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City of Philadelphia Municipal Retirement System

Experience Study Results for July 1, 2012 – June 30, 2017

Produced by Cheiron

March 2018

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LETTER OF TRANSMITTAL

March 28, 2018

City of Philadelphia Municipal Retirement System
Two Penn Center Plaza – 16th Floor
Philadelphia, Pennsylvania 19102-1721

Dear Board Members:

At your request, we have completed an experience study of the City of Philadelphia Municipal Retirement System (Retirement System). Our study compares assumed versus actual experience with respect to all demographic and economic assumptions used in the preparation of the Actuarial Valuations for the five-year period from July 1, 2012 through June 30, 2017 in compliance with the Pennsylvanian Municipal Pension Plan Funding Standard and Recovery Act (Act 205) Chapter 2, Section 2.01.

This report presents the results of our study as well as alternative assumptions for consideration to be employed for the July 1, 2018 Actuarial Valuation.

In preparing our report, we relied on information (some oral and some written) supplied by the System's staff. This information includes, but is not limited to, plan provisions, employee data, and financial information. We performed an informal examination of the obvious characteristics of the data for reasonableness and consistency in accordance with Actuarial Standard of Practice No. 23.

To the best of our knowledge, this report has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the Code of Professional Conduct and applicable Actuarial Standards of Practice set out by the Actuarial Standards Board, and that we meet the Qualification Standards, as defined by the American Academy of Actuaries, to render the opinion contained in this report.

This experience study report was prepared solely for the City of Philadelphia Municipal Retirement System for the purposes described herein. This actuarial valuation report is not intended to benefit any third party, and Cheiron assumes no duty or liability to any such party.

Sincerely,
Cheiron

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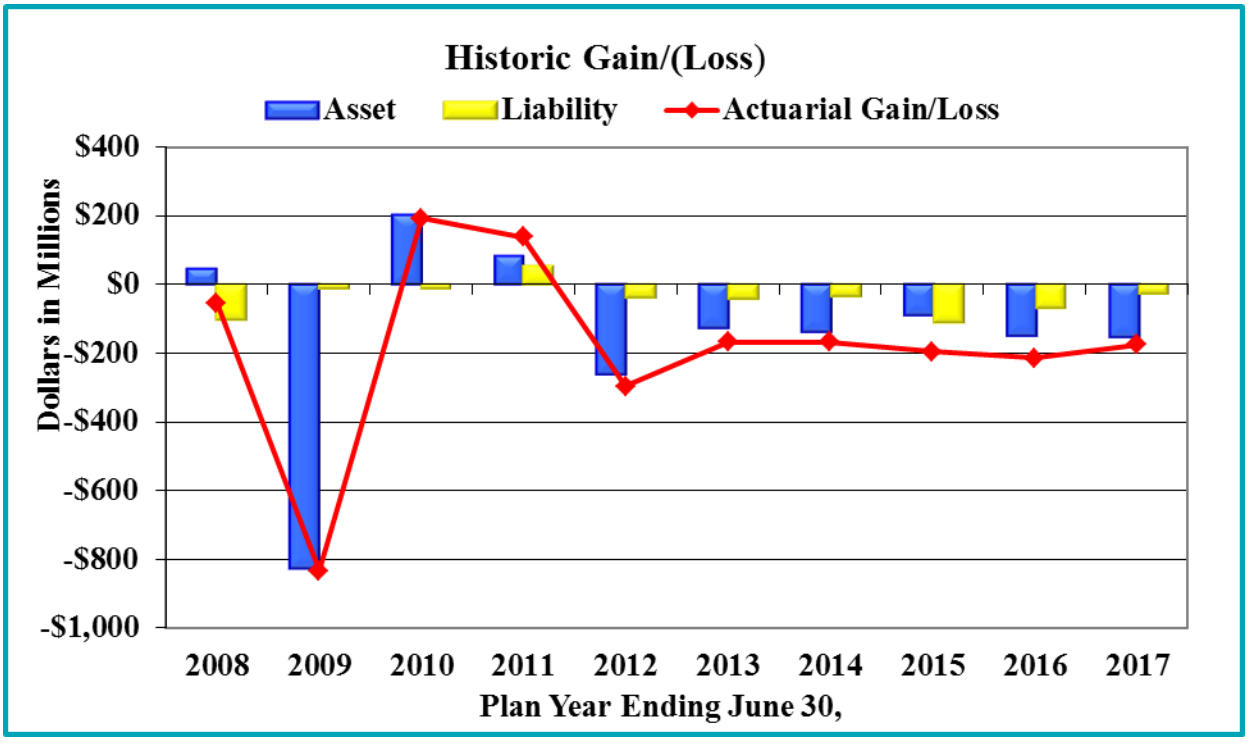
SECTION I – BOARD SUMMARY

Actuarial assumptions (economic and demographic) are intended to be long-term in nature, and should be both individually reasonable and consistent in the aggregate. The purpose of this experience study is to evaluate whether or not the current assumptions adequately reflect the long-term expectations for the City of Philadelphia Municipal Retirement System (the System), and if not, to provide alternatives that might be needed. It is important to note that frequent and significant changes in the actuarial assumptions are not typically recommended, unless there are known fundamental changes in expectations of the economy, or with respect to the System's membership or assets, that would warrant such changes.

We studied the System's experience with respect to both "demographic" and "economic" assumptions. Demographic assumptions deal with expected membership behavior including rates for retirement, termination, disability, and mortality. Economic assumptions deal with the System wide elements such as investment returns, inflation, salary increase rate (salary scale), payroll growth, and administrative expenses. Salary increases can be considered either demographic (membership oriented) or economic (given the inflation component). For this study, we included salary experience under the economic portion of the study.

Before summarizing the key results of our experience study, we present in the graph below a historical review of the deviation of actual experience against anticipated experience based on the assumptions used in past actuarial valuations. The blue bars in the graph represent annual investment experience gains or losses (G/(L)), and the yellow bars represent the annual liability experience gains or losses (G/(L)).



SECTION I – BOARD SUMMARY

In summary, the graph indicates that for nine out of ten years, the assumptions employed in each year's actuarial valuation produced a liability experience loss, which implies the current assumptions may understate liabilities. During the five years of our study the net gain/loss of liabilities relative to our assumptions was approximately $267 million (on average, $54 million per year). There are consistent gains and losses that have partially offset each other. For example, there have been consistent losses from higher than expected salary growth with, lower than expected participant employment terminations and higher than expected liabilities for retirees living longer than expected. These losses are partially offset by lower than expected retirement. We can reasonably anticipate these trends may continue. The average annual liability loss during this ten-year period shown on the graph was $37 million or 0.4% of the average annual actuarial liability of $10.0 billion over that period. While this level of loss may be considered immaterial relative to the total System liabilities, the consistency suggests more conservative assumptions would be appropriate.

On the investment side, the graph indicates that investment performance, based upon the smoothed actuarial value of assets, was less than the assumed rate of return in seven of the ten years. The average annual investment loss over the ten-year period was $140 million or 3.0% of the average annual market value of assets of $4.7 billion over this ten-year period. These losses are primarily due to the market downturn in 2009. The investment assumption has been reviewed and changed almost annually. The data supports this policy as well as continual review and reduction of the long-term investment/discount rate assumption.

Summary of principal experience study results and alternatives:

1. **Retirement –** Rates of retirement were lower than expected for all Plans. There could be a number of factors impacting members' behavior including the current economic environment, the trend for employees to work longer and beyond traditional retirement ages and the cost of medical benefits subsequent to the five years of coverage provide by the City. In addition, there were a significant number of participants who took the Deferred Retirement Option Plan (DROP) during the last experience study which had an effect in the higher retirement rates. It is expected that anticipated future experience is likely to reflect recent experience.

   The changes in retirement assumptions are supported when analyzing the total actual retirements versus expected number of retirements based upon the current assumptions over the five-year testing period. The ratio of actual divided by expected number of retirements during this period demonstrates how well the current assumptions meet the actual experience of the plan. Ideally, this ratio should be about 100% to show that the expected retirements approximately match the actual retirements. However, this ratio analysis must be balanced with the experience graphs (presented within the body of this report) and the data used to determine this ratio, because outlier age groups may skew this ratio accuracy.

SECTION I – BOARD SUMMARY

Table I-1			
Plan	**Actual Retirements**	**Expected Retirements**	**Ratio: Actual/ Expected**
Uniformed Plan 67	376	601	63%
Uniformed Plan 87	379	569	67%
Municipal Plan 67	1,197	1,740	69%
Municipal Plan 87	1,157	1,739	67%

The alternative retirement tables suggested in this report decrease the retirement assumptions for both Plan 67 and Plan 87.

2. **Termination –** This assumption becomes immaterial to Plan 67 members as we anticipate most of them will continue to work until retirement eligible. Therefore, we are proposing that a combined table be created for the 67 and 87 Plan participants to measure the expectation of employment severance prior to retirement eligibility.

   Termination rates were significantly lower than expected for the Uniformed and Municipal Plans. This experience aligns with the results from the last experience study. At the time of the last study, it was considered possible that the experience was a function of the 2009 recession and along with the City's response to allow for workforce reductions through attrition resulting in no changes to these assumptions. However, this trend in lower termination rates continues and at this time could be expected to continue.

   The table below shows how a decline in termination has occurred as it provides the actual versus expected terminations from the Police and Fire Division Plans and the Municipal Division Plans during the period studied.

Table I – 2			
	Actual Terminations	**Expected Terminations**	**Ratio: Actual /Expected**
Uniformed Plans	378	576	66%
Municipal Plans	5,200	6,862	76%

The alternative termination tables suggested in this report decrease the termination assumptions.

3. **Disability** – We continued to combine the males and females for the analysis of the Police and Fire Divisions. The actual rates of disability are higher than the expected rates of disability.

   For the Municipal participants, the rate of disability was higher than expected for females, and lower than expected for males.

SECTION I – BOARD SUMMARY

The table below provides the actual versus expected disabled participants from the Police and Fire Division Plans and the Municipal Division Plans.

Table I – 3

Plan	Actual Disabled Participants	Expected Disabled Participants	Ratio: Actual /Expected
Uniformed Plans	152	142	107%
Municipal Plan Males	127	166	76%
Municipal Plan Females	129	118	109%

Based on this information, we are providing alternative tables that increase the expected disability rates for the Police and Fire Division and Municipal Division female participants and decrease the expected rates for the Municipal Division male participants.

4. **Mortality** – Post-retirement mortality assumptions are typically developed separately by gender for both healthy annuitants and disabled annuitants. Pre-retirement mortality assumptions are also developed separately for males and females. Unlike most of the other demographic assumptions that rely exclusively on the experience of the plan, for mortality, standard mortality tables and projection scales serve as the foundation for the assumption which is then modified to better reflect the Systems experience.

   The Society of Actuaries (SOA) recently completed an extensive mortality study and issued a set of mortality tables named the RP-2014 mortality tables which has replaced the RP-2000 mortality tables.

   In addition, there has been a long history of mortality improvement among pensioners in the U.S., and there is an expectation that mortality rates will continue to improve in the future. The recently completed project by the SOA concluded that mortality improvement in the U.S over the recent past "differed quite noticeably" from the prior standard projection scale (Scale AA). As a result, the MP-2017 scale is the most recent mortality improvement projection scale which has replaced Scale AA.

   The steps in our analysis of the mortality assumptions are as follows:

   1. Select a standard mortality table that is based on experience most closely matching the anticipated experience of the System.
   2. Compare actual experience of the System to what would have been predicted by the selected standard table for the period of the experience study.
   3. Adjust the standard table either fully or partially depending on the level of credibility for the System's experience. This adjusted table is called the base table.
   4. Select an appropriate standard mortality improvement projection scale and apply it to the base table.

SECTION I – BOARD SUMMARY

Similar to the methodology used to develop the RP-2014 tables, when actual experience of the System is compared to that of the standard table, the experience is weighted based on the amount of benefit being paid for post-retirement mortality. Mortality studies in the U.S. have consistently shown that individuals with higher pension benefit have longer life expectancies than individual with lower pension benefit. It is important for a pension plan to use assumptions that are weighted to reflect the impact on liability. We are not using weighted based experience for pre-retirement mortality.

The fourth step described above develops a mortality projection assumption. In the past, the assumption has been static so each time an experience study is performed the assumption has been updated to anticipate additional future improvements in mortality. Based on recent experience, we use the MP-2017 scale projected to 2021 to cover the period to the next experience study.

The following table provides the actual versus expected deaths and the ratio of these values. For each of the separate incidents of mortality, when the ratio is less than 100% it means fewer deaths are occurring than expected and participants are living longer.

Table I – 4

Plan	Mortality Incidents	Actual Deaths	Actual Deaths (Weighted)	Expected Deaths (Weighted)	Ratio: Actual/ Expected
Municipal (M)	Pre-Retirement	109	109	73	149%
Municipal (F)	Pre-Retirement	64	64	55	116%
Municipal (M)	Post-Retirement	1,833	32,759,022	34,569,819	95%
Municipal (F)	Post-Retirement	2,288	21,300,014	24,059,389	89%
Municipal (M)	Post-Disabled	265	3,876,128	4,806,391	81%
Municipal (F)	Post-Disabled	109	1,219,505	1,273,931	96%
Uniformed (M)	Pre-Retirement	44	44	42	105%
Uniformed (F)	Pre-Retirement	9	9	7	138%
Uniformed (M)	Post-Retirement	1,172	27,966,947	27,753,986	101%
Uniformed (F)	Post-Retirement	748	5,938,706	6,105,710	97%
Uniformed (M)	Post-Disabled	364	5,617,600	6,759,542	83%
Uniformed (F)	Post-Disabled	8	143,629	443,869	32%

The alternative mortality tables suggested in this report are based on the steps followed above for the appropriate RP-2014 mortality tables and the MP-2017 mortality improvement projection scale in response to the Retirement System experience.

5. **Salary Increase** - The salary increase rate represents the year over year increase in pay of continuing actives. The current assumption is an annual increase based on the participants' age.

SECTION I – BOARD SUMMARY

Table I-5 below illustrates the five-year average rate of salary increases year over year by five-year age groups broken out by Municipal and Uniformed. The actual salary scale rates are significantly higher for Municipal than the expected salary increase rates over the five-year period.

Table I-5
Average Salary Increases:
Data from Fiscal Years 2012 through 2017

Age	Actual - Municipal	Actual - Uniformed	Expected	Delta - Municipal	Delta - Uniformed
<20	42.29%	12.72%	20.00%	22.29%	-7.28%
20-24	13.86%	12.20%	11.00%	2.86%	1.20%
25-29	9.31%	7.18%	7.00%	2.31%	0.18%
30-34	7.18%	5.26%	5.00%	2.18%	0.26%
35-39	6.33%	4.36%	4.25%	2.08%	0.11%
40-44	5.29%	4.07%	4.00%	1.29%	0.07%
45-49	4.91%	4.00%	3.50%	1.41%	0.50%
50-54	4.29%	4.07%	3.30%	0.99%	0.77%
55-60	4.34%	3.91%	3.00%	1.34%	0.91%
61+	4.52%	3.78%	2.75%	1.77%	1.03%

Based upon the data, we provide an alternative assumption with higher salary increase rates for Municipal and no changes to the assumption currently used for Uniformed.

6. **Investment Return Assumption/Discount Rate** - The discount rate assumption is generally the most significant of all the assumptions employed in actuarial valuations. The discount rate is based on the long-term expected return on plan investments. In the short-term, a higher discount rate results in lower expected contributions. But, over the long term, actual contributions will depend on actual investment returns and not the discount rate (or expected investment returns). If actual investment returns are lower than expected, contribution rates will increase in the future. It is important to set a realistic discount rate so that projections of future contributions for budgeting purposes will not be biased, particularly to be too low.

   The current investment return assumption is 7.70%. While this rate is within the range of a variety of acceptable investment return assumptions, it is appropriate to continue to look at decreasing this assumption as a basis for reducing investment risk and exposure to market volatility as reflected in the long-term discount rate for benefit cash flows and determination of the System's liabilities. We support continual consideration of bringing this rate down thus reducing future relative risk of the System by increasing the liabilities and increasing the likelihood future investment returns will achieve the assumption.

SECTION I – BOARD SUMMARY

7. **Inflation Assumption** – While this assumption does not have a direct impact on the valuation it is an underlying building block of the investment and salary scale assumptions and needs to be reviewed within this study. The current rate of 2.75% is still within the generally accepted range used by other public plans. Although this rate is higher than the recent experience, this can be anticipated to remain a reasonable estimate for the underlying building block for the other related economic assumptions.

8. **Payroll growth assumption –** At this point the payroll growth assumption only impacts the City's Funding Policy contribution as the initial unfunded liabilities are being amortized as a level percent of payroll which is projected to grow at 3.3%.

The alternative assumptions that will ultimately be selected by the Retirement Board are anticipated to be measured for their financial impact and considered for implementation with the July 1, 2018 actuarial valuation which determines the June 30, 2020 fiscal year-end Minimum Municipal Obligation, City Funding Policy and Revenue Recognition Policy contributions.

On the following page we present Table I-6 summarizing all keys findings and alternative assumptions arising from this study.

SECTION I – BOARD SUMMARY

Table I – 6
Possible Changes to Economic and Demographic Assumptions
(All Municipal and Police and Fire Employees)

	Current Assumption	Alternative Assumption
Economic		
Inflation	2.75%	No Change
Investment Return/Discount Rate	7.70%	Continue to review each year
Salary Increase Rate	Salary scale by age	Increase for Municipal (separate table), No change for Uniformed
Payroll Growth	3.30%	No Change
Expenses	Increases annually by 3.3%	No Change
Demographic		
Retirement Rates	Retirement rates by age	Decreases for all Plans
Termination Rates	Termination Rates by Age	Decease for all Plans; combine assumptions for 67 Plans with 87 Plans
Disability Rates	Disability Rates by age	Minor adjustments to all Plans
Active Mortality Rates (Pre-Retirement)	RP-2000 Blue Collar projected to 2017 using Scale AA • Municipal: 5 year set back (males/females) • Uniformed: 2 year set back (males/females)	RP-2014 Employee projected to 2021 • Municipal: rates adjusted by 110% (males) and 115% (females) • Uniformed: Blue collar rates adjusted by 85% (males/females)
Healthy Retiree Mortality Rates (Post-Retirement)	RP-2000 Blue Collar projected to 2017 using Scale AA • All: 1 year set forward (males/females)	RP-2014 Healthy Annuitant projected to 2021 • Municipal: rates adjusted 127% (males) 119% (females) • Uniformed: Blue collar rates adjusted 115% (males/females)
Disabled Mortality Rates (Post-Disabled)	RP-2000 Blue Collar projected to 2017 using Scale AA • Municipal – 1% downward adjustment and 1 year set back (males / females) • Uniformed – 1% upward adjustment and 5 year set back (males/females)	RP-2014 Disabled Annuitant projected to 2021 • Municipal: rates adjusted 95% (males/females) • Uniformed: rates adjusted 80% (males/females)

SECTION I – BOARD SUMMARY

Table I – 6 (continued)
Possible Changes to Economic and Demographic Assumptions
(All Municipal and Police and Fire Employees)

	Current Assumption	Alternative Assumption
Miscellaneous Demographic		
Family Composition	• 70% active/60% retirees with 50% J&S refund of contribution option • Male spouses assumed four-years older than female spouses	• 50% of non-active members assumed married • No changes to active married or spouse age difference
Disability: Ordinary vs Service Connected	• Municipal: 70% Ordinary / 30% Service • Uniformed: 50% / 50%	Increase service connected disability rates • Municipal: 65% / 35% • Uniformed: 25% / 75%
Death: Ordinary vs Service Connected	• Municipal: 98.5% / 1.5% • Uniformed: 92% / 8%	No Change

The financial implications of alternative assumptions will be provided separately to the Board for consideration and opportunity to reflect and weigh in regarding our observations and anticipated long-term trends to support the alternative assumptions suggested.

The balance of this report presents the rationale for the alternatives presented above. In Section II, we present detailed analysis and exhibits supporting the various economic assumptions and alternatives. In Section III, we present detailed analysis and exhibits supporting the various demographic assumptions and alternatives.

SECTION II – ANALYSIS OF ECONOMIC ASSUMPTIONS

Economic Assumptions

We considered the following to be "economic" assumptions in our analysis:

1. Inflation
2. Investment Return/Discount Rate
3. Salary Increase
4. Payroll Growth
5. Expenses

Both the investment and salary increase assumptions are interrelated with the inflation rate. The rate of investment return consists of two components; the "real rate" of return and the inflation component. Similarly, the rate of salary increase is separated into different components: the inflation rate, a merit increase (seniority) and sometimes there is a component set aside for "productivity" gains.

In developing recommendations for these assumptions, several factors are considered:

- historical data in general (i.e. the markets)
- historical experience of the plan
- outlook for the future
- assumptions used by other public sector plans.

1. Inflation

A. Current Assumptions

The inflation rate is an underlying aspect of all economic assumptions. In a growing economy, wages, and investments are expected to grow at the underlying inflation rate plus some additional real growth rate, whether it reflects productivity in terms of wages or risk premiums in terms of investments. The difference between other economic assumptions relative to the long-term underlying rate of inflation is an important measure. The current assumption for inflation is 2.75%.

SECTION II – ANALYSIS OF ECONOMIC ASSUMPTIONS

B. Experience

1. Historical Experience in General

Based on the Consumer Price Index for all Philadelphia-Wilmington-Atlantic City Urban Consumers, Table II-1 on the next page shows the inflation rates for the past 20 years. The current 2.75% rate of inflation exceeds the regional rate of inflation over the last five years (as shown in Table II-1) but it is generally accepted that this is a historically unusual period for this measurement.

