Teachers' and State Employees' Retirement System of North Carolina

Investigation of Demographic and Economic Experience
Five-Year Period from January 1, 2010 – December 31, 2014

Board of Trustees Meeting

Larry Langer, Mike Ribble and Kai Petersen

October 22, 2015

buckconsultants

xerox

State Plans Covered

- Teachers' and State Employees' Retirement System
- Consolidated Judicial Retirement System
- Legislative Retirement System
- National Guard Pension Fund

Plans to be Covered in January 2016

- Disability Income Plan
- Death Benefit Plans

Agenda

- Experience Review Process
- Review of Demographic Assumptions
- Review of Economic Assumptions
- Review of Funding Methods
- Cost Impact of Proposed Assumption and Method Changes

The Valuation Process

INPUT

- Member Data
- Asset Data
- Benefit Provisions
- Actuarial Assumptions
- Funding Methodology

RESULTS

- Actuarial Value of Assets
- Actuarial Accrued Liability
- Net Actuarial Gain or Loss
- Funded Ratio
- Employer Contributions

Over the short term, contributions are determined by the actuarial valuation based upon estimated investment return, benefits and expenses using assumptions and methods recommended by the actuary and adopted by the Board. Over the long term, contributions are adjusted to reflect actual investment return, benefits and expenses.

Actuarial Assumptions

- Actuarial assumptions bridge the gap between the information that we know with reasonable certainty as of the valuation date – age, gender, service, pay or benefits of the members – and what may happen in the future.
- The actuarial assumptions of the North Carolina Retirement Systems are reviewed every five years in a process known as an Experience Review.
  - The last experience review was prepared as of December 31, 2009 and first used in the December 31, 2009 valuation.
  - The results of this review will be used with the December 31, 2015 valuation.
- Detailed summaries of current actuarial assumptions are provided in the most recent actuarial valuation reports prepared for these four systems.

Actuarial Assumptions – 12/31/2014 TSERS Valuation

- **Demographic**
  - Mortality
    - Based on RP-2000 mortality tables adjusted for NCRS experience
    - Projected improvements based on Scale AA
  - Service Retirement
    - Varies by age, gender, service and employee group
    - Study reduced retirement and unreduced retirement
  - Disability
    - Only for grandfathered group of employees
  - Termination
    - Varies by gender and employee group
    - Varies by service prior to five years of service and by age after five years of service
  - Leave Conversions
    - Adjustments to service and pay at retirement
    - Varies by gender and employee group

- **Economic**
  - Rate of Return (7.25%)
  - Inflation (3.00%)
  - Productivity Growth (0.5%)
  - Merit Pay Increases:

Years of Service	Classroom Teachers	General Employees and Other Education	Law Enforcement Officers
0	4.05%	2.00%	5.60%
5	3.05%	2.00%	3.60%
10	2.20%	1.95%	1.90%
15	1.95%	1.75%	1.45%
20	1.75%	1.75%	1.15%
25	1.75%	1.75%	0.75%
30	1.75%	1.75%	0.75%
35	1.75%	1.75%	0.75%

This is a summary of the assumptions currently used in the actuarial valuation of TSERS.

Assumptions are generally split into two broad categories – demographic assumptions and economic assumptions. Demographic assumptions are assumptions related to people, while economic assumptions relate to money.

Actuarial Assumptions – 12/31/2014 CJRS Valuation

- **Demographic**
  - Mortality
    - Based on RP-2000 mortality tables adjusted for NCRS experience
    - Projected improvements based on Scale AA
  - Service Retirement
    - Varies by age, gender, and service
    - Study reduced retirement and unreduced retirement
  - Disability
    - Varies by age
  - Termination
    - No termination of employment assumed to occur prior to retirement, other than death or disability

- **Economic**
  - Rate of Return (7.25%)
  - Inflation (3.00%)
  - Productivity Growth (0.5%)
  - Merit Pay Increases:

Years of Service	Judicial
0	2.45%
5	2.20%
10	1.95%
15	1.75%
20	1.70%
25	1.50%
30	1.50%
35	1.50%

This is a summary of the assumptions currently used in the actuarial valuation of CJRS.

Note that there are some similarities to the TSERS assumptions, but where appropriate, we tailor assumptions to reflect what we expect will happen in CJRS.

Actuarial Assumptions – 12/31/2014 LRS Valuation

- **Demographic**
  - Mortality
    - 1971 Group Annuity Mortality Table for males
    - No mortality improvements projected
  - Service Retirement
    - 100% for all members at age 65
  - Disability
    - Varies by age
  - Termination
    - No termination of employment assumed to occur prior to retirement, other than death or disability

- **Economic**
  - Rate of Return (7.25%)
  - Inflation (3.00%)
  - Productivity Growth (0.5%)
  - Merit Pay Increases (4.00%)

This is a summary of the assumptions currently used in the actuarial valuation of LRS.

Most significantly, the base mortality has not been updated in many years, compounded by the lack of projected mortality improvements.

Actuarial Assumptions – 12/31/2014 National Guard

- **Demographic**
  - Mortality
    - Based on RP-2000 mortality tables adjusted for NCRS experience
    - Projected improvements based on Scale AA
  - Service Retirement
    - 50% for members under age 60 with 20 years of service
    - 100% for members age 60 with 20 years of service or at any age with 30 years of service
  - Disability
    - Varies by age for members with less than 20 years of service
  - Termination
    - No rates of termination are assumed to occur prior to 20 years of service

- **Economic**
  - Rate of Return (7.25%)
  - Inflation (3.00%)
  - Productivity Growth: Not Applicable
  - Merit Pay Increases: Not Applicable

This is a summary of the assumptions currently used in the actuarial valuation of National Guard.

Note that there are some similarities to the TSERS assumptions, but where appropriate, we tailor assumptions to reflect what we expect will happen in NGPF.

Experience Review Process

- Based on Five-Year Experience Review for Period January 1, 2010 – December 31, 2014
- Consider trends observed during the previous Experience Review
- Compare Experience ("Actual") with Assumptions ("Expected")
- Make Judgments About Future Trends:
  - Plan-Specific Experience vs. National Trends
  - Long-Term vs. Short-Term Factors
- Recommend changes in assumptions as needed
- Implement effective with the December 31, 2015 Actuarial Valuation
- For full sets of rates see corresponding reports

"Enhancing Reliability of Actuarial Valuations for Pension Plans" by the GFOA

Engage the actuary to perform additional services to validate the actuarial assumptions used for the valuation. Such services include…Actuarial Experience Study. An actuarial experience study reviews the differences between a plan's assumed and actual experience over multiple years (typically 3 to 5), with the goal of examining the trends related to actual experience and recommending changes to assumptions, if needed.

Key Takeaways - TSERS

Assumption	Observed Experience Relative to Expectations	Recommendation	Impact on Costs
1. Mortality	Fewer Deaths	Decrease Rates and Update Mortality Improvement Projection Scale	Significant Increase
2. Service retirement	Fewer Retirements	Decrease Rates	Slight Decrease
3. Disability retirement	Small Group	No Change	N/A
4. Termination from active employment	Fewer Terminations	Decrease Rates	Slight Decrease
5. Leave conversions at retirement	Varies by Group	Varies by Group	Immaterial
6. Investment return	Current Assumption Reasonable	No Change	N/A
7. Merit pay increases	Lower Increases	Decrease Rates	Significant Decrease
8. Inflation	Current Assumption Reasonable	No Change	N/A
9. Productivity growth	Current Assumption Reasonable	No Change	N/A
10. Amortization method	Current Assumption Reasonable	No Change	N/A
11. Actuarial cost method	Current Assumption Reasonable	No Change	N/A
12. Asset valuation method	Not Transparent or Predictable	5-year Smoothing	Slight Increase

Notes:

1. The mortality assumption was the source of the largest increase in costs. While we did observe fewer deaths than expected over the past few years, the increase in costs was driven more by the increase in mortality improvements suggested by national studies
6. The current investment return assumption of 7.25% remains reasonable
7. The merit increase assumption was the source of the largest decrease in costs as salaries continued to fall short of the long-term assumptions

Overall, the net impact on liabilities was an increase

Key Takeaways - CJRS

Assumption	Observed Experience Relative to Expectations	Recommendation	Impact on Costs
1. Mortality	Fewer Deaths	Decrease Rates and Update Mortality Improvement Projection Scale	Significant Increase
2. Service Retirement	Fewer Retirements	Decrease Rates	Slight Decrease
3. Disability Retirement	Low Creditability	No Change	N/A
4. Termination from active employment	N/A	N/A	N/A
5. Leave conversions at retirement	N/A	N/A	N/A
6. Investment return	Current Assumption Reasonable	No Change	N/A
7. Merit pay increases	Lower Increases	Decrease Rates	Significant Decrease
8. Inflation	Current Assumption Reasonable	No Change	N/A
9. Productivity growth	Current Assumption Reasonable	No Change	N/A
10. Amortization Method	Current Assumption Reasonable	No Change	N/A
11. Actuarial Cost Method	Inconsistent to Other Systems	Move to Entry Age	Increase
12. Asset Valuation Method	Not Transparent or Predictable	5-year Smoothing	Slight Decrease

Notes:

1. The mortality assumption was the source of the largest increase in costs. While we did observe fewer deaths than expected over the past few years, the increase in costs was driven more by the increase in mortality improvements suggested by national studies

6. The current investment return assumption of 7.25% remains reasonable

7. The merit increase assumption was the source of the largest decrease in costs as salaries continued to fall short of the long-term assumptions

Overall, the net impact on liabilities was an increase

Key Takeaways - LRS

Assumption	Observed Experience Relative to Expectations	Recommendation	Impact on Costs
1. Mortality	Fewer Deaths	Decrease Rates and Update Mortality Improvement Projection Scale	Significant Increase
2. Service Retirement	Fewer Retirements	Decrease Rates and Vary by Age	Significant Decrease
3. Disability Retirement	Low Creditability	No Change	N/A
4. Termination from active employment	More Terminations	Add Rates	Significant Decrease
5. Administrative expenses	No Provision	1% of Payroll	Increase
6. Investment return	Current Assumption Reasonable	No Change	N/A
7. Merit pay increases	Lower Increases	Decrease Rates	Significant Decrease
8. Inflation	Current Assumption Reasonable	No Change	N/A
9. Productivity growth	Current Assumption Reasonable	No Change	N/A
10. Amortization Method	Inconsistent to Other Systems	Change to 12-year	Slight Decrease
11. Actuarial Cost Method	Inconsistent to Other Systems	Move to Entry Age	Increase
12. Asset Valuation Method	Not Transparent or Predictable	5-year Smoothing	Slight Increase

Notes:

1. The mortality assumption was the source of the largest increase in costs. While we did observe fewer deaths than expected over the past few years, the increase in costs was driven more by the increase in mortality improvements suggested by national studies
2. The service retirement assumption had largest decrease in costs as rates that varied based on age were developed. Prior assumption does not vary by age (100% retirement assumed at age 65)
4. The termination assumption results in a large decrease in costs. Prior valuation had no assumed termination rates
6. The current investment return assumption of 7.25% remains reasonable
7. The merit increase assumption was a large decrease source of decrease in costs as salaries continued to fall short of the long-term assumptions

Overall, the net impact on liabilities was an increase

Key Takeaways – National Guard

Assumption	Observed Experience Relative to Expectations	Recommendation	Impact on Costs
1. Mortality	Fewer Deaths	Decrease Rates and Update Mortality Improvement Projection Scale	Significant Increase
2. Service Retirement	Fewer Retirements	Decrease Rates	Significant Decrease
3. Disability Retirement	Low Creditability	No Change	N/A
4. Termination from active employment	More Terminations	Add Rates	Significant Decrease
5. Administrative expenses	No Provision	Prior Year's Expenses	Increase
6. Investment return	Current Assumption Reasonable	No Change	N/A
7. Merit pay increases	N/A	N/A	N/A
8. Inflation	Current Assumption Reasonable	No Change	N/A
9. Productivity growth	N/A	N/A	N/A
10. Amortization Method	Current Assumption Reasonable	No Change	N/A
11. Actuarial Cost Method	Current Assumption Reasonable	No Change	N/A
12. Asset Valuation Method	Not Transparent or Predictable	5-year Smoothing	Slight Increase

Notes:

1. The mortality assumption was the source of the largest increase in costs. While we did observe fewer deaths than expected over the past few years, the increase in costs was driven more by the increase in mortality improvements suggested by national studies
2. The service retirement assumption results in a large decrease in costs as rates were decreased due to fewer retirements than expected

4. The termination assumption results in a large decrease in costs as rates that varied based on age were developed

6. The current investment return assumption of 7.25% remains reasonable

Overall, the net impact on liabilities was an increase

Demographic Assumptions

Post-Retirement and Active Mortality

Retirement

Termination

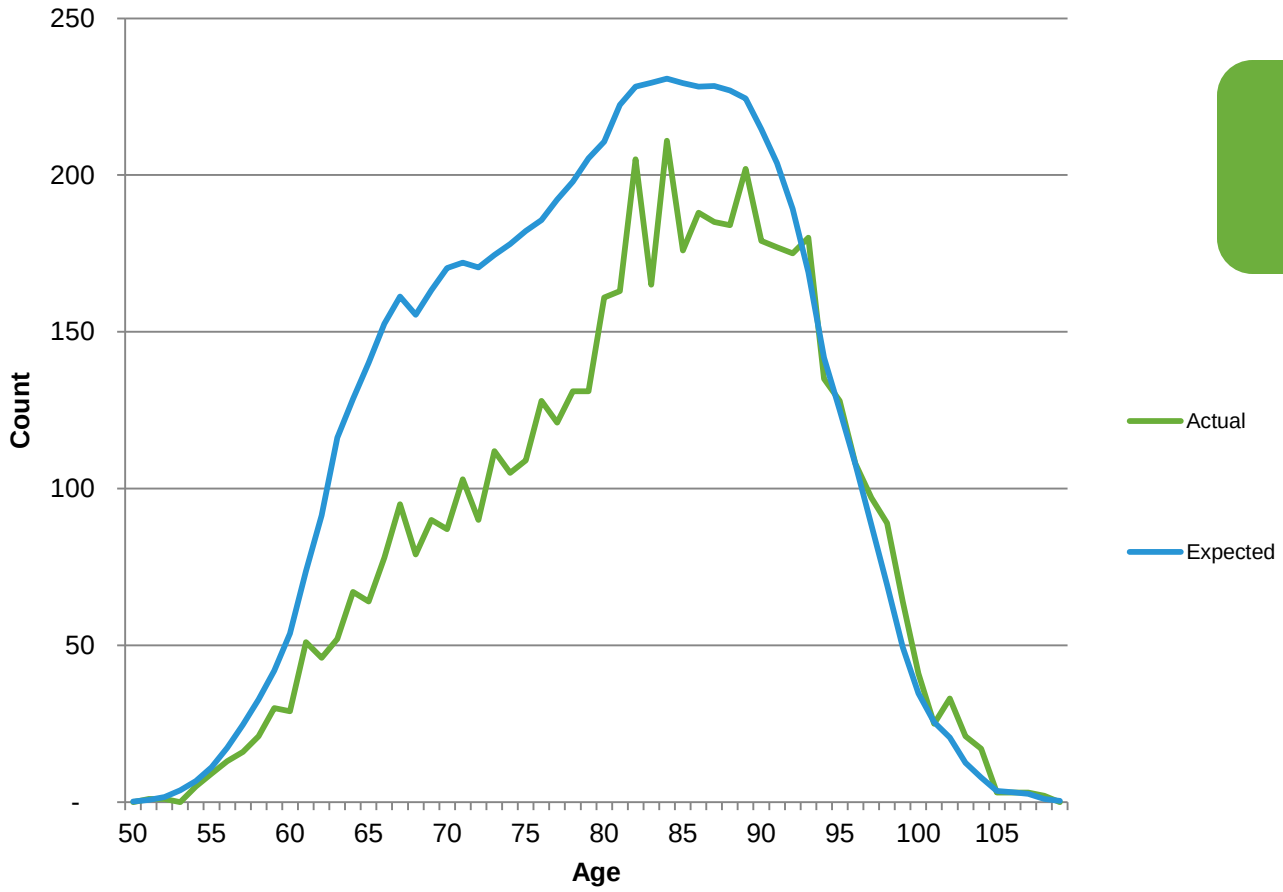
Disability

Leave Conversions

Mortality Rates - Considerations

- Mortality tables vary by age, gender, employee group and health status
- Current mortality rates
  - Based on RP-2000 mortality tables released in 2003
  - Adjusted to TSERS population based on results of December 31, 2009 experience study
  - Includes provision to reflect future mortality improvements based on mortality projection Scale AA (for members healthy at retirement, not disabled at retirement)
- Recent studies of the U.S. Population have determined that overall rates of mortality have decreased faster than predicted by Scale AA
  - Project that longevity will continue to improve
  - Society of Actuaries released new mortality tables to reflect improved base mortality rates (RP-2014) and mortality improvement rates (MP-2014)
- In most age groups, the experience review showed actual observed mortality rates significantly lower than expected mortality rates based on current tables

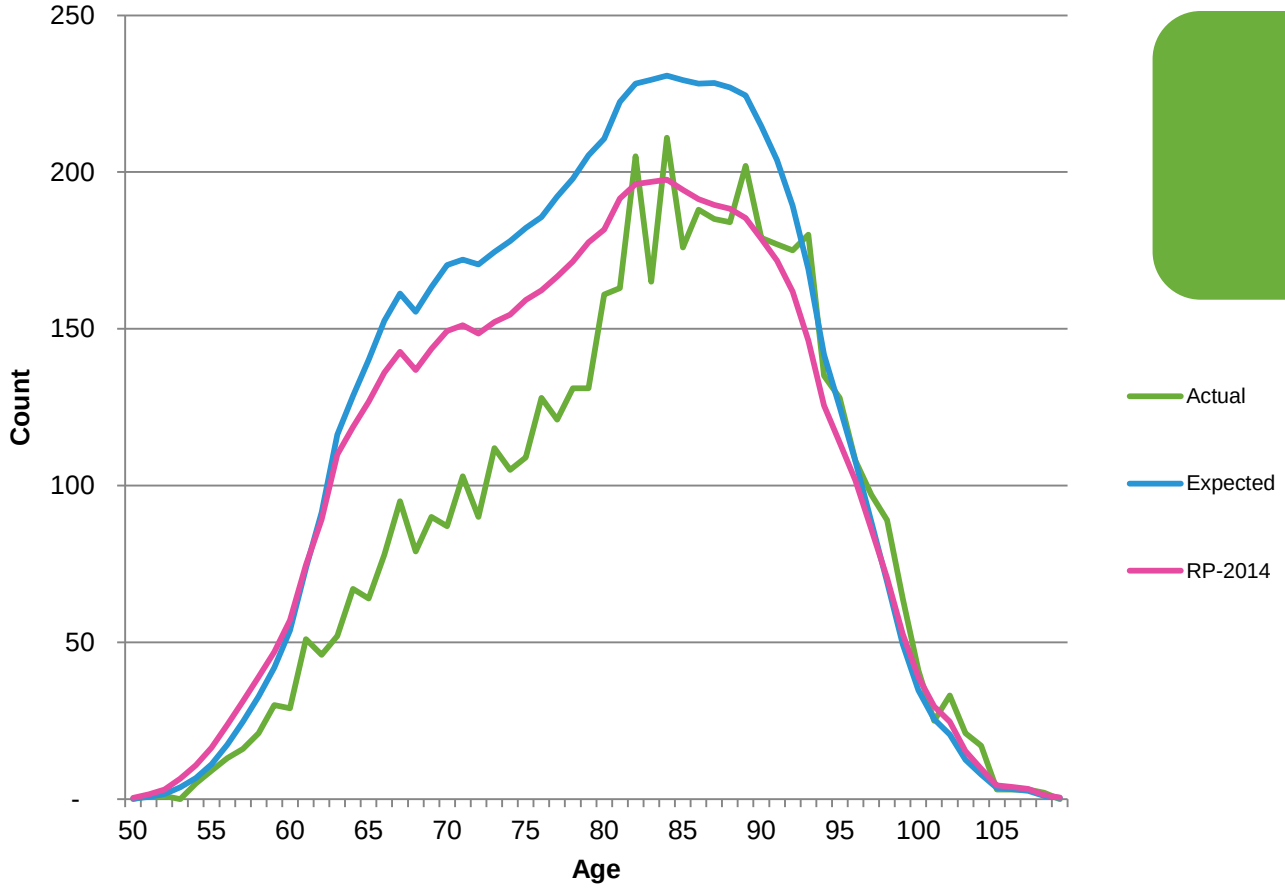
Post-Retirement Mortality – Female Teachers



Actual
vs.
Expected

Observation: Actual experience shows significantly fewer observed deaths at most ages than expected based on current mortality tables

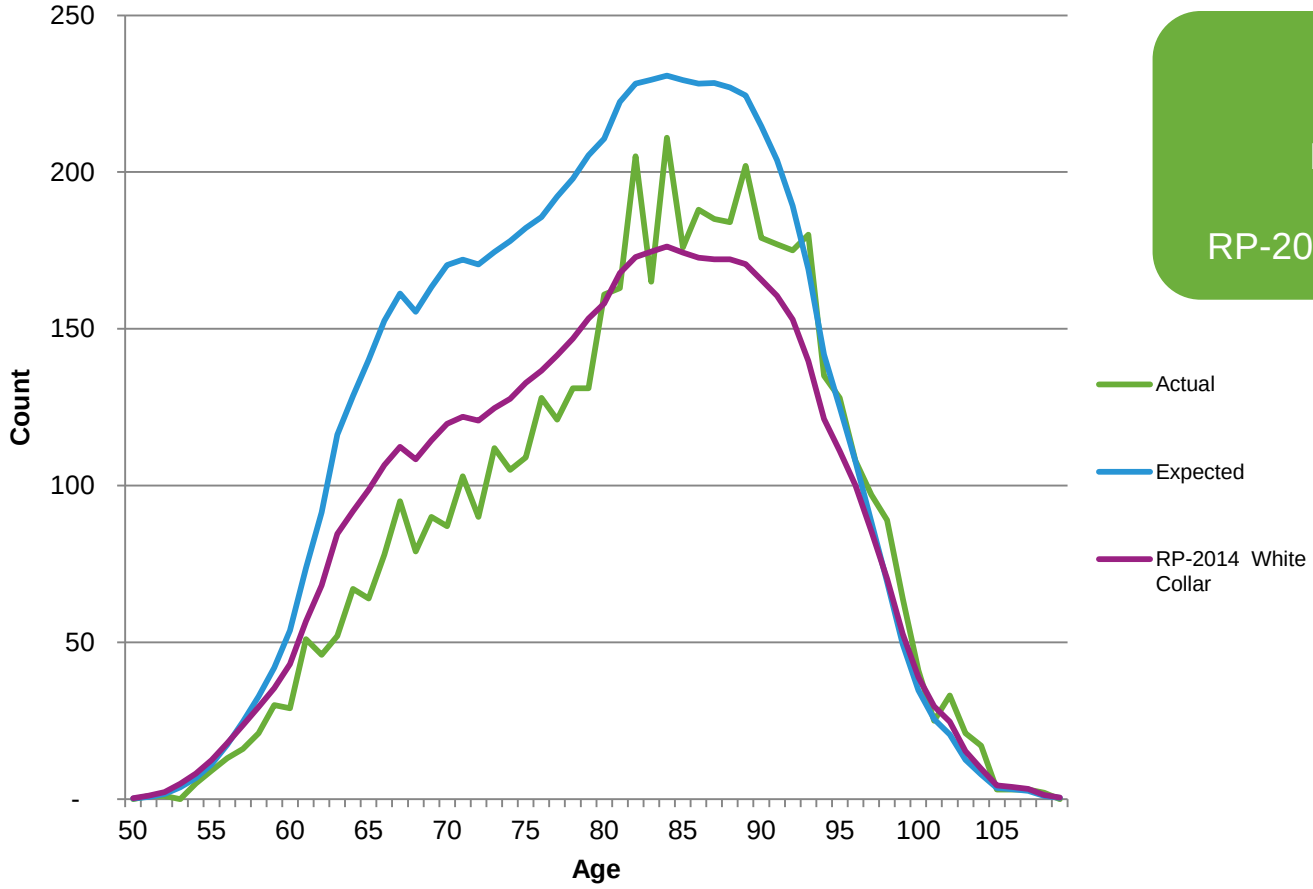
Post-Retirement Mortality – Female Teachers



Actual
vs.
Expected
vs.
RP-2014

Observation: The base mortality table for females released by the Society of Actuaries (RP-2014) is a better fit for Female Teachers, but still predicts significantly more deaths than those observed

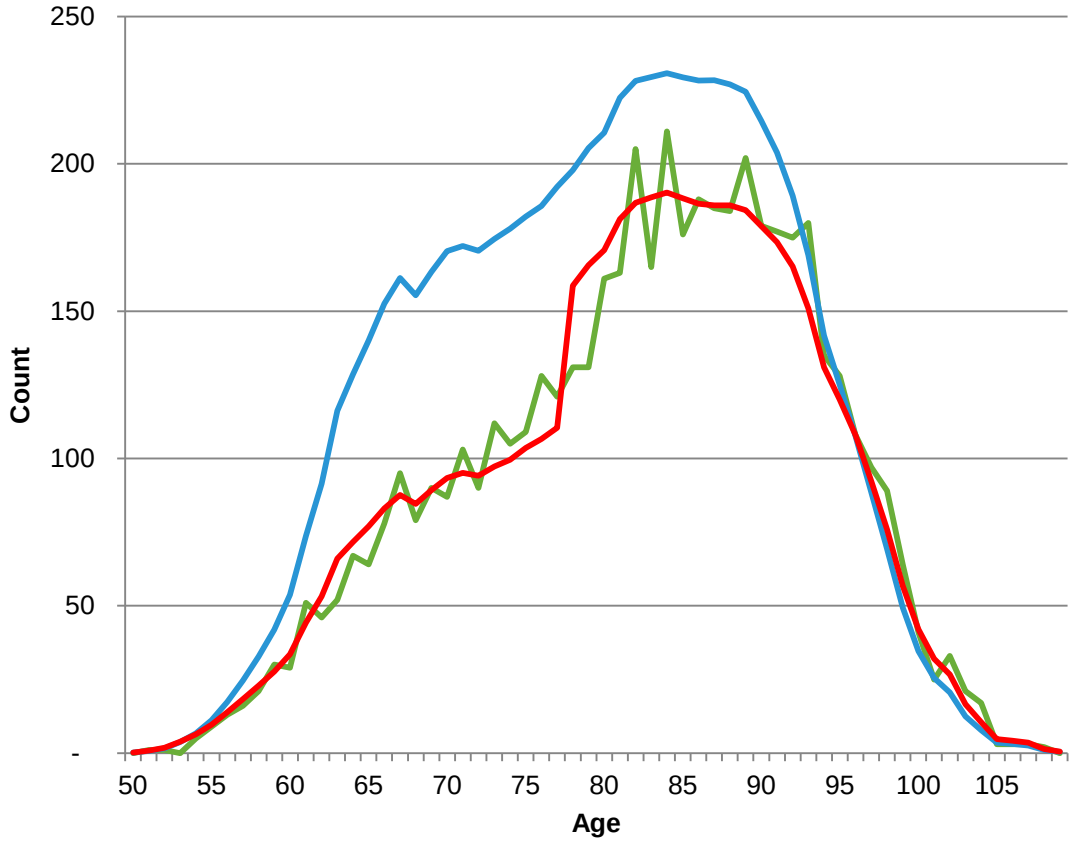
Post-Retirement Mortality – Female Teachers



Actual
vs.
Expected
vs.
RP-2014 White Collar

The Society of Actuaries also released mortality tables with a White Collar adjustment (based on the 75th percentile of base mortality rates). This table is a better fit, but Female Teachers had still lower mortality rates at younger ages and higher mortality at older ages.

