumed rate of inflation.
[3] The expected average increase in salary in excess of the 2.30% recommended assumed rate of inflation.

The overall effect of the changes to the salary increase assumption will result in slightly higher assumed rate of salary increases (and actuarial accrued liability) for all Systems. Note, while the actual experience over inflation for Hazardous duty employees appears materially larger than the proposed assumptions, wages are slower to move than actual inflation and thus the differences appear wider than they actually are. In addition, it is likely pension and retiree-medical costs will dampen the amount of resources available for salary increases over the short to intermediate term.

PAYROLL GROWTH RATE

The salary increase rates discussed above are assumptions applied to individuals and are used in projecting future benefits.

Current State Statutes requires that participating employers in the Systems maintained by KRS to make contributions to the system as a percentage of covered payroll. Therefore, it is necessary to make an

assumption regarding the anticipated overall change in covered payroll to develop the amortization rate to finance the unfunded actuarial accrued liability over the specified funding period.

The change in total covered payroll is dependent on the salary increases provided to individual members as well as the change in active membership. Given the historical change in covered payroll and membership, as well as the change in the recently enacted contribution rates, it is appropriate to review the change in total payroll and membership in developing this assumption.

Average Annual Payroll and Active Membership Change				
	Change in Membership		Change in Payroll	
Averaging Period	5 Years	10 Years	5 Years	10 Years
KERS Non-Hazardous	-3.61%	-3.09%	-2.20%	-2.20%
KERS Hazardous	-.98%	-1.11%	3.69%	0.62%
CERS Non-Hazardous	0.00%	-0.41%	1.98%	1.31%
CERS Hazardous	0.31%	-0.93%	2.94%	1.19%
SPRS	-0.36%	-1.13%	1.52%	-0.87%

In 2017 the KRS Board decreased the payroll growth assumption from 4.00% to 0.00% for both KERS Systems (Non-Hazardous and Hazardous) and the SPRS. At the same time, the Board also decreased the payroll growth assumption from 4.00% to 2.00% for both CERS Systems (non-hazardous and hazardous).

Our recommendation is for the Board to maintain the current payroll growth assumption for all the systems for use in the June 30, 2019 actuarial valuation. Note, since the CERS Systems are phasing into the full actuarially determined contribution rate over the next three or four years, the Board has more time to observe the experience to identify whether a change in the payroll growth assumption for the Systems is needed.

The recent increases in the employer contribution rates have greatly incentivized the participating employers to reduce their pension cost by reducing the number of covered members (which also reduces their covered payroll). However, this employer behavior requires the System to further increase the contribution rate to maintain the same contribution dollar amount to fund the System. As a result, we believe that the long-term solution is for the General Assembly to enact legislation to change the method the System collects contributions from the participating employers such that the System invoices the employer the required amortization payment and the employer just contributes the normal cost rate on the payroll of their employees.

DEMOGRAPHIC ASSUMPTIONS

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

POST-RETIREMENT MORTALITY RATES

KRS's actuarial liabilities depend in part on how long retirees live. The longer a retiree lives, the longer the retiree receives benefits from the System resulting in a larger liability to the System.

The current mortality assumption is gender distinct, but there is no distinction between retirees in KERS or CERS, or the Non-Hazardous and Hazardous Systems. Separate mortality tables are used for active members and disabled retirees; and discussed separately in a following subsection. The currently mortality assumption used in the actuarial valuation for non-disabled retirees is a variation of the RP-2000 Combined mortality table. The life expectancy for an age 65 retiree is 19.0 years for males and 22.1 years for females. The current mortality assumption does not include an explicit assumption for future improvement in life expectancy. Rather, this mortality assumption is implicitly stating that the life expectancy for a member who retirees 20, 30, or 40 years from now will have the same life expectancy of current retiree of the same age.

The issue of mortality improvement is one that our profession has increasingly become more focused on studying and ensuring that the actuarial profession remains on the forefront of this issue. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 35, and published practice notes to increase the disclosure regarding expected mortality improvement after the valuation date. As a result, it is becoming industry practice to use a mortality assumption that explicitly incorporates mortality improvement. By doing this, future life expectancy will be projected to continually increase each year in the future and the life expectancy of someone who will reach age 65 in 2035 with have a slightly longer life expectancy compared to someone who is currently age 65.

Analysis of Credibility of the Retirement Systems' Mortality Experience

When selecting an appropriate mortality assumption, actuaries often use standard, published, mortality tables. Depending on the size, or statistical credibility, of the retiree population increases, actuaries often also adjust these published mortality tables with multipliers or age setbacks, to better reflect characteristics of the covered group and to provide for expectations of future mortality improvement (both up to and after the measurement date). On the other hand, a retirement system with a sufficiently large number of retirees may be able to better model mortality experience using a mortality table based on their experience. Factors that may be considered in selecting and/or adjusting a mortality table include the demographics of the retiree group, the statistical credibility of its experience, and the anticipated rate of future mortality improvement.

In our analysis of the mortality experience for KRS, we first measured the credibility of the dataset to determine whether standard published tables should be used or if a statistical analysis of the Retirement Systems' data was warranted. Based on a practice note issued by the American Academy of Actuaries in June 2015, a dataset needs 96 expected deaths for each gender to be within +/- 20% of the actual pattern with 95% confidence. However, we believe a +/- 20% range to too large to be considered fully credible, for mortality section. Other sources suggest higher requirements, such as 1,000 deaths per gender is necessary to be considered fully credible. The following table gives the number of deaths needed by gender to have a given level of confidence that the data is +/- X% of the actual pattern.

Statistical Confidence by Observed Deaths during the Experience Period

Std Score	Confidence	99%-101%	97%-103%	95%-105%	90%-110%	80%-120%
1.1503	75%	13,233	1,470	529	132	33
1.2816	80%	16,424	1,825	657	164	41
1.6449	90%	27,055	3,006	1,082	271	68
1.9600	95%	38,415	4,268	1,537	384	96
2.5758	99%	66,349	7,372	2,654	663	166

Using this information, 1,082 deaths are needed by gender to have 90% confidence that the data is within +/- 5% of the actual pattern. The Kentucky Retirement Systems (all Systems combined) had 5,078 male deaths and 5,060 female deaths during the five-year period ending June 30, 2018. Based on the statistical credibility table, we are 99% confident that the experience for the 5-year observation period are within 5% and 3% of the true mortality experience for males and females, respectively. While the use of more years of experience would provide more data (and higher credibility), the additional years of experience would temper real changes that have occurred in the mortality assumption due to improvements in life expectancy during the time period.

Studies on mortality consistently show that longevity can vary significantly among industries, ethnicity, education, and geographic location. It has been documented in several sources that residents in Kentucky have a life expectancy well below the national average (e.g. a report issued by the American Human Development Reports "*The Measure of America, 2013-2014*", states that Kentucky residents ranked 44th in life expectancy compared to people in the other US States). However, members in KRS predominately have formal education beyond high school or a profession degree, which is also well documented to be an indicator they will have a longer life expectancy than someone in the same geographic location without a formal education beyond high school. Due to these possible variances, it is even more important to consider the statistical credibility of the system's experience and provide the appropriate credibility weighting to the observed mortality experience, versus the use of a published table based on national population experience.

Furthermore, we have also concluded it is appropriate to utilize the System's experience and develop a system-specific mortality assumption. Using a system-specific mortality assumption will reduce the risk of undervaluing or overvaluing liabilities, provide better future estimates of liabilities and projected benefit payments. It will also allow for smaller, more frequent adjustments to the assumption as necessary in future experience studies instead of having to wait for a new, published table.

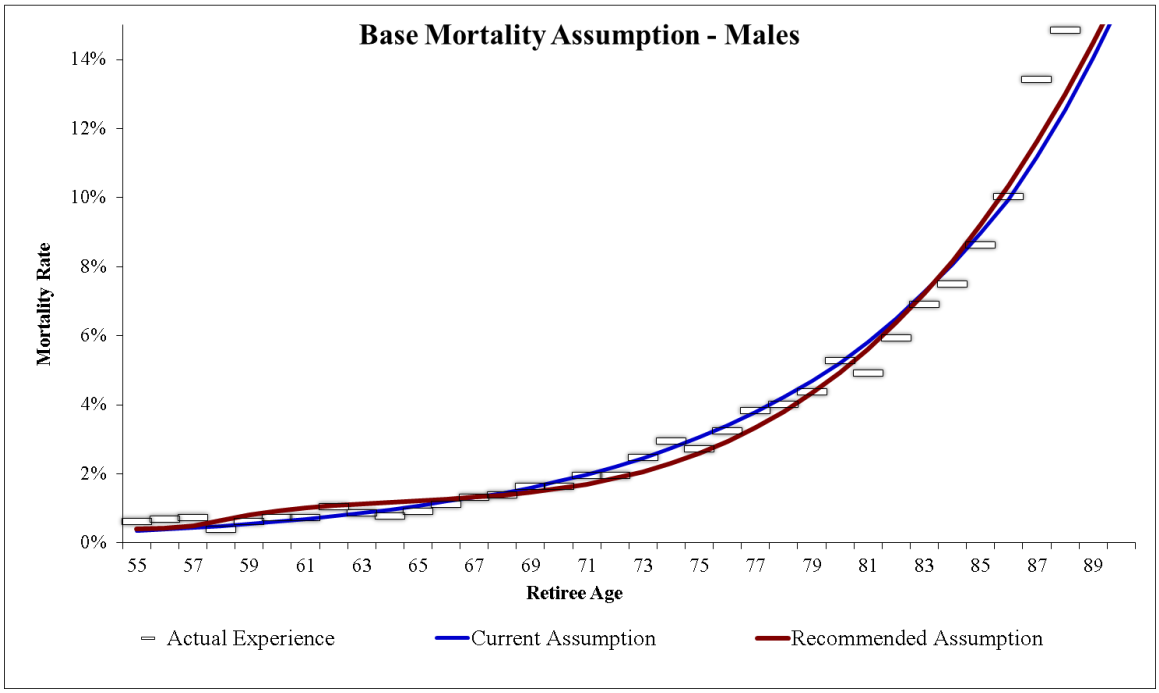
Recommended Base Mortality Assumption

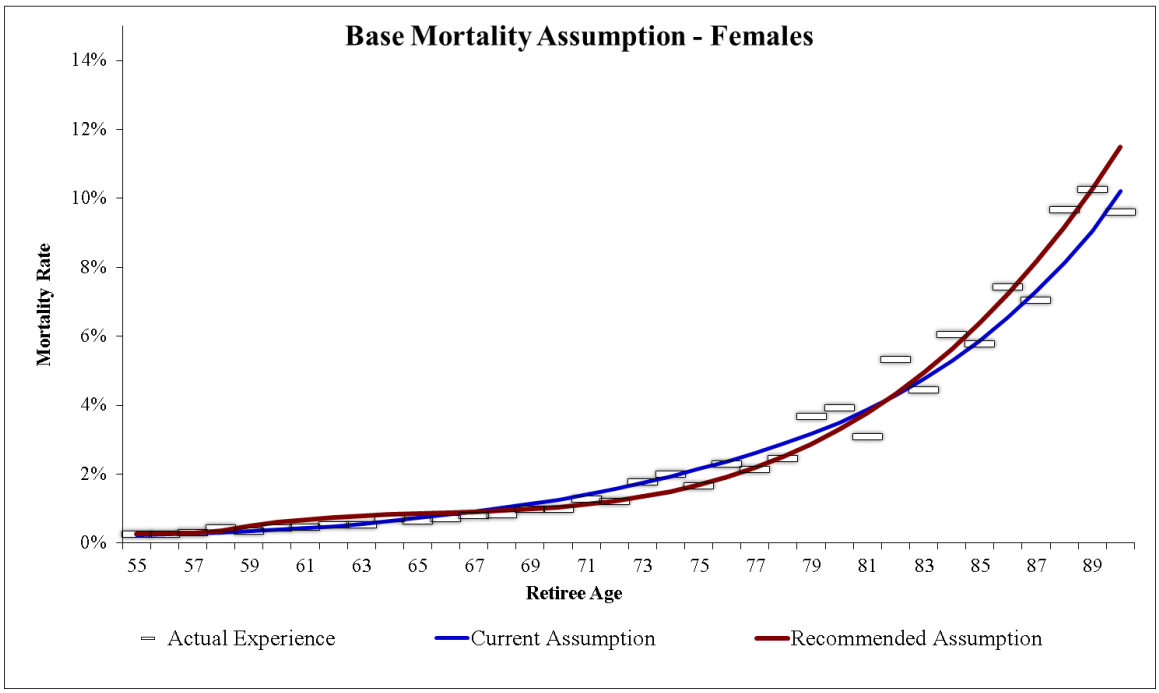
We performed our analysis using a benefit-weighted approach, where we measure the exposures and actual deaths as the retiree's benefit amount, rather than a headcount approach that applies an equal weighting to all retirees. Developing a base table using a benefit-weighted approach is preferable because: (1) research studies have consistently shown that higher wage earners generally have a longer life expectancy than lower wage earners and (2) this approach should better model the actual liability that is released when retirees die. A benefit-weighted approach is the same method used by the Society of Actuaries' Retirement Plans Experience Committee when they develop published mortality tables.

Mortality rates for the core ages of retirees, age 58 to 94, are based on the Retirement System's experience, using a polynomial model to provide a smooth fit to the midpoint of the experience. Mortality rates for ages under 58 and over 98, are equal to the most recently published Pub-2010 mortality assumptions for general members (adjusted from a base year to the central point of the experience period using projection scale MP-Ultimate). Finally, the mortality rates for the transitional age ranges, ages 94 to 98, were developed by a 5-year blending method to orderly transition from the rates based on the System's experience to the published mortality table. The R^2 for the fit of the tables to actual experience in five-year age bands was .9988 and .9978 for males and females, respectively.

The final step in the creation of the base mortality assumption was to project the preliminary table from the center point of the analysis period (i.e., the year 2015) to the year 2019 using the MP-Ultimate mortality improvement assumption. We will refer to this new table as the 2019 Public Retirees of Kentucky Mortality Table (2019 PRK).

The following charts show the actual mortality experience assumption for male and female retirees, along with the current mortality assumption, and the recommended mortality assumption. As the chart shows, the best way to provide a better fit along the entire "curve" is to use an assumption developed using actual experience.





As the charts show, the current assumption tracks relatively closely to the recommended base mortality assumption. As a result, the cost impact of changing to a recommended base table based on the Systems' experience is minor. However, the recommended mortality assumption also includes an explicit assumption for future improvement in mortality (and life expectancy) that is discussed on the following page, which will have a material impact on the liability and cost.

Recommended Mortality Improvement Assumption

Society of Actuaries' Retirement Plans Experience Committee (RPEC) recognizes that there is a wide range of opinion with respect to future levels of mortality and that the assumptions underlying mortality improvement reflect some degree of subjectivity. Generational mortality improvement assumption Scale AA was released by the Society of Actuaries along with the release of the RP-2000 mortality tables in the year 2000. In October 2014, the Society of Actuaries issued final reports of the mortality study that included the release of the RP-2014 mortality tables and the MP-2014 mortality improvement assumption. MP-2014 is a two-dimensional improvement assumption that is a function of the age and calendar year. In 2015, 2016, 2017, and 2018, the Society of Actuaries issued mortality improvement assumptions MP-2015, MP-2016, MP-2017, and MP-2018, respectively. In each of these updates, the rates of improvement during the selection period were decreased compared to the prior year improvement assumption, which means that the original MP-2014 assumption was shown to be too conservative.

After approximately 15 years, all of the versions of the MP improvement assumptions have the same rate of improvement at each future calendar year (the ultimate rate of mortality improvement). In general, the assumed rate of improvement after 15 years is a flat 1% per year across most ages. This general 1% is in line with other demographer sources and we prefer a more consistent technique for this assumption that doesn't give the appearance of more precision than actually is possible. Given the fact that actual improvement in mortality has not tracked well during the select period of the MP tables, we believe it is reasonable to use the ultimate mortality improvement rates in the MP tables for all years. Therefore, we recommend the use of "MP-Ultimate" for the mortality improvement assumption.

Below is a table with the life expectancy for an age 65 retiree, in years, under the current and recommended mortality assumption.

Life Expectancy for an Age 65 Retiree in Years					
Assumption	**Year of Retirement**				
	2020	**2025**	**2030**	**2035**	**2040**
Current Assumption – Male	19.0	19.0	19.0	19.0	19.0
Recommended Assumption – Male	21.0	21.4	21.8	22.2	22.6
Current Assumption – Female	22.1	22.1	22.1	22.1	22.1
Recommended Assumption – Female	24.0	24.4	24.8	25.2	25.6

As shown, the life expectancies under the new assumption are longer than the current assumption, and the generational approach to projecting longevity is built into the liability stream. A 65 year old in 2040 is assumed to have longer life expectancies than a 65 year old in 2020.

Disabled Retiree Mortality Rates

This is a less significant assumption than the mortality assumption for non-disabled retirees, because only one out of fifteen retirees is classified as disability retirement. Because the number of disabled retirees is much smaller, there is not sufficient experience to develop a system-specific assumption and we must continue to rely on using a published table.

The current disability mortality assumption is based on the RP-2000 Disabled Mortality table, with various adjustments to appropriately fit to the experience.

The analysis shows that the current assumption tracked reasonably well to the experience, especially for disabled male retirees. However, we recommend updating this assumption as a new published disabled mortality table has been published by the Society of Actuaries. Specifically, we recommend using the PUB-2010 Disabled Mortality table, with a 4-year set-forward for both male and female rates. We also recommend applying the MP-Ultimate mortality improvement assumption to this assumption as well.