Table II-1
Philadelphia/Wilmington/Atlantic City Average (CPI-U)

Year Ending June 30,	Increase in CPI-U
1994	2.72%
1995	2.46%
1996	2.46%
1997	2.34%
1998	1.14%
1999	2.44%
2000	2.61%
2001	3.34%
2002	2.08%
2003	1.83%
2004	4.38%
2005	3.43%
2006	4.44%
2007	1.57%
2008	5.13%
2009	-2.01%
2010	1.91%
2011	2.80%
2012	1.25%
2013	1.51%
2014	1.77%
2015	0.17%
2016	0.12%
2017	0.70%
1998 - 2017	2.02%
2008 - 2017	1.32%
2013 - 2017	0.85%

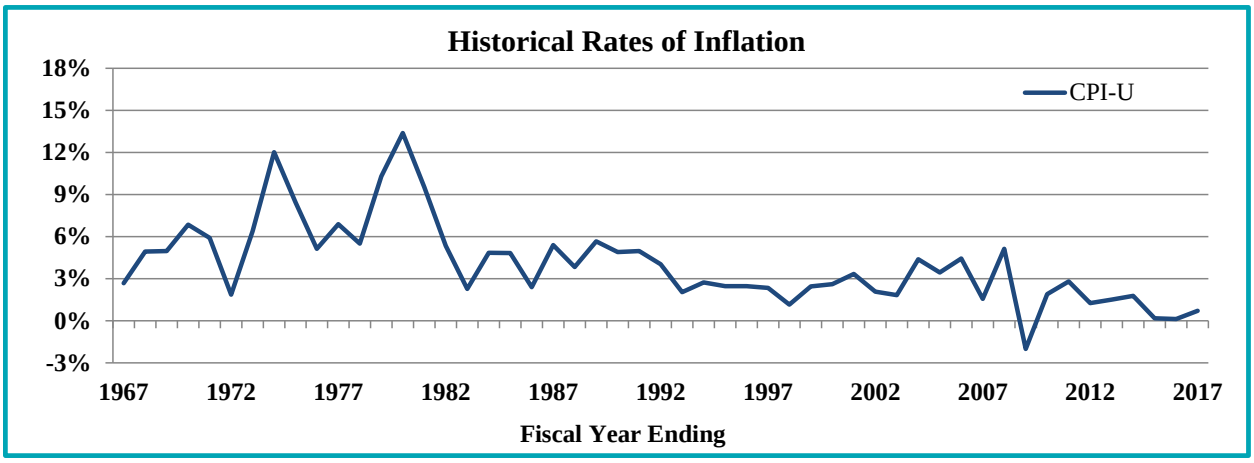
The inflation rates have declined significantly over the past 20 years, especially in the past eleven years due in part to the Federal Reserve's decision to keep treasury rates low to stimulate the economy. However, there are indications that this rate will increase in the future.

SECTION II – ANALYSIS OF ECONOMIC ASSUMPTIONS

2. Market Expectations

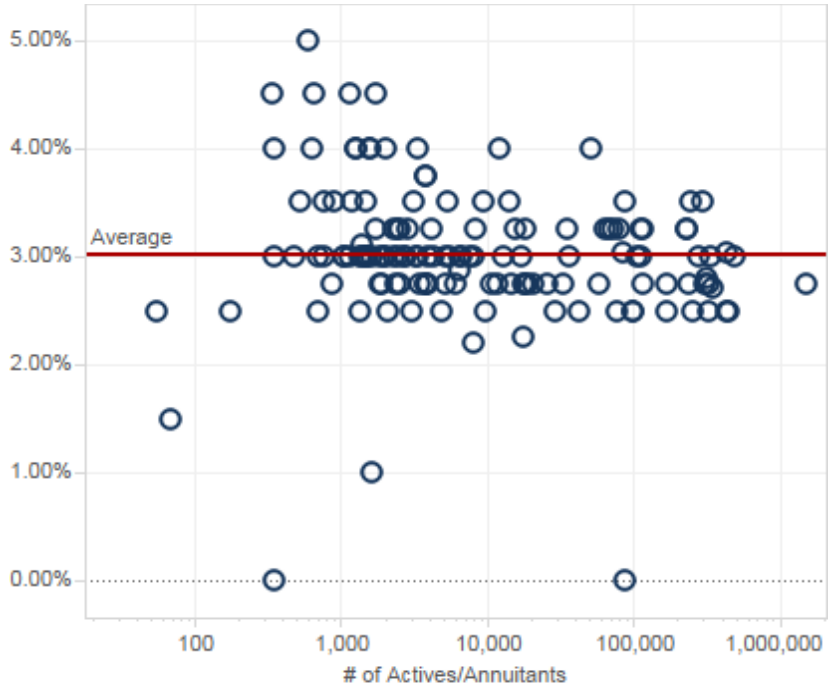
While the market data implies a lower rate the historic data shows much more volatility in the rates and continues to support the current assumption. Over the last 30 years, the geometric average inflation rate has been 2.5%.

Chart II-1



The *National Conference on Public Employee Retirement Systems* (NCPERS) December 2016 Public Retirement Systems Study includes the following graphic of respondents' inflation assumptions:

Chart II-2



SECTION II – ANALYSIS OF ECONOMIC ASSUMPTIONS

This shows that the current 2.75% assumption is lower than the average inflation assumptions used among the 159 systems that responded to this study, with 3.0% as the average. However, we note that 40% of the systems in the two most recent studies reduced their inflation assumption between the 2015 and 2016 studies with an average reduction of 0.39%. The downward trend in this assumption is further supported by the 3.0% average for the 2016 study being a 0.2% reduction from the prior year.

2. Investment Return/Discount Rate

A. Current Assumptions

All Municipal and Police and Fire Employees

The Retirement Systems' assets are assumed to earn 7.70% net of expenses.

B. Experience

1. Historical Experience in General

Table II-2 provides the rates of investment returns experienced by the System during the last ten fiscal years. Rates of return were computed as the ratio of the net investment earnings to market value of asset.

Current Assumption: 7.70% per annum

Table II-2
Investme nt Returns on Market Value of Assets

Year Ending June 30,	Return
2007	16.98%
2008	-4.53%
2009	-19.87%
2010	13.81%
2011	19.40%
2012	0.18%
2013	10.94%
2014	15.70%
2015	0.29%
2016	-3.17%
2017	13.08%
Compounded Averages up to July 1, 2017	
Last 5 Years (2013 - 2017)	7.10%
Last 10 Years (2008 - 2017)	3.91%

SECTION II – ANALYSIS OF ECONOMIC ASSUMPTIONS

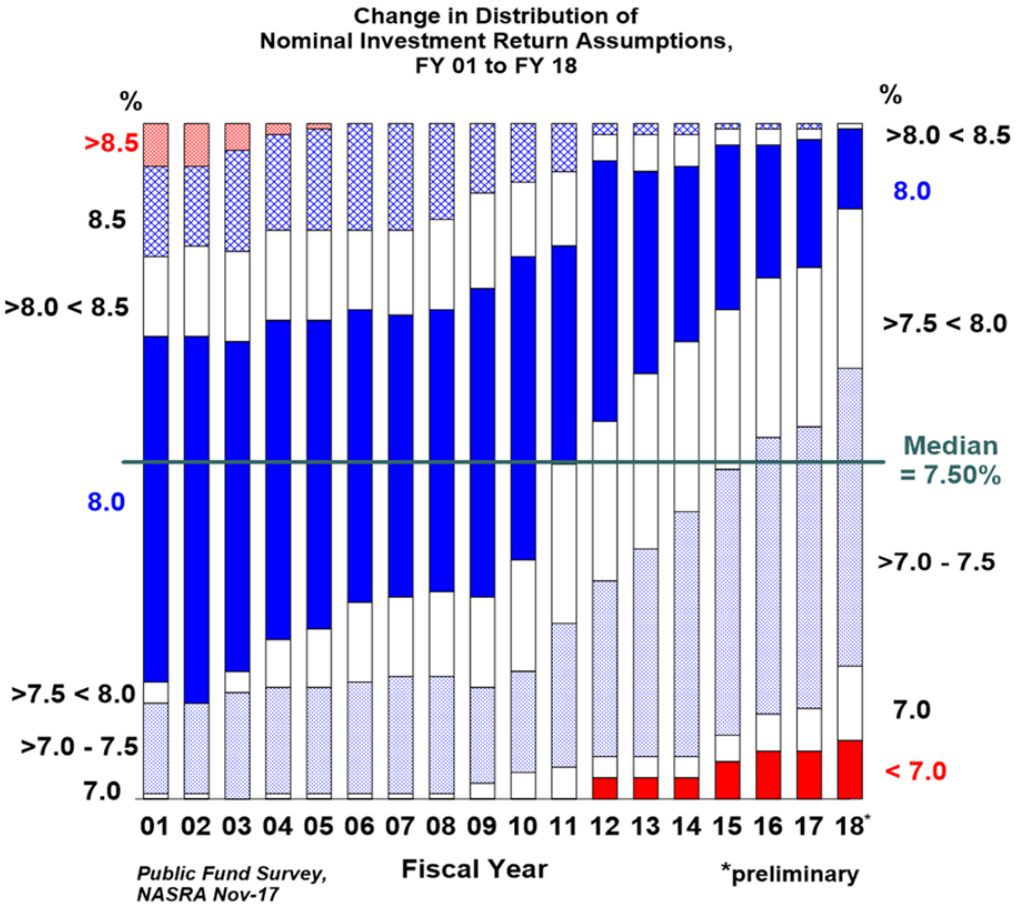
The investment returns on a five- and ten-year basis are lower than the current assumption. The ten-year average still incorporates the financial market decline during 2008 and 2009.

However long-term investment return expectations on assets should not be the sole measure used in the determination of the value of liabilities under the Retirement System. The higher this assumption the greater the risk that the measure of liabilities could be understated and the Retirement System costs will increase in the future. Reducing the investment return/discount rate increases the liability measurement; reducing the risk of future System cost increases.

2. Other Public Sector Plans

The National Association of State Retirement Administrators (NASRA) conducts an annual survey of public funds. The Public Fund Survey covers 126 large retirement systems, including other Pennsylvania systems. Chart II-2 shows the change in the distribution of assumptions since 2001. The median assumption is now 7.50 percent and the number of plans using a discount rate of 7.50 percent or lower has increased significantly.

Chart II- 3



SECTION II – ANALYSIS OF ECONOMIC ASSUMPTIONS

C. Alternatives

All Municipal and Police and Fire Employees

Based on historical returns; both in the general markets and actual for the System, as well as other plans' assumptions, the System's current 7.70% assumption is not outside the range of acceptable investment return assumptions. Based on the System's investment return experience, this trend supports continued consideration to decrease the investment return/discount rate assumption.

3. Salary Increase

A. Current Assumptions

All Municipal and Police and Fire Employees

The current salary increase assumption for all Municipal and Police and Fire employees is an age-based assumption.

B. Experience

All Municipal and Police and Fire Employees

The average salary increase over the testing period is 5.79% for Municipal and 4.76% for Police and Fire participants resulting in 5.39% combined rate. If we compare the salary increases of both divisions combined to the salary increase that we expected, we can see that the actual increase was significantly lower. The Table II-3 below shows the total salary increase rate experienced by the System during the five-year study period.

Table II-3
Average Salary Increases - Data from Fiscal Years 2012 through 2017

Age	Municipal	Police and Fire	Combined	Current
<20	42.29%	12.72%	35.50%	20.00%
20-24	13.86%	12.20%	13.26%	11.00%
25-29	9.31%	7.18%	8.43%	7.00%
30-34	7.18%	5.26%	6.34%	5.00%
35-39	6.33%	4.36%	5.41%	4.25%
40-44	5.29%	4.07%	4.70%	4.00%
45-49	4.91%	4.00%	4.53%	3.50%
50-54	4.29%	4.07%	4.23%	3.30%
55-60	4.34%	3.91%	4.26%	3.00%
61+	4.52%	3.78%	4.46%	2.75%
Total Average Increase	5.79%	4.76%	5.39%	N/A

SECTION II – ANALYSIS OF ECONOMIC ASSUMPTIONS

C. Recommendations

All Municipal and Police and Fire Employees

Actual increases have been significantly higher for Municipal than the expected salary increase rate. Based upon the data, we provide an alternative assumption with higher salary increase rates for Municipal and no changes to the assumption currently used for Uniformed.

D. Results

The following Table II – 4 and corresponding graph shows the age-based salary increase rate that might be applied.

Appendix A provides more detailed information on the salary increase experience over the study period.

Table II-4
Average Salary Increases - Data from Fiscal Years 2012 through 2017

Age	Municipal	Current	Alternative - Municipal Only
<20	42.29%	20.00%	20.00%
20-24	13.86%	11.00%	18.00%
25-29	9.31%	7.00%	10.00%
30-34	7.18%	5.00%	7.00%
35-39	6.33%	4.25%	5.75%
40-44	5.29%	4.00%	5.00%
45-49	4.91%	3.50%	4.60%
50-54	4.29%	3.30%	4.35%
55-60	4.34%	3.00%	4.10%
61+	4.52%	2.75%	3.50%
Total Average Increase	5.79%	N/A	N/A

SECTION II – ANALYSIS OF ECONOMIC ASSUMPTIONS

Chart II- 4

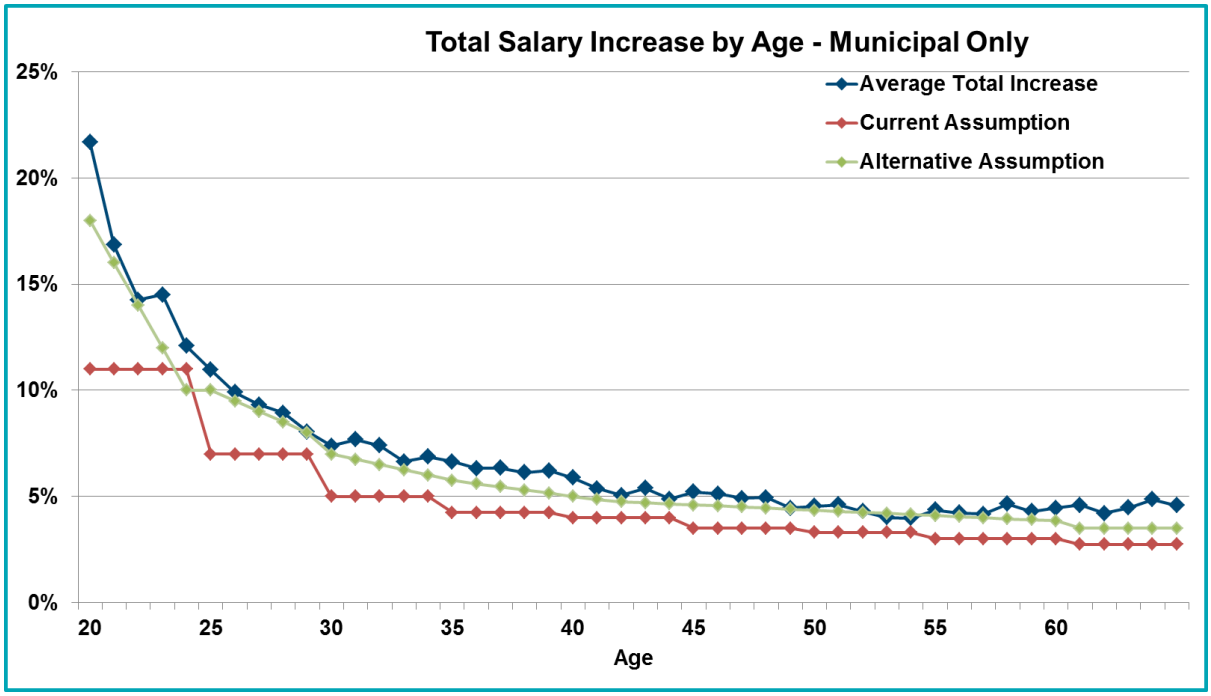
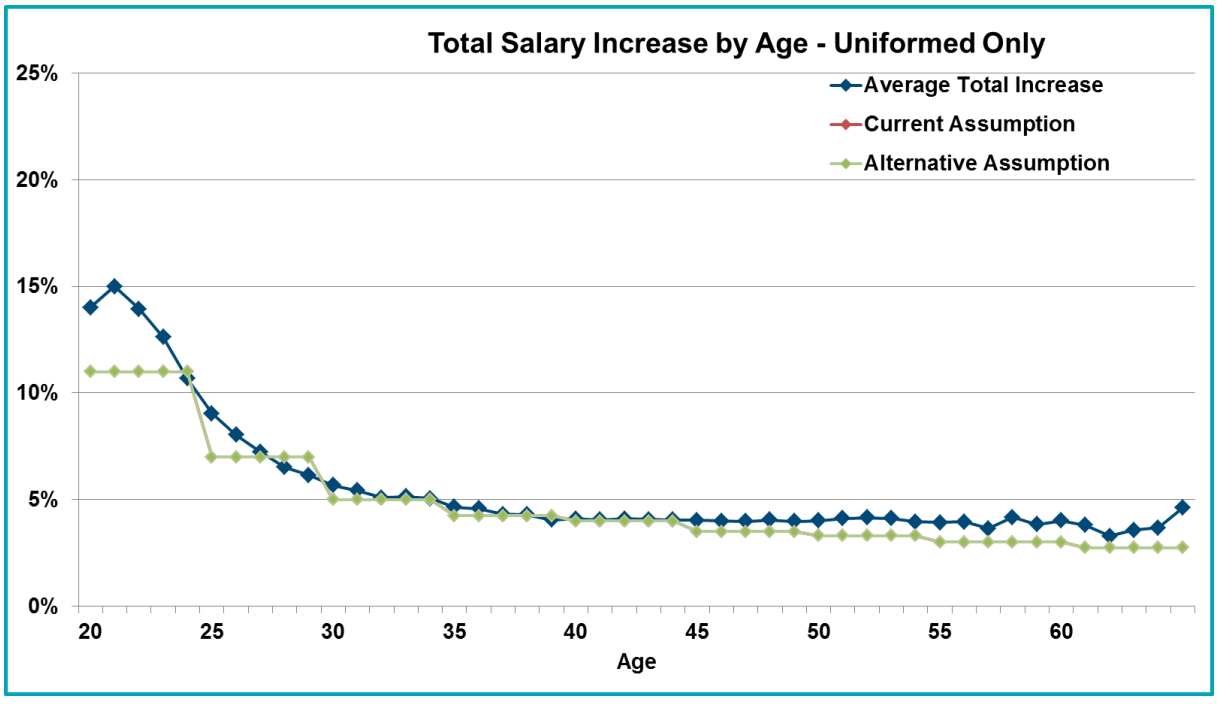


Chart II- 5



SECTION II – ANALYSIS OF ECONOMIC ASSUMPTIONS

4. Payroll Growth Rate

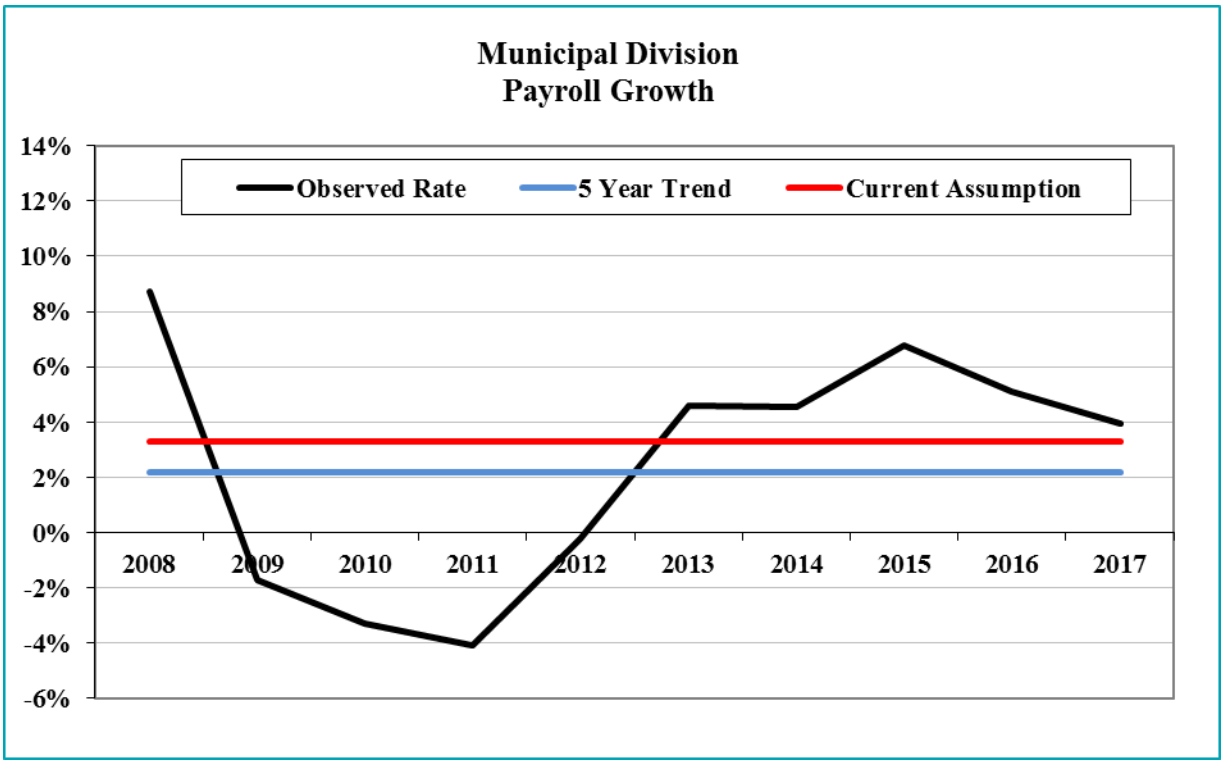
A. Current Assumptions

All Municipal and Police and Fire Employees
The Systems' total payroll growth assumption is currently 3.3%. This assumption represents the assumed growth in payroll, which includes not only the continuing active participants' year over year increases, but also the participants employed for only a short period of time. It is a reflection of both payroll growth and number of employees covered by the System.