Post-Retirement Mortality – Female Teachers



Summary Metrics:
Actual: 5,185
Expected: 6,935
Actual to Expected: 75%
Proposed: 5,162
Actual to Proposed: 100%

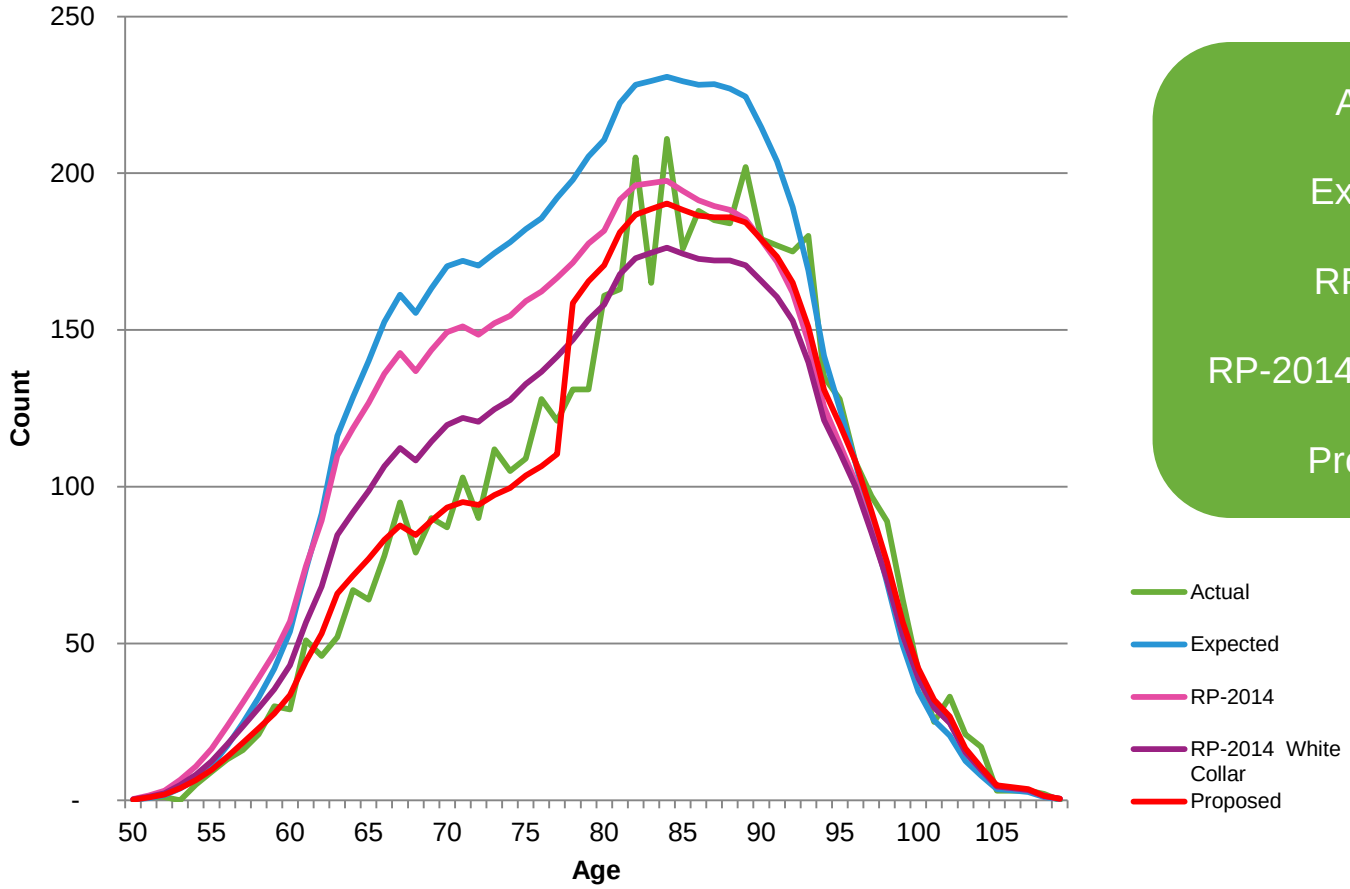
Actual
Expected
Proposed

Observation: By grouping ages 50 to 77 and grouping ages 78 and over, we have enough credible data to make a better fit to the observed experience

Recommendation: Update base rates to RP-2014 with White Collar adjustment, then multiply rates by 78% for ages under 78 and by 108% for ages 78 and over

Impact: Significant increase in liability

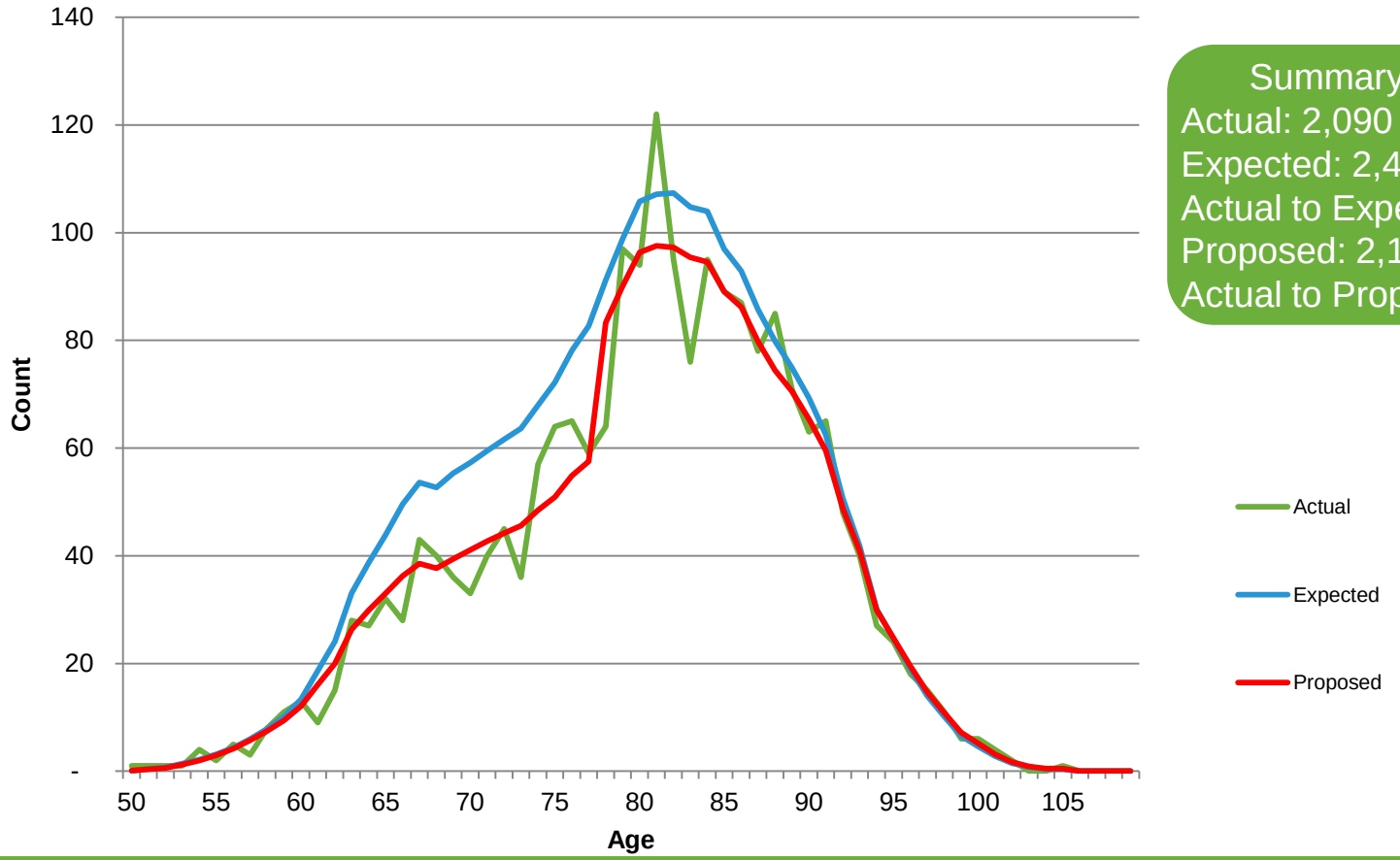
Post-Retirement Mortality – Female Teachers



Actual
vs.
Expected
vs.
RP-2014
vs.
RP-2014 White Collar
vs.
Proposed

Observation: This process was reviewed for all employee groups and retirement systems. Where credible data exists (typically 1,082 observed deaths for fully credible groupings), we have proposed tables that are adjusted to fit the observed data. A few groups are partially credible and a few groups do not have enough credible date to justify moving beyond RP-2014 (e.g., State Law Enforcement Officers)

Post-Retirement Mortality – Male Teachers



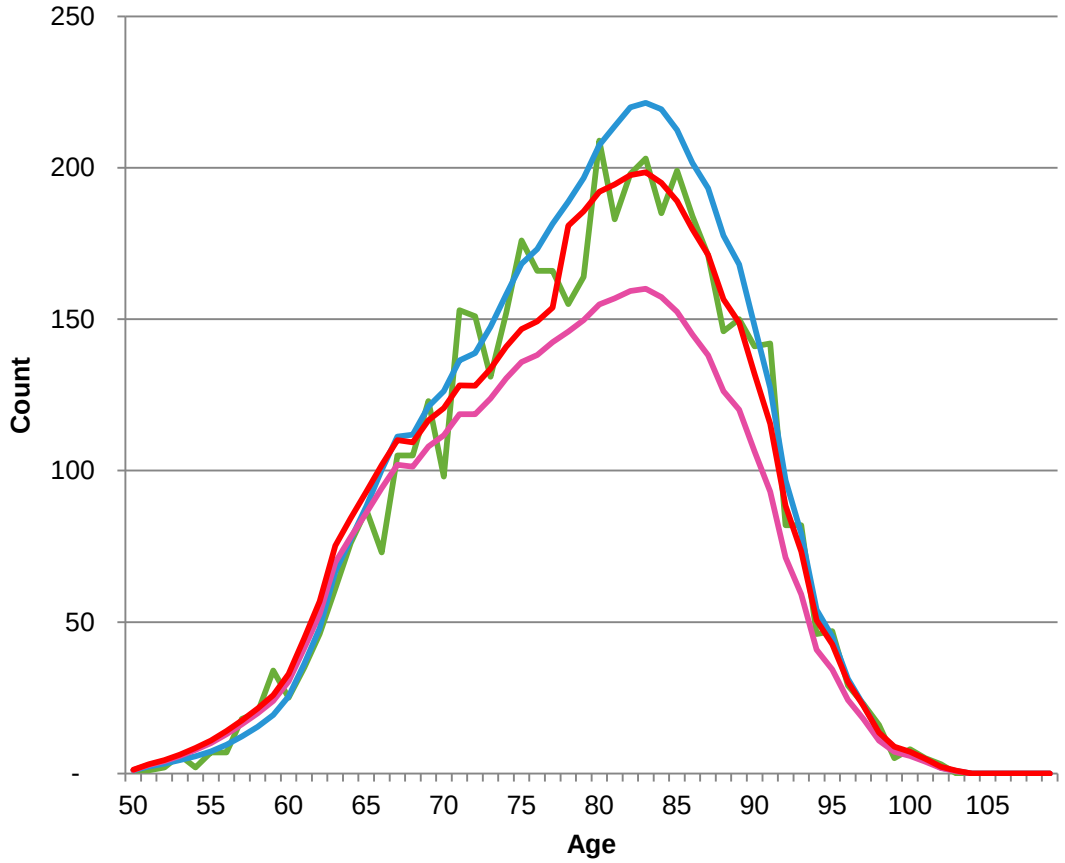
Summary Metrics:
Actual: 2,090
Expected: 2,451
Actual to Expected: 85%
Proposed: 2,103
Actual to Proposed: 99%

Observation: Fewer observed deaths especially at younger ages

Recommendation: Update base rates to RP-2014 with White Collar adjustment, then multiply rates by 92% for ages under 78 and by 120% for ages 78 and over

Impact: Significant increase in liability

Post-Retirement Mortality – Male General Employees



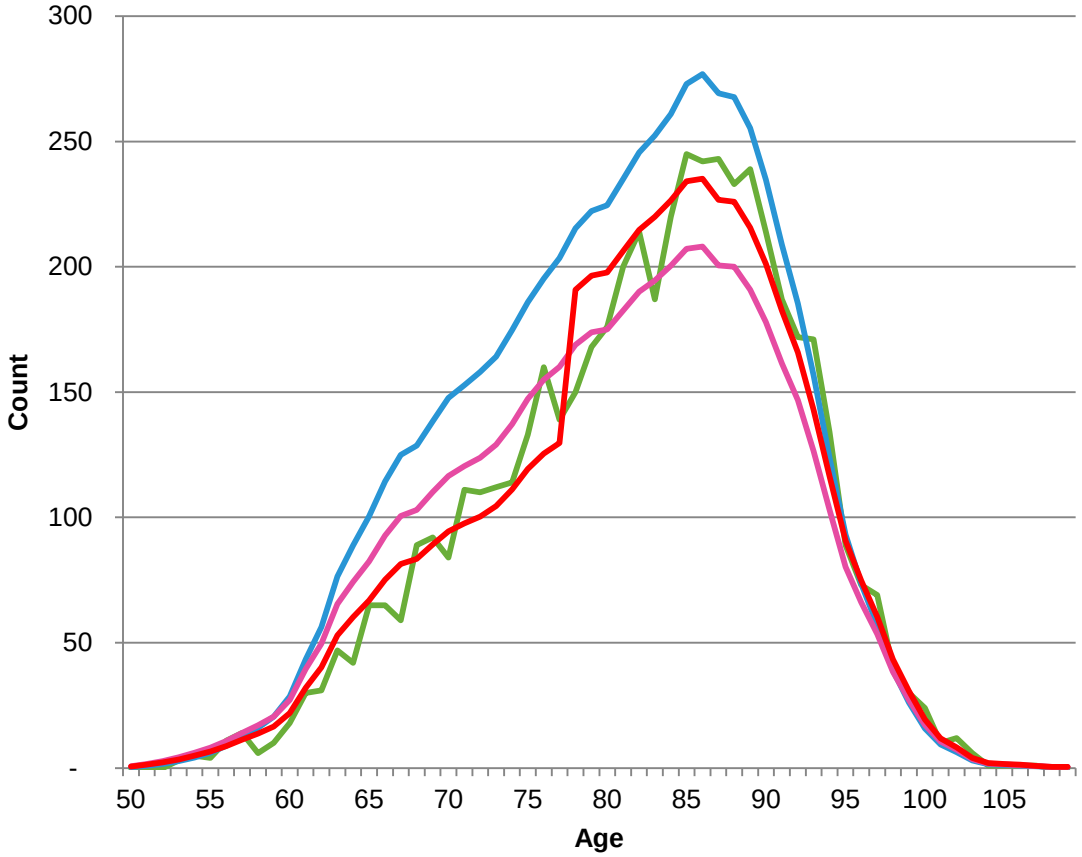
Summary Metrics:
Actual: 4,805
Expected: 5,156
Actual to Expected: 93%
Proposed: 4,821
Actual to Proposed: 100%

Observation: Significant differences occurred over the period

Recommendation: Update base rates to RP-2014 multiplied by 108% for ages under 78 and by 124% for ages 78 and over

Impact: Significant increase in liability

Post-Retirement Mortality – Female General Employees



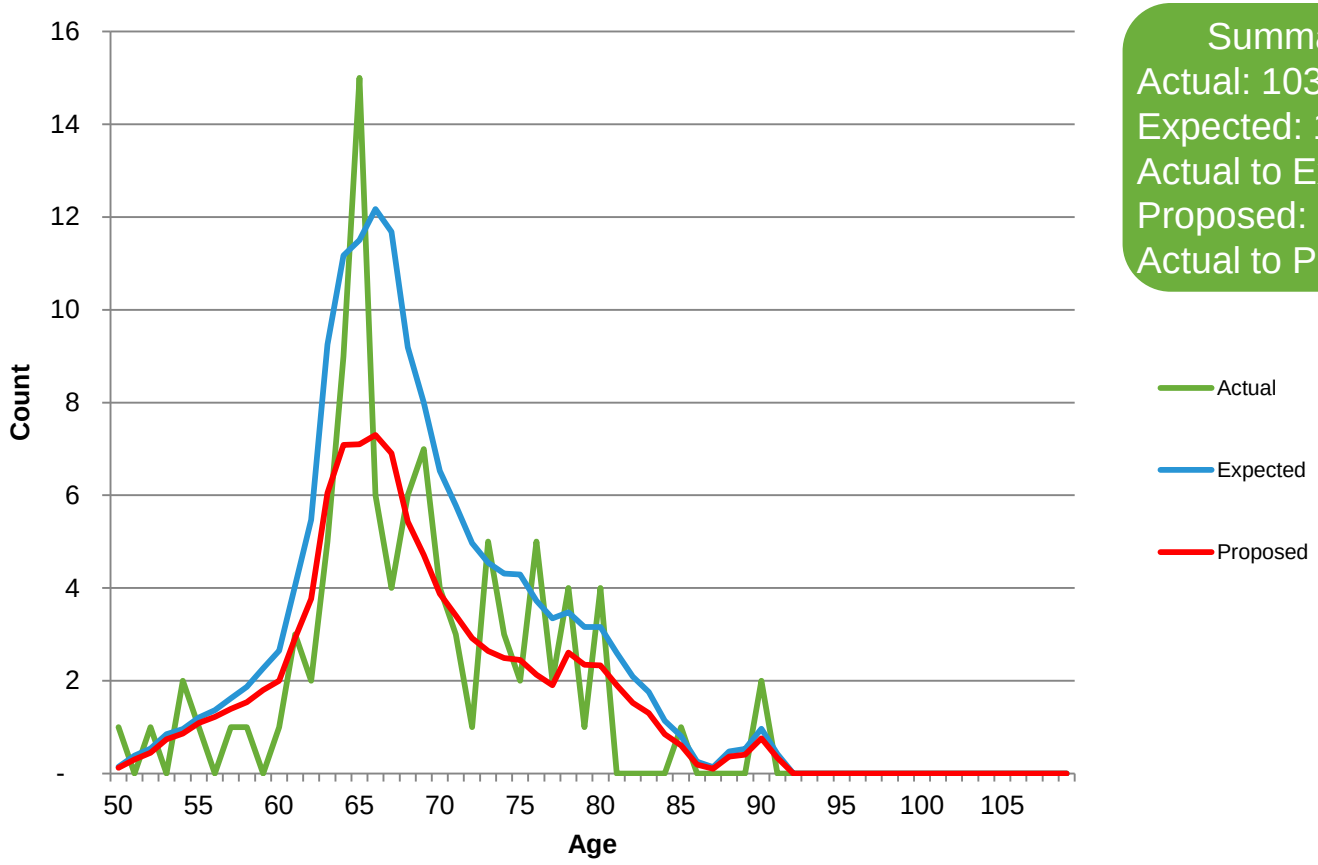
Summary Metrics:
Actual: 5,306
Expected: 6,594
Actual to Expected: 80%
Proposed: 5,306
Actual to Proposed: 100%

Observation: Significant differences occurred over the period

Recommendation: Update base rates to RP-2014 multiplied by 81% for ages under 78 and by 113% for ages 78 and over

Impact: Significant increase in liability

Post-Retirement Mortality – Male Other Education



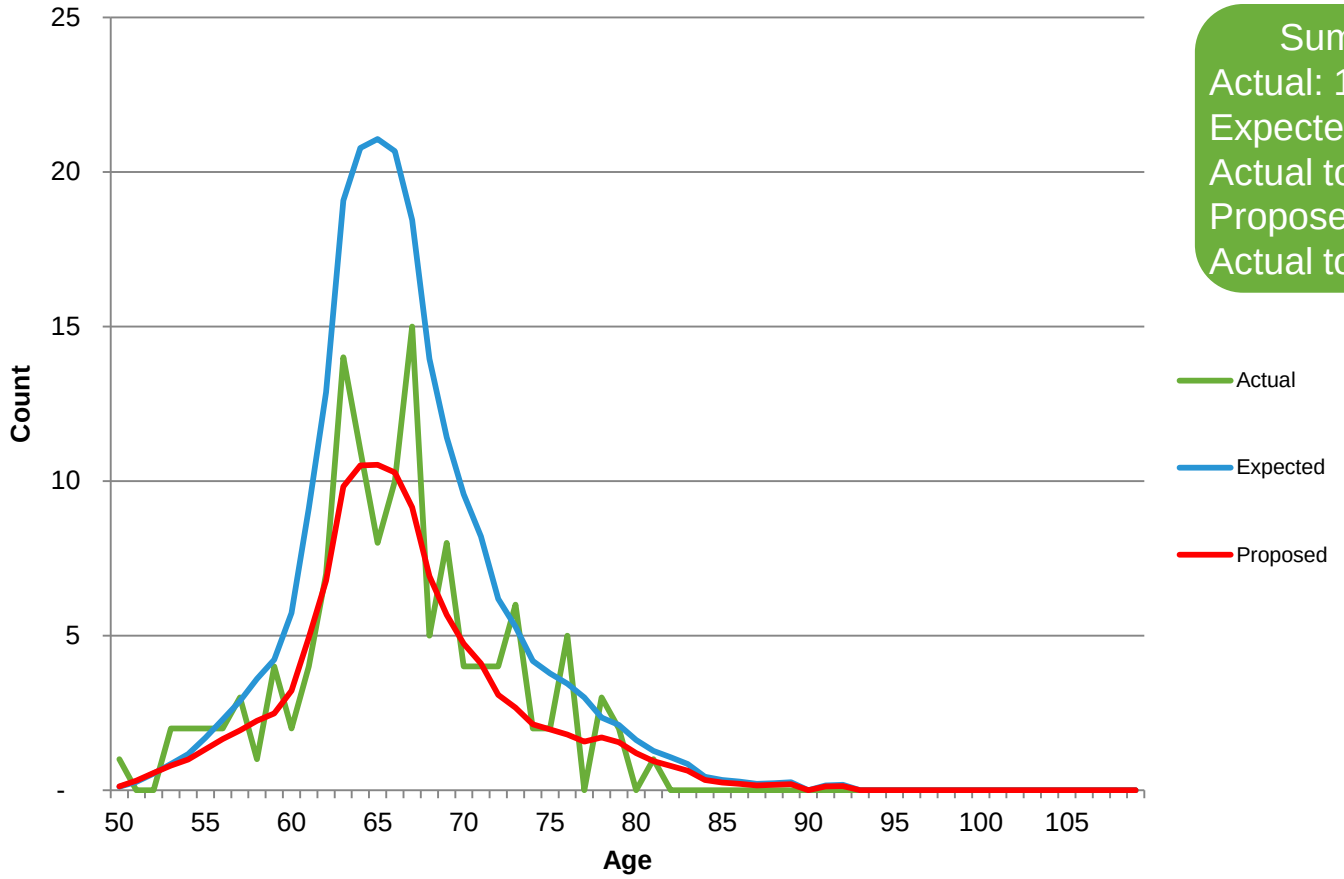
Summary Metrics:
Actual: 103
Expected: 156
Actual to Expected: 66%
Proposed: 101
Actual to Proposed: 102%

Observation: Mortality consistent with Male Teachers; low number of exposures

Recommendation: Update base rates to RP-2014 with White Collar adjustment, then multiply rates by 92% for ages under 78 and by 120% for ages 78 and over (same as Male Teachers)

Impact: Significant increase in liability

Post-Retirement Mortality – Female Other Education



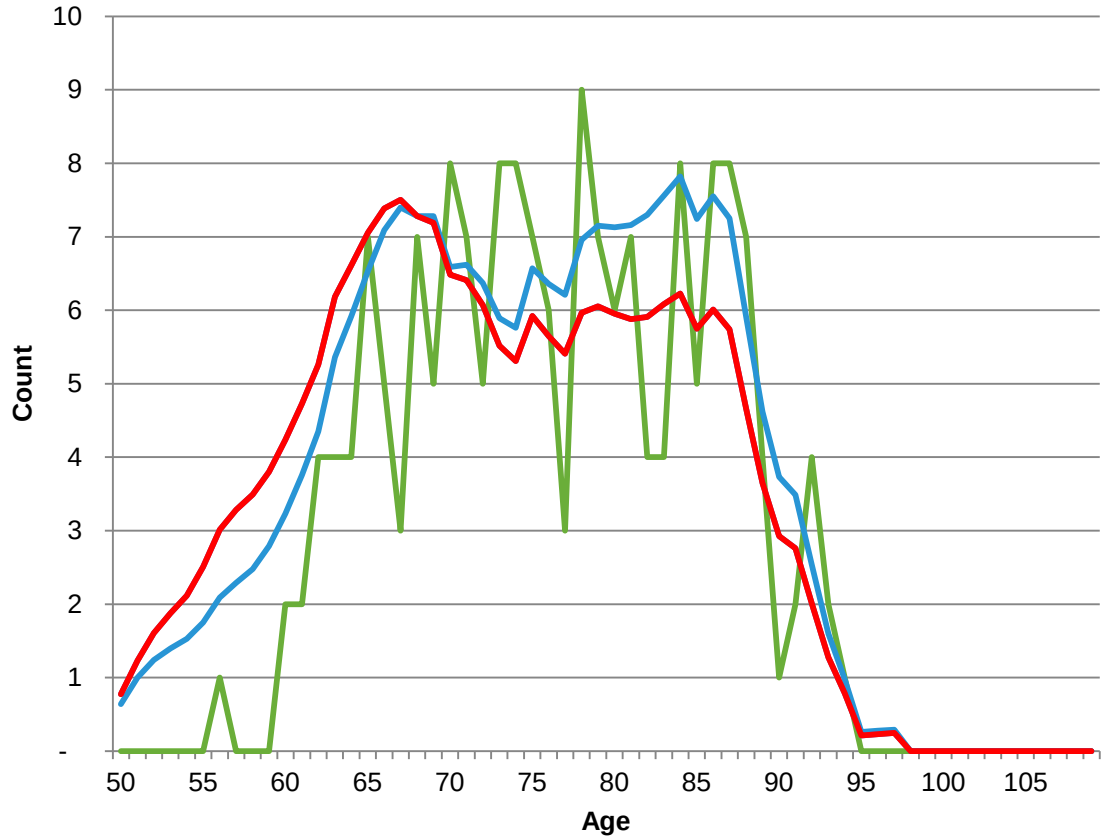
Summary Metrics:
Actual: 134
Expected: 226
Actual to Expected: 59%
Proposed: 120
Actual to Proposed: 112%

Observation: Mortality consistent with Female Teachers; low number of exposures

Recommendation: Update base rates to RP-2014 with White Collar adjustment, then multiply rates by 78% for ages under 78 and by 108% for ages 78 and over (same as Female Teachers)

Impact: Significant increase in liability

Post-Retirement Mortality – Male Law Enforcement Officers



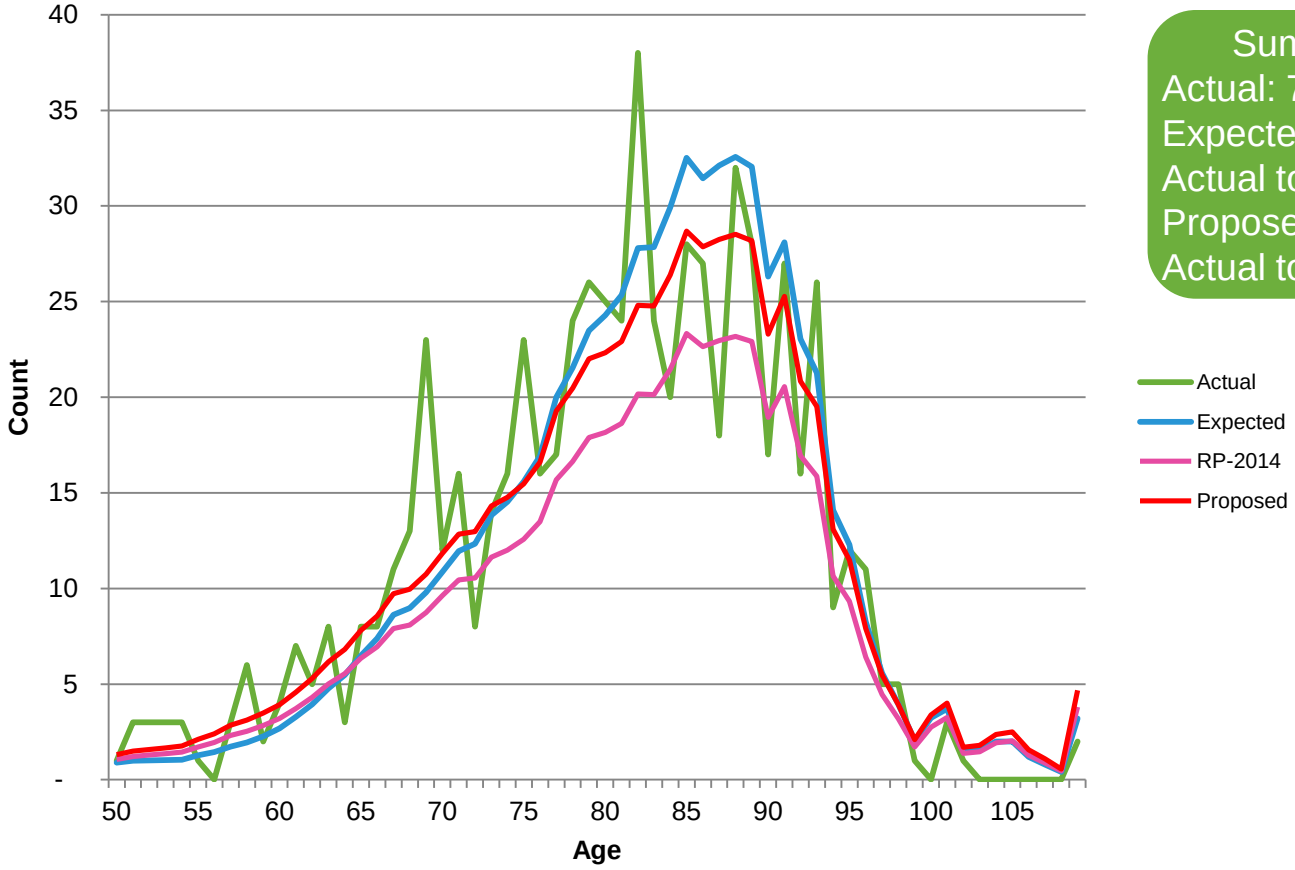
Summary Metrics:
Actual: 183
Expected: 223
Actual to Expected: 82%
Proposed: 213
Actual to Proposed: 86%

Observation: Too few observed deaths to modify tables based on experience

Recommendation: Update base rates to RP-2014

Impact: Increase in liability

Post-Retirement Mortality – Male Beneficiaries (including LGERS)



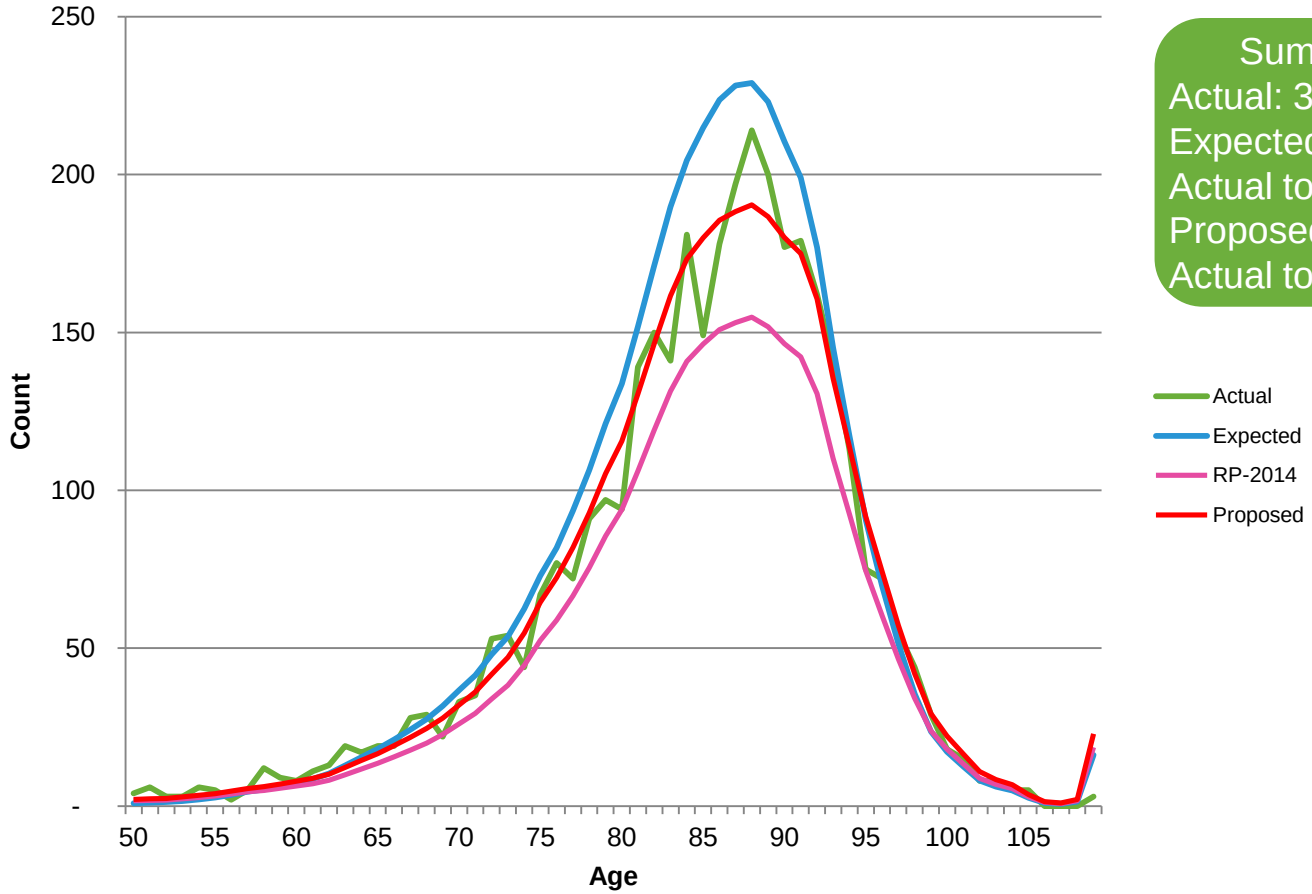
Summary Metrics:
Actual: 702
Expected: 700
Actual to Expected: 100%
Proposed: 677
Actual to Proposed: 104%

Observation: TSERS and LGERS experience for beneficiaries of deceased retirees have been combined to give more credibility to the data. Actual mortality rates are much higher than for service retirements.

