



Cavanaugh Macdonald
CONSULTING, LLC

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City of Chattanooga General Pension Plan

**Experience Investigation for the Five-Year
Period Ending December 31, 2017**





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The experience and dedication you deserve

February 21, 2019

General Pension Board of Trustees
City of Chattanooga
101 East 11th Street, Suite 201, City Hall
Chattanooga, TN 37402

Members of the Board:

We are pleased to submit the results of an investigation of the economic and demographic experience for the City of Chattanooga General Pension Plan (the Plan) for the five-year period from January 1, 2013 to December 31, 2017. The study was based on the data submitted by the Plan for the annual valuation. In preparing this report, we relied, without audit, on the data provided.

The purpose of the investigation was to assess the reasonability of the economic and demographic actuarial assumptions for the Plan. As a result of the investigation, it is recommended that revised economic and demographic assumptions be adopted by the Board for future use.

The investigation of the demographic experience of members of the Plan includes all active and retired members and beneficiaries of deceased members. The results of the investigation indicate that the assumed rates of separation from active service due to withdrawal, disability, retirement, and mortality as well as rates of salary increase should be changed to more accurately reflect the actual and anticipated experience of the Plan.

This report shows a comparison of the actual and expected cases of separation from active service, actual and expected number of deaths, and actual and expected salary increases. These tables are shown based on current assumed expected rates and based on new proposed expected rates. A comparison between the rates of separation and mortality presently in use and the recommended revised rates are also shown in this report.



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All proposed rates of separation, mortality and salary increase at each age are shown in the attached table in Appendix C of this report. Use of the new assumptions, when adopted by the Board, will commence with the January 1, 2019 valuation and are suitable for use until further experience indicates that modifications are desirable.

We hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board (ASB) and the Code of Professional Conduct and Qualification Standards for Public Statements of Actuarial Opinion of the American Academy of Actuaries.

We further certify that, in our opinion, the assumptions developed in this report satisfy Actuarial Standards of Practice, in particular, No. 27 (Selection of Economic Assumptions for Measuring Pension Obligations) and No. 35 (Selection of Demographic and Other Non-economic Assumptions for Measuring Pension Obligations).

The experience investigation was performed by, and under the supervision of, independent actuaries who are members of the American Academy of Actuaries with experience in performing valuations for public retirement Plans. The undersigned meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,

A handwritten signature in blue ink that reads 'Edward J. Koebel'.

Edward J. Koebel, EA, FCA, MAAA
Principal and Consulting Actuary

A handwritten signature in blue ink that reads 'Jennifer Johnson'.

Jennifer Johnson
Senior Consultant

EJK/jj



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Section I - Executive Summary

The purpose of an actuarial valuation is to provide a timely best estimate of the ultimate costs of a retirement Plan. An actuarial valuation for the City of Chattanooga General Pension Plan (Plan) is prepared annually to determine the actuarial contribution rate required to fund the Plan on an actuarial reserve basis, (i.e. the current assets plus future contributions, along with investment earnings will be sufficient to provide the benefits promised by the Plan). The valuation requires the use of certain assumptions with respect to the occurrence of future events, such as rates of death, termination of employment, retirement age, and salary changes to estimate the obligations of the Plan.

The basic purpose of an experience study is to determine whether the actuarial assumptions currently in use have adequately anticipated the actual emerging experience. This information, along with the professional judgment of Plan personnel and advisors, is used to evaluate the appropriateness of continued use of the current actuarial assumptions. When analyzing experience and assumptions, it is important to recognize that actual experience is reported in the short term while assumptions are intended to be long-term estimates of experience. Therefore, actual experience is expected to vary from study period to study period, without necessarily indicating a change in assumptions is needed.

Cavanaugh Macdonald Consulting, LLC (CMC) has performed a study of the experience of the City of Chattanooga General Pension Plan for the five-year period ending December 31, 2017. This report presents the results, analysis, and resulting recommendations of our study. It is anticipated that the changes, if approved, will first be reflected in the January 1, 2019 actuarial valuation.

These assumptions have been developed in accordance with generally recognized and accepted actuarial principles and practices that are consistent with the applicable Actuarial Standards of Practice adopted by the Actuarial Standards Board (ASB). While the recommended assumptions represent our best estimate of future experience, there are other reasonable assumption sets that could be supported by the results of this experience study. Those other sets of reasonable assumptions could produce liabilities and costs that are either higher or lower.



Section I - Executive Summary

Our Philosophy

Similar to an actuarial valuation, the calculation of actual and expected experience is a fairly mechanical process, and differences between actuaries in this area are generally minor. However, the setting of assumptions differs, as it is more art than science. In this report, we have recommended changes to certain assumptions. To explain our thought process, we offer a brief summary of our philosophy:

- **Do Not Overreact:** When we see significant changes in experience, we generally do not adjust our rates to reflect the entire difference. We will typically recommend rates somewhere between the old rates and the new experience. If the experience during the next study period shows the same result, we will probably recognize the trend at that point in time or at least move further in the direction of the observed experience. On the other hand, if experience returns closer to its prior level, we will not have overreacted, possibly causing volatility in the actuarial contribution rates.
- **Anticipate Trends:** If there is an identified trend that is expected to continue, we believe that this should be recognized. An example is the retiree mortality assumption. It is an established trend that people are living longer. Therefore, we believe the best estimate of liabilities in the valuation should reflect the expected increase in life expectancy.
- **Simplify:** In general, we attempt to identify which factors are significant and eliminate or ignore the ones that do not materially improve the accuracy of the liability projections.

The following summarizes the findings and recommendations with regard to the assumptions utilized for the Plan. Detailed explanations for the recommendations are found in the sections that follow.



Section I - Executive Summary

Recommended Economic Assumption Changes

Economic assumptions are some of the most visible and significant assumptions used in the valuation process. The items in the broad economy modeled by these assumptions can be very volatile over short periods of time, as clearly seen in the economic downturn in 2008 followed by the rebound in many financial markets in the years following. Our goal is to try to find the emerging long-term trends in the midst of this volatility so that we can then apply reasonable assumptions.

Most of the economic assumptions used by actuaries are developed through a building-block approach. For example, the expected return on assets is based on the expectation for inflation plus the expected real return on assets. At the core of the economic assumptions is the inflation assumption. Based on recent trends of inflation, the market pricing of inflation, and the Chief Actuary of the Social Security Administration's view of inflation, **we recommend lowering the price inflation assumption from 2.75% to 2.50%.**

In addition, we are also recommending lowering the long-term expected return on assets assumption from 7.00% to 6.75%, in conjunction with the lowering of the price inflation assumption by 0.25%. A real rate of return of 4.25% (difference between 6.75% and 2.50%) is supported by the analysis of the capital market assumptions and a 20-year horizon in the future.

The following table summarizes the current and proposed economic assumptions:

Item	Current	Proposed
Price Inflation	2.75%	2.50%
Investment Return*	7.00%	6.75%

* Net of investment expenses only.

Although we have recommended a change in the set of economic assumptions, we recognize there may be other sets of economic assumptions that are also reasonable for purposes of funding the Plan. For example, we have typically reflected conservatism to the degree we would classify as moderate. Actuarial Standards of Practice allow for this difference in approaches and the Plan perspective as long as the assumptions are reasonable and consistent.



Section I - Executive Summary

Actuarial Methods

The basic actuarial methodologies used in the valuation process include the:

- Actuarial Cost Method
- Asset Valuation Method
- Amortization Method

Based on our review, discussed in full detail in Section II of this report, we recommend a change in the smoothing of asset gains and losses from 10 years to 5 years. There are no recommended changes in the actuarial cost method or amortization method.

Recommended Demographic Assumption Changes

In the experience study, actual experience for the study period is compared to that expected based on the current actuarial assumption. The analysis is most commonly performed based on counts, i.e. each member is one exposure as to the probability of the event occurring and one occurrence if the event actually occurs. Comparing the actual incidence of the event to what was expected (called the Actual-to-Expected ratio, or A/E ratio) then provides the basis for our analysis.

The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying in recent years. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*. This ASOP requires the pension actuary to make and disclose a specific recommendation with respect to future improvements in mortality after the valuation date. There have been significant improvements in longevity in the past, although there are different opinions about future expectations. We believe it is prudent to anticipate that the trend will continue to some degree in the future. Therefore, we believe it is appropriate to reflect some future mortality improvement as part of the mortality assumption.

The current post-retirement healthy mortality assumption for the Plan is the RP-2000 Combined Mortality Table set forward four years for males and set forward two years for females and using a Scale AA projection to 2025. This is a static mortality table selected with the previous experience study to anticipate some margin for improved mortality. The results of the experience analysis indicated that this table anticipated fewer deaths than the actual number of deaths during the period. We note that the Tennessee Consolidated Retirement Plan (TCRS) has recently changed their mortality table to one of the newer RP-2014 family of mortality tables. Since the Plan has a smaller



Section I - Executive Summary

number of deaths when compared to the State in whole and the State's data provides for more credible statistics, **we are recommending that the Plan adopt a static mortality approach similar to the State's mortality table.** More information will be discussed later in the report.

The following is a list of other recommended changes to the demographic assumptions for the Plan.

- **Withdrawal:** We recommend minor adjustments in the rates of withdrawal for service periods less than 2 years of service and increasing the rates of withdrawal for service periods of 2 or more years of service as the actual number of withdrawals over the period was higher than expected.
- **Disability:** Overall, the actual number of disability retirements over the investigative period was lower than expected at most ages. Therefore, we recommend adjusting the rates of disability further to better match the experience of the Plan.
- **Retirement:** Overall, the actual number of retirements was extremely close to what was expected over the period. Therefore, we only recommend minor adjustments in the rates of retirement for a standard retirement and Rule of 80 retirement.
- **Merit Salary Scale:** We recommend decreasing the rates of salary increase at most levels of service.
- **Other Assumptions:**
 - We recommend increasing the assumed administrative expense component that is added to the total normal cost from 0.42% to 0.50% of payroll.

Section III of this report will provide more detail to these recommended changes.



Section I - Executive Summary

Financial Impact

The following tables highlight the impact of the recommended changes on the unfunded actuarial accrued liabilities (UAAL), actuarially determined employer contribution (ADEC) rate as a percentage of payroll, and the funding ratio based on actuarial value of assets for the pension valuation as of December 31, 2017.

Pension Results (\$ in Thousands)

	(A)	(B)	(C)	(D)
	December 31, 2017 Valuation	(A) With changes to Demographic Assumptions	(B) With changes to Actuarial Methods	(C) With changes to Economic Assumptions
UAAL	\$76,117	72,368	71,995	81,312
ADEC	20.50%	20.15%	20.10%	21.69%
Funding Ratio*	78.8%	79.6%	79.7%	77.7%

* The actuarial value of plan assets as a percentage of actuarial accrued liability.



Section II – Economic Assumptions

There are two economic assumptions used in the actuarial valuations performed for Chattanooga. They are:

- Price Inflation
- Investment Return

Note that future price inflation has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return and the rates of salary increases. However, it is not directly used in the valuation process.

Actuarial Standard of Practice (ASOP) No. 27, “*Selection of Economic Assumptions for Measuring Pension Obligations*” provides guidance to actuaries in selecting economic assumptions for measuring obligations under defined benefit plans. ASOP No. 27 was revised in September, 2013 and no longer includes the concept of a “best estimate range”. Instead, the revised standard now requires that each economic assumption selected by the actuary should be reasonable which means it has the following characteristics:

- It is appropriate for the purpose of the measurement;
- It reflects the actuary’s professional judgment;
- It takes into account historical and current economic data that is relevant as of the measurement date;
- It reflects the actuary’s estimate of future experience, the actuary’s observation of the estimates inherent in market data, or a combination thereof; and
- It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed, or when alternative assumptions are used for the assessment of risk.

Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period.

In our opinion, the economic assumptions recommended in this report have been developed in accordance with ASOP No. 27.



Section II – Economic Assumptions

Price Inflation

Background

As can be seen from the table on the previous page, assumed price inflation is used as the basis for both the investment return assumption and the wage inflation assumption. These latter two assumptions will be discussed in detail in the following sections.

It is important that the price inflation assumption be consistently applied throughout the economic assumptions utilized in an actuarial valuation. This is called for in ASOP No. 27 and is also required to meet the parameters for determining pension liabilities and expense under Governmental Accounting Standards Board (GASB) Statements No. 67 and 68.

The long-term relationship between price inflation and investment return has long been recognized by economists. The basic principle is that the investor demands a more or less level “real return” – the excess of actual investment return over price inflation. If inflation rates are expected to be high, investment return rates are also expected to be high, while low inflation rates are expected to result in lower expected investment returns, at least in the long run.

The current price inflation assumption is 2.75% per year.

Past Experience

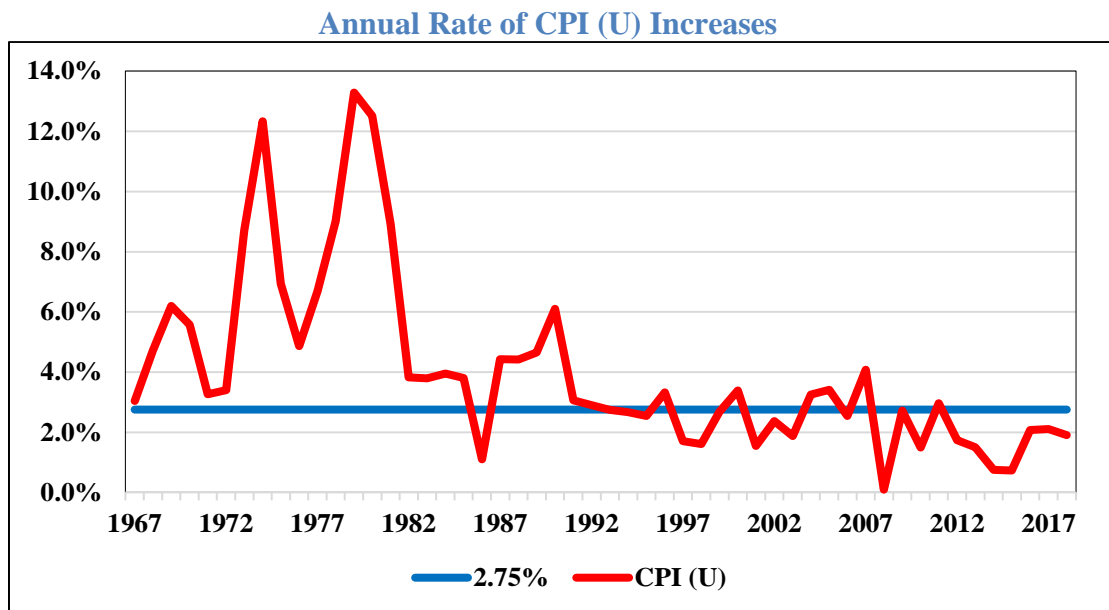
The Consumer Price Index, US City Average, All Urban Consumers, CPI (U), has been used as the basis for reviewing historical levels of price inflation. The table below provides historical annualized rates and annual standard deviation of the CPI-U over periods ending December 31st.

