TUCSON SUPPLEMENTAL RETIREMENT SYSTEM

ACTUARIAL EXPERIENCE STUDY
FOR THE FIVE-YEAR PERIOD ENDING JUNE 30, 2013

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The Board of Trustees
Tucson Supplemental Retirement System
Tucson, AZ

Members of the Board:

Subject: Results of the Tucson Supplemental Retirement System Experience Study for the Five-Year Period Ending June 30, 2013

We are pleased to present our report of the Tucson Supplemental Retirement System (TSRS) Experience Study for the five-year period ending June 30, 2013. Our report includes a discussion of the recent experience of the System, it presents our recommendations for new actuarial assumptions and methods, and it provides information about the actuarial impact of these recommendations on the liabilities and other key actuarial measures of TSRS.

With the Board of Trustees' approval of the recommendations in this report, we believe the actuarial condition of the System will be more accurately measured and portrayed.

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

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

Sincerely,

Leslie Thompson, FSA, FCA, EA, MAAA
Senior Consultant

Dana Woolfrey, FSA, FCA, EA, MAAA
Consultant

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SECTION I

INTRODUCTION

Introduction

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

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

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

In conducting experience studies, actuaries generally use data over a period of several years. This is necessary in order to gather enough data so that the results are statistically significant. In addition, if the study period is too short, the impact of the current economic conditions may lead to misleading results. It is known, for example, that the health of the general economy can impact salary increase rates and withdrawal rates. Using results gathered during a short-term boom or bust will not be representative of the long-term trends in these assumptions. Also, the adoption of legislation, such as plan improvements or changes in salary schedules, will sometimes cause a short-term distortion in the experience. For example, if an early retirement window was opened during the study period, we would usually see a short-term spike in the number of retirements followed by a dearth of retirements for the following two-to-four years. Using a longer period prevents giving too much weight to such short-term effects. On the other hand, using a much longer period would water down real changes that may be occurring, such as mortality improvement or a change in the ages at which members retire. In our view, using a five-year period is reasonable.

In an experience study, the first step is to determine the number of deaths, retirements, etc. that occurred during the period. Then the number of deaths, retirements, etc. expected to occur is determined, based on the current actuarial assumptions. The number “expected” is determined from using the probability of the occurrence at the given age, times the “exposures” at that same age. For example, look at a rate of retirement of 50% at age 55. The number of exposures can only be those members who are age 55 and eligible for retirement at that time. Thus they are considered “exposed” to that assumption. Finally the A/E ratio is calculated, where "A" is the actual number (of retirements, for example) and "E" is the expected number. If the current assumptions were "perfect", the A/E ratio would be 100%. For some assumptions (e.g. termination), an A/E ratio greater than 100% is conservative (i.e. generates actuarial gains for the System) while for other

assumptions (e.g. retirement) an A/E ratio less than 100% is conservative. When the A/E ratio varies much from 100%, it is a sign that new assumptions may be needed. Of course we not only look at the assumptions as a whole, but we also review how well they fit the actual results by sex, by age, and by service.

Finally, the actuary graduates or "smoothes" the results since the raw results can be quite uneven from age to age or from service year to service year.

UPDATED ACTUARIAL STANDARDS OF PRACTICE (ASOPS)

Since the last experience study two key areas have been highlighted in changes to actuarial practice. First, under ASOP 35, greater clarity and disclosure is required for margin for future mortality improvement in the mortality assumption. Thus this experience study recommends an update to the mortality assumption and also illustrates the margin for future improvements that exists with the adoption of the new mortality table. ASOP 27 impacts the economic assumptions and eliminates the "reasonable range" for the discount range effective September 30, 2014. In lieu of presenting a reasonable range for the investment return assumption, as actuaries we must now provide a single estimate for the investment return assumption.

ORGANIZATION OF REPORT

Section II contains a summary of the recommended assumption and method changes. Section III contains our findings and recommendations for each actuarial assumption. Section IV contains the impact of the recommendations on the actuarial valuation results as of June 30, 2013. Appendix A summarizes the recommended changes.

SECTION II

SUMMARY OF RECOMMENDED CHANGES

Summary of Recommended Changes

Our recommended changes to the current major actuarial assumptions and methods may be summarized as follows:

Assumption	Current	Proposed
Inflation	**3.50%**	**3.00%**
Investment Return	**7.75%**	**7.25%**
Salary growth	**3.5% wage inflation plus merit ranging from 2.% down to .75%**	**Reduce wage inflation to 3.00% and reduce merit .5% for each year so merit ranges from 1.5% to .0% (net decrease is 1.0%)**
Payroll growth	**3.50%**	**3.00%**
Mortality	**The 1994 Group Annuity Mortality Table with a multiplier of 80% (set forward one year for men and women for post-retirement rates).**	**RP 2000 Scale BB to 2020**
Retirement Rates	**Custom table**	**Modest updates**
Termination Rates	**Custom table**	**Increase rates to reflect higher turnover**
Disability Rates	**Custom table**	**Increase rates to reflect higher turnover**
Unused sick and vacation	**2.2% load on liabilities**	**Refined to adjust service and final average compensation separately.**
Asset smoothing method	**Five year smoothing**	**No change recommended**
Funding method	**Entry Age Normal**	**No change recommended**
Amortization method	**20 year open, level percent of pay**	**No change recommended**

Economic Assumptions:

1. Reduce the inflation assumption from 3.50% to 3.00% to reflect reduced inflation expectations in the financial markets.

2. Leave the net real return at 4.25% and accordingly reduce the nominal investment return

assumption from 7.75% to 7.25% (3.00% inflation plus 4.25% net real return).

3. Reduce the wage inflation from 3.50% to 3.00%. Also set total payroll growth to 3.00%. Both assumptions are currently 3.50%. This change is a decrease in assumed future pay increases and assumed total payroll growth.

4. Reduce the merit component of the salary scale assumption by 0.5%.

Demographic Assumptions:

5. Update to a more current healthy (active and retiree) mortality table which includes some margin for expected mortality improvements. We recommend RP-2000 Combined Mortality Table with projection by Scale BB through 2020.

6. Update to the RP-2000 Disabled Mortality Table for disabled retirees.

7. Make modest updates to retirement rates reflecting actual plan experience as well as the End of Service Program which concluded December 31, 2010.

8. Increase termination rates to reflect actual plan experience.

9. Increase disability rates to reflect actual plan experience.

10. Further refine the unused sick and vacation leave assumption for Tier 1.

Cost Impact of Changes:

Based on the valuation results as of June 30, 2013, incorporation of all economic and demographic changes increases the total Computed Contribution from 32.22% of pay to 34.62%. This is primarily due to the reduced inflation and investment return assumptions.

SECTION III

ANALYSIS OF EXPERIENCE AND RECOMMENDATIONS

Analysis of Experience and Recommendations

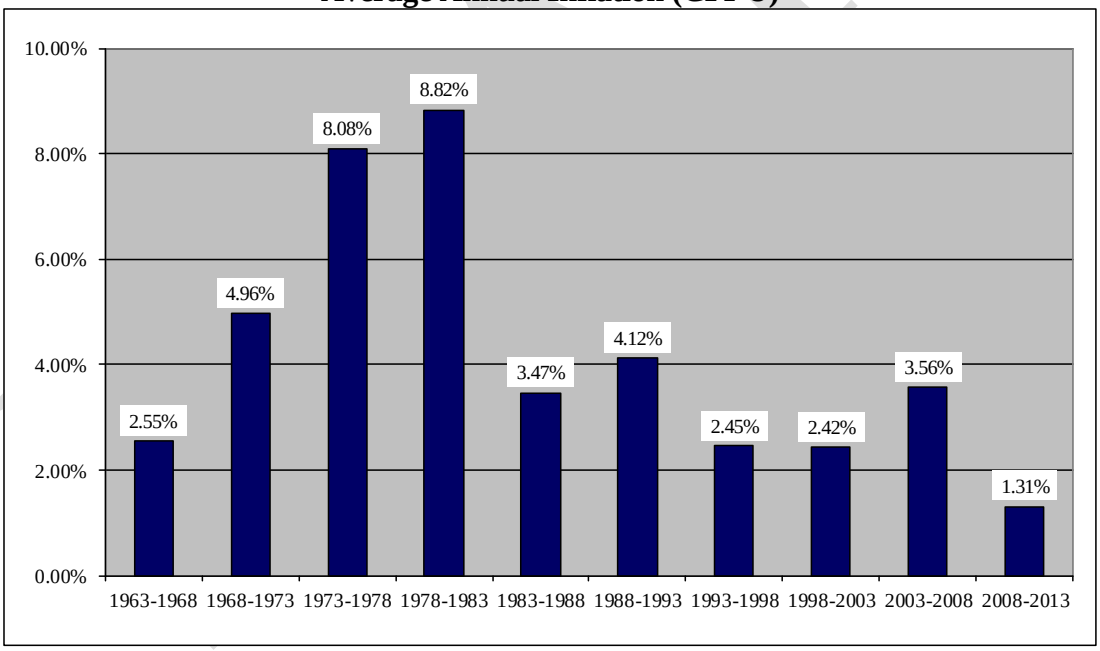
This section begins by discussing the economic assumptions: inflation, the investment return rate, the salary increase assumption, and the payroll growth rate. Next, the discussion will turn to the demographic assumptions: mortality, disability, retirement and termination. Finally, the analysis will include a review of the assumptions and methods used in the valuation.

INFLATION RATE

By "inflation", this analysis is referring to price inflation, as measured by annual increases in the Consumer Price Index (CPI). This inflation assumption underlies all of the other economic assumptions used in an actuarial valuation, including the investment return, individual salary increases, payroll growth and COLA assumptions. The valuation currently uses a 3.5% inflation assumption.

The chart below shows the average annual inflation (based on the CPI) in each of the ten consecutive five-year periods ending December 31 over the last fifty years. Over the five-year period from July 1, 2008 through June 30, 2013, the CPI-U has increased at an average rate of 1.31%.

Average Annual Inflation (CPI-U)



The table below shows the average inflation over various periods, ending June 30, 2013:

Periods Ending December 2011	Average Annual Increase in CPI-U
Last five (5) years	1.31%
Last ten (10) years	2.43%
Last fifteen (15) years	2.43%
Last twenty (20) years	2.43%
Last thirty (30) years	2.88%
Since 1913 (first available year)	3.22%

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

As shown above, inflation has been relatively low over the last twenty years, compared to prior periods. There has been a steady decline in inflation rates over the last 25 years.

However, the assumed inflation rate is only weakly tied to past results, so it is helpful to use other sources of information to gain insight into expectations for the future. Inflation tends run in economic cycles, experiencing periods of relatively high rates and period of relatively lower rates of increase.