Recommendation: Update base rates to RP-2014 multiplied by 123% for all ages

Impact: Increase in liability

Post-Retirement Mortality – Female Beneficiaries (including LGERS)



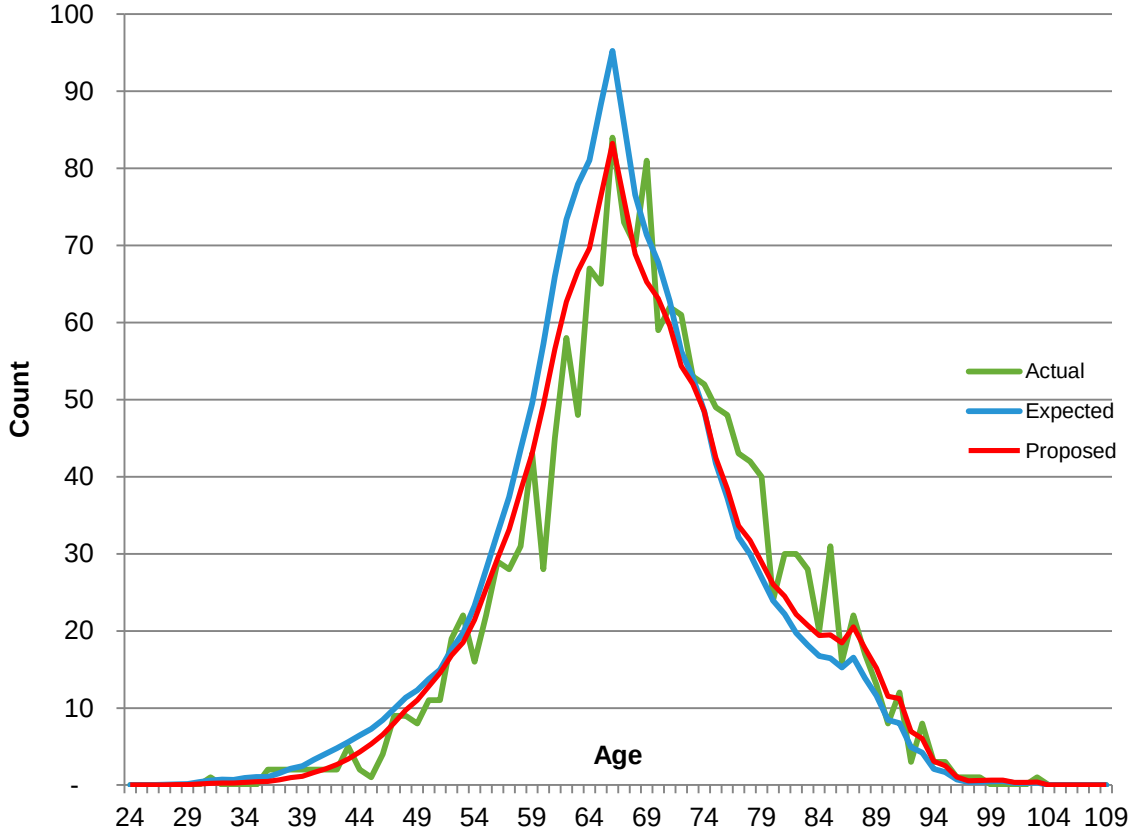
Summary Metrics:
Actual: 3,633
Expected: 4,088
Actual to Expected: 89%
Proposed: 3,646
Actual to Proposed: 100%

Observation: TSERS and LGERS experience for beneficiaries of deceased retirees have been combined to give more credibility to the data. Actual mortality rates are much higher than for service retirements.

Recommendation: Update base rates to RP-2014 multiplied by 123% for all ages

Impact: Significant increase in liability

Post-Retirement Mortality – Male Disabled (including LGERS)



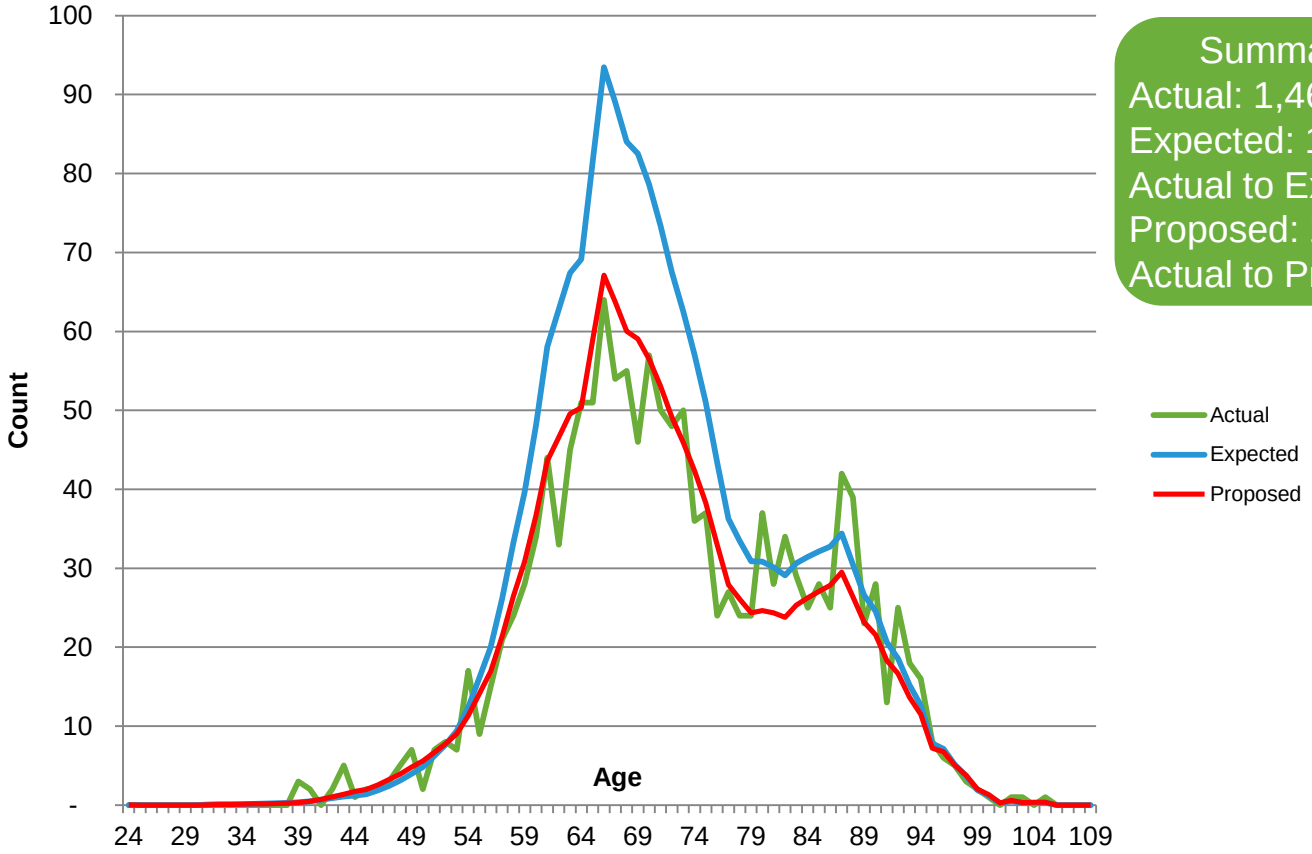
Summary Metrics:
Actual: 1,685
Expected: 1,802
Actual to Expected: 94%
Proposed: 1,691
Actual to Proposed: 100%

Observation: TSERS and LGERS experience for members disabled at retirement have been combined to give more credibility to the data. Actual mortality rates are very close to RP-2014 Disabled mortality table recently released by Society of Actuaries

Recommendation: Update base rates to RP-2014 Disabled mortality multiplied by 103% for all ages

Impact: Significant increase in liability

Post-Retirement Mortality – Female Disabled (including LGERS)



Summary Metrics:
Actual: 1,462
Expected: 1,893
Actual to Expected: 77%
Proposed: 1,474
Actual to Proposed: 99%

Observation: TSERS and LGERS experience for members disabled at retirement have been combined to give more credibility to the data. Actual mortality rates are very close to RP-2014 Disabled mortality table recently released by Society of Actuaries

Recommendation: Update base rates to RP-2014 Disabled mortality multiplied by 99% for all ages

Impact: Significant increase in liability

Post-Retirement Mortality (Summary) - TSERS

Number of Post-Retirement Deaths						
Type of Retiree		Actual	Expected	Actual ÷ Expected	Proposed	Actual ÷ Proposed
Service Retirement	Teachers Male	2,090	2,451	85%	2,103	99%
	Teachers Female	5,185	6,935	75%	5,162	100%
	General Employees Male	4,805	5,156	93%	4,821	100%
	General Employees Female	5,306	6,594	80%	5,306	100%
	Other Education Male	103	156	66%	101	102%
	Other Education Female	134	226	59%	120	112%
	Law Enforcement Officers Male	183	223	82%	213	86%
Beneficiary*	Male	702	700	100%	677	104%
	Female	3,633	4,088	89%	3,646	100%
Disability*	Male	1,685	1,802	94%	1,691	100%
	Female	1,462	1,893	77%	1,474	99%

* Data shown includes LGERS. Mortality rates for members disabled at retirement and survivors of deceased members were studied based on the combined experience of TSERS and LGERS.

Observation: Fewer members have died than expected almost across all groupings.

Recommendation: Update base rates from TSERS adjusted versions of RP-2000 tables to TSERS adjusted versions of RP-2014 tables. Use “White Collar” base rates for teachers and other education service retirements.

Cost impact: Significant increase in liability

Post-Retirement Mortality – CJRS and LRS

Number of CJRS Post Retirement Deaths	Actual	Expected	Actual ÷ Expected	Proposed	Actual ÷ Proposed
Male	46	59	78%	47	98%
Female	13	16	81%	13	100%

Number of LRS Post Retirement Deaths	Actual	Expected	Actual ÷ Expected	Proposed	Actual ÷ Proposed
Combined	28	51	55%	34	82%

Observation: Over the last five years, fewer CJRS and LRS members have died than expected. The number of deaths was too few for meaningful credibility, but the RP-2014 tables fit well

Recommendation: For both CJRS and LRS, update base rates from adjusted versions of RP-2000 tables to the RP-2014 table

Cost impact: Significant increase in liability

Active Mortality – TSERS, CJRS, LRS

Mortality for actives is not a big driver of costs because of the number of deaths and the potentially lower amount of benefits than had the member retired.

Observation: Over the last five years, fewer actives have died than expected for TSERS, CJRS and LRS. The number of deaths was too few for meaningful credibility. However, classroom teachers and other education had enough data to indicate the trend towards using “white collar” mortality table, as was seen with post-retirement mortality.

Recommendation: Update base rates from adjusted versions of RP-2000 tables to RP-2014 employee table. Use “White Collar” employee base rates for teachers and other education.

Cost impact: Immaterial

Mortality Improvement

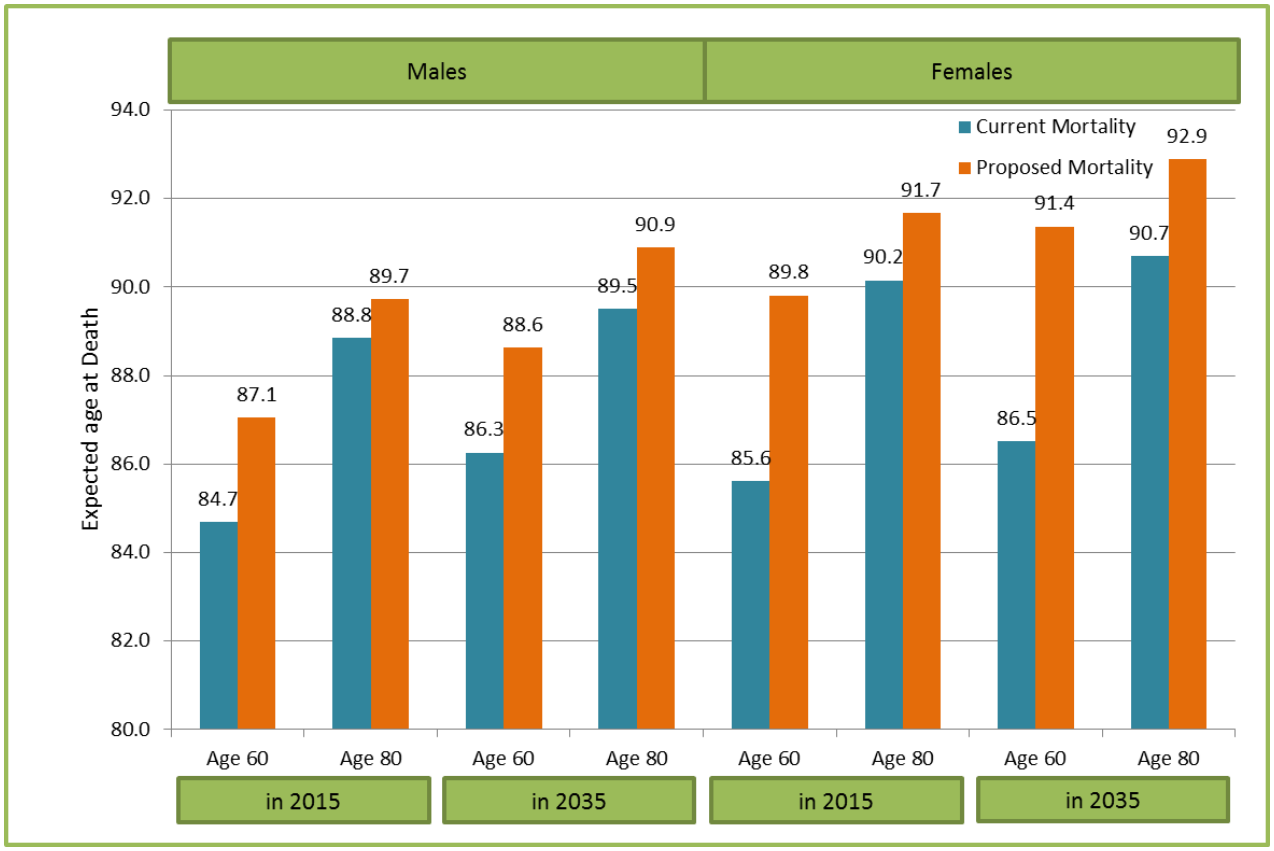
We have seen continued and steady improvement in mortality rates over time. Actuarial Standard of Practice No. 35 states that the actuary should "include an assumption as to expected mortality improvement after the measurement date." Based on the recommendation contained in the December 31, 2004 experience review, the Board in 2006 adopted generational mortality based on rates of mortality improvement known as Scale AA. The use of scale AA was recommended for the December 31, 2009 experience review. At that time no other projection scales had been developed. Since the last experience study, the Society of Actuaries (SOA) conducted a mortality study and determined that the overall rates of mortality improvement in the US have differed from those predicted by Scale AA. In November 2014, the SOA released projection scale MP-2014. There are alternate viewpoints on the use of Scale MP-2014. First, there are those that believe that MP-2014 is unduly conservative with unrealistic mortality improvement rates. Emerging experience since the data was collected by the SOA seems to support that contention. Second, many systems reflect mortality improvements for a set period of years into the future, not forever. These alternate viewpoints suggest using mortality tables that project shorter life expectancy than those based on MP-2014. All that being said, North Carolina Retirement Systems have been consistently ahead of the curve in updating mortality tables and improvement scales. In addition, MP-2014 is based on more current data and has a two-dimensional improvement assumption that is a function of both age and calendar year.

Observation: SOA Study indicates that overall rates of mortality in the US have decreased faster than predicted by Scale AA (adopted by the Board in 2006)

Recommendation: Update from projection Scale AA to MP-2014; project base mortality rates to the valuation date using MP-2014; project forward generationally from the valuation date using MP-2014

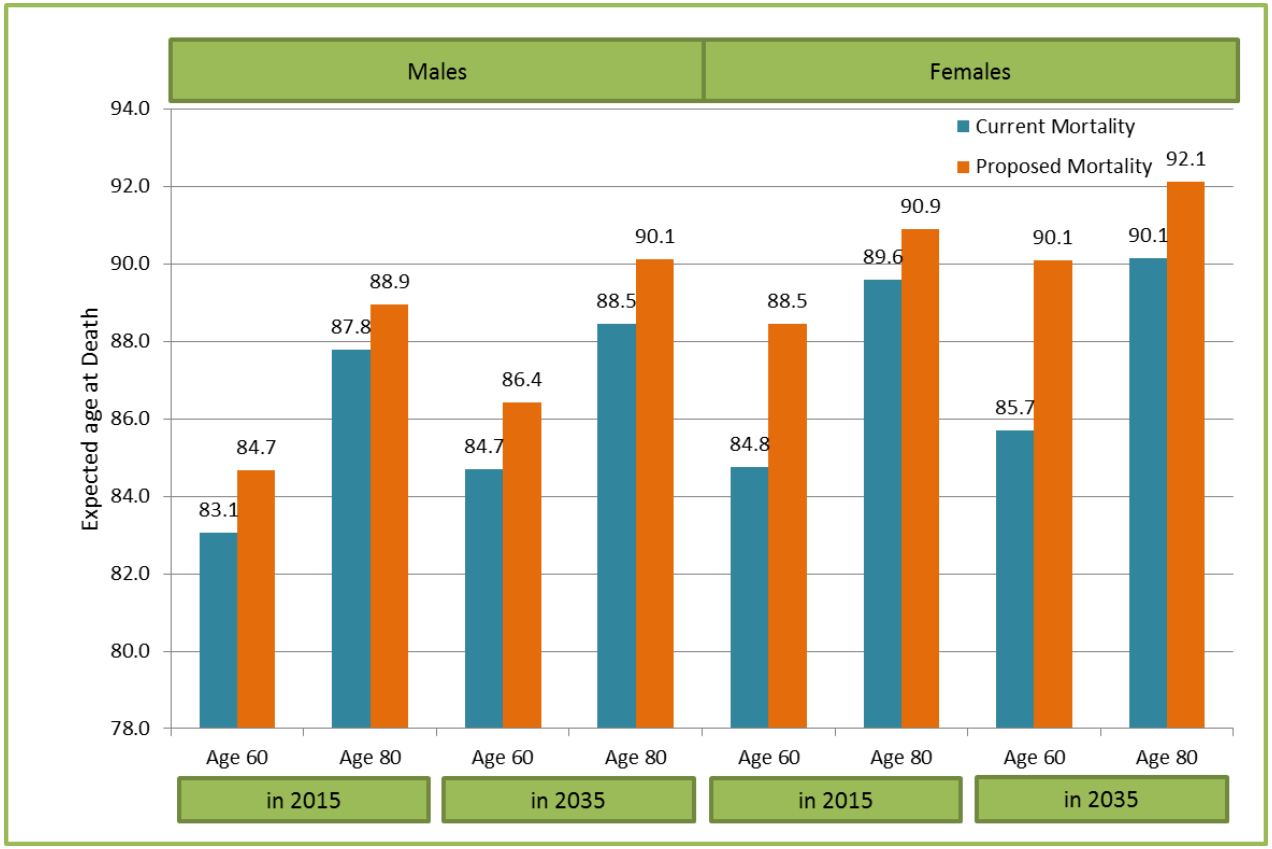
Cost impact: Significant increase in liability

Expected Ages at Death – Teachers and Other Education (Service Retirements)



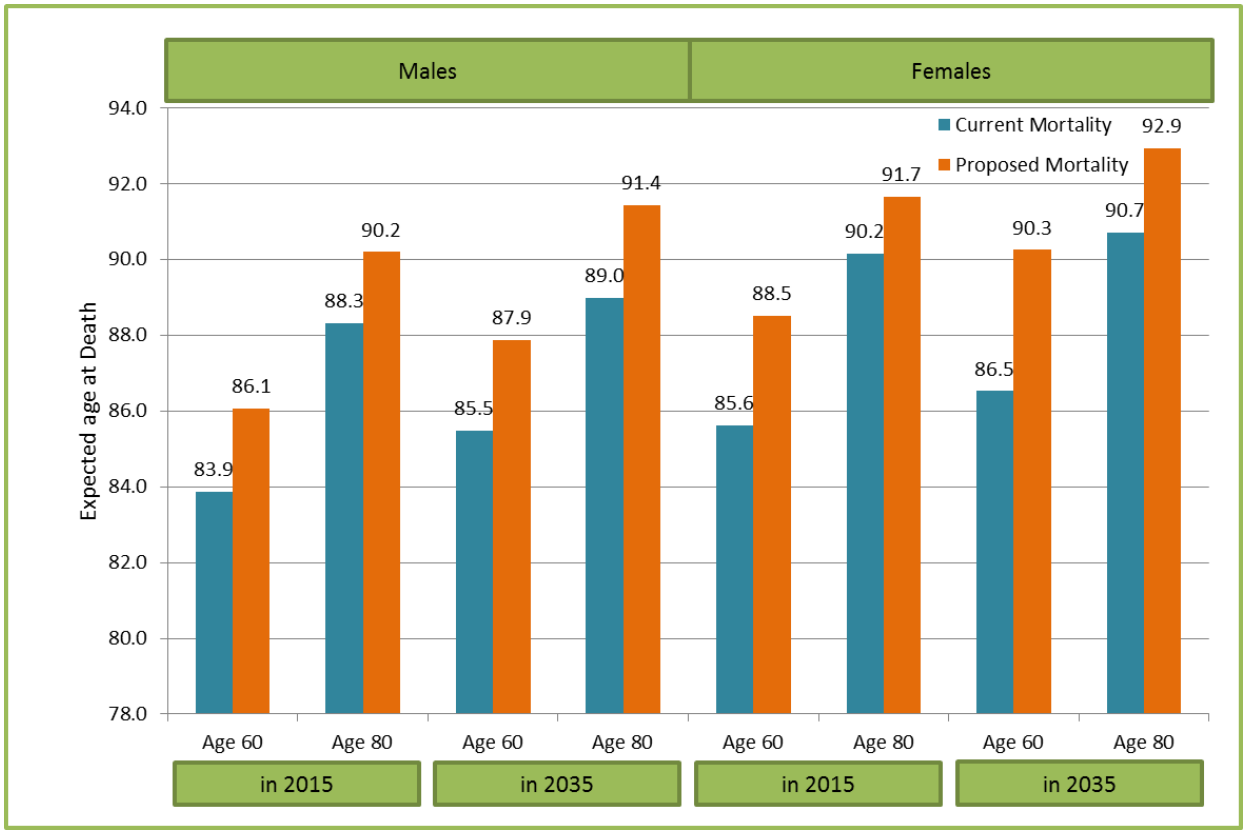
The expected ages at death shown above are based on the current and proposed mortality assumptions. The ages at death under the proposed assumptions are significantly later than those under current assumptions for the ages and genders shown. Note that we show expected age at death in 2015 and 2035 to illustrate the impact of generational mortality improvement.

Expected Ages at Death – General Employees (Service Retirements)



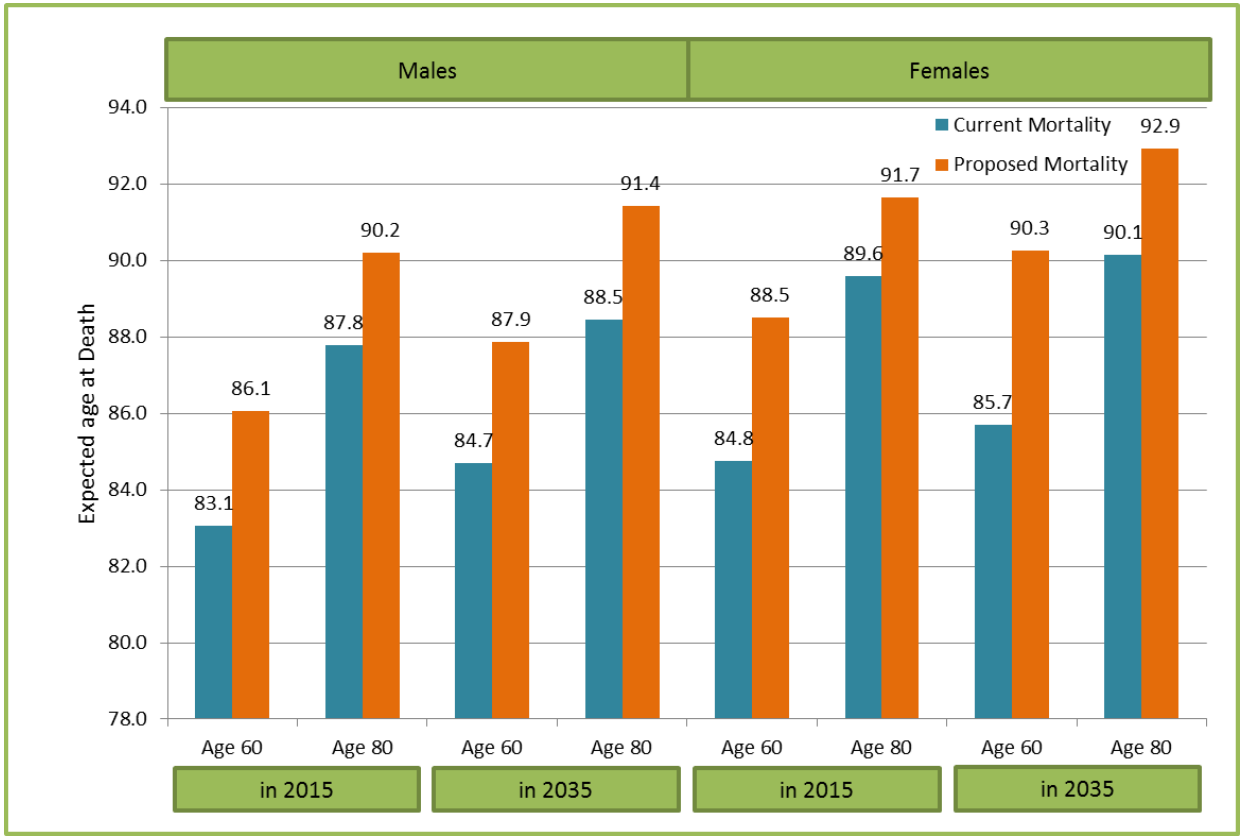
The expected ages at death shown above are based on the current and proposed mortality assumptions. The ages at death under the proposed assumptions are significantly later than those under current assumptions for the ages and genders shown. Note that we show expected age at death in 2015 and 2035 to illustrate the impact of generational mortality improvement.

Expected Ages at Death – Law Enforcement Officers (Service Retirements)



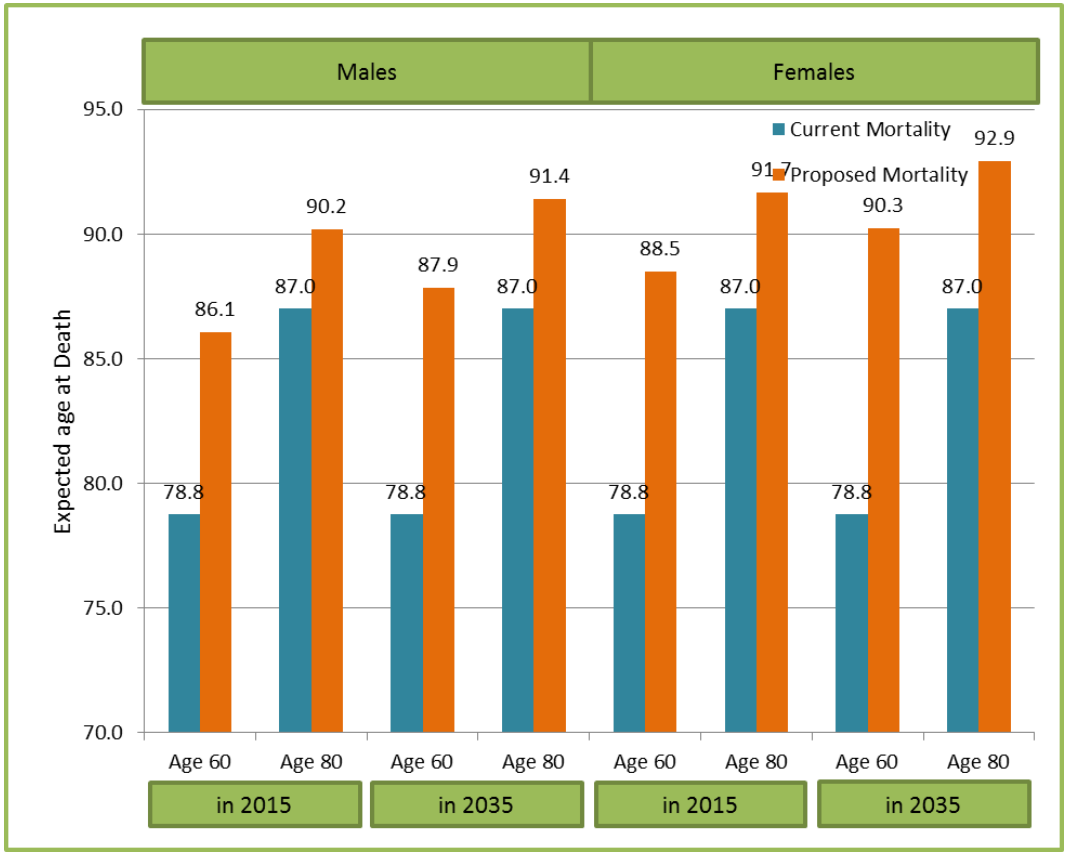
The expected ages at death shown above are based on the current and proposed mortality assumptions. The ages at death under the proposed assumptions are significantly later than those under current assumptions for the ages and genders shown. Note that we show expected age at death in 2015 and 2035 to illustrate the impact of generational mortality improvement.

Expected Ages at Death – Judicial (Service Retirements)



The expected ages at death shown above are based on the current and proposed mortality assumptions. The ages at death under the proposed assumptions are significantly later than those under current assumptions for the ages and genders shown. Note that we show expected age at death in 2015 and 2035 to illustrate the impact of generational mortality improvement.