Period	Number of Years	Annualized Rate of Inflation	Annual Standard Deviation
1967 – 2017	50	4.05%	3.00%
1977 – 2017	40	3.51	2.84
1987 – 2017	30	2.56	1.25
1997 – 2017	20	2.14	1.01
2007 – 2017	10	1.61	0.91



Section II – Economic Assumptions

The following graph illustrates the historical levels of price inflation measured as of December 31st of each of the last 50 years and compared to the current 2.75% annual rate currently assumed.



Over the last 30 years, the average annual rate of increase in the CPI-U has been below 3.00%. The period of high inflation from 1973 to 1982 has a significant impact on the averages over periods which include these rates. The volatility of the annual rates in the more recent years has been markedly lower as indicated by the significantly lower annual standard deviations. Many experts attribute the lower average annual rates and lower volatility to the increased efforts of the Federal Reserve since the early 1980's to stabilize price inflation.

Forecasts

Based upon information contained in the “Survey of Professional Forecasters” for the first quarter of 2018 as published by the Philadelphia Federal Reserve Bank, the median expected annual rate of inflation for the next ten years is 2.3%. Although 10 years of future expectation is too short of a period for the basis of our inflation assumption, the information does provide some evidence that the consensus expectations of these experts are for lower rates of inflation for the near term future.



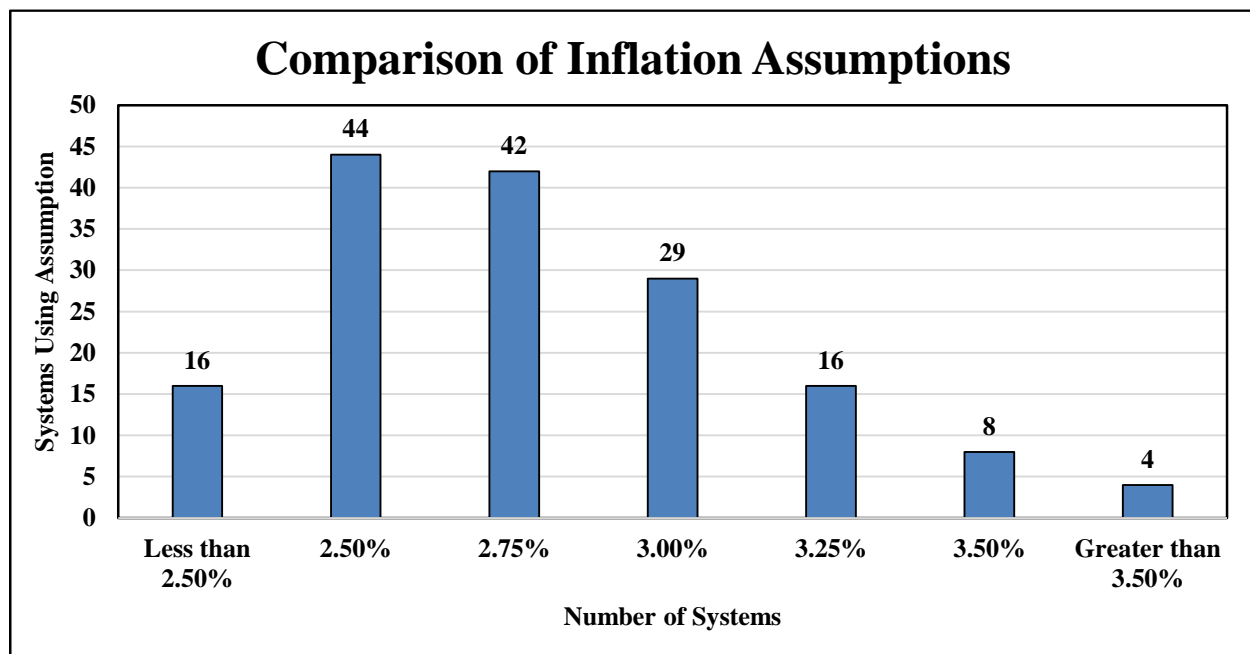
Section II – Economic Assumptions

Social Security Administration

Although many economists forecast lower inflation than the assumption used by most retirement plans, they are generally looking at a shorter time horizon than is appropriate for a pension valuation. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the most recent report (June, 2018), the projected ultimate average annual increase in the CPI over the next 75 years was estimated to be 2.60%, under the intermediate (best estimate) cost assumption. The range of inflation assumptions used in the Social Security 75-year modeling, which includes a low and high cost scenario, in addition to the intermediate cost projection, was 2.00% to 3.20%.

Peer Comparison

While we do not recommend the selection of any assumption based on what other systems use, it does provide another set of relevant information to consider. The following chart shows the inflation rate assumptions of 159 plans in the Public Plan Database of the Center for Retirement Research. The assumptions are from the 2017 actuarial valuation reported to the center.





Section II – Economic Assumptions

Recommendation

It is difficult to predict inflation accurately. Inflation's short-term volatility is illustrated by comparing its average rate over the last 10 and 50 years. Although the 10-year average of 1.1% is lower than the System's assumed rate of 2.75%, the longer 50-year averages of 4.0% is somewhat higher than Chattanooga's current rate. The reasonableness of Chattanooga's assumption is, therefore, dependent upon the emphasis one assigns to the short and long-terms.

Current economic forecasts suggest lower inflation but are generally looking at a shorter time period than appropriate for our purposes. We consider the range included in the Social Security Administration of 2.00% to 3.20% to be reasonable and, therefore, **we recommend the inflation assumption for Chattanooga be lowered from 2.75% to 2.50% at this time.**

Price Inflation Assumption	
Current	2.75%
Recommended	2.50%



Section II – Economic Assumptions

Investment Return

Background

The assumed investment return is one of the most significant assumptions in the annual actuarial valuation process as it is used to discount the expected benefit payments for all active, inactive and retired members. Minor changes in this assumption can have a major impact on valuation results. The investment return assumption should reflect the asset allocation target for the funds set by the Board of Trustees.

The current assumption is 7.00%, consisting of a price inflation assumption of 2.75% and a real rate of return assumption of 4.25%.

Long Term Chattanooga Perspective

Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon in order to make prudent choices regarding how to invest the trust funds. For actuarial calculations, we typically consider very long periods of time. For example, a newly-hired employee who is 25 years old may work for 35 years, to age 60, and live another 30 years, to age 90 (or longer). The retirement system would receive contributions for the first 35 years and then pay out benefits for the next 30 years. During the entire 65-year period, the system is investing assets related to the member. For such a typical career employee, more than one-half of the investment income earned on assets accumulated to pay benefits is received after the employee retires. In addition, in an open, ongoing system like Chattanooga, the stream of benefit payments is continually increasing as new hires replace current members who leave covered employment due to death, termination of employment, and retirement. This difference in the time horizon used by actuaries and investment consultants is frequently a source of debate and confusion when setting economic assumptions.

Past Experience

One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the timeframe used, especially if the year-to-year results vary widely. In addition, the asset allocation can also impact the investment returns so comparing results over long periods when different asset allocations were in place may not be meaningful.



Section II – Economic Assumptions

The assets for Chattanooga are valued using a widely accepted asset-smoothing methodology that fully recognizes the expected investment income and also recognizes 10% of each year’s investment gain or loss (the difference between actual and expected investment income). The recent experience over the last five years is shown in the table below.

Year Ending 12/31	Actuarial Value	Actual Market Value Returns
2013	6.32%	17.05%
2014	6.61	5.54
2015	5.63	-1.37
2016	4.44	7.04
2017	4.61	13.14
Average	5.52%	8.28%

While important to review and analyze, historical returns over such a short time period are not credible for the purpose of setting the long-term assumed future rate of return.

Future Expectation Analysis

ASOP 27 provides that the actuary may rely on outside experts in setting economic assumptions. Chattanooga utilizes the services of Gavion to assist them in developing investment strategies and providing capital market assumptions for the Chattanooga portfolio. As part of their duties, Gavion periodically performs asset-liability studies, along with comprehensive reviews of the expected return of the various asset classes in which the Chattanooga portfolio is invested. We believe it is appropriate to consider the results of Gavion’s work as one factor in assessing expected future returns.

We also recognize that there can be differences of opinion among investment professionals regarding future return expectations. Horizon Actuarial Services prepares an annual study in which they survey various investment advisors (35 were included in the 2018 study with a 10-year horizon) and provide ranges of results as well as averages. This information provides an additional Chattanooga perspective on what a broad group of investment experts anticipate for future investment returns.



Section II – Economic Assumptions

Our forward-looking analysis used the real rates of return in Gavion’s capital market assumptions from the second quarter of 2018 (which uses a 3-year horizon) and Chattanooga’s target asset allocation. Using statistical projections that assume investment returns approximately follow a lognormal distribution with no correlation between years, produces an expected range of real rates of return over a 50 year time horizon. Looking at one year’s results produces a mean real return of 3.01%, but also has a high standard deviation or measurement of volatility. By expanding the time horizon, the real return does not change, but the volatility declines significantly. The table below provides a summary of results.

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5 th	25 th	50 th	75 th	95 th
1	3.01%	9.47%	(11.79)%	(3.57)%	2.58%	9.13%	19.29%
5	2.67	4.21	(4.11)	(0.22)	2.58	5.46	9.74
10	2.62	2.98	(2.20)	0.59	2.58	4.61	7.60
20	2.60	2.10	(0.82)	1.17	2.58	4.01	6.10
30	2.60	1.72	(0.21)	1.43	2.58	3.75	5.45
40	2.59	1.49	0.16	1.58	2.58	3.59	5.06
50	2.59	1.33	0.42	1.69	2.58	3.48	4.79

The percentile results are the percentages of random returns over the time span shown that are expected to be less than the amount indicated. For example, for the 10 year time span, 5% of the resulting real rates of return will be below (2.20)% and 95% will be above that. As the time span increases, the results begin to converge. Over a 50 year time span, the results indicate there will be a 25% chance that real returns will be below 1.69% and a 25% chance they will be above 3.48%. In other words, there is a 50% chance the real returns will be between 1.69% and 3.48%.

For a broader view of expected returns, we also reviewed the 2018 Survey of Capital Market Assumptions produced by Horizon Actuarial Services, LLC to see what other investment professionals are currently using for capital market assumptions. The Horizon survey includes both 10-year horizon and 20-year horizon capital market assumptions. Using the current Chattanooga target asset allocation, we applied the same statistical analysis to these survey results as we did the capital market assumption of Chattanooga investment advisor with the following real return results for the 10-year horizon:



Section II – Economic Assumptions

Mean Real Return Projection based on the Chattanooga Asset Allocation and the Capital Market Assumptions from the 10-year Horizon Actuarial Services Survey

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5 th	25 th	50 th	75 th	95 th
1	4.16%	10.61%	(12.32)%	(3.24)%	3.62%	10.97%	22.47%
5	3.73	4.72	(3.84)	0.50	3.62	6.85	11.66
10	3.68	3.33	(1.71)	1.40	3.62	5.89	9.25
20	3.65	2.35	(0.18)	2.05	3.62	5.22	7.57
30	3.64	1.92	0.51	2.33	3.62	4.93	6.83
40	3.64	1.66	0.92	2.51	3.62	4.75	6.40
50	3.63	1.49	1.20	2.62	3.62	4.63	6.10

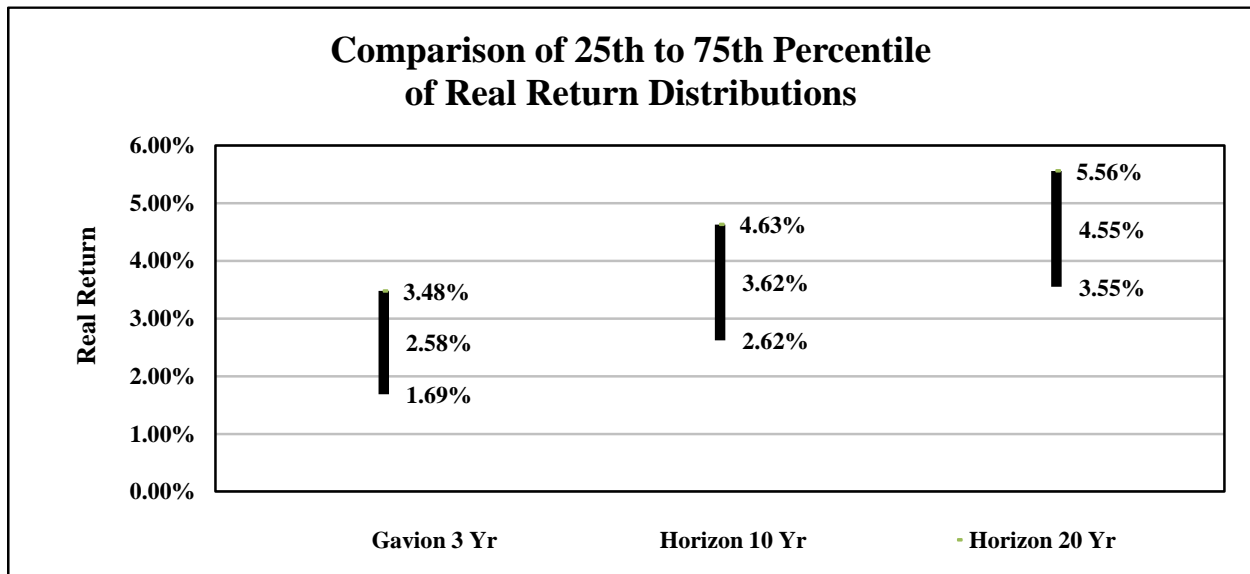
The results for the 20-year horizon are contained in the following table:

Mean Real Return Projection based on the Chattanooga Asset Allocation and the Capital Market Assumptions from the 20-year Horizon Actuarial Services Survey

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5 th	25 th	50 th	75 th	95 th
1	5.09%	10.61%	(11.41)%	(2.31)%	4.55%	11.90%	23.39%
5	4.66	4.72	(2.91)	1.43	4.55	7.78	12.59
10	4.61	3.33	(0.78)	2.33	4.55	6.82	10.18
20	4.58	2.36	0.75	2.98	4.55	6.15	8.50
30	4.57	1.92	1.44	3.27	4.55	5.86	7.76
40	4.57	1.67	1.85	3.44	4.55	5.68	7.33
50	4.56	1.49	2.13	3.55	4.55	5.56	7.03