Investment Consulting Firms

Most investment consulting firms develop an underlying inflation assumption for their forecasting and derivation of forward-looking capital market assumptions. The 2013 capital market assumption sets for eight investment consulting firms were examined. The eight firms are New England Pension Consulting (NEPC), Hewitt Ennis Knupp, J. P. Morgan, Mercer, Pension Consulting Alliance (PCA), RV Kuhns, SunGard and Towers Watson. The average assumption for inflation among these firms was 2.59%, with a range of 2.30% to 3.00%. However, the investment consulting firms typically set their assumptions based on a five to ten year outlook, while actuaries must make projections encompassing a longer time period. This horizon difference frequently creates a difference between the inflation assumption in the valuation and the inflation assumption used by the investment consultant.

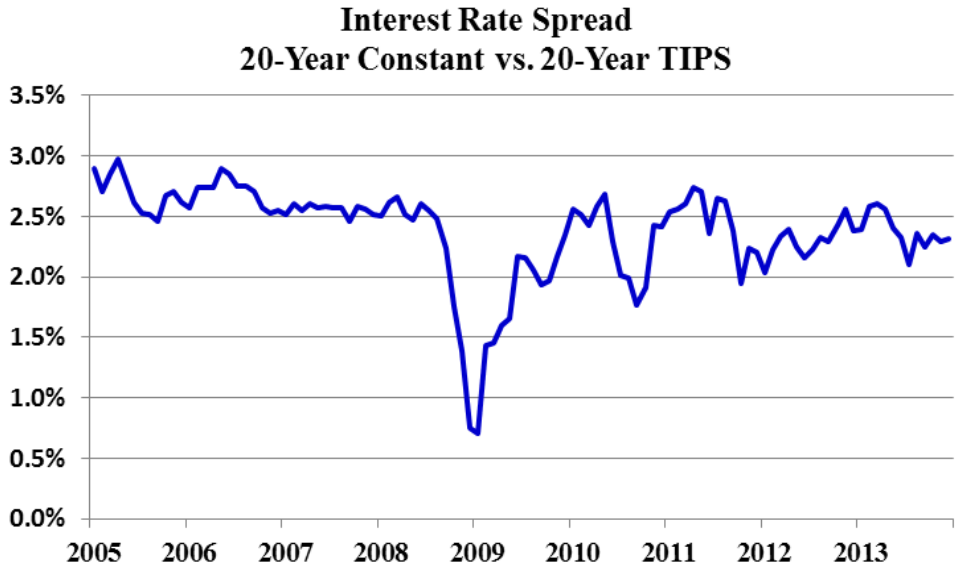
Bond Market

Another source of information about future inflation is the market for US Treasury bonds. Comparing the yields for conventional Treasury securities and Treasury Inflation-Protected Securities (TIPS) provides a useful measure of the market's expectation of future inflation. Conventional Treasury securities compensate its holders by providing a nominal yield with two components, the real rate of interest plus inflation compensation. Since TIPS already adjust for inflation, the yield only includes the real rate of interest. Therefore the difference roughly reflects the inflation expectation for that maturity horizon.

For example, the December 13, 2013 yield for 20-year TIPS was 1.30% plus actual inflation. The yield for 20-year non-indexed US Treasury bonds was 3.61%. Simplistically, this means that

on that day the bond market was predicting that inflation over the next twenty years would average 2.31% (3.61% – 1.30%) per year.

Below is a chart with the historical spread between 20-year constant and 20-year inflation protected Treasury bonds.



The historical spread between the constant and inflation protected securities was relatively constant from 2005 up to the beginning of the crisis in the credit market. The decrease in the spread during the collapse of the US investment markets and the subsequent volatility reflect differences in liquidity and the risk premiums that buyers of US Treasury securities require.

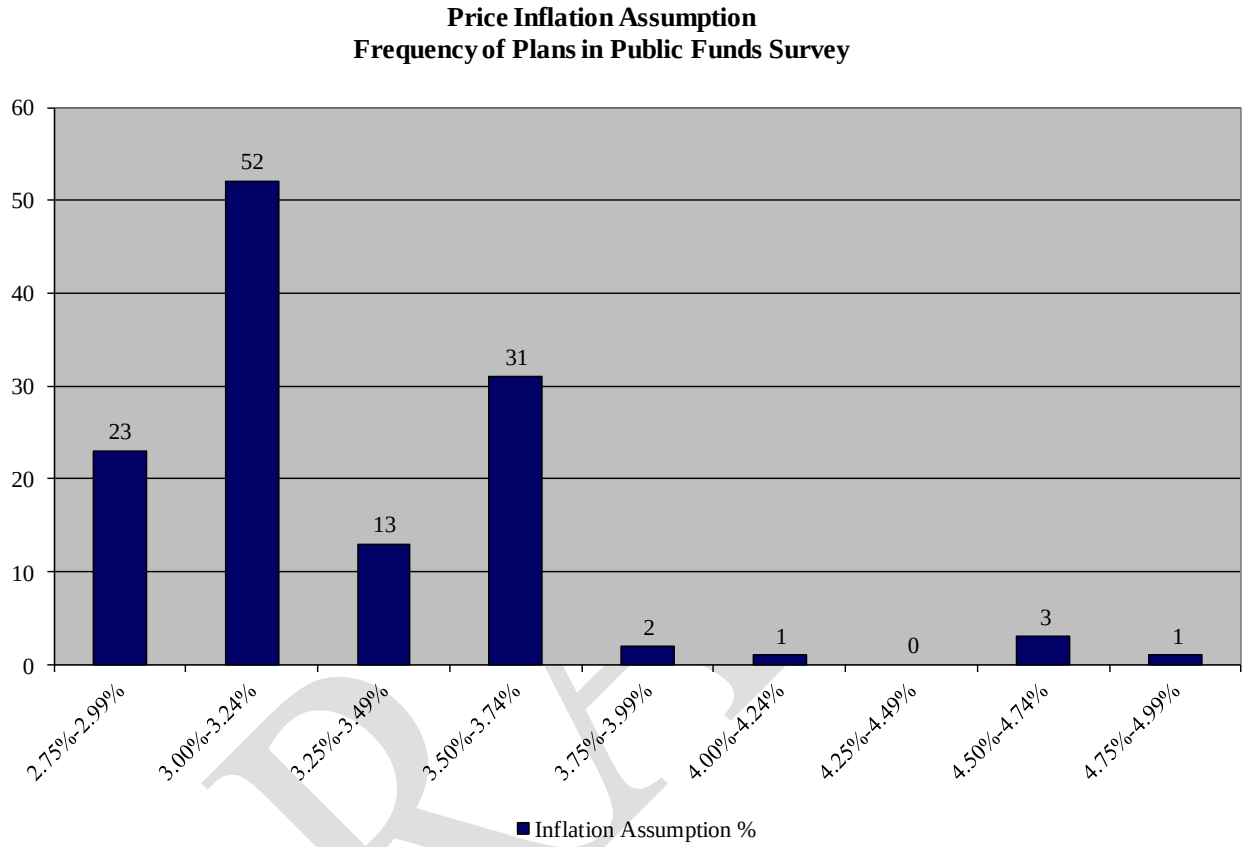
The Cleveland Fed has developed a model that combines information from a number of sources to address the shortcomings of the "break-even" rate illustrated above. Based on the results of its model, the Federal Reserve Bank of Cleveland reported in December of 2013 that it estimates the 10-year expected inflation to be 1.75%, which implies expectations for inflation to be less than 2.00% on average for the next decade.

Other Sources of Inflation Forecasts

In the Social Security Administration's 2013 Trustees Report, the Office of the Chief Actuary is projecting a long-term average annual inflation rate of 2.80% under the intermediate cost assumption. (The inflation assumptions are 1.80% and 3.80% respectively in the low cost and high cost projection scenarios.) These inflation assumptions have remained unchanged for several years.

The Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. Its most recent forecast (second quarter of 2012) was for inflation over the next five years to average 2.10% and over the next ten years to average 2.20%.

Another source of information about this assumption is the Public Funds Survey that is prepared on behalf of the National Association of State Retirement Administrators (NASRA) and the National Council on Teacher Retirement (NCTR). This report surveys about 126 plans, including all of the largest public funds covering state employees or teachers.



Source: http://www.publicfundsurvey.org/publicfundsurvey/actuarialassumptions.asp. Data summarized by GRS for valuation dates ranging from 6/30/2010 through January 1, 2013.

The current survey shows that the median inflation rate assumed for large public retirement systems in the U.S. is 3.00%, which is also the most prevalent assumption. Approximately 60% of the surveyed systems use an assumption of 3.00% or less, and the trend continues in this direction. The information in the Public Funds Survey for many of the systems is more than a year old and it is possible that some systems have subsequently updated their assumptions.

Recommendation

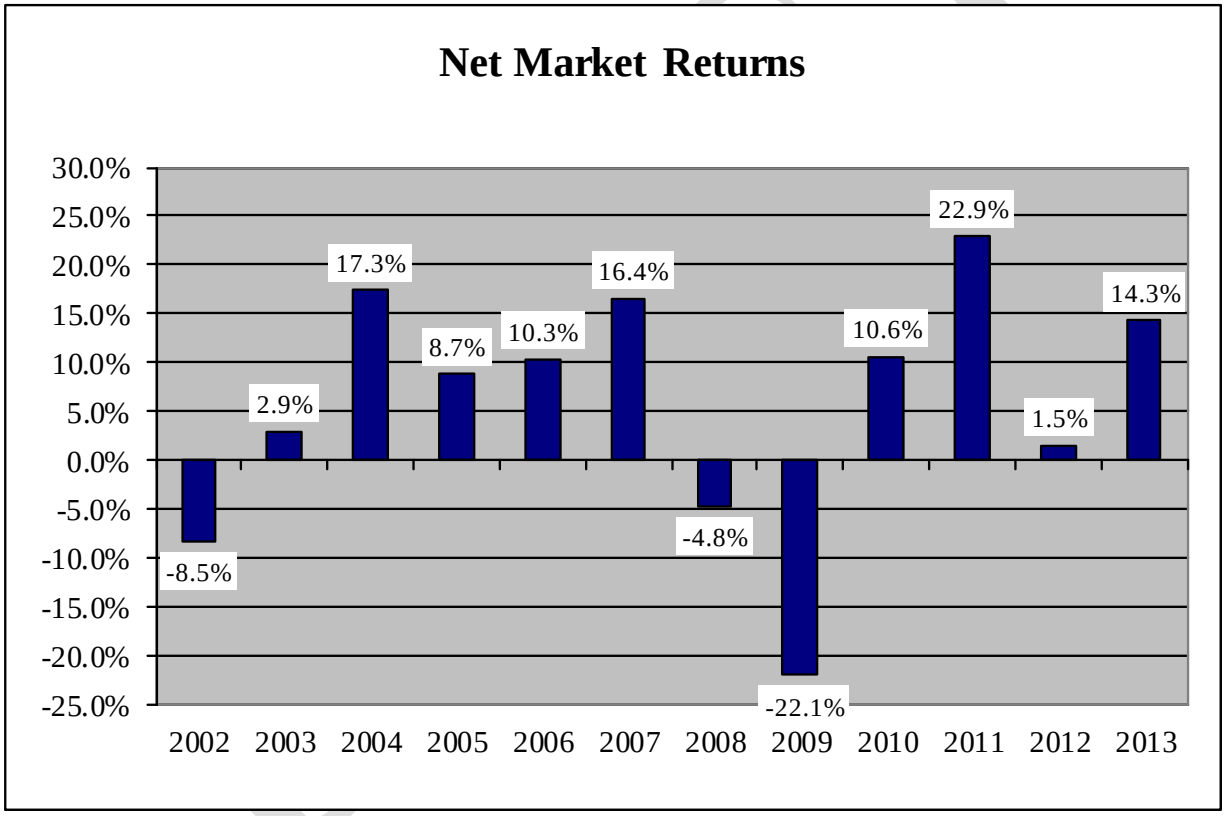
Peer group members, investment consultants, and even selected other measures all indicate a decrease in the expectation for inflation. The horizon for the inflation assumption is larger than that of the investment consultants, meaning their lower assumed inflation rates are potentially too low for the longer period. Therefore, a reasonable long-term inflation assumption range is between 2.50% and 3.00%. The recommended change to the Board is to consider a decrease their inflation assumption from 3.50% to 3.00%, which would place it closer to the shorter-term levels expected in the financial markets.