Mortality Experience for Disabled Retirees for the Five-Year Period Ending June 30, 2018 (Amounts are benefit-weighted and scaled)					
		Current		Recommended	
Group	Actual	Expected	A/E	Expected	A/E
Male	75	70	108%	70	107%
Female	59	48	123%	55	108%

Details are provided in Section VIII on pages 79-82.

Active Mortality Rates

This is the least significant of all the mortality assumptions because the mortality rates for active members are considerably lower than mortality rates for retired members (nondisabled and disabled).

The current mortality assumption for employees is a variation of the RP-2000 Mortality Table for Employees, with multipliers applied to provide a better fit for the genders. We were only able to readily identify the active membership deaths for the years 2016/2017 and 2017/2018, as the data we received for the years prior to 2017 did not include a code to identify the members who died while employed.

We believe that two years of experience is not statistically credible, therefore did not compare the actual to the expected number deaths based on the current assumption. That said, we still recommend updating this assumption a newly published employee mortality table by the Society of Actuaries. Specifically, we recommend using the Public Retirement Plan (PUB-2010) Mortality table for employees. The assumption for the Non-Hazardous Systems would use the published table for General Employees and the assumption for the Hazardous and State Police Systems would use the published table developed using experience of Public Safety members. Finally, we also recommend using the MP-Ultimate mortality improvement assumption in conjunction with these base mortality tables.

The following table compares the expected number of deaths, by system, for the last five-year period using the current and recommended mortality assumption. Overall, the number of expected deaths will be slightly higher with the recommended mortality assumption.

Expected Deaths for the 5-Year Observation Period (Headcount Basis)		
System	Current Assumption	Recommended Assumption
KERS Non-Hazardous	325	384
KERS Hazardous	23	26
CERS Non-Hazardous	827	941
CERS Hazardous	24	26
SPRS	4	5

Since the death benefit provided to a beneficiary is different (i.e. more generous) if an active member dies while in the line of duty, it is relevant to make an assumption regarding the number of expected deaths that will occur in the line of duty. The valuation currently assumes that 25% of the active membership deaths occur in the line of duty (same assumption for each system). Over the last five years there were a total of ten active members who died in the line of duty (1 KERS Non-Hazardous, 0 KERS Hazardous, 4 CERS Non-Hazardous, 2 CERS Hazardous, and 1 SPRS). This assumption is likely higher than the actual experience, but we don't know for sure because we were unable to identify the total number of in service deaths during the entire observation period. However, we believe the current line-of-duty death assumption is reasonable when compared to the assumption used by other comparable statewide retirement systems. As a result, we do not recommend a change to this assumption.

Disability Incidence

The disability rates are intended to reflect the probability that a member will retire with a disability retirement allowance. We analyzed the disability experience separately by System, but combined the males and females experience to increase the statistical credibility of the analysis. Our review includes an investigation to determine if there is a time-lag in the processing of disability retirements that we discuss in more detail below. The following is a table with a summary of the results of the analysis for the five-year period ending June 30, 2018.

Disability Incidence for the Five-Year Period Ending June 30, 2018							
Group	Census Data	Processing Time-Lag	Actual for Analysis	Current		Recommended	
				Exp.	A/E	Exp.	A/E
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
KERS Non-Hazardous	279	135	414	235	176%	424	98%
KERS Hazardous	16	26	42	23	186%	41	102%
CERS Non-Hazardous	785	354	1,139	527	216%	1,106	103%
CERS Hazardous	77	46	123	95	129%	125	98%
SPRS	4	0	4	7	57%	7	57%

Note: the actual and expected statistics are headcount based and not benefit-weighted.

Typically, when we review a System's disability experience, our review includes an investigation into whether there is delay in a System's classification of a retiree as a disabled retiree. Often if there is a delay, it is due to a combination of the time of year the member becomes disabled and the time necessary to approve a member's application for a disability retirement benefit. For example, a member who becomes disabled late in the fiscal year may be reported in the census data files as follow: Year 1: "Active", Year 2: "Inactive", Year 3: "Disabled Retiree". The reporting of the member as "Inactive" in year 2 is due to the processing of a member's application for a disability retirement, where in reality the member was actually a "Disabled Retiree" in year 2.

The count in column (2) provides the number of members who are identified as having a year-to-year status change from "Active" to "Disabled Retiree". The count in column (3) is the number of members who were identified as having a status change from "Inactive" to "Disabled Retiree" in a subsequent year. Together, these represent the number of disability retirements that occurred during the measurement period.

As a result of the observed processing time-lag, we significantly increased the rate of disability incidence for both KERS Systems, and the CERS Non-Hazardous System. We also slightly increased the rate of disability incidence for the CERS Hazardous System and recommended no change in the disability rates for SPRS.

Since there are minimum benefits provided to members who become disabled as a direct result of an act in the line of duty, it is important to review the System's experience regarding disability retirements due to duty-related events.

Currently, the actuarial valuation assumes that 0% of the disabilities are to occur in the line of duty for all Systems. We are recommending updates to this assumption for all the Systems. Since the number of actual disabilities and duty disabilities is relatively small, we are not assigning complete credibility to the actual experience during the observation period.

Prevalence of Duty-Related Disability Incidence for the Five-Year Period Ending June 30, 2018				
Group	Total Disabilities	Duty-Related	Actual Percent	Recommended Assumption
(1)	(2)	(3)	(4)	(5)
KERS Non-Hazardous	279	0	0%	2%
KERS Hazardous	16	4	25%	10%
CERS Non-Hazardous	785	2	0%	2%
CERS Hazardous	77	57	74%	50%
SPRS	4	4	100%	70%

TERMINATION RATES

The termination assumption is used to model the effect of members leaving active membership in the System for any reason other than death, disability, or service retirement. This applies whether the termination is voluntary or involuntary, and whether the member takes a refund or keeps his/her account balance on deposit. However, we only consider a termination to occur if the member changes status in the retirement system to an inactive member. We don't consider a termination to occur if the member works for a new employer, but remains an active member in the same System. The valuation uses the same termination assumption for males and females, but different assumptions for non-hazardous and hazardous members. The current assumption is structured as a function of service. No terminations are assumed once a member becomes eligible to commence their retirement benefit.

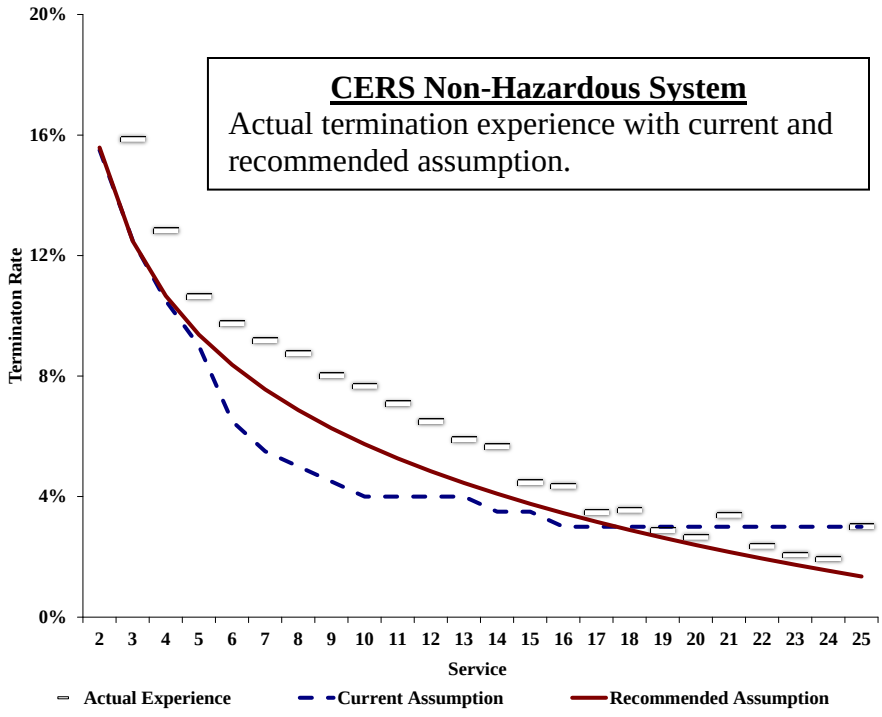
A higher paid member has a greater liability relative to a lower paid member, and has shown to have lower turnover. Along those lines the termination pattern for the higher paid members will have more impact on the future liabilities of the plan. Therefore, we have weighted the experience by salary and are counting the payroll and the portion of the payroll that terminates employment (versus headcount) for the last 5 years. For this assumption, it is more conservative to have an A/E ratio over 100%.

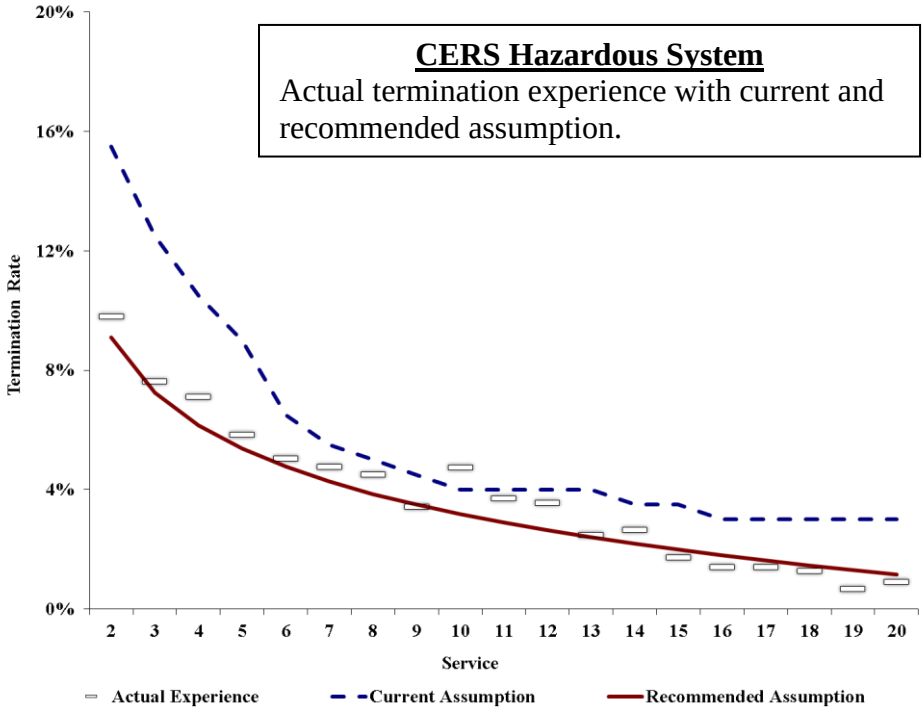
The analysis indicated that termination experience is still correlated with service. Also, we continue to develop a termination assumption that is applied to both genders for increased statistical credibility. The following table provides a summary of the results for the termination rates by System:

Summary of Termination Analysis (Hundreds of Thousands of Payroll)					
	Actual	Current Assumption		Recommended Assumption	
System	Experience	Expected	A/E	Expected	A/E
(1)	(2)	(3)	(4)	(5)	(6)
KERS Non-Hazardous	15,528	8,548	182%	11,031	141%
KERS Hazardous	1,935	801	242%	1,343	144%
CERS Non-Hazardous	12,831	9,373	137%	10,218	126%
CERS Hazardous	2,003	4,418	45%	1,899	106%
SPRS	170	256	66%	124	137%

In summary, the rates of termination were significantly increased for both KERS Systems, and slightly increased for the CERS Non-Hazardous System. On the other hand, the rates of termination were decreased for the CERS Hazardous and SPRS Systems. We did not increase the termination rates for the KERS Systems and the CERS Non-Hazardous System match the observed experience to avoid possibly over-adjusting the assumption. The recommended termination rates for the CERS Hazardous and SPRS were decreased to result in an "A/E" ratio that is above 100% to provide some margin or conservatism in the assumption. Note, the recommended change to the CERS Hazardous System had a large fiscal impact to the System, but is also the assumption with the least amount of conservatism as it has the lowest "A/E" ratio compared to the other recommended termination assumption for the other Systems.

The charts below provide an illustration of the actual experience and the current and recommended assumption for the CERS Systems (Non-Hazardous and Hazardous).





Details of the termination experience are provided in Section VIII on pages 83-87. Note, since active membership deaths were included in the termination data for the experience prior to June 30, 2016, we performed the analysis treating all active deaths as terminations and then the recommended termination rates will be adjusted (i.e. reduced) in the model by the pre-retirement mortality probabilities so as not to double count the decrements.

Refund of Member Contribution Balance

If a member terminates employment with a vested benefit but prior to their retirement age, they may keep their member contributions in the System and receive a monthly annuity when they reach their eligible retirement age or withdrawal their member contributions at any time and forfeit the monthly annuity. Currently, the valuation assumes that members in each System will refund their contributions if the value of their member contributions exceeds the value of their deferred monthly retirement benefit. We recommend no change to this assumption.

RETIREMENT RATES

The retirement rates are used to model when an employee will commence their retirement allowance. The current retirement assumption is the same for males and females, but vary for Non-Hazardous and Hazardous members. Also, there is a variation in the retirement assumption for Tier 1 members whose participation date is before September 1, 2008 and for members whose participation date is on and after September 1, 2008 due to differences in retirement benefits.

For this analysis we have weighted the experience by the member's benefit. Thus, the retirement pattern for the members with a greater benefit will have a larger impact on the future liabilities of the plan. For this assumption, it is more conservative to have an A/E ratio less 100%, however, it is still reasonable to have an A/E ratio greater than 100% if there is reason to believe that future retirement experience will be different than the experience period reviewed. Below are comments regarding the recommended retirement assumption for members with a participation date before July 1, 2003 for each System.

KERS Non-Hazardous System

We recommend the continued use of an age based assumption, but the experience for males and females were sufficiently different for us to recommend the use of gender-distinct retirement assumption. We are recommending a decrease in the retirement rates below age 65 for males and females, but are recommending higher retirement rates at and above age 65. We are also recommending a slight decrease in the retirement rates for members (males and females) electing an early retirement. Overall this change will slightly increase the expected average retirement age from age 57 to age 58 for males and from age 56 to age 57 for females.

KERS Hazardous System

We recommend continued use of the service based assumption and the use of the same retirement assumption for males and females. We also recommend an increase in the retirement rate when a member attains 20 years of service, but a decrease retirement rate when the member has more than 20 years of service. Overall this will slightly decrease the average age a member is expected to retire by approximately a half year.

CERS Non-Hazardous System

We recommend the continued use of an age based assumption. The experience for males and females was sufficiently different that we are recommending the use of gender-distinct retirement assumption. We are recommending an increase in the retirement rates below age 50 and above age 65 for males. We are also recommending a decrease in the retirement rates below age 62 and an increase in the retirement rates at and above age 62 for females. Finally, we are also recommending a slight decrease in the retirement rates for members (males and females) electing an early retirement. Overall this change will slightly change the expected average retirement age for males and increase the female expected average retirement age for approximately one year to age 61.

CERS Hazardous System

We recommend continued use of the service based assumption and the use of the same retirement assumption for males and females. We also recommend an increase in the retirement rate when a member attains 20 years of service, but a slight decrease in the retirement assumption when the member has more than 20 years of service. The recommended update will result in a minimal change in the expected retirement age.

SPRS

We recommend no change to the retirement rates for members with a participation date prior to July 1, 2003. We are recommending an adjustment to the retirement rates for members with a participation date on or after July 1, 2003 (discussed below).

Adjustment to Retirement Rates for Members Participating in KRS on or after July 1, 2003

Members with a participation date on or after July 1, 2003, receive a relatively less generous pre-age 65 health insurance benefit compared to the benefit provided to members who become participants prior to July 1, 2003. Therefore we recommend using a different retirement assumption to reflect an expectation that these members will retire at slightly later ages. Specifically, for members with a participation date on or after July 1, 2003 we are recommending that the retirement rates at each age (or service) below the maximum retirement age are 80% of the recommended retirement rates that are developed for the members with a participation date prior to July 1, 2003. Please note that we must rely on our professional judgement regarding this recommended adjustment as it will be many years into the future before there is sufficient experience to analyze their actual retirement pattern.

The new rates are shown in Sections V, VI, and VII.

Retiree Medical Participation

A retiree's participation in the health insurance plan is voluntary, not mandatory. Some retirees may not elect to be covered, especially if they have coverage through a spouse or a previous employer. As a result, it is relevant to make an assumption regarding the number of future retirees that will elect to participate in the retiree health insurance plan. It may be relevant to take into consideration the design of the health insurance plan when selecting this assumption as eligibility, plan choices, and retiree contribution requirements may affect a retiree's decision to participate in the health insurance plan.

The current assumption is a service based assumption, which is logical since the retiree's cost subsidy increases as their service at retirement increases. The table on the following page summarizes the current participation assumption.

Health Insurance Participation Assumption at Retirement

Service at Retirement (Years)	System	
	KERS and CERS	SPRS
(1)	(2)	(3)
Under 10	50%	100%
10 to 14	75%	100%
15 to 19	90%	100%
20 or more	100%	100%

Additionally, 50% of inactive vested members with a participation date before July 1, 2003 and 100% inactive vested members with a participation date on or after July 1, 2003 are assumed to elect health coverage.

We reviewed the actual participation experience for the five-year period for each System. The actual election rate was relatively close to the expected election rate for those retirees with 20 or more years of service. On the other hand, the difference between the actual and expected election rate was greater for those retirees with less than 20 years of service. When establishing a recommendation it is important to take into account the materiality of the assumption and the election rate for those retirees with 20 or more years of service is by far the most important assumption as this group of retirees represents the largest number of future retirees and has the largest potential cost impact because the employer cost subsidy is the greatest for this retiree group. To that point the participation assumption for the retirees with less than 20 years of service is relatively immaterial because the number of retirees with less than 20 years of service is relatively smaller as well as the employer subsidy on retiree health cost.