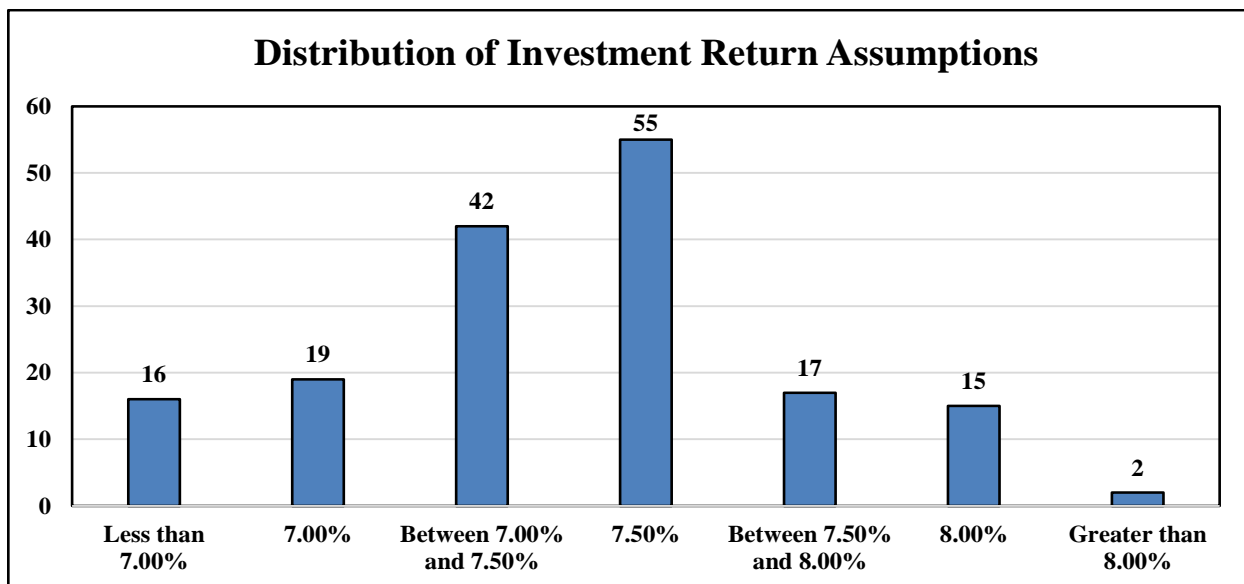


Section II – Economic Assumptions



Peer Comparison

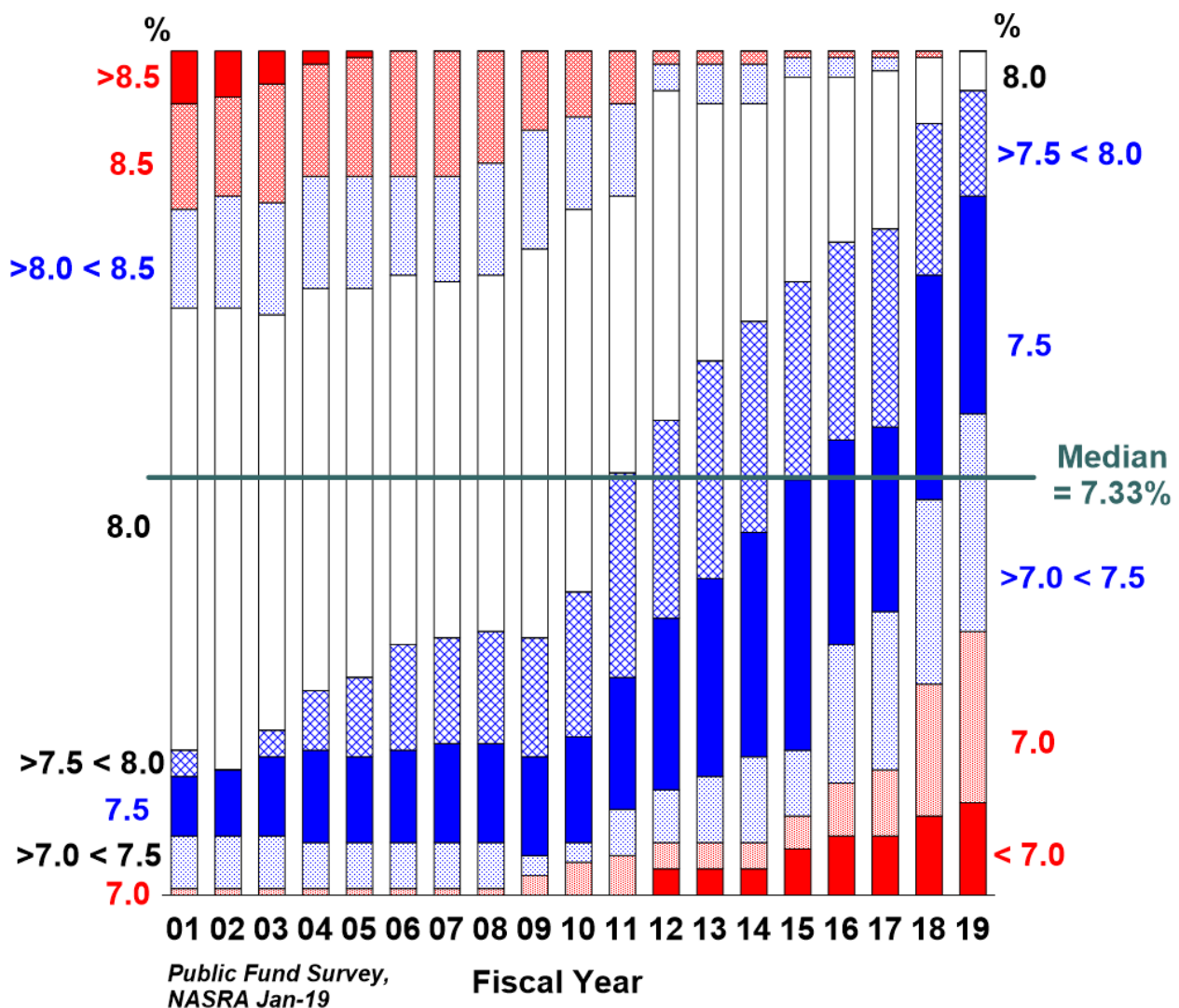
The following chart shows the nominal investment return assumptions of the 166 plans from the Public Plans Database of the Center for Retirement Research for the 2017 actuarial valuation.





Section II – Economic Assumptions

As can be seen from the chart on the previous page, the majority of Plans from this database are using either 7.25% or 7.50%. However, there has been a significant trend downward of the investment return assumption over the past 18 years. According to the National Association of State Retirement Administrators (NASRA) Issue Brief entitled, “Public Pension Plan Investment Return Assumptions”, updated January, 2019, the median nominal investment return from this survey is now 7.33% and the following chart displays this downward trend. Just eight years ago, the median nominal investment return was approximately 8.00%.





Section II – Economic Assumptions

Recommendation

By actuarial standards, we are required to maintain a long-term Chattanooga perspective in setting all assumptions, including the investment return assumption. Therefore, we believe we must be careful not to let recent experience or the short-term expectations impact our judgment regarding the appropriateness of the current assumption over the long term.

This is a particularly challenging time to develop a recommendation for the investment return assumption. We need to recognize that there is no right answer to the question as no one knows what the future holds. Lately, there has been a significant trend in lowering the investment return assumption for pension plans across the country. According to the 2018 NASRA Issue Brief, the average return assumption has decreased from 7.91% in 2010 to 7.33% in 2019.

Although Gavion’s 3-year horizon analysis generates a real return of 2.58% at the 50th percentile, the Horizon Actuarial Services Survey using 10-year horizon analysis is 1.04% higher, or 3.62%, at the 50th percentile. And the 20-year horizon analysis is 1.97% higher, or 4.55% at the 50th percentile. Ideally, we would recommend the Board consider a real return analysis with a longer time horizon (not using such a short-term approach) and slightly less than the 50th percentile to be somewhat conservative in the assumption.

Taking all of this information into consideration, we are recommending the Board lower the investment return assumption from 7.00% to 6.75%, in conjunction with the recommendation of lowering the price inflation assumption by 0.25%. Using the longer time horizon analysis, a real return of 4.25% is still lower than the 50th percentile.

Investment Return Assumption		
	Current	Recommended
Real Rate of Return*	4.25%	4.25%
Inflation	<u>2.75</u>	<u>2.50</u>
Net Investment Return	7.00%	6.75%

* net of investment expenses.



Section III – Actuarial Methods

Actuarial Cost Method

There are various actuarial cost methods, each of which has different characteristics, advantages and disadvantages. However, Governmental Accounting Standard Board (GASB) Statement Numbers 67 and 68 require that the Entry Age Normal cost method be used for financial reporting. Most Plans do not want to use a different actuarial cost method for funding and financial reporting. In addition, the Entry Age Normal method has been the most common funding method for public Plans for many years. This is the cost method currently used by the Plan.

The rationale of the Entry Age Normal (EAN) cost method is that the cost of each member's benefit is determined to be a level percentage of his salary from date of hire to the end of his employment with the employer. This level percentage multiplied by the member's annual salary is referred to as the normal cost and is that portion of the total cost of the employee's benefit that is allocated to the current year. The portion of the present value of future benefits allocated to the future is determined by multiplying this percentage times the present value of the member's assumed earnings for all future years including the current year. The Entry Age Normal actuarial accrued liability is then developed by subtracting from the present value of future benefits that portion of costs allocated to the future. To determine the unfunded actuarial accrued liability, the value of plan assets is subtracted from the Entry Age Normal actuarial accrued liability. The current year's cost to amortize the unfunded actuarial accrued liability is developed by applying an amortization factor.

It is to be expected that future events will not occur exactly as anticipated by the actuarial assumptions in each year. Actuarial gains/losses from experience under this actuarial cost method can be directly calculated and are reflected as a decrease/increase in the unfunded actuarial accrued liability. Consequently, the gain/loss results in a decrease/increase in the amortization payment, and therefore the contribution rate.

Considering that the Entry Age Normal cost method is the most commonly used cost method by public plans, that it develops a normal cost rate that tends to be stable and less volatile, and is the required cost method under calculations required by GASB Numbers 67 and 68, **we recommend the Entry Age Normal actuarial cost method be retained for the Plan.**



Section III – Actuarial Methods

Actuarial Value of Assets

In preparing an actuarial valuation, the actuary must assign a value to the assets of the fund. An adjusted market value is often used to smooth out the volatility that is reflected in the market value of assets. This is because most employers would rather have annual costs remain relatively smooth, as a percentage of payroll or in actual dollars, as opposed to a cost pattern that is extremely volatile.

The actuary does not have complete freedom in assigning this value. The Actuarial Standards Board also has basic principles regarding the calculation of a smoothed asset value, Actuarial Standard of Practice No. 44 (ASOP 44), *Selection and Use of Asset Valuation Methods for Pension Valuations*.

ASOP 44 provides that the asset valuation method should bear a reasonable relationship to the market value. Furthermore, the asset valuation method should be likely to satisfy both of the following:

- Produce values within a reasonable range around market value, AND
- Recognize differences from market value in a reasonable amount of time.

In lieu of both of the above, the standard will be met if either of the following requirements is satisfied:

- There is a sufficiently narrow range around the market value, OR
- The method recognizes differences from market value in a sufficiently short period.

These rules or principles prevent the asset valuation methodology from being used to manipulate annual funding patterns. No matter what asset valuation method is used, it is important to note that, like a cost method or actuarial assumptions, the asset valuation method does not affect the true cost of the plan; it only impacts the incidence of cost.

Currently, the actuarial value of assets recognizes a portion of the difference between the market value of assets and the expected market value of assets, based on the assumed valuation rate of return. The amount recognized each year is 10% of the difference between market value and expected market value or a 10-year smoothed period.



Section III – Actuarial Methods

Asset smoothing is used to dampen the impact of volatility of market value returns on the required contributions to the plan. Although some in the actuarial profession use asset smoothing periods longer than five years, it is somewhat uncommon and various actuarial organizations have expressed their opinions recently:

- The Conference of Consulting Actuaries (CCA) Public Plan Community White Paper endorses smoothing periods of 3 years to 10 years with market value corridors on smoothing periods of 5 to 10 years.
- The Report of the Blue Ribbon Panel of the Society of Actuaries on Public Pension Plan Funding recommends limiting smoothing periods to 5 years.
- The Government Finance Officers Association (GFOA) Best Practice recommends asset smoothing periods of ideally 5 years or less but no longer than 10 years with market value corridors for smoothing periods greater than 5 years.

We recommend the Board consider changing the asset smoothing to a five year smoothing method with a 20% corridor around the market value of assets. Five year smoothing is the most widely used method and although it may produce more volatility in the contribution requirements than the 10-year smoothing method, gains and losses are recognized faster and the Plan will not recognize significant investment events, like the housing downturn in 2008 and 2009, over such a long period of time.

Amortization of the Unfunded Actuarial Accrued Liability

The actuarial accrued liability is the portion of the actuarial present value of future benefits that are not included in future normal costs. Thus, it represents the liability that, in theory, should have been funded through normal costs for past service. Unfunded actuarial accrued liability (UAAL) exists when the actuarial accrued liability exceeds the actuarial value of plan assets. These deficiencies can result from:

- (i) plan improvements that have not been completely paid for,
- (ii) experience that is less favorable than expected,
- (iii) assumption changes that increase liabilities, or
- (iv) contributions that are less than the actuarial contribution rate.



Section III – Actuarial Methods

There are a variety of different methods that can be used to amortize the UAAL. Each method results in a different payment stream and, therefore, has cost implications. For each methodology, there are three characteristics:

- The period over which the UAAL is amortized,
- The rate at which the amortization payment increases, and
- The number of components of UAAL (separate amortization bases).

Amortization Period: The amortization period can be either closed or open. If it is a closed amortization period, the number of years remaining in the amortization period declines by one in each future valuation. Alternatively, if the amortization period is an open or rolling period, the amortization period does not decline but is reset to the same number each year. This approach essentially “refinances” the Plan’s debt (UAAL) every year.

We recommend a continuation of the closed period approach.

Amortization Payment: The level dollar amortization method is similar to the method in which a homeowner pays off a mortgage. The liability, once calculated, is financed by a constant fixed dollar amount, based on the amortization period until the liability is extinguished. This results in the liability steadily decreasing while the payments, though remaining level in dollar terms, in all probability decrease as a percentage of payroll. (Even if a plan sponsor’s population is not growing, inflationary salary increases will usually be sufficient to increase the aggregate covered payroll).

The rationale behind the level percentage of payroll amortization method is that since normal costs are calculated to be a constant percentage of pay, the unfunded actuarial accrued liability should be paid off in the same manner. When this method of amortizing the unfunded actuarial accrued liability is adopted, the initial amortization payments are lower than they would be under a level dollar amortization payment method, but the payments increase at a fixed rate each year so that ultimately the annual payment far exceeds the level dollar payment. The expectation is that total payroll will increase at the same rate so that the amortization payments will remain constant, as a percentage of payroll. In the initial years, the level percentage of payroll amortization payment is often less than the interest accruing on the unfunded actuarial accrued liability meaning that even if there are no experience losses, the dollar amount of the unfunded actuarial accrued liability will grow (called negative amortization). This is particularly true if the plan sponsor is paying off the unfunded actuarial accrued liability over a long period, such as 20 or more years.