INVESTMENT RETURN RATE

Currently, the Tucson Supplemental Retirement System valuation assumes an investment return rate of 7.75%, net of investment expenses. This is the rate used in discounting future payments and in calculating the actuarial present value of those payments. The current assumption assumes inflation of 3.50% per annum and an annual real rate of return of 4.25% net of investment expenses.

Historical Information Performance

The assumption of an 7.75% investment return has been used since the June 30, 2004 valuation and was 8.00% in the prior year. The following chart shows the year-by-year returns since 2002, as estimated by GRS.



For the last five years, the average market return has been 4.19%, for the last 10 years has been 6.71%. However, for this assumption, past performance, even averaged over five years or longer, is not a reliable indicator of future performance.

Asset Allocation

The actual asset allocation of the trust fund will significantly impact the overall performance, so returns achieved under a different allocation are not meaningful. More importantly, the real rates of return for many asset classes, especially equities, vary so dramatically from year to year that even a

ten-year period is not long enough to provide reasonable guidance, so the actual asset allocation used by the trust is reviewed over a long horizon.

The current target asset allocation, as established by the Board, is shown below. The Tucson Supplemental Retirement System is in the middle of an Asset Liability Modeling Study. A new target asset allocation may result from this study which will likely change the real return expectations from the Capital Market Assumption Modeler.

Asset Class	Percent of Total Pension Fund		
	Minimum	Target	Maximum
Equities:			
Large Cap	31%	36%	41%
Small/Mid Cap	6%	10%	14%
International	13%	15%	17%
Total Equities	56%	61%	66%
Fixed Income	21%	26%	31%
Real Estate	6%	8%	10%
Infrastructure	3%	5%	7%

Capital Market Assumptions

Using capital market assumptions for 2014 from eight large investment consulting entities mentioned previously in the Inflation Rate section and using the above asset allocation targets (using the "Target" column), the following range for return assumptions was developed, net of both administrative and investment expenses.

The following analysis assumes an inflation assumption of 3.00%, which is the recommended inflation rate assumption from the prior section of this report. In addition, there is an administrative expense assumption of 0.13% included in the development of the real rate of return. This was the average administrative expense over the last five years.

Expected Real Returns

Given the plan's current target asset allocation and the investment consultant's capital market assumptions, the development of the average real return, net of administrative and investment expenses, is provided in the following table.

Investment Consultant	Investment Consultant Expected Nominal Return	Investment Consultant Inflation Assumption	Expected Real Return (2)–(3)	Plan Incurred Expense Assumption	Expected Real Return Net of Expenses (4)-(5)
(1)	(2)	(3)	(4)	(5)	(6)
1	6.78%	3.00%	3.78%	0.13%	3.65%
2	6.82%	2.50%	4.32%	0.13%	4.18%
3	7.15%	2.75%	4.40%	0.13%	4.26%
4	7.12%	2.22%	4.89%	0.13%	4.76%
5	7.39%	2.25%	5.14%	0.13%	5.01%
6	7.35%	2.20%	5.15%	0.13%	5.02%
7	7.61%	2.26%	5.35%	0.13%	5.21%
8	7.86%	2.50%	5.36%	0.13%	5.23%
Average	**7.26%**	**2.46%**	**4.80%**	**0.13%**	**4.67%**

We have determined for each firm the expected nominal return rate, then subtracted that firm's expected inflation to arrive at their expected real return in col. (4). Then we have subtracted 0.13% for expenses to get a net real return in col. (6). As the table shows, the average net one-year real return of the eight firms is 4.67%, which is 0.42% more than the current assumption of 4.25%. Additionally, all but two of the firms have an expected arithmetic real return that exceeds the current 4.25% assumption.

However, in addition to examining the expected one-year return, it is important to review anticipated volatility of the investment portfolio and understand the range of long-term net return that could be expected to be produced by the investment portfolio. Therefore, the table on the following page provides the 25th, 50th, and 75th percentiles of the 20-year geometric average of the expected real return, net of expenses. In addition, the table includes the probability of the asset allocation producing a real return at or above the current assumption of 4.25%

Investment Consultant	Distribution of 20-Year Average Geometric Net Real Return 25th	50th	75th	Probability of exceeding 4.25%*
(1)	(2)	(3)	(4)	(5)
1	0.97%	2.87%	4.80%	31.4%
2	1.55%	3.42%	5.33%	38.4%
3	1.51%	3.45%	5.42%	39.1%
4	2.28%	4.07%	5.89%	47.3%
5	2.20%	4.17%	6.18%	49.0%
6	2.26%	4.20%	6.18%	49.3%
7	2.94%	4.61%	6.31%	55.8%
8	2.45%	4.41%	6.40%	52.1%
Average	**2.02%**	**3.90%**	**5.81%**	**45.3%**

*Plan's current return assumption net of expenses.

In addition to the results using the Capital Market Assumption Modeler of these eight investment firms, a Callan presentation to the Board in May of 2014 entitled "2014 Asset Allocation and Liability Study: Phase 1" suggests that using a 10-year geometric return, the plan is expected to earn 4.55% real return.

Actuarial Standard of Practice #27

ASOP 27 governs the advice that an actuary can give to a client in setting the long term investment return assumption. Previously, actuaries were to give a "range" for a reasonable assumption, and that range became the 25% to 75% likelihood range. Based on the above chart, that would mean the reasonable range for the long term investment return would be 4.91% to 8.79%. The Actuarial Standards Board felt that range was far too wide and therefore issued a statement favoring the recommendation of a single reasonable rate for the long term investment return assumption. The additional factors which are to be considered include:

1. The investment return assumption is appropriate for the purpose of the measurement;
2. The investment return assumption reflects the actuary's professional judgment;
3. The recommendations takes into account historical and current economic data relevant as of the measurement date;
4. The recommendation reflects the actuary's estimate of current or future experience;
5. The recommended assumption has no significant bias.

Different actuaries may have differing opinions on what the single reasonable rate would be for a given set of facts and circumstances. Additionally, one actuary might use different rates for different clients.

Recommendation

We recommend no change to the current 4.25% net real return assumption. 4.25% is almost exactly the midpoint between the arithmetic (4.67%) and geometric (3.90%) averages based on the survey of investment consultants. Many statisticians believe the arithmetic return is biased to the high side and the geometric is biased to the low side, so being in-between can be considered an optimal assumption.

In turn, we recommend lowering the nominal investment return assumption from 7.75% to 7.25%, net of expenses. This would be composed of an inflation rate of 3.00% and a real return of 4.25% net of expenses. Under the prior ASOP, a wide range of 5.02% to 8.81% could be developed based on the results of the distribution of the 20-year average of the geometric net real returns. However, as discussed above, the recommendations of this experience study can no longer be in terms of the reasonable range and thus we make a reasonable single recommendation for the investment return assumption, taking into account the factors discussed above.

Further considerations

The estimates for core investments (i.e. fixed income, equities, and real estate) are generally based on anticipated returns produced by passive index funds. Please note that the actuarial standards do not allow us to consider alpha that may be generated by active management. To the extent that Tucson uses active management practices, this could be used as support for the Board choosing a slightly higher real return.

In addition, the funding policy adopted by the Board in December of 2013 includes a "round-up contribution policy". The policy rounds up the variable rate member contributions to the nearest 25 basis points and rounds up the net City contribution to the nearest 50 basis points, with the stipulation that the City rate never be less than the calculated rate for any of the three employee groups (pre-2006, 2006-2011, post-2011). The cost impact to the valuation results shown in Section IV of this report shows that 25 basis points of investment return assumption translates to about 150 basis points of additional contribution requirement. The round-up policy will vary in its impact to the contributions paid into the fund each year, but if an investment return of 7.50% is adopted, the round-up policy will partially close the gap between the resulting lower actuarial contribution rate at 7.50% and what it would have been at 7.25%.

Although these considerations provide support for possibly increasing the adopted investment return assumption above our 7.25% recommendation, we advise that you not exceed 7.50% as your adopted investment return.

Ongoing Asset Liability Modeling Study

The Board has engaged Callan Associates to perform an Asset Liability Modeling Study. This study is still ongoing and the final asset allocation is not yet determined. In a presentation issued in May of 2014, Callan presented the results of the current target asset allocation along with 5 alternative asset mixes. Using the asset allocations provided by Callan, we have the results shown earlier in the report using Capital Market Assumption Modeler for each of the alternative asset mixes and the results are shown below.

	Target/ Current	Alternate Mix 1	Alternate Mix 2	Alternate Mix 3	Alternate Mix 4	Alternate Mix 5
	Asset Class					
Broad U.S. Equity*	46%	23%	26%	30%	34%	38%
Broad International Equity	15%	16%	19%	22%	25%	28%
Broad U.S. Fixed Income	26%	51%	43%	35%	27%	19%
Real Estate	8%	5%	7%	8%	9%	10%
Infrastructure	5%	5%	5%	5%	5%	5%
Total	100%	100%	100%	100%	100%	100%
	Capital Market Modeling Results					
1-Year Expected	7.67%	6.57%	6.92%	7.29%	7.66%	8.03%
Median Return	6.90%	6.17%	6.44%	6.69%	6.93%	7.16%
Halfway point (arith/geom)	**7.28%**	**6.37%**	**6.68%**	**6.99%**	**7.30%**	**7.59%**
Standard Deviation	12.71%	9.15%	10.13%	11.25%	12.41%	13.61%
Probability of Exceeding 7.25%	45.3%	30.7%	36.5%	41.5%	45.6%	48.9%

*Assumes 80/20 Large/Small Cap Mix

The results indicate that Mix 4 produces very similar results to the current Target Asset Allocation. If Mix 4 is chosen by the Board, our recommendation of 7.25% nominal investment return would

remain unchanged. If the Board choses Mix 1, 2, or 3, our recommendation would be lowered. If the Board choses Mix 5, our recommendation would be increased.