Expected Ages at Death – Legislative (Service Retirements)

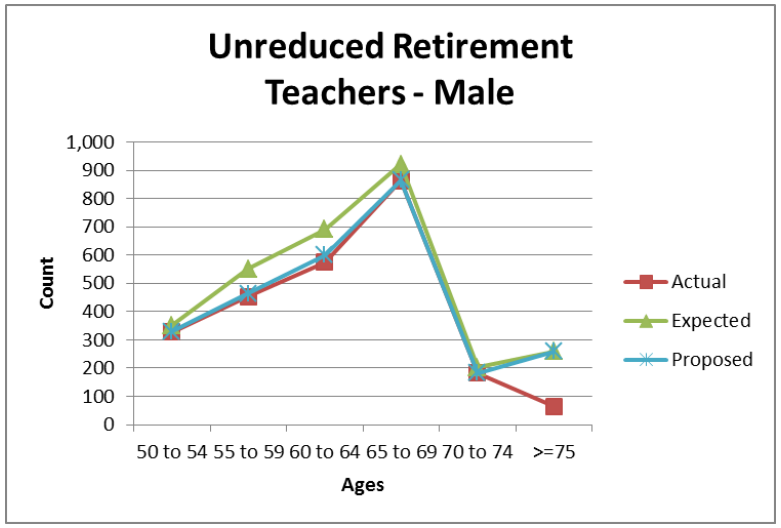


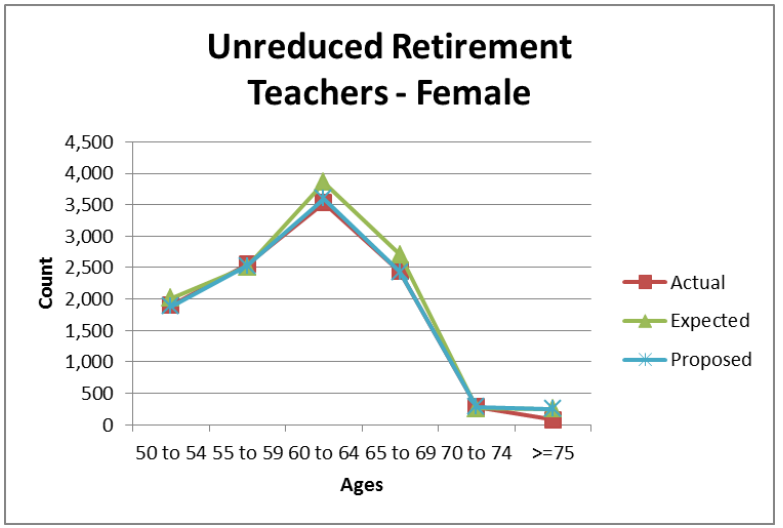
The expected ages at death shown above are based on the current and proposed mortality assumptions. The ages at death under the proposed assumptions are significantly later than those under current assumptions for the ages and genders shown. Note that we show expected age at death in 2015 and 2035 to illustrate the impact of generational mortality improvement.

Retirement Rates - Considerations

- Retirement rates vary by age, gender, employee group and type of retirement (i.e., reduced and unreduced)
- The current retirement rates are based on the recommendation made in the prior experience study
- The retirement rates result in expected retirements greater than actual retirements for both unreduced retirements and reduced retirements for all employee groups other than law enforcement officers
- Use of actual experience of the plan is common practice
- Generally, assuming more retirements results in higher estimated costs

Retirement Rates – Unreduced – Teachers





Summary Metrics (Male):
Actual: 2,473
Expected: 2,979
Actual to Expected: 83%
Proposed: 2,703
Actual to Proposed: 91%

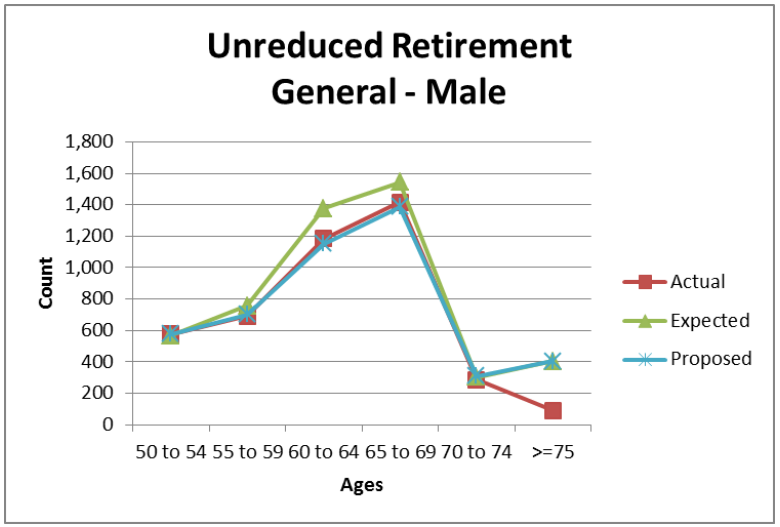
Summary Metrics (Female):
Actual: 10,803
Expected: 11,633
Actual to Expected: 93%
Proposed: 11,001
Actual to Proposed: 98%

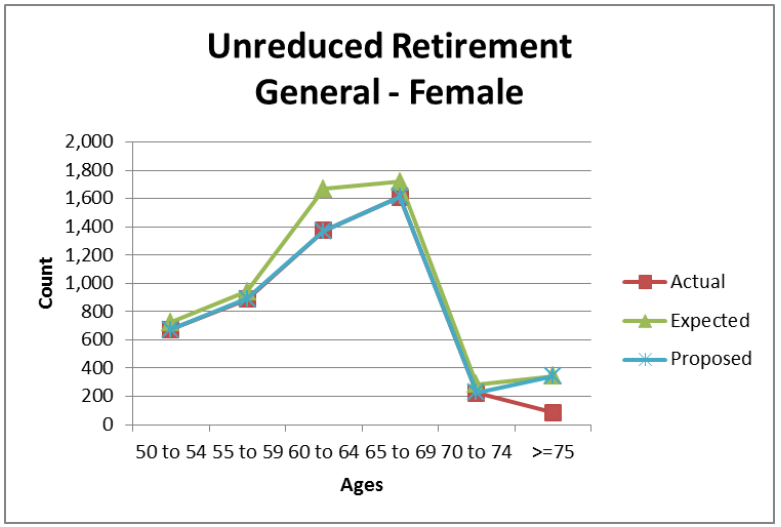
Observation: There were fewer retirements than expected for both males and females

Recommendation: Decrease rates of retirement to reflect experience

Impact: Slight decrease in costs

Retirement Rates – Unreduced – General Employees





Summary Metrics (Male):
Actual: 4,342
Expected: 5,048
Actual to Expected: 86%
Proposed: 4,618
Actual to Proposed: 94%

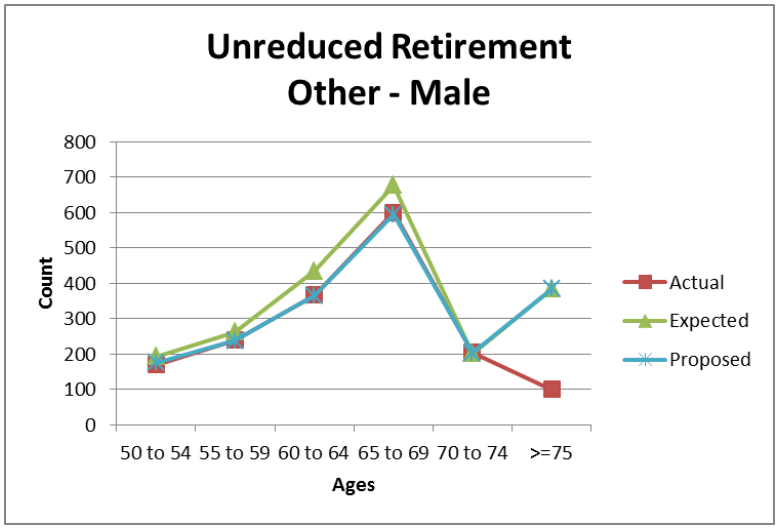
Summary Metrics (Female):
Actual: 4,944
Expected: 5,781
Actual to Expected: 86%
Proposed: 5,203
Actual to Proposed: 95%

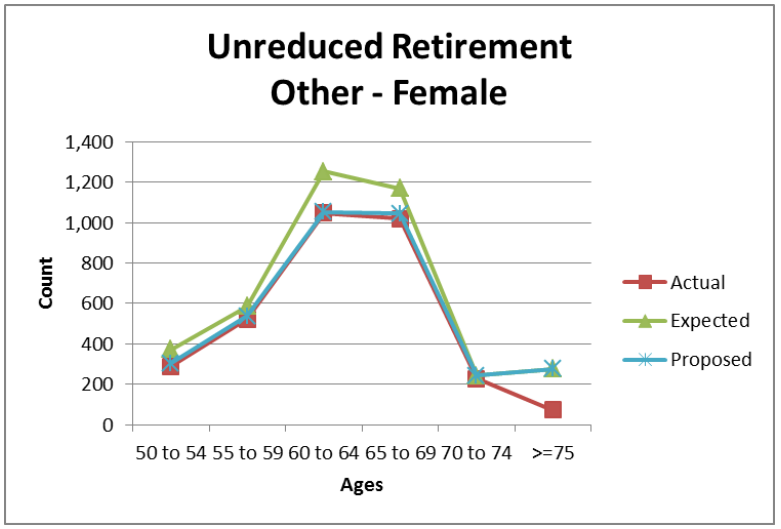
Observation: There were fewer retirements than expected for both males and females

Recommendation: Decrease rates of retirement to reflect experience

Impact: Slight decrease in costs

Retirement Rates – Unreduced – Other Education





Summary Metrics (Male):
Actual: 1,706
Expected: 2,178
Actual to Expected: 78%
Proposed: 1,981
Actual to Proposed: 86%

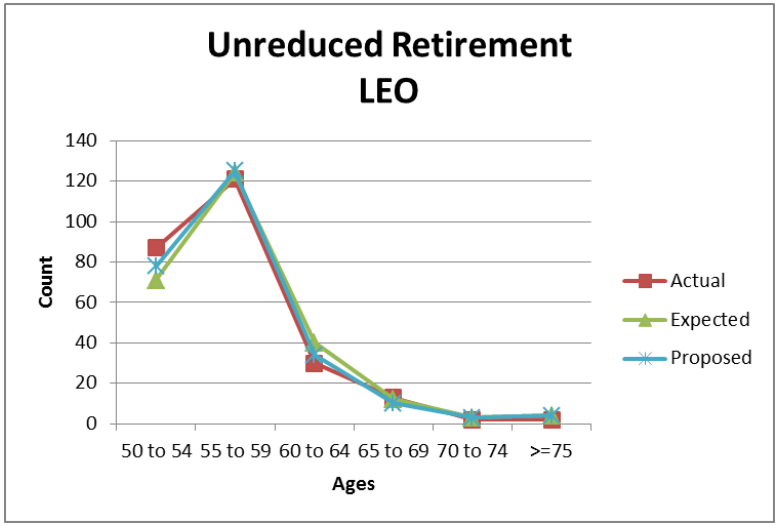
Summary Metrics (Female):
Actual: 3,202
Expected: 3,932
Actual to Expected: 81%
Proposed: 3,482
Actual to Proposed: 92%

Observation: There were fewer retirements than expected for both males and females

Recommendation: Decrease rates of retirement to reflect experience

Impact: Slight decrease in costs

Retirement Rates – Unreduced – Law Enforcement



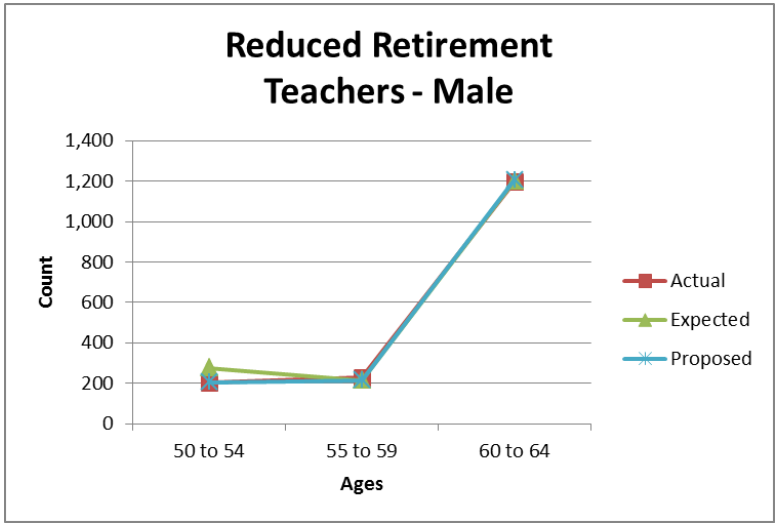
Summary Metrics (Male only)
Actual: 292
Expected: 285
Actual to Expected: 102%
Proposed: 287
Actual to Proposed: 102%

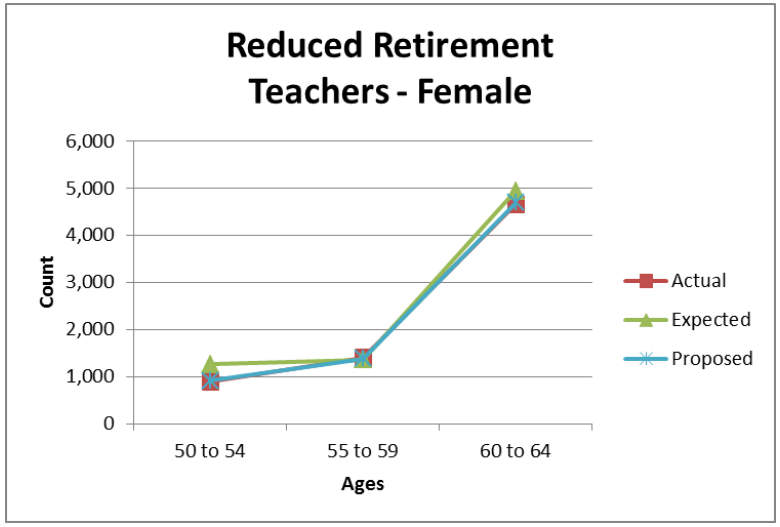
Observation: No significant differences over the period for both males and females

Recommendation: Slight change in rates at certain ages to reflect experience

Impact: Immaterial

Retirement Rates – Reduced – Teachers





Summary Metrics (Male):
Actual: 1,629
Expected: 1,694
Actual to Expected: 96%
Proposed: 1,629
Actual to Proposed: 100%

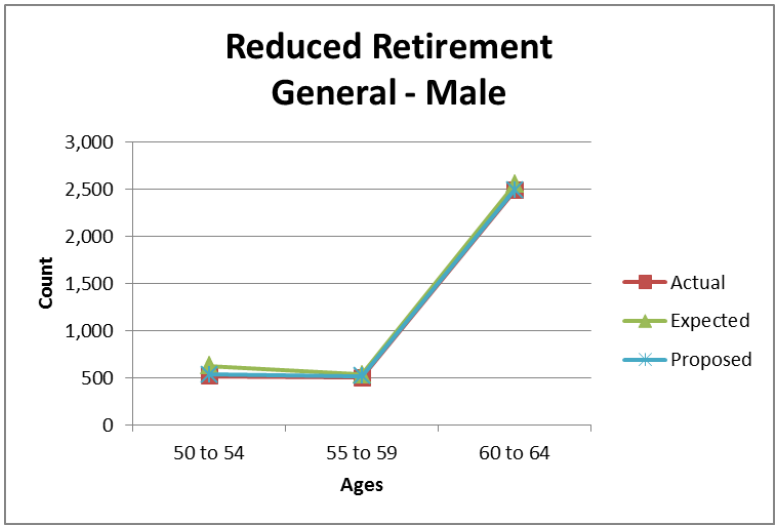
Summary Metrics (Female):
Actual: 6,937
Expected: 7,557
Actual to Expected: 92%
Proposed: 6,973
Actual to Proposed: 99%

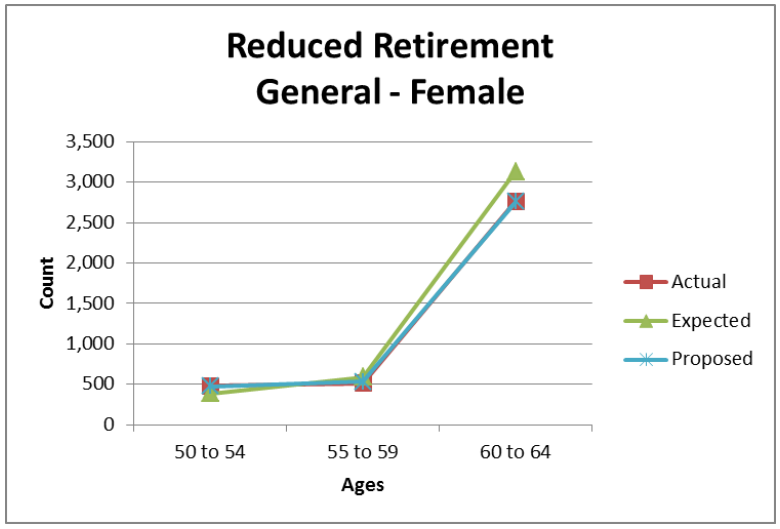
Observation: There were fewer retirements than expected, especially for females

Recommendation: Decrease rates of retirement to reflect experience

Impact: Slight decrease in costs

Retirement Rates – Reduced – General Employees





Summary Metrics (Male):
Actual: 3,498
Expected: 3,712
Actual to Expected: 94%
Proposed: 3,534
Actual to Proposed: 99%

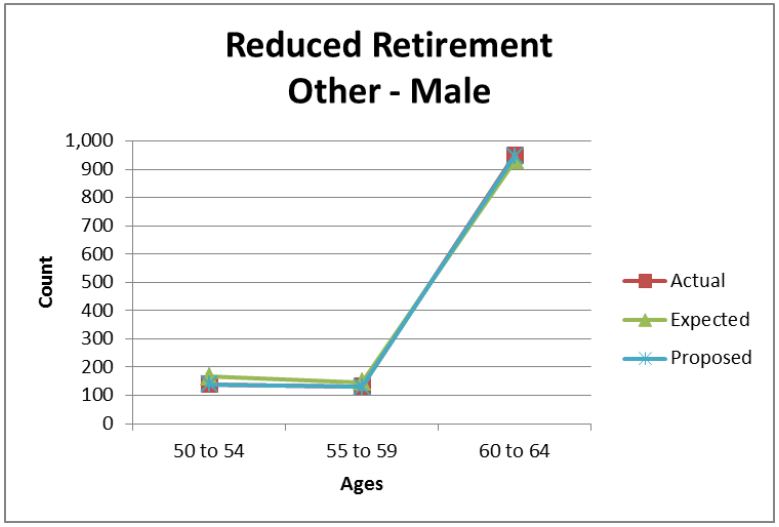
Summary Metrics (Female):
Actual: 3,755
Expected: 4,110
Actual to Expected: 91%
Proposed: 3,764
Actual to Proposed: 100%

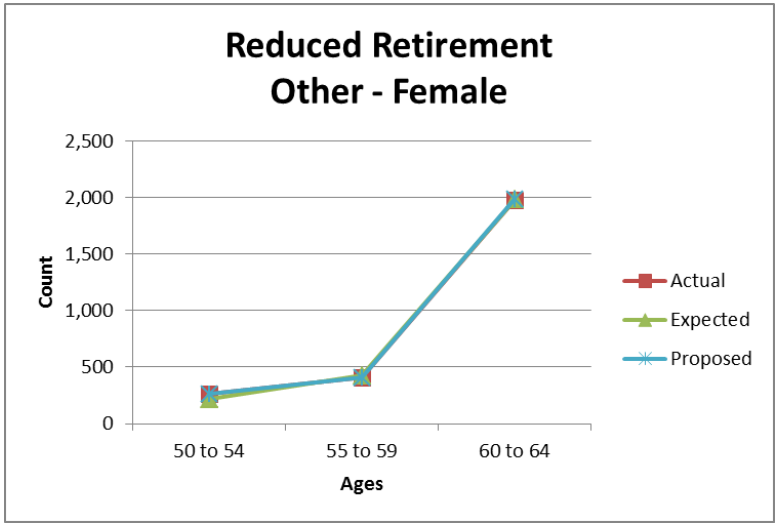
Observation: There were fewer retirements than expected, especially for females

Recommendation: Decrease rates of retirement to reflect experience

Impact: Slight decrease in costs

Retirement Rates – Reduced – Other Education



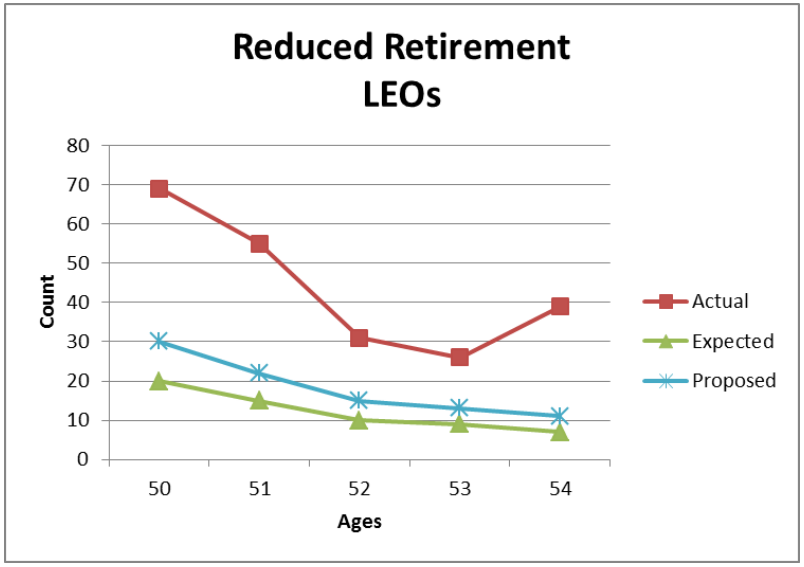


Summary Metrics (Male):
Actual: 1,220
Expected: 1,243
Actual to Expected: 98%
Proposed: 1,215
Actual to Proposed: 100%

Summary Metrics (Female):
Actual: 2,646
Expected: 2,623
Actual to Expected: 101%
Proposed: 2,652
Actual to Proposed: 100%

Observation: No significant differences over the period
Recommendation: Small change in rates at certain ages to reflect experience
Impact: Immaterial

Retirement Rates – Reduced – Law Enforcement



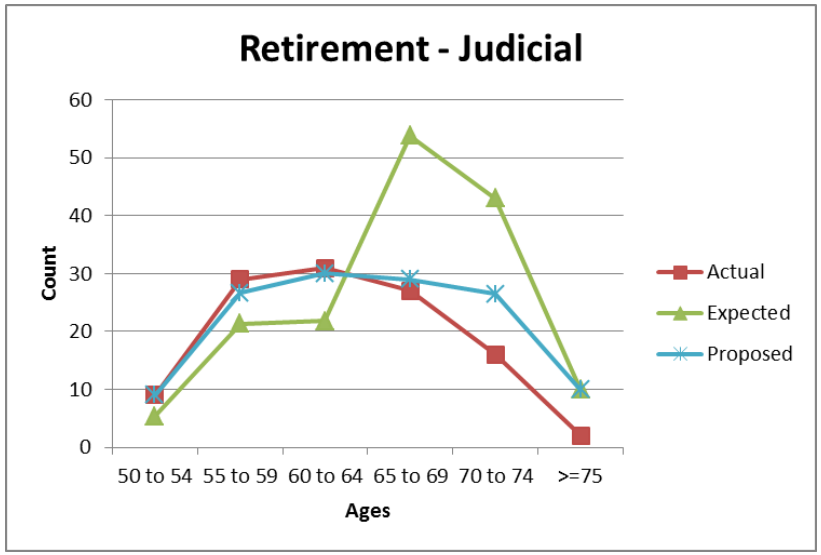
Summary Metrics (Combined)
Actual: 220
Expected: 61
Actual to Expected: 361%
Proposed: 92
Actual to Proposed: 239%

Observation: There were more retirements than expected for the combined genders. However, data suggests that leave conversions at retirement allow many of the actual retirements to receive unreduced benefits.

Recommendation: Increase rates of retirement to reflect experience as adjusted for leave conversions

Impact: Slight increase in costs

Retirement Rates - CJRS



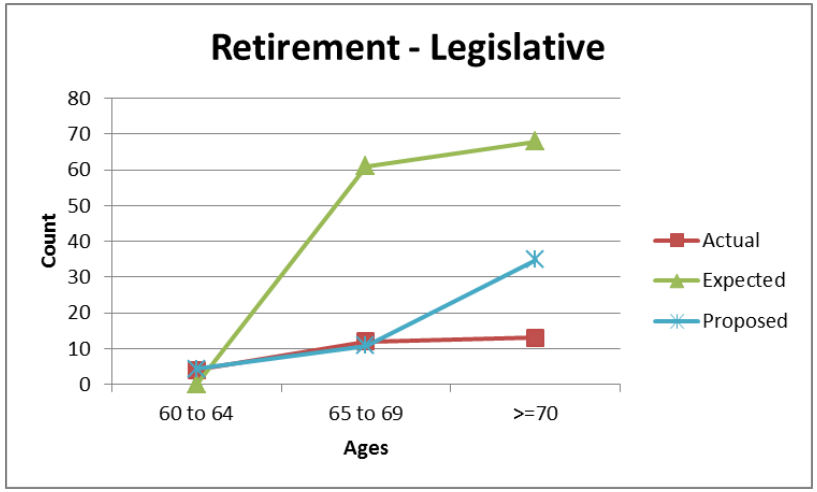
Summary Metrics (Combined)
Actual: 114
Expected: 155
Actual to Expected: 73%
Proposed: 131
Actual to Proposed: 87%

Observation: There were fewer retirements than expected for the combined group.

Recommendation: Decrease rates of retirement to reflect experience as adjusted for leave conversions

Impact: Slight decrease in costs

Retirement Rates - LRS



Summary Metrics (Combined)
Actual: 29
Expected: 129
Actual to Expected: 22%
Proposed: 50
Actual to Proposed: 58%

Observation: There were fewer retirements than expected for the combined group. Prior assumption does not vary by age (100% retirement assumed at age 65).

Recommendation: Decrease overall rates of retirement by reflecting rates that vary by age

Impact: Significant decrease in costs

Disability Rates

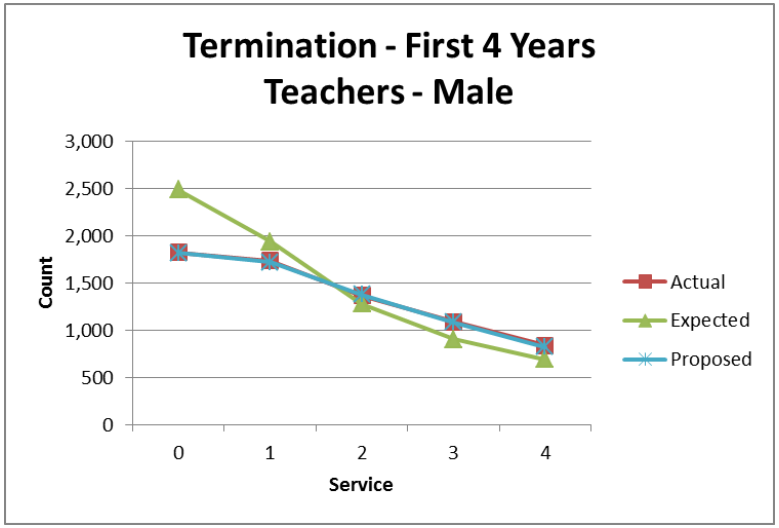
- Disability rates measure the probability that a member will become disabled and receive a disability retirement benefit.
- TSERS currently uses disability rates that vary by age, gender, employee group (i.e., teacher, general, law enforcement office) and grandfathered status (i.e., eligible for disability retirement and not eligible for disability retirement)
- The current grandfathered group and the experience for this group are very small
- As the disability retirement benefit has little impact on the liability for active members, we are recommending no change in the disability rates

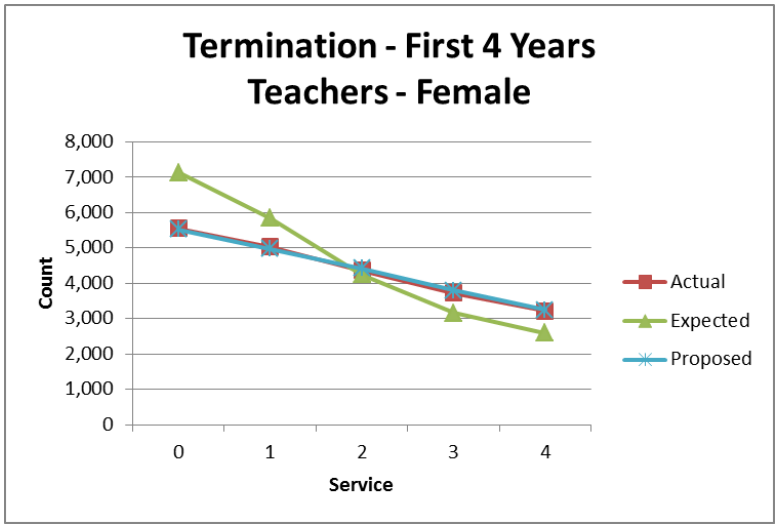
Please note that there are no disability rates assumed for active members who would be eligible for benefits from the Disability Income Plan (DIP). If an active member becomes disabled and receives a benefit from the DIP, retirement rates and termination rates are no longer applied to this member until the member is eligible for a retirement benefit. The mortality tables used for members receiving DIP payments are based on the disabled mortality rates.