Section III – Actuarial Methods

We recommend continuation of the level dollar amortization methodology.

Amortization Bases: The UAAL can be amortized either as one single amount or as components or “layers”, each with a separate amortization base, payment and period. If the UAAL is amortized as one amount, the UAAL is recalculated each year in the valuation and experience gains/losses or other changes in the UAAL are folded into the single UAAL amortization base. The amortization payment is then the total UAAL divided by an amortization factor for the applicable amortization period.

If separate amortization bases are maintained, the UAAL is composed of multiple amortization bases, each with its own payment schedule and remaining amortization period. In each valuation, the unexpected change in the UAAL is established as a new amortization base over the appropriate amortization period beginning on that valuation date. The UAAL is then the sum of all of the outstanding amortization bases on the valuation date and the UAAL payment is the sum of all of the amortization payments on the existing amortization bases. This approach provides transparency in that the current UAAL is paid off over a fixed period of time and the remaining components of the UAAL are clearly identified. Adjustments to the UAAL in future years are also separately identified in each future year. One downside of this approach is that it can create some discontinuities in contribution rates when UAAL layers/components are fully paid off. If this occurs, it likely would be far in the future, with adequate time to address any adjustments needed.

We recommend continuation of separate amortization bases to pay off the UAAL.



Section IV – Demographic Assumptions

There are several demographic assumptions used in the actuarial valuations performed for the Plan. They are:

- Rates of Withdrawal
- Rates of Disability Retirement
- Rates of Service Retirement
- Rates of Mortality
- Rates of Salary Increase

Actuarial Standard of Practice (ASOP) No. 35, “*Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*” provides guidance to actuaries in selecting demographic assumptions for measuring obligations under defined benefit plans. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP No. 35.

The purpose of a study of demographic experience is to compare what actually happened to the membership during the study period (January 1, 2013 through December 31, 2017) with what was expected to happen based on the assumptions used in the most recent Actuarial Valuations.

Detailed tabulations by age, service and/or gender are performed over the entire study period. These tabulations look at all active and retired members during the period as well as separately annotating those who experience a demographic event, also referred to as a decrement. In addition the tabulation of all members together with the current assumptions permits the calculation of the number of expected decrements during the study period.

If the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements, or rates of decrement, by age, gender, or service does not follow the expected pattern, new assumptions are recommended. Recommended changes usually do not follow the exact actual experience during the observation period. Judgment is required to extrapolate future experience from past trends and current member behavior. In addition, non-recurring events, such as early retirement windows, need to be taken into account in determining the weight to give to recent experience.

The remainder of this section presents the results of the demographic study. We have prepared tables that show a comparison of the actual and expected decrements and the overall ratio of actual to expected results (A/E Ratios) under the current assumptions. If a change is being proposed, the



Section IV – Demographic Assumptions

revised A/E Ratios are shown as well. Salary adjustments, other than the economic assumption for wage inflation discussed in the previous section, are treated as demographic assumptions.



Section IV – Demographic Assumptions

RATES OF WITHDRAWAL

**COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS
FROM ACTIVE SERVICE**

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with less than 2 years of service		
20-24	5	9	0.556
25-29	31	37	0.838
30-34	17	19	0.895
35-39	22	23	0.957
40-44	21	16	1.313
45-49	14	13	1.077
50-54	11	11	1.000
55+	17	15	1.133
TOTAL	138	143	0.965

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with 2 to 4 years of service		
20-24	4	3	1.333
25-29	26	16	1.625
30-34	27	19	1.421
35-39	20	17	1.176
40-44	25	15	1.667
45-49	15	16	0.938
50-54	15	15	1.000
55+	6	14	0.429
TOTAL	138	115	1.200



Section IV – Demographic Assumptions

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with 5 to 9 years of service		
20-24	1	0	0.000
25-29	2	3	0.667
30-34	20	9	2.222
35-39	14	15	0.933
40-44	9	5	1.800
45-49	7	6	1.167
50-54	14	6	2.333
55+	1	0	0.000
TOTAL	68	44	1.545

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with 10 to 14 years of service		
20-24	0	0	0.000
25-29	0	0	0.000
30-34	3	1	3.000
35-39	4	4	1.000
40-44	4	3	1.333
45-49	7	4	1.750
50-54	3	4	0.750
55+	0	0	0.000
TOTAL	21	16	1.313



Section IV – Demographic Assumptions

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with 15 or more years of service		
20-24	0	0	0.000
25-29	0	0	0.000
30-34	0	0	0.000
35-39	1	1	1.000
40-44	7	3	2.333
45-49	8	6	1.333
50-54	8	7	1.143
55+	0	0	0.000
TOTAL	24	17	1.412

The rates of withdrawal adopted by the Board are used to determine the expected number of separations from active service which will occur as a result of resignation or dismissal. Overall, there were more withdrawals than expected over the study period. Specifically, withdrawals at ages 25 and below were less than expected while withdrawals between the ages of 25 and 55 were greater than expected.

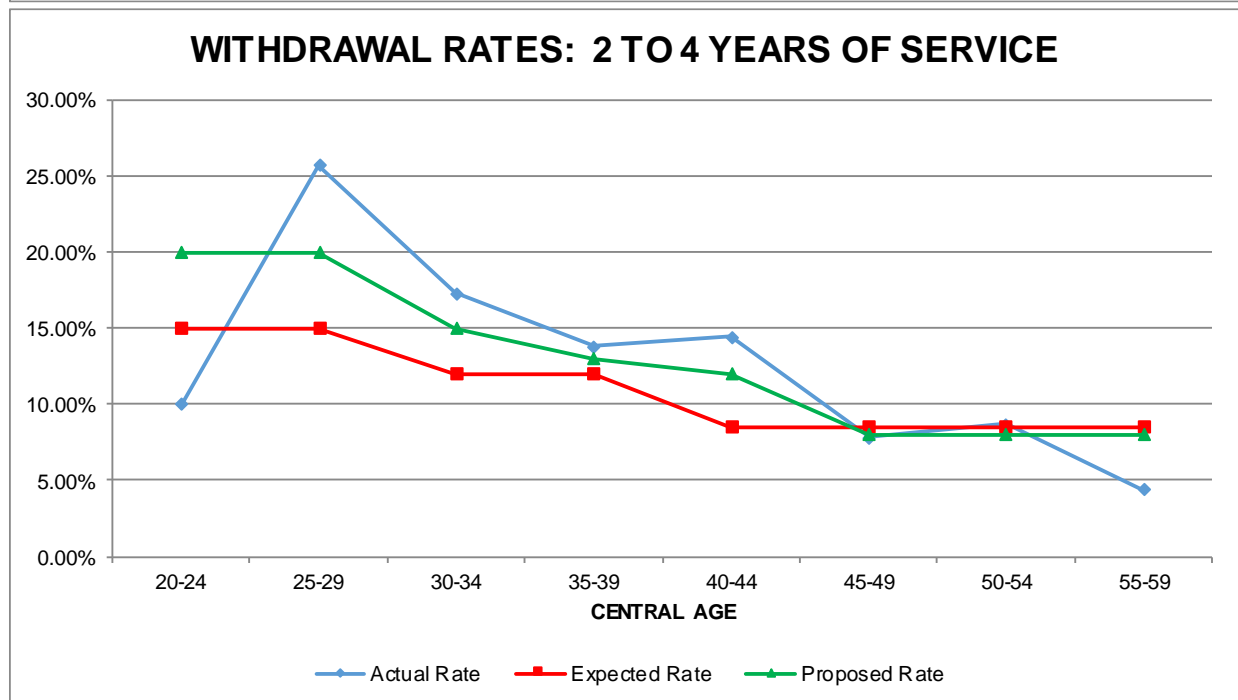
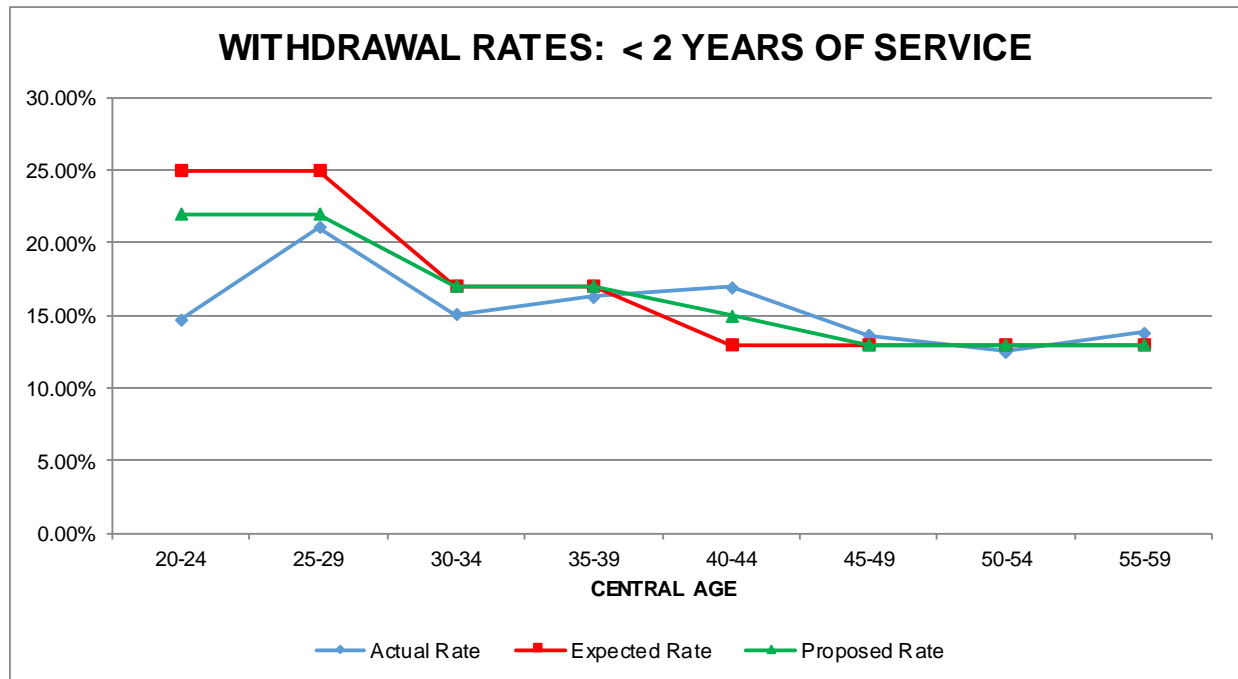
For employees with less than 2 years of service, withdrawals were generally higher than what was anticipated by the current assumed rates for ages greater than 40, and less than expected for ages below 40. **We recommend minor adjustments in the rates of withdrawal for this group to more closely reflect the experience of the Plan.**

For employees with 2 or more years of service, withdrawals were generally higher than what was anticipated by the current assumed rates. **We recommend increasing the rates of withdrawal for these service intervals to more closely reflect the experience of the Plan.**



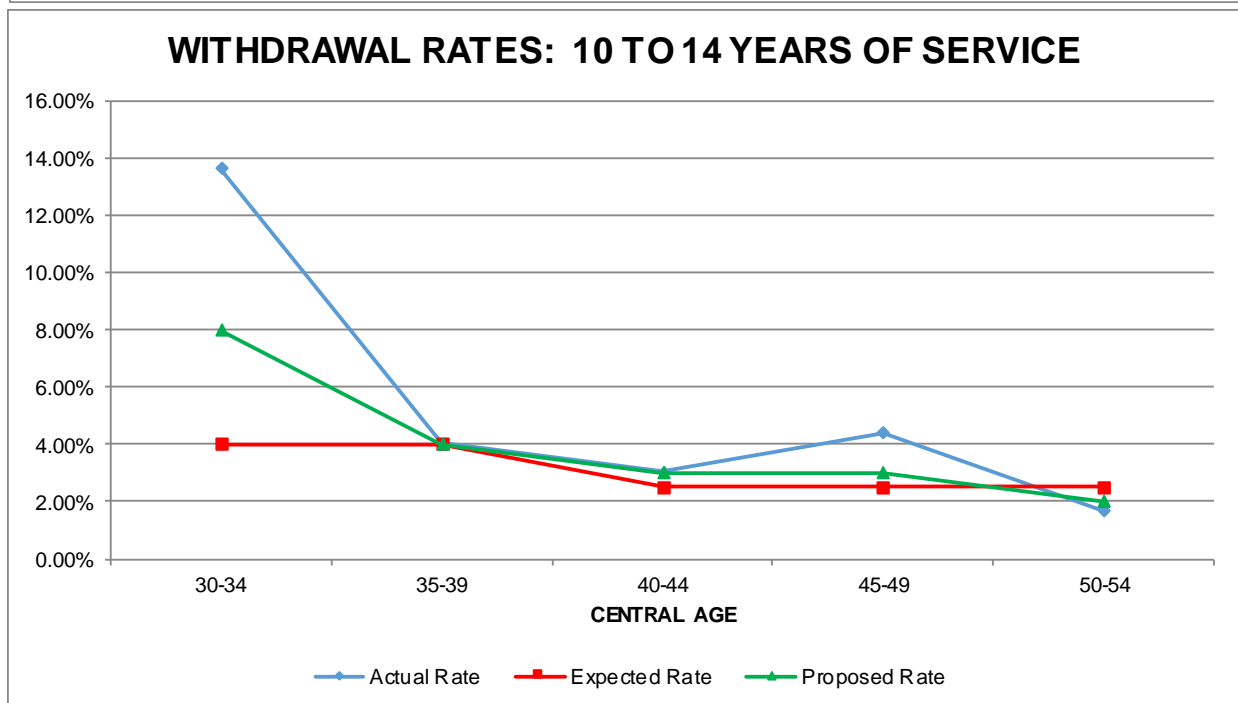
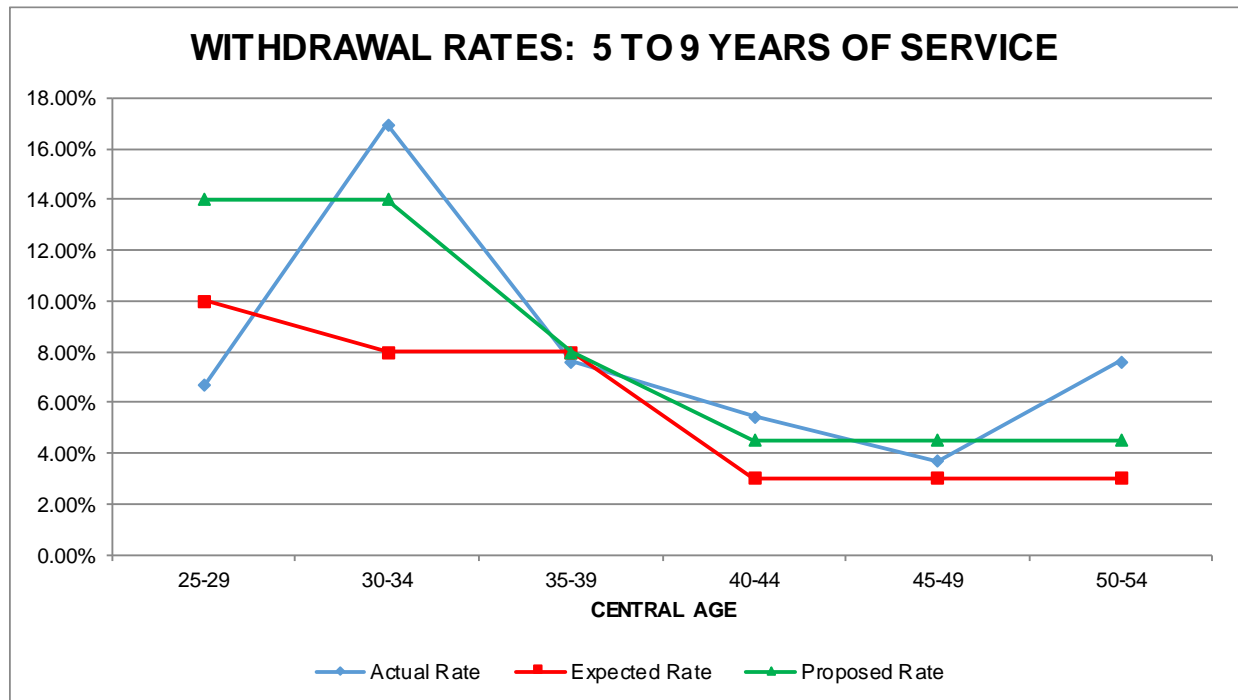
Section IV – Demographic Assumptions

The following graphs show a comparison of the present, actual and proposed rates of withdrawal.