SALARY INCREASE RATES

Generally, the salary scale assumption consists of a wage inflation assumption that represents the increases for long-service employees plus a component for merit and promotion increases for members early in their career. Historically, wage inflation almost always exceeds price inflation. This is because wage inflation is the result of (a) price inflation, and (b) productivity gains being passed through to wages. For the last ten years, for the economy as a whole, wage inflation has outpaced price inflation by about 0.30%, and for the last twenty years, wage inflation has exceeded price inflation by about 0.79%. Since 1951, wage inflation has been about 1.00% a year larger than price inflation.

During most of the experience study period, the City of Tucson was under a pay freeze. Of the 1,900 members that have been active since the beginning of the study period, the valuation pay for 1,300 of those members has risen by 1.0 percent or less. The valuation assumptions model benefits accrued over the next 30 years and beyond. Using a salary increase assumption developed using data during a pay freeze would not produce a reasonable long-term assumption. Currently, the City of Tucson uses an inflation component of 3.5% along with an age and service based merit component.

We recommend reducing the inflation component to account for the general price inflation reduction from 3.50% to 3.00%. We also recommend reducing the merit component by 0.50% so that the **net effect on total pay increases is a reduction of 1.00%,** consistent with the reduction in the general price inflation assumption. Reducing the inflation will affect the payroll of new hires used in projection scenarios as well the total payroll growth rate discussed in the following section.

Current assumption:

Less than Five Years of Service				Five or More Years of Service			
Service	Inflation Component	Merit & Seniority	Total	Sample Ages	Inflation Component	Merit & Seniority	Total
0	3.50 %	4.00 %	7.50 %	20	3.50 %	2.00 %	5.50 %
1	3.50	3.50	7.00	25	3.50	2.00	5.50
2	3.50	3.00	6.50	30	3.50	2.00	5.50
3	3.50	2.50	6.00	35	3.50	2.00	5.50
4	3.50	2.00	5.50	40	3.50	1.50	5.00
				45	3.50	1.00	4.50
				50	3.50	0.75	4.25
				55	3.50	0.75	4.25
				60	3.50	0.75	4.25
				65	3.50	0.00	3.50

Recommended assumption:

Less than Five Years of Service				Five or More Years of Service			
Service	Inflation Component	Merit & Seniority	Total	Sample Ages	Inflation Component	Merit & Seniority	Total
0	3.00 %	3.50 %	6.50 %	20	3.00 %	1.50 %	4.50 %
1	3.00	3.00	6.00	25	3.00	1.50	4.50
2	3.00	2.50	5.50	30	3.00	1.50	4.50
3	3.00	2.00	5.00	35	3.00	1.50	4.50
4	3.00	1.50	4.50	40	3.00	1.00	4.00
				45	3.00	0.50	3.50
				50	3.00	0.25	3.25
				55	3.00	0.25	3.25
				60	3.00	0.25	3.25
				65	3.00	0.00	3.00

PAYROLL GROWTH RATE

The salary increase rates discussed above are assumptions applied to the growth in an individual's pay. These rates are used in projecting future benefits. A separate payroll growth assumption, currently 3.50%, is used in determining the charge needed to amortize the unfunded actuarial accrued liability. The amortization payments are calculated to be a level percentage of payroll, so as payroll increases over time, these charges also increase. The amortization payment is dependent on the rate at which payroll is assumed to increase. Higher payroll total growth rate means a lower payment can be made today since more dollars will be contributed in the future (and vice versa).

Payroll can grow at a rate different from the average pay increase for individual members. There are two reasons for this. First, when older, longer-service members terminate, retire or die, they are generally replaced with new members who have a lower salary. Because of this, in most populations that are not growing in size, the growth in total payroll will be smaller than the average pay increase for members. Second, payroll can grow due to an increase in the size of the group. However, GASB 25 prohibits systems from using anticipated membership growth in setting the payroll growth assumption.

It is recommended that the payroll growth assumption be set to inflation, or 3.00%.

POST-RETIREMENT MORTALITY RATES

TSRS's actuarial liabilities depend in part on how long retirees live. If members live longer, benefits will be paid for a longer period of time, and the liability will be larger.

The rates currently being used for non-disabled retirees and for beneficiaries receiving benefits are 80 percent of the 1994 Group Annuity Mortality (GAM) table. This table has separate rates for males and females.

To analyze the data, we begin by determining the expected number of deaths in each year at each age for males and females. Then we compare the actual number to the expected number. The ratio of the actual deaths to the expected deaths—the A/E ratio—then tells us whether the assumptions are reasonable. For this assumption, using a static mortality table such as 1994 GAM, an A/E ratio of between 110% and 120% has traditionally been desired for conservatism and to build in a margin for continued future improvements in mortality rates.

We recommend updating to the RP-2000 Combined Mortality Table for males and females projected with Scale BB to 2020. The recommended table gives an A/E Ratio of 124% for males and 91% for females on the limited data. Overall, for both males and females, this gives an overall A/E ratio of 114%.

Male Healthy Post-Retirement Mortality

Age	Deaths	Exposure	Crude Rates	Sample Rates*		Expected Deaths		A/E Ratio	
				Old	New	Old	New	Old	New
50-54	1	160	0.006250	0.002867	0.002511	1	-		-
55-59	6	809	0.007417	0.005040	0.004331	4	4	150.0%	150.0%
60-64	13	1,588	0.008186	0.009177	0.007309	15	12	86.7%	108.3%
65-69	19	1,400	0.013571	0.015887	0.012125	22	17	86.4%	111.8%
70-74	15	983	0.015259	0.024961	0.020164	25	20	60.0%	75.0%
75-79	33	801	0.041199	0.040169	0.034670	32	28	103.1%	117.9%
80-84	40	472	0.084746	0.066008	0.059490	31	28	129.0%	142.9%
85-89	34	240	0.141667	0.101584	0.102616	24	24	141.7%	141.7%
90-94	23	104	0.221154	0.158714	0.180776	16	18	143.8%	127.8%
95-99	5	9	0.555556	0.228222	0.276754	2	2	250.0%	250.0%
100-104	-	-	N/A	0.294834	0.357097	-	-	N/A	N/A
105-109	-	-	N/A	0.366042	0.400000	-	-	N/A	N/A
Totals	189	6,566	0.028785	0.026196	0.023302	172	153	109.9%	123.5%

Sample rates are taken from midpoint of age group.

Female Healthy Post-Retirement Mortality

Age	Deaths	Exposure	Crude Rates	Sample Rates*		Expected Deaths**		A/E Ratio	
				Old	New	Old	New	Old	New
50-54	-	185	0.000000	0.001526	0.001900	-	-		-
55-59	1	655	0.001527	0.002687	0.003022	2	2	50.0%	50.0%
60-64	6	777	0.007722	0.005342	0.005229	4	4	150.0%	150.0%
65-69	2	742	0.002695	0.009410	0.009554	7	7	28.6%	28.6%
70-74	12	485	0.024742	0.014675	0.016232	7	8	171.4%	150.0%
75-79	7	302	0.023179	0.025382	0.026789	8	8	87.5%	87.5%
80-84	5	248	0.020161	0.043886	0.044218	11	11	45.5%	45.5%
85-89	14	156	0.089744	0.075056	0.075671	11	12	127.3%	116.7%
90-94	6	70	0.085714	0.124745	0.131546	9	9	66.7%	66.7%
95-99	4	15	0.266667	0.190170	0.198660	3	3	133.3%	133.3%
100-104	1	1	1.000000	0.270804	0.244509	-	-	N/A	N/A
105-109	-	-	N\A	0.355494	0.322725	-	-	N/A	N/A
Totals	58	3,636	0.015952	0.017052	0.017602	62	64	93.5%	90.6%

** Sample rates are taken from midpoint of age group.*

Gender	Deaths	Expected Deaths (Current)	Expected Deaths (Proposed)	A/E Ratio (Current)	A/E Ratio (Proposed)
Male	189	172	153	110%	124%
Female	58	62	64	94%	91%
Total	247	234	217	106%	114%

ACTIVE AND DISABLED MORTALITY RATES

There were 26 active member deaths and 25 disabled member deaths during the 5-year experience study period. This data is not considered sufficient enough exposure on which to base these assumptions. Accordingly, we are recommending standard tables that parallel the retiree proposed table. For active mortality, we recommend using the same table used for healthy retirees, RP-2000 Combined Mortality Table projected with Scale BB to 2020.

For disabled mortality, we recommend using RP-2000 Disabled Mortality Tables for males and females without projection.

DISABILITY RATES

For this assumption, A/E ratios under 100% are conservative (when there are fewer disabilities than expected, the Plan usually experiences a gain). Disability is an assumption with a minor impact on the liabilities of the System. The recommended rates increase the number of expected disabilities, consistent with System experience, and also increase with age across all age ranges.

Age	Disabilities	Exposure	Crude Rates	Sample Rates*		Expected Disabilities		A/E Ratio	
				Old	New	Old	New	Old	New
Under 20	-	-	N/A	0.0000	0.0001	-	-	N/A	N/A
20-24	-	-	N/A	0.0001	0.0001	-	-	N/A	N/A
25-29	-	33	0.0000	0.0002	0.0005	-	-	N/A	N/A
30-34	-	260	0.0000	0.0003	0.0008	0.1	0.2	0%	0%
35-39	1	668	0.0015	0.0005	0.0011	0.3	0.8	333%	125%
40-44	3	1,152	0.0026	0.0007	0.0014	0.8	1.7	375%	176%
45-49	4	1,628	0.0025	0.0011	0.0020	1.7	3.3	235%	121%
50-54	3	2,082	0.0014	0.0019	0.0029	3.7	6.1	81%	49%
55-59	7	929	0.0075	0.0028	0.0040	2.4	3.7	292%	189%
60-64	6	251	0.0239	0.0025	0.0054	0.7	1.2	857%	500%
Totals	24	7,003	0.0034	0.0014	0.0024	9.7	17.0	247%	141%

RETIREMENT RATES

This assumption includes only members who retired from active status. For this assumption, A/E ratios under 100% are conservative (when there are fewer retirements than expected, the System usually experiences a gain).

The long term rates of retirement for TSRS have been difficult to study in both this and the last experience study due to the End of Service Program which was available to members from July 1, 2006 to December 31, 2010. During the experience study period, more than half of the retirements occurred during 2010, likely to take advantage of the End of Service Program. Due to this rush of retirements, there tends to be less in the way of age or service patterns – the data tells us members tend to retire at whatever age and service they were in 2010. Given this wave of retirements, we have moderated any recommended changes to rates which increase the expected number or retirements.