As a result, we recommend no change to the participation assumption for the health insurance systems.

Other Assumptions

There are other assumptions made in the course of a valuation, such as the percentage of members who are married, the age difference between members and spouses, the likelihood that a terminating employee will take a refund, etc. Currently 100% of the members are assumed to be married with the husband three years older than the wife. We believe they are generally realistic and/or conservative and recommend no changes to these other assumptions.

There are also some other assumptions that are specifically used in the valuation of the retiree health insurance funds. These include: the age related morbidity/claims utilization, health care trend, excise tax, and baseline claims cost. Each of these assumptions are reviewed on an annual basis and may be periodically updated as each year of claim experience is reviewed, as well as with possible plan design changes that are adopted by KRS.

Actuarial Cost Method

The individual Entry Age Normal cost method (EAN) is the current funding method being used to allocate the actuarial costs of the System. The Entry Age Normal method will generally produce relatively level contribution amounts as a percentage of payroll from year-to-year, and allocates costs among various generations of taxpayers in a reasonable manner. It is by far the most commonly used actuarial cost method

for large public retirement systems. We continue to believe this is the most appropriate funding method and recommend no change.

For members who have correlated service with another employer, the cost method will assume the member has no accrued liability at the date of hire and will accrue all benefits from the hire date with the current employer. Service from the other employers will be used in determining retirement eligibilities, but not in allocating the accruals over the career of the employee.

ACTUARIAL ASSET METHOD

The current method for developing the actuarial value of assets is based on a five-year asset smoothing method that will identify each year's investment gain or loss on a market value of asset basis, and recognize that amount at the rate of 20% per year. Under this method, an investment gain or loss that occurs in a particular year will be fully recognized in the actuarial value of assets after five years. This asset method is also the most common asset valuation method used by large public retirement systems.

We recommend continued use of this asset smoothing method. However, we recommend a modification to the presentation of the smoothing method calculations in the valuation report to be consistent with the format that is commonly used by other Systems for increased transparency and comparability to stakeholders. This modification will not have a cost impact.

SECTION IV

ACTUARIAL IMPACT OF RECOMMENDATIONS

Fiscal Impact – KERS

($ thousands)

The following pages provide the actuarial impact of the recommended assumptions for each retirement system based on the June 30, 2018 actuarial valuation. In actuality, these recommended assumptions will be first used when preparing the June 30, 2019 actuarial valuation, which identifies the employer contribution requirements for the biennium period beginning July 1, 2020 and ending June 30, 2022 (FYE 2020/2021 and FYE 2022/2022).

For informational purposes, the tables show the changes in the contribution requirement, unfunded actuarial accrued liability, and funded ratio due to the recommended assumption changes. The exhibits identify the financial effect due to the change in mortality, individual salary increase assumption, and all other recommended assumptions. The mortality assumption and individual salary increase assumption are illustrated separately so stakeholders can identify the financial impact of these individual assumption changes on the liability and contributions. We believe the Board's decision about whether or not to adopt our recommendations should be based on the collective effect on the contribution rate or the actuarial liabilities. Stated another way, we do not recommend changes in individual assumptions be selectively picked based on their financial impact.

Fiscal Impact – KERS

($ thousands)

Pension

	KERS Non-Hazardous			
	Valuation 06/30/2018	Mortality Assumption Changes	Mortality and Salary Assumption Changes	All Assumption Changes
Employer Contribution Rate				
Normal Cost Rate and Admin Expense	8.0%	8.7%	8.6%	8.0%
UAAL	66.6%	70.1%	69.8%	70.0%
Total Employer Rate	74.5%	78.8%	78.4%	78.0%
Actuarial Accrued Liability	$ 15,675,232	$ 16,343,793	$ 16,296,449	$ 16,340,469
Actuarial Value of Assets	$ 2,019,278	$ 2,019,278	$ 2,019,278	$ 2,019,278
UAAL	$ 13,655,954	$ 14,324,515	$ 14,277,171	$ 14,321,191
Funded Ratio	12.9%	12.4%	12.4%	12.4%

	KERS Hazardous			
	Valuation 06/30/2018	Mortality Assumption Changes	Mortality and Salary Assumption Changes	All Assumption Changes
Employer Contribution Rate				
Normal Cost Rate and Admin Expense	9.2%	9.8%	10.0%	9.5%
UAAL	25.2%	27.2%	27.1%	27.7%
Total Employer Rate	34.4%	36.9%	37.1%	37.2%
Actuarial Accrued Liability	$ 1,151,923	$ 1,187,956	$ 1,186,212	$ 1,199,248
Actuarial Value of Assets	$ 639,262	$ 639,262	$ 639,262	$ 639,262
UAAL	$ 512,661	$ 548,694	$ 546,950	$ 559,986
Funded Ratio	55.5%	53.8%	53.9%	53.3%

Insurance

	KERS Non-Hazardous		
	Valuation 06/30/2018	Mortality Assumption Changes	All Assumption Changes
Employer Contribution Rate			
Normal Cost Rate and Admin Expense	2.5%	2.6%	2.4%
UAAL	8.2%	8.8%	8.8%
Total Employer Rate	10.7%	11.4%	11.2%
Actuarial Accrued Liability	$ 2,435,505	$ 2,535,588	$ 2,545,218
Actuarial Value of Assets	$ 887,121	$ 887,121	$ 887,121
UAAL	$ 1,548,384	$ 1,648,467	$ 1,658,097
Funded Ratio	36.4%	35.0%	34.9%

	KERS Hazardous		
	Valuation 06/30/2018	Mortality Assumption Changes	All Assumption Changes
Employer Contribution Rate			
Normal Cost Rate and Admin Expense	5.2%	5.5%	4.6%
UAAL	-6.1%	-5.4%	-5.3%
Total Employer Rate	0.0%	0.0%	0.0%
Actuarial Accrued Liability	$ 393,481	$ 405,719	$ 408,700
Actuarial Value of Assets	$ 511,441	$ 511,441	$ 511,441
UAAL	$ (117,960)	$ (105,722)	$ (102,741)
Funded Ratio	130.0%	126.1%	125.1%

Fiscal Impact – CERS

($ thousands)

Pension

	CERS Non-Hazardous			
	Valuation 06/30/2018	Mortality Assumption Changes	Mortality and Salary Assumption Changes	All Assumption Changes
Employer Contribution Rate				
Normal Cost Rate and Admin Expense	5.8%	6.2%	6.4%	6.8%
UAAL	16.7%	18.2%	18.2%	18.6%
Total Employer Rate	22.5%	24.5%	24.6%	25.4%
Actuarial Accrued Liability	$ 13,191,505	$ 13,718,916	$ 13,705,225	$ 13,852,607
Actuarial Value of Assets	$ 6,950,225	$ 6,950,225	$ 6,950,225	$ 6,950,225
UAAL	$ 6,241,280	$ 6,768,691	$ 6,755,000	$ 6,902,382
Funded Ratio	52.7%	50.7%	50.7%	50.2%

	CERS Hazardous			
	Valuation 06/30/2018	Mortality Assumption Changes	Mortality and Salary Assumption Changes	All Assumption Changes
Employer Contribution Rate				
Normal Cost Rate and Admin Expense	6.4%	6.8%	7.5%	11.9%
UAAL	30.6%	32.4%	32.7%	34.0%
Total Employer Rate	37.0%	39.1%	40.2%	45.9%
Actuarial Accrued Liability	$ 4,792,548	$ 4,923,349	$ 4,947,683	$ 5,024,284
Actuarial Value of Assets	$ 2,321,721	$ 2,321,721	$ 2,321,721	$ 2,321,721
UAAL	$ 2,470,827	$ 2,601,628	$ 2,625,962	$ 2,702,563
Funded Ratio	48.4%	47.2%	46.9%	46.2%

Insurance

	CERS Non-Hazardous		
	Valuation 06/30/2018	Mortality Assumption Changes	All Assumption Changes
Employer Contribution Rate			
Normal Cost Rate and Admin Expense	2.9%	3.1%	3.0%
UAAL	1.9%	2.3%	2.3%
Total Employer Rate	4.8%	5.4%	5.4%
Actuarial Accrued Liability	$ 3,092,624	$ 3,235,596	$ 3,253,448
Actuarial Value of Assets	$ 2,371,430	$ 2,371,430	$ 2,371,430
UAAL	$ 721,194	$ 864,166	$ 882,018
Funded Ratio	76.7%	73.3%	72.9%

	CERS Hazardous		
	Valuation 06/30/2018	Mortality Assumption Changes	All Assumption Changes
Employer Contribution Rate			
Normal Cost Rate and Admin Expense	4.4%	4.6%	6.1%
UAAL	5.1%	5.7%	5.6%
Total Employer Rate	9.5%	10.3%	11.7%
Actuarial Accrued Liability	$ 1,684,028	$ 1,727,549	$ 1,714,583
Actuarial Value of Assets	$ 1,256,306	$ 1,256,306	$ 1,256,306
UAAL	$ 427,722	$ 471,243	$ 458,277
Funded Ratio	74.6%	72.7%	73.3%

Note: Contribution rates shown for CERS are without regard to the phase-in provision.

Fiscal Impact – SPRS

($ thousands)

Pension

	SPRS			
	Valuation 06/30/2018	Mortality Assumption Changes	Mortality and Salary Assumption Changes	All Assumption Changes
Employer Contribution Rate				
Normal Cost Rate and Admin Expense	15.8%	16.8%	17.6%	20.4%
UAAL	104.7%	110.1%	110.7%	111.4%
Total Employer Rate	120.5%	126.9%	128.3%	131.7%
Actuarial Accrued Liability	$ 989,528	$ 1,023,694	$ 1,026,990	$ 1,029,639
Actuarial Value of Assets	$ 268,259	$ 268,259	$ 268,259	$ 268,259
UAAL	$ 721,269	$ 755,435	$ 758,731	$ 761,380
Funded Ratio	27.1%	26.2%	26.1%	26.1%

Insurance

	SPRS		
	Valuation 06/30/2018	Mortality Assumption Changes	All Assumption Changes
Employer Contribution Rate			
Normal Cost Rate and Admin Expense	8.1%	8.3%	8.9%
UAAL	11.4%	12.7%	12.5%
Total Employer Rate	19.5%	21.0%	21.3%
Actuarial Accrued Liability	$ 262,088	$ 269,095	$ 267,508
Actuarial Value of Assets	$ 187,535	$ 187,535	$ 187,535
UAAL	$ 74,553	$ 81,560	$ 79,973
Funded Ratio	71.6%	69.7%	70.1%

SECTION V

SUMMARY OF NEW ASSUMPTIONS – KERS

Kentucky Employees Retirement System
Summary of Actuarial Methods and Assumptions

The following presents a summary of the actuarial assumptions and methods used in the valuation of the Kentucky Employees Retirement System.

Investment return rate:

Assumed annual rate of 5.25% net of investment expenses for the non-hazardous retirement fund
Assumed annual rate of 6.25% net of investment expenses for the hazardous retirement fund, non-hazardous insurance fund, and hazardous insurance fund

Price Inflation:

Assumed annual rate of 2.30%

Rates of Annual Salary Increase:

Assumed rates of annual salary increases are shown below.

Service Years	Annual Rates of Salary Increases					
	Merit & Seniority		Price Inflation & Productivity		Total Increase	
	Non-Hazardous	Hazardous	Non-Hazardous	Hazardous	Non-Hazardous	Hazardous
0	12.00%	16.50%	3.30%	3.55%	15.30%	20.05%
1	3.50%	4.00%	3.30%	3.55%	6.80%	7.55%
2	2.75%	3.00%	3.30%	3.55%	6.05%	6.55%
3	2.50%	3.00%	3.30%	3.55%	5.80%	6.55%
4	2.00%	2.00%	3.30%	3.55%	5.30%	5.55%
5	1.50%	1.50%	3.30%	3.55%	4.80%	5.05%
6	1.25%	1.00%	3.30%	3.55%	4.55%	4.55%
7	1.00%	0.50%	3.30%	3.55%	4.30%	4.05%
8	0.75%	0.50%	3.30%	3.55%	4.05%	4.05%
9	0.50%	0.00%	3.30%	3.55%	3.80%	3.55%
10	0.50%	0.00%	3.30%	3.55%	3.80%	3.55%
11 & Over	0.00%	0.00%	3.30%	3.55%	3.30%	3.55%

Kentucky Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Retirement rates:

Assumed annual rates of retirement are shown below. Rates are only applicable for members who are eligible for a service retirement.

	Non-Hazardous					Hazardous			
	Normal Retirement		Early Retirement[1]			Members participating before 9/1/2008[2]		Members participating between 9/1/2008 and 1/1/2014[3]	Members participating after 1/1/2014[3]
Age	Male	Female	Male	Female	Service	Age 55-61	Age 62+		
Under 45	20.0%	33.0%			5	10.0%	35.0%		
45	21.0%	33.0%			6	10.0%	35.0%		
46	22.0%	33.0%			7	10.0%	35.0%		
47	23.0%	33.0%			8	10.0%	35.0%		
48	24.0%	33.0%			9	10.0%	35.0%		
49	25.0%	33.0%			10	10.0%	35.0%		
50	26.0%	33.0%			11	10.0%	35.0%		
51	27.0%	33.0%			12	10.0%	35.0%		
52	28.0%	33.0%			13	10.0%	35.0%		
53	29.0%	33.0%			14	10.0%	35.0%		
54	30.0%	33.0%			15	10.0%	35.0%		
55	30.0%	33.0%	5.0%	5.0%	16	10.0%	35.0%		
56	30.0%	33.0%	5.0%	5.0%	17	10.0%	35.0%		
57	30.0%	33.0%	5.0%	5.0%	18	10.0%	35.0%		
58	30.0%	33.0%	5.0%	5.0%	19	10.0%	35.0%		
59	30.0%	33.0%	5.0%	5.0%	20	50.0%	50.0%		
60	30.0%	33.0%	5.0%	8.0%	21	32.0%	32.0%		
61	30.0%	33.0%	8.0%	9.0%	22	32.0%	32.0%		
62	35.0%	35.0%	15.0%	20.0%	23	32.0%	32.0%		
63	30.0%	33.0%	15.0%	18.0%	24	32.0%	32.0%		
64	30.0%	33.0%	15.0%	16.0%	25	32.0%	32.0%	25.6%	16.0%
65	30.0%	33.0%			26	32.0%	32.0%	25.6%	16.0%
66	30.0%	33.0%			27	32.0%	32.0%	25.6%	16.0%
67	30.0%	33.0%			28	32.0%	32.0%	25.6%	16.0%
68	30.0%	33.0%			29	32.0%	32.0%	25.6%	16.0%
69	30.0%	33.0%			30	32.0%	32.0%	25.6%	100.0%
70	30.0%	33.0%							
71	30.0%	33.0%							
72	30.0%	33.0%							
73	30.0%	33.0%							
74	30.0%	33.0%							
75	100.0%	100.0%							

[1] The annual rate of retirement is 12% for male members and 14% for female members with 25-26 years of service.
[2] The annual rate of retirement is 100% at age 65.
[3] The annual rate of retirement is 100% at age 60.
Non-Hazardous System: For members hired after 7/1/2003, the rates shown above that are prior to age 65 are multiplied by 80% to reflect the different retiree health insurance benefit.
Hazardous System: For members hired after 7/1/2003 and prior to 9/1/2008, the rates shown above that are prior the member's assumed maximum retirement age multiplied by 80% to reflect the different retiree health insurance benefit.

Kentucky Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Disability rates:

An abbreviated table with assumed rates of disability is shown below.

Age	Non-Hazardous		Hazardous	
	Male	Female	Male	Female
20	0.03%	0.03%	0.05%	0.05%
30	0.06%	0.06%	0.08%	0.08%
40	0.12%	0.12%	0.18%	0.18%
50	0.34%	0.34%	0.50%	0.50%
60	0.88%	0.88%	1.32%	1.32%

Withdrawal rates (for causes other than death, disability or retirement):

Assumed annual rates of withdrawal are shown below and are prior to offset for pre-retirement mortality.

Service	Annual Rates of Withdrawal	
Years	Non-Hazardous	Hazardous
1	20.00%	25.00%
2	16.45%	19.68%
3	13.39%	15.12%
4	11.61%	12.45%
5	10.34%	10.56%
6	9.35%	9.09%
7	8.55%	7.89%
8	7.87%	6.87%
9	7.28%	5.99%
10	6.76%	5.22%
11	6.30%	4.53%
12	5.88%	3.90%
13	5.49%	3.33%
14	5.14%	2.80%
15	4.81%	2.31%
16	4.51%	1.86%
17	4.22%	1.43%
18	3.96%	1.03%
19	3.70%	0.66%
20	3.47%	0.30%
21	3.24%	0.00%
22	3.02%	0.00%
23	2.82%	0.00%
24	2.62%	0.00%
25	2.43%	0.00%

Kentucky Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Mortality Assumption:

Pre-retirement mortality: PUB-2010 General Mortality table, for the Non-Hazardous System, and the PUB-2010 Public Safety Mortality table for the Hazardous System, projected with the ultimate rates from the MP-2014 mortality improvement scale using a base year of 2010.

Post-retirement mortality (non-disabled): System-specific mortality table based on mortality experience from 2013-2018, projected with the ultimate rates from MP-2014 mortality improvement scale using a base year of 2019.