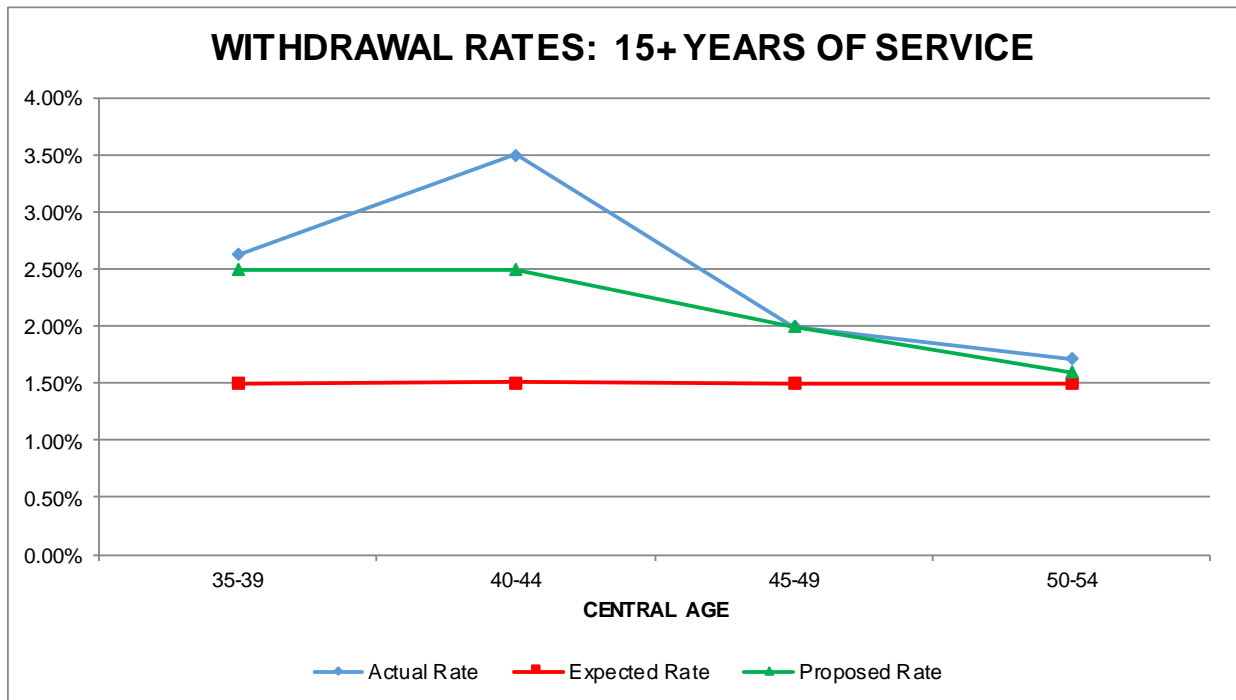


Section IV – Demographic Assumptions





Section IV – Demographic Assumptions



The following tables show a comparison between the present withdrawal rates and the proposed rates.



Section IV – Demographic Assumptions

**COMPARATIVE RATES OF WITHDRAWAL
FROM ACTIVE SERVICE**

CENTRAL AGE OF GROUP	RATES OF WITHDRAWAL				
	Present				
	Years of Service				
	Less than 2	2 to 4	5 to 9	10 to 14	15 & Over
20-24	25.0%	15.0%	10.0%	4.0%	1.5%
25-29	25.0%	15.0%	10.0%	4.0%	1.5%
30-34	17.0%	12.0%	8.0%	4.0%	1.5%
35-39	17.0%	12.0%	8.0%	4.0%	1.5%
40 & Over	13.0%	8.5%	3.0%	2.5%	1.5%

CENTRAL AGE OF GROUP	RATES OF WITHDRAWAL				
	Proposed				
	Years of Service				
	Less than 2	2 to 4	5 to 9	10 to 14	15 & Over
20-24	22.0%	20.0%	14.0%	8.0%	2.5%
25-29	22.0%	20.0%	14.0%	8.0%	2.5%
30-34	17.0%	15.0%	14.0%	8.0%	2.5%
35-39	17.0%	13.0%	8.0%	4.0%	2.5%
40-44	15.0%	12.0%	4.5%	3.0%	2.5%
45-49	13.0%	8.0%	4.5%	3.0%	2.0%
50 & Over	13.0%	8.0%	4.5%	2.0%	1.6%



Section IV – Demographic Assumptions

**COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS
FROM ACTIVE SERVICE BASED ON PROPOSED RATES OF WITHDRAWAL**

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with less than 2 years of service		
20-24	5	7	0.714
25-29	31	32	0.969
30-34	17	19	0.895
35-39	22	23	0.957
40-44	21	19	1.105
45-49	14	13	1.077
50-54	11	11	1.000
55+	17	15	1.133
TOTAL	138	139	0.993



Section IV – Demographic Assumptions

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with 2 to 4 years of service		
20-24	4	4	1.000
25-29	26	22	1.182
30-34	27	23	1.174
35-39	20	19	1.053
40-44	25	21	1.190
45-49	15	15	1.000
50-54	15	14	1.071
55+	6	14	0.429
TOTAL	138	132	1.045

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with 5 to 9 years of service		
20-24	1	0	0.000
25-29	2	4	0.500
30-34	20	17	1.176
35-39	14	15	0.933
40-44	9	7	1.286
45-49	7	9	0.778
50-54	14	8	1.750
55+	1	0	0.000
TOTAL	68	60	1.133



Section IV – Demographic Assumptions

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with 10 to 14 years of service		
20-24	0	0	0.000
25-29	0	0	0.000
30-34	3	2	1.500
35-39	4	4	1.000
40-44	4	4	1.000
45-49	7	5	1.400
50-54	3	4	0.750
55+	0	0	0.000
TOTAL	21	19	1.105

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with 15 or more years of service		
20-24	0	0	0.000
25-29	0	0	0.000
30-34	0	0	0.000
35-39	1	1	1.000
40-44	7	5	1.400
45-49	8	8	1.000
50-54	8	7	1.143
55+	0	0	0.000
TOTAL	24	21	1.143



Section IV – Demographic Assumptions

RATES OF DISABILITY RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED DISABILITY RETIREMENTS

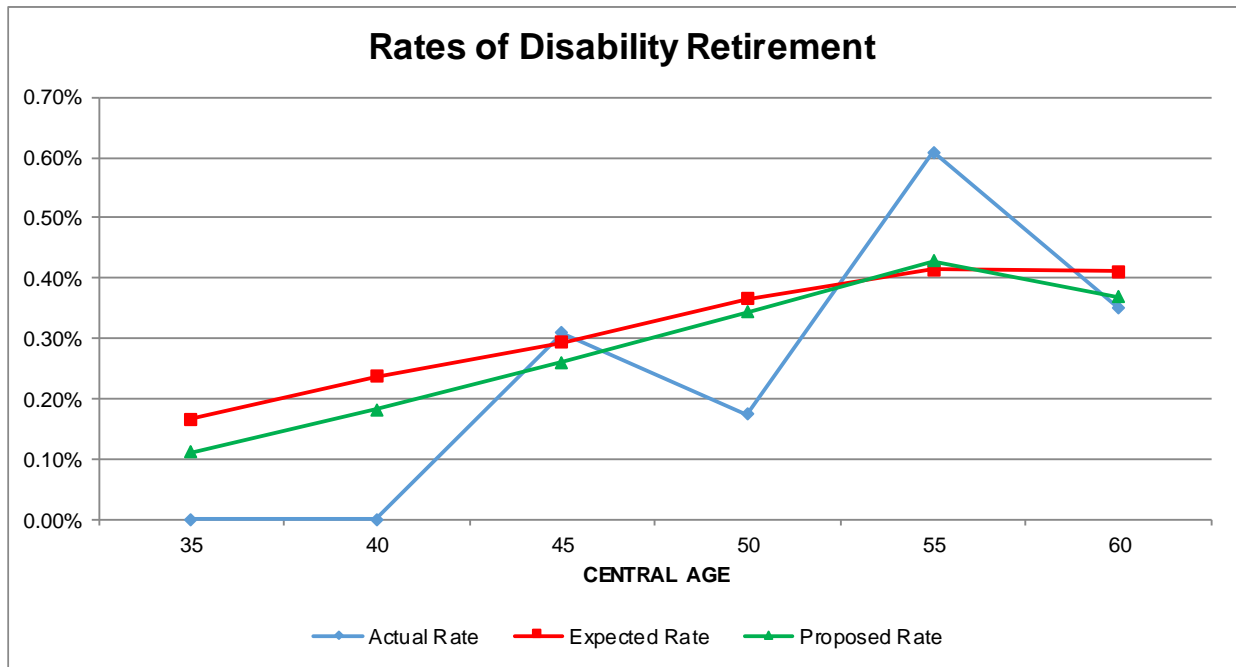
CENTRAL AGE OF GROUP	NUMBER OF DISABILITY RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
35	0	1	0.000
40	0	2	0.000
45	3	3	1.000
50	2	4	0.500
55	8	5	1.600
60	4	5	0.800
TOTAL	17	20	0.850

During the period under investigation, there were relatively few instances of disability retirements. In addition, actual rates of disability retirement were slightly less than expected. **Therefore, we recommend that the rates of disability from active service be decreased slightly to more closely reflect the experience of the Plan.**

The following graph shows a comparison of the present, actual and proposed rates of disability retirement.



Section IV – Demographic Assumptions



The following table shows a comparison between the present disability retirement rates and the proposed rates.

COMPARATIVE RATES OF DISABILITY RETIREMENT

AGE	RATES OF DISABILITY RETIREMENT	
	Present	Proposed
35	0.16%	0.10%
40	0.23%	0.18%
45	0.29%	0.26%
50	0.38%	0.34%
55	0.41%	0.44%
60	0.50%	0.44%



Section IV – Demographic Assumptions

**COMPARISON OF ACTUAL AND EXPECTED DISABILITY RETIREMENTS
BASED ON PROPOSED RATES**

CENTRAL AGE OF GROUP	NUMBER OF DISABILITY RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
35	0	1	0.000
40	0	1	0.000
45	3	3	1.000
50	2	4	0.500
55	8	6	1.333
60	4	4	1.000
TOTAL	17	19	0.895



Section IV – Demographic Assumptions

RATES OF SERVICE RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED SERVICE RETIREMENTS

Service retirements for members retiring subject to the Rule of 80 were examined separately from those members retiring at 62 under a standard retirement (or retiring at age 55 with a reduced benefit).

Standard Retirement

AGE	NUMBER OF SERVICE RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
55	5	7	0.714
56	7	6	1.167
57	6	6	1.000
58	8	6	1.333
59	5	5	1.000
60	2	6	0.333
61	12	14	0.857
62	50	56	0.893
63	33	28	1.179
64	20	21	0.952
65	20	16	1.250
66	14	12	1.167
67	10	9	1.111
68	8	8	1.000
69	5	6	0.833
70	5	5	1.000
71	1	3	0.333
72	3	2	1.500
73	2	2	1.000
74	0	2	0.000
SUBTOTAL	216	220	0.982
75 & Over	9	32	0.281
TOTAL	225	252	0.893



Section IV – Demographic Assumptions

Rule of 80 Retirement

AGE	NUMBER OF SERVICE RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
50	1	1	1.000
51	2	1	2.000
52	5	2	2.500
53	1	3	0.333
54	4	5	0.800
55	9	6	1.500
56	4	7	0.571
57	10	8	1.250
58	7	8	0.875
59	9	10	0.900
60	13	9	1.444
61	20	25	0.800
TOTAL	85	85	1.000

The following graphs show a comparison of the present, actual and proposed rates of service retirement.



Section IV – Demographic Assumptions





Section IV – Demographic Assumptions

For members retiring under standard retirement, the actual rates of service retirement were fairly close to expected at ages less than 60. For ages 60 to 62, the actual rates were lower than expected, and for ages 62 to 67 the actual rates were somewhat higher than expected.

For members retiring under the Rule of 80, the actual rates of service retirement were higher than expected for ages less than 53, and slightly less than expected at age 61.

Therefore, we recommend slight revisions to the rates of service retirement to more closely reflect the experience of the Plan.



Section IV – Demographic Assumptions

The following table shows a comparison between the present service retirement rates and the proposed rates.