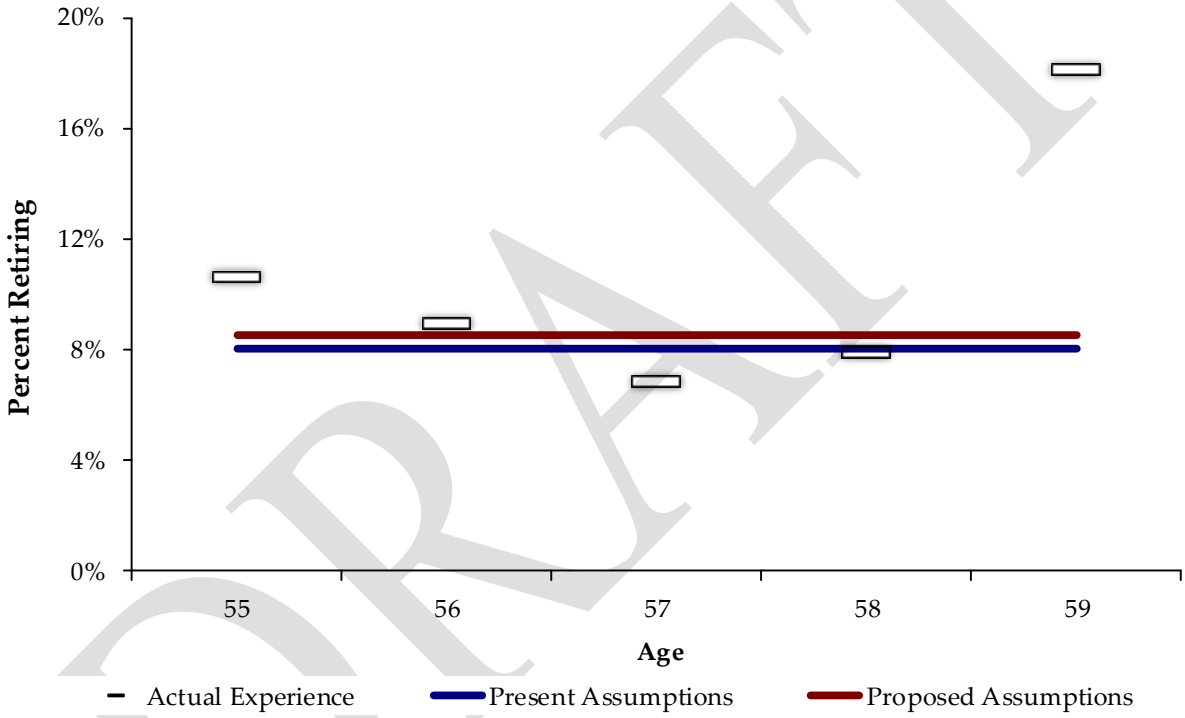
We currently use retirement rates that are split into three separate eligibility categories:

- Age Based Early Retirement
- Age Based Normal Retirement
- Age Based Rule of 80

We recommend continued use of this rate structure. The following shows the experience and recommended rates under each of the different eligibility categories.

Age-Based Early Retirement

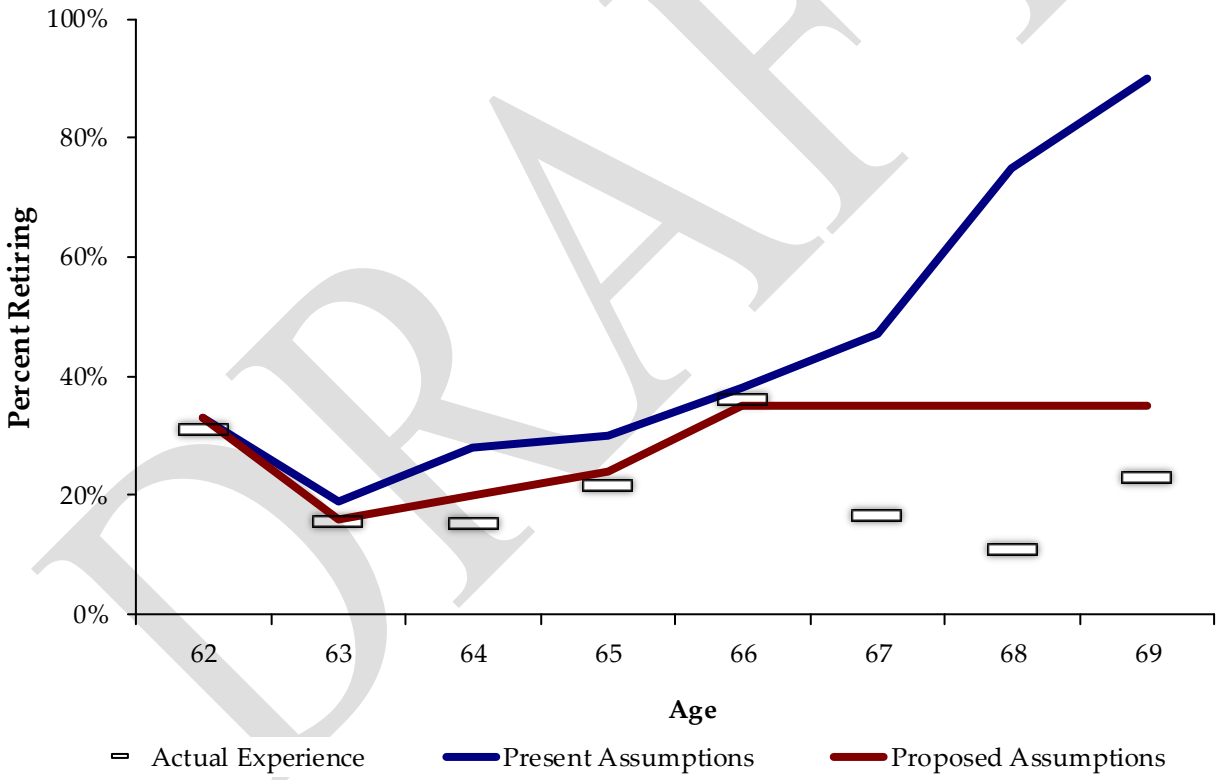
Age	Retirements	Exposure	Crude Rates	Sample Rates		Expected Retirements		A/E Ratio	
				Old	New	Old	New	Old	New
55	11	103	0.1068	0.0800	0.0850	8.2	8.8	133%	126%
56	8	89	0.0899	0.0800	0.0850	7.1	7.6	112%	106%
57	4	58	0.0690	0.0800	0.0850	4.6	4.9	86%	81%
58	3	38	0.0789	0.0800	0.0850	3.0	3.2	99%	93%
59	4	22	0.1818	0.0800	0.0850	1.8	1.9	227%	214%
Totals	30	310	0.0968			24.8	26.4	121%	114%



As mentioned previously, we have moderated any increased to recommended rates to account for the End of Service Program which ended in 2010. The actual to expected ratio of 114% represents a move toward the observed experience while at the same time recognizing that long term rates of retirement may not be as high.

Age-Based Normal Retirement (not Rule of 80 eligible)

Age	Retirements	Exposure	Crude Rates	Sample Rates		Expected Retirements		A/E Ratio	
				Old	New	Old	New	Old	New
62	52	167	0.3114	0.3300	0.3300	55	55	95%	95%
63	17	109	0.1560	0.1900	0.1600	21	17	81%	100%
64	13	85	0.1529	0.2800	0.2000	24	17	54%	76%
65	14	64	0.2188	0.3000	0.2400	19	15	74%	93%
66	18	50	0.3600	0.3800	0.3500	19	18	95%	100%
67	4	24	0.1667	0.4700	0.3500	11	8	36%	50%
68	2	18	0.1111	0.7500	0.3500	14	6	14%	33%
69	3	13	0.2308	0.9000	0.3500	12	5	25%	60%
Totals	123	530	0.2321			175	141	70%	87%
70 & Over	5	43	0.1163	1.0000	1.0000	43	43	12%	12%
Total	128	573	0.2234			218	184	59%	70%



The recommended rates reflect fewer retirements observed at older ages.

Age-Based Rule of 80

The observed retirement experience for Rule of 80 eligibility showed little correlation with age. The current rates of 25% at any age also indicate that age has not been a good predictor of retirement for this eligibility category in the past either. We studied this eligibility group based on the variable of years from retirement eligibility hoping that it would be a better predictor of retirement, but it was not. This may be again due to the End of Service Program. We recommend studying this group based on years from retirement eligibility again with the next experience study.

The data did show more retirements than expected. The current assumption is a flat rate of 25%. The observed experience showed a rate of 30.4%. We recommend increasing the rate slightly to 27%, changing the actual to expected ratio from 120 to 112%. This is another instance where we do not recommend further adjustment because, in absence of the End of Service Program, long-term retirement rates may not be as high as observed during the experience period.

TERMINATION RATES

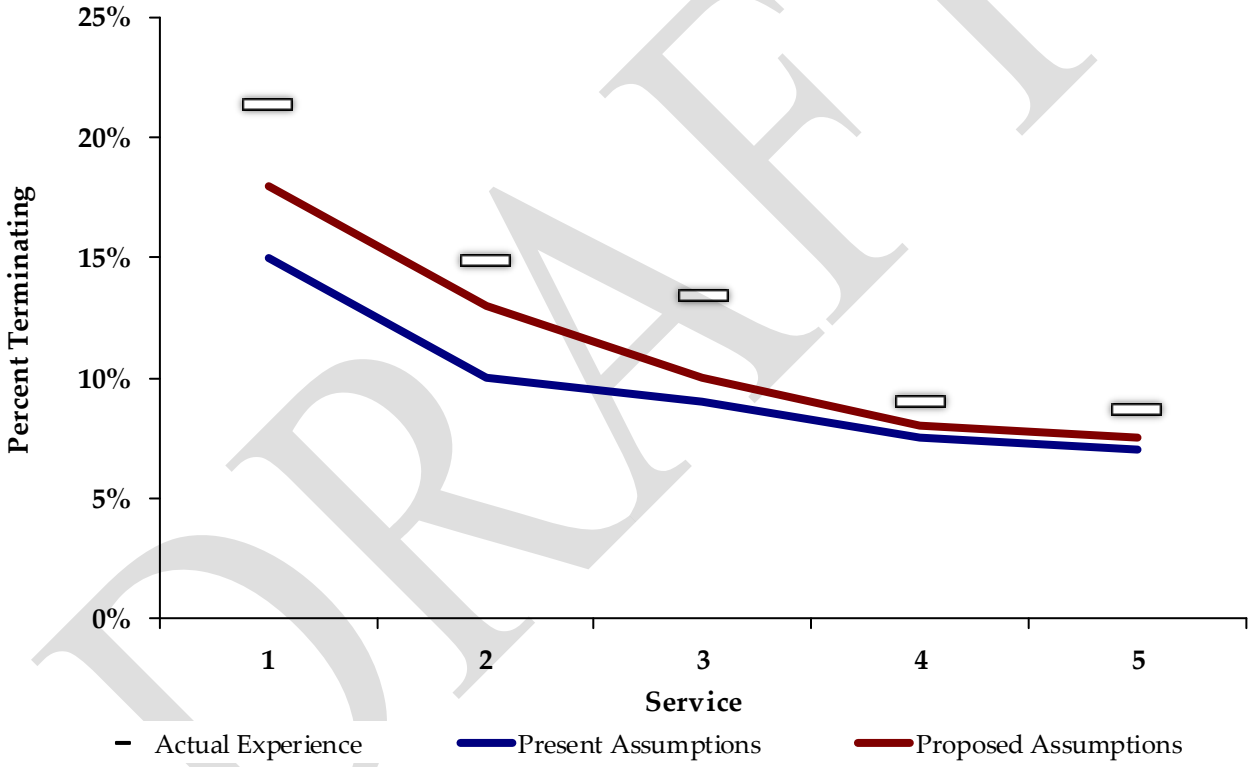
Termination rates reflect members who leave for any reason other than death, disability or service retirement. They apply whether the termination is voluntary or involuntary, and whether the member takes a refund or keeps his/her account balance on deposit in the Pension Trust. For this assumption, A/E ratios over 100% are conservative (when there are more terminations than expected, the Plan usually experiences a gain).