The following table provides the life expectancy for a non-disabled retiree in future years based on the assumption with full generational projection:

Life Expectancy for an Age 65 Retiree in Years					
Gender	**Year of Retirement**				
	2020	**2025**	**2030**	**2035**	**2040**
Male	21.0	21.4	21.8	22.2	22.6
Female	24.0	24.4	24.8	25.2	25.6

Post-retirement mortality (disabled): PUB-2010 Disabled Mortality table, with a 4-year set-forward for both male and female rates, projected with the ultimate rates from the MP-2014 mortality improvement scale using a base year of 2010.

Marital status:

100% of employees are assumed to be married, with the female spouse 3 years younger than the male spouse.

Line of Duty Disability

Non-Hazardous: 2% of disabilities are assumed to occur in the line of duty

Hazardous: 10% of disabilities are assumed to occur in the line of duty

Line of Duty Death

25% of deaths are assumed to occur in the line of duty

Kentucky Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Dependent Children:

For members in the Hazardous Plan who receive a duty-related death benefit, the member is assumed to be survived by two dependent children, each age 6 with payments for 15 years.

Form of Payment:

Members are assumed to elect a life-only annuity at retirement.

Actuarial Cost Method:

Entry Age Normal, Level Percentage of Pay. The Entry Age Normal actuarial cost method allocates the System's actuarial present value of future benefits to various periods based upon service. The portion of the present value of future benefits allocated to years of service prior to the valuation date is the actuarial accrued liability, and the portion allocated to years following the valuation date is the present value of future normal costs. The normal cost is determined for each active member as the level percent of pay necessary to fully fund the expected benefits to be earned over the career of each individual active member. The normal cost is partially funded with active member contributions with the remainder funded by employer contributions.

Health Care Age Related Morbidity/Claims Utilization:

To model the impact of aging on the underlying health care costs for Medicare retirees, the valuation relied on the Society of Actuaries' 2013 Study "Health Care Costs – From Birth to Death". Table 4 (Development of Plan Specific Medicare Age Curve) was used to model the impact of aging for ages 65 and over.

Kentucky Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Health Care Cost Trend Rates[1]*:*

January 1	Non-Medicare Plans	Medicare Plans	Dollar Contribution[2]
2020	7.00%	5.00%	1.50%
2021	6.75%	4.90%	1.50%
2022	6.50%	4.80%	1.50%
2023	6.25%	4.70%	1.50%
2024	6.00%	4.60%	1.50%
2025	5.75%	4.50%	1.50%
2026	5.50%	4.40%	1.50%
2027	5.25%	4.30%	1.50%
2028	5.00%	4.20%	1.50%
2029	4.75%	4.10%	1.50%
2030	4.50%	4.05%	1.50%
2031	4.25%	4.05%	1.50%
2032 & Beyond	4.05%	4.05%	1.50%

[1]All increases are assumed to occur on January 1. The 2019 premiums were known at the time of the valuation and were incorporated into the liability measurement.

[2]Applies to members participating on or after July 1, 2003

Health care trend assumptions are based on the model issued by the Society of Actuaries "Getzen model of Long-Run Medical Cost Trends for the SOA; Thomas E. Getzen, iHEA and Temple University 2014 © Society of Actuaries.

The underlying assumptions used to develop the health care trend rates include:

- A short run period-this is a period for which anticipated health care trend rates are manually set based on local information as well as plan-specific and carrier information.
- Long-term real GDP growth – 1.75%
- Long-term rate of inflation – 2.30%
- Long-term nominal GDP growth – 4.05%
- Year that excess rate converges to 0 – 15 years from the valuation

Health care trend rates are thus the manually set rates for the short run period and rates which decline to an ultimate trend rate which equals the assumed nominal long-term GDP growth rate.

Kentucky Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Health Care Participation Assumptions:

- Members are assumed to elect health coverage at retirement at the following participation rates.

Service at Retirement	Members participating before 7/1/2003*	Members participating after 7/1/2003
Under 10	50%	100%
10-14	75%	100%
15-19	90%	100%
Over 20	100%	100%

* 100% of members with a duty disability or a duty death (in service) benefit are assumed to elect coverage at retirement.

- Future retirees are assumed to have a similar distribution by plan type as the current retirees.

Medicare Plan	Participation Percentage
Medical Only	7%
Essential	8%
Premium	85%

Non-Medicare Plan	Participation Percentage
LivingWell Limited	2%
LivingWell Basic	13%
LivingWell CDHP	27%
LivingWell PPO	58%

- 50% of deferred vested members participating before July 1, 2003 are assumed to elect health coverage at retirement. 100% of deferred vested members participating after July 1, 2003 are assumed to elect health coverage at retirement. Deferred vested members with non-hazardous service are assumed to begin health coverage at age 55 for members participating before September 1, 2008, and at age 60 for members participating on or after September 1, 2008. Deferred vested members with hazardous service are assumed to begin health coverage at age 50.

- 50% of future retirees, with hazardous service, are assumed to elect spouse health care coverage. No dependent coverage is assumed for members who only have non-hazardous service. 100% of spouses with health care coverage are assumed to continue coverage after the member's death.

Excise ("Cadillac") Tax:

For taxable years beginning after December 31, 2021, a 40% excise tax will be required to be paid (by the employer and/or insurer) on the aggregate cost of the health plan in excess of certain legislated thresholds. For 2018, the thresholds are $850 per month for individual coverage and $2,292 per month for family coverage.
Both Actuarial Standard of Practice No. 6 and GASB Statement Nos. 74 and 75 reference this tax, and, in accordance with these standards an estimate of the impact of the Cadillac tax has been included in this valuation.

Assumptions and methods used to determine the impact of the Cadillac Tax include:

- 2018 thresholds of $850/$2,292 were indexed annually by 2.30%.
- Premium data submitted was not adjusted for permissible exclusions to the Cadillac Tax.
- There were no special adjustments to the dollar limit other than those permissible for non-Medicare retirees over 55.

In this valuation, the impact of the Cadillac Tax has been calculated by increasing the employer paid premiums for Non-Medicare retirees, who became participants before July 1, 2003, by 3.6%. Non-Medicare retirees who became participants after July 1, 2003 receive dollar subsidies per year of service, which are not expected to exceed the overall Non-Medicare premiums. As a result, the costs attributable to the Cadillac Tax for members who became participants after July 1, 2003 will be paid by the retirees.

Kentucky Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Other Assumptions

1. Valuation payroll (used for determining the amortization contribution rate): Current fiscal year payroll.

2. Individual salaries used to project benefits: Actual salaries from the past fiscal year are used to determine the final average salary as of the valuation date. For future salaries, the salary from the last fiscal year is projected forward with one year's salary scale.

3. Pay increase timing: Beginning of (fiscal) year. This is equivalent to assuming that reported salaries represent amounts paid to members during the year ended on the valuation date.

4. Percent electing annuity on death (when eligible): All of the spouses of vested, married participants are assumed to elect an immediate life annuity.

5. Inactive Population: All non-vested members are assumed to take an immediate refund. Vested members are assumed to elect a refund at the time of their termination if the value of their account balance exceeds the present value of their deferral benefit.

6. There will be no recoveries once disabled.

7. Decrement timing: Decrements of all types are assumed to occur mid-year.

8. Eligibility testing: Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.

9. Decrement relativity: Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.

10. Incidence of Contributions: Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made.

11. Service: All members are assumed to accrue 1 year of benefit and eligibility service each year.

12. Payroll Growth Assumption: In determining the level percent of payroll amortization rate, payroll is assumed to grow annually at 0.00% percent for the Non-Hazardous and Hazardous systems.

13. Cash Balance Interest Crediting Rate: The cash balance interest crediting rate assumption for years after the valuation date is equal to 4.9375% for the Non-Hazardous System and 5.6875% for the Hazardous System.

Kentucky Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Participant Data

Participant data was supplied in electronic text files. There were separate files for (i) active and inactive members, and (ii) members and beneficiaries receiving benefits.

The data for active members included birthdate, gender, service with the current city and total vesting service, salary, and employee contribution account balances. For retired members and beneficiaries, the data included date of birth, gender, spouse's date of birth (where applicable), amount of monthly benefit, date of retirement, and form of payment code.

Salary supplied for the current year was based on the annualized earnings for the year preceding the valuation date.

Assumptions were made to correct for missing, bad, or inconsistent data. These had no material impact on the results presented.

Changes from the June 30, 2018 Valuation

- Annual salary increases were updated based on the 2018 Experience Study
- Annual rates of retirement, disability, withdrawal, and mortality were updated based on the 2018 Experience Study
- The percent of disabilities assumed to occur in the line of duty was updated from 0% to 2% for non-hazardous members and 10% for hazardous members

SECTION VI

SUMMARY OF NEW ASSUMPTIONS – CERS

County Employees Retirement System
Summary of Actuarial Methods and Assumptions

The following presents a summary of the actuarial assumptions and methods used in the valuation of the County Employees Retirement System.

Investment return rate:

Assumed annual rate of 6.25% net of investment expenses for the retirement funds and the insurance funds

Price Inflation:

Assumed annual rate of 2.30%

Rates of Annual Salary Increase:

Assumed rates of annual salary increases are shown below.

Service Years	Annual Rates of Salary Increases					
	Merit & Seniority		Price Inflation & Productivity		Total Increase	
	Non-Hazardous	Hazardous	Non-Hazardous	Hazardous	Non-Hazardous	Hazardous
0	7.00%	15.50%	3.30%	3.55%	10.30%	19.05%
1	4.00%	4.00%	3.30%	3.55%	7.30%	7.55%
2	3.00%	2.00%	3.30%	3.55%	6.30%	5.55%
3	1.50%	1.25%	3.30%	3.55%	4.80%	4.80%
4	1.25%	1.00%	3.30%	3.55%	4.55%	4.55%
5	1.25%	1.00%	3.30%	3.55%	4.55%	4.55%
6	1.00%	1.00%	3.30%	3.55%	4.30%	4.55%
7	1.00%	0.50%	3.30%	3.55%	4.30%	4.05%
8	0.75%	0.50%	3.30%	3.55%	4.05%	4.05%
9	0.75%	0.00%	3.30%	3.55%	4.05%	3.55%
10	0.50%	0.00%	3.30%	3.55%	3.80%	3.55%
11	0.50%	0.00%	3.30%	3.55%	3.80%	3.55%
12	0.25%	0.00%	3.30%	3.55%	3.55%	3.55%
13	0.25%	0.00%	3.30%	3.55%	3.55%	3.55%
14	0.25%	0.00%	3.30%	3.55%	3.55%	3.55%
15 & Over	0.00%	0.00%	3.30%	3.55%	3.30%	3.55%

County Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Retirement rates:

Assumed annual rates of retirement are shown below. Rates are only applicable for members who are eligible for a service retirement.

	Non-Hazardous					Hazardous		
	Normal Retirement		Early Retirement[1]			Members participating before 9/1/2008[2]	Members participating between 9/1/2008 and 1/1/2014[3]	Members participating after 1/1/2014[3]
Age	Male	Female	Male	Female	Service			
Under 45	35.0%	27.0%			5	17.0%		
45	35.0%	27.0%			6	17.0%		
46	35.0%	27.0%			7	17.0%		
47	35.0%	27.0%			8	17.0%		
48	35.0%	27.0%			9	17.0%		
49	35.0%	27.0%			10	17.0%		
50	30.0%	27.0%			11	17.0%		
51	30.0%	27.0%			12	17.0%		
52	30.0%	27.0%			13	17.0%		
53	30.0%	27.0%			14	17.0%		
54	30.0%	27.0%			15	17.0%		
55	30.0%	27.0%	4.0%	5.0%	16	17.0%		
56	30.0%	27.0%	4.0%	5.0%	17	17.0%		
57	30.0%	27.0%	4.0%	5.0%	18	17.0%		
58	30.0%	27.0%	4.0%	5.0%	19	17.0%		
59	30.0%	27.0%	4.0%	5.0%	20	30.0%		
60	30.0%	27.0%	4.0%	8.0%	21	22.5%		
61	30.0%	27.0%	4.0%	9.0%	22	18.0%		
62	30.0%	40.0%	15.0%	20.0%	23	21.0%		
63	30.0%	35.0%	15.0%	18.0%	24	24.0%		
64	30.0%	30.0%	15.0%	16.0%	25	27.0%	21.6%	16.0%
65	30.0%	30.0%			26	30.0%	24.0%	16.0%
66	30.0%	27.0%			27	33.0%	26.4%	16.0%
67	30.0%	27.0%			28	36.0%	28.8%	16.0%
68	30.0%	27.0%			29	39.0%	31.2%	16.0%
69	30.0%	27.0%			30	39.0%	31.2%	100.0%
70	30.0%	27.0%						
71	30.0%	27.0%						
72	30.0%	27.0%						
73	30.0%	27.0%						
74	30.0%	27.0%						
75	100.0%	100.0%						

[1] *The annual rate of retirement is 11% for male members and 12% for female members with 25-26 years of service.*
[2] *The annual rate of retirement is 100% at age 62.*
[3] *The annual rate of retirement is 100% at age 60.*
Non-Hazardous System: For members hired after 7/1/2003, the rates shown above that are prior to age 65 are multiplied by 80% to reflect the different retiree health insurance benefit.

Hazardous System: For members hired after 7/1/2003 and prior to 9/1/2008, the rates shown above that are prior the member's assumed maximum retirement age multiplied by 80% to reflect the different retiree health insurance benefit.

County Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Disability rates:

An abbreviated table with assumed rates of disability is shown below.

Age	Non-Hazardous		Hazardous	
	Male	Female	Male	Female
20	0.04%	0.04%	0.07%	0.07%
30	0.06%	0.06%	0.12%	0.12%
40	0.14%	0.14%	0.26%	0.26%
50	0.39%	0.39%	0.73%	0.73%
60	1.02%	1.02%	1.90%	1.90%

Withdrawal rates (for causes other than death, disability or retirement):

Assumed annual rates of withdrawal are shown below and are prior to offset for pre-retirement mortality.

Service	Annual Rates of Withdrawal	
Years	Non-Hazardous	Hazardous
1	20.00%	20.00%
2	15.58%	9.11%
3	12.48%	7.24%
4	10.66%	6.14%
5	9.37%	5.37%
6	8.37%	4.76%
7	7.56%	4.27%
8	6.87%	3.85%
9	6.27%	3.49%
10	5.74%	3.18%
11	5.27%	2.89%
12	4.84%	2.63%
13	4.45%	2.40%
14	4.09%	2.18%
15	3.76%	1.98%
16	3.45%	1.80%
17	3.16%	1.62%
18	2.89%	1.46%
19	2.64%	1.30%
20	2.39%	1.16%
21	2.16%	0.00%
22	1.94%	0.00%
23	1.74%	0.00%
24	1.54%	0.00%
25	1.35%	0.00%
26	0.00%	0.00%

County Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Mortality Assumption:

Pre-retirement mortality: PUB-2010 General Mortality table, for the Non-Hazardous System, and the PUB-2010 Public Safety Mortality table for the Hazardous System, projected with the ultimate rates from the MP-2014 mortality improvement scale using a base year of 2010.

Post-retirement mortality (non-disabled): System-specific mortality table based on mortality experience from 2013-2018, projected with the ultimate rates from the MP-2014 mortality improvement scale using a base year of 2019.

The following table provides the life expectancy for a non-disabled retiree in future years based on the assumption with full generational projection:

Life Expectancy for an Age 65 Retiree in Years					
Gender	**Year of Retirement**				
	2020	**2025**	**2030**	**2035**	**2040**
Male	21.0	21.4	21.8	22.2	22.6
Female	24.0	24.4	24.8	25.2	25.6

Post-retirement mortality (disabled): PUB-2010 Disabled Mortality table, with a 4-year set-forward for both male and female rates, projected with the ultimate rates from the MP-2014 mortality improvement scale using a base year of 2010.

Marital status:

100% of employees are assumed to be married, with the female spouse 3 years younger than the male spouse.

Line of Duty Disability

Non-Hazardous: 2% of disabilities are assumed to occur in the line of duty

Hazardous: 50% of disabilities are assumed to occur in the line of duty

Line of Duty Death

25% of deaths are assumed to occur in the line of duty

County Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Dependent Children:

For members in the Hazardous Plan who receive a duty-related death benefit, the member is assumed to be survived by two dependent children, each age 6 with payments for 15 years.

Form of Payment:

Members are assumed to elect a life-only annuity at retirement.

Actuarial Cost Method:

Entry Age Normal, Level Percentage of Pay. The Entry Age Normal actuarial cost method allocates the System's actuarial present value of future benefits to various periods based upon service. The portion of the present value of future benefits allocated to years of service prior to the valuation date is the actuarial accrued liability, and the portion allocated to years following the valuation date is the present value of future normal costs. The normal cost is determined for each active member as the level percent of pay necessary to fully fund the expected benefits to be earned over the career of each individual active member. The normal cost is partially funded with active member contributions with the remainder funded by employer contributions.

Health Care Age Related Morbidity/Claims Utilization:

To model the impact of aging on the underlying health care costs for Medicare retirees, the valuation relied on the Society of Actuaries' 2013 Study "Health Care Costs – From Birth to Death". Table 4 (Development of Plan Specific Medicare Age Curve) was used to model the impact of aging for ages 65 and over.

County Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Health Care Cost Trend Rates[1]*:*

January 1	Non-Medicare Plans	Medicare Plans	Dollar Contribution[2]
2020	7.00%	5.00%	1.50%
2021	6.75%	4.90%	1.50%
2022	6.50%	4.80%	1.50%
2023	6.25%	4.70%	1.50%
2024	6.00%	4.60%	1.50%
2025	5.75%	4.50%	1.50%
2026	5.50%	4.40%	1.50%
2027	5.25%	4.30%	1.50%
2028	5.00%	4.20%	1.50%
2029	4.75%	4.10%	1.50%
2030	4.50%	4.05%	1.50%
2031	4.25%	4.05%	1.50%
2032 & Beyond	4.05%	4.05%	1.50%

[1]All increases are assumed to occur on January 1. The 2019 premiums were known at the time of the valuation and were incorporated into the liability measurement.