Termination Rates - Considerations

- The valuation anticipates that members may leave active service for reasons other than retirement, disability and death. We refer to these other reasons as termination.
- Rates of termination can vary significantly from plan to plan
- Use of actual experience of the plan is common practice
- Generally, assuming more terminations results in lower estimated costs
- Rates of termination tend to be higher earlier in a member's career. So we use two sets of rates:
  - A set of rates for the first five years of a member's career. These rates are higher than those assumed in the rest of the career and vary based on the member's service
  - A set of rates for the rest of a member's career that vary based on the member's age
- Rates of termination also vary by gender and employee group (i.e., teacher, general, other education, law enforcement)
- Due to the very small number of actual withdrawals prior to retirement, no termination rates have been assumed for CJRS and LRS

Termination Rates (<5 Years Service) – Teachers





Summary Metrics (Male):
Actual: 6,840
Expected: 7,285
Actual to Expected: 94%
Proposed: 6,808
Actual to Proposed: 100%

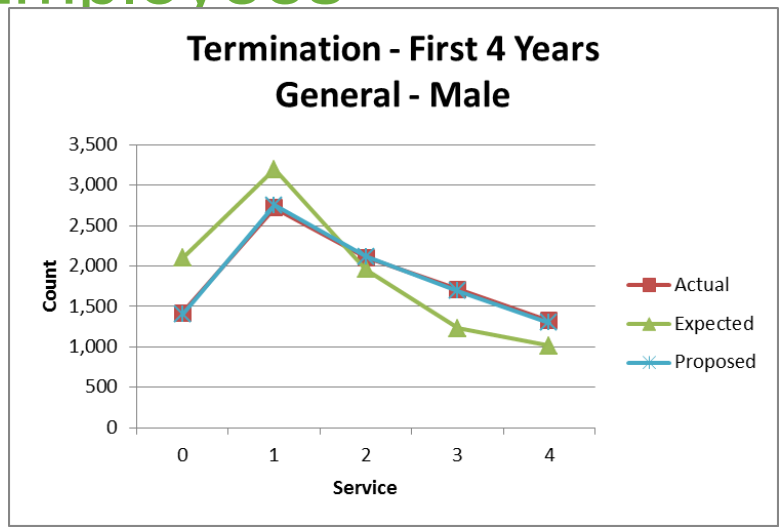
Summary Metrics (Female):
Actual: 21,882
Expected: 22,991
Actual to Expected: 95%
Proposed: 21,955
Actual to Proposed: 100%

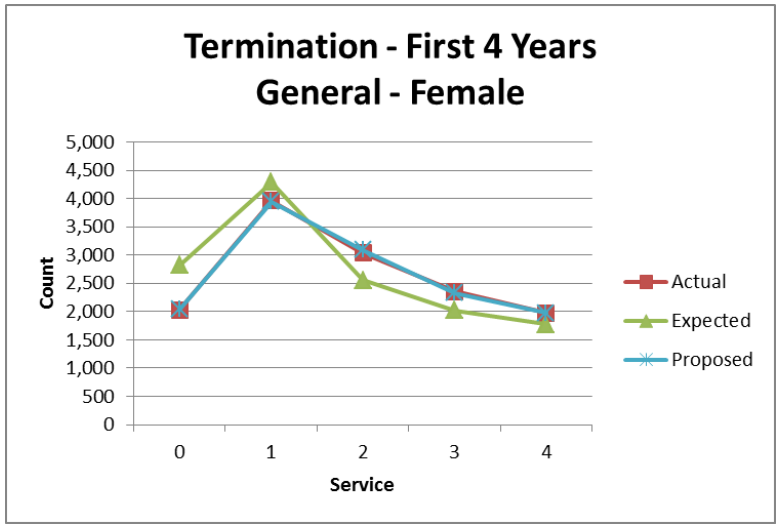
Observation: There were fewer terminations than expected for both males and females

Recommendation: Decrease rates of terminations to reflect experience

Impact: Slight increase in costs

Termination Rates (<5 Years Service) – General Employees





Summary Metrics (Male):
Actual: 9,283
Expected: 9,499
Actual to Expected: 98%
Proposed: 9,267
Actual to Proposed: 100%

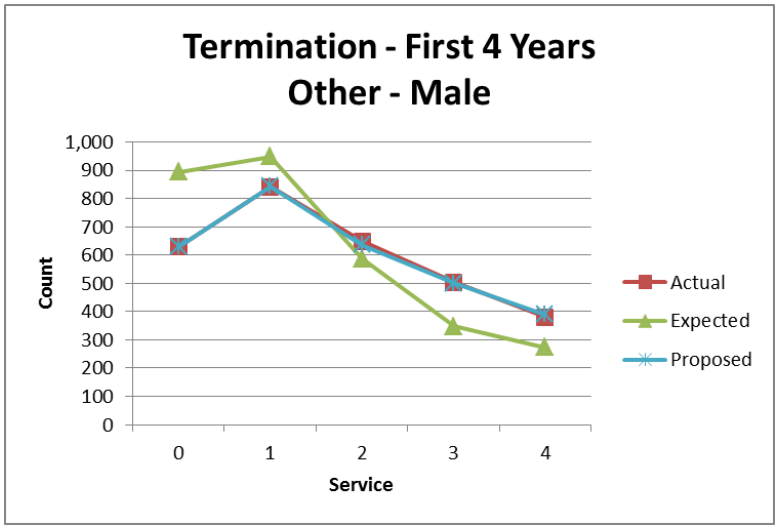
Summary Metrics (Female):
Actual: 13,348
Expected: 13,462
Actual to Expected: 99%
Proposed: 13,363
Actual to Proposed: 100%

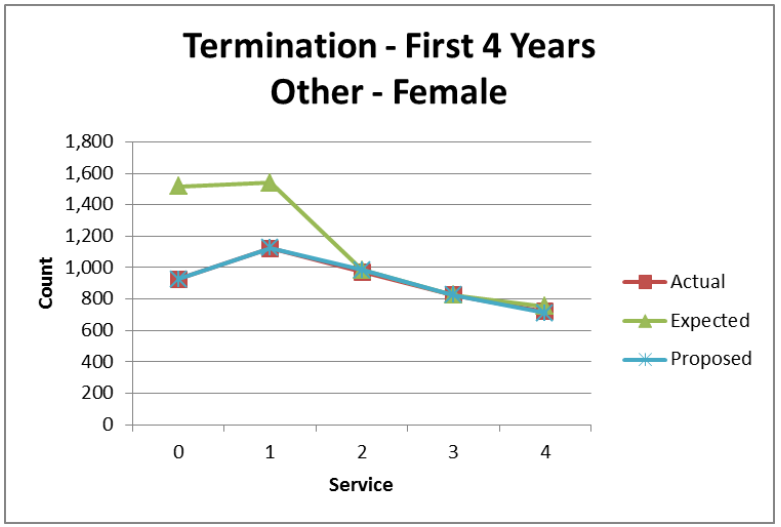
Observation: There were slightly fewer terminations than expected for both males and females

Recommendation: Decrease rates of terminations to reflect experience

Impact: Slight increase in costs

Termination Rates (<5 Years Service) – Other Education





Summary Metrics (Male):
Actual: 3,000
Expected: 3,052
Actual to Expected: 98%
Proposed: 2,998
Actual to Proposed: 100%

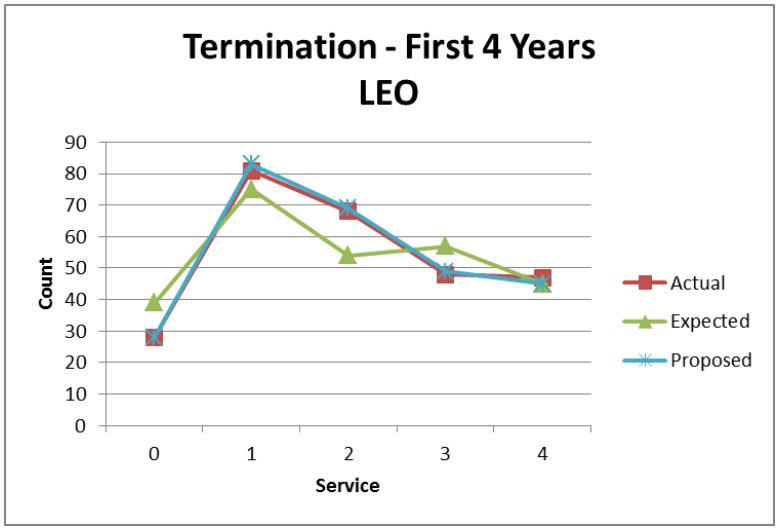
Summary Metrics (Female):
Actual: 4,565
Expected: 5,621
Actual to Expected: 81%
Proposed: 4,573
Actual to Proposed: 100%

Observation: There were fewer terminations than expected, especially for females

Recommendation: Decrease rates of terminations to reflect experience

Impact: Slight increase in costs

Termination Rates (<5 Years Service) – Law Enforcement



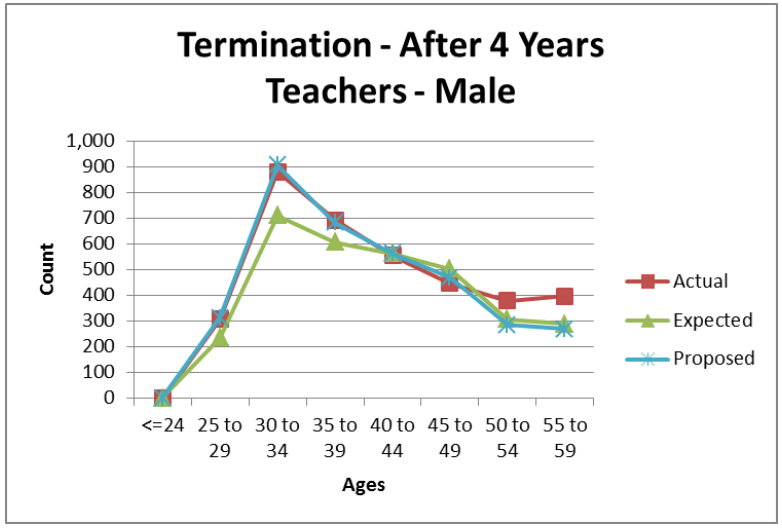
Summary Metrics (Combined)
Actual: 272
Expected: 270
Actual to Expected: 101%
Proposed: 274
Actual to Proposed: 99%

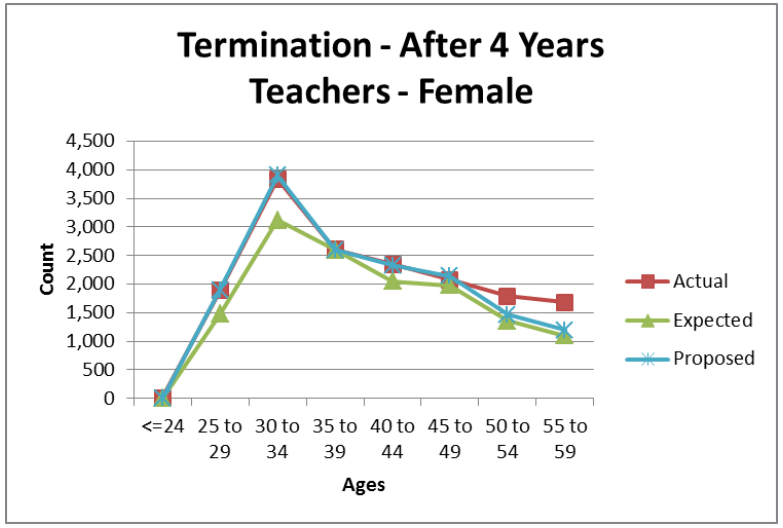
Observation: No significant differences over the period

Recommendation: Slight change in rates to reflect experience

Impact: Immaterial

Termination Rates (5+ Years Service) – Teachers





Summary Metrics (Male):
Actual: 3,662
Expected: 3,218
Actual to Expected: 114%
Proposed: 3,492
Actual to Proposed: 105%

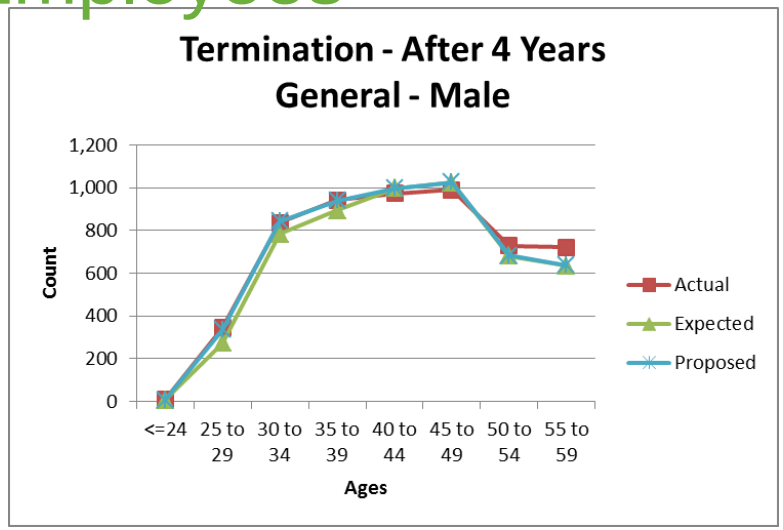
Summary Metrics (Female):
Actual: 16,224
Expected: 13,666
Actual to Expected: 119%
Proposed: 15,510
Actual to Proposed: 105%

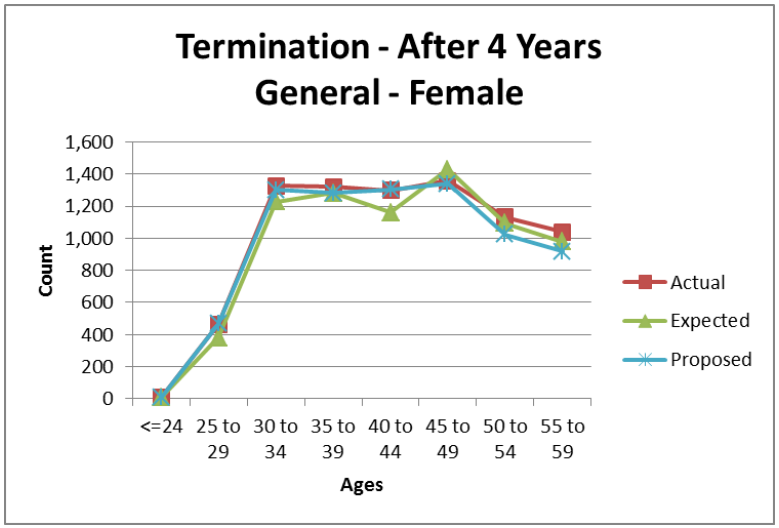
Observation: There were more terminations than expected for both males and females

Recommendation: Increase rates of terminations to reflect experience

Impact: Slight decrease in costs

Termination Rates (5+Years Service) – General Employees





Summary Metrics (Male):
Actual: 5,545
Expected: 5,297
Actual to Expected: 105%
Proposed: 5,468
Actual to Proposed: 101%

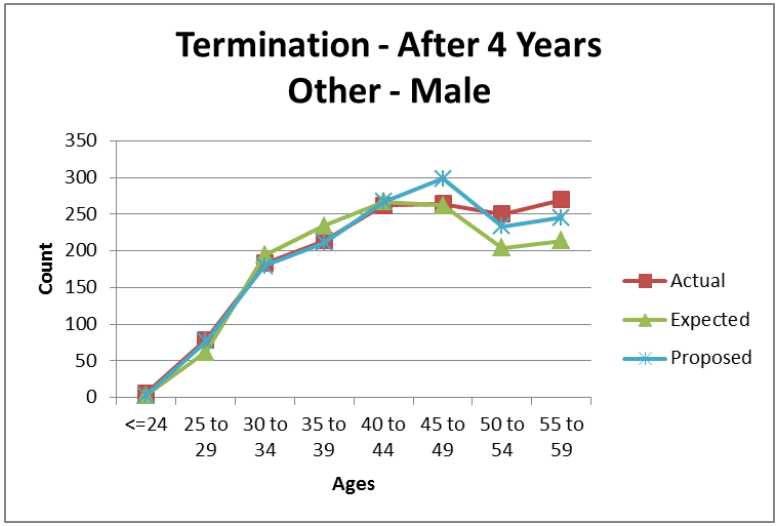
Summary Metrics (Female):
Actual: 7,940
Expected: 7,553
Actual to Expected: 105%
Proposed: 7,642
Actual to Proposed: 104%

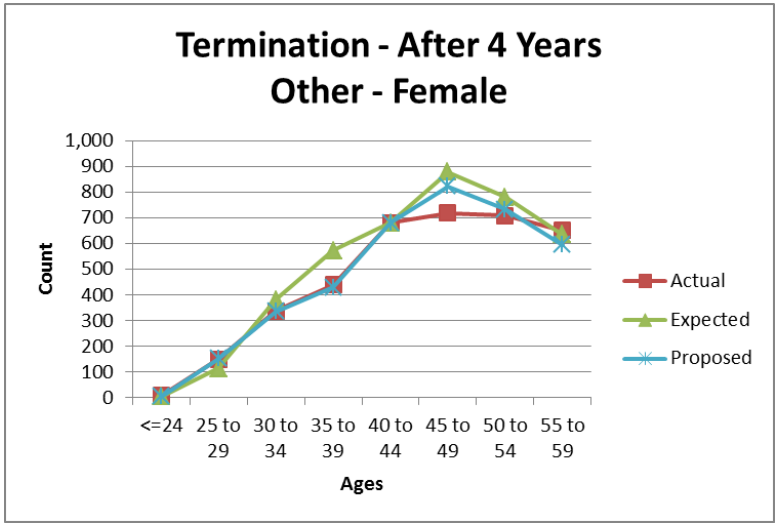
Observation: There were more terminations than expected for both males and females

Recommendation: Increase rates of terminations to reflect experience

Impact: Slight decrease in costs

Termination Rates (5+ Years Service) – Other Education





Summary Metrics (Male):
Actual: 1,528
Expected: 1,441
Actual to Expected: 106%
Proposed: 1,515
Actual to Proposed: 101%

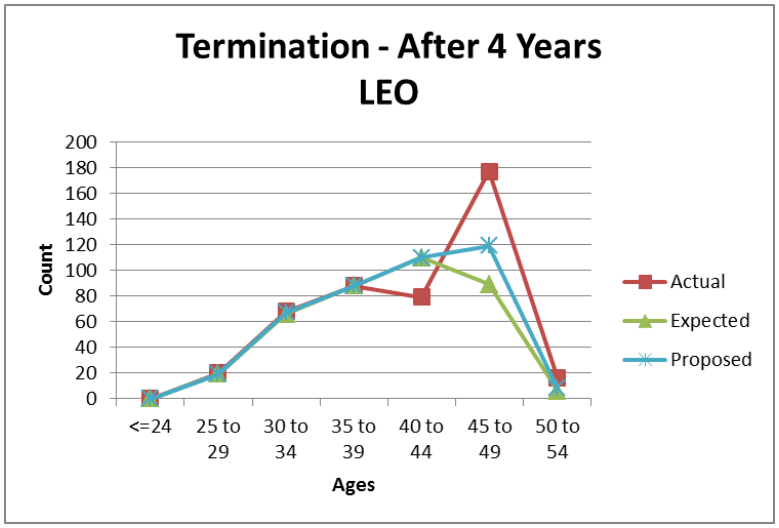
Summary Metrics (Female):
Actual: 3,697
Expected: 4,048
Actual to Expected: 91%
Proposed: 3,753
Actual to Proposed: 99%

Observation: There were more terminations than expected for males and fewer terminations than expected for females

Recommendation: Increase rates of terminations to reflect experience for males and decrease rates of termination to reflect experience for females

Impact: Immaterial

Termination Rates (5+ Years Service) – Law Enforcement



Summary Metrics (Combined)
Actual: 448
Expected: 378
Actual to Expected: 119%
Proposed: 411
Actual to Proposed: 109%

Observation: There were more terminations than expected

Recommendation: Increase in rates of termination to reflect experience

Impact: Slight decrease in costs

Leave Conversions – Increase in Creditable Service for TSERS

Increase in Creditable Service (Years)	Actual	Expected	Actual ÷ Expected	Proposed	Actual ÷ Proposed
Classroom Teachers					
Male	1.09	1.25	87%	1.10	99%
Female	0.82	1.00	82%	0.85	97%
General Employees					
Male	1.04	0.90	116%	1.00	104%
Female	0.73	0.65	112%	0.70	104%
Law Enforcement					
Combined	1.55	1.50	103%	1.50	103%
Other Education					
Male	1.33	1.25	106%	1.30	102%
Female	0.98	1.00	98%	1.00	98%

The valuation anticipates that retirees will receive service credits for unused sick leave or unused vacation leave.

Observation: Conversion of unused sick leave and unused vacation leave to service credits has decreased for teachers and female other education and increased for general employees, law enforcement and male other education

Recommendation: Adjust factors to reflect experience

Cost Impact: Immaterial

Leave Conversions – Increase in Average Final Compensation (AFC) for TSERS

Increase in AFC	Actual	Expected	Actual ÷ Expected	Proposed	Actual ÷ Proposed
Classroom Teachers	1.91	2.25	85%	2.00	95%
General Employees	2.65	2.25	118%	2.50	106%
Law Enforcement	1.71	1.50	114%	1.75	98%
Other Education	1.67	3.50	48%	1.75	96%

The valuation anticipates that some retirees from active service will convert unused vacation leave to additional compensation.

Observation: The conversion of unused vacation leave to additional compensation has generally declined for teachers and other education and increased for general employees and law enforcement

Recommendation: Adjust factors to reflect experience

Cost Impact: Immaterial

Administrative Expense

- TSERS – we recommend no change to current assumption of 0.10% of payroll
- CJRS – we recommend no change to current assumption of 0.75% of normal cost
- LRS – we recommend a change from current assumption of no administrative expense to 1% of payroll
- National Guard – we recommend a change from current assumption of no administrative expense to prior year's actual expenses added to normal cost (2014 administrative expenses of $82,000)

Economic Assumptions

Inflation

Investment Return

Salary Increases

buckconsultants

xerox

ASOP 27

- Provides guidance to actuaries in selecting economic assumptions
  - General Selection Process
    - Identify components, if any, of the assumption
    - Evaluate relevant data
      - Review appropriate recent and long-term historical economic data
      - The actuary should not give undue weight to recent experience
      - Some historical economic data may not be appropriate due to changes in the underlying environment
    - Consider factors specific to the measurement
    - Consider other general factors
      - The actuary should consider the balance between refined economic assumptions and materiality
      - The actuary may incorporate the views of experts but the selection or advice should reflect the actuary's professional judgment
    - Select a reasonable assumption
      - See next slide
  - After completing these steps for each economic assumption, the actuary should review the set of economic assumptions for consistency and make appropriate adjustments if necessary

ASOP 27 – Selecting a Reasonable Assumption

Recent ASOP 27 Change in Determining the Reasonableness of a Selected Assumption

- Previously: Use a "best-estimate" range
  - Assumption is reasonable if selected from within a range over which it was "more likely than not" to fall
- New: Apply best-estimate standard
  - Each economic assumption selected by the actuary should be reasonable.
  - For this purpose, an assumption is reasonable if it has the following characteristics:
    - It is appropriate for the purpose of the measurement
    - Reflects the actuary's professional judgment
    - Takes into account historical and current economic data that is relevant as of the measurement date
    - Reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
    - Has no significant bias

Current Economic Assumptions

Inflation (General and Wage)	3.00% per year
Real Rate of Return	4.25% per year
Nominal Rate of Return	7.25% per year
Real Wage Growth (productivity)	0.50% per year
Merit Adjustments (Individual Salary Increases related to performance, promotion, etc.)	Vary by service and employee group

Inflation

Buck inflation modeling considerations	Short-term calibration to current economic conditions Intermediate calibration to inflation forecasts Long term calibration to inflation forecasts and historical average inflation
Expectations of future	Data points: 3.32%: 100-year average through 1915-2014 2.15%: Survey of Professional Forecasters - 3Q2015 2.0%-3.4%: 2014 & 2015 OASDI Trustees Report 3.25%: Average rate used by public retirement systems[1] 3.00% Buck assumption
Proposed rate of inflation	3.00%

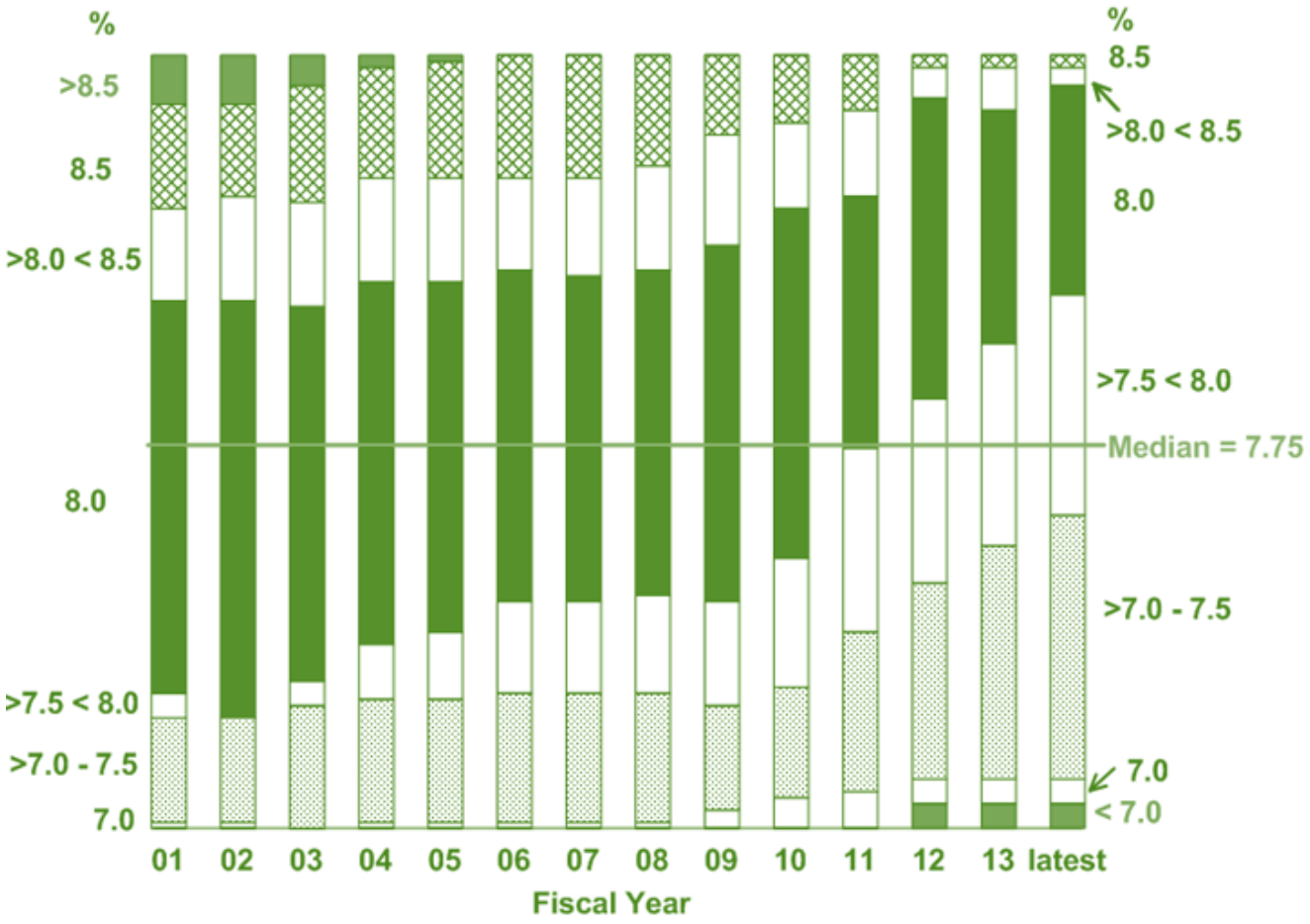
[1] Public Funds Survey Summary of Findings for FY 2013

Investment Return Assumption - Considerations

- Use Expected Rates of Return by Asset Class Based Upon Accepted Industry Practice
- Determine Aggregate Real Return for Board's Target Asset Allocation Policy
- Recent investment performance is driven by economic and capital market factors that may or may not persist over the longer term over different economic and capital market cycles
- Actuarial Standards of Practice allow for the inclusion of a margin of conservatism
  - All else being equal, a lower return assumption is easier to achieve and has a higher likelihood of securing the benefits by increasing future contributions
  - Historically North Carolina Retirement Systems has been on lower end of the range of assumptions selected by state retirement systems

Investment Return

Change in distribution of public pension investment return assumptions, FY 01 through May 2015, compiled by NASRA based on Public Fund Survey.



As seen in this survey, the trend in public pension plan investment return assumptions has been a steady decrease over the past 15 years. At 7.25%, North Carolina Retirement Systems continues to be well below the median rates shown in the survey.

Investment Return

Asset Class	Allocation
Fixed Income – Investment Grade	28.00%
Cash	1.00%
Public Equity	42.00%
Private equity	6.00%
Non-Core Real Estate	3.00%
Fixed Income – Opportunistic	7.00%
Inflation Sensitive	6.00%
Core Real Estate	5.00%
Multi-Strategy	2.00%
	100.00%

The assumed rate of return is based on the target asset allocation and the expectation of future asset returns for each asset class. The current return assumption of 7.25% was last reviewed and adopted at the July, 2010 Board of Trustees meeting in conjunction with all economic assumptions.

On the next slide we have estimated nominal and real returns over various time periods based on this allocation and Buck's current return expectations.

Nominal and Real Returns - Buck Estimate

Compound (Geometric) Returns over Projected Periods

	1-Year	5-Year	10-Year	15-Year	20-Year	25-Year	30-Year
Nominal							
75th Percentile	10.25%	8.79%	9.00%	9.38%	9.65%	9.84%	9.89%
60th Percentile	7.51%	7.14%	7.66%	8.18%	8.41%	8.85%	8.95%
50th Percentile	5.85%	6.06%	6.88%	7.48%	7.85%	8.23%	8.43%
40th Percentile	3.96%	5.04%	6.15%	6.78%	7.29%	7.62%	7.87%
25th Percentile	0.98%	3.11%	4.81%	5.74%	6.37%	6.65%	6.96%
Real							
75th Percentile	8.28%	6.87%	6.77%	6.71%	6.77%	6.84%	6.89%
60th Percentile	5.62%	5.14%	5.44%	5.69%	5.77%	5.91%	6.00%
50th Percentile	3.72%	4.02%	4.57%	4.97%	5.16%	5.35%	5.58%
40th Percentile	1.85%	2.80%	3.74%	4.23%	4.54%	4.81%	4.98%
25th Percentile	-1.20%	0.87%	2.29%	3.11%	3.56%	3.82%	3.96%

Based on 2015 assumptions. Amounts shown are net of investment expenses.

The current assumption of 7.25% is expected to be achieved on average at least 60% of the time over time horizons of 20 years and beyond. In the next 20 years, earning 7.25% is less likely to occur.

Current standards of practice suggest the use of an assumption that falls within the 40th and 50th percentile of projected returns based on the long term asset allocation. This is a change from the last time we reviewed the assumed rate of return, where the Actuarial Standards of Practice defined the range as between the 25th and 75th percentiles. Under the previous guidelines, Buck restricted the range to returns that were between the 25th and 50th percentiles.

Based on the above, the 7.25% investment return assumption can be maintained.

As an indication of the sensitivity of contributions to changes in the assumption, a 7.00% assumed investment return would increase the TSERS annual required contributions by 2.38% of payroll.