TSRS incorporates both age and service in the "select and ultimate" assumption. This means that, for a five year select period, every employee will be assumed to terminate according to the rates in the select table, regardless of age. Upon earning five years of service, each employee will, from then on, be assumed to terminate according to the age-based rates in the ultimate table. We recommend continued use of this rate structure.

TSRS experienced more terminations than expected, both during and after the five-year select period. We recommend reducing the termination rates midway between observed and expected experience.

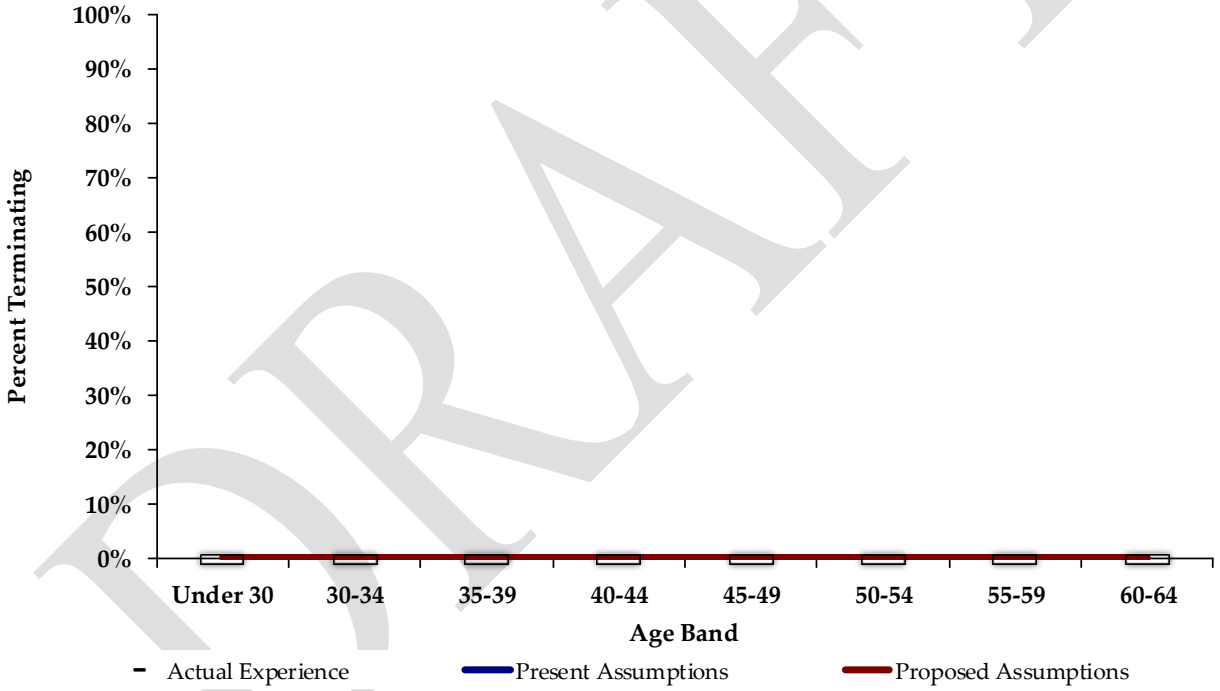
Service-based Withdrawal Experience for Members with Less Than Five Years of Service

Service Index	Withdrawal	Exposure	Crude Rates	Sample Rates		Expected Withdrawals		Actual to Expected	
				Old	New	Old	New	Old	New
1	80	373	0.2145	0.1500	0.1800	56	67	143%	119%
2	117	784	0.1492	0.1000	0.1300	80	102	146%	115%
3	99	737	0.1343	0.0900	0.1000	66	74	150%	134%
4	71	786	0.0903	0.0750	0.0800	59	63	120%	113%
5	74	849	0.0872	0.0700	0.0750	60	64	123%	116%
Totals	441	3,529	0.1250	0.0910	0.1048	321	370	137%	119%



Age-based Withdrawal Experience for Members with More Than Five Years of Service

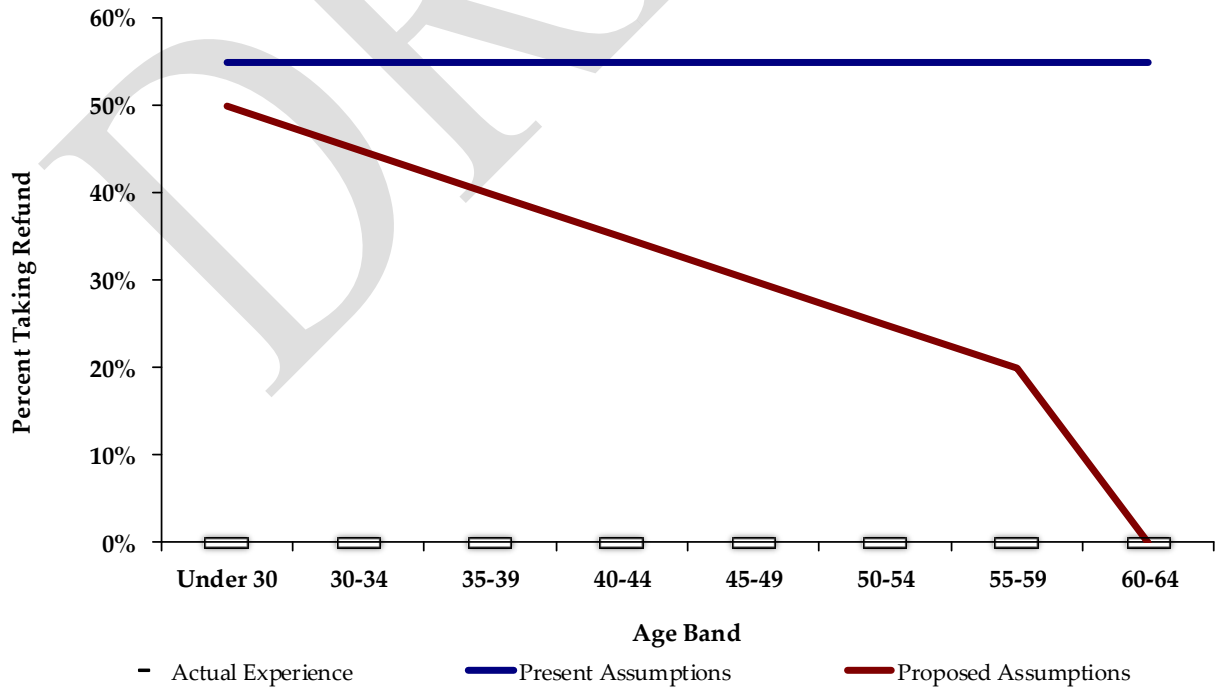
Age	Withdrawal	Exposure	Crude Rates	Sample Rates		Expected Withdrawals		Actual to Expected	
				Old	New	Old	New	Old	New
Under 30	8	126	0.0635	0.0635	0.0710	8	9	100%	89%
30-34	38	556	0.0683	0.0499	0.0574	28	32	137%	119%
35-39	63	1,054	0.0598	0.0333	0.0408	35	43	180%	147%
40-44	61	1,555	0.0392	0.0260	0.0335	40	52	151%	117%
45-49	65	1,987	0.0327	0.0197	0.0272	39	54	166%	120%
50-54	61	2,432	0.0251	0.0175	0.0250	42	61	144%	100%
55-59	34	1,175	0.0289	0.0175	0.0250	21	29	165%	117%
60-64	5	319	0.0157	0.0176	0.0251	6	8	89%	63%
Totals	335	9,204	0.0364	0.0238	0.0313	219	288	153%	116%



REFUNDS

The valuation includes an assumption that, for members terminating with a vested annuity benefit, 55% of those members will elect a refund of contributions rather than taking the annuity benefit. We recommend changing from the current flat 55% assumption to an age-graded rate. We also recommend reducing it even further than observed experience indicates. That is because, with the new funding methodology where members hired on or after July 1, 2006 contribute 50% of the normal cost, rather than 40% of the Annual Required Contribution, the relative value of the member contribution account to the annuity benefit will be lower. Assuming a high rate of refund when the relative value of the member account is significantly less than the annuity benefit would be an aggressive assumption.

Age	Withdrawals	Annuity	Refund	Sample Rates		
				Raw	Old	New
Under 30	8	4	4	0.5000	0.5500	0.5000
30-34	38	21	17	0.4474	0.5500	0.4500
35-39	63	22	41	0.6508	0.5500	0.4000
40-44	61	27	34	0.5574	0.5500	0.3500
45-49	65	39	26	0.4000	0.5500	0.3000
50-54	61	38	23	0.3770	0.5500	0.2500
55-59	34	21	13	0.3824	0.5500	0.2000
60-64	5	5	-	0.0000	0.5500	0.0000
Totals	335	177	158			



OTHER ASSUMPTIONS

Load for Tier 1 Unused Sick and Vacation Leave: Currently the valuation uses a 2.20% load on the present value of benefits for normal retirement, early retirement and vested termination decrements. We recommend further refinement of this assumption to recognize service levels at termination which correlate to the amount of unused sick and vacation leave available. We recommend assuming that total benefit and eligibility service will be increased by 1.9%. This assumption was developed using sick and vacation leave and service amounts for active members included in the actuarial valuation as of June 30, 2013.

In addition, the final average compensation will be increased by 2.6% for each fractional year of assumed unused sick and vacation leave at termination.