[2]Applies to members participating on or after July 1, 2003

Health care trend assumptions are based on the model issued by the Society of Actuaries "Getzen model of Long-Run Medical Cost Trends for the SOA; Thomas E. Getzen, iHEA and Temple University 2014 © Society of Actuaries.

The underlying assumptions used to develop the health care trend rates include:

- A short run period – this is a period for which anticipated health care trend rates are manually set based on local information as well as plan-specific and carrier information.
- Long-term real GDP growth – 1.75%
- Long-term rate of inflation – 2.30%
- Long-term nominal GDP growth – 4.05%
- Year that excess rate converges to 0 – 15 years from the valuation

Health care trend rates are thus the manually set rates for the short run period and rates which decline to an ultimate trend rate which equals the assumed nominal long-term GDP growth rate.

County Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Health Care Participation Assumptions:

- Members are assumed to elect health coverage at retirement at the following participation rates.

Service at Retirement	Members participating before 7/1/2003*	Members participating after 7/1/2003
Under 10	50%	100%
10-14	75%	100%
15-19	90%	100%
Over 20	100%	100%

* 100% of members with a duty disability or a duty death (in service) benefit are assumed to elect coverage at retirement.

- Future retirees are assumed to have a similar distribution by plan type as the current retirees.

Medicare Plan	Participation Percentage
Medical Only	7%
Essential	8%
Premium	85%

Non-Medicare Plan	Participation Percentage
LivingWell Limited	2%
LivingWell Basic	13%
LivingWell CDHP	27%
LivingWell PPO	58%

County Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

- 50% of deferred vested members participating before July 1, 2003 are assumed to elect health coverage at retirement. 100% of deferred vested members participating after July 1, 2003 are assumed to elect health coverage at retirement. Deferred vested members with non-hazardous service are assumed to begin health coverage at age 55 for members participating before September 1, 2008, and at age 60 for members participating on or after September 1, 2008. Deferred vested members with hazardous service are assumed to begin health coverage at age 50.

- 75% of future retirees, with hazardous service, are assumed to elect spouse health care coverage. No dependent coverage is assumed for members who only have non-hazardous service. 100% of spouses with health care coverage are assumed to continue coverage after the member's death.

Excise ("Cadillac") Tax:

For taxable years beginning after December 31, 2021, a 40% excise tax will be required to be paid (by the employer and/or insurer) on the aggregate cost of the health plan in excess of certain legislated thresholds. For 2018, the thresholds are $850 per month for individual coverage and $2,292 per month for family coverage.

Both Actuarial Standard of Practice No. 6 and GASB Statement Nos. 74 and 75 reference this tax, and, in accordance with these standards an estimate of the impact of the Cadillac tax has been included in this valuation.

Assumptions and methods used to determine the impact of the Cadillac Tax include:

- 2018 thresholds of $850/$2,292 were indexed annually by 2.30%.
- Premium data submitted was not adjusted for permissible exclusions to the Cadillac Tax.
- There were no special adjustments to the dollar limit other than those permissible for non-Medicare retirees over 55.

In this valuation, the impact of the Cadillac Tax has been calculated by increasing the employer paid premiums for Non-Medicare retirees, who became participants before July 1, 2003, by 3.6%. Non-Medicare retirees who became participants after July 1, 2003 receive dollar subsidies per year of service, which are not expected to exceed the overall Non-Medicare premiums. As a result, the costs attributable to the Cadillac Tax for members who became participants after July 1, 2003 will be paid by the retirees.

County Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Other Assumptions

1. Valuation payroll (used for determining the amortization contribution rate): Current fiscal year payroll.

2. Individual salaries used to project benefits: Actual salaries from the past fiscal year are used to determine the final average salary as of the valuation date. For future salaries,the salary from the last fiscal year is projected forward with one year's salary scale.

3. Pay increase timing: Beginning of (fiscal) year. This is equivalent to assuming that reported salaries represent amounts paid to members during the year ended on the valuation date.

4. Percent electing annuity on death (when eligible): All of the spouses of vested, married participants are assumed to elect an immediate life annuity.

5. Inactive Population: All non-vested members are assumed to take an immediate refund. Vested members are assumed to elect a refund at the time of their termination if the value of their account balance exceeds the present value of their deferral benefit.

6. There will be no recoveries once disabled.

7. Decrement timing: Decrements of all types are assumed to occur mid-year.

8. Eligibility testing: Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.

9. Decrement relativity: Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.

10. Incidence of Contributions: Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made.

11. Service: All members are assumed to accrue 1 year of benefit and eligibility service each year.

12. Payroll Growth Assumption: In determining the level percent of payroll amortization rate, payroll is assumed to grow annually at 2.00% percent for the Non-Hazardous and Hazardous systems.

13. Cash Balance Interest Crediting Rate: The cash balance interest crediting rate assumption for years after the valuation date is equal to 5.6875% for the Non-Hazardous and Hazardous Systems.

County Employees Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Participant Data

Participant data was supplied in electronic text files. There were separate files for (i) active and inactive members, and (ii) members and beneficiaries receiving benefits.

The data for active members included birthdate, gender, service with the current city and total vesting service, salary, and employee contribution account balances. For retired members and beneficiaries, the data included date of birth, gender, spouse's date of birth (where applicable), amount of monthly benefit, date of retirement, and form of payment code.

Salary supplied for the current year was based on the annualized earnings for the year preceding the valuation date.

Assumptions were made to correct for missing, bad, or inconsistent data. These had no material impact on the results presented.

Changes from the June 30, 2018 Valuation

- Annual salary increases were updated based on the 2018 Experience Study
- Annual rates of retirement, disability, withdrawal, and mortality were updated based on the 2018 Experience Study
- The percent of disabilities assumed to occur in the line of duty was updated from 0% to 2% for non-hazardous members and 50% for hazardous members

SECTION VII

SUMMARY OF NEW ASSUMPTIONS – SPRS

State Police Retirement System
Summary of Actuarial Methods and Assumptions

The following presents a summary of the actuarial assumptions and methods used in the valuation of the State Police Retirement System.

Investment return rate:

Assumed annual rate of 5.25% net of investment expenses for the retirement fund

Assumed annual rate of 6.25% net of investment expenses for the insurance fund

Price Inflation:

Assumed annual rate of 2.30%

Rates of Annual Salary Increase:

Assumed rates of annual salary increases are shown below.

	Annual Rates of Salary Increases		
Service Years	Merit & Seniority	Price Inflation & Productivity	Total Increase
0	12.50%	3.55%	16.05%
1	5.00%	3.55%	8.55%
2	4.00%	3.55%	7.55%
3	2.00%	3.55%	5.55%
4	2.00%	3.55%	5.55%
5	2.00%	3.55%	5.55%
6	2.00%	3.55%	5.55%
7	1.00%	3.55%	4.55%
8	1.00%	3.55%	4.55%
9	0.00%	3.55%	3.55%
10 & over	0.00%	3.55%	3.55%

State Police Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Retirement rates:

Assumed annual rates of retirement are shown below. Rates are only applicable for members who are eligible for a service retirement.

Service	Members participating before 9/1/2008[1]	Members participating between 9/1/2008 and 1/1/2014[2]	Members participating after 1/1/2014[2]
20	22.0%		
21	22.0%		
22	22.0%		
23	28.0%		
24	28.0%		
25	28.0%	17.6%	16.0%
26	28.0%	17.6%	16.0%
27	28.0%	17.6%	16.0%
28	44.0%	22.4%	16.0%
29	44.0%	22.4%	16.0%
30	44.0%	22.4%	100.0%
31	58.0%	22.4%	
32	58.0%	22.4%	
33	58.0%	35.2%	
34	58.0%	35.2%	
35	58.0%	35.2%	
36	58.0%	46.4%	
37	58.0%	46.4%	
38	58.0%	46.4%	
39	58.0%	46.4%	
40	58.0%	46.4%	

[1] *The annual rate of service retirement is 100% at age 55.*

[2] *The annual rate of service retirement is 100% at age 60.*

For members hired after 7/1/2003 and prior to 9/1/2008, the rates shown above that are prior the member's assumed maximum retirement age multiplied by 80% to reflect the different retiree health insurance benefit.

State Police Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Disability rates:

An abbreviated table with assumed rates of disability is shown below.

Age	Annual Rates of Disability	
	Male	Female
20	0.05%	0.05%
30	0.09%	0.09%
40	0.20%	0.20%
50	0.56%	0.56%
60	1.46%	1.46%

Withdrawal rates (for causes other than disability or retirement):

Assumed annual rates of withdrawal are shown below and are prior to offset for pre-retirement mortality.

Service	Annual Rates of Withdrawal
1	15.00%
2	4.82%
3	3.76%
4	3.15%
5	2.71%
6	2.37%
7	2.09%
8	1.86%
9	1.66%
10	1.48%
11	1.32%
12	1.17%
13	1.04%
14	0.92%
15	0.80%
16	0.70%
17	0.60%
18	0.51%
19	0.42%
20	0.34%

State Police Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Mortality Assumption:

Pre-retirement mortality: PUB-2010 Public Safety Mortality, projected with the ultimate rates from the MP-2014 mortality improvement scale using a base year of 2010.

Post-retirement mortality (non-disabled): System-specific mortality table based on mortality experience from 2013-2018, projected with the ultimate rates from the MP-2014 mortality improvement scale using a base year of 2019.

The following table provides the life expectancy for a non-disabled retiree in future years based on the assumption with full generational projection:

Life Expectancy for an Age 65 Retiree in Years					
Gender	**Year of Retirement**				
	2020	**2025**	**2030**	**2035**	**2040**
Male	21.0	21.4	21.8	22.2	22.6
Female	24.0	24.4	24.8	25.2	25.6

Post-retirement mortality (disabled): PUB-2010 Disabled Mortality table, with a 4-year set-forward for both male and female rates, projected with the ultimate rates from the mortality improvement scale using a base year of 2010.

Marital status:

100% of employees are assumed to be married, with the female spouse 3 years younger than the male spouse.

Line of Duty Disability

70% of disabilities are assumed to occur in the line of duty

Line of Duty Death

25% of deaths are assumed to occur in the line of duty

State Police Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Dependent Children:

For members in the Hazardous Plan who receive a duty-related death benefit, the member is assumed to be survived by two dependent children, each age 6 with payments for 15 years.

Form of Payment:

Members are assumed to elect a life-only annuity at retirement.

Actuarial Cost Method:

Entry Age Normal, Level Percentage of Pay. The Entry Age Normal actuarial cost method allocates the System's actuarial present value of future benefits to various periods based upon service. The portion of the present value of future benefits allocated to years of service prior to the valuation date is the actuarial accrued liability, and the portion allocated to years following the valuation date is the present value of future normal costs. The normal cost is determined for each active member as the level percent of pay necessary to fully fund the expected benefits to be earned over the career of each individual active member. The normal cost is partially funded with active member contributions with the remainder funded by employer contributions.

Health Care Age Related Morbidity/Claims Utilization:

To model the impact of aging on the underlying health care costs for Medicare retirees, the valuation relied on the Society of Actuaries' 2013 Study "Health Care Costs – From Birth to Death". Table 4 (Development of Plan Specific Medicare Age Curve) was used to model the impact of aging for ages 65 and over.

State Police Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Health Care Cost Trend Rates[1]*:*

Year	Non-Medicare Plans	Medicare Plans	Dollar Contribution[2]
2020	7.00%	5.00%	1.50%
2021	6.75%	4.90%	1.50%
2022	6.50%	4.80%	1.50%
2023	6.25%	4.70%	1.50%
2024	6.00%	4.60%	1.50%
2025	5.75%	4.50%	1.50%
2026	5.50%	4.40%	1.50%
2027	5.25%	4.30%	1.50%
2028	5.00%	4.20%	1.50%
2029	4.75%	4.10%	1.50%
2030	4.50%	4.05%	1.50%
2031	4.25%	4.05%	1.50%
2032 & Beyond	4.05%	4.05%	1.50%

[1]All increases are assumed to occur on January 1. The 2019 premiums were known at the time of the valuation and were incorporated into the liability measurement.

[2]Applies to members participating on or after July 1, 2003

Health care trend assumptions are based on the model issued by the Society of Actuaries "Getzen model of Long-Run Medical Cost Trends for the SOA; Thomas E. Getzen, iHEA and Temple University 2014 © Society of Actuaries.

The underlying assumptions used to develop the health care trend rates include:

- A short run period – this is a period for which anticipated health care trend rates are manually set based on local information as well as plan-specific and carrier information.
- Long-term real GDP growth – 1.75%
- Long-term rate of inflation – 2.30%
- Long-term nominal GDP growth – 4.05%
- Year that excess rate converges to 0 – 15 years from the valuation

Health care trend rates are thus the manually set rates for the short-run period and rates which decline to an ultimate trend rate which equals the assumed nominal long-term GDP growth rate.

State Police Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Health Care Participation Assumptions:

- Members are assumed to elect health coverage at retirement at the following participation rates.

Service at Retirement	Members participating before 7/1/2003*	Members participating after 7/1/2003
Under 10	100%	100%
10-14	100%	100%
15-19	100%	100%
Over 20	100%	100%

* 100% of members with a duty disability or a duty death (in service) benefit are assumed to elect coverage at retirement.

- Future retirees are assumed to have a similar distribution by plan type as the current retirees.

Medicare Plan	Participation
Medical Only	7%
Essential	8%
Premium	85%

Non-Medicare Plan	Participation
LivingWell Limited	2%
LivingWell Basic	13%
LivingWell CDHP	27%
LivingWell PPO	58%

- 100% of deferred vested members participating are assumed to elect health coverage at retirement. Deferred vested members are assumed to begin health coverage at age 50.

- 75% of future retirees, with hazardous service, are assumed to elect spouse health care coverage. No dependent coverage is assumed for members who only have non-hazardous service. 100% of spouses with health care coverage are assumed to continue coverage after the member's death.

State Police Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Excise ("Cadillac") Tax:

For taxable years beginning after December 31, 2021, a 40% excise tax will be required to be paid (by the employer and/or insurer) on the aggregate cost of the health plan in excess of certain legislated thresholds. For 2018, the thresholds are $850 per month for individual coverage and $2,292 per month for family coverage.

Both Actuarial Standard of Practice No. 6 and GASB Statement Nos. 74 and 75 reference this tax, and, in accordance with these standards an estimate of the impact of the Cadillac tax has been included in this valuation.

Assumptions and methods used to determine the impact of the Cadillac Tax include:

- 2018 thresholds of $850/$2,292 were indexed annually by 2.30%.
- Premium data submitted was not adjusted for permissible exclusions to the Cadillac Tax.
- There were no special adjustments to the dollar limit other than those permissible for non-Medicare retirees over 55.

In this valuation, the impact of the Cadillac Tax has been calculated by increasing the employer paid premiums for Non-Medicare retirees, who became participants before July 1, 2003, by 3.6%. Non-Medicare retirees who became participants after July 1, 2003 receive dollar subsidies per year of service, which are not expected to exceed the overall Non-Medicare premiums. As a result, the costs attributable to the Cadillac Tax for members who became participants after July 1, 2003 will be paid by the retirees

State Police Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Other Assumptions

1. Valuation payroll (used for determining the amortization contribution rate): Current fiscal year payroll.

2. Individual salaries used to project benefits: Actual salaries from the past fiscal year are used to determine the final average salary as of the valuation date. For future salaries, the salary from the last fiscal year is projected forward with one year's salary scale.

3. Pay increase timing: Beginning of (fiscal) year. This is equivalent to assuming that reported salaries represent amounts paid to members during the year ended on the valuation date.

4. Percent electing annuity on death (when eligible): All of the spouses of vested, married participants are assumed to elect an immediate life annuity.

5. Inactive Population: All non-vested members are assumed to take an immediate refund. Vested members are assumed to elect a refund at the time of their termination if the value of their account balance exceeds the present value of their deferral benefit.

6. There will be no recoveries once disabled.

7. Decrement timing: Decrements of all types are assumed to occur mid-year.

8. Eligibility testing: Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.

9. Decrement relativity: Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.

10. Incidence of Contributions: Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made.

11. Service: All members are assumed to accrue 1 year of benefit and eligibility service each year.

12. Payroll Growth Assumption: In determining the level percent of payroll amortization rate, payroll is assumed to grow annually at 0.00% percent

13. Cash Balance Interest Crediting Rate: The cash balance interest crediting rate assumption for years after the valuation date is equal to 4.9375%.

State Police Retirement System
Summary of Actuarial Methods and Assumptions
(Continued)

Participant Data

Participant data was supplied in electronic text files. There were separate files for (i) active and inactive members, and (ii) members and beneficiaries receiving benefits.

The data for active members included birthdate, gender, service with the current city and total vesting service, salary, and employee contribution account balances. For retired members and beneficiaries, the data included date of birth, gender, spouse's date of birth (where applicable), amount of monthly benefit, date of retirement, and form of payment code.

Salary supplied for the current year was based on the annualized earnings for the year preceding the valuation date.

Assumptions were made to correct for missing, bad, or inconsistent data. These had no material impact on the results presented.