B. Experience

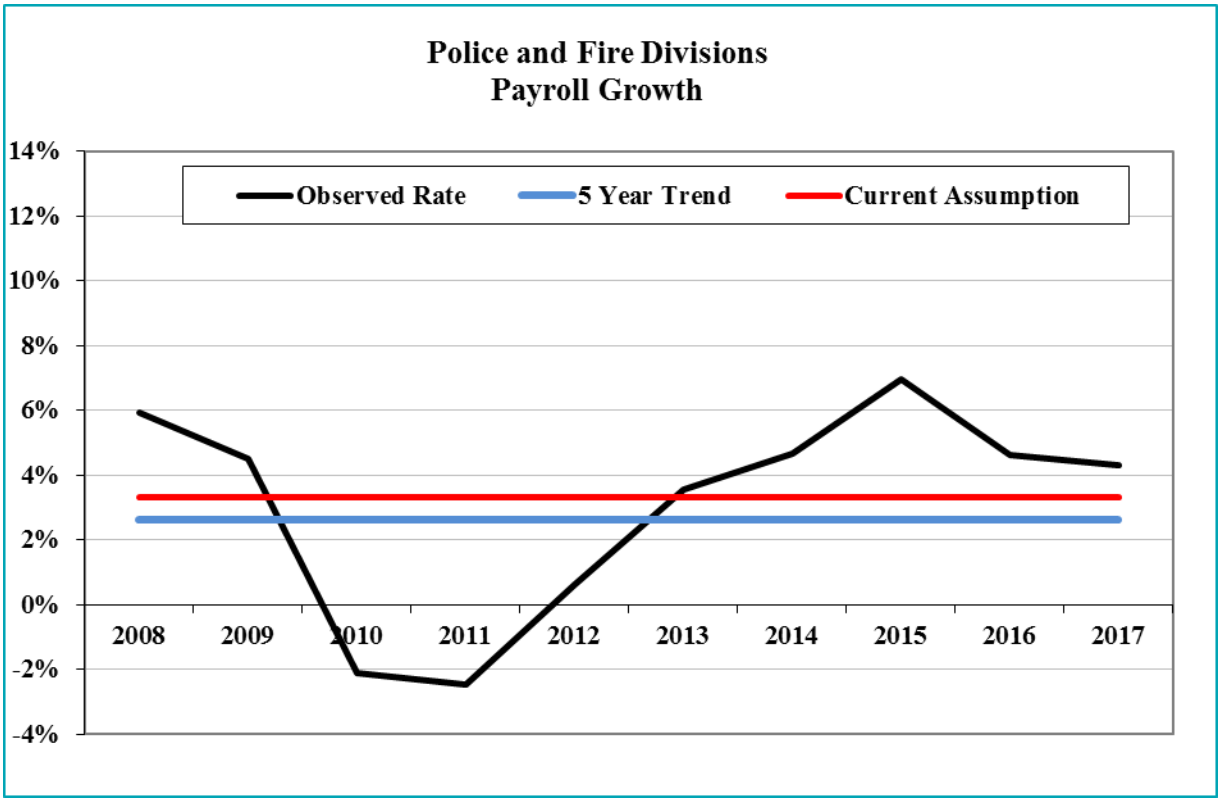
The Systems' total payroll growth since 2012 was greater than expected. However, for the Municipal Division, the average of the five-year trend (running five-year averages over last ten years) is about 2.16% while for the Police and Fire Divisions this is about 2.64%. The following graphs show the experience, the five-year trend, and the current assumption for Municipal and Police and Fire Divisions.

Chart II- 6



SECTION II – ANALYSIS OF ECONOMIC ASSUMPTIONS

Chart II- 7



C. Recommendations

All Municipal and Police and Fire Employees

While it may still be high compared to the long-term averages it is a reflection of reductions in total workforce during the period which has since leveled off. At this time, this assumption may continue to be appropriate reflecting long-term expectations of the City. This assumption only impacts the amortization of the initial unfunded liability base under the City's Funding Policy, the rollforward of the expected expenses and our projection modeling.

5. Administrative Expenses

A. Current Assumptions

The expense assumption is based on the average of the administrative expenses from the past year incurred by the plan. This amount is then rolled forward to the following year based on the payroll growth assumption.

B. Recommendation

This assumption is reviewed and updated every year based upon the Plan's experience, thus no change is provided at this time.

SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Demographic Assumptions

In Section III we present similar information with respect to the demographic assumptions. We present the key findings of our experience review of the demographic assumptions used by the System, including alternative assumptions for consideration. The demographic assumptions included in this review are:

1. Retirement
2. Termination from Active Employment (Other than Death, Disability, or Retirement)
3. Disability
4. Mortality (Active, Retired Healthy, and Retired Disabled)
5. Family Composition
6. Disability: Ordinary vs Service Connected
7. Death: Ordinary vs Service Connected

For each of the first four sets of assumptions noted above, we determined an actual to expected occurrence ratio at each age (sometimes further segregated by gender). For example, for Municipal Plan 67 there are 1,321 participants who were age 55 during the study period of which 403 retired. Based on the assumption in place during the study, 594 of the 1,321 participants were expected to retire. Therefore the ratio of actual to expect retirees is 68% (403 divided by 594). Another way to say this is, 32% less members retired than expected during the study period.

If the "actual to expected" ratio is greater than one, the assumption may be too low; if it is less than one, the assumption may be too high.

The tables and graphs in each section compare three items:

1. the number of participants eligible to have the occurrence (such as retirement),
2. the number of participants expected to have the occurrence (such as retire) based on the current assumptions (illustrated in red), and,
3. the number of participants expected to have the occurrence based on the alternative assumptions (illustrated in green)
4. The "actual to expected" ratios for items 2 and 3.

The alternative assumptions bring the ratios closer to one, which means the number of participants we expect for an occurrence under the alternative assumptions is closer to the actual number of participants who had the occurrence.

SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Part of our analysis is dependent on whether there is sufficient data to represent a true trend in participant behavior. We call this credibility, determining whether there are enough participants exposed to an event like mortality or disability to reflect a real distinction from say national statistics over just the exposures within the System. To determine this we perform statistical analysis and create a "confidence level" around the data. If this confidence level is relatively high we can say the data reflects a real trend.

We calculate the 90 percent confidence interval, which represents the range within which the true decrement rate during the experience study period falls with 90 percent confidence. (If there is insufficient data to calculate a confidence interval, the confidence interval is shown as the entire range of the graph.) We generally propose assumption changes when the current assumption is outside the 90 percent confidence interval of the observed experience. However, adjustments are made to account for differences between future expectations and historical experience, to account for the past experience represented by the current assumption, and to maintain a neutral to slight conservative bias in the selection of the assumption. For mortality rates, we compare the System's experience to that of a standard table and adjust the standard table to the extent the System's experience is large enough to be credible.

We also calculate an r-squared statistic for each assumption. R-squared measures how well the pattern of the assumption fits the pattern of the actual data and can be thought of as the percentage of the variation in actual data explained by the assumption. Ideally, r-squared would equal 100 percent although this is never the case. Generally, alternative assumption changes should increase the r-squared compared to the current assumption making it closer to 100 percent unless the pattern of future decrements is expected to be different from the pattern experienced during the period of study.

Also, we aggregate participants for the demographic assumption review when the data at individual ages is no longer credible. For example, for the retirement assumption review for Municipal 67, participants 70+ are aggregated because analyzing the retirement trends for active participants 70 and older at each age would not provide credible data. By aggregating the data at 70+, there are more participants in this group which creates a smaller confidence interval.

Typically, we would like the assumptions to fall within the confidence interval, especially if this confidence interval is narrow. At the same time, it is important not to change an assumption too much from the previous assumption because anomalies in the data that occurred for one or two years could skew the results. Therefore, suggested alternative assumptions are updated by reviewing the prior assumptions and the current confidence intervals as well as participant behavior that is believed to be inconsistent with the past and future behavior due to external factors at the time.

When applying the assumptions to the data at the end points (for example, age 70+ for Municipal 67 retirement assumption review), the current assumptions and alternative assumptions will often fall outside the confidence interval. This is to be expected due to the aggregation of the data at these points and is the one exception to the general goal of choosing assumptions that will be within the confidence interval.

SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

1. Retirement

A. Current Assumptions

All Municipal Employees

Normal Retirement assumptions for City Municipal employees under Plan 67 start at age 55, regardless of service. Under Plan 87, Normal Retirement starts at age 60 with ten years of service with the exception of those in the Elected group, which start at age 55 with ten years of service.

All Police and Fire Employees

Normal Retirement assumptions for City Police and Fire employees under Plan 67 start at age 45, regardless of service. Under Plan 87, Normal Retirement starts at age 50 with ten years of service.

The current retirement rates for all employee groups vary based on age. Once a Municipal employee, or a Police and Fire employee, reaches age 70, we assume 100% probability of retirement.

B. Experience

All Municipal, Police and Fire Employees

The current assumptions for all employee groups are based on age. Overall, for Municipal and the Police and Fire employees in all Plans, the actual retirements during the study period were lower than expected (see the Results section outlined in item D below). The experience shows lower ratios of actual to expected retirements at almost all ages for all Plans.

C. Alternative

All Municipal, Police and Fire Employees

We propose increasing the rates for Police, Fire and Municipal in all Plans.

The alternative retirement rates are provided in the next section.

D. Results

The following Table III - 1 provides the average age at retirement for those new retirees during the year by Division over the past five years. The average age for “All Retirements” is the average age at retirement for all retirees in the system as of July 1, 2017 (regardless of their date of retirement).

SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-1
Average Retirement Ages for New Retirees Each Year

Year Ending June 30	Municipal Division	Police and Fire Division	Total
2013	61.0	58.8	60.3
2014	60.8	56.2	59.9
2015	62.0	57.4	61.0
2016	61.9	58.2	60.8
2017	61.9	57.7	60.9
All Retirements*	59.8	52.6	57.3

*Average retirement age for all retirees as of July 1, 2017

This table shows us that overall the average retirement ages are slowly increasing.

The following tables and graphs compare three items; the number of people eligible for retirement, the number of people expected to retire based on the current assumptions, and the number of people expected to retire based on the alternative assumptions. Also, the tables show the calculation of actual-to-expected (A/E) ratios and the r-squared statistic.

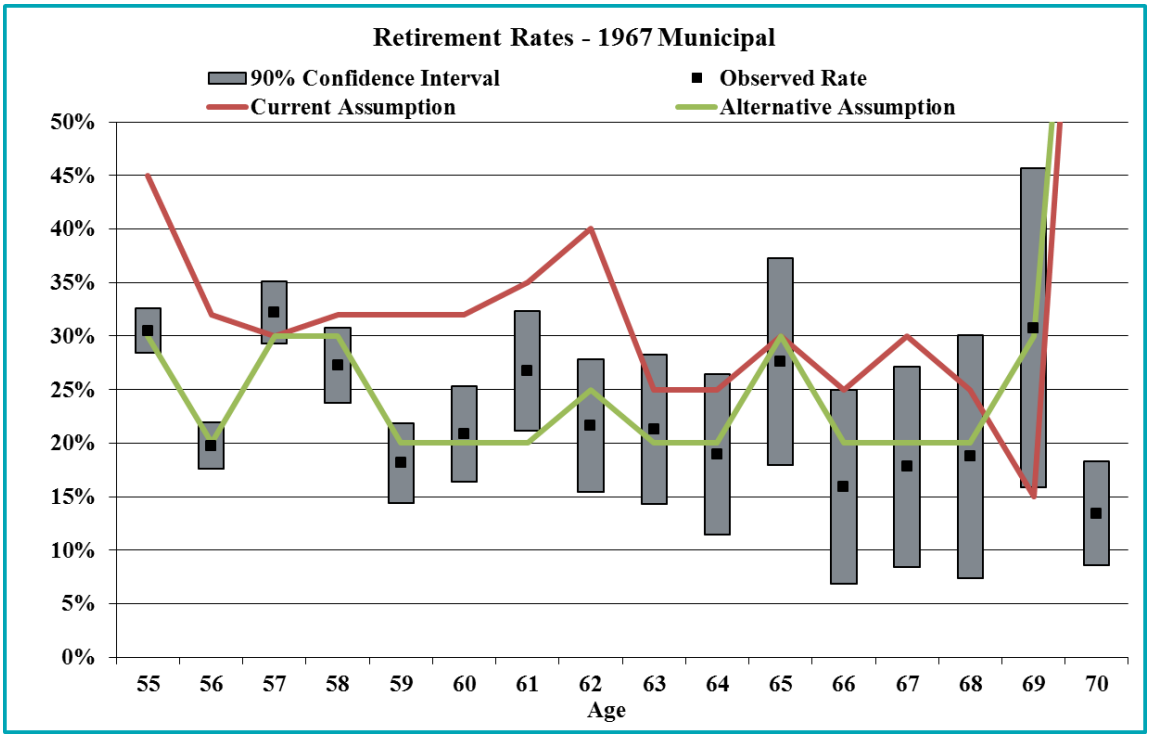
In all Plans, the data shows lower actual retirement rates than expected under the current assumption which was based on prior experience. The alternative assumption decreases the assumed rates of retirement to be more in-line with the confidence intervals and increases the aggregate A/E ratio to be closer to 100%.

SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-R1

Retirement Rates - 1967 Municipal						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Alternative	Current	Alternative
55	1,321	403	594	396	68%	102%
56	916	181	293	183	62%	99%
57	699	225	210	210	107%	107%
58	436	119	140	131	85%	91%
59	292	53	93	58	57%	91%
60	225	47	72	45	65%	104%
61	172	46	60	34	76%	134%
62	120	26	48	30	54%	87%
63	94	20	24	19	85%	106%
64	74	14	19	15	76%	95%
65	58	16	17	17	92%	92%
66	44	7	11	9	64%	80%
67	45	8	14	9	59%	89%
68	32	6	8	6	75%	94%
69	26	8	4	8	205%	103%
70	134	18	134	134	13%	13%
Total	**4,688**	**1,197**	**1,740**	**1,305**	**69%**	**92%**
R-squared			**0.9261**	**0.9260**		

Chart III-R1

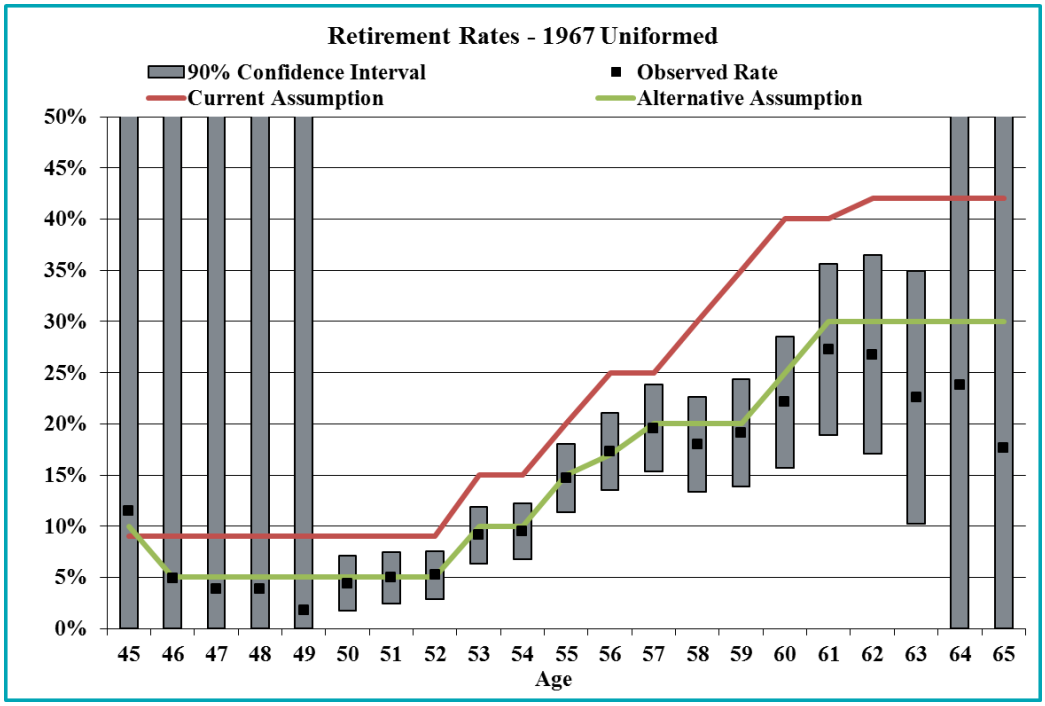


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-R2

Retirement Rates - 1967 Uniformed						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Alternative	Current	Alternative
45	26	3	2	3	128%	115%
46	41	2	4	2	54%	98%
47	52	2	5	3	43%	77%
48	78	3	7	4	43%	77%
49	112	2	10	6	20%	36%
50	159	7	14	8	49%	88%
51	201	10	18	10	55%	100%
52	249	13	22	12	58%	104%
53	296	27	44	30	61%	91%
54	315	30	47	32	63%	95%
55	306	45	61	46	74%	98%
56	272	47	68	46	69%	102%
57	235	46	59	47	78%	98%
58	189	34	57	38	60%	90%
59	152	29	53	30	55%	95%
60	113	25	45	28	55%	88%
61	77	21	31	23	68%	91%
62	56	15	24	17	64%	89%
63	31	7	13	9	54%	75%
64	21	5	9	6	57%	79%
65	17	3	7	5	42%	59%
Total	**2,998**	**376**	**601**	**404**	**63%**	**93%**
R-squared			**0.9650**	**0.9932**		

Chart III-R2

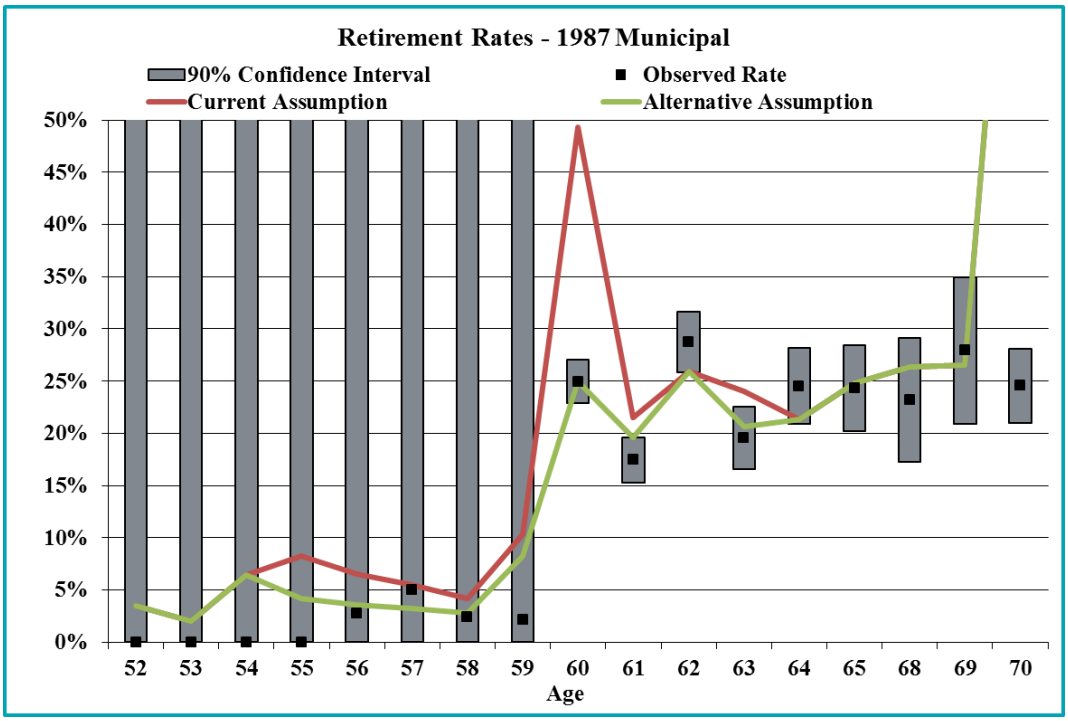


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-R3

Retirement Rates - 1987 Municipal						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Alternative	Current	Alternative
52	4	0	0	0	0%	0%
53	5	0	0	0	0%	0%
54	9	0	1	1	0%	0%
55	22	0	2	1	0%	0%
56	36	1	2	1	43%	78%
57	40	2	2	1	92%	156%
58	42	1	2	1	57%	86%
59	47	1	5	4	21%	26%
60	1,183	295	583	296	51%	100%
61	831	145	178	163	81%	89%
62	647	186	168	168	111%	111%
63	475	93	114	98	82%	95%
64	375	92	80	80	115%	115%
65	292	71	72	72	98%	98%
66	239	60	60	60	100%	100%
67	184	50	48	48	104%	104%
68	138	32	36	36	88%	88%
69	111	31	29	29	105%	105%
70	395	97	356	356	27%	27%
Total	**5,075**	**1,157**	**1,739**	**1,417**	**67%**	**82%**
R-squared			**0.7969**	**0.6687**		

Chart III-R3

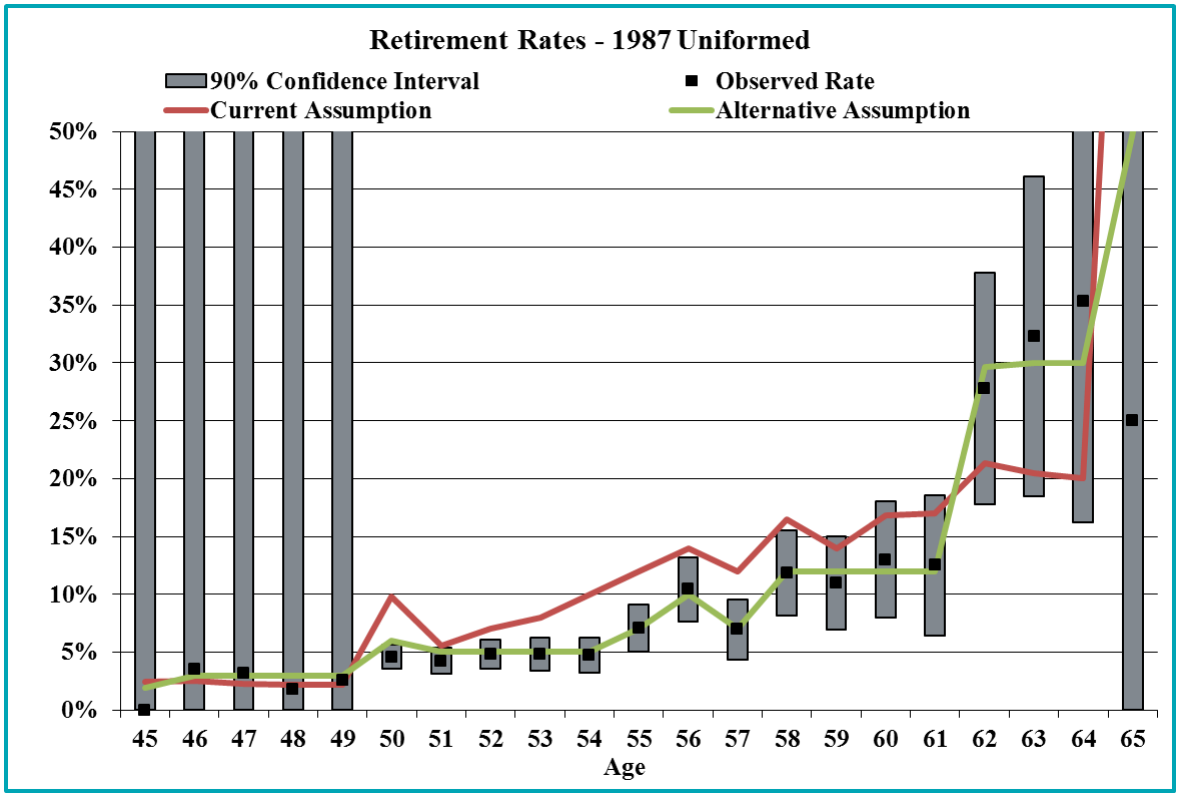


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-R4

Retirement Rates - 1987 Uniformed						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Alternative	Current	Alternative
45	48	0	1	1	0%	0%
46	113	4	3	3	138%	118%
47	156	5	4	5	142%	107%
48	165	3	4	5	83%	61%
49	192	5	4	6	118%	87%
50	1,065	49	104	64	47%	77%
51	916	39	51	46	77%	84%
52	770	37	54	39	68%	95%
53	617	30	49	31	61%	97%
54	506	24	51	25	47%	94%
55	423	30	51	30	59%	101%
56	326	34	46	33	75%	104%
57	258	18	31	18	58%	99%
58	211	25	35	25	72%	99%
59	164	18	23	20	79%	92%
60	123	16	21	15	77%	109%
61	80	10	14	10	74%	104%
62	54	15	11	16	130%	94%
63	31	10	6	9	157%	108%
64	17	6	3	5	176%	118%
65	4	1	4	2	25%	50%
Total	**6,239**	**379**	**569**	**407**	**67%**	**93%**
R-squared			**0.9076**	**0.9696**		

Chart III-R4



SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

2. Termination from Active Employment

A. Current Assumptions

All Municipal, Police and Fire Employees
Current termination assumptions for all Municipal, Police and Fire employees are age based. Under Plan 67, the rates are set to zero at ages 55 and above for the Municipal Division reflecting the point in time when retirement assumptions are expected to take over for turnover. Under Municipal Plan 87, the rates are set to zero at ages 71 and above accounting for the service requirement for retirement under this plan for Municipal and Elected. Due to very limited termination data for the Plan 67 participants as a greater portion become retirement eligible, termination data for Plan 67 was combined with Plan 87 to determine one set of termination assumptions for each group under the alternative assumptions.