COMPARATIVE RATES OF SERVICE RETIREMENT

Standard Retirement

AGE	RATES OF STANDARD SERVICE RETIREMENT	
	Present	Proposed
55	4.00%	4.00%
56	4.00%	4.00%
57	4.00%	4.00%
58	4.00%	4.00%
59	4.00%	4.00%
60	6.00%	4.00%
61	12.00%	11.00%
62	30.00%	28.00%
63	20.00%	22.00%
64	20.00%	20.00%
65	20.00%	23.00%
66	20.00%	21.00%
67	20.00%	20.00%
68	20.00%	20.00%
69	20.00%	20.00%
70-74	20.00%	20.00%
75+	100.00%	100.00%



Section IV – Demographic Assumptions

COMPARATIVE RATES OF SERVICE RETIREMENT

Rule of 80 Retirement

AGE	RATES OF RULE OF 80 SERVICE RETIREMENT	
	Present	Proposed
50	11.00%	11.00%
51	11.00%	11.00%
52	11.00%	15.00%
53	11.00%	11.00%
54	11.00%	11.00%
55	11.00%	11.00%
56	11.00%	11.00%
57	11.00%	11.00%
58	11.00%	11.00%
59	11.00%	11.00%
60	11.00%	11.00%
61	28.00%	25.00%



Section IV – Demographic Assumptions

**COMPARISON OF ACTUAL AND EXPECTED SERVICE RETIREMENTS
BASED ON PROPOSED RATES**

Standard Retirement

AGE	NUMBER OF SERVICE RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
55	5	7	0.714
56	7	6	1.167
57	6	6	1.000
58	8	6	1.333
59	5	4	1.250
60	2	4	0.500
61	12	13	0.923
62	50	52	0.962
63	33	31	1.065
64	20	21	0.952
65	20	19	1.053
66	14	13	1.077
67	10	9	1.111
68	8	8	1.000
69	5	6	0.833
70	5	5	1.000
71	1	3	0.333
72	3	2	1.500
73	2	2	1.000
74	0	2	0.000
SUBTOTAL	216	219	0.986
75 & Over	9	32	0.281
TOTAL	225	251	0.896



Section IV – Demographic Assumptions

**COMPARISON OF ACTUAL AND EXPECTED SERVICE RETIREMENTS
BASED ON PROPOSED RATES**

Rule of 80 Retirement

AGE	NUMBER OF SERVICE RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
50	1	1	1.000
51	2	1	2.000
52	5	3	1.667
53	1	3	0.333
54	4	5	0.800
55	9	6	1.500
56	4	7	0.571
57	10	8	1.250
58	7	8	0.875
59	9	10	0.900
60	13	9	1.444
61	20	22	0.909
TOTAL	85	83	1.024



Section IV – Demographic Assumptions

RATES OF MORTALITY

COMPARISON OF ACTUAL AND EXPECTED CASES OF POST-RETIREMENT DEATHS

CENTRAL AGE OF GROUP	NUMBER OF POST-RETIREMENT DEATHS					
	MALES			FEMALES		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
	SERVICE RETIREMENTS AND BENEFICIARIES					
50	0	0	N/A	3	0	N/A
55	2	1	2.000	4	0	N/A
60	6	3	2.000	8	2	4.000
65	13	10	1.300	12	6	2.000
70	18	13	1.385	12	9	1.333
75	20	14	1.429	14	11	1.273
80	15	20	0.750	12	10	1.200
85	13	18	0.722	15	16	0.938
90	10	9	1.111	12	14	0.857
95+	2	3	0.667	12	10	1.200
TOTAL	99	91	1.088	104	78	1.333
DISABILITY RETIREMENTS						
45	0	0	N/A	2	0	N/A
50	1	1	1.000	1	0	N/A
55	3	1	3.000	1	0	N/A
60	1	2	0.500	0	0	N/A
65	3	3	1.000	1	1	1.000
70	5	2	2.500	2	1	2.000
75	0	2	0.000	0	1	0.000
TOTAL	13	11	1.182	7	3	2.333

The current basis for rates of post-retirement mortality for service retirements and beneficiaries is the RP-2000 Combined Mortality Table set forward four years for males and set forward two years for females and using a Scale AA projection to 2025. This is a static mortality table selected with the previous experience study to anticipate some margin for improved mortality. There have been



Section IV – Demographic Assumptions

significant improvements in longevity in the past, although there are different opinions about future expectations.

For service retirements and beneficiaries over the study period, the number of deaths was higher than expected for both males and females at most ages. The actual number of male deaths was 16 more than what was expected and 32 more than expected for females. However, this data is not sufficiently large enough for the experience to be relied upon as fully credible.

Since the City's data is not sufficiently large enough, we considered the mortality assumption used by the Tennessee Consolidated Retirement Plan (TCRS) in our analysis. This is a much larger retirement Plan with significantly more mortality experience and it is reasonable to think that the Plan would have similar patterns of mortality. TCRS recently completed an experience investigation for the period ending December 31, 2016. The mortality table selected from that study for general employees was the RP-2014 Mortality Table with Blue Collar Adjustment with male rates adjusted by 102% and female rates adjusted by 97%. Future mortality improvements are anticipated with use of the MP-2016 projection scale.

To more closely match the experience observed for the Plan, **we recommend that the rates of post-retirement mortality for service retirements and beneficiaries be revised to the RP-2014 Mortality Table with Blue Collar Adjustment and projected to 2025 with projection scale MP-2017. We further recommend that rates be set forward 4 years for males and set forward 3 years for females.** This is a static mortality table with a built in margin for improved mortality in the future.

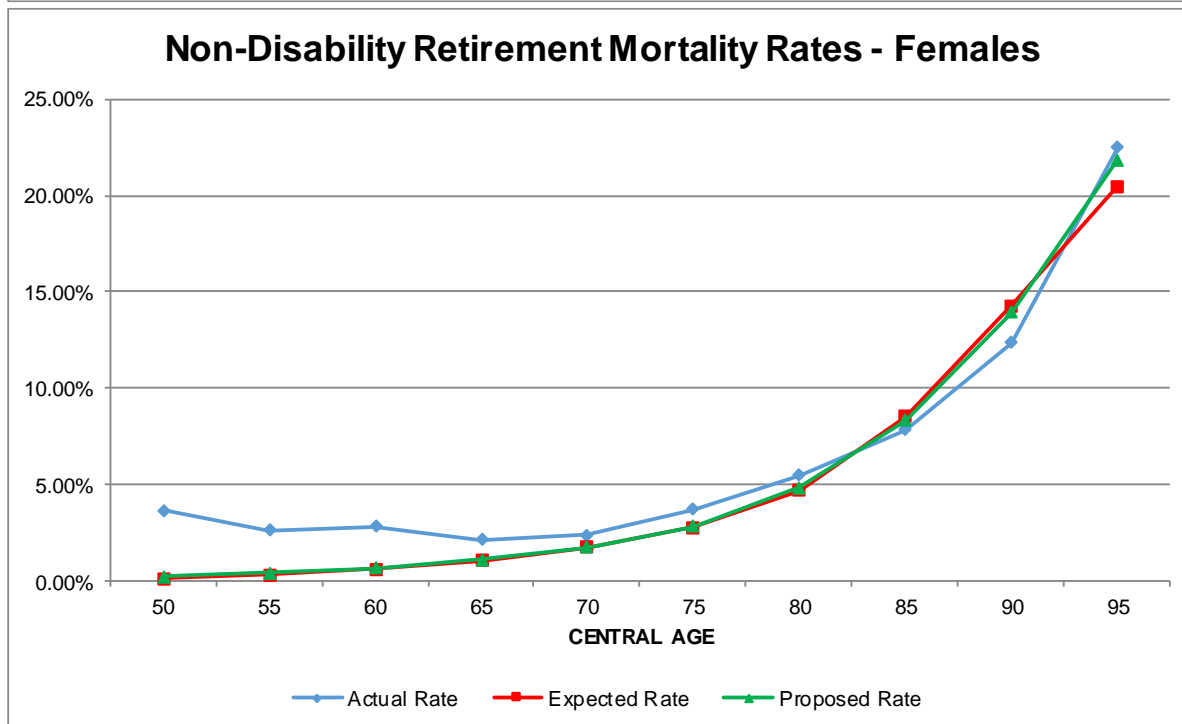
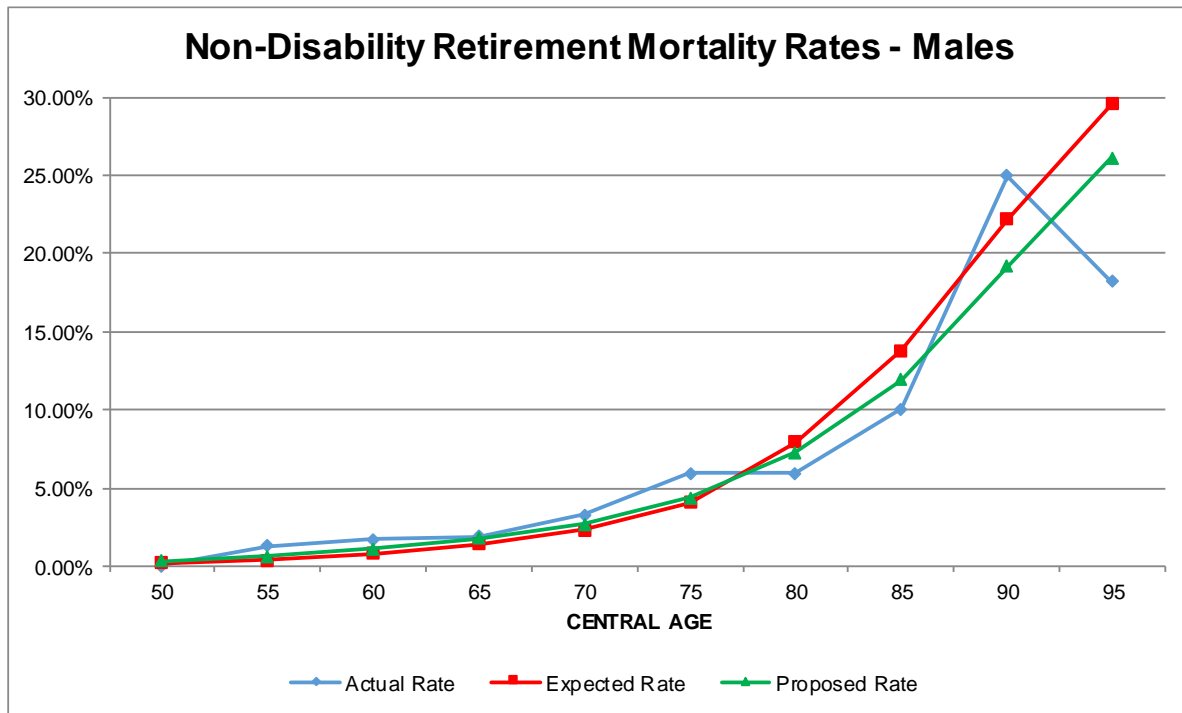
For disability retirements during the study period, there were only 20 deaths observed. This is not sufficient experience to be relied upon as fully credible. **We recommend adopting the RP-2014 Disabled Mortality Table projected to 2025 with projection scale MP-2017, set forward 4 years for males and set forward 7 years for females.**

During the study period, only 12 pre-retirement deaths were observed. This is also not sufficient experience to be relied upon as fully credible. **We recommend adopting the RP-2014 Mortality Table with Blue Collar Adjustment and projected to 2025 with projection MP-2017, set forward 4 years for males and set forward 3 years for females.**

The following graphs show a comparison of the present, actual and proposed rates of post-retirement deaths.

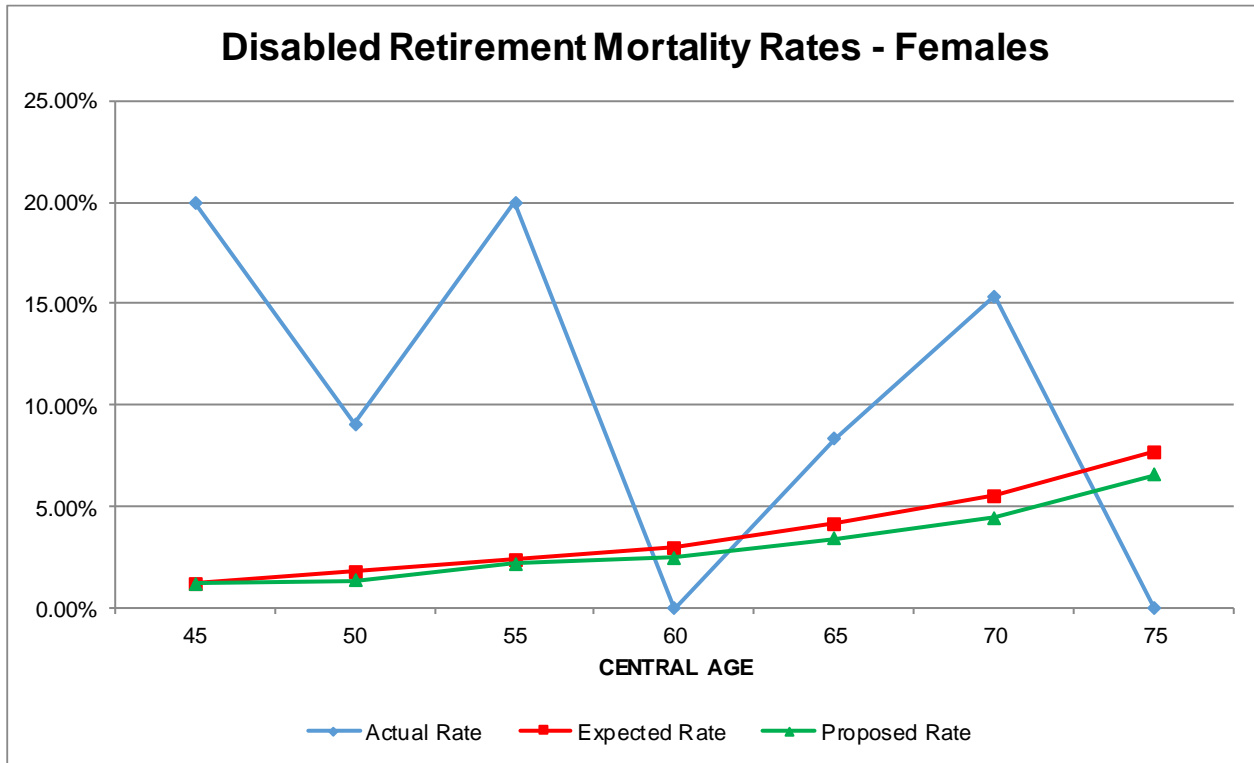
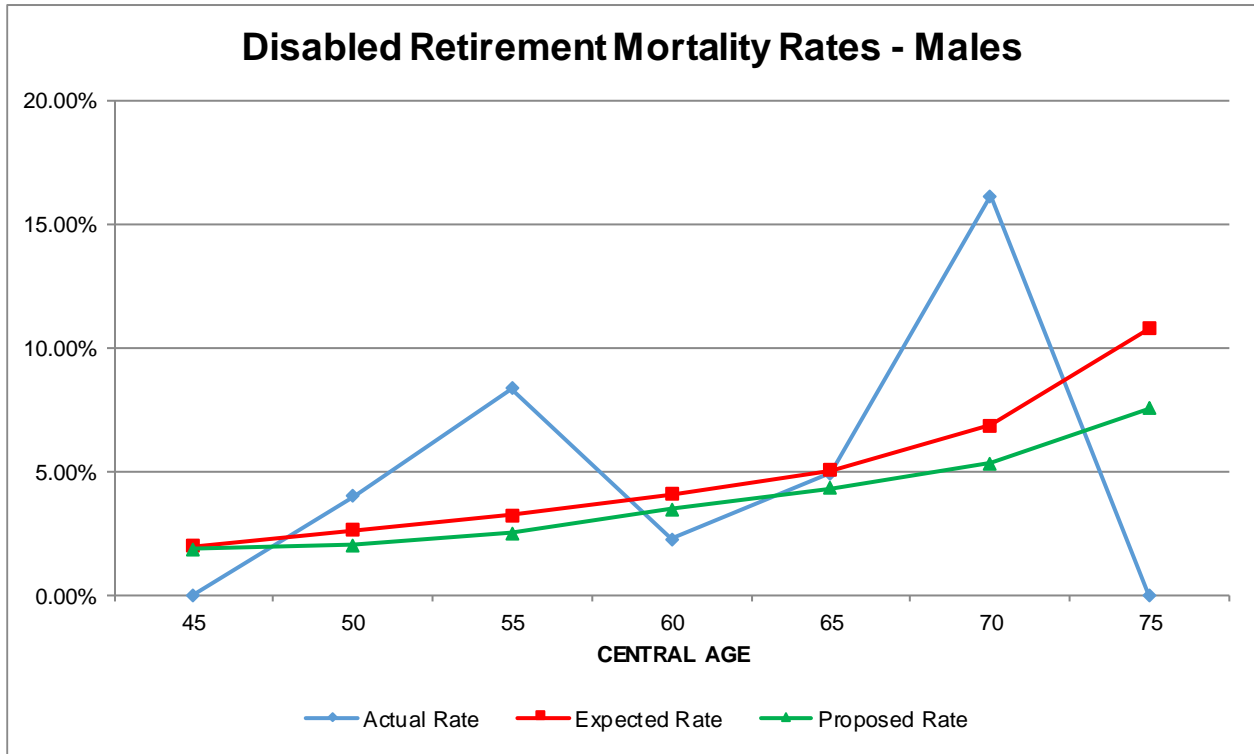