Salary Increases

- Generally, a participant's compensation will increase over the long term based on:
  - Inflation,
  - Productivity Growth (or Real Wage Growth), and
  - Merit Adjustments
- The assumption used to measure the anticipated year-to-year change in compensation is referred to as the assumed Annual Rate of Salary Increase
  - Building-block approach to setting assumption (Inflation plus Productivity plus Merit)
  - Merit adjustments vary by service and employee group

Productivity Growth (or Real Wage Growth)

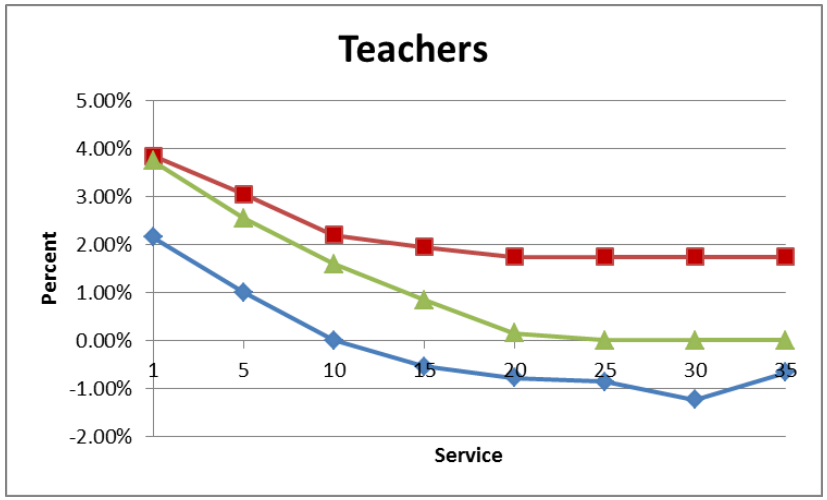
- Across the board pay increases in addition to inflation
- Generally, measures increases in productivity
- Over the past 30 years State employees have received about 0.05% per year across the board pay increases over inflation (0.24% per year over last 31 years)
- 2014 OASDI Trustees Report uses an annual expectation of 1.1%
  - Please note that assumptions utilized for the OASDI report are applicable nationally but may not necessarily be indicative of experience or expectations regionally or on a state-by-state basis

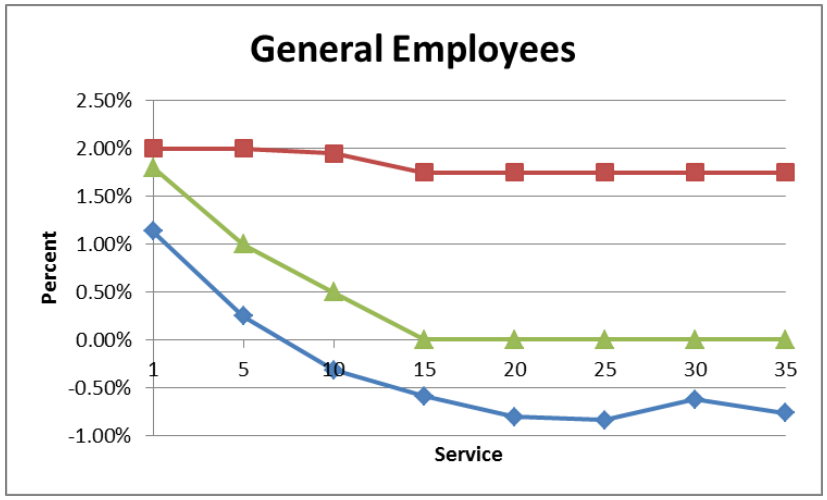
Proposed Rate of Real Wage Growth: 0.5%

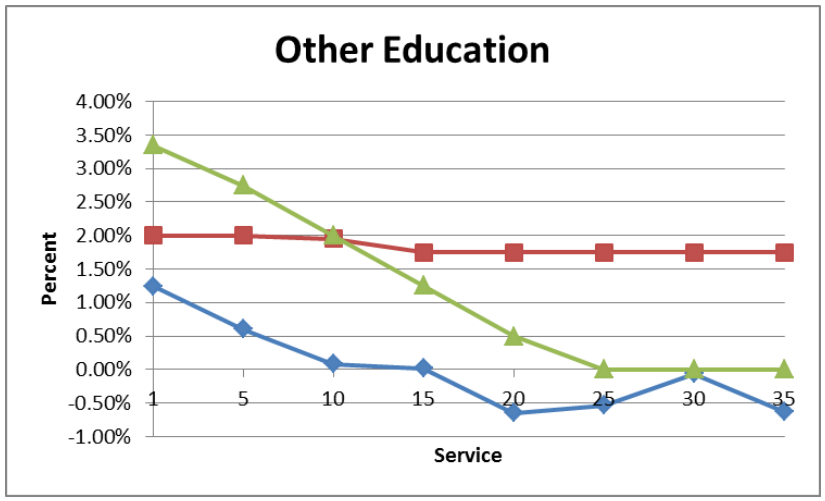
Merit Adjustments

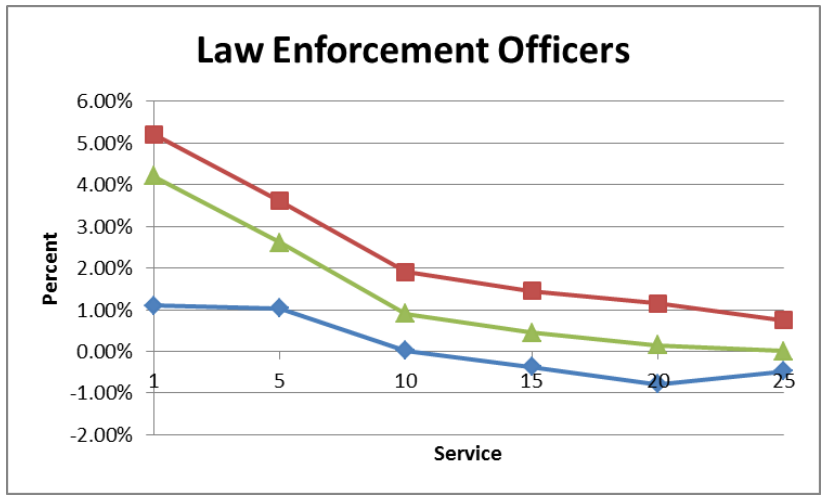
- Increases in a member's salary that are not related to across-the-board type increase (i.e., inflation and productivity)
- Includes elements of salary increase due to promotions and longevity
- Reviewed actual salary increases from 2010 – 2014
  - Removed inflation and productivity increase components
  - Studied merit adjustments by service and employee group
  - See next slide
- The valuation anticipates salary increases for members during their career
- Higher (lower) salary increases result in higher (lower) estimated benefits and higher (lower) projected costs.
- Because contributions are financed over projected payroll, higher (lower) salary increases tend to defer (accelerate) employer contributions.

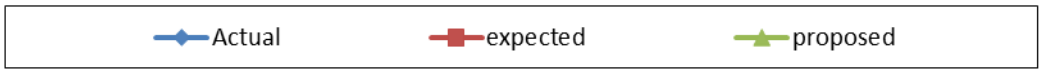
Proposed Merit Adjustments by Employee Group



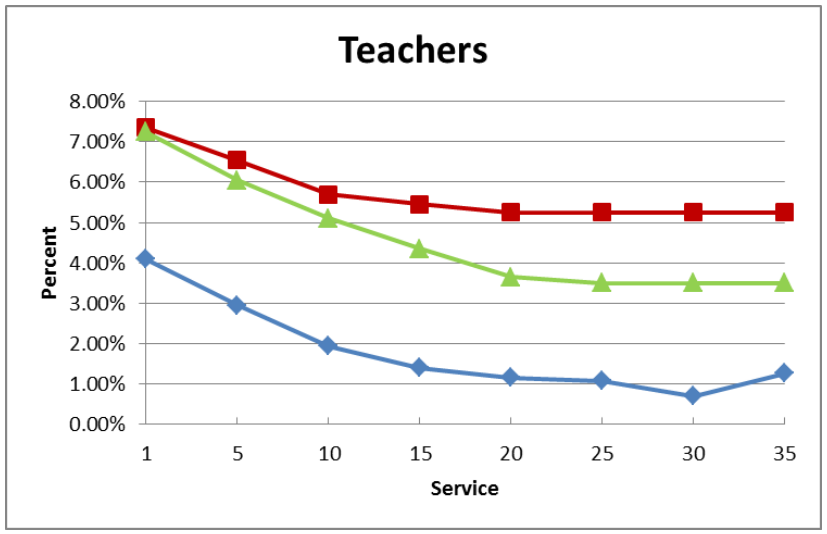


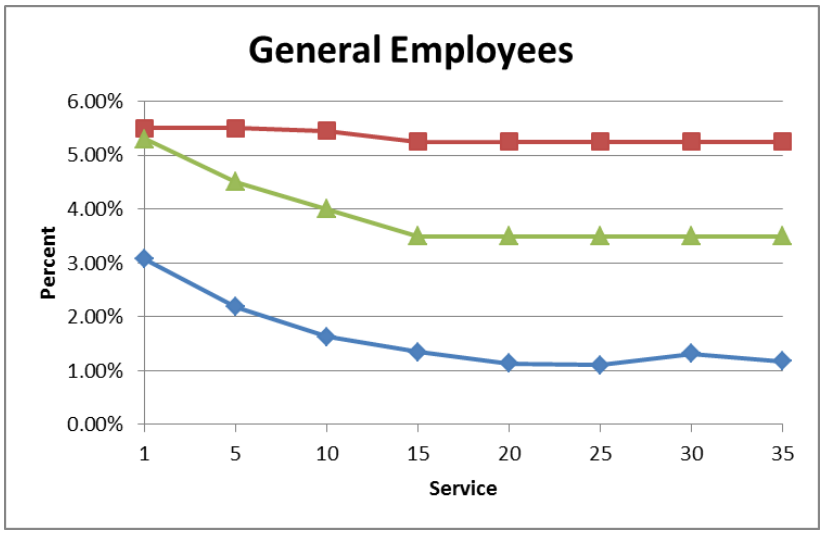


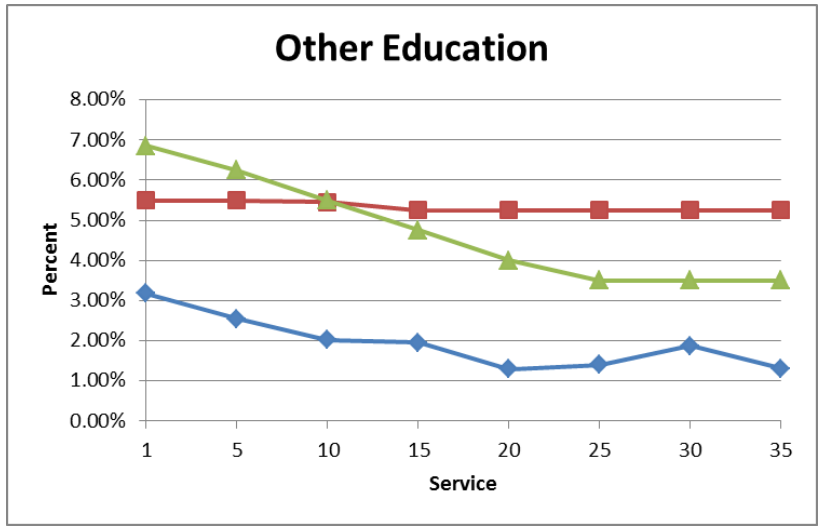


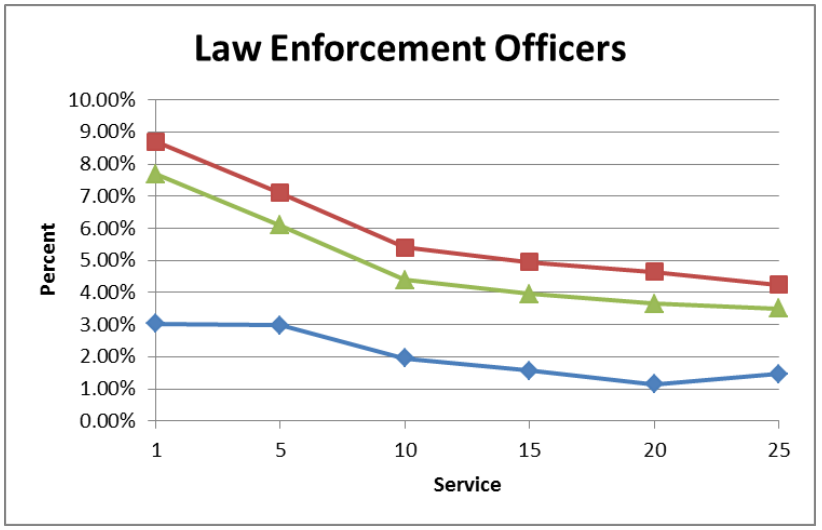


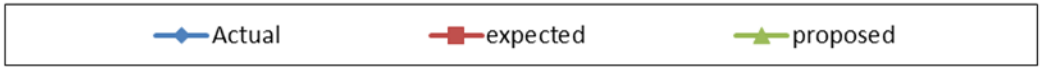
Proposed Salary Increases by Employee Group







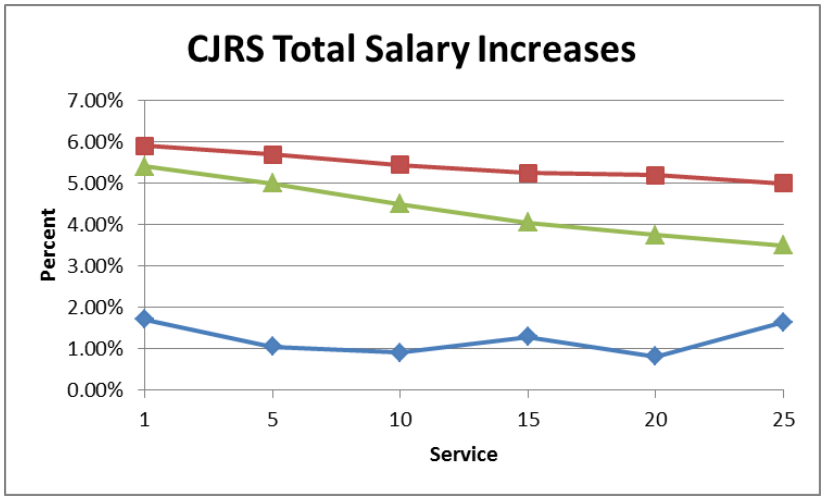


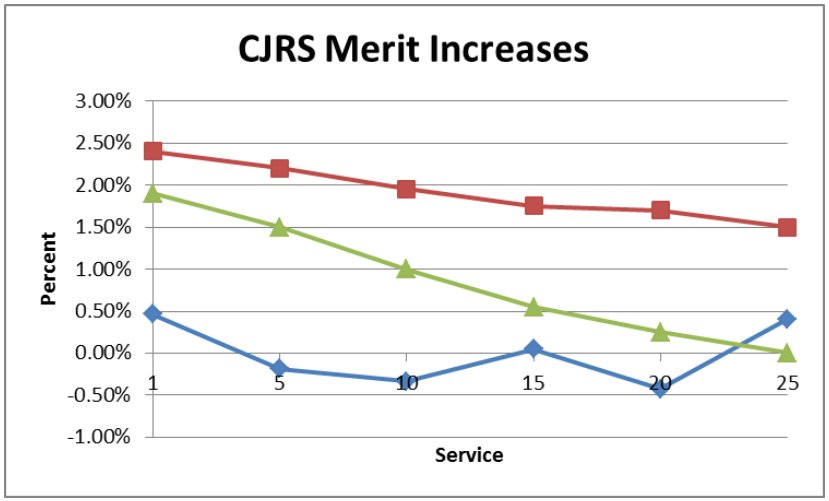


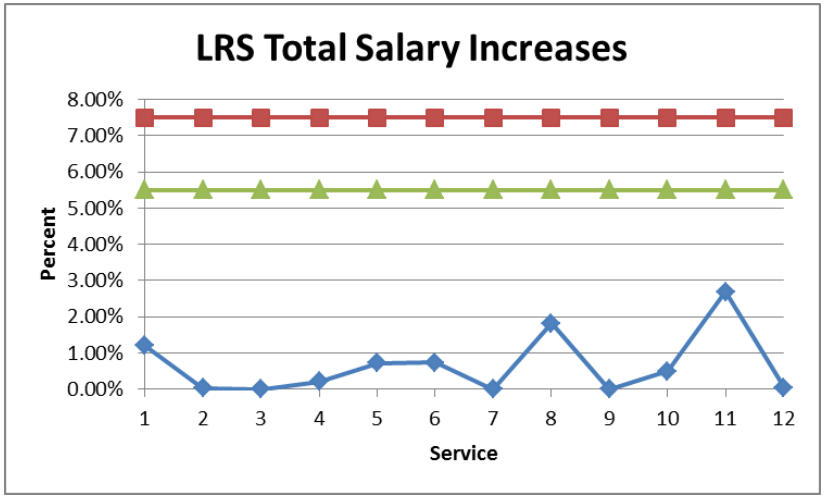
buckconsultants

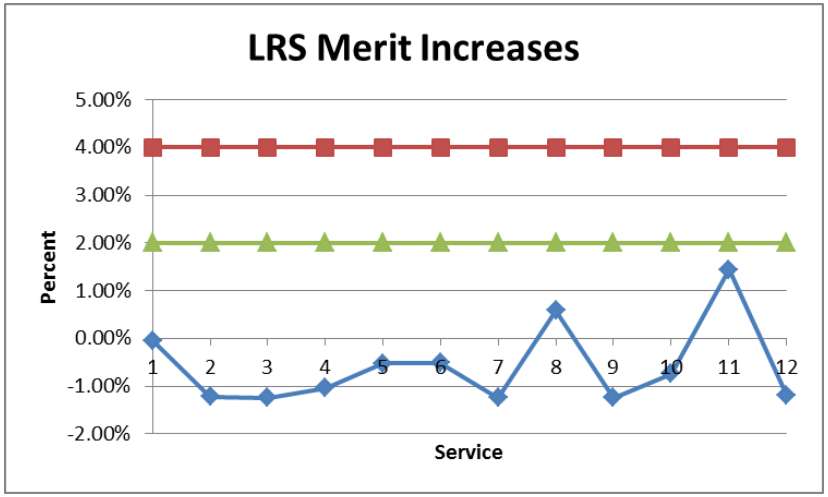
xerox

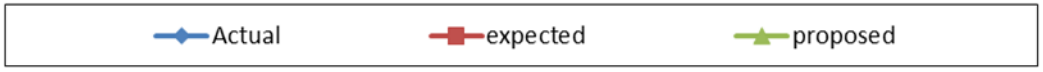
Proposed Merit Adjustment and Salary Increases











Salary Increases

- Observation: Salary increases continue to be significantly less than expected. Service continues to be a better indicator of salary increases than age.

- Recommendation: Reduce rates at all ages and base rates on service. Minimum increase for later career is 3.50%, which is the sum of the inflation assumption (3.00%) and the productivity assumptions (0.50%).

- Cost impact: Significant decrease in liability

Funding Methodology

Asset Valuation Methods

Actuarial Costs Method

Amortization Method

buckconsultants

xerox

Asset Valuation Methods

- Asset Valuation Methods smooth or average the market value returns over time to alleviate contribution volatility
  - ASOP 44 provides guidance to actuaries in selecting and recommending asset valuation methods
  - Actuarial value of assets should fall within a reasonable range around the market value and differences between the market value and the actuarial value should be recognized within a reasonable period of time
  - Sufficiently narrow ranges or sufficiently short periods are also reasonable
- Current asset valuation method reflects 20% of difference between expected actuarial value and market value, with a corridor of 80%-to-120% of market value of assets (corridor not used for LRS)
- Current method is smooth but not as transparent or predictable as other methods

We recommend that the current asset valuation method for TSERS, CJRS, LRS, and NG be modified to reflect a five-year smoothing method. An overview of the method is shown on the next slide.

Proposed Asset Valuation Method

- The proposed asset method is based upon a smoothed market value method. Under this method, asset returns in excess of or less than the expected return on market value of assets will be reflected in the actuarial value of assets over a five-year period. The calculation of the Actuarial Value of Assets is based on the following formula:

$$MV - 80\% \times G/(L)_1 - 60\% \times G/(L)_2 - 40\% \times G/(L)_3 - 20\% \times G/(L)_4$$

where:

MV	=	the market value of assets as of the valuation date
$G/(L)_i$	=	the asset gain or (loss) for the i-th year preceding the valuation date (i.e., actual return on market value of assets less expected return on market value of assets)

- Propose to set actuarial value equal to market value as of December 31, 2014, which will *decrease* actuarial value of assets by $146.7 million for TSERS, by $35,000 for LRS and by $354,000 for NG, and *increase* actuarial value of assets by $153,000 for CJRS
- May increase market volatility over the next 5 years

Actuarial Cost Method

- Actuarial Cost Methods allocate costs to the actuarial accrued liability (i.e., the amount of money that should be in the fund) for past service and normal cost (i.e., the cost of benefits accruing during the year) for current service.
  - The Board of Trustees has adopted Entry Age Normal as its actuarial cost method for TSERS and National Guard
  - Develops normal costs that stays level as a percent of payroll
  - CJRS and LRS utilize Projected Unit Credit method
- Entry Age Normal used by over 85% of public sector plans
- GASB has also adopted Entry Age Normal for all accounting calculations

No recommended changes in actuarial cost method for TSERS or National Guard. We recommend that the entry age normal method be adopted for CJRS and LRS

Amortization Methods

- Amortization Methods determine the payment schedule for unfunded actuarial accrued liability
  - Payment level: the payment is determined as a level dollar amount, similar to a mortgage payment
  - Payment period: a 12-year closed amortization period was adopted for fiscal year ending 2012. A new amortization base is created each year based on the prior years' experience.
- Timing adjustment: Interest adjustment applied to reflect 1½-year delay in contribution between valuation and beginning of fiscal year.
- Above methodology applies to TSERS, CJRS and National Guard
- LRS utilizes an 8-year, level dollar open amortization period

We recommend changing LRS to a 12-year, level dollar closed amortization period consistent with the other State systems. When compared to other Public Sector Retirement Systems in the United States, the 12-year closed amortization is quite aggressive, paying down the pension debt over a much shorter period of time compared to the national average of around 24 years.

Board Recommendations

Economic Assumptions

General and Wage Inflation – Proposed Rate of 3.00%

Real Rate of Return – Proposed Rate of 4.25%

Real Wage Growth – Proposed Rate of 0.50%

Funding Methodology

Asset Smoothing – Reset actuarial value to market value as of December 31, 2014; change to five-year smoothing method

Actuarial Cost Method – Update to Entry Age Normal for CJRS and LRS; No change to TSERS or National Guard

Amortization Method – Update to 12-year, level dollar closed amortization for LRS; No change to TSERS, CJRS or National Guard

Cost Impact – TSERS

Had the proposed assumptions and methods been reflected for the December 31, 2014 annual actuarial valuation, the impact would have been a net increase in costs:

- The actuarial accrued liability, or the amount of assets that should be in the fund, would be 3.0% higher, increasing from $67.7 billion to $69.7 billion
- The net change in Annual Required Contributions (ARC) as a percentage of payroll would have increased from 8.47% to 9.79% as shown in the table below.
- Resetting the asset smoothing method as of December 31, 2014 will decrease actuarial value of assets by $146.7 million
- For sensitivity purposes, the final column below shows the impact of the proposed assumptions and methods with an additional change from 7.25% to 7.00% discount rate.

	Current Valuation	Reflecting Mortality Changes	Reflecting Salary Increase Changes	Reflecting All Assumptions Changes	Final Results Reflecting Asset Smoothing		Final Results Assuming 7% Discount Rate
Normal Cost	5.21%	5.82%	4.54%	4.37%	4.37%		4.99%
Accrued Liability	3.26	7.51	5.37	5.27	5.42		7.14
Total	8.47%	13.33%	9.91%	9.64%	9.79%		12.13%
Cumulative Change		4.86%	1.44%	1.17%	1.32%		3.66%

Key Takeaways - TSERS

Assumption	Observed Experience Relative to Expectations	Recommendation	Impact on Costs
1. Mortality	Fewer Deaths	Decrease Rates and Update Mortality Improvement Projection Scale	Significant Increase
2. Service retirement	Fewer Retirements	Decrease Rates	Slight Decrease
3. Disability retirement	Small Group	No Change	N/A
4. Termination from active employment	Fewer Terminations	Decrease Rates	Slight Decrease
5. Leave conversions at retirement	Varies by Group	Varies by Group	Immaterial
6. Investment return	Current Assumption Reasonable	No Change	N/A
7. Merit pay increases	Lower Increases	Decrease Rates	Significant Decrease
8. Inflation	Current Assumption Reasonable	No Change	N/A
9. Productivity growth	Current Assumption Reasonable	No Change	N/A
10. Amortization method	Current Assumption Reasonable	No Change	N/A
11. Actuarial cost method	Current Assumption Reasonable	No Change	N/A
12. Asset valuation method	Not Transparent or Predictable	5-year Smoothing	Slight Increase

Notes:

1. The mortality assumption was the source of the largest increase in costs. While we did observe fewer deaths than expected over the past few years, the increase in costs was driven more by the increase in mortality improvements suggested by national studies
6. The current investment return assumption of 7.25% remains reasonable
7. The merit increase assumption was the source of the largest decrease in costs as salaries continued to fall short of the long-term assumptions

Overall, the net impact on liabilities was an increase

Cost Impact – CJRS

Had the proposed assumptions and methods been reflected for the December 31, 2014 annual actuarial valuation, the impact would have been a net increase in costs:

- The actuarial accrued liability, or the amount of assets that should be in the fund, would be 5.8% higher, increasing from $566.8 million to $599.5 million
- The net change in Annual Required Contributions (ARC) as a percentage of payroll would have increased from 25.09% to 29.16% as shown in the table below.
- Resetting the asset smoothing method as of December 31, 2014 will increase actuarial value of assets by $153,000
- For sensitivity purposes, the final column below shows the impact of the proposed assumptions and methods with an additional change from 7.25% to 7.00% discount rate.

	Current Valuation	Reflecting Mortality Changes	Reflecting Salary Increase Changes	Reflecting All Assumptions Changes	Reflecting Asset Smoothing	Final Results Reflecting Entry Age		Final Results Assuming 7% Discount Rate
Normal Cost	17.60%	19.15%	16.40%	16.48%	16.48%	15.41%		16.50%
Accrued Liability	7.14	15.93	11.85	11.13	11.10	13.37		15.97
Death Benefit	0.35	0.36	0.36	0.38	0.38	0.38		0.39
Total	25.09%	35.44%	28.61%	27.99%	27.96%	29.16%		32.86%
Cumulative Change		10.35%	3.52%	2.90%	2.87%	4.07%		7.77%

Key Takeaways - CJRS

Assumption	Observed Experience Relative to Expectations	Recommendation	Impact on Costs
1. Mortality	Fewer Deaths	Decrease Rates and Update Mortality Improvement Projection Scale	Significant Increase
2. Service Retirement	Fewer Retirements	Decrease Rates	Slight Decrease
3. Disability Retirement	Low Creditability	No Change	N/A
4. Termination from active employment	N/A	N/A	N/A
5. Leave conversions at retirement	N/A	N/A	N/A
6. Investment return	Current Assumption Reasonable	No Change	N/A
7. Merit pay increases	Lower Increases	Decrease Rates	Significant Decrease
8. Inflation	Current Assumption Reasonable	No Change	N/A
9. Productivity growth	Current Assumption Reasonable	No Change	N/A
10. Amortization Method	Current Assumption Reasonable	No Change	N/A
11. Actuarial Cost Method	Inconsistent to Other Systems	Move to Entry Age	Increase
12. Asset Valuation Method	Not Transparent or Predictable	5-year Smoothing	Slight Decrease

Notes:

1. The mortality assumption was the source of the largest increase in costs. While we did observe fewer deaths than expected over the past few years, the increase in costs was driven more by the increase in mortality improvements suggested by national studies

6. The current investment return assumption of 7.25% remains reasonable

7. The merit increase assumption was the source of the largest decrease in costs as salaries continued to fall short of the long-term assumptions

Overall, the net impact on liabilities was an increase

Cost Impact – LRS

Had the proposed assumptions and methods been reflected for the December 31, 2014 annual actuarial valuation, the impact would have been a net increase in costs:

- The actuarial accrued liability, or the amount of assets that should be in the fund, would be 20.3% higher, increasing from $24.1 million to $29.0 million
- The net change in Annual Required Contributions (ARC) as a percentage of payroll would have increased from 0.46% to 16.80% as shown in the table below.
- Resetting the asset smoothing method as of December 31, 2014 will decrease actuarial value of assets by $35,000
- For sensitivity purposes, the final column below shows the impact of the proposed assumptions and methods with an additional change from 7.25% to 7.00% discount rate.

	Current Valuation	Reflecting Mortality Changes	Reflecting Salary Increase Changes	Reflecting Retirement and Terminations	Reflecting Asset Smoothing and Administrative Expenses	Final Results Reflecting Entry Age		Final Results Assuming 7% Discount Rate
Normal Cost	21.40%	26.94%	24.02%	16.97%	17.97%	17.14%		18.04%
Disability Benefit	0.55	0.63	0.63	0.63	0.63	0.61		0.62
Accrued Liability	(21.49)	4.22	1.98	(1.83)	(1.68)	0.05		2.31
Total	0.46%	31.79%	26.63%	15.77%	16.92%	17.80%		20.97%
Cumulative Change		31.33%	26.17%	15.31%	16.46%	17.34%		20.51%

Key Takeaways - LRS

Assumption	Observed Experience Relative to Expectations	Recommendation	Impact on Costs
1. Mortality	Fewer Deaths	Decrease Rates and Update Mortality Improvement Projection Scale	Significant Increase
2. Service Retirement	Fewer Retirements	Decrease Rates and Vary by Age	Significant Decrease
3. Disability Retirement	Low Creditability	No Change	N/A
4. Termination from active employment	More Terminations	Add Rates	Significant Decrease
5. Administrative expenses	No Provision	1% of Payroll	Increase
6. Investment return	Current Assumption Reasonable	No Change	N/A
7. Merit pay increases	Lower Increases	Decrease Rates	Significant Decrease
8. Inflation	Current Assumption Reasonable	No Change	N/A
9. Productivity growth	Current Assumption Reasonable	No Change	N/A
10. Amortization Method	Inconsistent to Other Systems	Change to 12-year	Slight Decrease
11. Actuarial Cost Method	Inconsistent to Other Systems	Move to Entry Age	Increase
12. Asset Valuation Method	Not Transparent or Predictable	5-year Smoothing	Slight Increase

Notes:

1. The mortality assumption was the source of the largest increase in costs. While we did observe fewer deaths than expected over the past few years, the increase in costs was driven more by the increase in mortality improvements suggested by national studies
2. The service retirement assumption had largest decrease in costs as rates that varied based on age were developed. Prior assumption does not vary by age (100% retirement assumed at age 65)
4. The termination assumption results in a large decrease in costs. Prior valuation had no assumed termination rates
6. The current investment return assumption of 7.25% remains reasonable
7. The merit increase assumption was a large decrease source of decrease in costs as salaries continued to fall short of the long-term assumptions

Overall, the net impact on liabilities was an increase

Cost Impact – National Guard

Had the proposed assumptions and methods been reflected for the December 31, 2014 annual actuarial valuation, the impact would have been a net increase in costs:

- The actuarial accrued liability, or the amount of assets that should be in the fund, would be 9.1% higher, increasing from $151.1 million to $164.8 million
- The net change in Annual Required Contributions (ARC) would have increased from $6,922,0830 to $8,607,918 as shown in the table below.
- Resetting the asset smoothing method as of December 31, 2014 will decrease actuarial value of assets by $354,000
- For sensitivity purposes, the final column below shows the impact of the proposed assumptions and methods with an additional change from 7.25% to 7.00% discount rate.