B. Experience

All Municipal, Police and Fire Employees

Overall, the termination rates were lower for all ages than expected. The experience produces similar results to the prior experience study when the assumptions were lower than expected. The rates were not adjusted down at the last experience study because the results may have been driven by the economic down-turn in 2008 and 2009. However, the most recent experience continues to support the decrease in termination rates but the alternative adjustments are tempered based upon the expected future behavior of the active participants.

In addition to overall lower termination rates, the actual termination experience for Police and Fire Division reflects a small number of participants at the later ages (50+).

For Plan 67, the data is no longer credible. Therefore, it is recommended to combine the Plan 67 and Plan 87 data for review of the termination rates. Overall, the combined termination rates were lower than expected.

C. Alternative

All Municipal, Police and Fire Employees

Based on the limited credible data for Plan 67, we suggest combining the data from the Plan 67 and Plan 87 groups to have one termination rate assumption for all Municipal members and one termination rate for all Police Officers and Fire Fighters. The current termination rates may be lowered to some extent, but we do not suggest a large change in the termination assumptions. This is further supported by the fact that the termination rates for all Plans were right in line with the experience observed in the prior experience study.

The next section shows the proposed assumptions for both Municipal and Police and Fire employees over the study period.

SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

D. Results

The following tables and graphs compare three items; the number of people eligible for the termination decrement, the number of people expected to terminate based on the current assumptions, and the number of people expected to terminate based on the alternative assumptions. Also, the tables show the calculation of actual-to-expected (A/E) ratios and the r-squared statistic.

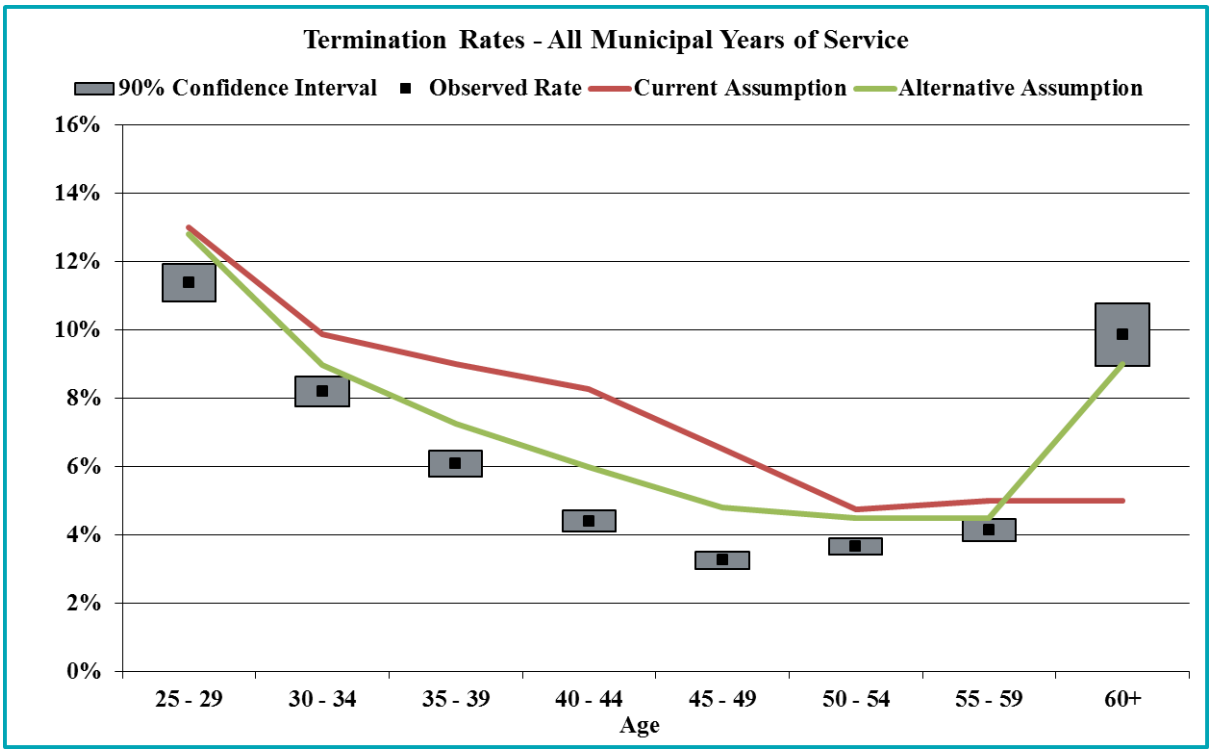
In all Plans, the data shows lower actual termination rates than expected under the current assumption which was based on prior experience. The alternative assumption decreases the assumed rates of termination to be more in-line with the confidence intervals and increases the aggregate A/E ratio to be closer to 100%.

SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-T1

Termination Rates - All Municipal Years of Service						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Alternative	Current	Alternative
<25	2,428	450	472	426	95%	106%
25 - 29	8,840	1,007	1,151	1,131	88%	89%
30 - 34	10,403	853	1,029	934	83%	91%
35 - 39	10,397	633	935	755	68%	84%
40 - 44	11,513	506	951	687	53%	74%
45 - 49	13,676	445	891	655	50%	68%
50 - 54	16,649	610	791	749	77%	81%
55 - 59	9,973	413	499	449	83%	92%
60+	2,867	283	143	258	197%	110%
Total	**86,746**	**5,200**	**6,862**	**6,044**	**76%**	**86%**
R-squared			**0.3567**	**0.7973**		

Chart III-T1

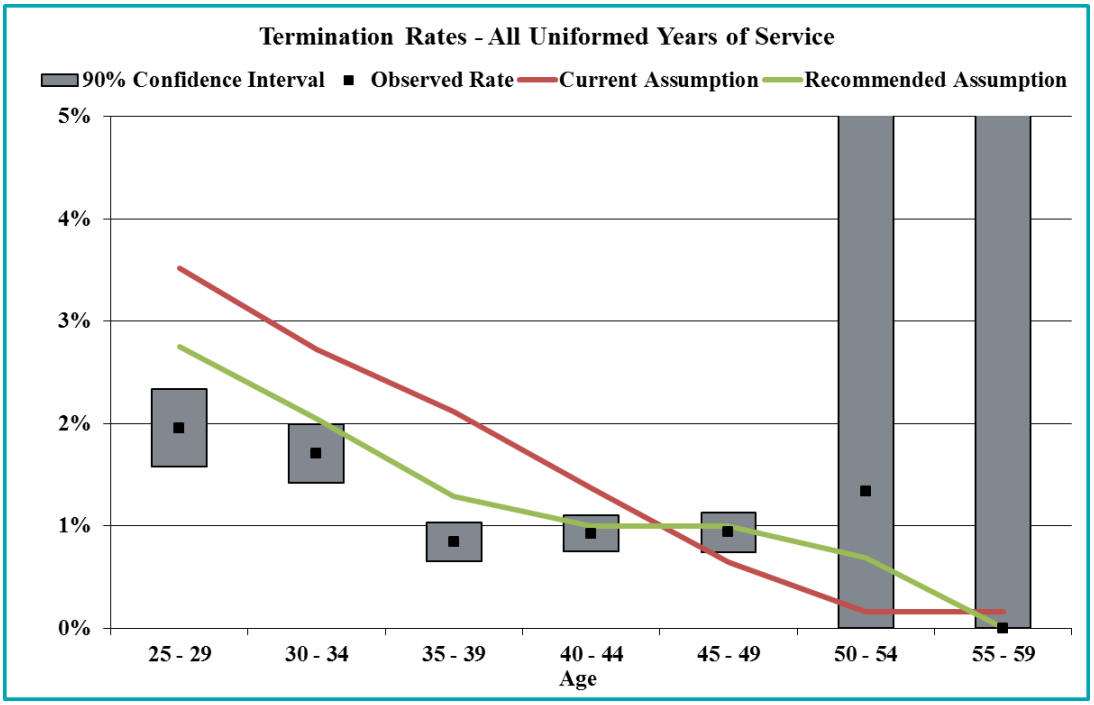


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-T2

Termination Rates - All Uniformed Years of Service						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Alternative	Current	Alternative
<25	682	26	19	24	136%	109%
25 - 29	3,678	72	129	101	56%	71%
30 - 34	5,456	93	149	111	63%	83%
35 - 39	6,172	52	131	80	40%	65%
40 - 44	7,672	71	105	77	68%	93%
45 - 49	6,728	63	43	67	146%	94%
50 - 54	75	1	0	1	833%	194%
55 - 59	21	-	0	-	0%	0%
60+	8	-	0	-	0%	0%
Total	**30,492**	**378**	**576**	**461**	**66%**	**82%**
R-squared			**0.6480**	**0.8055**		

Chart III-T2



SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

3. Disability

A. Current Assumptions

All Municipal, Police and Fire Employees

Current assumptions for all Municipal, Police and Fire employees are based on age. The rates are set to zero to reflect retirement eligibility at age 60 and above for all Municipal employees and at age 55 and above for all Police and Fire employees. This is done because the benefits for retirement and disability are equal.

B. Experience

All Municipal, Police and Fire Employees

The study shows that the actual number of male participants becoming disabled for the Municipal Division was lower than expected. The actual number of female participants becoming disabled for the Municipal Division and the Police and Fire Divisions was close to the current assumption.

C. Alternative

All Municipal, Police and Fire Employees

We suggest decreasing the assumptions for the males in the Municipal Plan. We also suggest an adjustment in assumptions for the females in the Municipal Plan and Police and Fire Division Plans.

In addition, due to the experience of some participants becoming disabled for Police and Fire Divisions between ages 55-59, the alternative assumptions provide rates for this age group.

D. Results

The following tables and graphs compare three things; the number of participants eligible to become disabled, the number of people expected to become disabled based on the current assumptions, and the number of participants expected to become disabled based on the alternative assumptions. Also, the tables show the calculation of actual-to-expected (A/E) ratios and the r-squared statistic.

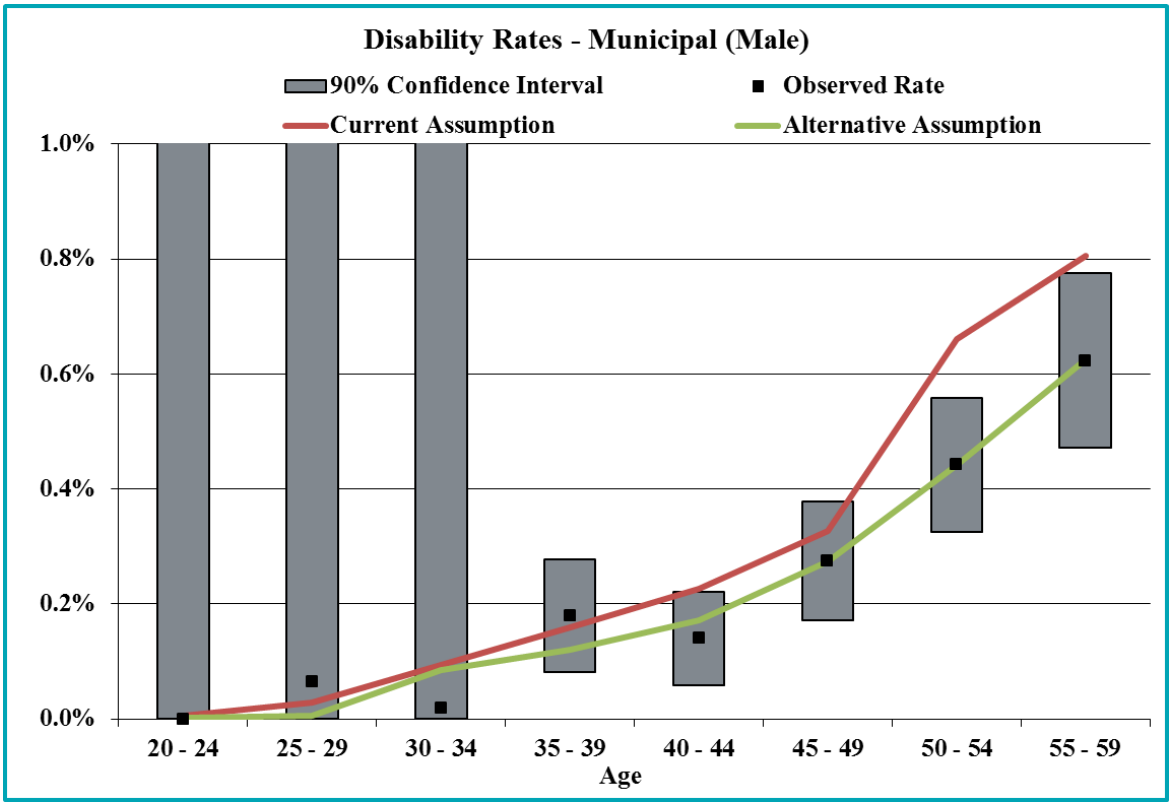
The data shows lower actual disability rates to be close to the expected under the current assumption which was based on prior experience. The alternative assumption makes adjustments to the assumed rates of disability to be more in-line with the confidence intervals and increases the aggregate A/E ratio to be closer to 100%.

SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-D1

Disability Rates - Municipal (Male)						
Age Band	Exposures	Disabilities			Actual to Expected Ratios	
		Actual	Current	Alternative	Current	Alternative
20 - 24	1,303	0	0	0	0%	0%
25 - 29	4,607	3	1	0	230%	1068%
30 - 34	5,232	1	5	4	20%	22%
35 - 39	5,012	9	8	6	112%	150%
40 - 44	5,706	8	13	10	62%	82%
45 - 49	6,930	19	23	19	84%	100%
50 - 54	8,821	39	58	39	67%	100%
55 - 59	7,220	45	58	45	77%	100%
60 +	4,085	3	-	-	0%	0%
Total	**48,916**	**127**	**166**	**124**	**76%**	**103%**
R-squared			**0.7984**	**0.7952**		

Chart III-D1

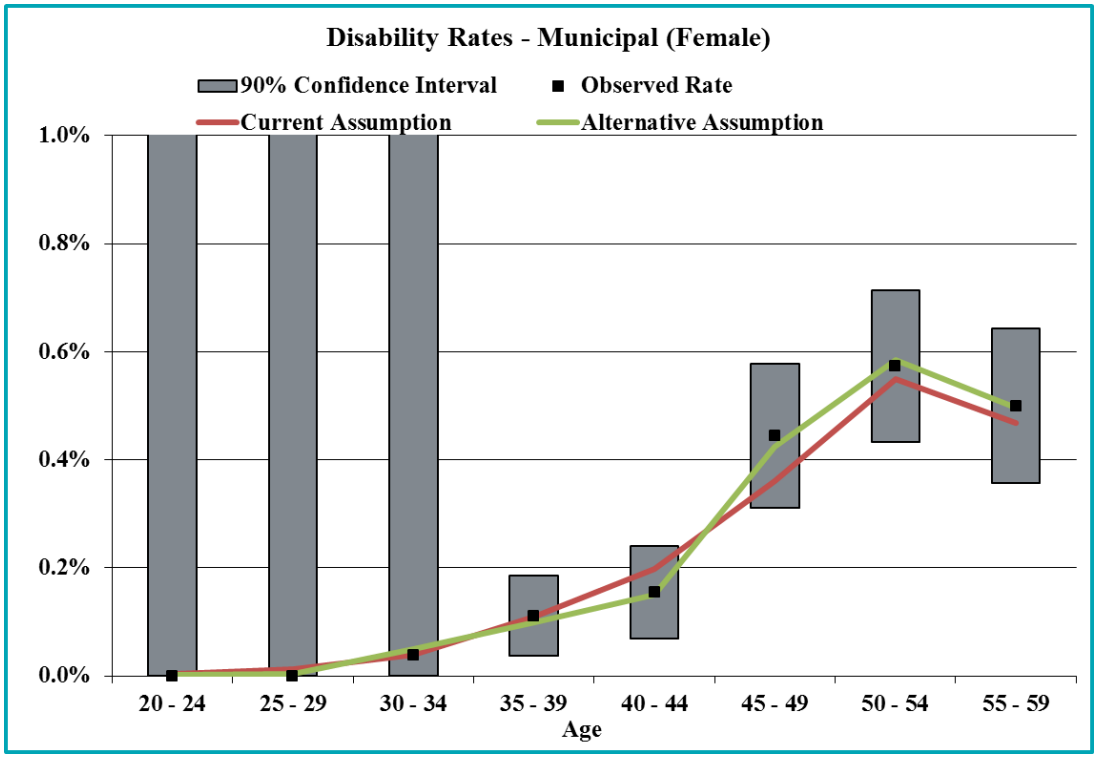


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-D2

Disability Rates - Municipal (Female)						
Age Band	Exposures	Disabilities			Actual to Expected Ratios	
		Actual	Current	Alternative	Current	Alternative
20 - 24	1,125	0	0	0	0%	0%
25 - 29	4,233	0	1	0	0%	0%
30 - 34	5,171	2	2	3	99%	77%
35 - 39	5,386	6	6	5	102%	112%
40 - 44	5,807	9	12	9	78%	103%
45 - 49	6,749	30	24	29	123%	105%
50 - 54	7,851	45	43	46	104%	98%
55 - 59	6,604	33	31	33	107%	101%
60 +	4,676	4	-	-	0%	0%
Total	**47,602**	**129**	**118**	**124**	**109%**	**104%**
R-squared			**0.6605**	**0.6989**		

Table III-D2

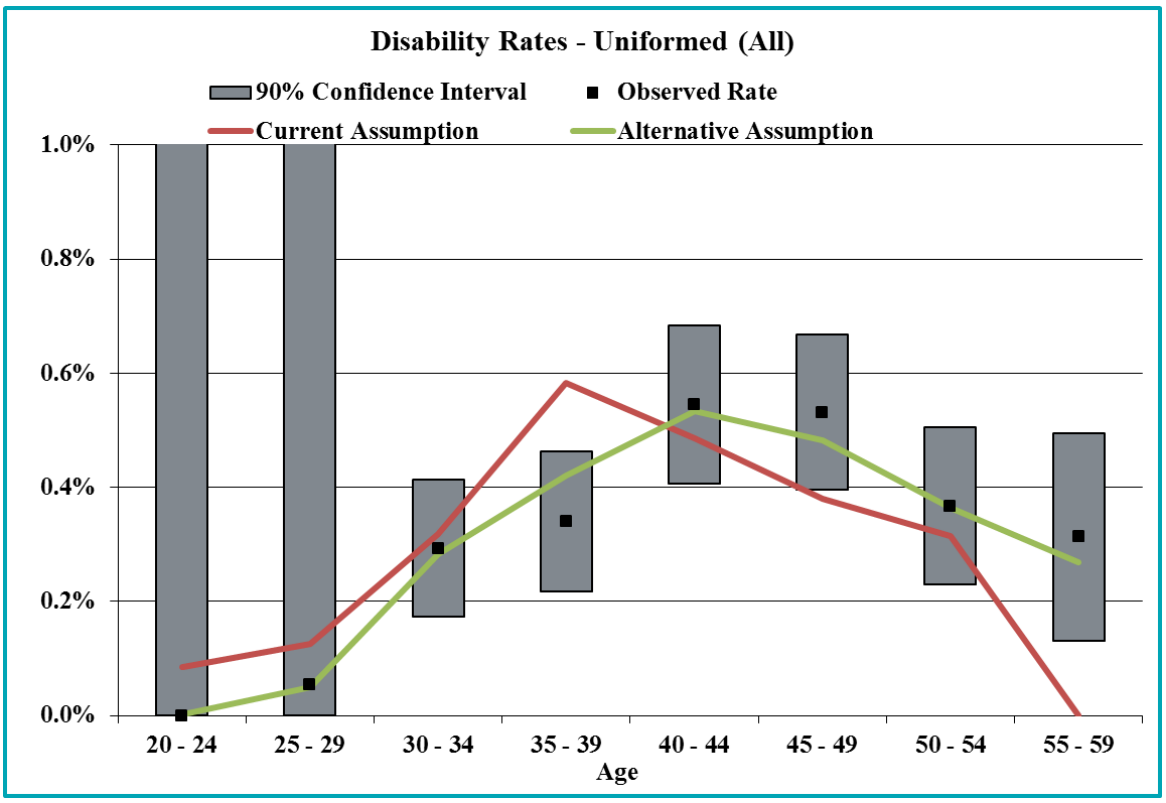


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-D3

Disability Rates - Uniformed (All)						
Age Band	Exposures	Disabilities			Actual to Expected Ratios	
		Actual	Current	Alternative	Current	Alternative
20 - 24	682	0	1	0	0%	0%
25 - 29	3,678	2	5	2	43%	109%
30 - 34	5,456	16	17	15	92%	104%
35 - 39	6,172	21	36	26	58%	81%
40 - 44	7,703	42	37	41	112%	102%
45 - 49	7,711	41	29	37	140%	110%
50 - 54	5,169	19	16	19	117%	101%
55 - 59	2,557	8	-	7	0%	117%
60 +	670	3	-	-	0%	0%
Total	**39,798**	**152**	**142**	**147**	**107%**	**103%**
R-squared			**0.6328**	**0.7799**		

Table III-D3



SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

4. Mortality

A. Current Assumptions

All Municipal, Police and Fire Employees Active Lives

For all members, the standard RP 2000 with Blue Collar adjustment, projected 17 years using Scale AA is used. For the Municipal males and females, this table is set back five years, and the Police and Fire females are set back two years.