Changes from the June 30, 2018 prior valuation:

- Annual salary increases were updated based on the 2018 Experience Study
- Annual rates of retirement, disability, withdrawal, and mortality were updated based on the 2018 Experience Study
- The percent of disabilities assumed to occur in the line of duty was updated from 0% to 70%

SECTION VIII

SUMMARY OF DATA AND EXPERIENCE

List of Tables

Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Salary Increase Experience

	Current Salary Scale		2013/2018 Actual Experience			Proposed Salary Scale	
Years of Service	Total	Step Rate/ Promotional	Total	Above Inflation	Step Rate/ Promotional	Total	Step Rate/ Promotional
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0	15.55%	12.00%	13.50%	11.97%	11.22%	15.30%	12.00%
1	7.55%	4.00%	5.92%	4.38%	3.64%	6.80%	3.50%
2	5.05%	1.50%	5.37%	3.83%	3.09%	6.05%	2.75%
3	4.55%	1.00%	5.15%	3.61%	2.87%	5.80%	2.50%
4	4.55%	1.00%	4.56%	3.03%	2.28%	5.30%	2.00%
5	4.55%	1.00%	4.11%	2.58%	1.83%	4.80%	1.50%
6	4.05%	0.50%	3.69%	2.15%	1.41%	4.55%	1.25%
7	4.05%	0.50%	3.42%	1.88%	1.14%	4.30%	1.00%
8	4.05%	0.50%	3.38%	1.85%	1.10%	4.05%	0.75%
9	3.55%	0.00%	2.86%	1.32%	0.58%	3.80%	0.50%
10	3.55%	0.00%	2.88%	1.35%	0.60%	3.80%	0.50%
11 & Over	3.55%	0.00%	2.28%	0.74%	0.00%	3.30%	0.00%

Current Inflation Assumption	2.30%	Proposed Inflation Assumption	2.30%
Current Productivity Component	1.25%	Proposed Productivity Component	1.00%
Actual CPI-U Inflation for June 2013 - June 2018	1.54%	Proposed Wage Inflation	3.30%
Apparent Productivity Component	0.74%		

Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Hazardous
Salary Increase Experience

	Current Salary Scale		2013/2018 Actual Experience			Proposed Salary Scale	
Years of Service	Total	Step Rate/ Promotional	Total	Above Inflation	Step Rate/ Promotional	Total	Step Rate/ Promotional
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0	19.55%	16.00%	23.02%	21.49%	17.72%	20.05%	16.50%
1	7.55%	4.00%	8.82%	7.28%	3.52%	7.55%	4.00%
2	5.55%	2.00%	8.27%	6.73%	2.97%	6.55%	3.00%
3	5.05%	1.50%	8.51%	6.98%	3.21%	6.55%	3.00%
4	4.55%	1.00%	6.91%	5.38%	1.61%	5.55%	2.00%
5	4.05%	0.50%	7.50%	5.96%	2.20%	5.05%	1.50%
6	3.55%	0.00%	6.30%	4.76%	1.00%	4.55%	1.00%
7	3.55%	0.00%	5.49%	3.96%	0.19%	4.05%	0.50%
8	3.55%	0.00%	6.27%	4.73%	0.96%	4.05%	0.50%
9	3.55%	0.00%	5.30%	3.77%	0.00%	3.55%	0.00%
10 & Over	3.55%	0.00%	5.30%	3.77%	0.00%	3.55%	0.00%

Current Inflation Assumption	2.30%	Proposed Inflation Assumption	2.30%
Current Productivity Component	1.25%	Proposed Productivity Component	1.25%
Actual CPI-U Inflation for June 2013 - June 2018	1.54%	Proposed Wage Inflation	3.55%
Apparent Productivity Component	0.74%		

Kentucky Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Salary Increase Experience

	Current Salary Scale		2013/2018 Actual Experience			Proposed Salary Scale	
Years of Service	Total	Step Rate/ Promotional	Total	Above Inflation	Step Rate/ Promotional	Total	Step Rate/ Promotional
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0	11.55%	8.25%	9.02%	7.48%	6.23%	10.30%	7.00%
1	8.05%	4.75%	5.97%	4.44%	3.18%	7.30%	4.00%
2	4.55%	1.25%	5.23%	3.70%	2.44%	6.30%	3.00%
3	4.55%	1.25%	4.76%	3.23%	1.97%	4.80%	1.50%
4	4.05%	0.75%	4.64%	3.10%	1.84%	4.55%	1.25%
5	4.05%	0.75%	4.20%	2.67%	1.41%	4.55%	1.25%
6	3.80%	0.50%	3.99%	2.46%	1.20%	4.30%	1.00%
7	3.80%	0.50%	3.62%	2.08%	0.83%	4.30%	1.00%
8	3.55%	0.25%	3.65%	2.12%	0.86%	4.05%	0.75%
9	3.55%	0.25%	3.77%	2.24%	0.98%	4.05%	0.75%
10	3.30%	0.00%	3.22%	1.68%	0.43%	3.80%	0.50%
11	3.30%	0.00%	3.36%	1.83%	0.57%	3.80%	0.50%
12	3.30%	0.00%	3.07%	1.54%	0.28%	3.55%	0.25%
13	3.30%	0.00%	3.05%	1.52%	0.26%	3.55%	0.25%
14	3.30%	0.00%	3.01%	1.47%	0.22%	3.55%	0.25%
15 & Over	3.30%	0.00%	2.79%	1.26%	0.00%	3.30%	0.00%

Current Inflation Assumption	2.30%	Proposed Inflation Assumption	2.30%
Current Productivity Component	1.00%	Proposed Productivity Component	1.00%
Actual CPI-U Inflation for June 2013 - June 2018	1.54%	Proposed Wage Inflation	3.30%
Apparent Productivity Component	1.26%		

Kentucky Retirement System
County Employees Retirement System (CERS)
Hazardous
Salary Increase Experience

	Current Salary Scale		2013/2018 Actual Experience			Proposed Salary Scale	
Years of Service	Total	Step Rate/ Promotional	Total	Above Inflation	Step Rate/ Promotional	Total	Step Rate/ Promotional
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0	18.55%	15.50%	19.40%	17.87%	15.15%	19.05%	15.50%
1	9.05%	6.00%	8.41%	6.88%	4.16%	7.55%	4.00%
2	5.05%	2.00%	6.41%	4.87%	2.15%	5.55%	2.00%
3	4.30%	1.25%	5.49%	3.96%	1.24%	4.80%	1.25%
4	4.05%	1.00%	5.18%	3.65%	0.93%	4.55%	1.00%
5	3.55%	0.50%	5.54%	4.00%	1.28%	4.55%	1.00%
6	3.05%	0.00%	5.19%	3.66%	0.94%	4.55%	1.00%
7	3.05%	0.00%	4.75%	3.22%	0.50%	4.05%	0.50%
8	3.05%	0.00%	4.56%	3.02%	0.30%	4.05%	0.50%
9	3.05%	0.00%	4.26%	2.72%	0.00%	3.55%	0.00%
10 & Over	3.05%	0.00%	4.26%	2.72%	0.00%	3.55%	0.00%

Current Inflation Assumption	2.30%	Proposed Inflation Assumption	2.30%
Current Productivity Component	0.75%	Proposed Productivity Component	1.25%
Actual CPI-U Inflation for June 2013 - June 2018	1.54%	Proposed Wage Inflation	3.55%
Apparent Productivity Component	2.72%		

Kentucky Retirement System
State Police Retirement System (SPRS)
Salary Increase Experience

	Current Salary Scale		2013/2018 Actual Experience			Proposed Salary Scale	
Years of Service	Total	Step Rate/ Promotional	Total	Above Inflation	Step Rate/ Promotional	Total	Step Rate/ Promotional
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0	15.55%	12.50%	43.91%	42.38%	39.93%	16.05%	12.50%
1	10.55%	7.50%	8.21%	6.67%	4.23%	8.55%	5.00%
2	8.55%	5.50%	7.79%	6.25%	3.81%	7.55%	4.00%
3	7.55%	4.50%	5.61%	4.08%	1.63%	5.55%	2.00%
4	6.55%	3.50%	5.58%	4.05%	1.60%	5.55%	2.00%
5	5.55%	2.50%	4.19%	2.66%	0.21%	5.55%	2.00%
6	5.05%	2.00%	6.15%	4.61%	2.17%	5.55%	2.00%
7	5.05%	2.00%	4.92%	3.38%	0.94%	4.55%	1.00%
8	4.05%	1.00%	2.50%	0.97%	-1.48%	4.55%	1.00%
9	3.55%	0.50%	3.98%	2.45%	0.00%	3.55%	0.00%
10 & Over	3.05%	0.00%	3.98%	2.45%	0.00%	3.55%	0.00%

Current Inflation Assumption	2.30%	Proposed Inflation Assumption	2.30%
Current Productivity Component	0.75%	Proposed Productivity Component	1.25%
Actual CPI-U Inflation for June 2013 - June 2018	1.54%	Proposed Wage Inflation	3.55%
Apparent Productivity Component	2.45%		

Mortality Experiences

Kentucky Retirement System
Post-Retirement Mortality Experience - Male

Age	Actual Deaths	Total Exposures	Actual Rate	Assumed Rate		Expected Deaths		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
50-54	14	3,844	0.0035	0.26%	0.32%	10	13	133.81%	105.84%
55-59	38	6,298	0.0061	0.44%	0.47%	29	36	133.18%	105.68%
60-64	76	9,072	0.0084	0.74%	1.05%	72	97	104.61%	77.98%
65-69	125	9,848	0.0127	1.25%	1.29%	131	131	94.81%	95.03%
70-74	126	5,913	0.0213	2.08%	1.81%	131	110	95.89%	114.01%
75-79	122	3,444	0.0354	3.57%	3.24%	131	114	93.31%	107.21%
80-84	110	1,851	0.0594	6.13%	6.19%	120	116	91.64%	94.98%
85-89	99	843	0.1178	10.56%	11.29%	92	94	107.41%	105.21%
90-94	49	246	0.1971	18.41%	19.17%	45	46	108.03%	105.37%
95-99	8	33	0.2419	27.90%	27.12%	9	9	90.97%	89.55%
100-104	1	3	0.4415	35.85%	34.87%	1	1	128.08%	132.08%
105-109	0	0	N/A	40.00%	44.40%	0	0	N/A	N/A
Total	767	41,395				772	768	99.39%	99.93%

Actual, expected and exposures are in thousands of benefit.

Mortality Experiences

Kentucky Retirement System
Post-Retirement Mortality Experience - Female

Age	Actual Deaths	Total Exposures	Actual Rate	Assumed Rate		Expected Deaths		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
50-54	4	2,116	0.0017	0.19%	0.22%	4	5	93.84%	73.05%
55-59	16	5,116	0.0031	0.32%	0.29%	15	18	106.88%	87.90%
60-64	42	7,800	0.0054	0.57%	0.72%	40	57	104.82%	73.58%
65-69	66	8,385	0.0078	1.04%	0.89%	78	77	84.39%	85.41%
70-74	78	5,545	0.0140	1.77%	1.19%	87	68	89.31%	114.05%
75-79	76	3,225	0.0235	2.92%	2.13%	84	70	90.14%	108.50%
80-84	75	1,683	0.0444	4.81%	4.20%	72	72	103.58%	104.20%
85-89	71	916	0.0772	8.23%	7.92%	66	73	106.63%	96.90%
90-94	48	337	0.1438	14.01%	13.81%	41	46	118.03%	106.28%
95-99	14	65	0.2146	20.43%	21.44%	12	13	117.30%	103.55%
100-104	2	7	0.3446	24.80%	30.81%	2	2	148.87%	118.31%
105-109	0	0	0.6386	32.27%	41.24%	0	0	206.95%	165.56%
Total	491	35,193				501	501	98.05%	98.01%

Actual, expected, and exposures are in thousands of benefit.

Mortality Experiences

Kentucky Retirement System
Post-Retirement Mortality Experience - Disabled Male

Age	Actual Deaths	Total Exposures	Actual Rate	Assumed Rate		Expected Deaths		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
50-54	4	240	0.0158	2.54%	2.03%	6	5	61.56%	75.84%
55-59	7	335	0.0195	3.12%	2.38%	10	8	62.60%	79.55%
60-64	17	419	0.0403	3.50%	2.95%	15	13	115.24%	133.64%
65-69	14	364	0.0373	3.88%	3.80%	14	14	96.02%	96.50%
70-74	11	209	0.0546	4.68%	5.11%	10	11	117.19%	105.40%
75-79	12	126	0.0934	6.02%	7.32%	8	9	155.98%	126.39%
80-84	8	61	0.1325	8.02%	10.78%	5	7	169.06%	124.20%
85-89	2	14	0.1298	10.68%	16.35%	1	2	125.96%	81.76%
90-94	1	3	0.2613	14.42%	23.47%	0	1	189.53%	115.68%
95-99	0	0	0.0000	22.18%	32.56%	0	0	0.00%	0.00%
100-104	0	0	N/A	30.72%	42.21%	0	0	N/A	N/A
105-109	0	0	N/A	38.30%	48.66%	0	0	N/A	N/A
Total	75	1,772				70	70	107.67%	107.25%

Actual, expected, and exposures are in thousands of benefit.

Mortality Experiences

Kentucky Retirement System
Post-Retirement Mortality Experience - Disabled Female

Age	Actual Deaths	Total Exposures	Actual Rate	Assumed Rate		Expected Deaths		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
50-54	6	176	0.0325	1.29%	1.65%	2	3	247.27%	192.32%
55-59	8	332	0.0235	1.70%	1.85%	6	6	136.66%	123.64%
60-64	10	405	0.0246	2.06%	2.16%	8	9	118.60%	110.96%
65-69	9	365	0.0249	2.68%	2.80%	10	10	93.16%	87.08%
70-74	12	238	0.0488	3.66%	3.99%	9	10	133.38%	119.78%
75-79	8	158	0.0530	5.09%	6.04%	8	10	105.84%	87.48%
80-84	4	52	0.0780	7.03%	9.38%	4	5	114.05%	84.65%
85-89	2	13	0.1408	9.79%	13.52%	1	2	149.41%	105.87%
90-94	1	2	0.2571	14.22%	19.33%	0	0	194.18%	136.81%
95-99	0	0	0.5425	20.43%	28.45%	0	0	290.80%	207.71%
100-104	0	0	N/A	24.80%	38.86%	0	0	N/A	N/A
105-109	0	0	N/A	32.27%	47.88%	0	0	N/A	N/A
Total	59	1,742				48	55	123.49%	107.62%

Actual, expected, and exposures are in thousands of benefit.

Termination Experiences

Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Termination Experience - Service Based

Service	Actual Terminations	Total Exposures	Actual Rate	Assumed Rate		Expected Terminations		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	322	1,269	0.2541	22.50%	20.00%	286	254	112.70%	126.90%
2	888	4,181	0.2124	15.50%	16.45%	651	688	136.40%	129.07%
3	964	4,910	0.1963	12.50%	13.39%	618	658	155.94%	146.46%
4	898	5,293	0.1696	10.50%	11.61%	560	614	160.29%	146.20%
5	847	5,881	0.1440	9.00%	10.34%	530	608	159.79%	139.29%
6	855	6,180	0.1383	6.50%	9.35%	399	578	214.30%	147.93%
7	887	6,919	0.1282	5.50%	8.55%	377	591	235.29%	150.09%
8	898	7,556	0.1188	5.00%	7.87%	374	595	239.99%	150.85%
9	912	8,267	0.1103	4.50%	7.28%	368	602	247.80%	151.48%
10	896	8,245	0.1087	4.50%	6.76%	367	557	244.24%	160.93%
11	873	8,514	0.1025	4.00%	6.30%	337	536	259.07%	162.88%
12	774	8,693	0.0890	4.00%	5.88%	344	511	224.86%	151.37%
13	784	9,012	0.0870	4.00%	5.49%	357	495	219.54%	158.34%
14	654	9,450	0.0692	3.50%	5.14%	327	486	200.01%	134.57%
15	665	10,229	0.0650	3.50%	4.81%	353	492	188.48%	135.23%
16	578	10,220	0.0565	3.00%	4.51%	302	461	191.28%	125.31%
17	536	9,703	0.0552	3.00%	4.22%	286	410	187.24%	130.61%
18	443	9,078	0.0488	3.00%	3.96%	268	359	165.28%	123.38%
19	419	8,426	0.0497	3.00%	3.70%	248	312	169.00%	134.33%
20	301	8,108	0.0371	3.00%	3.47%	239	281	125.77%	106.97%
21	361	7,827	0.0461	3.00%	3.24%	230	254	156.79%	141.97%
22	268	7,395	0.0363	3.00%	3.02%	217	224	123.69%	119.83%
23	170	7,250	0.0234	3.00%	2.82%	213	204	79.59%	83.10%
24	194	6,935	0.0280	3.00%	2.62%	204	182	95.20%	106.71%
25	144	3,237	0.0443	3.00%	2.43%	93	79	154.30%	181.65%
Total	15,528	182,778				8,548	11,031	181.66%	140.77%

Actual, expected, and exposures are in thousands of salary.