Section IV – Demographic Assumptions





Section IV – Demographic Assumptions





Section IV – Demographic Assumptions

The following table shows a comparison between the present mortality rates and the proposed mortality rates.

COMPARATIVE RATES OF POST-RETIREMENT MORTALITY

AGE	RATES OF POST-RETIREMENT DEATH			
	MALES		FEMALES	
	Present	Proposed	Present	Proposed
	SERVICE RETIREMENTS AND BENEFICIARIES			
35	0.0901%	0.0760%	0.0399%	0.0377%
40	0.1114%	0.1137%	0.0584%	0.0593%
45	0.1402%	0.1918%	0.0842%	0.0995%
50	0.1978%	0.5226%	0.1419%	0.3333%
55	0.3775%	0.7271%	0.3068%	0.4655%
60	0.7731%	1.0882%	0.5873%	0.7046%
65	1.4277%	1.7248%	1.0730%	1.1151%
70	2.3233%	2.7420%	1.7778%	1.7796%
75	4.0720%	4.3993%	2.8612%	2.8778%
80	7.9594%	7.2573%	4.7227%	4.8569%
85	13.9616%	12.2415%	8.7152%	8.4273%
90	22.6791%	19.6938%	14.6213%	14.3557%
95	31.4087%	27.8750%	20.9923%	22.1020%
100	39.2003%	37.7242%	25.4498%	32.0106%

AGE	RATES OF POST-RETIREMENT DEATH			
	MALES		FEMALES	
	Present	Proposed	Present	Proposed
	DISABILITY RETIREMENTS			
35	1.7118%	1.1834%	0.5106%	0.9123%
40	1.7642%	1.5817%	0.6753%	1.1331%
45	1.9829%	1.8158%	1.2054%	1.1392%
50	2.6281%	2.0058%	1.8322%	1.4466%
55	3.2746%	2.5005%	2.3467%	2.0269%
60	4.0004%	3.4035%	3.1173%	2.5831%
65	5.0230%	4.3441%	4.1020%	3.2833%
70	7.2202%	5.4897%	5.6874%	4.5393%
75	10.4994%	7.3412%	7.8688%	6.8283%
80	14.3084%	10.5446%	12.1495%	10.6404%
85	21.6754%	16.0176%	17.3875%	15.9633%
90	30.7507%	23.0140%	22.5671%	22.7662%



Section IV – Demographic Assumptions

COMPARISON OF ACTUAL AND EXPECTED CASES OF POST-RETIREMENT DEATHS BASED ON REVISED MORTALITY RATES

CENTRAL AGE OF GROUP	NUMBER OF POST-RETIREMENT DEATHS					
	MALES			FEMALES		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
	SERVICE RETIREMENTS AND BENEFICIARIES					
50	0	0	N/A	3	0	N/A
55	2	1	2.000	4	1	4.000
60	6	4	1.500	8	2	4.000
65	13	12	1.083	12	6	2.000
70	18	15	1.200	12	9	1.333
75	20	15	1.333	14	11	1.273
80	15	18	0.833	12	11	1.091
85	13	15	0.867	15	16	0.938
90	10	8	1.250	12	14	0.857
95+	2	3	0.667	12	12	1.000
TOTAL	99	91	1.088	104	82	1.268
DISABILITY RETIREMENTS						
45	0	0	N/A	2	0	N/A
50	1	1	N/A	1	0	N/A
55	3	1	3.000	1	0	N/A
60	1	2	0.500	0	0	N/A
65	3	3	1.000	1	1	1.000
70	5	2	2.500	2	1	2.000
75	0	1	0.000	0	1	0.000
TOTAL	13	10	1.300	7	3	2.333



Section IV – Demographic Assumptions

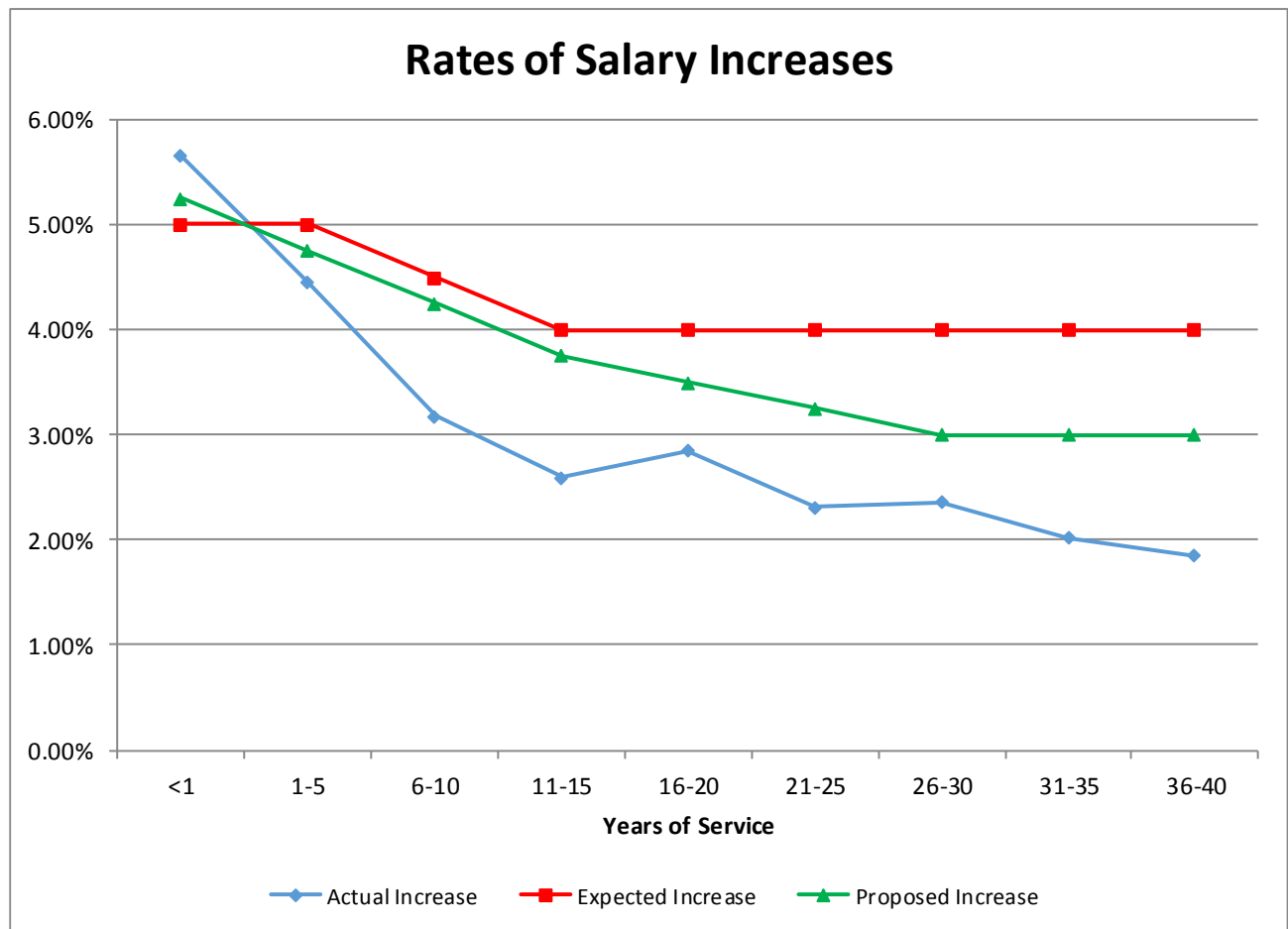
RATES OF SALARY INCREASE

**COMPARISON OF ACTUAL AND EXPECTED SALARIES
OF ACTIVE MEMBERS**

YEARS OF SERVICE	SALARIES AT END OF YEAR		
	Actual	Expected	Ratio of Actual to Expected
Less than 1	\$ 8,956,275	\$ 8,900,876	1.006
1-5	69,232,236	69,597,759	0.995
6-10	43,764,506	44,325,121	0.987
11-15	37,281,671	37,790,964	0.987
16-20	31,926,039	32,285,105	0.989
21-25	30,565,657	31,071,567	0.984
26-30	16,231,250	16,491,266	0.984
31-35	9,838,518	10,029,325	0.981
36 & Over	4,951,772	5,056,172	0.979
TOTAL	\$ 252,747,924	\$ 255,548,155	0.989



Section IV – Demographic Assumptions



Over the study period, actual rates of salary increase were in general lower than expected particularly at higher levels of service. In general, across many retirement Plans, the recent trend has been lower rates of salary increases. However, overall salary increases for the Plan have steadily increased over the five years of the study period. This suggests that, while lower assumed rates of salary increases are justified, we should be cautious about over-reacting. **We recommend that the Plan slightly lower the rates of salary increases at this time and if the trend continues in the next experience study, we will make further adjustments.**



Section IV – Demographic Assumptions

The following table shows a comparison between the present and proposed rates of salary increases.

COMPARATIVE RATES OF SALARY INCREASES

YEARS OF SERVICE	SALARY INCREASE RATES	
	Present	Proposed
Less than 1	5.00%	5.25%
1-5	5.00%	4.75%
6-10	4.50%	4.25%
11-15	4.00%	3.75%
16-20	4.00%	3.50%
21-25	4.00%	3.25%
26 & Over	4.00%	3.00%

**COMPARISON OF ACTUAL AND EXPECTED SALARIES
OF ACTIVE MEMBERS BASED ON PROPOSED RATES**

YEARS OF SERVICE	SALARIES AT END OF YEAR		
	Actual	Expected	Ratio of Actual to Expected
Less than 1	\$ 8,956,275	\$ 8,922,069	1.004
1-5	69,232,236	69,432,050	0.997
6-10	43,764,506	44,219,080	0.990
11-15	37,281,671	37,700,121	0.989
16-20	31,926,039	32,129,888	0.994
21-25	30,565,657	30,847,493	0.991
26-30	16,231,250	16,332,695	0.994
31-35	9,838,518	9,932,888	0.990
36 & Over	4,951,772	5,007,554	0.989
TOTAL	\$ 252,747,924	\$ 254,523,838	0.993



Section IV – Demographic Assumptions

OTHER ASSUMPTIONS

ADMINISTRATIVE EXPENSE LOAD: Currently, estimated budgeted administrative expenses of 0.42% of payroll are added to the normal cost rate. Over the study period actual administrative expenses as a percentage of payroll have averaged about 0.46% of payroll, and in the most recent year it was 0.52%. **We recommend increasing the administrative expense load added to the normal cost rate from 0.42% to 0.50% of payroll.**

OPTION FACTORS: Per statute, optional payment forms are to be actuarially equivalent to the normal form of payment based on the mortality tables and investment rate of return (discount rate) used in the valuation. **We recommend that the factors be revised to be based on the proposed mortality table and investment rate of return assumption recommended for the valuation.**

LINE-OF-DUTY DEATH ASSUMPTION: Currently, it is assumed that 75% of active member deaths are non-line of duty and 25% of active member deaths are in the line of duty. Since we do not have sufficient data regarding the type of death, and since the number of active member deaths is relatively small, **we recommend no change be made to this assumption.**

LINE-OF-DUTY DISABILITY ASSUMPTION: Currently, it is assumed that 75% of disability retirements are non-line of duty and 25% of disability retirements are in the line of duty. Since the total number of disability retirements is relatively small, **we recommend no change be made to this assumption.**

PERCENT MARRIED: Currently, for the purposes of valuing pre-retirement survivor benefits, 85% of members are assumed to be married. Since we do not have sufficient data to analyze this assumption, **we recommend no change be made at this time.**

SPOUSE AGE DIFFERENCE: Currently, for married members, it is assumed a male is four years older than his spouse. **We have reviewed this assumption and recommend no changes at this time.**



Appendix A – Historical December CPI (U) Index

Year	CPI (U)	Year	CPI (U)
1961	30.0	1990	133.8
1962	30.4	1991	137.9
1963	30.9	1992	141.9
1964	31.2	1993	145.8
1965	31.8	1994	149.7
1966	32.9	1995	153.5
1967	33.9	1996	158.6
1968	35.5	1997	161.3
1969	37.7	1998	163.9
1970	39.8	1999	168.3
1971	41.1	2000	174.0
1972	42.5	2001	176.7
1973	46.2	2002	180.9
1974	51.9	2003	184.3
1975	55.5	2004	190.3
1976	58.2	2005	196.8
1977	62.1	2006	201.8
1978	67.7	2007	210.036
1979	76.7	2008	210.228
1980	86.3	2009	215.949
1981	94.0	2010	219.179
1982	97.6	2011	225.672
1983	101.3	2012	229.601
1984	105.3	2013	233.049
1985	109.3	2014	234.812
1986	110.5	2015	236.525
1987	115.4	2016	241.432
1988	120.5	2017	246.524
1989	126.1		