All Municipal, Police and Fire Retired Healthy Lives

For all members, the standard RP 2000 with Blue Collar adjustment, projected 17 years using Scale AA is used. For the Municipal and Police and Fire Division males and females, this table is set forward one year.

All Municipal, Police and Fire Retired Disabled Lives

For all members, the standard RP 2000 with Blue Collar adjustment, projected 17 years using Scale AA is used. For the Municipal males and females, this table is set back one year, with a 1% downward adjustment. For the Police and Fire Divisions males and females, this table is set back five years, with a 1% upward adjustment.

B. Experience

All Municipal, Police and Fire Employees Active Lives

Deaths among active lives are typically small and may not provide meaningful statistics on pre-retirement mortality in a five-year period broken out between males and females. However, for the Municipal Division, there were about 50,000 exposures for each gender which provides a large enough sampling to analyze each group separately. The actual mortality rates were higher than the expected for both groups.

For the Police and Fire Divisions, the exposures were about 32,000 for males and only 7,000 for females. While the male group has a more sizable sample and is sufficient to complete analysis on the mortality rates, the female population is smaller. Nevertheless, both groups had higher mortality rates than expected.

Due to the higher death rates for the active females, the Police and Fire Division having similar modifications to the RP 2014 tables for the active male and female participants is reasonable if the analysis for both genders supports these similar modifications.

SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

All Municipal, Police and Fire Retired Healthy Lives

Mortality for retirees and beneficiaries gives us a larger group to analyze actual versus expected experience. The tables in the next section, split by male and females, show actual and expected experience among members for retirees and beneficiaries combined. The actual mortality among retirees and beneficiaries (male and female) for Municipal, Police and Fire members is lower than expected.

All Municipal, Police and Fire Retired Disabled Lives

Mortality for disabled lives gives us an even smaller group to analyze actual versus expected experience. However, based upon the data, the actual mortality among disabled lives (male and female) for both Municipal and Police and Fire members was lower than expected.

Similar to the active Police and Fire Division, the female disabled population is very small. Due to the lower death rates for the disabled females, the Police and Fire Division having similar modifications to the RP 2014 tables for the disabled male and female participants is reasonable if the analysis for both genders supports these similar modifications.

C. Alternatives

All Municipal, Police and Fire Employees Active Lives

The current assumptions for active mortality are the same as those for retired annuitant mortality. There is a large body of evidence that active employees have lower mortality rates than retirees of the same age. The current assumption is based on an adjusted version of the RP-2000 table that blends active and retiree experience for the overlapping ages. In the development of the RP-2014 table, the decision was made not to provide a blended table because the use of separate tables was more accurate and the appropriate blending factors varied by plan. We use a separate active adjusted RP-2014 Employee mortality table for the alternative assumptions. In addition, for the Police and Fire Divisions, we use a Blue Collar adjusted table which provides a better fit for this group.

Finally, the mortality tables have a mortality projection assumption using MP-2017 projected from base year of 2006 to 2021. This mortality improvement projection builds in the current improvements to the mortality as well as some expected future mortality improvements.

All Municipal, Police and Fire Retired Healthy Lives

Similar to the active assumption, the current assumption is based on an adjusted version of the RP-2000 table that blends active and retiree experience for the overlapping ages. We use a separate retired adjusted RP-2014 Healthy Annuitant mortality table for the alternative assumptions. In addition, for the Police and Fire Divisions, we use a Blue Collar adjusted table which provides a better fit for this group.

SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Finally, the mortality tables have a mortality projection assumption using MP-2017 projected from base year of 2006 to 2021. This mortality improvement projection builds in the current improvements to the mortality as well as some expected future mortality improvements.

All Municipal, Police and Fire Retired Disabled Lives

The current assumption is based on an adjusted version of the RP-2000 table. We use an adjusted Disabled Retiree RP-2014 mortality table for the alternative assumptions.

Finally, the mortality tables have a mortality projection assumption using MP-2017 projected from base year of 2006 to 2021. This mortality improvement projection builds in the current improvements to the mortality as well as some expected future mortality improvements.

D. Results

The following tables and graphs compare three things; the number of people exposed to the mortality assumption, the number of people expected to die based on the current assumptions, and the number of people expected to die based on the alternative assumptions. Note, for the non-active analysis, the experience is weighted based on the amount of benefit being paid. Also, the tables show the calculation of actual-to-expected (A/E) ratios.

For the non-active analysis, the data shows lower actual mortality rates than expected under the current assumption which was based on prior experience. The alternative assumption decreases the assumed rates of mortality based on the adjusted RP-2014 tables projected to 2021 to be more in-line with the confidence intervals and increases the aggregate A/E ratio to be closer to 100%.

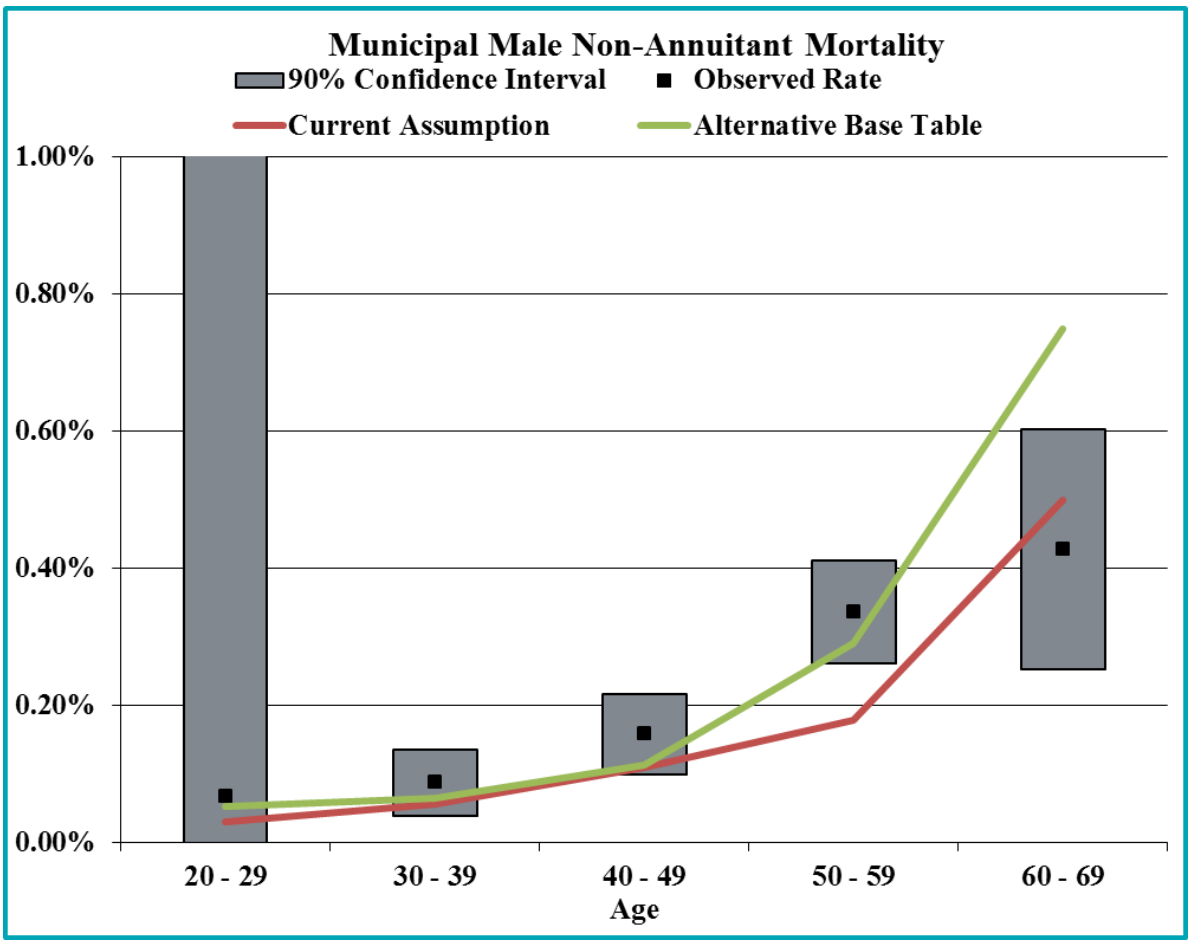
SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Active Mortality Analysis

Table III-M1

Municipal Non-Annuitant Mortality - Base Table for Males										
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths				Actual to Expected Ratios		
				Actual	Current	Standard	Alternative	Current	Standard	Alternative
20 - 29	5,910	4	5,910	4	2	3	3	217%	142%	129%
30 - 39	10,244	9	10,244	9	6	6	7	154%	149%	135%
40 - 49	12,636	20	12,636	20	14	13	14	143%	153%	139%
50 - 59	16,041	54	16,041	54	29	42	47	189%	128%	116%
60 - 69	3,740	16	3,740	16	19	25	28	86%	63%	57%
70 +	345	6	345	6	4	5	5	145%	123%	112%
Total	**48,916**	**109**	**48,916**	**109**	**73**	**95**	**104**	**149%**	**115%**	**105%**

Chart III-M1

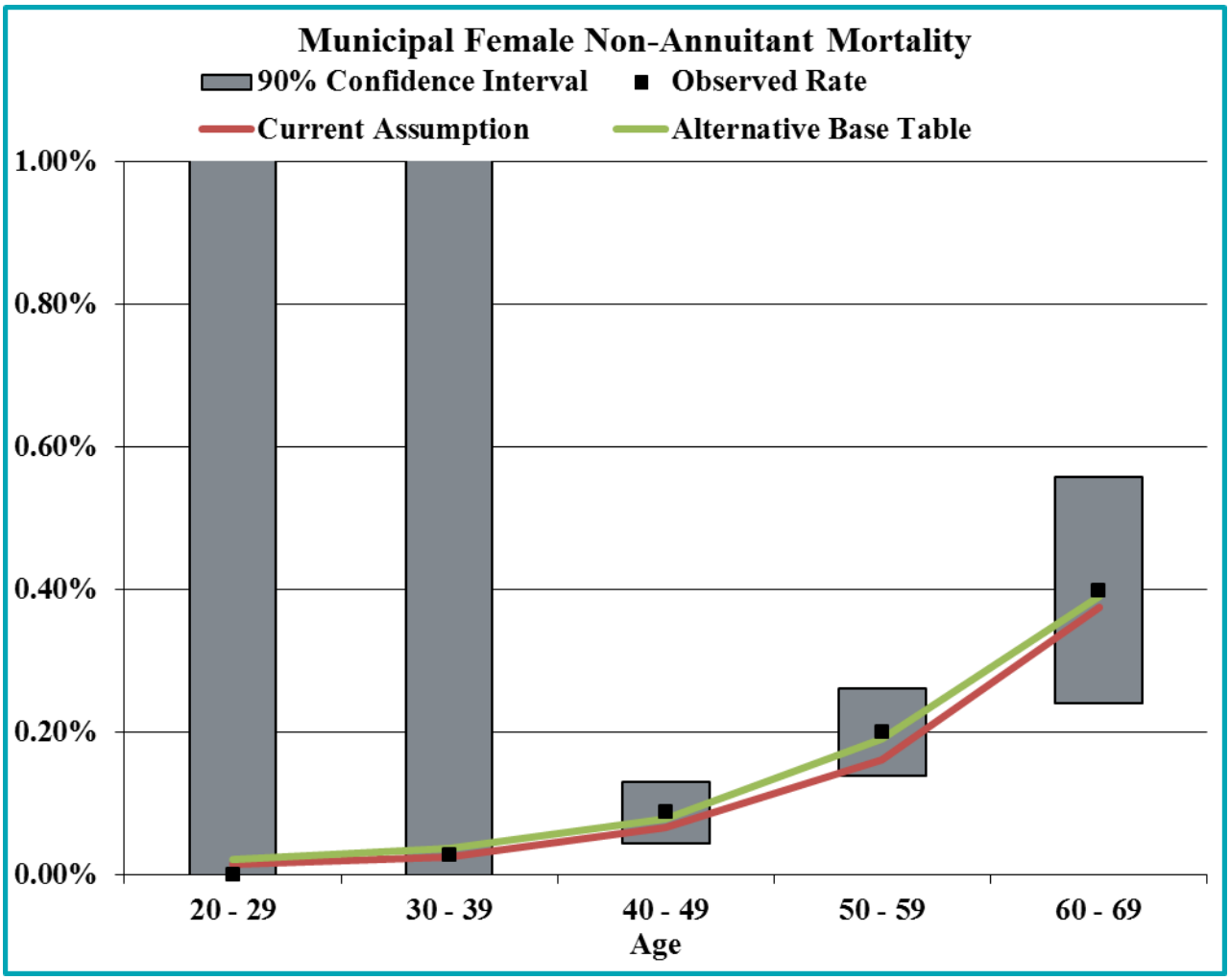


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-M2

Municipal Non-Annuitant Mortality - Base Table for Females										
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths				Actual to Expected Ratios		
				Actual	Current	Standard	Alternative	Current	Standard	Alternative
20 - 29	5,358	0	5,358	0	1	1	1	0%	0%	0%
30 - 39	10,557	3	10,557	3	3	3	4	115%	88%	76%
40 - 49	12,556	11	12,556	11	8	9	10	132%	128%	111%
50 - 59	14,455	29	14,455	29	23	24	28	124%	121%	105%
60 - 69	4,258	17	4,258	17	16	14	17	106%	118%	102%
70 +	418	4	418	4	4	3	3	100%	152%	132%
Total	**47,602**	**64**	**47,602**	**64**	**55**	**54**	**62**	**116%**	**118%**	**103%**

Chart III-M2

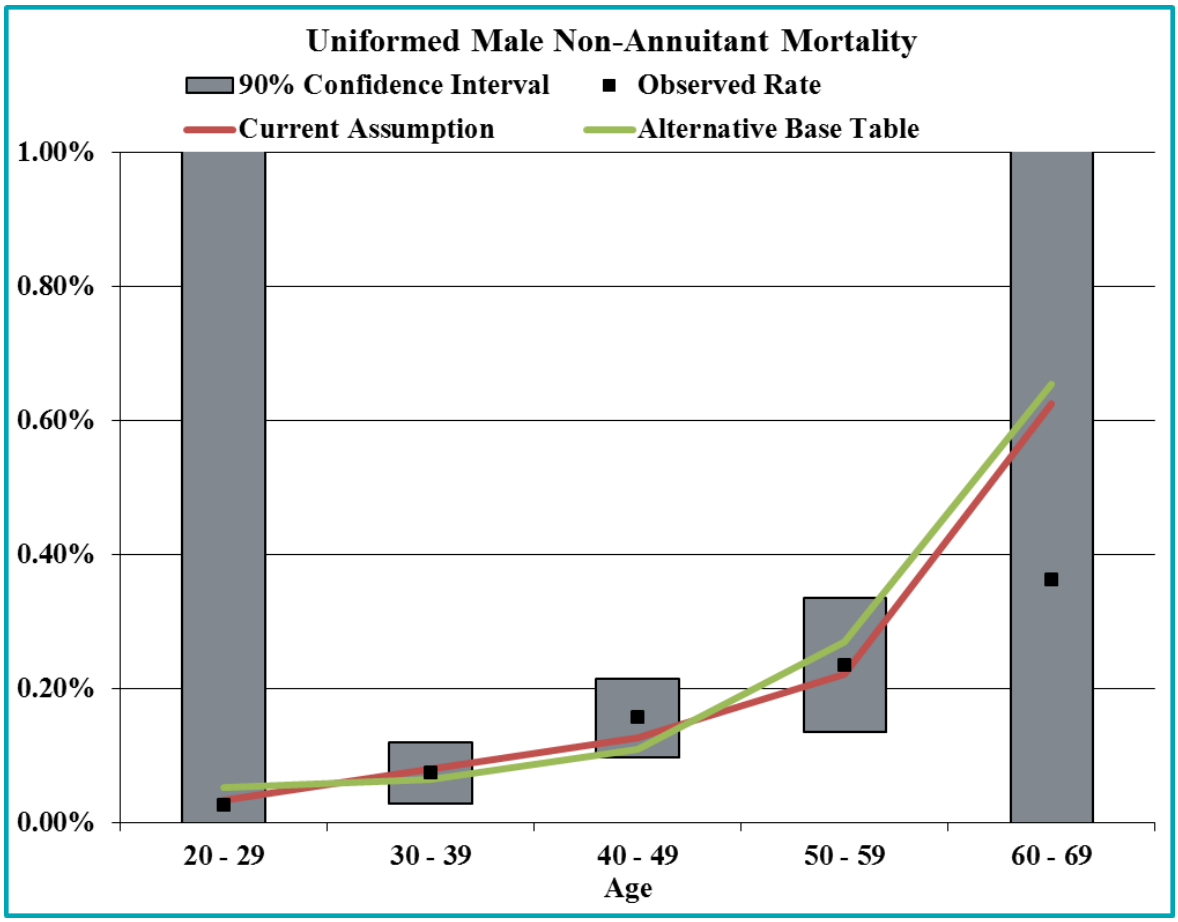


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-M3

Uniformed Non-Annuitant Mortality - Base Table for Males										
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths				Actual to Expected Ratios		
				Actual	Current	Standard	Alternative	Current	Standard	Alternative
20 - 29	3,815	1	3,815	1	1	2	2	79%	43%	50%
30 - 39	9,528	7	9,528	7	8	7	6	92%	95%	112%
40 - 49	12,149	19	12,149	19	15	16	13	123%	121%	142%
50 - 59	6,375	15	6,375	15	14	20	17	106%	74%	87%
60 - 69	553	2	553	2	3	4	4	58%	47%	55%
70 +	6	0	6	0	0	0	0	0%	0%	0%
Total	**32,426**	**44**	**32,426**	**44**	**42**	**50**	**43**	**105%**	**88%**	**104%**