	Current Valuation	Reflecting Mortality Changes	Reflecting Retirement and Terminations	Final Results Reflecting Asset Smoothing and Administrative Expenses		Final Results Assuming 7% Discount Rate
Normal Cost	572,610	613,709	249,027	331,027		354,973
Disability Benefit	6,349,473	8,512,149	8,228,462	8,276,891		8,816,838
Total	6,922,083	9,125,858	8,477,489	8,607,918		9,171,811
Cumulative Change		2,203,775	1,555,406	1,685,835		2,249,728

Key Takeaways – National Guard

Assumption	Observed Experience Relative to Expectations	Recommendation	Impact on Costs
1. Mortality	Fewer Deaths	Decrease Rates and Update Mortality Improvement Projection Scale	Significant Increase
2. Service Retirement	Fewer Retirements	Decrease Rates	Significant Decrease
3. Disability Retirement	Low Creditability	No Change	N/A
4. Termination from active employment	More Terminations	Add Rates	Significant Decrease
5. Administrative expenses	No Provision	Prior Year's Expenses	Increase
6. Investment return	Current Assumption Reasonable	No Change	N/A
7. Merit pay increases	N/A	N/A	N/A
8. Inflation	Current Assumption Reasonable	No Change	N/A
9. Productivity growth	N/A	N/A	N/A
10. Amortization Method	Current Assumption Reasonable	No Change	N/A
11. Actuarial Cost Method	Current Assumption Reasonable	No Change	N/A
12. Asset Valuation Method	Not Transparent or Predictable	5-year Smoothing	Slight Increase

Notes:

1. The mortality assumption was the source of the largest increase in costs. While we did observe fewer deaths than expected over the past few years, the increase in costs was driven more by the increase in mortality improvements suggested by national studies
2. The service retirement assumption results in a large decrease in costs as rates were decreased due to fewer retirements than expected

4. The termination assumption results in a large decrease in costs as rates that varied based on age were developed

6. The current investment return assumption of 7.25% remains reasonable

Overall, the net impact on liabilities was an increase

Disclosures

- Buck's work product contained herein was prepared exclusively for the Board of Trustees and Staff of NCRS. It is a complex, technical analysis that assumes a high level of knowledge concerning the operations of NCRS.
- No third party recipient of Buck's work product should rely upon Buck's work product absent involvement of Buck or without our approval. Third parties recipients inclined to present our work product should engage NCRS and Buck during the presentation process to ensure that this work product is appropriately represented. If this is not desirable, such recipients should engage qualified professionals for advice appropriate to their own specific needs.
- The consultants who worked on this assignment are pension actuaries with significant experience in public funds like NCRS. Buck's advice is not intended to be a substitute for qualified legal or accounting counsel.

Certification

The results were prepared under the direction of Larry Langer and Michael Ribble who meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. These results have been prepared in accordance with all applicable Actuarial Standards of Practice, and we are available to answer questions about them.

Future actuarial measurements may differ significantly from current measurements due to plan experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in plan provisions or applicable law.

Except where otherwise indicated, an analysis of the potential range of such future differences is beyond the scope of this report.

Larry Langer, FCA, ASA, EA, MAAA
Principal, Consulting Actuary

Michael Ribble, FSA, EA, MAAA
Principal, Consulting Actuary

Kai Petersen, FSA, CFA, FCA, MAAA, EA
Principal, Consulting Actuary

Questions?

THANK YOU

buckconsultants

xerox

Teachers' and State Employees' Retirement System of North Carolina

Statement of the Results of the Experience Investigation and Recommended Revised Tables for Adoption by the Board of Trustees

Prepared as of December 31, 2014

Buck Consultants, LLC
A Xerox Company
14911 Quorum Drive
Suite 200
Dallas, TX 75254

P: 972.628.6800
F: 972.628.6801

www.xerox.com\hrconsulting

October 8, 2015

Board of Trustees
Teachers' and State Employees'
Retirement System of North Carolina
3200 Atlantic Avenue
Raleigh, NC 27604

Members of the Board:

An investigation of the mortality, service and compensation experience of members and beneficiaries of the Teachers' and State Employees' Retirement System of North Carolina (the "Retirement System") has been made in accordance with Section 6(n) of Chapter 135 of the North Carolina General Statutes. This investigation covers the five-year period from January 1, 2010 to December 31, 2014. As a result of the investigation, it is recommended that revised tables be adopted by the Board for future use.

In addition to the investigation required by Section 6(n) of Chapter 135 of the North Carolina General Statutes, the experience with regard to the conversion of leave to additional service and compensation and the marriage and administrative expense assumptions have also been reviewed. As a result of this review, it is recommended that revised assumptions with regard to leave conversion be adopted by the Board for future use.

Experience for Active Members

The data were tabulated separately for general employees, classroom teachers, other education employees and law enforcement officers, and, where sufficient data exists, for males and females. The number of members expected to separate from active service was obtained using the rates currently used for the valuations and the members exposed to the rates. The expected separations were then compared with the actual separations. Based on the comparison of actual separations to expected separations and taking into account reasonable expectations of the future, proposed assumption changes have been made. The non-inflationary, nonproductively component of the salary scale was developed by analyzing actual versus expected merit increases during the five-year period.

The results of the investigation indicate that, in our view, the assumed salary increases, the leave conversion assumptions and the rates of separation from active service due to withdrawal, mortality, and retirement do not accurately reflect the actual and anticipated experience of the Retirement System. As a result of the investigation, new active service tables have been developed that more closely reflect the actual experience of the membership.

Experience for Retired Members and Survivors of Deceased Members

An investigation of the experience for retired members and survivors of deceased members was prepared separately by gender, cause of retirement, and for general employees, classroom teachers, other education employees and law enforcement officers. The expected deaths were determined by applying the assumed rates of mortality used for valuation purposes to the number of members in each retirement category. A comparison was then made between the expected and actual deaths in each retirement category.

The results of the investigation indicate that the assumed rates of mortality do not accurately reflect the actual and expected experience of the Retirement System. As a result of the investigation, we are recommending new mortality tables.

Summary

This report contains tables showing a comparison of the actual and expected cases of separation from active service, salary increases due to merit and actual and expected number of deaths among retired members and survivors of deceased members. A comparison between the rates presently in use and the recommended revised rates are also shown in this report. The table of contents outlines the material contained in this report.

The recommended rates of separation from active service, rates of salary increase and other demographic assumptions are shown in the attached tables in Schedule A of this report. In the actuary's judgment, the rates recommended are suitable for use until further experience indicates that modifications are desirable.

We have also included, in Schedule A, the economic assumptions and funding methods related to the December 31, 2014 valuation of the Retirement System, but such economic assumptions and funding methods are not part of the scope of this experience investigation report.

Future actuarial measurements may differ significantly from current measurements due to plan experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in plan provisions or applicable law. Because of limited scope, Buck performed no analysis of the potential range of such future differences.

The undersigned meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained in this report. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and we are available to answer questions about it.

Respectfully submitted,

Michael A. Ribble, FSA, EA, MAAA
Principal, Consulting Actuary

Larry Langer, ASA, EA, MAAA
Principal, Consulting Actuary

MAR:km
\NC\MIS\2014 EXPERIENCE RESULTS.DOCX

Table of Contents

Section 1: Post-Retirement Mortality

The Retirement System currently uses mortality tables that vary by age, gender, employee group (i.e., classroom teachers, general employees including other education employees, law enforcement officers) and health status (i.e., disabled and healthy). The current mortality rates are based on published tables and based on studies that cover significant portions of the U.S. population. The healthy mortality rates also contain a provision to reflect future mortality improvements. The following table shows that, in total, the current mortality tables result in expected mortality rates significantly higher than the actual mortality rates. In addition, recent studies of the U.S. population have determined that the overall rates of mortality improvement in the U.S. have differed from those predicted by the projection scale currently in use (Scale AA). Further, the current mortality tables do not provide for mortality improvements for members disabled at retirement.

Therefore, we are recommending that the Board adopt a set of mortality tables that better reflect the experience of the Retirement System. The recommended mortality tables are also based on recent studies that cover significant portions of the U.S. population, allow for future mortality improvements based on recent studies (Scale MP-2014) and apply mortality improvement to all members, including those disabled at retirement. Scale MP-2014 includes a two-dimensional improvement assumption that is a function of both age and calendar year.

The recommended mortality tables continue to vary by age, gender, and health status (i.e., disabled and healthy). In addition, the data reporting for employee groups has been enhanced and we have been tracking a new group of employees – other education employees. In the past, a majority of the other education employees were reported as general employees. The mortality rates for the other education employees are generally consistent with classroom teachers. The number of retired other education employees reported is relatively small. As such, we have studied other education employees and classroom teachers together for purposes of proposing post-retirement mortality rates.

It should be noted that mortality rates for disabled members and beneficiaries of deceased members of the Retirement System were studied based on the experience of such members and beneficiaries from this Retirement System and the North Carolina Local Governmental Employees' Retirement System. As such, the following table reflects the experience of both systems for disabled members and for beneficiaries of deceased members.

Section 1: Post-Retirement Mortality

Post-Retirement Mortality

Teachers - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=54	1,018	8	5	160%	4	200%
55 to 64	20,907	121	159	76%	135	90%
65 to 74	33,431	390	565	69%	411	95%
75 to 84	19,063	831	952	87%	820	101%
85 to 94	5,151	653	685	95%	644	101%
>=95	307	87	85	102%	89	98%
Total	79,877	2,090	2,451	85%	2,103	99%

Teachers - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=54	4,861	8	13	62%	13	62%
55 to 64	89,627	334	592	56%	361	93%
65 to 74	108,849	903	1,638	55%	901	100%
75 to 84	51,276	1,525	2,085	73%	1,562	98%
85 to 94	18,566	1,781	2,056	87%	1,730	103%
>=95	2,568	634	551	115%	595	107%
Total	275,747	5,185	6,935	75%	5,162	100%

General - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=54	3,518	14	17	82%	23	61%
55 to 64	34,994	329	317	104%	384	86%
65 to 74	58,807	1,178	1,239	95%	1,182	100%
75 to 84	32,462	1,805	1,990	91%	1,794	101%
85 to 94	9,137	1,343	1,458	92%	1,305	103%
>=95	445	136	135	101%	133	102%
Total	139,363	4,805	5,156	93%	4,821	100%

General - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=54	3,506	8	10	80%	13	62%
55 to 64	47,345	213	358	59%	265	80%
65 to 74	82,230	901	1,404	64%	904	100%
75 to 84	49,513	1,747	2,241	78%	1,827	96%
85 to 94	18,863	2,080	2,252	92%	1,947	107%
>=95	1,499	357	329	109%	350	102%
Total	202,956	5,306	6,594	80%	5,306	100%

Section 1: Post-Retirement Mortality

Post-Retirement Mortality

Other - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=54	629	5	3	167%	3	167%
55 to 64	4,519	23	41	56%	29	79%
65 to 74	4,363	54	79	68%	47	115%
75 to 84	536	18	29	62%	19	95%
85 to 94	23	3	4	75%	3	100%
>=95	0	0	0	N/A	0	N/A
Total	10,070	103	156	66%	101	102%

Other - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=54	1,064	5	3	167%	3	167%
55 to 64	10,905	50	82	61%	45	111%
65 to 74	8,345	66	119	55%	59	112%
75 to 84	528	13	20	65%	12	108%
85 to 94	15	0	2	0%	1	0%
>=95	0	0	0	N/A	0	N/A
Total	20,857	134	226	59%	120	112%

Law Enforcement Officers - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=54	1,336	0	6	0%	8	0%
55 to 64	4,490	17	34	50%	43	40%
65 to 74	3,748	63	67	94%	66	95%
75 to 84	1,290	61	70	87%	59	103%
85 to 94	322	42	45	93%	36	117%
>=95	3	0	1	0%	1	0%
Total	11,189	183	223	82%	213	86%

Section 1: Post-Retirement Mortality

Post-Retirement Mortality

Beneficiaries - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=54	3,218	29	8	363%	8	363%
55 to 64	3,409	39	29	134%	41	95%
65 to 74	4,862	129	105	123%	114	113%
75 to 84	3,673	237	233	102%	215	110%
85 to 94	1,647	228	273	84%	244	93%
>=95	159	40	52	77%	55	73%
Total	16,968	702	700	100%	677	104%

Beneficiaries - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=54	5,720	40	10	400%	13	308%
55 to 64	10,018	101	77	131%	81	125%
65 to 74	18,128	336	365	92%	322	104%
75 to 84	24,739	1,109	1,326	84%	1,144	97%
85 to 94	14,761	1,710	1,968	87%	1,696	101%
>=95	1,457	337	342	99%	390	86%
Total	74,823	3,633	4,088	89%	3,646	100%

Disabled - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
Total	43,178	1,685	1,802	94%	1,691	100%

Disabled - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
Total	50,872	1,462	1,893	77%	1,474	99%

Section 2: Active Mortality

The Retirement System currently uses mortality tables that vary by age, gender and employee group (i.e., classroom teachers, general employees including other education employees, law enforcement officers). The current mortality rates are based on published tables and based on studies that cover significant portions of the U.S. population. The mortality rates also contain a provision to reflect future mortality improvements. The following table shows that, in total, the current mortality tables result in expected mortality rates in excess of the actual mortality rates.

Therefore, we are recommending that the Board adopt a set of mortality tables that better reflect the experience of the Retirement System. Due to the low number of observed pre-retirement and reported deaths at any given age, the recommended mortality tables are the corresponding active employee table to the post-retirement rates recommended. The recommended mortality tables continue to vary by age and gender.

In addition, the data reporting for employee groups has been enhanced and we have been tracking a new group of employees – other education employees. In the past a majority of the other education employees were reported as general employees. For this experience review, active member mortality for other education employees has been studied separately.

Section 2: Active Mortality

Active Member Mortality

Teachers - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=29	21,555	3	8	38%	9	33%
30 to 39	41,159	17	26	65%	20	85%
40 to 49	39,167	20	48	42%	34	59%
50 to 59	33,617	67	80	84%	79	85%
60 to 69	14,802	51	76	67%	83	61%
>=70	1,190	7	5	140%	18	39%
Total	151,490	165	243	68%	243	68%

Teachers - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=29	91,418	6	18	33%	19	32%
30 to 39	149,772	27	62	44%	46	59%
40 to 49	166,417	74	158	47%	113	65%
50 to 59	151,154	151	346	44%	251	60%
60 to 69	46,309	70	213	33%	140	50%
>=70	1,347	8	11	73%	11	73%
Total	606,417	336	808	42%	580	58%

General - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=29	22,101	10	8	125%	10	100%
30 to 39	49,630	28	38	74%	26	108%
40 to 49	71,458	68	101	67%	72	94%
50 to 59	72,965	197	204	97%	198	99%
60 to 69	28,655	130	171	76%	188	69%
>=70	1,939	24	0	N/A	35	69%
Total	246,748	457	522	88%	529	86%

General - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=29	27,331	6	6	100%	7	86%
30 to 39	64,123	17	30	57%	26	65%
40 to 49	88,115	58	94	62%	80	73%
50 to 59	93,939	132	235	56%	201	66%
60 to 69	32,602	88	164	54%	129	68%
>=70	1,563	9	13	69%	15	60%
Total	307,673	310	542	57%	458	68%

Section 2: Active Mortality

Active Member Mortality

Other - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=29	4,183	2	2	100%	2	100%
30 to 39	11,623	8	9	89%	6	133%
40 to 49	19,778	11	29	38%	18	61%
50 to 59	24,089	54	70	77%	58	93%
60 to 69	12,146	45	75	60%	69	65%
>=70	1,570	15	18	83%	25	60%
Total	73,389	135	203	67%	178	76%

Other - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=29	6,009	1	1	100%	1	100%
30 to 39	23,439	2	11	18%	8	25%
40 to 49	51,915	31	56	55%	37	84%
50 to 59	60,484	63	151	42%	101	62%
60 to 69	21,568	43	109	39%	67	64%
>=70	1,396	4	12	33%	11	36%
Total	164,811	144	340	42%	225	64%

Law Enforcement Officers - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=29	1,671	1	1	100%	1	100%
30 to 39	5,278	0	4	0%	4	0%
40 to 49	6,614	4	9	44%	8	50%
50 to 59	1,783	3	4	75%	5	60%
60 to 69	197	1	1	100%	1	100%
>=70	14	0	0	N/A	0	N/A
Total	15,557	9	19	47%	19	47%

Section 3: Rates of Retirement

The Retirement System currently uses retirement rates that vary by age, gender, employee group (i.e., classroom teachers, general employees including other education employees, law enforcement officers) and type of retirement (i.e., reduced and unreduced). The current retirement rates are based on the recommendation made in the prior experience study. The following table shows that, in total, the retirement rates result in expected retirements greater than actual retirements for both unreduced retirements and reduced retirements for all employee groups other than law enforcement officers.

Therefore, we are recommending that the Board adopt a set of retirement rates that better reflect the experience of the Retirement System and the expectations for future retirements. As was the case for other separations from active service, other education employees have been studied separately.

Section 3: Rates of Retirement

Unreduced Retirement

Teachers - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=49	14	8	4	200%	4	200%
50 to 54	1,090	327	352	93%	330	99%
55 to 59	1,670	453	551	82%	464	98%
60 to 64	2,150	575	690	83%	599	96%
65 to 69	3,241	863	921	94%	865	100%
>=70	1,070	247	461	54%	441	56%
Total	9,235	2,473	2,979	83%	2,703	91%

Teachers - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=49	87	18	26	69%	24	75%
50 to 54	5,947	1,897	2,016	94%	1,887	101%
55 to 59	7,748	2,554	2,512	102%	2,528	101%
60 to 64	9,203	3,534	3,859	92%	3,599	98%
65 to 69	7,118	2,442	2,709	90%	2,426	101%
>=70	1,201	358	511	70%	537	67%
Total	31,304	10,803	11,633	93%	11,001	98%

General - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=49	281	97	98	99%	92	105%
50 to 54	2,200	576	566	102%	576	100%
55 to 59	3,051	690	758	91%	702	98%
60 to 64	4,061	1,183	1,377	86%	1,150	103%
65 to 69	5,736	1,417	1,544	92%	1,387	102%
>=70	1,754	379	705	54%	711	53%
Total	17,083	4,342	5,048	86%	4,618	94%

General - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=49	293	93	103	90%	86	108%
50 to 54	2,598	673	725	93%	672	100%
55 to 59	3,467	886	942	94%	891	99%
60 to 64	4,577	1,375	1,666	83%	1,371	100%
65 to 69	5,996	1,608	1,719	94%	1,614	100%
>=70	1,478	309	626	49%	569	54%
Total	18,409	4,944	5,781	86%	5,203	95%

Section 3: Rates of Retirement

Unreduced Retirement

Other - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=49	75	27	26	104%	22	123%
50 to 54	770	170	193	88%	175	97%
55 to 59	1,110	239	262	91%	238	100%
60 to 64	1,282	367	435	84%	365	101%
65 to 69	2,566	600	677	89%	594	101%
>=70	1,284	303	585	52%	587	52%
Total	7,087	1,706	2,178	78%	1,981	86%

Other - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=49	87	21	30	70%	20	105%
50 to 54	1,343	288	372	77%	305	94%
55 to 59	2,191	522	587	89%	537	97%
60 to 64	3,451	1,049	1,253	84%	1,053	100%
65 to 69	4,112	1,021	1,169	87%	1,046	98%
>=70	1,251	301	521	58%	521	58%
Total	12,435	3,202	3,932	81%	3,482	92%

Law Enforcement Officers - Male & Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=49	45	37	31	119%	33	112%
50 to 54	108	87	71	123%	78	112%
55 to 59	405	121	124	98%	125	97%
60 to 64	161	30	40	75%	34	88%
65 to 69	34	13	12	108%	10	130%
>=70	14	4	7	57%	7	57%
Total	767	292	285	102%	287	102%

Section 3: Rates of Retirement

Reduced Retirement

Teachers - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
50 to 54	4,378	202	275	73%	205	99%
55 to 59	3,311	229	215	107%	215	107%
60 to 64	7,125	1,198	1,204	100%	1,209	99%
Total	14,814	1,629	1,694	96%	1,629	100%

Teachers - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
50 to 54	20,211	886	1,263	70%	909	97%
55 to 59	18,764	1,400	1,361	103%	1,382	101%
60 to 64	25,979	4,651	4,933	94%	4,682	99%
Total	64,954	6,937	7,557	92%	6,973	99%

General - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
50 to 54	9,487	515	626	82%	529	97%
55 to 59	7,283	500	534	94%	513	97%
60 to 64	15,027	2,483	2,552	97%	2,492	100%
Total	31,797	3,498	3,712	94%	3,534	99%

General - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
50 to 54	10,264	478	387	124%	474	101%
55 to 59	8,546	512	588	87%	529	97%
60 to 64	18,151	2,765	3,135	88%	2,761	100%
Total	36,961	3,755	4,110	91%	3,764	100%

Other - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
50 to 54	2,413	139	166	84%	139	100%
55 to 59	1,946	131	147	89%	130	101%
60 to 64	5,430	950	930	102%	946	100%
Total	9,789	1,220	1,243	98%	1,215	100%

Other - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
50 to 54	5,668	260	216	120%	260	100%
55 to 59	6,362	409	427	96%	406	101%
60 to 64	11,525	1,977	1,980	100%	1,986	100%
Total	23,555	2,646	2,623	101%	2,652	100%

Law Enforcement Officers - Male & Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
50 to 54	1,021	220	61	361%	92	239%
Total	1,021	220	61	361%	92	239%

Section 4: Termination Rates

Termination rates measure the probability that a member will leave prior to retirement eligibility. The Retirement System currently uses termination rates that vary by gender, and employee group (i.e., classroom teachers, general employees including other education employees, law enforcement officers). Termination rates for the first five years of employment also vary by service. Termination rates after five years of employment also vary by age. The current termination rates are based on the recommendation of the prior experience study. The following table shows that, in total, the termination rates result in expected terminations close to actual terminations. However, there are some deviations in certain age or service groupings.

Therefore, we are recommending that the Board adopt a set of termination rates that better reflect the experience of the Retirement System and the expectations for future terminations. As was the case for other separations from service, other education employees have been studied separately.

Section 4: Termination Rates

Termination - First 4 Years

Teachers - Male

Service	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
0	9,549	1,824	2,483	73%	1,814	101%
1	10,739	1,732	1,933	90%	1,718	101%
2	9,823	1,365	1,277	107%	1,375	99%
3	9,017	1,085	902	120%	1,082	100%
4	8,624	834	690	121%	819	102%
Total	47,752	6,840	7,285	94%	6,808	100%

Teachers - Female

Service	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
0	32,463	5,556	7,142	78%	5,519	101%
1	34,339	5,032	5,838	86%	4,979	101%
2	32,710	4,361	4,252	103%	4,416	99%
3	31,634	3,721	3,163	118%	3,796	98%
4	32,450	3,212	2,596	124%	3,245	99%
Total	163,596	21,882	22,991	95%	21,955	100%

General - Male

Service	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
0	7,781	1,418	2,101	67%	1,401	101%
1	17,764	2,720	3,198	85%	2,753	99%
2	16,319	2,107	1,958	108%	2,121	99%
3	15,365	1,712	1,229	139%	1,690	101%
4	14,468	1,326	1,013	131%	1,302	102%
Total	71,697	9,283	9,499	98%	9,267	100%

General - Female

Service	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
0	10,443	2,026	2,820	72%	2,036	100%
1	23,172	3,958	4,287	92%	3,939	100%
2	21,293	3,035	2,555	119%	3,087	98%
3	20,226	2,352	2,023	116%	2,326	101%
4	19,745	1,977	1,777	111%	1,975	100%
Total	94,879	13,348	13,462	99%	13,363	100%

Section 4: Termination Rates

Termination - First 4 Years

Other- Male

Service	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
0	3,312	628	894	70%	629	100%
1	5,271	841	949	89%	843	100%
2	4,899	648	588	110%	637	102%
3	4,346	503	348	145%	500	101%
4	3,893	380	273	139%	389	98%
Total	21,721	3,000	3,052	98%	2,998	100%

Other - Female

Service	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
0	5,615	925	1,516	61%	926	100%
1	8,327	1,123	1,540	73%	1,124	100%
2	8,212	971	985	99%	985	99%
3	8,247	825	825	100%	825	100%
4	8,378	721	754	96%	712	101%
Total	38,779	4,565	5,621	81%	4,573	100%

Law Enforcement Officers - Male & Female

Service	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
0	217	28	39	72%	28	100%
1	828	81	75	108%	83	98%
2	769	68	54	126%	69	99%
3	817	48	57	84%	49	98%
4	758	47	45	104%	45	104%
Total	3,389	272	270	101%	274	99%

Section 4: Termination Rates

Termination - After 4 Years

Teachers - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=24	18	0	1	0%	1	0%
25 to 29	3,909	308	235	131%	313	98%
30 to 34	12,947	880	712	124%	906	97%
35 to 39	15,201	693	608	114%	684	101%
40 to 44	16,116	555	563	99%	564	98%
45 to 49	14,418	448	503	89%	469	96%
50 to 54	8,799	380	307	124%	286	133%
55 to 59	8,281	398	289	138%	269	148%
Total	79,689	3,662	3,218	114%	3,492	105%

Teachers - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=24	37	6	3	200%	3	200%
25 to 29	21,086	1,886	1,476	128%	1,898	99%
30 to 34	51,958	3,842	3,117	123%	3,897	99%
35 to 39	57,618	2,607	2,594	101%	2,593	101%
40 to 44	68,309	2,341	2,049	114%	2,323	101%
45 to 49	65,822	2,072	1,975	105%	2,139	97%
50 to 54	45,067	1,788	1,352	132%	1,465	122%
55 to 59	36,666	1,682	1,100	153%	1,192	141%
Total	346,563	16,224	13,666	119%	15,510	105%

General - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=24	90	10	6	167%	7	143%
25 to 29	4,206	345	274	126%	336	103%
30 to 34	12,051	836	784	107%	844	99%
35 to 39	17,885	941	894	105%	939	100%
40 to 44	24,953	973	998	97%	998	97%
45 to 49	29,294	991	1,024	97%	1,025	97%
50 to 54	19,489	728	681	107%	682	107%
55 to 59	18,203	721	636	113%	637	113%
Total	126,171	5,545	5,297	105%	5,468	101%

General - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=24	60	5	5	100%	7	71%
25 to 29	4,236	462	381	121%	466	99%
30 to 34	15,321	1,327	1,226	108%	1,302	102%
35 to 39	21,379	1,321	1,283	103%	1,283	103%
40 to 44	29,000	1,297	1,160	112%	1,305	99%
45 to 49	35,667	1,359	1,427	95%	1,338	102%
50 to 54	27,288	1,132	1,092	104%	1,023	111%
55 to 59	24,473	1,037	979	106%	918	113%
Total	157,424	7,940	7,553	105%	7,642	104%

Section 4: Termination Rates

Termination - After 4 Years

Other - Male

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=24	45	6	3	190%	4	167%
25 to 29	959	79	62	128%	77	103%
30 to 34	2,990	183	194	94%	179	102%
35 to 39	4,689	214	234	91%	211	101%
40 to 44	6,677	262	267	98%	267	98%
45 to 49	7,457	264	262	101%	298	89%
50 to 54	5,841	250	204	123%	234	107%
55 to 59	6,134	270	214	126%	245	110%
Total	34,792	1,528	1,441	106%	1,515	101%

Other - Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=24	30	7	3	259%	4	194%
25 to 29	1,266	150	114	132%	152	99%
30 to 34	4,778	338	382	88%	334	101%
35 to 39	9,540	439	572	77%	429	102%
40 to 44	17,049	681	682	100%	682	100%
45 to 49	21,951	720	878	82%	823	87%
50 to 54	19,549	710	782	91%	733	97%
55 to 59	15,879	652	635	103%	595	109%
Total	90,042	3,697	4,048	91%	3,753	99%

Law Enforcement Officers - Male & Female

Age	Exposed	Actual	Expected	Actual to Expected Ratio	Proposed	Actual to Proposed Ratio
<=24	0	0	0	N/A	0	N/A
25 to 29	487	20	19	105%	19	105%
30 to 34	1,910	68	66	103%	67	101%
35 to 39	2,944	88	88	100%	88	100%
40 to 44	3,670	79	110	72%	110	72%
45 to 49	2,981	177	89	199%	119	149%
50 to 54	199	16	6	267%	8	200%
Total	12,191	448	378	119%	411	109%

Section 5: Disability Rates

Disability rates measure the probability that a member will become disabled and receive a disability retirement benefit. The Retirement System currently uses disability rates that vary by age, gender, employee group (i.e., classroom teachers, general employees including other education employees, law enforcement officers) and grandfathered status (i.e., eligible for disability retirement and not eligible for disability retirement). The current grandfathered group and the experience for this group are very small. As the disability retirement benefit has little impact on the liability for active members, we are recommending no change in the disability rates.

Please note that there are no disability rates assumed for active members who would be eligible for benefits from the Disability Income Plan (the DIP). If an active member becomes disabled and receives a benefit from the DIP, retirement rates and termination rates are no longer applied to this member until the member is eligible for a retirement benefit. The mortality tables used for members receiving DIP payments are based on the disabled mortality rates.

Section 6: Individual Salary Increase Rates

Individual salary increase rates reflect the increases in a member's salary that are not related to across-the-board type increases (i.e., inflation and productivity). The salary increase rates include elements of salary increase due to promotions and longevity (collectively referred to as "merit increases"). The analysis for these rates is based on analyzing actual versus expected merit increases (i.e., removing the effects of inflation and productivity) for the five-year period of this investigation. Using this comparison, all salaries reflect recent experience such that prior inflation and productivity increases are consistent and can be ignored. We are recommending that the Board adopt a set of salary increase rates that reflect the experience of the Retirement System and the expectations for future increases. As was the case for separations from active service, other education employees have been studied separately.