Pay Increase Timing: Currently, pay increase timing is assumed to occur at middle of year (January 1). Since the largest component of pay increases, the inflation component, has historically occurred on July 1, we recommend changing to end of year (June 30).

Percent Married: No change is recommended to the current assumption that 80% of members are married.

Spouse Age Difference: The current assumption is that males are three years older than their female spouse. There is no recommended change to this assumption.

Assumed Age for Commencement of Deferred Benefits: Currently active members that terminate are assumed to retire at first eligibility for unreduced benefits terminated members are assumed to retire at 62.

We recommend that members (both active members terminating and members that are already terminated) be assumed to retire at first eligibility for unreduced benefits.

ACTUARIAL METHODS

Amortization Components

Level-dollar vs. Level-percent-of-pay.

TSRS uses level-percent-of pay-amortization. Level-percent-of-pay amortization initially has lower dollar payments, but these increase each year. Level-dollar amortization is similar to a fixed-rate home mortgage with a constant dollar payment. Since level-dollar amortization pays a greater portion of the Unfunded Accrued Liability (UAL) in earlier years, it is more conservative than level-percent-of-pay amortization. However, level-percent-of pay-amortization may be more consistent with the budgeting process of most governmental entities.

Length of the Amortization Period.

Generally, for public pension plans, amortization periods range from 15 to 30 years, although

some plans use shorter or longer periods. Shorter amortization periods result in the UAL being paid off sooner, but require higher and likely more volatile contributions. Longer amortization periods require lower contributions, but may shift some of the pension costs beyond the working careers of active employees and on to future generations. Up until recently, TSRS used an amortization period of 15 years. The current amortization period of 20-years is well within norms for the public sector funding policies.

Closed Amortization vs. Open Amortization

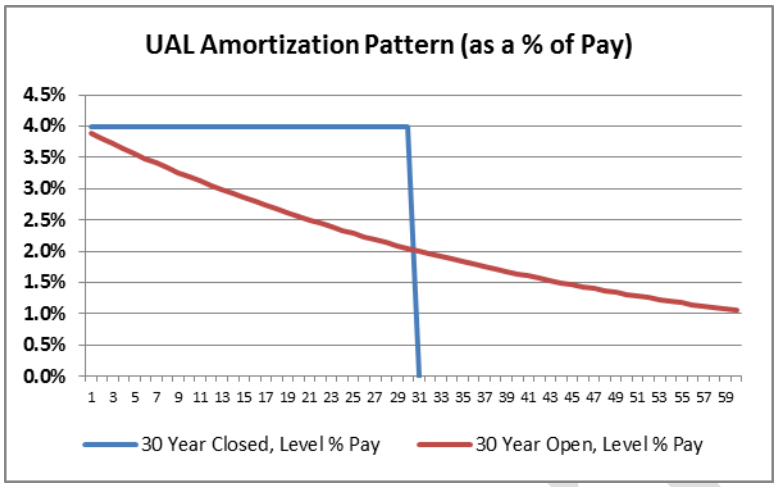
Closed amortization calculates the UAL each year and pays it off within the remaining (and declining) period. Open amortization resets the period each year.

If a closed amortization period is used, the UAL will be fully paid by the end of the period and contribution amounts will reflect those higher payments. Closed amortization creates a payment pattern where each payment pays off interest and a portion of principal. The decision being made, when contrasting between open and closed amortization, is the speed by which the principal (UAL) will be paid off. Closed amortization periods pay down the UAL more rapidly while producing greater volatility in the contribution rate as the period gets shorter.

By contrast, under an open amortization period, the period is reset each year. For example, TSRS for a number of years used 15-year open amortization, where the period to pay off the UAL remained at 15 years for all valuations. An open period results in a more gradual decline of the UAL and helps to control volatility in the contribution rate, but takes substantially longer to pay down the UAL. Moreover, an open amortization period is more likely to produce negative amortization (meaning, the UAL is actually growing since the payments don't touch the principal), at least when the period is 15 to 20 years or longer and when combined with level percent of pay financing.

In conclusion, the decision for which amortization method to use is really a decision about the speed for which the UAL is to be paid off, contrasted with the size and volatility of the contribution rate. Shorter amortization periods lead to higher contribution rates. Open amortization leads to a UAL that may not be paid off for a very long time. It is important to note that while the UAL increases when there is negative amortization, it is typically not expected to increase faster than the projected rate of payroll growth and is expected to be fully paid by the end of the period as long as a closed amortization method is employed. An open amortization period which allows negative amortization may be inconsistent with reaching a funding target of 100% in a reasonable period of time.

The graph below shows a theoretical illustration of the pattern of amortization payments under closed and open amortization periods.



Under the closed level-percent-of-pay approach the payments remain level until the UAL is fully paid off at the end of the 30 year period. However, under the open level-percent-of-pay approach, the amortization payments, and the UAL, extend beyond the 30-year period and continue to decline for decades thereafter. The rate at which the payment amounts decrease depends on a number of factors, including the expected investment return and payroll growth assumption. TSRS uses the open amortization method.

Discussion and Recommendations.

If the primary objective is to stabilize contributions then we would recommend an open amortization, but for a period of 20 years or less. If the primary objective is to pay off the UAL within the next generation, then we would recommend a 20-year closed (declining) amortization method.

Asset Smoothing Method

TSRS does use a smoothing method for determining the actuarial valuation of assets, with a smoothing period of five years. For each year a gain or loss on the investment return assumption is determined, and 20% of that gain loss is "smoothed" into the actuarial value of assets for that year. For example, as of June 30, 2013 the market value of assets was $641,046,190 and the actuarial value of assets was $600,330,066. The actuarial value is 94% of the market value of assets.

Smoothing asset returns is a useful tool in measuring the funded status of a plan. The smoothing feature will eliminate shorter term fluctuations which do not have a bearing on the funded status of the plan, and need to play a part in the determination of the annual required contribution rate determination. However, any smoothing method must converge to the market value of assets and must do so within a reasonable period of time. In addition, we recommend a smoothing method that does not depart so far from market in periods of sharp declines or increases. Private sector plans generally use a 20% corridor, meaning the actuarial value of assets should range from 80% to 120% of market value.

While it is generally true that a longer smoothing period would create more stability in the contribution rate, it would also be true that the actuarial value of assets would not respond as quickly to a market recovery. In deciding about the smoothing period, a plan sponsor has to balance the need for stable contributions against a need to track with market. For example, in this case with TSRS, the five year smoothing meant that it took five years to recognize those 2008 investment losses (which were quite substantial). That recognition is now complete and there are deferred asset gains (market value is higher than the actuarial value) which will serve as an additional cushion in the short term funding of the plan.

Further, there is a question about whether the TSRS should implement a corridor around the actuarial value of assets. In a plan with a long smoothing period, in markets that are moving quickly, there is a good probability that the actuarial value of assets will need to be continually adjusted to the corridor amount.

The continual adjustment to the corridor value will have the same volatility effect as valuing the plans at market with no smoothing period. Thus, we recommend no corridor be added at this time.

Cost Method

TSRS uses the Entry Age Normal cost method, and we recommend continuing to use this cost method. Entry Age Normal cost method is the cost method which best maintains cost which are level as a percentage of payroll.

ACTUARIAL FACTORS

In addition to updating the actuarial assumptions used in the actuarial valuations (beginning with valuations as of June 30, 2014), it is our recommendation that all actuarial factors be updated to reflect these new assumptions. Examples of such assumptions include joint and survivor benefit option factors and service purchase factors.

SECTION IV

COST IMPACT OF PROPOSED CHANGES

The following shows the incremental impact of each of the proposed assumption changes on the actuarial valuation results as of June 30, 2013. In measuring the impact of the assumption changes, the order in which the changes are measured affects the incremental cost. The cost impacts should be reviewed from a perspective of general magnitude.

The reduction in the inflation assumption (which in turn affects the discount rate and the inflation component of salary increases) by 0.50% was the primary assumption change affecting the valuation results.

	UAAL ($ in millions)	Funded Ratio	Normal Cost %	Amort %	Total CC %	Total CC ($ in millions)
Valuation Results as of June 30, 2013 (Baseline or Current)	$ 348.23	63.3%	12.08%	20.14%	32.22%	$ 42.70
Assumption Updated						
Mortality	$ 6.77	-0.5%	0.12%	0.39%	0.51%	$ 0.68
Disability	0.02	0.0%	-0.02%	0.00%	-0.02%	(0.03)
Termination	0.37	0.0%	-0.42%	0.02%	-0.40%	(0.53)
Retirement	1.47	-0.1%	0.00%	0.09%	0.09%	0.12
Sick Leave Service	4.16	-0.3%	0.09%	0.24%	0.33%	0.44
Salary Increase Timing	(6.96)	0.5%	0.04%	-0.40%	-0.36%	(0.48)
Salary and Payroll Growth	(8.03)	0.5%	-1.22%	0.38%	-0.84%	(1.42)
Investment Return	46.73	-2.9%	1.20%	1.89%	3.09%	4.07
Valuation Results as of June 30, 2013 (Using Recommended Assumptions)	$ 392.77	60.5%	11.87%	22.75%	34.62%	$ 45.55

UAAL = Unfunded Actuarial Accrued Liability.
Amort % = 20-Year Level Percent of Pay Amortization of Unfunded Liability
Total CC %= Total Computed Contribution. This number is not yet net of Member Contributions. Blended Member Contributions using the recommended assumptions would be 5.23%. The net City Financed Computed Contribution would be 29.39% of pay.

An asset liability modeling study is currently underway and the target asset allocation still being developed. The following shows a sensitivity analysis of the actuarial results as of June 30, 2013 including all proposed assumption changes, but using alternative discount rates:

- 7.75% (current): 3.00% inflation plus 4.75% real return
- 7.50% (alternate): 3.00% inflation plus 4.50% real return
- 7.25% (recommended based on current asset allocation): 3.00% inflation plus 4.25% real return

Valuation Results as of June 30, 2013 with Proposed Demographic and Salary Assumptions and Alternative Discount Rates

Discount Rate	UAAL ($ in millions)	Funded Ratio	Normal Cost %	Amort %	Total CC %	Total CC ($ in millions)
7.75% (Current)	$ 346.04	63.4%	10.67%	20.86%	31.53%	$ 41.48
7.50% (Alternate)	$ 368.94	61.9%	11.24%	21.81%	33.05%	$ 43.48
7.25% (Recommended*)	$ 392.77	60.5%	11.87%	22.75%	34.62%	$ 45.55

UAAL = Unfunded Actuarial Accrued Liability.
Amort % = 20-Year Level Percent of Pay Amortization of Unfunded Liability
Total CC %= Total Computed Contribution. This number is not yet net of Member Contributions. Blended Member Contributions using the recommended assumptions would be 5.07% (using 7.75%), 5.14% (using 7.50%), and 5.23% (using 7.25%). The net City Financed Computed Contribution would be 26.45%, 27.91%, and 29.39%, respectively.
*Based on current asset allocation. Recommendation may change following asset liability modeling study.