Chart III-M3

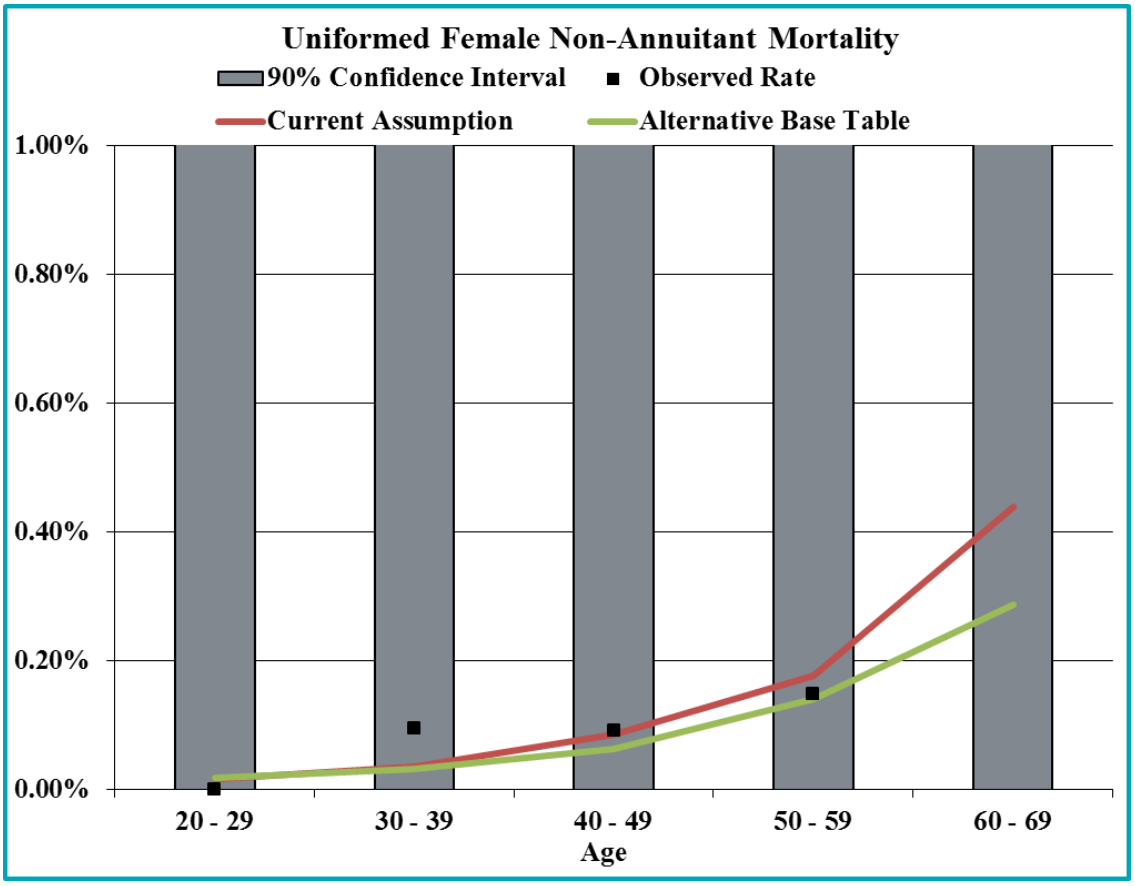


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-M4

Uniformed Non-Annuitant Mortality - Base Table for Females										
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths				Actual to Expected Ratios		
				Actual	Current	Standard	Alternative	Current	Standard	Alternative
20 - 29	545	0	545	0	0	0	0	0%	0%	0%
30 - 39	2,100	2	2,100	2	1	1	1	271%	255%	300%
40 - 49	3,265	3	3,265	3	3	2	2	108%	123%	145%
50 - 59	1,351	2	1,351	2	2	2	2	84%	90%	106%
60 - 69	108	2	108	2	0	0	0	422%	547%	644%
70 +	3	0	3	0	0	0	0	0%	0%	0%
Total	**7,372**	**9**	**7,372**	**9**	**7**	**6**	**5**	**138%**	**151%**	**178%**

Chart III-M4



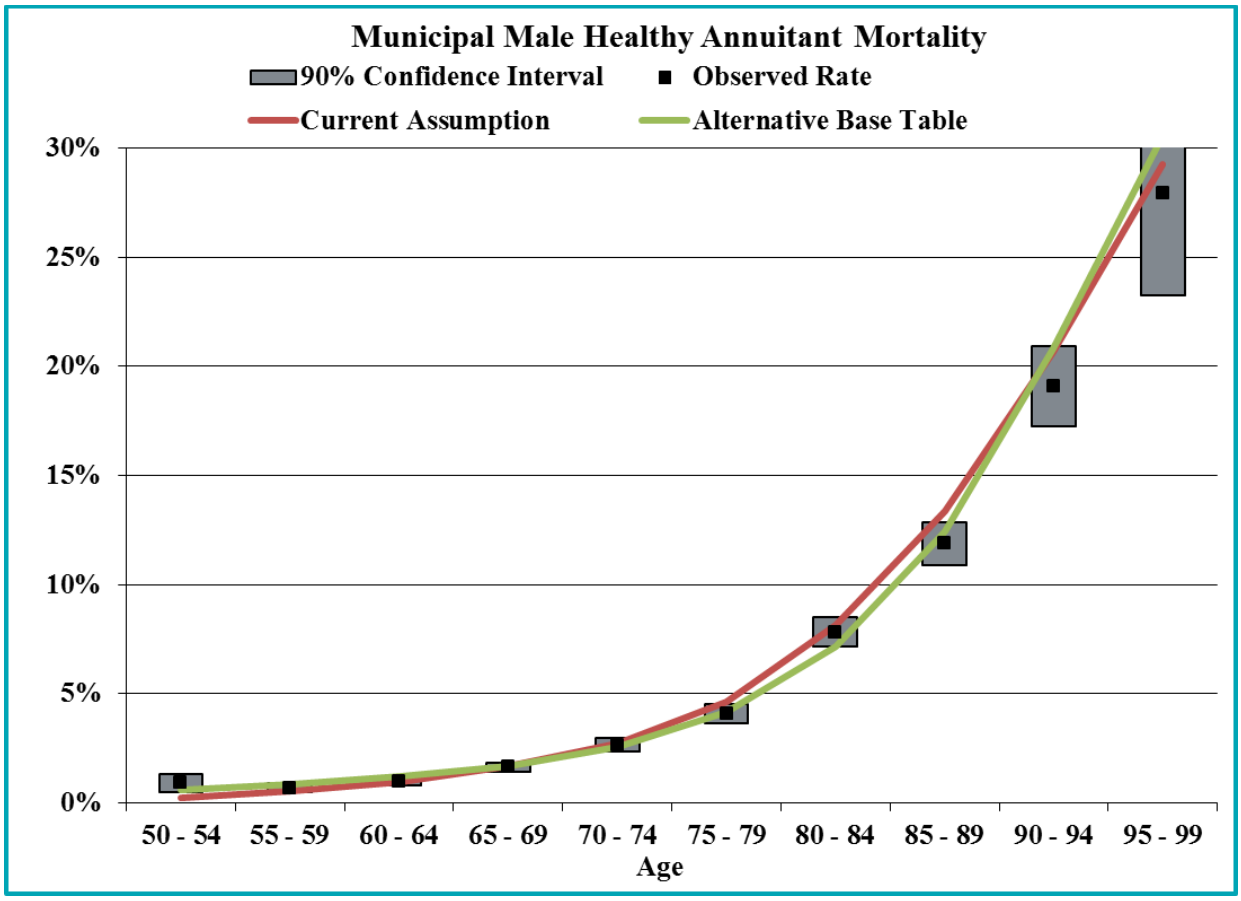
SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Non-Active Mortality Analysis – Retired Participants

Table III-M5

Municipal Healthy Annuitant Mortality - Base Table for Males										
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths				Actual to Expected Ratios		
				Actual	Current	Standard	Alternative	Current	Standard	Alternative
50 - 54	1,432	7	21,202,154	196,715	52,284	99,079	125,831	376%	199%	156%
55 - 59	4,644	39	142,471,329	979,390	749,823	965,579	1,226,285	131%	101%	80%
60 - 64	9,181	111	287,494,301	2,805,597	2,824,747	2,715,540	3,448,736	99%	103%	81%
65 - 69	10,664	205	301,435,055	4,924,706	5,146,588	4,041,272	5,132,415	96%	122%	96%
70 - 74	7,056	202	174,078,627	4,606,149	4,729,599	3,521,062	4,471,749	97%	131%	103%
75 - 79	5,444	251	116,683,823	4,749,063	5,423,975	3,849,618	4,889,015	88%	123%	97%
80 - 84	4,294	337	77,263,902	6,047,036	6,304,605	4,350,328	5,524,916	96%	139%	109%
85 - 89	2,890	363	42,527,579	5,055,010	5,694,540	4,161,259	5,284,799	89%	121%	96%
90 - 94	1,213	235	14,155,914	2,701,931	2,927,090	2,323,566	2,950,928	92%	116%	92%
95 - 99	246	70	2,178,954	608,908	637,437	524,297	665,857	96%	116%	91%
100 +	49	13	224,437	84,517	79,132	70,709	89,800	107%	120%	94%
Total	**47,113**	**1,833**	**1,179,716,075**	**32,759,022**	**34,569,819**	**26,622,308**	**33,810,331**	**95%**	**123%**	**97%**

Chart III-M5

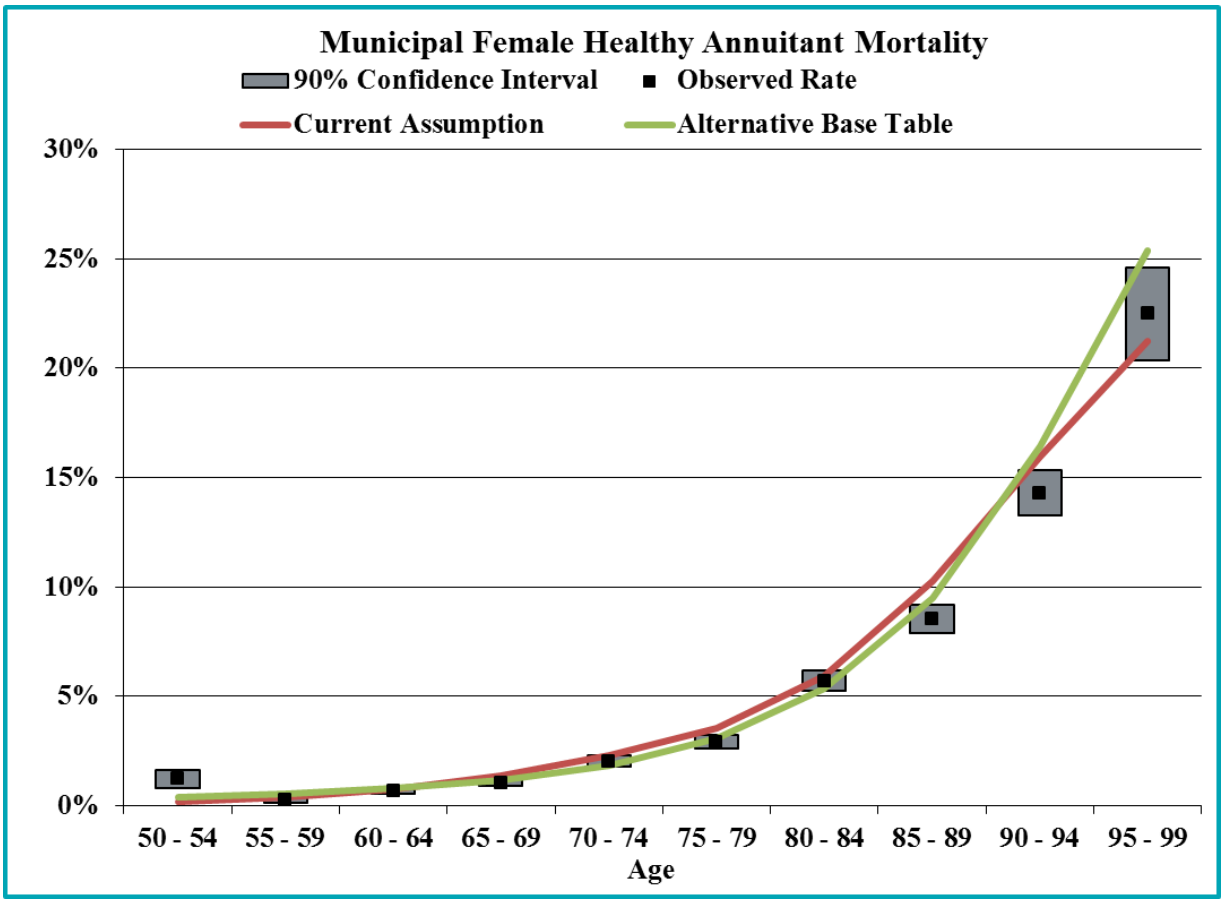


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-M6

Municipal Healthy Annuitant Mortality - Base Table for Females										
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths				Actual to Expected Ratios		
				Actual	Current	Standard	Alternative	Current	Standard	Alternative
50 - 54	1,760	10	22,243,763	272,738	43,988	68,860	81,944	620%	396%	333%
55 - 59	4,777	21	107,635,673	268,036	409,106	504,704	600,598	66%	53%	45%
60 - 64	8,690	68	192,407,031	1,289,833	1,438,381	1,304,592	1,552,465	90%	99%	83%
65 - 69	10,284	113	198,294,573	2,083,546	2,687,714	1,961,220	2,333,852	78%	106%	89%
70 - 74	8,761	200	141,192,447	2,873,025	3,223,641	2,191,248	2,607,585	89%	131%	110%
75 - 79	7,673	259	99,391,517	2,900,440	3,535,309	2,560,049	3,046,459	82%	113%	95%
80 - 84	6,662	383	68,662,095	3,922,715	4,074,173	3,101,531	3,690,821	96%	126%	106%
85 - 89	5,084	483	42,707,257	3,654,244	4,381,651	3,413,984	4,062,641	83%	107%	90%
90 - 94	3,019	458	18,547,519	2,652,661	2,959,431	2,557,666	3,043,623	90%	104%	87%
95 - 99	1,046	239	5,241,012	1,178,263	1,111,839	1,118,228	1,330,692	106%	105%	89%
100 +	207	54	806,605	204,513	194,154	227,027	270,163	105%	90%	76%
Total	**57,963**	**2,288**	**897,129,493**	**21,300,014**	**24,059,389**	**19,009,111**	**22,620,842**	**89%**	**112%**	**94%**

Chart III-M6

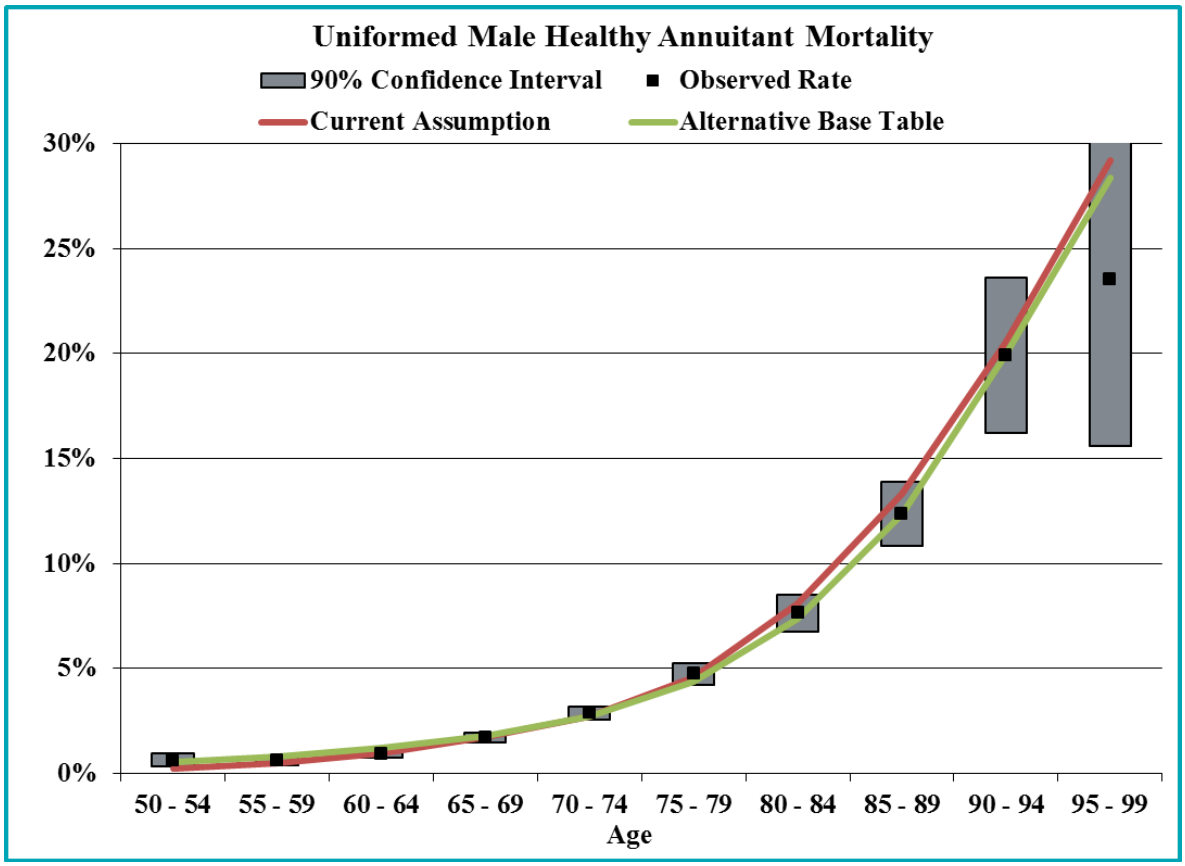


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-M7

Uniformed Healthy Annuitant Mortality - Base Table for Males										
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths				Actual to Expected Ratios		
				Actual	Current	Standard	Alternative	Current	Standard	Alternative
50 - 54	1,575	11	48,930,702	316,824	125,124	239,824	275,798	253%	132%	115%
55 - 59	3,861	24	142,560,858	882,263	725,961	1,013,173	1,165,149	122%	87%	76%
60 - 64	7,214	72	266,666,809	2,476,810	2,618,978	2,805,660	3,226,509	95%	88%	77%
65 - 69	9,345	172	298,013,238	5,113,819	5,120,807	4,661,811	5,361,083	100%	110%	95%
70 - 74	7,674	221	207,157,583	5,980,763	5,636,037	4,929,660	5,669,109	106%	121%	105%
75 - 79	4,574	222	106,447,221	5,062,667	4,854,245	4,039,665	4,645,614	104%	125%	109%
80 - 84	2,424	200	49,037,401	3,750,931	3,974,838	3,141,148	3,612,321	94%	119%	104%
85 - 89	1,255	161	24,068,970	2,971,294	3,200,958	2,580,389	2,967,448	93%	115%	100%
90 - 94	316	67	5,575,263	1,109,961	1,147,821	968,662	1,113,961	97%	115%	100%
95 - 99	78	19	1,089,238	256,158	318,158	268,637	308,933	81%	95%	83%
100 +	5	3	88,091	45,457	31,059	27,753	31,916	146%	164%	142%
Total	**38,321**	**1,172**	**1,149,635,374**	**27,966,947**	**27,753,986**	**24,676,383**	**28,377,840**	**101%**	**113%**	**99%**

Chart III-M7

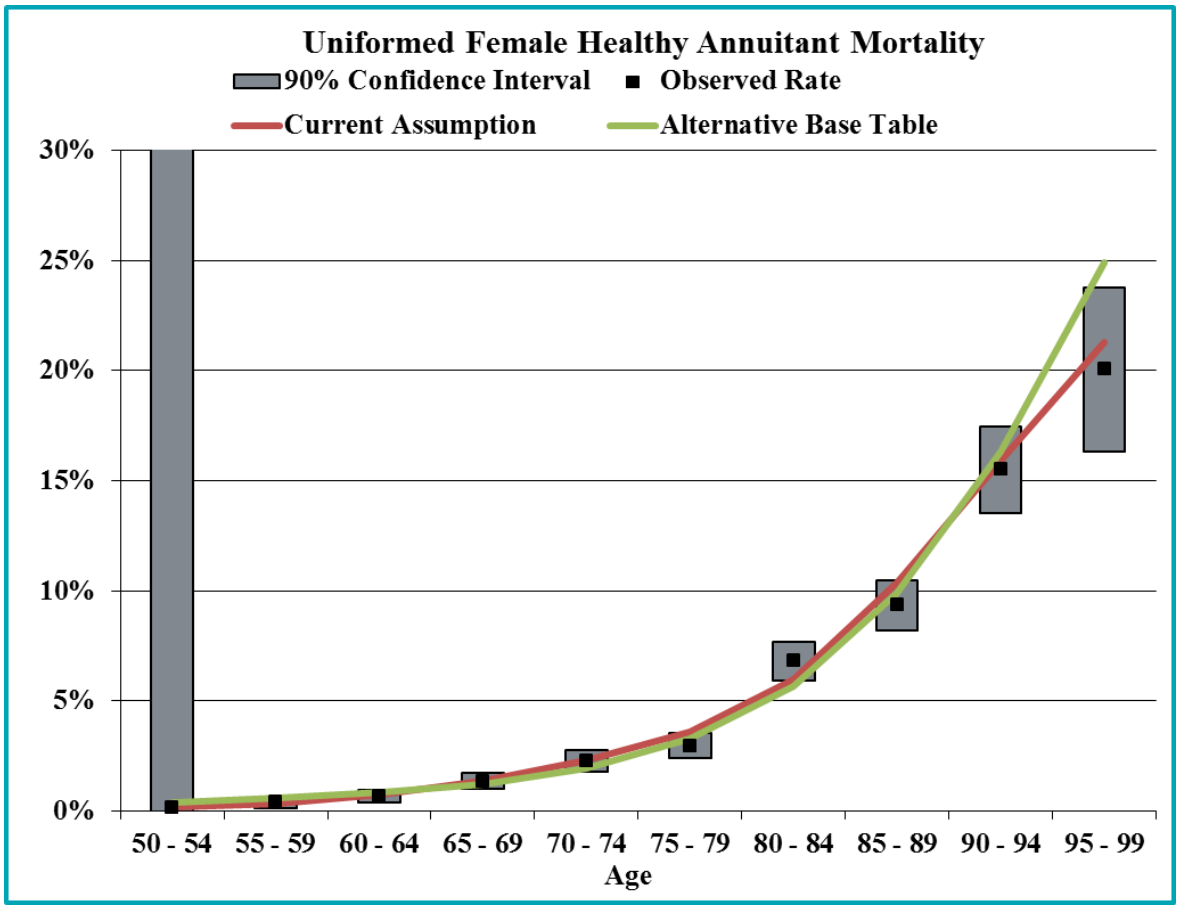


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-M8

Uniformed Healthy Annuitant Mortality - Base Table for Females										
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths				Actual to Expected Ratios		
				Actual	Current	Standard	Alternative	Current	Standard	Alternative
50 - 54	858	3	21,443,195	33,392	43,261	72,502	83,377	77%	46%	40%
55 - 59	1,653	8	42,772,658	171,079	154,692	216,208	248,639	111%	79%	69%
60 - 64	2,216	21	45,895,140	305,492	335,879	336,684	387,186	91%	91%	79%
65 - 69	2,526	36	36,548,285	499,956	495,643	391,669	450,419	101%	128%	111%
70 - 74	2,569	62	28,079,925	635,783	641,448	475,467	546,787	99%	134%	116%
75 - 79	2,476	83	22,012,477	655,371	788,702	627,532	721,662	83%	104%	91%
80 - 84	2,192	139	17,094,191	1,164,927	1,018,507	843,690	970,243	114%	138%	120%
85 - 89	1,762	168	12,531,467	1,171,897	1,301,674	1,078,112	1,239,828	90%	109%	95%
90 - 94	919	139	5,784,297	897,162	919,878	820,548	943,631	98%	109%	95%
95 - 99	316	70	1,599,921	320,847	340,948	346,336	398,287	94%	93%	81%
100 +	66	19	270,366	82,800	65,078	76,097	87,512	127%	109%	95%
Total	**17,553**	**748**	**234,031,922**	**5,938,706**	**6,105,710**	**5,284,844**	**6,077,571**	**97%**	**112%**	**98%**