Termination Experiences

Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Hazardous
Termination Experience - Service Based

				Assumed Rate		Expected Terminations		Actual/Expected	
Service	Actual Terminations	Total Exposures	Actual Rate	Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	134	324	0.4136	25.00%	25.00%	81	81	165.29%	165.29%
2	310	1,104	0.2807	10.50%	19.68%	117	217	264.88%	142.81%
3	237	1,108	0.2143	7.50%	15.12%	84	167	282.67%	142.18%
4	187	1,017	0.1843	6.50%	12.45%	67	127	279.82%	147.62%
5	154	956	0.1610	5.50%	10.56%	53	101	290.57%	152.48%
6	126	941	0.1341	4.50%	9.09%	42	86	300.51%	146.76%
7	132	977	0.1354	3.00%	7.89%	29	77	456.11%	171.78%
8	83	1,017	0.0815	3.00%	6.87%	30	70	276.15%	118.35%
9	97	1,201	0.0810	3.00%	5.99%	35	72	278.14%	135.21%
10	73	1,264	0.0579	2.50%	5.22%	31	66	236.24%	110.96%
11	60	1,309	0.0456	2.50%	5.43%	32	59	186.74%	101.28%
12	54	1,304	0.0414	2.00%	3.90%	25	51	215.77%	105.77%
13	58	1,285	0.0450	2.00%	3.33%	25	43	231.21%	134.42%
14	63	1,214	0.0519	2.00%	2.80%	23	34	274.19%	185.48%
15	40	1,220	0.0331	2.00%	2.31%	23	28	175.43%	144.10%
16	47	1,230	0.0385	2.00%	1.86%	24	23	197.42%	206.00%
17	34	1,254	0.0270	2.00%	1.43%	24	18	141.08%	188.10%
18	22	1,210	0.0181	2.00%	1.03%	23	13	95.18%	168.40%
19	10	1,150	0.0091	2.00%	0.66%	22	8	47.54%	130.72%
20	12	589	0.0199	2.00%	0.30%	11	2	106.74%	587.07%
Total	1,935	21,674				801	1,343	241.56%	144.07%

Actual, expected, and exposures are in thousands of salary.

Termination Experiences

Kentucky Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Termination Experience - Service Based

Service	Actual Terminations	Total Exposures	Actual Rate	Assumed Rate		Expected Terminations		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	468	1,864	0.2511	28.00%	20.00%	524	373	89.33%	125.49%
2	1,205	5,895	0.2044	16.00%	15.58%	949	919	126.94%	131.09%
3	996	6,278	0.1586	12.00%	12.48%	760	783	131.01%	127.16%
4	852	6,644	0.1282	10.00%	10.66%	672	708	126.78%	120.33%
5	727	6,836	0.1064	8.00%	9.37%	548	641	132.74%	113.48%
6	694	7,112	0.0975	6.00%	8.37%	422	596	164.34%	116.36%
7	685	7,461	0.0918	5.00%	7.56%	368	564	186.15%	121.46%
8	678	7,751	0.0874	5.00%	6.87%	382	532	177.36%	127.35%
9	645	8,039	0.0802	4.00%	6.27%	317	504	203.34%	127.89%
10	642	8,381	0.0766	4.00%	5.74%	330	481	194.54%	133.47%
11	602	8,499	0.0708	4.00%	5.27%	336	448	179.13%	134.35%
12	574	8,853	0.0649	4.00%	4.84%	350	429	164.12%	133.90%
13	548	9,302	0.0589	4.00%	4.45%	367	414	149.32%	132.36%
14	568	10,037	0.0566	4.00%	4.09%	396	411	143.49%	138.25%
15	477	10,681	0.0447	3.00%	3.76%	315	402	151.49%	118.70%
16	477	10,973	0.0435	3.00%	3.45%	323	379	147.62%	125.81%
17	372	10,708	0.0348	3.00%	3.16%	315	339	118.19%	109.82%
18	364	10,241	0.0356	3.00%	2.89%	301	296	120.97%	123.01%
19	276	9,580	0.0288	3.00%	2.64%	281	252	98.26%	109.56%
20	235	8,872	0.0265	3.00%	2.39%	260	212	90.57%	111.08%
21	265	7,849	0.0338	3.00%	2.16%	230	170	115.43%	156.18%
22	163	6,895	0.0236	3.00%	1.94%	202	134	80.57%	121.45%
23	130	6,306	0.0206	3.00%	1.74%	185	109	70.33%	119.37%
24	109	5,641	0.0193	3.00%	1.54%	165	87	66.04%	125.25%
25	79	2,633	0.0300	3.00%	1.35%	75	35	105.46%	225.99%
Total	12,831	193,329				9,373	10,218	136.90%	125.58%

Actual, expected, and exposures are in thousands of salary.

Termination Experiences

Kentucky Retirement System
County Employees Retirement System (CERS)
Hazardous
Termination Experience - Service Based

				Assumed Rate		Expected Terminations		Actual/Expected	
Service	Actual Terminations	Total Exposures	Actual Rate	Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	57	356	0.1605	20.50%	20.00%	73	71	78.19%	80.40%
2	103	1,049	0.0979	13.00%	9.11%	138	96	74.46%	107.04%
3	98	1,291	0.0762	10.50%	7.24%	137	93	71.79%	105.76%
4	102	1,434	0.0712	9.00%	6.14%	131	88	77.87%	115.93%
5	96	1,645	0.0583	8.00%	5.37%	132	88	72.68%	109.02%
6	95	1,881	0.0505	7.00%	4.76%	131	90	72.45%	105.45%
7	104	2,183	0.0477	7.00%	4.27%	152	93	68.45%	111.87%
8	119	2,644	0.0451	6.00%	3.85%	157	102	75.92%	116.86%
9	109	3,188	0.0343	6.00%	3.49%	190	111	57.48%	98.40%
10	178	3,754	0.0474	6.00%	3.18%	223	119	79.72%	149.39%
11	148	3,978	0.0371	6.00%	2.89%	236	115	62.52%	128.29%
12	150	4,223	0.0355	6.00%	2.63%	251	111	59.65%	134.88%
13	108	4,359	0.0247	6.00%	2.40%	259	105	41.65%	102.72%
14	126	4,761	0.0265	6.00%	2.18%	283	104	44.61%	121.39%
15	91	5,262	0.0173	6.00%	1.98%	312	104	29.20%	87.59%
16	82	5,865	0.0140	6.00%	1.80%	348	105	23.53%	78.00%
17	86	6,124	0.0140	6.00%	1.62%	363	99	23.61%	86.58%
18	78	6,176	0.0127	6.00%	1.46%	366	90	21.38%	86.96%
19	41	6,196	0.0067	6.00%	1.30%	367	81	11.26%	51.03%
20	32	2,894	0.0111	6.00%	1.16%	169	34	19.09%	94.89%
Total	2,003	69,264				4,418	1,899	45.34%	105.49%

Actual, expected, and exposures are in thousands of salary.

Termination Experiences

Kentucky Retirement System
State Police Retirement System (SPRS)
Termination Experience - Service Based

Service	Actual Terminations	Total Exposures	Actual Rate	Assumed Rate		Expected Terminations		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	9	36	0.2533	20.00%	15.00%	7	5	131.78%	184.50%
2	11	164	0.0640	7.00%	4.82%	12	8	87.71%	131.56%
3	9	245	0.0366	3.00%	3.76%	8	9	112.24%	99.77%
4	12	312	0.0394	3.00%	3.15%	10	10	123.25%	123.25%
5	14	305	0.0459	3.00%	2.71%	9	8	155.59%	175.04%
6	7	298	0.0237	3.00%	2.37%	9	7	78.58%	101.03%
7	13	369	0.0358	3.00%	2.09%	11	8	120.20%	165.28%
8	7	336	0.0201	3.00%	1.86%	10	6	67.52%	112.53%
9	10	407	0.0242	3.00%	1.66%	12	7	82.15%	140.83%
10	5	467	0.0116	2.50%	1.48%	12	7	45.13%	77.36%
11	8	568	0.0134	2.50%	1.32%	14	7	54.48%	108.97%
12	16	600	0.0265	2.50%	1.17%	15	7	105.84%	226.80%
13	6	646	0.0094	2.50%	1.04%	16	7	38.17%	87.25%
14	10	693	0.0143	2.50%	0.92%	17	6	58.38%	165.42%
15	3	680	0.0050	2.50%	0.80%	17	5	19.90%	67.66%
16	7	743	0.0093	2.50%	0.70%	18	5	38.51%	138.64%
17	7	667	0.0098	2.50%	0.60%	16	4	40.80%	163.19%
18	7	736	0.0089	2.50%	0.51%	18	4	36.22%	163.00%
19	10	738	0.0130	2.50%	0.42%	18	3	53.36%	320.16%
20	0	308	0.0000	2.50%	0.34%	7	1	0.00%	0.00%
Total	170	9,319				256	124	66.36%	137.00%

Actual, expected, and exposures are in thousands of salary.

Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Unreduced Retirement Experience - Age Based - Male

				Assumed Rate		Expected Retirements		Actual/Expected	
Age	Actual Retirements	Total Exposures	Actual Rate	Current[1]	Proposed[2]	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 45	71	371	0.1902		20.00%	130	74	54.33%	95.44%
45	43	267	0.1594		21.00%	93	56	45.74%	75.96%
46	83	375	0.2217		22.00%	131	83	63.49%	100.21%
47	126	527	0.2385		23.00%	185	121	67.97%	103.93%
48	148	735	0.2008		24.00%	257	176	57.40%	83.82%
49	154	891	0.1725		25.00%	312	223	49.28%	68.95%
50	228	1,230	0.1854		26.00%	430	320	53.02%	71.25%
51	325	1,459	0.2226		27.00%	511	394	63.56%	82.43%
52	324	1,423	0.2276		28.00%	498	399	65.04%	81.18%
53	408	1,441	0.2832		29.00%	505	418	80.84%	97.66%
54	362	1,338	0.2703		30.00%	468	401	77.26%	90.17%
55	243	1,175	0.2071	8.00%	30.00%	411	353	59.20%	68.93%
56	299	1,070	0.2790	8.00%	30.00%	375	321	79.64%	93.04%
57	232	1,001	0.2319	8.00%	30.00%	350	300	66.36%	77.42%
58	232	953	0.2431	8.00%	30.00%	334	286	69.36%	81.00%
59	201	989	0.2033	8.00%	30.00%	346	297	58.08%	67.66%
60	284	970	0.2923	10.00%	30.00%	339	291	83.65%	97.44%
61	219	836	0.2618	20.00%	30.00%	293	251	74.67%	87.17%
62	272	781	0.3481	20.00%	35.00%	273	273	99.61%	99.61%
63	167	563	0.2974	20.00%	30.00%	197	169	84.98%	99.06%
64	116	420	0.2756	20.00%	30.00%	147	126	78.76%	91.89%
65	330	1,420	0.2322	20.00%	30.00%	345	426	95.55%	77.38%
66	340	1,150	0.2961	20.00%	30.00%	280	345	121.58%	98.67%
67	248	836	0.2962	20.00%	30.00%	204	251	121.34%	98.62%
68	150	615	0.2441	20.00%	30.00%	144	184	104.24%	81.58%
69	129	491	0.2637	20.00%	30.00%	113	147	114.58%	88.08%
70	71	344	0.2062	20.00%	30.00%	79	103	89.73%	68.83%
71	50	256	0.1961	20.00%	30.00%	61	77	82.36%	65.25%
72	35	210	0.1647	20.00%	30.00%	51	63	67.75%	54.84%
73	54	160	0.3360	20.00%	30.00%	41	48	131.46%	112.29%
74	34	116	0.2959	20.00%	30.00%	28	35	122.58%	98.06%
Total	5,975	24,412				7,931	7,011	75.34%	85.23%
75 & Over	114	404	0.2825	100.00%	100.00%	404	404	28.25%	28.25%
Total	6,089	24,816				8,335	7,415	73.06%	82.12%

[1] For members hired before 09/01/2008, if service is at least 27 years, the rate is 35%.

[1] For members hired after 09/01/2008, if age plus service is at least 87, the rate is 35%.

[2] For members hired after 09/01/2008 and younger than 65, the rates other than 100% are reduced by 20% to account for a different health insurance benefit.

Actual, expected, and exposures are in thousands of benefit.

Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Unreduced Retirement Experience - Age Based - Female

				Assumed Rate		Expected Retirements		Actual/Expected	
Age	Actual Retirements	Total Exposures	Actual Rate	Current[1]	Proposed[2]	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 45	125	401	0.3114		33.00%	140	132	89.27%	94.68%
45	132	365	0.3625		33.00%	128	121	103.44%	109.43%
46	132	511	0.2587		33.00%	179	169	73.82%	78.19%
47	225	722	0.3115		33.00%	253	238	88.93%	94.53%
48	293	1,027	0.2856		33.00%	359	339	81.71%	86.53%
49	401	1,365	0.2938		33.00%	478	450	83.91%	89.13%
50	476	1,504	0.3166		33.00%	527	496	90.38%	96.02%
51	465	1,490	0.3124		33.00%	521	492	89.35%	94.61%
52	406	1,492	0.2721		33.00%	522	492	77.79%	82.53%
53	493	1,516	0.3255		33.00%	530	500	93.08%	98.66%
54	423	1,468	0.2880		33.00%	514	484	82.27%	87.36%
55	480	1,375	0.3493	8.00%	33.00%	481	454	99.84%	105.78%
56	358	1,180	0.3039	8.00%	33.00%	413	389	86.80%	92.16%
57	304	1,132	0.2688	8.00%	33.00%	396	373	76.81%	81.54%
58	272	1,043	0.2604	8.00%	33.00%	365	344	74.40%	78.94%
59	213	1,002	0.2128	8.00%	33.00%	351	331	60.74%	64.41%
60	300	984	0.3050	10.00%	33.00%	344	325	87.25%	92.35%
61	286	913	0.3132	20.00%	33.00%	319	301	89.59%	94.95%
62	253	718	0.3522	20.00%	35.00%	251	251	100.80%	100.80%
63	184	536	0.3434	20.00%	33.00%	188	177	97.91%	103.99%
64	139	448	0.3102	20.00%	33.00%	157	148	88.43%	93.81%
65	495	1,568	0.3155	20.00%	33.00%	366	517	135.11%	95.65%
66	368	1,102	0.3336	20.00%	33.00%	260	364	141.40%	101.00%
67	262	809	0.3238	20.00%	33.00%	193	267	135.73%	98.11%
68	116	535	0.2168	20.00%	33.00%	128	176	90.57%	65.87%
69	89	431	0.2064	20.00%	33.00%	104	142	85.53%	62.64%
70	116	358	0.3250	20.00%	33.00%	87	118	133.68%	98.56%
71	58	223	0.2584	20.00%	33.00%	53	74	108.96%	78.04%
72	25	156	0.1619	20.00%	33.00%	39	51	64.63%	49.42%
73	36	127	0.2881	20.00%	33.00%	32	42	113.94%	86.81%
74	37	91	0.4025	20.00%	33.00%	23	30	158.81%	121.75%
Total	7,964	26,590				8,701	8,787	91.53%	90.63%
75 & Over	72	214	0.3368	100.00%	100.00%	214	214	33.68%	33.68%
Total	8,036	26,804				8,915	9,001	90.14%	89.28%

[1] For members hired before 09/01/2008, if service is at least 27 years, the rate is 35%.

[1] For members hired after 09/01/2008, if age plus service is at least 87, the rate is 35%.

[2] For members hired after 09/01/2008 and younger than 65, the rates other than 100% are reduced by 20% to account for a different health insurance benefit.

Actual, expected, and exposures are in thousands of benefit.

Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Hazardous
Unreduced Retirement Experience - Service Based

				Assumed Rate		Expected Retirements		Actual/Expected	
Service	Actual Retirements	Total Exposures	Actual Rate	Current[1]	Proposed[2]	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
20	170	359	0.4735	40.00%	50.00%	144	180	118.38%	94.44%
21	62	203	0.3054	40.00%	32.00%	81	65	76.35%	95.38%
22	32	146	0.2192	40.00%	32.00%	58	47	54.79%	68.09%
23	37	127	0.2913	40.00%	32.00%	51	41	72.83%	90.24%
24	20	99	0.2020	40.00%	32.00%	40	32	50.51%	62.50%
25	31	104	0.2981	47.00%	32.00%	49	33	63.42%	93.94%
26	22	77	0.2857	47.00%	32.00%	36	25	60.79%	88.00%
27	18	56	0.3214	47.00%	32.00%	26	18	68.39%	100.00%
28	9	39	0.2308	47.00%	32.00%	18	12	49.10%	75.00%
29	13	28	0.4643	47.00%	32.00%	13	9	98.78%	144.44%
30	2	15	0.1333	47.00%	32.00%	7	5	28.37%	40.00%
31	3	16	0.1875	47.00%	32.00%	8	5	39.89%	60.00%
32	3	14	0.2143	50.00%	32.00%	7	4	42.86%	75.00%
33	4	11	0.3636	50.00%	32.00%	6	4	72.73%	100.00%
34	0	7	0.0000	50.00%	32.00%	4	2	0.00%	0.00%
35	2	9	0.2222	60.00%	32.00%	5	3	37.04%	66.67%
36	1	5	0.2000	60.00%	32.00%	3	2	33.33%	50.00%
37	0	3	0.0000	60.00%	32.00%	2	1	0.00%	0.00%
38	1	4	0.2500	60.00%	32.00%	2	1	41.67%	100.00%
39	2	2	1.0000	60.00%	32.00%	1	1	166.67%	200.00%
40	1	4	0.2500	60.00%	32.00%	2	1	41.67%	100.00%
Total	433	1,328				563	491	76.88%	88.19%

[1,2] For members hired before 09/01/2008, the annual rate of service retirement is 100% at age 65. For members hired after 09/01/2008, the annual rate of service retirement is 100% at age 60.

[2]For member with years of service greater than 5, but less than 20, the rate is 10% for age from 55 to 61 and 35% for age 62 and over.

[2] For members hired after 09/01/2008 and younger than 65, the rates other than 100% are reduced by 20% to account for a different health insurance benefit.

[2] For members hired after 01/01/2014, the rate is 20% until 30 years of service

Actual, expected, and exposures are in thousands of benefit.