APPENDIX A

SUMMARY OF RECOMMENDATIONS

Actuarial Cost Method

Normal cost contributions were computed as follows:

The series of contributions, payable from date of employment, sufficient to accumulate at time of retirement was computed as the discounted value of each member's projected pension and potential survivor's pension, using the assumptions summarized on the following pages. Each contribution in the series is a constant percentage of the member's year by year projected compensation (entry-age normal actuarial cost method).

Effective July 1, 2013 the new funding policy requires a computation of normal cost separately for those members in Tier 1 and Tier 2.

Actuarial accrued liability was computed and financed as follows:

(1) Retirants and beneficiaries. The discounted value of pensions likely to be paid to retired members and their potential survivors were computed using the investment return and mortality assumptions.

(2) Active members and former members. The actuarial accrued liability associated with service rendered prior to the valuation date, including experience gains and losses, was computed using the investment return, mortality and other assumptions outlined on the following pages. The computed amount was reduced by applicable valuation assets and the unfunded amount was amortized over 20 years as of June 30, 2013. An open amortization period of 20 years was adopted effective June 30, 2013.

Actuarial Assumptions

Level-percent contribution requirements and actuarial present values are calculated by using the entry-age actuarial cost method and assumptions concerning future experiences in the financial risk areas of a retirement plan. Actuarial gains and losses are amortized as a level percent-of-payroll over an open period of 20 years, effective June 30, 2013. The assumptions are selected based upon the recommendation of the actuary.

The principal areas of risk which require assumptions about future experiences are:

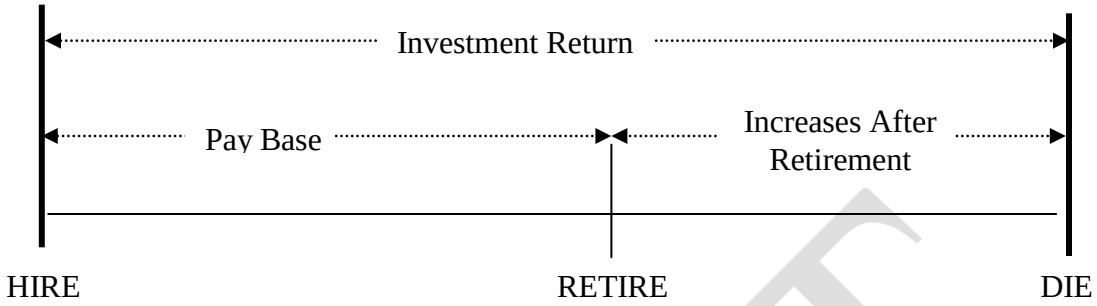
i. long-term rates of investment return to be generated by the assets of the system,
ii. patterns of pay increases to members,
iii. rates of mortality among members, retirants and beneficiaries,
iv. rates of withdrawal of active members,
v. rates of disability among active members, and
vi. the age patterns of actual retirements.

Through the valuation process, the monetary effect of each expected assumption against actual experience is projected for the lifetime of each covered member and potential beneficiary.

Actual experience of the system will not coincide exactly with assumed experience. Each valuation provides a complete recalculation of assumed future experience and takes into account all past differences between assumed and actual experience. The result is a continual series of adjustments (usually small) to the computed contribution rate.

From time to time, one or more of the assumptions are modified to reflect experience trends (but not random or temporary year to year fluctuations). The Board of Trustees adopts the assumptions based upon recommendations of the actuary. The demographic assumptions were last revised for the June 30, 2014 actuarial valuation following an actuarial investigation of experience of the Retirement System covering the period July 1, 2008 through June 30, 2013.

Relationship of Economic Assumptions In Computing Contributions to a Retirement System



Investment Return

An increase in this assumption reduces computed contributions. The assumption operates over all parts of an employee's lifetime.

Pay Base

An increase in this assumption increases computed contributions. However, a 1% increase in this assumption, coupled with a 1% increase in Investment Return reduces computed contributions. This is due to the fact that the Pay Base assumption operates only over an employee's working lifetime, while the Investment Return assumption operates over the employee's entire lifetime, and therefore has a greater impact.

Increase After Retirement

An increase in this element increases computed contributions.

If Investment Return, Pay Base, and Increases After Retirement are each increased by equal amounts, computed contributions remain the same (except in plans using Final Average Pay as a factor in computing benefits; the multi-year average used for Final Average Pay causes computed contributions to decrease slightly).

If Investment Return and Pay Base are increased by equal amounts, with no change in Increases After Retirement, computed contributions decrease – sometimes significantly. The decreases represent the projected devaluation of an employee's benefits following retirement.

Investment Return. 7.25 percent per year, compounded annually. This consists of a real rate of return of 4.25% a year plus a long-term rate of inflation of 3.00% a year.

This rate of return should not be used for measurement of an investment advisor's performance or for comparisons with other plans -- to do so will mislead.

Pay Projections. These assumptions are used to project current pays to those which will determine average final compensation. The assumptions should consist of the same inflation component used for the investment return assumption plus an age graded component to reflect promotion and seniority increments.

	Less than Five Years of Service				Five or More Years of Service		
Service	Inflation Component	Merit & Seniority	Total	Sample Ages	Inflation Component	Merit & Seniority	Total
0	3.00 %	3.50 %	6.50 %	20	3.00 %	1.50 %	4.50 %
1	3.00	3.00	6.00	25	3.00	1.50	4.50
2	3.00	2.50	5.50	30	3.00	1.50	4.50
3	3.00	2.00	5.00	35	3.00	1.50	4.50
4	3.00	1.50	4.50	40	3.00	1.00	4.00
				45	3.00	0.50	3.50
				50	3.00	0.25	3.25
				55	3.00	0.25	3.25
				60	3.00	0.25	3.25
				65	3.00	0.00	3.00

The pay increase assumptions will produce 3.00% annual increases in active member payroll (the base rate) given a constant active member group size. This is the same payroll growth assumption used to amortize unfunded actuarial accrued liability.

Mortality Table for Active Members and Healthy Annuitants. RP-2000 Combined Mortality Table for males and females projected with Scale BB to 2020. Mortality rates were adjusted to include margin for future mortality improvement as described in the table name above.

Sample Ages	Future Life Expectancy (years)		Deaths per 1,000 Lives	
	Men	Women	Men	Women
50	33.0	35.6	2.0	1.6
55	28.4	30.9	3.4	2.5
60	23.9	26.3	5.9	4.1
65	19.7	22.0	10.0	7.6
70	15.8	17.9	16.4	13.2
75	12.3	14.2	28.0	22.1
80	9.1	11.0	47.6	36.0
85	6.5	8.1	81.9	60.8

Mortality Table for Disabled Annuitants. RP-2000 Disabled Mortality Table for males and females.

Sample Ages	Future Life Expectancy (years)		Deaths per 1,000 Lives	
	Men	Women	Men	Women
50	18.2	25.1	29.0	11.5
55	15.9	21.7	35.4	16.5
60	13.8	18.6	42.0	21.8
65	11.8	15.7	50.2	28.0
70	9.8	12.9	62.6	37.6
75	7.9	10.5	82.1	52.2
80	6.4	8.4	109.4	72.3
85	5.1	6.6	141.6	100.2

Rates of Retirement for Tier 1. Rates of retirement are used to measure the probabilities of an eligible member retiring during the next year. For those ages 62+, the Rule of 80 retirement rates only applies if the Rule of 80 is attained by age 62.

Tier 1 Members

Retirement Ages	Percentage of Those Eligible Retiring During Year		
	Rule of 80	Age Based	Early
50	27 %		
51	27		
52	27		
53	27		
54	27		
55	27		8.5 %
56	27		8.5
57	27		8.5
58	27		8.5
59	27		8.5
60	27		
61	27		
62	27	33 %	
63	27	16	
64	27	20	
65	27	24	
66	27	35	
67	27	35	
68	27	35	
69	27	35	
70	100	100	

Deferred vested members are assumed to retire at age first eligibility for unreduced benefits.

Rates of Retirement for Tier 2. For those ages 65+, the Rule of 85 retirement rates only applies if the Rule of 85 is attained by age 65.

Tier 2 Members

Retirement Ages	Percentage of Those Eligible Retiring During Year		
	Rule of 85	**Age Based**	**Early**
60	27 %		8.5 %
61	27		8.5
62	27		8.5
63	27		8.5
64	27		8.5
65	27	24 %	
66	27	35	
67	27	35	
68	27	35	
69	27	35	
70	100	100	

Deferred vested members are assumed to retire at age first eligibility for unreduced benefits.

Rates of Separation from Active Membership. This assumption measures the probabilities of a member terminating employment. The rates do not apply to members who are eligible to retire.

Sample Ages	Years of Creditable Service	Probability of Termination During Year
Any	0	18.00 %
	1	13.00
	2	10.00
	3	8.00
	4	7.50
25	5 & Over	7.05
30		6.65
35		4.65
40		3.65
45		2.95
50		2.55
55		2.45
60		2.45

Rates of Disability. This assumption measures the probabilities of a member becoming disabled. The rates do not apply to members who are eligible to retire.

Sample Ages	% of Active Members Becoming Disabled During Next Year
25	0.01 %
30	0.07
35	0.09
40	0.14
45	0.17
50	0.25
55	0.36
60	0.48
65	0.63

Disabled life mortality is measured by the RP-2000 Disabled Mortality Table, as previously noted, with ages set forward eight years. It is assumed that no valued disability retirement benefits will be offset by Worker's Compensation benefits or earned income received by the disabled retiree.

Forfeiture of Vested Benefits. The percentages below represent the probability that a vested terminated member will take a refund of contributions rather than receive a deferred annuity benefit.

Sample Ages	% of Vested Terminating Members Choosing Refund at Termination
Under 30	50 %
30	45
35	40
40	35
45	30
50	25
55	20
60 and Over	0

Benefit and Eligibility Service due to Accrued Sick and Vacation Leave at Retirement and Termination. Tier 1 Members are assumed to have an additional 0.019 years per year of benefit and eligibility service at early or normal retirement and termination due to accrued sick and vacation leave.

Adjustment to Final Average Pay due to Accrued Sick and Vacation Leave at Retirement and Termination. For each year of additional service attributable to the prior service assumption, final average pay is assumed to increase 2.6% .

Marital Status. 80% of men and women were assumed married at retirement.

Spouse Census. Women were assumed to be 3 years younger than men.

Assumed Age for Commencement of Deferred Benefits. Members electing to receive a deferred benefit are assumed to commence receipt at the earlier of age 62 and eligibility for rule of 80 for Tier 1 and the earlier of 65 and eligibility for the rule of 85 (but at least 60) for Tier 2.

Active Member Group Size. For supplemental projection studies and calculation of future payroll, the number of active members is assumed to remain constant.

Decrement Timing. Middle of Year.

Pay Increase Timing. End of Year.