Chart III-M8



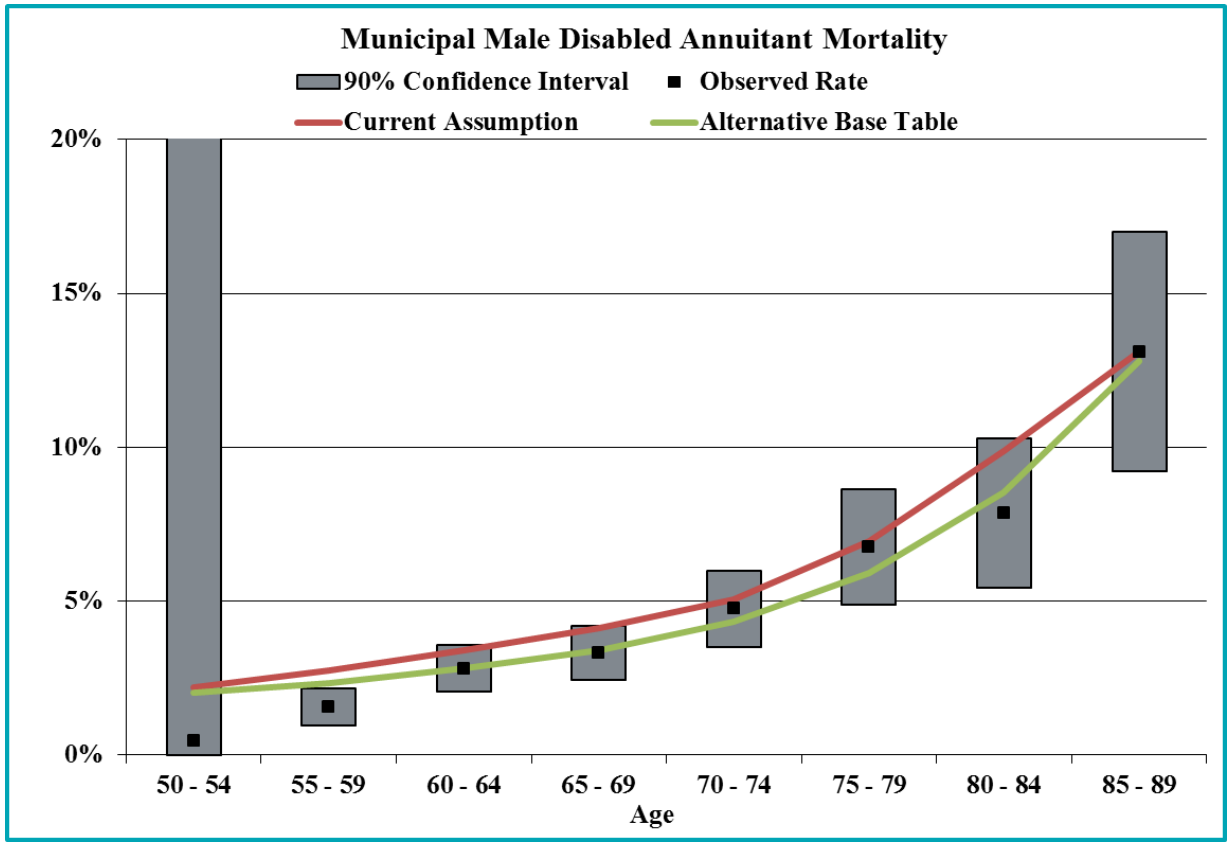
SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Non-Active Mortality Analysis – Disabled Participants

Table III-M9

Municipal Disabled Annuitant Mortality - Base Table for Males										
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths				Actual to Expected Ratios		
				Actual	Current	Standard	Alternative	Current	Standard	Alternative
< 50	213	0	4,873,716	0	91,456	89,631	85,150	0%	0%	0%
50 - 54	488	4	10,572,235	47,343	232,815	226,031	214,729	20%	21%	22%
55 - 59	1,105	18	23,921,839	371,439	658,992	590,976	561,427	56%	63%	66%
60 - 64	1,265	40	25,307,659	709,044	856,351	752,519	714,893	83%	94%	99%
65 - 69	1,132	38	21,819,462	723,986	900,367	784,369	745,150	80%	92%	97%
70 - 74	800	42	14,426,658	684,686	730,735	656,340	623,523	94%	104%	110%
75 - 79	480	40	7,732,651	522,962	535,821	480,811	456,771	98%	109%	114%
80 - 84	334	34	4,066,676	320,054	401,523	365,689	347,404	80%	88%	92%
85 - 89	203	27	2,198,755	287,916	288,252	295,809	281,018	100%	97%	102%
90 +	63	22	574,228	208,698	110,079	119,773	113,784	190%	174%	183%
Total	**6,083**	**265**	**115,493,879**	**3,876,128**	**4,806,391**	**4,361,947**	**4,143,850**	**81%**	**89%**	**94%**

Chart III-M9

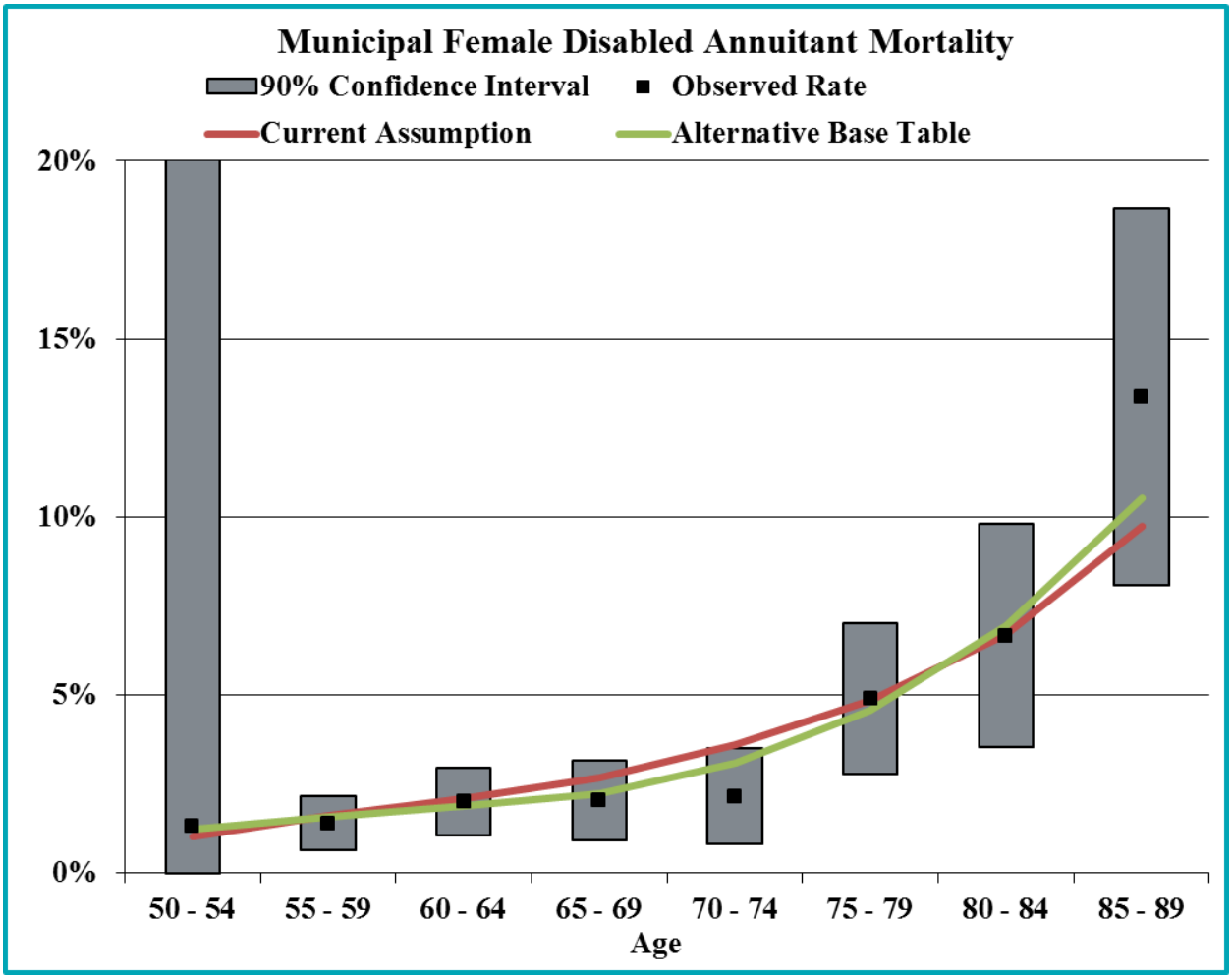


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-M10

Municipal Disabled Annuitant Mortality - Base Table for Females										
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths				Actual to Expected Ratios		
				Actual	Current	Standard	Alternative	Current	Standard	Alternative
< 50	208	4	3,781,570	67,589	23,968	38,659	36,726	282%	175%	184%
50 - 54	409	5	7,428,104	97,679	75,805	96,646	91,813	129%	101%	106%
55 - 59	645	11	12,463,882	173,781	199,995	207,583	197,204	87%	84%	88%
60 - 64	592	13	10,761,050	216,162	225,662	213,119	202,463	96%	101%	107%
65 - 69	421	10	7,068,320	144,060	189,762	166,788	158,448	76%	86%	91%
70 - 74	314	8	4,726,313	101,654	171,019	154,019	146,318	59%	66%	69%
75 - 79	279	15	2,983,162	146,164	144,790	142,959	135,811	101%	102%	108%
80 - 84	171	11	1,379,249	91,915	92,607	100,593	95,563	99%	91%	96%
85 - 89	112	17	786,638	105,195	76,611	87,212	82,851	137%	121%	127%
90 +	86	15	466,622	75,306	73,712	87,119	82,763	102%	86%	91%
Total	**3,237**	**109**	**51,844,910**	**1,219,505**	**1,273,931**	**1,294,696**	**1,229,961**	**96%**	**94%**	**99%**

Chart III-M10

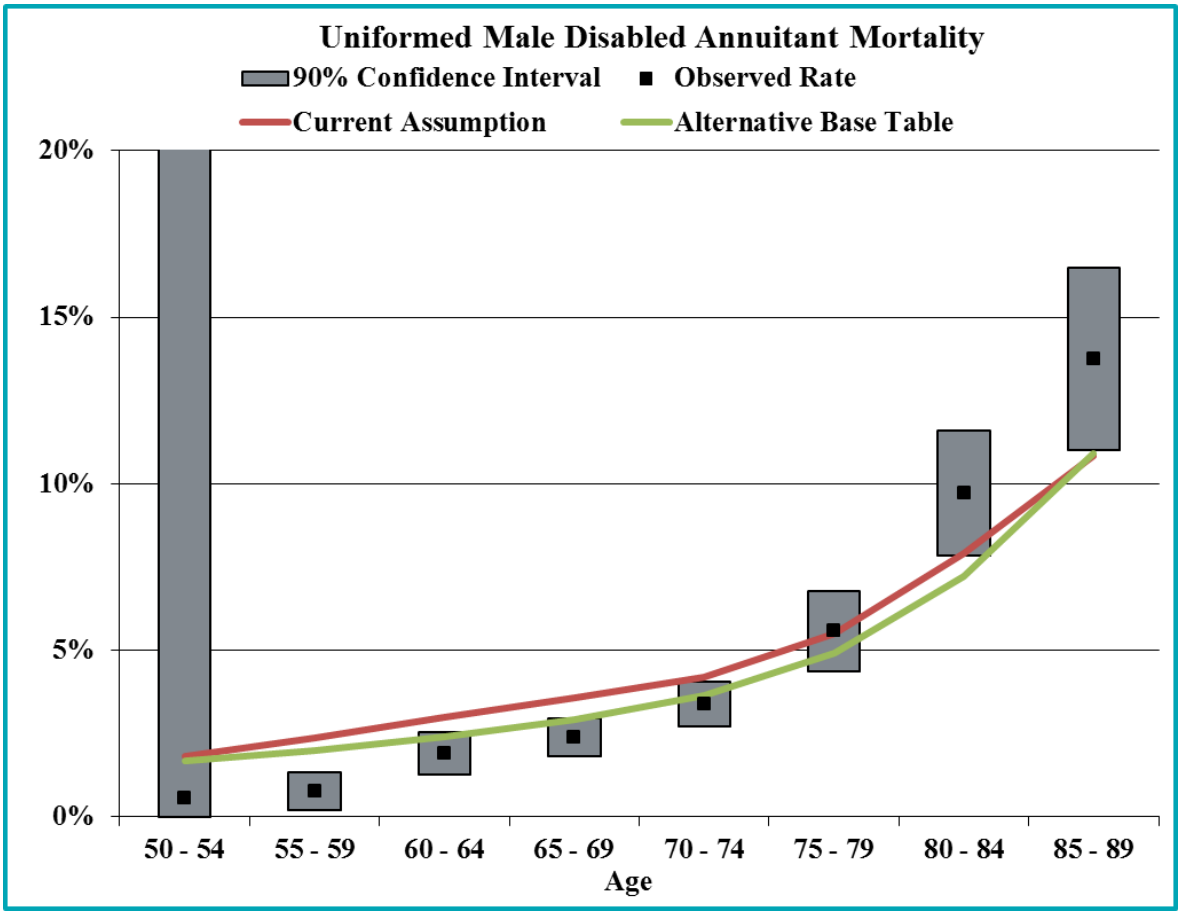


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-M11

Uniformed Disabled Annuitant Mortality - Base Table for Males										
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths				Actual to Expected Ratios		
				Actual	Current	Standard	Alternative	Current	Standard	Alternative
< 50	319	3	11,730,689	105,401	204,518	214,434	171,547	52%	49%	61%
50 - 54	407	3	13,385,459	74,139	241,304	282,761	226,209	31%	26%	33%
55 - 59	637	7	17,365,527	132,097	411,081	429,008	343,207	32%	31%	38%
60 - 64	1,221	23	26,589,890	505,366	792,273	796,496	637,197	64%	63%	79%
65 - 69	2,015	51	38,992,123	927,008	1,396,234	1,415,735	1,132,588	66%	65%	82%
70 - 74	1,935	64	32,281,659	1,095,030	1,351,885	1,466,078	1,172,863	81%	75%	93%
75 - 79	998	55	15,048,870	838,754	825,497	926,081	740,865	102%	91%	113%
80 - 84	673	69	8,885,103	863,614	703,331	803,163	642,531	123%	108%	134%
85 - 89	431	60	5,242,800	720,250	568,728	714,583	571,666	127%	101%	126%
90 +	135	29	1,738,368	355,941	264,691	366,569	293,255	134%	97%	121%
Total	**8,771**	**364**	**171,260,488**	**5,617,600**	**6,759,542**	**7,414,909**	**5,931,927**	**83%**	**76%**	**95%**

Chart III-M11

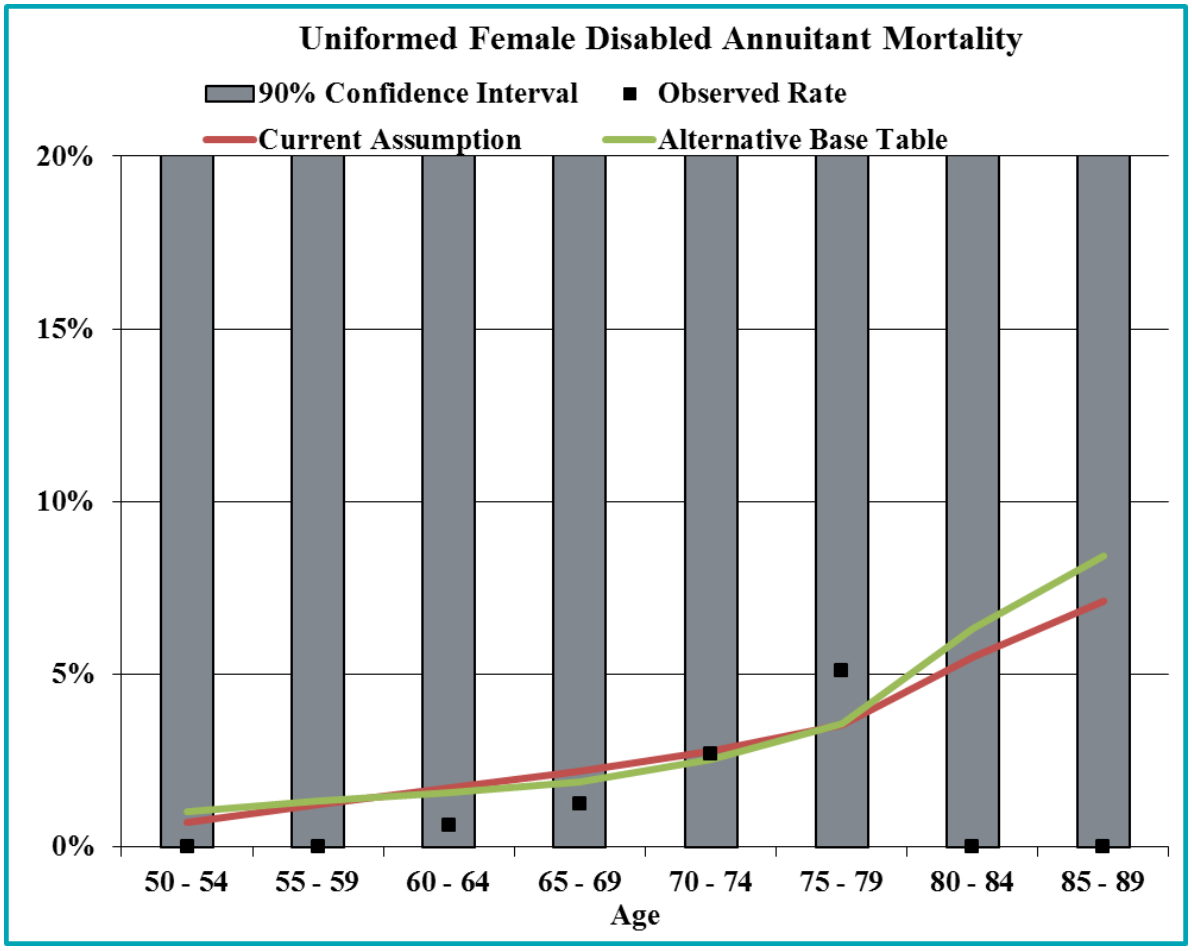


SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

Table III-M12

Uniformed Disabled Annuitant Mortality - Base Table for Females										
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths				Actual to Expected Ratios		
				Actual	Current	Standard	Alternative	Current	Standard	Alternative
< 50	212	1	7,284,930	10,153	40,276	73,335	58,668	25%	14%	17%
50 - 54	280	0	9,167,848	0	65,677	117,796	94,237	0%	0%	0%
55 - 59	268	0	7,770,605	0	94,714	128,734	102,987	0%	0%	0%
60 - 64	274	2	6,914,197	44,218	117,193	136,697	109,358	38%	32%	40%
65 - 69	158	2	3,566,885	44,284	77,737	84,002	67,202	57%	53%	66%
70 - 74	63	2	1,221,979	32,974	33,826	38,607	30,885	97%	85%	107%
75 - 79	12	1	235,887	12,000	8,321	10,560	8,448	144%	114%	142%
80 - 84	7	0	68,568	0	3,770	5,408	4,326	0%	0%	0%
85 - 89	3	0	33,048	0	2,355	3,476	2,781	0%	0%	0%
90 +	-	0	-	0	-	-	-	0%	0%	0%
Total	**1,277**	**8**	**36,263,947**	**143,629**	**443,869**	**598,615**	**478,892**	**32%**	**24%**	**30%**

Chart III-M12



SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

5. Family Composition

A. Current Assumptions

All Municipal and Police and Fire Employees

For pensioners receiving are 50% J&S annuity with return of contributions option, 70% of active members and 60% of non-active members are assumed to be married. This assumption was analyzed for the 2017 valuation based upon data provided by the City as well as an improved understanding that many unmarried retirees elect this payment option.

Male spouses are assumed to be four-years older than female spouses.

B. Experience

All Municipal, Police and Fire Employees

The 36% of the deceased retirees that elected the 50% Joint and Survivor option had spouses upon their death. Assuming that slightly more than 50% of these deaths had spouses that deceased before the retiree, we are assuming that 70% of active members and 60% of non-active members with this form of payment are married.

Male spouses are three and a half years older than female spouses based deceased retirees that had spouses.

C. Alternative

All Municipal, Police and Fire Employees

60% of non-active members are assumed married. There are no suggested changes for active members assumed married or spouse age difference.

6. Disability: Ordinary vs Service Connected

A. Current Assumptions

All Municipal and Police and Fire Employees

For Municipal members, we assume 70% of all disabilities are ordinary and 30% are service-connected. For Police and Fire members, we assume 50% are ordinary and 50% are service-connected.

SECTION III – ANYALYSIS OF DEMOGRAPHIC ASSUMPTIONS

B. Experience

All Municipal, Police and Fire Employees

Based on disability exposures from 2012-2017 for Municipal members, 61% of all disabilities were ordinary and 39% were service-connected. Based on disability exposures from 2012-2017 for Police and Fire members, 10% were ordinary and 90% were service-connected. The experience shows that service-connected disabilities were higher than expected for all Plans.

C. Alternative

All Municipal, Police and Fire Employees

For Municipal members, we assume 65% of all disabilities are ordinary and 35% are service-connected. For Police and Fire members, we assume 25% are ordinary and 75% are service-connected.