Kentucky Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Unreduced Retirement Experience - Age Based - Male

				Assumed Rate		Expected Retirements		Actual/Expected	
Age	Actual Retirements	Total Exposures	Actual Rate	Current[1]	Proposed[2]	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 45	68	216	0.3162		35.00%	65	76	105.22%	90.00%
45	46	122	0.3746		35.00%	37	43	123.33%	106.12%
46	58	188	0.3062		35.00%	56	66	102.88%	87.29%
47	156	386	0.4051		35.00%	116	135	134.66%	115.71%
48	113	506	0.2233		35.00%	152	177	74.31%	63.82%
49	197	621	0.3167		35.00%	186	217	105.72%	90.62%
50	214	796	0.2683		30.00%	239	239	89.40%	89.40%
51	305	1,040	0.2935		30.00%	312	312	97.83%	97.83%
52	249	1,076	0.2319		30.00%	323	323	77.24%	77.24%
53	342	1,274	0.2683		30.00%	382	382	89.49%	89.49%
54	376	1,359	0.2764		30.00%	408	408	92.06%	92.06%
55	378	1,373	0.2753	5.00%	30.00%	412	412	91.71%	91.71%
56	332	1,213	0.2737	6.00%	30.00%	364	364	91.23%	91.23%
57	337	1,144	0.2941	7.00%	30.00%	343	343	98.11%	98.11%
58	357	1,102	0.3238	7.00%	30.00%	330	330	108.10%	108.10%
59	294	1,004	0.2930	8.00%	30.00%	301	301	97.77%	97.77%
60	260	993	0.2621	9.00%	30.00%	298	298	87.32%	87.32%
61	219	944	0.2319	15.00%	30.00%	283	283	77.36%	77.36%
62	332	818	0.4061	18.00%	30.00%	246	246	135.08%	135.08%
63	203	656	0.3100	18.00%	30.00%	197	197	103.17%	103.17%
64	144	523	0.2747	18.00%	30.00%	157	157	91.47%	91.47%
65	545	2,234	0.2441	18.00%	30.00%	450	670	121.18%	81.39%
66	482	1,707	0.2825	18.00%	30.00%	345	512	139.81%	94.21%
67	275	1,251	0.2200	18.00%	30.00%	257	375	107.09%	73.39%
68	222	877	0.2533	18.00%	30.00%	178	263	124.85%	84.50%
69	140	710	0.1977	18.00%	30.00%	146	213	96.09%	65.86%
70	128	555	0.2313	18.00%	30.00%	115	167	111.67%	76.90%
71	101	457	0.2207	18.00%	30.00%	93	137	108.48%	73.64%
72	86	351	0.2461	18.00%	30.00%	70	105	123.42%	82.28%
73	61	292	0.2080	18.00%	30.00%	58	87	104.57%	69.72%
74	44	239	0.1823	18.00%	30.00%	47	72	92.75%	60.55%
Total	7,064	26,027				6,966	7,910	101.41%	89.31%
75 & Over	200	737	0.2710	100.00%	100.00%	732	737	27.28%	27.10%
Total	7,264	26,763				7,698	8,647	94.36%	84.01%

[1] For members hired before 09/01/2008, if service is at least 27 years, the rate is 30%.

[1] For members hired after 09/01/2008, if age plus service is at least 87, the rate is 30%.

[2] For members hired after 09/01/2008 and younger than 65, the rates other than 100% are reduced by 20% to account for a different health insurance benefit.

Actual, expected, and exposures are in thousands of benefit.

Kentucky Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Unreduced Retirement Experience - Age Based - Female

Age	Actual Retirements	Total Exposures	Actual Rate	Assumed Rate		Expected Retirements		Actual/Expected	
				Current[1]	Proposed[2]	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 45	37	163	0.2299		27.00%	49	44	76.24%	84.91%
45	32	149	0.2139		27.00%	45	40	70.72%	79.56%
46	58	277	0.2093		27.00%	83	75	69.75%	77.19%
47	99	384	0.2592		27.00%	115	104	86.50%	95.64%
48	132	496	0.2663		27.00%	149	134	88.66%	98.58%
49	158	634	0.2495		27.00%	190	171	83.18%	92.42%
50	165	691	0.2391		27.00%	207	187	79.85%	88.39%
51	159	837	0.1895		27.00%	251	226	63.16%	70.15%
52	251	1,011	0.2485		27.00%	303	273	82.93%	92.04%
53	248	984	0.2520		27.00%	295	266	84.03%	93.19%
54	289	1,007	0.2872		27.00%	302	272	95.72%	106.27%
55	255	1,026	0.2488	5.00%	27.00%	308	277	82.85%	92.12%
56	231	1,079	0.2140	6.00%	27.00%	324	291	71.27%	79.35%
57	286	1,178	0.2427	7.00%	27.00%	353	318	80.97%	89.89%
58	307	1,262	0.2431	7.00%	27.00%	379	341	80.96%	89.98%
59	332	1,219	0.2725	8.00%	27.00%	366	329	90.76%	100.96%
60	307	1,210	0.2540	9.00%	27.00%	363	327	84.63%	93.95%
61	277	1,154	0.2403	15.00%	27.00%	346	312	80.18%	88.91%
62	412	1,055	0.3909	18.00%	40.00%	316	422	130.52%	97.73%
63	303	845	0.3589	18.00%	35.00%	254	296	119.43%	102.49%
64	198	719	0.2749	18.00%	30.00%	216	216	91.47%	91.47%
65	840	3,133	0.2681	18.00%	30.00%	631	940	133.11%	89.36%
66	693	2,360	0.2936	18.00%	27.00%	486	637	142.59%	108.79%
67	439	1,701	0.2584	18.00%	27.00%	353	459	124.50%	95.75%
68	284	1,257	0.2255	18.00%	27.00%	267	339	106.19%	83.64%
69	238	1,022	0.2332	18.00%	27.00%	219	276	108.79%	86.32%
70	191	824	0.2315	18.00%	27.00%	178	223	107.20%	85.57%
71	170	634	0.2687	18.00%	27.00%	138	171	123.44%	99.62%
72	94	438	0.2138	18.00%	27.00%	95	118	98.58%	79.36%
73	78	342	0.2282	18.00%	27.00%	73	92	106.74%	84.70%
74	55	251	0.2177	18.00%	27.00%	52	68	105.00%	80.29%
Total	7,619	29,338				7,706	8,244	98.87%	92.42%
75 & Over	213	788	0.2702	100.00%	100.00%	783	788	27.21%	27.02%
Total	7,832	30,127				8,489	9,032	92.26%	86.71%

[1] For members hired before 09/01/2008, if service is at least 27 years, the rate is 30%.

[1] For members hired after 09/01/2008, if age plus service is at least 87, the rate is 30%.

[2] For members hired after 09/01/2008 and younger than 65, the rates other than 100% are reduced by 20% to account for a different health insurance benefit.

Actual, expected, and exposures are in thousands of benefit.

Kentucky Retirement System
County Employees Retirement System (CERS)
Hazardous
Unreduced Retirement Experience - Service Based

				Assumed Rate		Expected Retirements		Actual/Expected	
Service	Actual Retirements	Total Exposures	Actual Rate	Current[1]	Proposed[2]	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
20	1,451	5,808	0.2498	22.50%	30.00%	1,307	1,742	111.02%	83.26%
21	981	4,470	0.2195	22.50%	22.50%	1,006	1,006	97.57%	97.56%
22	608	3,601	0.1688	22.50%	18.00%	810	648	75.04%	93.82%
23	561	3,052	0.1837	22.50%	21.00%	687	641	81.65%	87.48%
24	580	2,790	0.2077	30.00%	24.00%	837	670	69.25%	86.52%
25	585	2,529	0.2313	33.00%	27.00%	834	683	70.10%	85.65%
26	623	2,231	0.2794	33.00%	30.00%	736	669	84.65%	93.16%
27	533	1,763	0.3025	36.00%	33.00%	635	582	84.02%	91.62%
28	431	1,353	0.3182	39.00%	36.00%	528	487	81.60%	88.42%
29	359	1,028	0.3493	55.00%	39.00%	566	401	63.50%	89.56%
30	233	784	0.2971	33.00%	39.00%	259	306	90.04%	76.08%
31	127	537	0.2364	33.00%	39.00%	177	210	71.65%	60.50%
32	164	454	0.3611	50.00%	39.00%	227	177	72.22%	92.71%
33	81	260	0.3128	40.00%	39.00%	104	101	78.21%	80.61%
34	36	192	0.1901	40.00%	39.00%	77	75	47.52%	48.56%
35	63	132	0.4748	40.00%	39.00%	53	52	118.71%	120.97%
36	28	94	0.2979	40.00%	39.00%	38	37	74.48%	76.02%
37	40	86	0.4673	40.00%	39.00%	35	34	116.81%	118.59%
38	8	68	0.1160	40.00%	39.00%	27	27	29.00%	29.43%
39	9	53	0.1697	40.00%	39.00%	21	21	42.43%	43.10%
40	22	42	0.5090	40.00%	39.00%	17	17	127.25%	127.16%
Total	7,523	31,330				8,980	8,586	83.78%	87.62%

[1,2] For members hired before 09/01/2008, the annual rate of service retirement is 100% at age 62. For members hired after 09/01/2008, the annual rate of service retirement is 100% at age 60.

[2] For members hired after 09/01/2008 and younger than 65, the rates other than 100% are reduced by 20% to account for a different health insurance benefit.

[2] For members hired after 01/01/2014, the rate is 20% until 30 years of service

Actual, expected, and exposures are in thousands of benefit.

Kentucky Retirement System
State Police Retirement System (SPRS)
Members hired before 09/01/2008
Unreduced Retirement Experience - Service Based - M&F

				Assumed Rate		Expected Retirements		Actual/Expected	
Service	Actual Retirements	Total Exposures	Actual Rate	Current[1]	Proposed[2]	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
20	92	731	0.1263	22.00%	22.00%	161	161	57.41%	57.41%
21	122	652	0.1870	22.00%	22.00%	143	143	85.00%	85.00%
22	104	580	0.1795	22.00%	22.00%	128	128	81.58%	81.58%
23	96	488	0.1970	28.00%	28.00%	137	137	70.34%	70.34%
24	162	401	0.4035	28.00%	28.00%	112	112	144.09%	144.09%
25	59	261	0.2251	28.00%	28.00%	73	73	80.40%	80.40%
26	59	232	0.2530	28.00%	28.00%	65	65	90.37%	90.37%
27	85	222	0.3808	28.00%	28.00%	62	62	136.01%	136.01%
28	22	114	0.1902	44.00%	44.00%	50	50	43.22%	43.22%
29	60	89	0.6748	44.00%	44.00%	39	39	153.37%	153.37%
30	6	31	0.2087	44.00%	44.00%	14	14	47.43%	47.43%
31	7	40	0.1874	58.00%	58.00%	23	23	32.31%	32.31%
32	0	17	0.0000	58.00%	58.00%	10	10	0.00%	0.00%
33	28	28	1.0000	58.00%	58.00%	16	16	172.41%	172.41%
Total	902	3,886				1,033	1,033	87.27%	87.27%

[1,2] The annual rate of service retirement is 100% at age 55.

[2] For members hired after 09/01/2008 and younger than 65, the rates other than 100% are reduced by 20% to account for a different health insurance benefit.

Actual, expected, and exposures are in thousands of benefit.

Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Reduced Retirement Experience - Age Based - Male

				Assumed Rate		Expected Retirements		Actual/Expected	
Age	Actual Retirements	Total Exposures	Actual Rate	Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	102	2,181	0.0466	8.00%	5.00%	174	109	58.43%	93.28%
56	85	2,047	0.0416	8.00%	5.00%	164	102	51.87%	83.40%
57	84	2,009	0.0418	8.00%	5.00%	161	100	52.19%	84.03%
58	78	1,947	0.0398	8.00%	5.00%	156	97	49.69%	79.91%
59	70	1,814	0.0384	8.00%	5.00%	145	91	48.05%	76.56%
60	80	1,671	0.0480	10.00%	5.00%	167	84	48.06%	95.54%
61	113	1,593	0.0711	20.00%	8.00%	319	127	35.49%	89.14%
62	212	1,474	0.1436	20.00%	15.00%	295	221	71.73%	95.75%
63	179	1,308	0.1370	20.00%	15.00%	262	196	68.40%	91.44%
64	159	1,090	0.1460	20.00%	15.00%	218	164	73.01%	97.05%
Total	1,161	17,135				2,061	1,291	56.35%	89.96%

Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Reduced Retirement Experience - Age Based - Female

				Assumed Rate		Expected Retirements		Actual/Expected	
Age	Actual Retirements	Total Exposures	Actual Rate	Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	189	3,882	0.0487	8.00%	5.00%	311	194	60.79%	97.44%
56	178	3,699	0.0482	8.00%	5.00%	296	185	60.24%	96.39%
57	196	3,520	0.0558	8.00%	5.00%	282	176	69.67%	111.64%
58	164	3,356	0.0489	8.00%	5.00%	268	168	61.22%	97.66%
59	178	3,089	0.0576	8.00%	5.00%	247	154	72.01%	115.49%
60	210	2,780	0.0755	10.00%	8.00%	278	222	75.49%	94.53%
61	224	2,490	0.0899	20.00%	9.00%	498	224	44.94%	99.90%
62	423	2,232	0.1893	20.00%	20.00%	446	446	94.77%	94.77%
63	308	1,832	0.1679	20.00%	18.00%	366	330	84.03%	93.20%
64	221	1,474	0.1500	20.00%	16.00%	295	236	74.92%	93.65%
Total	2,291	28,353				3,287	2,335	69.69%	98.10%

Actual, expected, and exposures are in thousands of benefit.

Retirement Experiences

Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Reduced Retirement Experience - Service Based - Male

				Assumed Rate		Expected Retirements		Actual/Expected	
Service	Actual Retirements	Total Exposures	Actual Rate	Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	388	3,971	0.0978	3.47%	12.00%	138	477	281.45%	81.42%
56	506	3,811	0.1328	3.91%	12.00%	149	457	339.67%	110.75%
Total	895	7,782				287	934	311.67%	95.77%

Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Reduced Retirement Experience - Service Based - Female

				Assumed Rate		Expected Retirements		Actual/Expected	
Service	Actual Retirements	Total Exposures	Actual Rate	Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	618	5,759	0.1074	3.61%	14.00%	208	806	297.31%	76.73%
56	884	5,399	0.1637	3.95%	14.00%	213	756	414.82%	116.87%
Total	1,502	11,157				421	1,562	356.76%	96.16%

Actual, expected, and exposures are in thousands of benefit.

Retirement Experiences

Kentucky Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Reduced Retirement Experience - Age Based - Male

				Assumed Rate		Expected Retirements		Actual/Expected	
Age	Actual Retirements	Total Exposures	Actual Rate	Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	145	3,886	0.0373	5.00%	4.00%	194	155	74.74%	93.55%
56	122	3,680	0.0332	6.00%	4.00%	221	147	55.34%	83.19%
57	109	3,602	0.0302	7.00%	4.00%	252	144	43.10%	75.43%
58	118	3,522	0.0335	7.00%	4.00%	247	141	47.74%	83.63%
59	118	3,379	0.0349	8.00%	4.00%	270	135	43.64%	87.29%
60	130	3,168	0.0410	9.00%	4.00%	285	127	45.56%	102.23%
61	137	2,963	0.0462	15.00%	4.00%	444	119	30.83%	115.03%
62	436	2,857	0.1526	18.00%	15.00%	514	429	84.84%	101.65%
63	313	2,361	0.1327	18.00%	15.00%	425	354	73.72%	88.51%
64	267	1,993	0.1340	18.00%	15.00%	359	299	74.39%	89.32%
Total	1,895	31,411				3,211	2,050	59.01%	92.43%

Kentucky Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Reduced Retirement Experience - Age Based - Female

				Assumed Rate		Expected Retirements		Actual/Expected	
Age	Actual Retirements	Total Exposures	Actual Rate	Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	264	6,960	0.0379	5.00%	5.00%	348	348	75.75%	75.75%
56	285	6,742	0.0423	6.00%	5.00%	405	337	70.45%	84.67%
57	281	6,607	0.0426	7.00%	5.00%	463	330	60.78%	85.28%
58	326	6,365	0.0512	7.00%	5.00%	446	318	73.11%	102.54%
59	321	5,988	0.0537	8.00%	5.00%	479	299	67.12%	107.52%
60	404	5,620	0.0718	9.00%	8.00%	506	450	79.76%	89.69%
61	427	5,134	0.0832	15.00%	9.00%	770	462	55.45%	92.42%
62	807	4,617	0.1747	18.00%	20.00%	831	923	97.09%	87.41%
63	624	3,705	0.1683	18.00%	18.00%	667	667	93.48%	93.48%
64	433	2,967	0.1458	18.00%	16.00%	534	475	81.02%	91.08%
Total	4,171	54,706				5,449	4,609	76.56%	90.51%

Actual, expected, and exposures are in thousands of benefit.

Retirement Experiences

Kentucky Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Reduced Retirement Experience - Service Based - Male

				Assumed Rate		Expected Retirements		Actual/Expected	
Service	Actual Retirements	Total Exposures	Actual Rate	Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	388	4,654	0.0833	3.93%	11.00%	183	512	211.77%	75.69%
56	489	4,413	0.1108	4.15%	11.00%	183	485	267.08%	100.77%
Total	876	9,067				366	997	239.42%	87.89%

Kentucky Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Reduced Retirement Experience - Service Based - Female

				Assumed Rate		Expected Retirements		Actual/Expected	
Service	Actual Retirements	Total Exposures	Actual Rate	Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	583	5,715	0.1020	6.14%	12.00%	351	686	166.09%	84.98%
56	670	5,147	0.1302	6.31%	12.00%	325	618	206.25%	108.47%
Total	1,253	10,862				676	1,304	185.40%	96.11%

Actual, expected, and exposures are in thousands of benefit.