Appendix B – Capital Market Assumptions and Asset Allocation

**Gavion’s Capital Market Assumptions and
City of Chattanooga’s Board of Trustees Asset Allocation**

Arithmetic Real Rates of Return and Standard Deviations by Asset Class

Asset Class	Expected Real Rate of Return	Standard Deviation
Large Cap	3.0%	14.7%
Small Cap	4.0%	19.6%
International Equity	4.5%	18.5%
Core Fixed	0.3%	5.7%
High Yield	2.0%	10.4%
International Fixed	(1.5)%	6.5%
Private Debt	4.4%	10.0%
Equity Hedge Funds	3.5%	5.0%
Diversified Hedge Funds	3.0%	4.1%
Private Equity	12.0%	7.5%
Real Estate	3.0%	24.7%

Asset Allocation Targets

Asset Class	Asset Allocation
Large Cap	22.7%
Small Cap	4.9%
International Equity	12.6%
Core Fixed	12.3%
High Yield	4.4%
International Fixed	6.1%
Private Debt	5.1%
Equity Hedge Funds	9.9%
Diversified Hedge Funds	7.5%
Private Equity	3.4%
Real Estate	11.2%



Appendix C – Recommended Rates

Table 1

RATES OF WITHDRAWAL FROM ACTIVE SERVICE

AGE	WITHDRAWAL				
	YEARS OF SERVICE				
	< 2	2 TO 4	5 TO 9	10 TO 14	15 +
20-24	22.0%	20.0%	14.0%	8.0%	2.5%
25-29	22.0%	20.0%	14.0%	8.0%	2.5%
30-34	17.0%	15.0%	14.0%	8.0%	2.5%
35-39	17.0%	13.0%	8.0%	4.0%	2.5%
40-44	15.0%	12.0%	4.5%	3.0%	2.5%
45-49	13.0%	8.0%	4.5%	3.0%	2.0%
50+	13.0%	8.0%	4.5%	2.0%	1.6%



Appendix C – Recommended Rates

Table 2

RATES OF DISABILITY RETIREMENT FROM ACTIVE SERVICE

AGE	DISABILITY
26	0.00100
27	0.00100
28	0.00100
29	0.00100
30	0.00100
31	0.00100
32	0.00100
33	0.00100
34	0.00100
35	0.00100
36	0.00116
37	0.00132
38	0.00148
39	0.00164
40	0.00180
41	0.00196
42	0.00212
43	0.00228
44	0.00244
45	0.00260
46	0.00276
47	0.00292
48	0.00308
49	0.00324
50	0.00340
51	0.00360
52	0.00380
53	0.00400
54	0.00420
55	0.00440
56	0.00440
57	0.00440
58	0.00440
59	0.00440
60	0.00440
61	0.00440
62	0.00000



Appendix C – Recommended Rates

Table 3
RATES OF SERVICE RETIREMENT FROM ACTIVE SERVICE

AGE	STANDARD RATE	RULE OF 80 RATE
45	0.0000	0.1100
46	0.0000	0.1100
47	0.0000	0.1100
48	0.0000	0.1100
49	0.0000	0.1100
50	0.0000	0.1100
51	0.0000	0.1100
52	0.0000	0.1500
53	0.0000	0.1100
54	0.0000	0.1100
55	0.0400	0.1100
56	0.0400	0.1100
57	0.0400	0.1100
58	0.0400	0.1100
59	0.0400	0.1100
60	0.0400	0.1100
61	0.1100	0.2500
62	0.2800	
63	0.2200	
64	0.2000	
65	0.2300	
66	0.2100	
67	0.2000	
68	0.2000	
69	0.2000	
70	0.2000	
71	0.2000	
72	0.2000	
73	0.2000	
74	0.2000	
75	1.0000	



Appendix C – Recommended Rates

**Table 4
RATES OF PRE-RETIREMENT MORTALITY**

AGE	MALES	FEMALES	AGE	MALES	FEMALES
20	0.0608%	0.0174%	68	2.0133%	0.7411%
21	0.0571%	0.0179%	69	2.2121%	0.8179%
22	0.0547%	0.0183%	70	2.4286%	0.9020%
23	0.0532%	0.0189%	71	2.6633%	0.9956%
24	0.0528%	0.0198%	72	2.9190%	1.0987%
25	0.0531%	0.0208%	73	3.1976%	1.2140%
26	0.0540%	0.0219%	74	3.5024%	1.3422%
27	0.0556%	0.0232%	75	3.8385%	1.4856%
28	0.0576%	0.0247%	76	4.2073%	1.6464%
29	0.0599%	0.0263%	77	5.3545%	1.8261%
30	0.0622%	0.0279%	78	5.9185%	3.9190%
31	0.0647%	0.0296%	79	6.5499%	4.3594%
32	0.0669%	0.0313%	80	7.2573%	4.8569%
33	0.0693%	0.0330%	81	8.0472%	5.4173%
34	0.0723%	0.0352%	82	8.9316%	6.0481%
35	0.0760%	0.0377%	83	9.9181%	6.7558%
36	0.0808%	0.0407%	84	11.0175%	7.5441%
37	0.0866%	0.0443%	85	12.2415%	8.4273%
38	0.0939%	0.0486%	86	13.6208%	9.4176%
39	0.1029%	0.0535%	87	15.0774%	10.5241%
40	0.1137%	0.0593%	88	16.5886%	11.7221%
41	0.1260%	0.0660%	89	18.1350%	13.0038%
42	0.1403%	0.0733%	90	19.6938%	14.3557%
43	0.1560%	0.0814%	91	21.2812%	15.7706%
44	0.1732%	0.0901%	92	22.8907%	17.2492%
45	0.1918%	0.0995%	93	24.5311%	18.7873%
46	0.2116%	0.1092%	94	26.1968%	20.3798%
47	0.2327%	0.1194%	95	27.8750%	22.1020%
48	0.2554%	0.1298%	96	29.7248%	23.9825%
49	0.2799%	0.1406%	97	31.7400%	25.9350%
50	0.3066%	0.1520%	98	33.7592%	27.9347%
51	0.3361%	0.1639%	99	35.7603%	29.9623%
52	0.3693%	0.1767%	100	37.7242%	32.0106%
53	0.4074%	0.1903%	101	39.6484%	34.0501%
54	0.4511%	0.2053%	102	41.5090%	36.0779%
55	0.5018%	0.2216%	103	43.2951%	38.0677%
56	0.5606%	0.2396%	104	45.0112%	40.0087%
57	0.6284%	0.2598%	105	46.6383%	41.8879%
58	0.7065%	0.2822%	106	48.1667%	43.6945%
59	0.7957%	0.3074%	107	48.8615%	45.4199%
60	0.8970%	0.3357%	108	49.0038%	47.0575%
61	1.0117%	0.3669%	109	49.1464%	48.6032%
62	1.1185%	0.4013%	110	49.2796%	49.4031%
63	1.2363%	0.4461%	111	49.4279%	49.5220%
64	1.3652%	0.4951%	112	49.5617%	49.6411%
65	1.5065%	0.5487%	113	49.7207%	49.7555%
66	1.6613%	0.6072%	114	49.8402%	49.8801%
67	1.8298%	0.6713%	115	50.0000%	50.0000%



Appendix C – Recommended Rates

**Table 5
RATES OF POST-RETIREMENT MORTALITY
Service Retirements and Beneficiaries**

AGE	MALES	FEMALES	AGE	MALES	FEMALES
20	0.0608%	0.0174%	68	2.2777%	1.4755%
21	0.0571%	0.0179%	69	2.4985%	1.6205%
22	0.0547%	0.0183%	70	2.7420%	1.7796%
23	0.0532%	0.0189%	71	3.0096%	1.9560%
24	0.0528%	0.0198%	72	3.3050%	2.1502%
25	0.0531%	0.0208%	73	3.6316%	2.3667%
26	0.0540%	0.0219%	74	3.9941%	2.6074%
27	0.0556%	0.0232%	75	4.3993%	2.8778%
28	0.0576%	0.0247%	76	4.8499%	3.1833%
29	0.0599%	0.0263%	77	5.3545%	3.5280%
30	0.0622%	0.0279%	78	5.9185%	3.9190%
31	0.0647%	0.0296%	79	6.5499%	4.3594%
32	0.0669%	0.0313%	80	7.2573%	4.8569%
33	0.0693%	0.0330%	81	8.0472%	5.4173%
34	0.0723%	0.0352%	82	8.9316%	6.0481%
35	0.0760%	0.0377%	83	9.9181%	6.7558%
36	0.0808%	0.0407%	84	11.0175%	7.5441%
37	0.0866%	0.0443%	85	12.2415%	8.4273%
38	0.0939%	0.0486%	86	13.6208%	9.4176%
39	0.1029%	0.0535%	87	15.0774%	10.5241%
40	0.1137%	0.0593%	88	16.5886%	11.7221%
41	0.1260%	0.0660%	89	18.1350%	13.0038%
42	0.1403%	0.0733%	90	19.6938%	14.3557%
43	0.1560%	0.0814%	91	21.2812%	15.7706%
44	0.1732%	0.0901%	92	22.8907%	17.2492%
45	0.1918%	0.0995%	93	24.5311%	18.7873%
46	0.3941%	0.1092%	94	26.1968%	20.3798%
47	0.4214%	0.2725%	95	27.8750%	22.1020%
48	0.4510%	0.2921%	96	29.7248%	23.9825%
49	0.4867%	0.3123%	97	31.7400%	25.9350%
50	0.5226%	0.3333%	98	33.7592%	27.9347%
51	0.5589%	0.3554%	99	35.7603%	29.9623%
52	0.5965%	0.3790%	100	37.7242%	32.0106%
53	0.6363%	0.4048%	101	39.6484%	34.0501%
54	0.6793%	0.4334%	102	41.5090%	36.0779%
55	0.7271%	0.4655%	103	43.2951%	38.0677%
56	0.7814%	0.5022%	104	45.0112%	40.0087%
57	0.8434%	0.5440%	105	46.6383%	41.8879%
58	0.9147%	0.5913%	106	48.1667%	43.6945%
59	0.9959%	0.6448%	107	48.8615%	45.4199%
60	1.0882%	0.7046%	108	49.0038%	47.0575%
61	1.1915%	0.7709%	109	49.1464%	48.6032%
62	1.3063%	0.8447%	110	49.2796%	49.4031%
63	1.4332%	0.9262%	111	49.4279%	49.5220%
64	1.5722%	1.0160%	112	49.5617%	49.6411%
65	1.7248%	1.1151%	113	49.7207%	49.7555%
66	1.8926%	1.2240%	114	49.8402%	49.8801%
67	2.0762%	1.3439%	115	50.0000%	50.0000%



Appendix C – Recommended Rates

**Table 6
RATES OF POST-RETIREMENT MORTALITY
Disability Retirements**

AGE	MALES	FEMALES	AGE	MALES	FEMALES
20	0.6337%	0.2175%	68	4.9729%	3.9440%
21	0.6261%	0.2323%	69	5.2181%	4.2237%
22	0.6253%	0.2516%	70	5.4897%	4.5393%
23	0.6308%	0.2757%	71	5.7889%	4.8969%
24	0.6429%	0.3048%	72	6.1189%	5.2991%
25	0.6627%	0.3389%	73	6.4844%	5.7544%
26	0.6905%	0.3779%	74	6.8899%	6.2618%
27	0.7264%	0.4216%	75	7.3412%	6.8283%
28	0.7702%	0.4689%	76	7.8448%	7.4603%
29	0.8207%	0.5187%	77	8.4086%	8.1590%
30	0.8722%	0.5739%	78	9.0405%	8.9219%
31	0.9297%	0.6345%	79	9.7483%	9.7495%
32	0.9911%	0.6999%	80	10.5446%	10.6404%
33	1.0541%	0.7702%	81	11.4300%	11.5835%
34	1.1179%	0.8400%	82	12.4089%	12.5820%
35	1.1834%	0.9123%	83	13.5013%	13.6392%
36	1.2522%	0.9869%	84	14.7048%	14.7642%
37	1.3204%	1.0625%	85	16.0176%	15.9633%
38	1.3968%	1.1387%	86	17.4740%	17.2213%
39	1.4839%	1.1378%	87	18.9029%	18.5221%
40	1.5817%	1.1331%	88	20.3058%	19.8642%
41	1.6933%	1.1238%	89	21.6836%	21.2910%
42	1.7302%	1.1158%	90	23.0140%	22.7662%
43	1.7608%	1.1137%	91	24.2954%	24.2883%
44	1.7883%	1.1206%	92	25.6897%	25.8546%
45	1.8158%	1.1392%	93	27.0762%	27.4571%
46	1.8459%	1.1710%	94	28.4557%	29.0789%
47	1.8808%	1.2170%	95	29.8101%	30.7249%
48	1.9225%	1.2786%	96	31.3613%	32.5043%
49	1.9605%	1.3554%	97	32.9171%	34.3097%
50	2.0058%	1.4466%	98	34.5220%	36.1474%
51	2.0651%	1.5495%	99	36.1707%	38.0139%
52	2.1424%	1.6636%	100	37.8593%	39.7910%
53	2.2403%	1.7827%	101	39.5953%	41.4965%
54	2.3604%	1.9056%	102	41.3988%	43.1340%
55	2.5005%	2.0269%	103	43.1017%	44.6753%
56	2.6595%	2.1446%	104	44.7378%	46.1144%
57	2.8337%	2.2583%	105	46.2850%	47.4576%
58	3.0188%	2.3667%	106	47.7107%	48.0749%
59	3.2100%	2.4741%	107	48.3260%	47.9983%
60	3.4035%	2.5831%	108	48.3843%	47.9460%
61	3.5953%	2.6969%	109	48.4427%	48.2255%
62	3.7840%	2.8207%	110	48.4915%	48.5260%
63	3.9702%	2.9586%	111	48.5551%	48.8184%
64	4.1547%	3.1110%	112	48.9016%	49.1175%
65	4.3441%	3.2833%	113	49.2800%	49.7771%
66	4.5401%	3.4770%	114	49.6214%	99.3918%
67	4.7465%	3.6966%	115	50.0000%	100.0000%



Appendix C – Recommended Rates

Table 7
RATES OF ANTICIPATED SALARY INCREASES

YEARS OF SERVICE	RATES OF INCREASE
< 1	5.25%
1-5	4.75%
6-10	4.25%
11-15	3.75%
16-20	3.50%
21-25	3.25%
26 & Over	3.00%