7. Death: Ordinary vs Service Connected

A. Current Assumptions

All Municipal and Police and Fire Employees

For Municipal members, we assume 98.5% of all deaths are ordinary and 1.5% is service-connected. For Police and Fire members, we assume 92% are ordinary and 8% are service-connected.

B. Experience

All Municipal, Police and Fire Employees

Based on death exposures from 2012-2017 for Municipal members, 99.3% of all disabilities were ordinary and 0.7% were service-connected. Based on death exposures from 2012-2017 for Police and Fire members, 95% were ordinary and 5% were service-connected. The experience appears to be in-line with the current assumptions.

C. Alternative

All Municipal, Police and Fire Employees

There are no suggested changes.

APPENDIX A – CURRENT ACTUARIAL ASSUMPTIONS

Data Assumptions and Practices

In preparing our data, we relied on information supplied by the City of Philadelphia Municipal Retirement System staff. The data was reviewed to ensure that it complies with generally accepted actuarial standards. This information includes, but is not limited to, plan provisions, employee data, and financial information. Our methodology for obtaining the data used for the valuation is based upon the following assumptions and practices:

- We exclude raw active records with dates of hire after the valuation date.
- We include terminated vested records in the valuation data, regardless of whether they have enough service for vesting.
- We exclude terminated vested and retired records with values of zero in the benefit field.
- If a participant is found in multiple data files (e.g., both the active and retired data files), based on a match of both employee number and Social Security Number, we first attempt to identify the record with the most recent status change, and keep only that record. If it is not apparent which record is the most recent, we keep the record that generates the highest liability in our valuation system.
- If a participant is found multiple times in the same data file, based on a match of both employee number and Social Security Number, we keep the record that generates the highest liability in our valuation system.
- Valuation pay reflects a load of 6% of pay for police (stress pay) and firefighters (premium pay).
- The date of retirement for a terminated vested participant was set to the valuation date, if the given date was earlier.
- If the payment form field for pensioners is missing, we assume that 1967 Plan members receive a 50% J&S annuity with a return of contributions in excess of payments received upon death of the member, and we assume that Plan 87 members receive a life annuity, also with a return of contributions. However, if the pensioner is a beneficiary or survivor, we assume that they receive a life annuity only.
- For pensioners under the form of payment 50% J&S annuity with return of contributions, 60% are assumed to be married based upon data provided by the City. All other forms of payments are explicitly valued.
- Records with missing dates of birth have their data filled in based on the average for their plan.

APPENDIX A – CURRENT ACTUARIAL ASSUMPTIONS

- We assumed that all changes in participant data from last year to this year were valid unless indicated otherwise by System staff.

- We use the dates of hire and service credit provided in the data to calculate actuarial liability. We understand from the System staff that the service credit data provided does not include adjustments for breaks in service so to the extent that some members may have had breaks in service the actuarial liability is overstated.

- DROP participants are assumed to begin payments immediately

- For Municipal Plan 1967 participants pay was assumed to be below the Social Security Taxable Wage Base for purposes of determining the aggregate member contribution amount.

- We assumed that any participant who was active last year, missing this year is now a terminated non-vested participant.

- We assumed that any participant who was inactive last year and missing from this year without a clear reason is now deceased.

APPENDIX A – CURRENT ACTUARIAL ASSUMPTIONS

Actuarial Assumptions

1. Investment Return Assumption

7.70% compounded annually, net of expenses.

2. Salary Increase Rate

Age	All Divisions
<20	20.00%
20-24	11.00%
25-29	7.00%
30-34	5.00%
35-39	4.25%
40-44	4.00%
45-49	3.50%
50-54	3.30%
55-60	3.00%
61+	2.75%

3. Total Annual Payroll Growth

3.30% per year.

4. Administrative Expenses

Annual expected expenses included in this report are $9,166,488, and assumed to increase by 3.30% per year.

5. Funding of the Pension Adjustment Fund

To recognize the expense of the benefits payable under the Pension Adjustment Fund, the actuarial liabilities have been increased by 0.54%. This estimate is based on the statistical average expected value of the benefits.

APPENDIX A – CURRENT ACTUARIAL ASSUMPTIONS

6. Rates of Termination

	1967 Plan			1987 Plan	
	Municipal		Uniformed	Municipal and Elected Officials	Uniformed
Age	Male	Female	Unisex	Unisex	Unisex
20	0.100000	0.105319	0.022050	0.260000	0.030000
25	0.086000	0.096000	0.021148	0.150000	0.037800
30	0.072000	0.071562	0.019148	0.105000	0.029900
35	0.045000	0.056170	0.016148	0.090000	0.025200
40	0.035000	0.039379	0.012148	0.090000	0.015400
45	0.030000	0.035597	0.000000	0.075000	0.010000
50	0.020000	0.022400	0.000000	0.065000	0.001600
55	0.000000	0.000000	0.000000	0.050000	0.001600

We assume that a vested employee who terminates will elect a pension deferred to service retirement age as long as their age plus years of service at termination are greater than or equal to 55 (45 for police and fire employees in the 1967 Plan). Otherwise, we assume they elect a refund of member contributions.

7. Rates of Disability

	Municipal and Elected Officials		Uniformed
Age	**Male**	**Female**	**Unisex**
20	0.000025	0.000043	0.000795
25	0.000070	0.000061	0.000870
30	0.000557	0.000263	0.002668
35	0.001014	0.000870	0.005418
40	0.001800	0.001564	0.004684
45	0.002340	0.003109	0.003834
50	0.006600	0.004535	0.003154
55	0.007680	0.007338	0.000000
60	0.000000	0.000000	0.000000

For municipal and elected members, we assume that 70% of all disabilities are ordinary and 30% are service-connected. For police and fire members, we assume that 50% are ordinary and 50% are service-connected.

APPENDIX A – CURRENT ACTUARIAL ASSUMPTIONS

8. Rates of Pre-Retirement Mortality (RP 2000 with Blue Collar adjustment, projected 17 years using Scale AA with a five year set back for Municipal males and females and a 2 year set back for Police and Fire males and females)

Experience studies are performed every four years as required by State law which require regular and detailed experience and analysis of the mortality trends such that improvements are addressed incrementally with assumption changes as a result of these studies. This mandatory process allows for periodic recognition of mortality improvements which are sufficient in addressing the potential trend. The most recent experience study was conducted for the period between July 1, 2008 and June 30, 2013.

	Municipal and Elected Officials		Uniformed	
Age	**Male**	**Female**	**Male**	**Female**
20	0.000194	0.000129	0.000228	0.000143
25	0.000291	0.00015	0.000314	0.000155
30	0.000345	0.000174	0.000361	0.000198
35	0.000667	0.000243	0.000871	0.000342
40	0.000948	0.000401	0.001101	0.000553
45	0.001098	0.000667	0.001274	0.000894
50	0.001317	0.001036	0.001563	0.001279
55	0.001741	0.001712	0.002379	0.002101
60	0.003190	0.002567	0.004864	0.003488
65	0.006507	0.004545	0.009686	0.007327

* For municipal and elected members, we assume that 98.5% of all deaths are ordinary, with 1.5% service-connected. For police and fire members, 92% are assumed to be ordinary and 8% service-connected.

9. Rates of Post-Retirement Mortality

For all groups we assume that mortality for healthy inactive lives will follow RP 2000 with Blue Collar adjustment, projected 17 years using Scale AA with a one year set forward for males and females.

Age	Male	Female
50	0.002015	0.001568
55	0.003585	0.002669
60	0.007167	0.005321
65	0.013813	0.010871
70	0.022690	0.019040
75	0.037529	0.029472
80	0.065888	0.048128
85	0.112135	0.083357
90	0.183439	0.141251
95	0.274405	0.198507

APPENDIX A – CURRENT ACTUARIAL ASSUMPTIONS

10. Rates of Post-Disability Mortality

For Police and Fire, we assume that mortality for disabled retirees follows RP 2000 Healthy mortality with Blue Collar adjustment, projected 17 years using Scale AA, with a 5 year set back for males and females and a 1% upward adjustment. For Municipal and Elected officials, we assume the same mortality table with projections as Police and Fire, but with a 1 year set back for males and females and a 1% upward adjustment.

	Municipal and Elected Officials		Uniformed	
Age	**Male**	**Female**	**Male**	**Female**
35	0.02073	0.00617	0.02073	0.00617
40	0.01969	0.00576	0.01969	0.00576
45	0.01807	0.00566	0.01807	0.00566
50	0.02033	0.00795	0.01657	0.00557
55	0.02465	0.01352	0.02091	0.01006
60	0.03092	0.01907	0.02694	0.01519
65	0.03801	0.02443	0.03308	0.02006
70	0.04611	0.03245	0.03881	0.02574
75	0.06099	0.04265	0.04925	0.03283
80	0.08715	0.06016	0.06918	0.04635

11. Rates of Retirement

Rates of Service Retirement - 1967 Plan		
Age	**Municipal**	**Uniformed**
45-51	0.00	0.09
52	0.05	0.09
53	0.05	0.15
54	0.05	0.15
55	0.45	0.20
56	0.32	0.25
57	0.30	0.25
58	0.32	0.30
59	0.32	0.35
60	0.32	0.40
61	0.35	0.40
62	0.40	0.42
63	0.25	0.42
64	0.25	0.42
65	0.30	0.42
66	0.25	0.42
67	0.30	0.42
68	0.25	0.42
69	0.15	0.42
70 and up	1.00	1.00

APPENDIX A – CURRENT ACTUARIAL ASSUMPTIONS

Rates of Service Retirement - 1987 Plan and Plan '10

	Municipal and Elected Officials		Uniformed	
Age	First Year Eligible	Subsequent Years	First Year Eligible	Subsequent Years
40-49	0.000	0.000	0.030	0.015
50	0.000	0.000	0.100	0.080
51	0.000	0.000	0.100	0.055
52	0.050	0.020	0.100	0.070
53	0.100	0.020	0.100	0.080
54	0.100	0.020	0.100	0.100
55	0.250	0.020	0.100	0.120
56	0.250	0.020	0.100	0.140
57	0.250	0.020	0.100	0.120
58	0.250	0.020	0.100	0.165
59	0.300	0.080	0.100	0.140
60	0.500	0.300	0.100	0.170
61	0.400	0.200	0.100	0.170
62	0.400	0.250	0.100	0.215
63	0.500	0.200	0.100	0.205
64	0.300	0.200	0.100	0.200
65	0.600	0.200	0.100	1.000
66	0.600	0.200	0.100	1.000
67	0.600	0.200	0.100	1.000
68	0.600	0.200	0.100	1.000
69	0.600	0.200	0.100	1.000
70	0.100	1.000	0.100	1.000

Retirements under DROP are included in the rates above.

12. Family Composition Assumptions

70% of active members and 60% of non-active members are assumed to be married for retirees with the 50% J&S with return on contribution form of payment only. Male spouses are assumed to be four-years older than female spouses.

13. Service-connected disability benefit

Service-connected disability benefits are increased by 2.9% to account for the periodic adjustment.

APPENDIX A – CURRENT ACTUARIAL ASSUMPTIONS

B. Actuarial Methods

1. Actuarial Funding Method

The Entry Age Normal actuarial funding method was used for active employees, whereby the normal cost is computed as the level annual percentage of pay required to fund the retirement benefits between each member's date of hire and assumed retirement. The actuarial liability is the difference between the present value of future benefits and the present value of future normal cost. The unfunded actuarial liability is the difference between the actuarial liability and the actuarial value of assets.

2. Funding Methods

City's Funding Policy:
The initial July 1, 1985 UAL is amortized over 34 years ending June 30, 2019, with payments increasing at 3.3% per year, the assumed payroll growth. Other changes in the actuarial liability are amortized in level-dollar payments as follows:

- Actuarial gains and losses – 20 years beginning July 1, 2009. Prior to July 1, 2009, gains and losses were amortized over 15 years
- Assumption changes – 15 years beginning July 1, 2010. Prior to July 1, 2010, assumption changes were amortized over 20 years
- Plan changes for active members – 10 years
- Plan changes for inactive members – 1 year
- Plan changes mandated by the State – 20 years

MMO:
For the purposes of the MMO under Act 205 reflecting the fresh start amortization schedule, the July 1, 2009 UAL was "fresh started" to be amortized over 30 years ending June 30, 2039. This is a level dollar amortization of the UAL. All future amortization periods will follow the City's Funding Policy as outlined above.

Revenue Recognition Policy:
This calculation is similar to the MMO except that the assets used to determine the unfunded liability do not include the accumulated value of sales tax revenue and tier member contributions received by the System. These sources of income are contributed over and above the City's contribution of the MMO and will be in addition to the MMO. Therefore under this funding method the additional revenue amounts are separately tracked and accumulated in a notional account which is then subtracted them from the assets before calculating the contribution amounts due under the Minimum Municipal Obligation (MMO) methodology. We accumulate these amounts in a notional account and deduct them from the Actuarial Asset Value before the MMO is determined. These amounts are accumulated at the Actuarial Asset Value return rates to preserve the new funding methodology objective.

APPENDIX A – CURRENT ACTUARIAL ASSUMPTIONS

3. Asset Valuation Method

The actuarial value of assets (AVA) is determined using an adjusted market value. Under this method, a preliminary AVA is determined as the market value of assets on the valuation date, minus the existing balance of the Pension Adjustment Fund (PAF) rolled forward at the current year's market rate of return, minus a decreasing fraction (9/10, 8/10, 7/10, etc.) of the investment gains or losses in each of the preceding nine years. Gains and losses prior to FYE June 30, 2008 were smoothed over a five year period and have now all been fully recognized. The gain or loss for a given year is the difference between the actual investment return (on a market-to-market basis) and the assumed investment return based on the market value of assets at the beginning of the year and actual cash flow. The AVA is adjusted, if necessary, to remain between 80% and 120% of the market value net of the PAF. The final AVA is determined by subtracting the additional transfer amount (if any) to the PAF. The additional transfer amount to the PAF remains to be calculated based on the five-year smoothing method.

APPENDIX B – ALTERNATIVE ACTUARIAL ASSUMPTIONS

1. Investment Return Assumption

7.70% compounded annually, net of expenses.

2. Salary Increase Rate

Salary increases are based on Division and age, sample rates shown below.

Age	Municipal and Elected Officals	Uniformed
<20	20.00%	20.00%
20	18.00%	11.00%
25	10.00%	7.00%
30	7.00%	5.00%
35	5.75%	4.25%
40	5.00%	4.00%
45	4.60%	3.50%
50	4.35%	3.30%
55	4.10%	3.00%
60	3.85%	3.00%
65+	3.50%	2.75%

3. Total Annual Payroll Growth

3.30% per year.

4. Administrative Expenses

Annual expected expenses included in this report are $9,166,488, and assumed to increase by 3.30% per year.

5. Funding of the Pension Adjustment Fund

To recognize the expense of the benefits payable under the Pension Adjustment Fund, the actuarial liabilities have been increased by 0.54%. This estimate is based on the statistical average expected value of the benefits.

APPENDIX B – ALTERNATIVE ACTUARIAL ASSUMPTIONS

6. Rates of Termination

Termination rates are based on Division and age, sample rates shown below.

Age	Municipal and Elected Officals	Uniformed
20	0.2200	0.0350
25	0.1500	0.0310
30	0.1000	0.0235
35	0.0775	0.0160
40	0.0650	0.0100
45	0.0525	0.0100
50	0.0450	0.0100
55	0.0450	0.0000
60	0.0900	0.0000

We assume that a vested employee who terminates will elect a pension deferred to service retirement age as long as their age plus years of service at termination are greater than or equal to 55 (45 for police and fire employees in the 1967 Plan). Otherwise, we assume they elect a refund of member contributions.

7. Rates of Disability

Disability rates are based on Division and age and split between gender for Municipal and Elected Officials, sample rates shown below.

	Municipal and Elected Officials		Uniformed
Age	**Male**	**Female**	**Unisex**
20	0.000025	0.000025	0.000025
25	0.000050	0.000025	0.000500
30	0.000750	0.000400	0.001800
35	0.001000	0.000800	0.004000
40	0.001500	0.001300	0.005000
45	0.001900	0.002800	0.005200
50	0.004000	0.005700	0.004000
55	0.005400	0.005500	0.003000
60	0.000000	0.000000	0.000000

* For municipal and elected members, we assume that 65% of all disabilities are ordinary and 35% are service-connected. For police and fire members, we assume that 25% are ordinary and 75% are service-connected.

APPENDIX B – ALTERNATIVE ACTUARIAL ASSUMPTIONS

8. Rates of Pre-Retirement Mortality

Municipal and Elected Officials: 110% and 115%, for males and females, respectively, of the RP-2014 Employee Table projected from base year of 2006 to 2021 using mortality improvement scale MP-2017.

Uniformed: 85% of the RP-2014 Blue Collar Employee Table projected from base year of 2006 to 2021 using mortality improvement scale MP-2017.

Experience studies are performed every four years as required by State law which require regular and detailed experience and analysis of the mortality trends such that improvements are addressed incrementally with assumption changes as a result of these studies. This mandatory process allows for periodic recognition of mortality improvements which are sufficient in addressing the potential trend. The most recent experience study was conducted for the period between July 1, 2012 and June 30, 2017.

	Municipal and Elected Officials		Uniformed	
Age	**Male**	**Female**	**Male**	**Female**
20	0.000409	0.000189	0.000408	0.000157
25	0.000530	0.000212	0.000530	0.000176
30	0.000550	0.000268	0.000550	0.000221
35	0.000668	0.000380	0.000668	0.000315
40	0.000772	0.000524	0.000772	0.000434
45	0.001086	0.000769	0.001086	0.000638
50	0.001802	0.001226	0.001802	0.001016
55	0.003018	0.002002	0.003018	0.001660
60	0.005319	0.003088	0.005319	0.002560
65	0.009579	0.004453	0.009578	0.003691

* For municipal and elected members, we assume that 98.5% of all deaths are ordinary, with 1.5% service-connected. For police and fire members, 92% are assumed to be ordinary and 8% service-connected.

APPENDIX B – ALTERNATIVE ACTUARIAL ASSUMPTIONS

9. Rates of Post-Retirement Mortality

Municipal and Elected Officials: 127% and 119% for males and females, respectively, of the RP-2014 Healthy Annuitant Table projected from base year 2006 to 2021 using mortality improvement scale MP-2017.

Uniformed: 115% of the RP-2014 Blue Collar Healthy Annuitant Table projected from base year of 2006 to 2021 using mortality improvement scale MP-2017.

	Municipal and Elected Officials		Uniformed	
Age	**Male**	**Female**	**Male**	**Female**
50	0.005015	0.003186	0.004541	0.003139
55	0.007168	0.004486	0.006789	0.004817
60	0.010180	0.006792	0.010031	0.007252
65	0.014715	0.010033	0.015263	0.010512
70	0.021742	0.015288	0.023114	0.016035
75	0.034319	0.024900	0.036499	0.026399
80	0.057729	0.042731	0.060617	0.045229
85	0.101295	0.076712	0.102771	0.079656
90	0.178648	0.137255	0.174268	0.138509
95	0.278849	0.224212	0.261914	0.219761

10. Rates of Post-Disability Mortality

Municipal and Elected Officials: 95% of the RP-2014 Disabled Retiree Table projected from base year 2006 to 2021 using mortality improvement scale MP-2017.

Uniformed: 80% of the RP-2014 Disabled Retiree Table projected from base year 2006 to 2021 using mortality improvement scale MP-2017.

	Municipal and Elected Officials		Uniformed	
Age	**Male**	**Female**	**Male**	**Female**
35	0.010106	0.004319	0.008510	0.003637
40	0.011676	0.005959	0.009832	0.005018
45	0.016427	0.008752	0.013834	0.007370
50	0.018826	0.010942	0.015854	0.009214
55	0.021849	0.014315	0.018399	0.012055
60	0.026070	0.017756	0.021954	0.014953
65	0.031668	0.020761	0.026668	0.017483
70	0.039130	0.026749	0.032952	0.022526
75	0.051951	0.038967	0.043748	0.032814
80	0.073980	0.059755	0.062299	0.050320

APPENDIX B – ALTERNATIVE ACTUARIAL ASSUMPTIONS

11. Rates of Retirement

Rates of Service Retirement - 1967 Plan		
Age	**Municipal**	**Uniformed**
45	0.00	0.10
46-52	0.00	0.05
53-54	0.00	0.10
55	0.30	0.15
56	0.20	0.17
57	0.30	0.20
58	0.30	0.20
59	0.20	0.20
60	0.20	0.25
61	0.20	0.30
62	0.25	0.30
63	0.20	0.30
64	0.20	0.30
65	0.30	0.30
66	0.20	0.30
67	0.20	0.30
68	0.20	0.30
69	0.30	0.30
70+	1.00	1.00

APPENDIX B – ALTERNATIVE ACTUARIAL ASSUMPTIONS

Rates of Service Retirement - 1987 Plan and Plan '10

	Municipal and Elected Officials		Uniformed	
Age	First Year Eligible	Subsequent Years	First Year Eligible	Subsequent Years
45	0.000	0.000	0.030	0.000
46-49	0.000	0.000	0.030	0.030
50	0.000	0.000	0.060	0.060
51	0.000	0.000	0.100	0.050
52	0.050	0.020	0.100	0.050
53-54	0.100	0.020	0.100	0.050
55	0.100	0.020	0.100	0.070
56	0.100	0.020	0.100	0.100
57	0.100	0.020	0.100	0.070
58	0.100	0.020	0.100	0.120
59	0.100	0.080	0.100	0.120
60	0.250	0.250	0.100	0.120
61	0.150	0.200	0.100	0.120
62	0.400	0.250	0.100	0.300
63	0.250	0.200	0.100	0.300
64	0.300	0.200	0.100	0.300
65-69	0.600	0.200	0.100	0.500
70	0.100	1.000	0.100	1.000

Retirements under DROP are included in the rates above.

12. Family Composition Assumptions

70% of active members and 50% of non-active members are assumed to be married for retirees with the 50% J&S with return on contribution form of payment only. Male spouses are assumed to be four-years older than female spouses.

13. Service-connected disability benefit

Service-connected disability benefits are increased by 2.9% to account for the periodic adjustment.