Teachers

Service	Average Prior Year Salaries (in 000s)	Average Actual Merit-Only Salaries (in 000s)	Actual Underlying Merit Increase	Average Expected Merit-Only Salaries (in 000s)	Expected Merit Increase	Actual to Expected Ratio	Average Proposed Merit-Only Salaries (in 000s)	Proposed Merit Increase	Actual to Proposed Ratio
1 to 5	36,774	37,246	1.28%	38,081	3.55%	97.8%	37,923	3.12%	98.2%
6 to 10	41,312	41,547	0.57%	42,379	2.58%	98.0%	42,129	1.98%	98.6%
11 to 15	44,961	44,829	-0.29%	45,918	2.13%	97.6%	45,487	1.17%	98.6%
16 to 20	49,587	49,365	-0.45%	50,519	1.88%	97.7%	49,802	0.43%	99.1%
21 to 25	54,333	53,962	-0.68%	55,317	1.81%	97.5%	54,339	0.01%	99.3%
26 to 30	60,807	60,330	-0.78%	61,908	1.81%	97.5%	60,807	0.00%	99.2%
31+	70,163	69,382	-1.11%	71,367	1.72%	97.2%	70,163	0.00%	98.9%

General Employees

Service	Average Prior Year Salaries (in 000s)	Average Actual Merit-Only Salaries (in 000s)	Actual Underlying Merit Increase	Average Expected Merit-Only Salaries (in 000s)	Expected Merit Increase	Actual to Expected Ratio	Average Proposed Merit-Only Salaries (in 000s)	Proposed Merit Increase	Actual to Proposed Ratio
1 to 5	40,097	40,318	0.55%	40,927	2.07%	98.5%	40,660	1.40%	99.2%
6 to 10	43,022	43,062	0.09%	43,909	2.06%	98.1%	43,330	0.71%	99.4%
11 to 15	46,447	46,226	-0.48%	47,319	1.88%	97.7%	46,545	0.21%	99.3%
16 to 20	50,020	49,748	-0.54%	50,926	1.81%	97.7%	50,020	0.00%	99.5%
21 to 25	53,518	53,191	-0.61%	54,487	1.81%	97.6%	53,518	0.00%	99.4%
26 to 30	57,993	57,518	-0.82%	59,043	1.81%	97.4%	57,993	0.00%	99.2%
31+	63,772	63,224	-0.86%	64,873	1.73%	97.5%	63,772	0.00%	99.1%

Other Education

Service	Average Prior Year Salaries (in 000s)	Average Actual Merit-Only Salaries (in 000s)	Actual Underlying Merit Increase	Average Expected Merit-Only Salaries (in 000s)	Expected Merit Increase	Actual to Expected Ratio	Average Proposed Merit-Only Salaries (in 000s)	Proposed Merit Increase	Actual to Proposed Ratio
1 to 5	29,729	29,968	0.80%	30,345	2.07%	98.8%	30,633	3.04%	97.8%
6 to 10	34,465	34,631	0.48%	35,175	2.06%	98.5%	35,259	2.30%	98.2%
11 to 15	40,930	40,924	-0.01%	41,698	1.88%	98.1%	41,570	1.56%	98.4%
16 to 20	48,843	48,732	-0.23%	49,728	1.81%	98.0%	49,244	0.82%	99.0%
21 to 25	55,371	55,185	-0.34%	56,374	1.81%	97.9%	55,489	0.21%	99.5%
26 to 30	67,304	67,215	-0.13%	68,523	1.81%	98.1%	67,304	0.00%	99.9%
31+	81,942	81,510	-0.53%	83,226	1.57%	97.9%	81,942	0.00%	99.5%

Law Enforcement Officers

Service	Average Prior Year Salaries (in 000s)	Average Actual Merit-Only Salaries (in 000s)	Actual Underlying Merit Increase	Average Expected Merit-Only Salaries (in 000s)	Expected Merit Increase	Actual to Expected Ratio	Average Proposed Merit-Only Salaries (in 000s)	Proposed Merit Increase	Actual to Proposed Ratio
1 to 5	42,816	43,351	1.25%	44,749	4.51%	96.9%	44,256	3.36%	98.0%
6 to 10	52,003	52,436	0.83%	53,339	2.57%	98.3%	52,774	1.48%	99.4%
11 to 15	57,802	57,803	0.00%	58,761	1.66%	98.4%	58,150	0.60%	99.4%
16 to 20	62,213	62,014	-0.32%	63,046	1.34%	98.4%	62,396	0.29%	99.4%
21 to 25	67,384	66,798	-0.87%	67,992	0.90%	98.2%	67,391	0.01%	99.1%
26 to 30	66,951	67,017	0.10%	67,470	0.78%	99.3%	66,951	0.00%	100.1%
31+	83,404	84,102	0.84%	83,883	0.57%	100.3%	83,404	0.00%	100.8%

Section 7: Leave Conversions

Under the Retirement System, unused vacation leave may increase a member's average final compensation (AFC) or a member's creditable service and unused sick leave may increase a member's creditable service. The following table shows the increases in AFC and creditable service for recently retired members, based on data provided by the Retirement Systems Division.

Based on this information, we are recommending that the Board adopt the following assumptions for leave conversions of members expected to retire with unreduced benefits. Please note that the creditable service is split between the creditable service used to determine eligibility for benefits and the eligibility used to determine the benefit. This distinction is made to comply with the requirements for actuarial valuation software where eligibility for retirement and other benefits are based on ages and services that are integers.

Increase in AFC	Actual	Expected	Actual ÷ Expected	Proposed	Actual ÷ Proposed
Classroom Teachers	1.91	2.25	85%	2.00	95%
General Employees	2.65	2.25	118%	2.50	106%
Law Enforcement	1.71	1.50	114%	1.75	98%
Other Education	1.67	3.50	48%	1.75	96%

Increase in Creditable Service (Years)	Actual	Expected	Actual ÷ Expected	Proposed Credited	Actual ÷ Proposed	Proposed Eligibility
Classroom Teachers						
Male	1.09	1.25	87%	1.10	99%	1.00
Female	0.82	1.00	82%	0.85	97%	1.00
General Employees						
Male	1.04	0.90	116%	1.00	104%	1.00
Female	0.73	0.65	112%	0.70	104%	1.00
Law Enforcement						
Combined	1.55	1.50	103%	1.50	103%	1.00
Other Education						
Male	1.33	1.25	106%	1.30	102%	1.00
Female	0.98	1.00	98%	1.00	98%	1.00

Section 8: Other Assumptions

We are recommending no changes in the administrative expense or marriage assumptions. As complete data is not available for inactive members, the liability for inactive members is based on a percentage of their accumulated contributions. The current percentage is 200%. We recommend no change to this assumption as it already includes a margin of conservatism.

Section 9: Summary and Cost of Changes

As a result of the experience investigation, we are recommending revised rates of withdrawal, mortality, retirement and salary increase for active members, and revised rates of mortality for retired members and survivors of deceased members. In addition, we are recommending revised rates of projected mortality improvements to apply to all base retirement rates. Finally, we are recommending revised assumptions for leave conversions.

Based on the results of the December 31, 2014 valuation and these proposed assumptions, the accrued liability of the Retirement System would increase from $67,715,066,544 to $69,736,837,397 and the required contribution would increase from 8.47% of payroll to 9.64% of payroll if such proposed assumptions were reflected in the December 31, 2014 valuation. However, it is our understanding that such assumptions, if adopted, would be applied to the December 31, 2015 valuation.

If the Board of Trustees approves these recommendations, the attached set of resolutions may be used. In the actuary's judgment, the rates recommended are suitable for use until further experience indicates that modifications are desirable.

Note: The cost impacts listed above only apply to demographic-type assumptions. Economic assumptions including investment return, real rate of return, general and wage inflation and real wage growth are not included in this report. Additionally, funding methods such as asset valuation method, actuarial cost method and amortization method are not included in this report. These economic assumptions and funding methodologies are not required by Section 6(n) of Chapter 135 of the General Statues.

Appendix A: Statement of Actuarial Assumptions and Methods

INTEREST RATE: 7.25% per annum.

INFLATION: 3.00% per annum.

REAL WAGE GROWTH: 0.50% per annum.

ADMINISTRATIVE EXPENSES: 0.75% of normal cost.

MARRIAGE ASSUMPTION: 100% married with the male spouses four years older than female spouses.

REPORTED COMPENSATION: Calendar year compensation as furnished by the system's office.

VALUATION COMPENSATION: Reported compensation adjusted to reflect the assumed rate of pay as of the valuation date.

ACTUARIAL COST METHOD: Entry age normal cost method. Entry age is established on an individual basis.

ASSET VALUATION METHOD: Actuarial value. The actuarial value of assets recognizes a portion of the difference between the market value of assets and the expected actuarial value of assets, based on the assumed valuation rate of return. The amount recognized each year is 20% of the difference between market value and expected actuarial value. The actuarial value of assets is not allowed to be greater than 120% of the market value of assets or less than 80% of the market value of assets.

TIMING OF ASSUMPTIONS: All withdrawals, deaths, disabilities, retirements and salary increases are assumed to occur July 1 of each year.

LEAVE CONVERSIONS:

	Classroom Teachers		General		Law Enforcement		Other Education	
	Males	Females	Males	Females	Males	Females	Males	Females
Increase in AFC								
	2.00%	2.00%	2.50%	2.50%	1.75%	1.75%	1.75%	1.75%
Increase in Creditable Service (years)								
Credited	1.10	0.85	1.00	0.70	1.50	1.50	1.30	1.00
Eligibility	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

DEATHS AFTER RETIREMENT (NON-DISABLED): According to the RP-2014 Mortality tables for retirees. For classroom teachers and other education employees, these tables are adjusted to white collar and for males multiplied by 92% for ages under 78 and by 120% for ages 78 and over and for females multiplied by 78% for ages under 78 and by 108% for ages 78 and over. For male general employees, these tables are multiplied by 108% for ages under 78 and by 124% for ages 78 and over and for female general employees multiplied by 81% for ages under 78 and by 113% for ages 78 and over. The tables are unadjusted for law enforcement officers. For survivors of deceased members, these tables are multiplied by 123% for both males and females. The applicable active employee rates of RP-2014 are used for ages less than 50.

Appendix A: Statement of Actuarial Assumptions and Methods

DEATH AFTER DISABILITY: According to the RP-2014 Mortality tables for disabled annuitants multiplied by 103% for males and by 99% for females.

DEATHS PRIOR TO RETIREMENT: According to the RP-2014 Mortality tables for active employees. Classroom teachers and other education employees are adjusted to white collar.

MORTALITY PROJECTION (NON-DISABLED): All mortality rates are projected from 2014 using Scale MP-2014.

LIABILITY FOR INACTIVE MEMBERS: The data provided for inactive members does not contain all the elements to calculate the member's deferred benefit. The liability for these members is estimated to be 200% of the member's accumulated contributions.

Appendix A: Statement of Actuarial Assumptions and Methods

TSERS Retirement Rates

Teachers - Male

	Service										
Age	<=3	4	5	6 to 19	20 to 23	24	25	26 to 28	29	30	>=31
<=48	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.300	0.300	0.300
50	0.000	0.000	0.000	0.000	0.025	0.025	0.065	0.065	0.300	0.300	0.300
51	0.000	0.000	0.000	0.000	0.025	0.025	0.065	0.065	0.300	0.300	0.300
52	0.000	0.000	0.000	0.000	0.025	0.025	0.065	0.065	0.325	0.325	0.250
53	0.000	0.000	0.000	0.000	0.025	0.025	0.065	0.065	0.325	0.325	0.250
54	0.000	0.000	0.000	0.000	0.025	0.025	0.065	0.065	0.325	0.325	0.250
55	0.000	0.000	0.000	0.000	0.045	0.045	0.090	0.090	0.325	0.325	0.250
56	0.000	0.000	0.000	0.000	0.045	0.045	0.090	0.090	0.325	0.325	0.250
57	0.000	0.000	0.000	0.000	0.045	0.045	0.090	0.090	0.325	0.325	0.250
58	0.000	0.000	0.000	0.000	0.045	0.045	0.090	0.090	0.325	0.325	0.250
59	0.000	0.000	0.000	0.000	0.045	0.045	0.090	0.090	0.350	0.300	0.250
60	0.000	0.000	0.120	0.120	0.120	0.300	0.300	0.300	0.400	0.250	0.250
61	0.000	0.000	0.140	0.140	0.140	0.250	0.250	0.250	0.250	0.250	0.250
62	0.000	0.000	0.225	0.225	0.225	0.400	0.350	0.350	0.350	0.350	0.350
63	0.000	0.000	0.180	0.180	0.180	0.500	0.250	0.250	0.250	0.250	0.250
64	0.000	0.000	0.210	0.210	0.210	0.400	0.250	0.150	0.150	0.150	0.150
65	0.000	0.300	0.300	0.325	0.325	0.325	0.200	0.200	0.200	0.200	0.200
66	0.000	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275
67	0.000	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
68	0.000	0.225	0.250	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225
69 to 74	0.000	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225
>=75	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A: Statement of Actuarial Assumptions and Methods

TSERS Retirement Rates

Teachers - Female

	Service										
Age	<=3	4	5	6 to 19	20 to 23	24	25	26 to 28	29	30	>=31
<=48	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.275	0.275	0.275
50	0.000	0.000	0.000	0.000	0.035	0.035	0.055	0.055	0.275	0.275	0.275
51	0.000	0.000	0.000	0.000	0.035	0.035	0.055	0.055	0.275	0.275	0.275
52	0.000	0.000	0.000	0.000	0.035	0.035	0.055	0.055	0.325	0.400	0.250
53	0.000	0.000	0.000	0.000	0.035	0.035	0.055	0.055	0.325	0.350	0.250
54	0.000	0.000	0.000	0.000	0.035	0.035	0.055	0.055	0.325	0.400	0.300
55	0.000	0.000	0.000	0.000	0.060	0.060	0.095	0.095	0.325	0.400	0.300
56	0.000	0.000	0.000	0.000	0.060	0.060	0.095	0.095	0.325	0.400	0.275
57	0.000	0.000	0.000	0.000	0.060	0.060	0.095	0.095	0.325	0.450	0.300
58	0.000	0.000	0.000	0.000	0.060	0.060	0.095	0.095	0.325	0.450	0.325
59	0.000	0.000	0.000	0.000	0.060	0.060	0.095	0.095	0.450	0.375	0.300
60	0.000	0.000	0.135	0.135	0.135	0.300	0.450	0.450	0.450	0.500	0.325
61	0.000	0.000	0.150	0.150	0.150	0.300	0.400	0.350	0.350	0.350	0.350
62	0.000	0.000	0.250	0.250	0.250	0.500	0.500	0.425	0.425	0.425	0.425
63	0.000	0.000	0.190	0.190	0.190	0.500	0.500	0.325	0.325	0.325	0.325
64	0.000	0.000	0.225	0.225	0.225	0.500	0.500	0.325	0.325	0.325	0.325
65	0.000	0.150	0.350	0.375	0.375	0.375	0.350	0.350	0.350	0.350	0.350
66	0.000	0.150	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375
67	0.000	0.150	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
68	0.000	0.150	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275
69	0.000	0.150	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
70 to 74	0.000	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
>=75	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A: Statement of Actuarial Assumptions and Methods

TSERS Retirement Rates

General - Male

	Service										
Age	<=3	4	5	6 to 19	20 to 23	24	25	26 to 28	29	30	>=31
<=48	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.325	0.350	0.200
50	0.000	0.000	0.000	0.000	0.035	0.035	0.080	0.080	0.350	0.350	0.200
51	0.000	0.000	0.000	0.000	0.035	0.035	0.080	0.080	0.350	0.350	0.200
52	0.000	0.000	0.000	0.000	0.035	0.035	0.080	0.080	0.250	0.250	0.200
53	0.000	0.000	0.000	0.000	0.035	0.035	0.080	0.080	0.250	0.300	0.200
54	0.000	0.000	0.000	0.000	0.035	0.035	0.080	0.080	0.300	0.300	0.150
55	0.000	0.000	0.000	0.000	0.050	0.050	0.100	0.100	0.325	0.350	0.200
56	0.000	0.000	0.000	0.000	0.050	0.050	0.100	0.100	0.300	0.275	0.175
57	0.000	0.000	0.000	0.000	0.050	0.050	0.100	0.100	0.225	0.275	0.200
58	0.000	0.000	0.000	0.000	0.050	0.050	0.100	0.100	0.275	0.275	0.200
59	0.000	0.000	0.000	0.000	0.050	0.050	0.100	0.100	0.275	0.275	0.200
60	0.000	0.000	0.085	0.085	0.085	0.225	0.275	0.275	0.350	0.300	0.225
61	0.000	0.000	0.135	0.135	0.135	0.250	0.300	0.275	0.275	0.275	0.275
62	0.000	0.000	0.260	0.260	0.260	0.350	0.350	0.350	0.350	0.350	0.350
63	0.000	0.000	0.195	0.195	0.195	0.275	0.275	0.275	0.275	0.275	0.275
64	0.000	0.000	0.195	0.195	0.195	0.200	0.200	0.275	0.275	0.275	0.275
65	0.000	0.200	0.250	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275
66	0.000	0.175	0.325	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
67	0.000	0.175	0.325	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
68	0.000	0.175	0.325	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
69 to 74	0.000	0.175	0.325	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225
>=75	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A: Statement of Actuarial Assumptions and Methods

TSERS Retirement Rates

General - Female

	Service										
Age	<=3	4	5	6 to 19	20 to 23	24	25	26 to 28	29	30	>=31
<=48	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.275	0.350	0.300
50	0.000	0.000	0.000	0.000	0.035	0.035	0.060	0.060	0.275	0.400	0.300
51	0.000	0.000	0.000	0.000	0.035	0.035	0.060	0.060	0.275	0.300	0.225
52	0.000	0.000	0.000	0.000	0.035	0.035	0.060	0.060	0.250	0.275	0.225
53	0.000	0.000	0.000	0.000	0.035	0.035	0.060	0.060	0.250	0.275	0.225
54	0.000	0.000	0.000	0.000	0.035	0.035	0.060	0.060	0.250	0.275	0.225
55 to 59	0.000	0.000	0.000	0.000	0.050	0.050	0.080	0.080	0.300	0.325	0.225
60	0.000	0.000	0.095	0.095	0.095	0.250	0.250	0.325	0.450	0.300	0.200
61	0.000	0.000	0.120	0.120	0.120	0.275	0.275	0.250	0.250	0.250	0.250
62	0.000	0.000	0.215	0.215	0.215	0.425	0.425	0.400	0.400	0.400	0.400
63	0.000	0.000	0.180	0.180	0.180	0.275	0.375	0.275	0.275	0.275	0.275
64	0.000	0.000	0.195	0.195	0.195	0.325	0.325	0.250	0.250	0.250	0.250
65	0.000	0.150	0.400	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
66	0.000	0.150	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275
67	0.000	0.150	0.400	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225
68	0.000	0.150	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
69	0.000	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
70 to 74	0.000	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
>=75	0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A: Statement of Actuarial Assumptions and Methods

TSERS Retirement Rates

Other - Male

	Service									
Age	<=3	4	5	6 to 19	20 to 23	24	25 to 28	29	30	>=31
<=48	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.300	0.300	0.150
50	0.000	0.000	0.000	0.000	0.035	0.035	0.080	0.300	0.300	0.150
51	0.000	0.000	0.000	0.000	0.035	0.035	0.080	0.300	0.300	0.150
52	0.000	0.000	0.000	0.000	0.035	0.035	0.080	0.250	0.250	0.175
53	0.000	0.000	0.000	0.000	0.035	0.035	0.080	0.250	0.250	0.200
54	0.000	0.000	0.000	0.000	0.035	0.035	0.080	0.150	0.250	0.200
55	0.000	0.000	0.000	0.000	0.040	0.040	0.100	0.250	0.250	0.200
56	0.000	0.000	0.000	0.000	0.040	0.040	0.100	0.250	0.250	0.150
57	0.000	0.000	0.000	0.000	0.040	0.040	0.100	0.250	0.250	0.200
58	0.000	0.000	0.000	0.000	0.040	0.040	0.100	0.250	0.250	0.250
59	0.000	0.000	0.000	0.000	0.040	0.040	0.100	0.250	0.250	0.200
60	0.000	0.000	0.090	0.090	0.090	0.225	0.225	0.250	0.250	0.250
61	0.000	0.000	0.125	0.125	0.125	0.225	0.225	0.225	0.225	0.225
62	0.000	0.000	0.280	0.280	0.280	0.400	0.400	0.400	0.400	0.400
63	0.000	0.000	0.220	0.220	0.220	0.300	0.300	0.300	0.300	0.300
64	0.000	0.000	0.190	0.190	0.190	0.300	0.300	0.300	0.300	0.300
65	0.000	0.150	0.275	0.300	0.300	0.300	0.275	0.275	0.275	0.275
66	0.000	0.150	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
67	0.000	0.150	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175
68	0.000	0.150	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
69	0.000	0.150	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225
70 to 74	0.000	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225
>=75	0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A: Statement of Actuarial Assumptions and Methods

TSERS Retirement Rates

Other - Female

	Service										
Age	<=3	4	5	6 to 19	20 to 23	24	25	26 to 28	29	30	>=31
<=48	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.175	0.325	0.225
50	0.000	0.000	0.000	0.000	0.040	0.040	0.055	0.055	0.175	0.325	0.225
51	0.000	0.000	0.000	0.000	0.040	0.040	0.055	0.055	0.175	0.325	0.225
52	0.000	0.000	0.000	0.000	0.040	0.040	0.055	0.055	0.225	0.225	0.225
53	0.000	0.000	0.000	0.000	0.040	0.040	0.055	0.055	0.150	0.300	0.225
54	0.000	0.000	0.000	0.000	0.040	0.040	0.055	0.055	0.225	0.225	0.225
55	0.000	0.000	0.000	0.000	0.050	0.050	0.090	0.090	0.225	0.225	0.225
56 to 59	0.000	0.000	0.000	0.000	0.050	0.050	0.090	0.090	0.250	0.250	0.250
60	0.000	0.000	0.110	0.110	0.110	0.200	0.250	0.275	0.250	0.250	0.250
61	0.000	0.000	0.150	0.150	0.150	0.275	0.275	0.275	0.275	0.275	0.275
62	0.000	0.000	0.270	0.270	0.270	0.375	0.400	0.400	0.400	0.400	0.400
63	0.000	0.000	0.175	0.175	0.175	0.375	0.400	0.300	0.300	0.300	0.300
64	0.000	0.000	0.195	0.195	0.195	0.375	0.400	0.300	0.300	0.300	0.300
65	0.000	0.150	0.250	0.275	0.275	0.275	0.350	0.350	0.350	0.350	0.350
66	0.000	0.150	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275
67	0.000	0.150	0.200	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225
68	0.000	0.150	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
69	0.000	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
70 to 74	0.000	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
>=75	0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A: Statement of Actuarial Assumptions and Methods

TSERS Retirement Rates

Law Enforcement - Male and Female

	Service					
Age	<=3	4	5 to 14	15 to 28	29	>=30
<=48	0.000	0.000	0.000	0.000	0.000	0.000
49	0.000	0.000	0.000	0.000	0.750	0.600
50 to 54	0.000	0.000	0.000	0.090	0.750	0.600
55	0.000	0.500	0.500	0.500	0.750	0.500
56 to 59	0.000	0.150	0.175	0.175	0.750	0.500
60 to 64	0.000	0.200	0.200	0.200	0.750	0.500
65	0.000	0.250	0.250	0.250	0.250	0.250
66 to 74	0.000	0.300	0.300	0.300	0.300	0.300
>=75	0.000	1.000	1.000	1.000	1.000	1.000

Appendix A: Statement of Actuarial Assumptions and Methods

TSERS Termination Rates

Teachers - Male

	Service					
Age	0	1	2	3	4	>=5
<=24	0.190	0.160	0.140	0.120	0.095	0.080
25 to 29	0.190	0.160	0.140	0.120	0.095	0.080
30 to 34	0.190	0.160	0.140	0.120	0.095	0.070
35 to 39	0.190	0.160	0.140	0.120	0.095	0.045
40 to 44	0.190	0.160	0.140	0.120	0.095	0.035
45 to 49	0.190	0.160	0.140	0.120	0.095	0.0325
>=50	0.190	0.160	0.140	0.120	0.095	0.0325

Teachers - Female

	Service					
Age	0	1	2	3	4	>=5
<=24	0.170	0.145	0.135	0.120	0.100	0.090
25 to 29	0.170	0.145	0.135	0.120	0.100	0.090
30 to 34	0.170	0.145	0.135	0.120	0.100	0.075
35 to 39	0.170	0.145	0.135	0.120	0.100	0.045
40 to 44	0.170	0.145	0.135	0.120	0.100	0.034
45 to 49	0.170	0.145	0.135	0.120	0.100	0.0325
>=50	0.170	0.145	0.135	0.120	0.100	0.0325

General - Male

	Service					
Age	0	1	2	3	4	>=5
<=24	0.180	0.155	0.130	0.110	0.090	0.080
25 to 29	0.180	0.155	0.130	0.110	0.090	0.080
30 to 34	0.180	0.155	0.130	0.110	0.090	0.070
35 to 39	0.180	0.155	0.130	0.110	0.090	0.0525
40 to 44	0.180	0.155	0.130	0.110	0.090	0.040
45 to 49	0.180	0.155	0.130	0.110	0.090	0.035
>=50	0.180	0.155	0.130	0.110	0.090	0.035

General - Female

	Service					
Age	0	1	2	3	4	>=5
<=24	0.195	0.170	0.145	0.115	0.100	0.110
25 to 29	0.195	0.170	0.145	0.115	0.100	0.110
30 to 34	0.195	0.170	0.145	0.115	0.100	0.085
35 to 39	0.195	0.170	0.145	0.115	0.100	0.060
40 to 44	0.195	0.170	0.145	0.115	0.100	0.045
45 to 49	0.195	0.170	0.145	0.115	0.100	0.0375
>=50	0.195	0.170	0.145	0.115	0.100	0.0375

Appendix A: Statement of Actuarial Assumptions and Methods

TSERS Termination Rates

Other - Male

	Service					
Age	0	1	2	3	4	>=5
<=24	0.190	0.160	0.130	0.115	0.100	0.080
25 to 29	0.190	0.160	0.130	0.115	0.100	0.080
30 to 34	0.190	0.160	0.130	0.115	0.100	0.060
35 to 39	0.190	0.160	0.130	0.115	0.100	0.045
40 to 44	0.190	0.160	0.130	0.115	0.100	0.040
45 to 49	0.190	0.160	0.130	0.115	0.100	0.040
>=50	0.190	0.160	0.130	0.115	0.100	0.040

Other - Female

	Service					
Age	0	1	2	3	4	>=5
<=24	0.165	0.135	0.120	0.100	0.085	0.120
25 to 29	0.165	0.135	0.120	0.100	0.085	0.120
30 to 34	0.165	0.135	0.120	0.100	0.085	0.070
35 to 39	0.165	0.135	0.120	0.100	0.085	0.045
40 to 44	0.165	0.135	0.120	0.100	0.085	0.040
45 to 49	0.165	0.135	0.120	0.100	0.085	0.0375
>=50	0.165	0.135	0.120	0.100	0.085	0.0375

Law Enforcement - Male and Female

	Service					
Age	0	1	2	3	4	>=5
<=24	0.130	0.100	0.090	0.060	0.060	0.040
25 to 29	0.130	0.100	0.090	0.060	0.060	0.040
30 to 34	0.130	0.100	0.090	0.060	0.060	0.035
35 to 39	0.130	0.100	0.090	0.060	0.060	0.030
40 to 44	0.130	0.100	0.090	0.060	0.060	0.030
45 to 49	0.130	0.100	0.090	0.060	0.060	0.040
>=50	0.130	0.100	0.090	0.060	0.060	0.040

Appendix A: Statement of Actuarial Assumptions and Methods

TSERS Salary Merit Scales

Service	Teachers	General	Other	Law Enforcement
0	0.0405	0.0200	0.0350	0.0460
1	0.0375	0.0180	0.0335	0.0420
2	0.0345	0.0160	0.0320	0.0380
3	0.0315	0.0140	0.0305	0.0340
4	0.0285	0.0120	0.0290	0.0300
5	0.0255	0.0100	0.0275	0.0260
6	0.0235	0.0090	0.0260	0.0220
7	0.0215	0.0080	0.0245	0.0180
8	0.0195	0.0070	0.0230	0.0140
9	0.0175	0.0060	0.0215	0.0100
10	0.0160	0.0050	0.0200	0.0090
11	0.0145	0.0040	0.0185	0.0080
12	0.0130	0.0030	0.0170	0.0070
13	0.0115	0.0020	0.0155	0.0060
14	0.0100	0.0010	0.0140	0.0050
15	0.0085	0.0000	0.0125	0.0045
16	0.0070	0.0000	0.0110	0.0040
17	0.0055	0.0000	0.0095	0.0035
18	0.0040	0.0000	0.0080	0.0030
19	0.0025	0.0000	0.0065	0.0025
20	0.0015	0.0000	0.0050	0.0015
21	0.0005	0.0000	0.0040	0.0005
22	0.0000	0.0000	0.0030	0.0000
23	0.0000	0.0000	0.0020	0.0000
24	0.0000	0.0000	0.0010	0.0000
>=25	0.0000	0.0000	0.0000	0.0000

Appendix B: Resolution to the Board

ADOPTION OF TABLES HEREIN PRESENTED

In order that the tables herein presented may have the official approval of the Board of Trustees, the following resolutions are recommended for adoption.

WHEREAS, The investigation of the mortality, service and compensation experience of the members of the Teachers' and State Employees' Retirement System of North Carolina that was prepared as of December 31, 2014 indicated that the active service tables and mortality tables previously adopted by the Board of Trustees require modification in order that they may reflect more closely the actual past experience of the membership, and

WHEREAS, The actuary has prepared new tables of rates which he recommends for adoption, therefore, be it

RESOLVED, That the Board of Trustees, acting in accordance with Section 6(n) of Chapter 135 of the North Carolina General Statutes and upon the recommendation of the actuary, hereby discontinues the use in calculating the State's rates of contribution and in valuing the liabilities of the System of the active service tables and mortality tables previously used and approves for use instead the attached tables, and be it further

RESOLVED, That the use of the new tables in the valuation as of December 31, 2015 and in all actuarial valuations thereafter, is hereby approved. The Board of Trustees of the Teachers' and State Employees' Retirement System of North Carolina approved the preceding resolution at a meeting held on October 22, 2015.

BOARD OF TRUSTEES,
TEACHERS' AND STATE EMPLOYEES'
RETIREMENT SYSTEM OF NORTH CAROLINA

By .....
Secretary

Attest: