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Experience Study Review
of MSRS, PERA, and TRA for the

Minnesota Legislative Commission
on Pensions and Retirement

Prepared by:

Milliman, Inc.

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June 22, 2010

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Minnesota Legislative Commission
  on Pensions and Retirement
State Office Building, Room 55
100 Rev. Dr. Martin Luther King Jr. Blvd.
St. Paul, MN 55155

ATTN: Mr. Lawrence A. Martin, Executive Director

RE: Actuarial Review of the Experience Study Reports

Ladies and Gentlemen:

The enclosed report presents the findings and comments resulting from a review of the 2004-2008 Experience Study reports of the Minnesota Public Employees Retirement Association (PERA), the Minnesota State Retirement System (MSRS), and the Minnesota Teachers Retirement Association (TRA). An overview of our major findings is included in the Executive Summary section of the report. More detailed commentary is provided in the sections devoted to each fund individually.

We pursued this review with a constructive mindset. We looked to identify any possible suggestions that might improve understanding of or confidence in the actuarial services being provided. Naturally, some of the comments may be viewed as personal preference or nit-picky in nature. While we are not trying to impose our own preferences or biases on the Fund or the retained actuary, neither did we hesitate to make such comments if we believed that some change, however minor, would improve the actuarial functions.

This report is prepared for use by the Minnesota Legislative Commission on Pensions and Retirement (LCPR) in their appropriate oversight role with regard to the above mentioned retirement systems. It has been prepared using standard review techniques. A complete duplication of the numerical results of the Experience Studies has not been performed.

In preparing this report, we relied, without audit, on information (some oral and some in writing) supplied by both the actuarial firm who prepares the formal valuations and the relevant staff at each of the retirement systems. This information includes, but is not limited to, statutory provisions, employee data and financial information. It should be noted that if any data or other information provided to us is inaccurate or incomplete, our calculations and recommendations may need to be revised.

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

Any distribution of the enclosed report must be in its entirety including this cover letter, unless prior written consent is obtained from Milliman, Inc. This report has been prepared in accordance with the terms and provisions of the Consulting Services Agreement effective November 25, 2009.
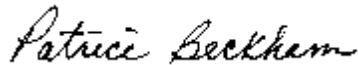
I, Patrice A. Beckham, FSA, am an actuary for Milliman, Inc. I am a member of the American Academy of Actuaries and a Fellow of the Society of Actuaries, and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

I, William V. Hogan, FSA, am an actuary for Milliman, Inc. I am a member of the American Academy of Actuaries and a Fellow of the Society of Actuaries, and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

We look forward to making a personal presentation of our findings in briefings to the Minnesota Legislative Commission on Pensions and Retirement and to relevant staff members.
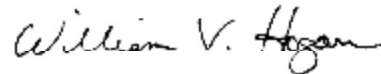
Respectfully submitted,

Milliman, Inc.

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William V. Hogan, FSA
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**Experience Study Review
for the**

Minnesota Legislative Commission
on Pensions and Retirement

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Section 1: Executive Summary

Purpose and Scope of the Actuarial Review

In accordance with Minnesota Statues, Section 356.214, Subdivision 4, the Minnesota Legislative Commission on Pensions and Retirement (LCPR) has engaged Milliman, Inc. to perform an actuarial review of the 2004-2008 experience study reports prepared for the Minnesota State Retirement System (MSRS), Minnesota Public Employees Retirement Association (PERA), and the Minnesota Teacher Retirement Association (TRA). The studies were completed and issued in 2009 so we refer to them as the "2009 studies" throughout our report. The prior experience studies were completed by Segal, Inc. as part of their work as the Commission actuary. Those experience study reports were issued in 2005 and are referred to as the "2005 studies" in our report.

The purpose of an actuarial valuation is to provide a timely best estimate of the ultimate costs of a retirement system. The valuation requires the use of certain assumptions with respect to the occurrence of future events, such as rates of death, termination of employment, retirement age and salary changes to estimate the obligations or liabilities of the System. The assumptions are a critical part of the valuation process to allocate the cost of benefits to periods of service. Consequently, an experience study is performed periodically to determine whether the actuarial assumptions currently in use have adequately projected actual emerging experience. This information, along with the professional judgment of System personnel and advisors, is used to evaluate the appropriateness of continued use of the current actuarial assumptions. When analyzing experience and assumptions, it is important to recognize that actual experience is reported short term while assumptions are intended to be long-term estimates of experience. While the actuary's goal is to make the best possible estimate of future experience, it will almost certainly differ from our current best efforts to forecast it. Reviews of the actuarial assumptions are done every four years for MSRS, PERA and TRA to identify where assumptions differ from emerging experience and to adjust the assumptions, if appropriate.

An actuarial valuation uses two different types of assumptions: economic and demographic. Economic assumptions are related to the general economy and its long-term impact on the system, or to the operation of the system itself. These include investment return assumption, price inflation, general wage increase, and payroll growth assumption. Demographic assumptions are based on the emergence of the specific experience of the system's members. These include assumed rates of mortality, disability, retirement, termination of employment and merit salary scale.

In the Mercer experience study reports, we found the methodology to be in accordance with standard actuarial techniques. Mercer reported the actual to expected ratios (A/E) ratios, which are a common way to display the percentage of actual decrements (status changes) to the expected decrements. They are the required form of communication of experience study results set out in the Commission's Standards for Actuarial Work. An A/E ratio greater than one indicates that there were more actual decrements than expected and an A/E ratio less than one indicates there were fewer actual decrements than expected. These ratios were displayed for the current assumptions as well as for the recommended assumption throughout the reports. Detailed A/E ratios for the experience separately in each year were also provided in the appendices, which was very helpful.

Choosing actuarial assumptions is highly subjective. It is unlikely that any two actuaries, given the same set of experience statistics, would arrive at exactly the same set of actuarial assumptions for any system. Even allowing for the minor variations that occur because of the variability of the underlying statistics and possible data anomalies, differences among actuarial approaches will occur in analyzing trends. Some actuaries prefer to match the results of recent experience very closely in setting future assumptions, while other actuaries will use recent experience as a guide, but tend to change existing assumptions gradually over time. Valid arguments can be made for either approach. In many situations, our comments will reflect the fact that our approach in setting assumptions appears to differ from Mercer's. After reviewing the experience study reports, Mercer appears to set the recommended assumption very close to recent experience. Our approach results in more gradual changes, moving only part of the way toward emerging

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experience. Throughout this report, there will be discussion on several assumptions for each Fund where this difference in approach led to Milliman making a different recommendation for the new assumption.

It is important to recognize that setting actuarial assumptions is as much art as it is science. There is room for differences in opinion and interpretation of results. Therefore, it is not uncommon for the auditing or reviewing actuary to have a different opinion than the retained actuary on how, or if, the assumptions should be changed. In reading our report, it is important to remember that there is no "correct" answer with respect to actuarial assumptions as the future is unknown. A range of results is acceptable and reasonable so our comments should be viewed in that context.

Statement of Key Findings

In general, we found the recommendations with respect to changes in the actuarial assumptions to be reasonable, justified by observed experience, and consistent with standard actuarial practice. However, the July 1, 2009 actuarial valuation for each Fund indicated that the funded ratios were around 75-85%, actuarial assets were about 30% higher than market value (meaning there are significant deferred investment losses yet to be recognized) and the current, fixed contribution rates were much lower than the actuarial contribution rates. Therefore, at this particular point in time we believe it is prudent to be more conservative in setting assumptions, especially if there is any doubt or concern about the assumption change. If assumptions are set more aggressively, they are more likely to produce experience losses which will only add to the Fund's difficulty in recovering from the recent investment losses. Many of the proposed changes to the demographic assumptions result in lower costs, with the exception of mortality changes. Therefore, we are more uncomfortable when all of the changes are considered together than with any one assumption change by itself. We consider it our responsibility to educate the Commission about the proposed assumptions and provide insight into the possible impact of proposed changes. Ultimately, the Commission will have to evaluate the proposed changes and decide how they wish to proceed. While none of Mercer's recommended changes are unreasonable or unsupported by the experience, there are many changes proposed, some of which are significantly different in approach. Given the long term funding situation, additional effort was expended to be thorough in our review of the experience study findings and recommendations.

In the past, the Commission retained their own actuary who performed the annual valuations and the experience studies for all of the Funds. The current (2009 Study) experience study is the first time in the recent past that each Fund's retained actuary has performed the formal experience study. The last study (2005 Study) was performed by Segal, Inc. as the Commission's actuary. It is our understanding that Segal gave Mercer the TRA data for 2004 and 2005 that was used in the 2009 experience study. A change in actuaries often results in many changes in the actuarial assumptions due to individual preference and the subjective nature of setting assumptions, as discussed above. There were changes recommended to almost all of the assumptions for all three Funds (MSRS, PERA, and TRA). Some of those were significant and others were less dramatic. While we understand the basis for the recommendations, there are certain situations where we don't feel comfortable moving forward with the recommended change. This generally applies to proposed changes to the salary increase assumption, termination of employment assumption, and certain of the post-retirement mortality assumption changes. From our perspective, some modification of the current assumption could be made now and the results from the 2009 experience study could be aggregated with results of the next study to develop an assumption that is based on more data and thus, should produce assumptions that better anticipate future experience.

Data

Data was provided to us from the Fund administrators and the retained actuary (Mercer is the retained actuary for all three funds). We also requested and reviewed additional, more detailed information provided by Mercer for several assumptions. We did not replicate the numerical results presented in the

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experience study, i.e. the calculation of decrements and exposure. We reviewed them for general reasonableness, but relied on the accuracy of those calculations as performed and reported by Mercer. We were particularly concerned about the data given the significantly different results in the 2009 Studies compared to the 2005 Studies for several assumptions.

We reviewed the data files in detail for two of the four years for each of the Funds and independently developed the exposure at each age. We then compared our results to the exposure shown in the experience study report for that year. The match was very good so we are comfortable that the exposure in the Mercer report is reasonable. In an attempt to independently verify the decrements in the experience study report, we compared the number of members shown as changing status (retirement, death, disability, termination) in the "Reconciliation of Member Data" exhibit in the valuation reports to the counts shown in the experience study report for each year. The number of status changes shown in the valuation data was not consistent with the decrements reported in the experience study. We would note that the valuations for years before 2008 were performed by Segal rather than Mercer. In addition, we noticed that for some years, the Reconciliation of Member Data exhibit contained significant adjustments from year to year so we are unsure how reliable the valuation data was with respect to changes in member status. For example, in the MSRS valuation reports there were adjustments to the active member count of 446 in the July 1, 2005 report, 1,879 in July 1, 2006 report, 1,644 in the July 1, 2007 report, and 1,550 in the July 1, 2008 report. The active count is around 48,000 members so some of these adjustments represent a significant portion of the active exposure for that year. To illustrate the apparent inconsistency of the valuation data with the experience study data, the following table shows the difference in the number of members retiring and terminating employment for MSRS.

	MSRS			
	Retirements		Termination of Employment	
	Valuation	Experience Study	Valuation	Experience Study
7/1/04 to 6/30/05	776	877	3,941	3,492
7/1/05 to 6/30/06	871	999	3,907	3,422
7/1/06 to 6/30/07	1099	1,235	4,205	3,701
7/1/07 to 6/30/08	1,050	1,194	3,926	3,482

Based on discussions with Mercer after this draft report was issued, we were told that numbers shown in the reconciliation of member data exhibit in the valuation report were provided by the Fund, i.e. the status reconciliation was not performed by the actuary. This could explain some of the inconsistencies in the counts shown in the experience study report as compared to the valuation exhibit. Mercer has advised us that they will be performing the reconciliation of member status in the future which should address this issue. In addition, if a member was eligible to retire and terminated employment but did not commence benefits, they were classified as a retirement not a termination. This fact could account for some of the difference in the counts of termination and retirement. We believe it is appropriate to treat these members as retirees rather than terminations.

Even with this information, we were unable to attain a high level of comfort with respect to the data. As a result, we believe we should proceed cautiously with any significant changes in the assumptions.

Combined Service Annuity

The valuations for PERA, MSRS, and TRA include a load on active and deferred vested liabilities to reflect the impact of the Combined Service Annuity rules, which can result in a higher retirement benefit for an inactive member than the data in the prior system would indicate (final average salary is used to calculate the benefit in both systems).

Mercer's report states that this assumption is outside the scope of the experience study, but they recommend that the actual Combined Service Annuity data be collected and reviewed in order to determine whether the current assumptions are appropriate. We are not in a position to weigh in on whether or not the Combined Service Annuity assumption is outside the scope of the experience study. The Standards for Actuarial Work state that all assumptions used in the valuation should be included in the experience study. It does not provide for an exception, but to the extent the data is not available it is understandable that Mercer did not include such information. It does not appear the Combined Service Annuity was studied in the 2005 Experience Study either.

It is our understanding that this has been an issue for many years and the data is not readily available. However, we believe it would be worth the effort to gather the data and review the current assumption as it appears it has not been evaluated for some time.

Economic Assumptions

The economic assumptions are the same for all three Funds and include:

(1) investment return assumption,
(2) price inflation,
(3) wage growth assumption, and
(4) payroll growth assumption.

We have two comments related to the economic assumptions:

- The current assumption of 8.5% is within the "best estimate" range that must be developed under actuarial standards issued by the American Academy of Actuaries. However, there is a significant difference in where the 8.5% lies within that range using the capital market assumptions developed by Mercer, Milliman and the State Board of Investment (SBI). The net expected rate of return (50th percentile) using the capital market assumptions developed by Mercer and Milliman is 8.2% and 7.8% respectively. Note that these are based on the current (2010) capital market assumptions, but the results don't vary significantly if we use assumptions in place when the experience study was issued. The expected rate of return using SBI's assumptions was 9.1%. Given the importance of this assumption and the significant difference in results, we recommend there be further discussion on the subject. We are aware that both Mercer and SBI made presentations regarding the rate of return assumption after the experience study was issued and consensus could not be reached. It is clear that there are differing opinions on the subject. Because the 8.5% assumption is in statute, there is no urgency to make a decision immediately as it will not impact the current valuation. However, due to its importance further analysis should not be deferred until the next experience study, but should transpire over the next six to nine months. Given the differences of opinion and the importance of this assumption we believe an unbiased opinion from a totally independent third party with specific investment expertise could be very valuable to the Commission.

- Mercer recommended that the payroll growth assumption be lowered from 4.5% to 4.0%, which is the same rate as the general wage growth assumption. The payroll increase assumption is typically set equal to the wage growth assumption. However, the proposed merit salary scale assumption for all three Funds includes negative merit rates for certain years of service (varies somewhat by Fund). Given the recommended salary increase assumption, we are concerned that the proposed payroll growth assumption is too high. The negative merit scale, which applies to a large number of active members and an even greater portion of total payroll, is likely to result in covered payrolls that do not increase at the general wage growth assumption (4%) even if all other assumptions are met. We suggest Mercer perform further study on this issue before a decision is made if the recommended salary assumptions are adopted.

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Demographic Assumptions

Termination of Employment

Mercer recommended changing the termination of employment assumption from a three year select and ultimate rate to an assumption based on service, age and gender for MSRS and PERA and to an assumption based on service and gender for TRA. The proposed assumptions represent a new approach to developing the termination assumption and would require that the rates be set only using the actual experience in the current study period since comparable information from the prior study is not available. Since in most cases, the termination data in this experience study was very different from the prior study and there has been no explanation, we would prefer not to make a material change to the approach used in the termination of employment assumption at this time. When the next study is performed there will be more data upon which to base this assumption and most of the data will be that used by Mercer in the Fund's valuations so the reliability of that data should be higher.

For MSRS and PERA, Mercer's recommended approach "slices and dices" the data into many different groupings. As a result, there are small numbers of members at some of the age groupings (older age with higher service) which can cause volatility in the observed rates and make it more difficult to develop smooth rates that will provide a reasonable estimate of future experience. Rather than moving to a full age and service assumption for all ages and years of service, it may make sense to remain with the select and ultimate assumption and extend the select period. We suggest Mercer revisit their proposed approach and address this issue.

Salary Increase Assumption

Mercer commented that the observed salary increases had a stronger correlation to service than age in general and they recommended moving to a service based table for all three Funds. We agree that the change to a service-based table is reasonable and in line with common actuarial practice for public retirement systems, but we are concerned that the proposed salary scale is based on only four years of experience, which may not be representative of long term salary increases. In addition, the way the salary increase assumption was developed does not directly address the separate components of the assumption, i.e. the total salary assumption includes a merit scale and the general wage growth assumption. Inflation and wage increases, in general, have been below the recommended assumption over the last decade and we believe this overall economic trend could have impacted the salary experience in the study period. In addition, the salary increase assumption contains a negative merit scale at certain service durations, which we have rarely seen in our experience. These factors make us less comfortable with a significant change in the assumption as is being proposed. In our opinion, the salary assumption being proposed does not appear to provide much conservatism. We believe the salary assumption should be studied further to determine the appropriate change, particularly if a new service based assumption is to be implemented.

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Comments Specific to Each Fund

MSRS

Post-retirement Mortality: The A/E ratio for postretirement mortality for males dropped from 139% in the prior study to 101% in the current study. This is a dramatic change in a very short period, which is very unusual. There was no discussion of this in the experience study report and we could find no explanation for the observed data. In discussions with Mercer after the initial draft of this report was issued, they indicated that they had questioned Segal's results back when the prior experience study (2005) was issued. The difference was never resolved, but Mercer's results in the 2009 Study are consistent with the 1996-2000 Experience Study which makes the Segal results appear questionable.

- While the overall A/E ratio for males and females using the recommended assumption was 105% and 99%, we are concerned with the fit of the recommended assumptions at certain key ages. The A/E ratio at age 65 to 80 is 92% which means that mortality rates are higher than the actual experience at those ages, resulting in a shorter expected benefit payment period and potential understatement of liabilities. Given that a large portion of the exposure is in this age group, this may be reason for concern. We support the use of generational mortality, as recommended by Mercer, but want to be sure the starting mortality rates are a good fit. We suggest Mercer revisit the mortality assumption in light of the comments in this report and evaluate whether or not it is appropriate to modify the rates in the standard RP 2000 Table.

Retirement Rates: The proposed retirement rates are lower than the current assumption and closely follow the actual experience. Given that the retirement rates for Rule of 90 were lowered in the last study with a resulting A/E ratio of 103%, the experience in this study seems unusually low (A/E ratio of 66%). We would prefer to move only part of the way toward the actual experience and maintain some conservatism in the retirement rates for Rule of 90. We also would suggest that some conservatism be introduced into the non-Rule of 90 retirement rates by moving only part of the way toward the observed experience even though the experience was fairly consistent in both studies.

Disability Rates: Mercer recommended lowering the disability rates for males across the board by 10%. The disability rates were increased in the last experience study with a resulting A/E ratio for males of 101%, indicating a close fit to the actual observed experience in that study. The A/E ratio for males in the current study was 85%. Due to the small number of disabilities, there is a tendency for variability in the A/E ratio. Since the assumption was just increased in the last study and the aggregate results of the combined 2005 and 2009 study period is an A/E ratio of 93%, we would suggest the current assumption for males remain in place.

PERA

Post-retirement Mortality: The A/E ratio for postretirement mortality for males dropped from 102% in the prior study to 90% in the current study. For females, the A/E ratio dropped from 104% to 91% from the 2005 to 2009 study. This is material and we believe it should have been discussed in the experience study report. While the overall A/E ratio on the proposed assumption was 103% for males and 96% for females, we are concerned with the fit at certain ages. The A/E ratio for females at ages 55 to 64 is 91% and at ages 65 to 80 is 95% which means that mortality rates are higher than the actual experience at those ages (which produces a shorter life expectancy and as potential understatement of liabilities). Because a large portion of the exposure is in these age groups, this may be reason for concern. We support the use of generational mortality, as recommended by Mercer, but want to be sure the starting mortality rates are a good fit.   We suggest Mercer revisit the

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mortality assumption in light of the comments in this report and evaluate whether or not it is appropriate to modify the rates in the standard RP 2000 Table.

Retirement Rates: The proposed retirement rates are lower than the current assumption and closely follow the actual experience. Given that the rates for Rule of 90 were lowered in the last study, we would prefer to move only part of the way toward the actual experience and maintain some conservatism in the retirement rates for Rule of 90. If the proposed rates are adopted, we suggest some minor adjustments at age 57, 58, 63 and 64. We also suggest that some conservatism be introduced into the non-Rule of 90 retirement rates by moving only part of the way toward the observed experience or at least changing the retirement rates at ages 65 and 66.

TRA

Post-retirement Mortality: The A/E ratio for postretirement mortality for males changed from 94% in the prior study to 114% in the current study. This change is material and we believe that it should have been discussed in the experience study report. While the overall A/E ratio for males and females using the recommended assumption is 104% and 107% respectively, we are concerned about the fit at certain key retirement ages. The A/E ratio for females at ages 55 to 64 is 80% and at ages 65 to 80 is 82% which means that assumed mortality rates are much higher than the actual experience at those ages (which produces a shorter life expectancy and potentially understates liabilities). Because a large portion of the exposure is in these age groups, this may be reason for concern. We support the use of generational mortality, as recommended by Mercer, but want to be sure the starting mortality rates are a good fit. .   We suggest Mercer revisit the mortality assumption in light of the comments in this report and evaluate whether or not it is appropriate to modify the rates in the standard RP 2000 Table.

Retirement Rates: In the 2005 Study, the retirement rates were increased for age 56 and 57 with a resulting A/E ratio of 107%, indicating the actual retirements were still greater than the number assumed using the new assumption. The A/E ratio in the current study, using the retirement assumption adopted after the last study, is 72% so the A/E ratio dropped significantly. Because of the significant drop since the last study, we believe some conservatism should be retained in the retirement rates in case the experience in this study period is unusual and not a long-term trend. The recommended rates very closely match the actual experience during the study period as the resulting A/E ratio of 101% indicates. We would suggest moving only part of the way toward the observed experience for Rule of 90 retirements rather than all the way as recommended by Mercer. We also suggest that some conservatism be introduced into the non-Rule of 90 retirement rates by moving only part of the way toward the observed experience.

Actuarial Methods

While we are not recommending any change to the actuarial methods used in the valuation, we do believe that the funded ratio, UAAL, and actuarial contribution rate should be reported on both a market value basis and an actuarial value basis, particularly if there is a significant difference in the two asset values. We would note that this reporting was included in the July 1, 2009 actuarial valuation reports prepared by Mercer.

It may be appropriate to have further discussion on the use of a corridor with the asset valuation method and the layered amortization approach. Input from the retained actuary and Fund Administrators should be solicited as part of any discussion.

Actuarial Standards of Practice (American Academy of Actuaries)

The Actuarial Standards Board of the American Academy of Actuaries establishes and approves standards of actuarial practice. These Actuarial Standards of Practice (ASOPs) identify what the actuary should consider, document, and disclose when performing an actuarial assignment. Standards of practice are in place to assure the public that actuaries are professionally accountable. At the same time, the standards provide practicing actuaries with a basis for assuring that their work will conform to appropriate practices. Written standards of practice, coupled with written provisions for disciplining members, show that the profession governs itself and take an active interest in protecting the public.

There are ASOPs for each area of specialty (Casualty, Health, Life, Pension) and also general standards that apply to all practice areas. The specific pension ASOPs that apply to the actuarial work reviewed by Milliman include:

§ ASOP 4:   Measuring Pension Obligations
§ ASOP 27: Selection of Economic Assumptions for Measuring Pension Obligations
§ ASOP 35: Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations
§ ASOP 44: Selection and Use of Asset Valuation Methods for Pension Valuations

Since ASOPs 27 and 35 provide guidance in the selection of actuarial assumptions, they are particularly pertinent to our review of the experience studies prepared for MSRS, PERA, and TRA. More detail on the requirements of ASOP 27 and 35 are included later in this report in the sections on economic and demographic assumptions.

ASOP 44, *Selection and Use of Asset Valuation Methods for Pension Valuations*, provides that the asset valuation method, which is used to develop the actuarial value of assets, should bear a reasonable relationship to the market value. It further provides that the asset valuation method should be likely to satisfy both of the following:

§ Produce values within a reasonable range around market value <u>AND</u>
§ Recognize differences from market value in a reasonable amount of time.

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

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

We believe the current asset smoothing methodology in statute meets the requirements of ASOP 44 because it recognizes the difference between market value and actuarial value in a sufficiently short period.

ASOP 4 governs the calculation of pension obligations and the communication of those results. In general, the report should contain sufficient information such that:

§ It would be properly interpreted and applied by the person to whom the communication is directed, and
§ Another actuary in the pension practice could form an opinion about the reasonableness of the conclusion.

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Standard of Practice No. 4 also indicates specific requirements for content of actuarial reports including:

§   The name of the person or firm retaining the actuary and the purpose of the report,
§   An outline of the benefits being valued,
§   The effective date of the calculation,
§   A summary of the participant data,
§   A summary of asset information,
§   A description of the actuarial methods and assumptions, and
§   A statement of the findings, conclusions or recommendations necessary to satisfy the purpose of the communication.

In our opinion, all three of the Experience Study reports prepared by Mercer meet the requirements of this ASOP.

Standards for Actuarial Work (Legislative Commission on Pensions and Retirement)

The Legislative Commission on Pensions and Retirement (LCPR) has adopted standards for actuarial work. The purposes of the standards are:

1. To ensure that sound actuarial procedures are utilized in developing actuarial assumptions, actuarial valuations, and cost estimates for proposed legislation for each retirement plan.
2. To establish sufficient uniformity of actuarial procedures that financial comparability of the retirement plans of the State of Minnesota is maximized.
3. To facilitate the development of sound public policy decision making in the pension area by the Legislature and the Legislative Commission on Pension and Retirement.

These standards are updated periodically, most recently as of August 20, 2007. All actuarial work for retirement plans subject to Minnesota Statutes, Section 356.215 and not subject to Minnesota Statutes, Section 356.216 must be prepared in accordance with the appropriate standards in effect as of the date of the valuation. In general, the requirements of the Standards for Actuarial Work were met. There were a few items that technically are required to be included in the experience study analysis, but were not:

•   The annual investment return on the assets available for benefits must be calculated on a market value basis and on a current asset basis using the dollar weighted calculation technique. This information was not included in Mercer's report for any of the three Funds.

•   The Commission's Standards for Actuarial Work require that the experience study report show the results by each year and also combined for all years. For PERA, the individual yearly results did not show results separately for the select period from the ultimate period for the termination of employment assumption. While the combined results were shown by year, we believe that, based on the Standards, the results should be shown for both select and ultimate by year.

•   The benefit commencement age assumption for inactive vested members for MSRS was not included in the experience study report.

Specific comments regarding the Commission's Standards are included in our discussion of each Plan.

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Audit Conclusion

The actuarial methods used in the valuation process are:
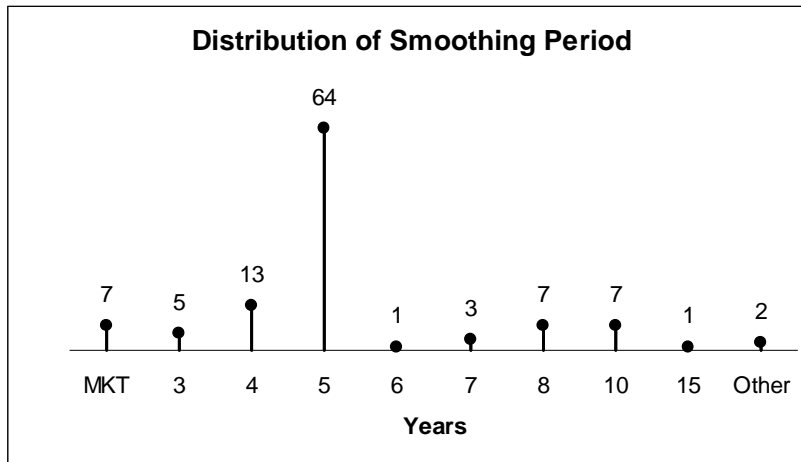
- asset valuation method,
- actuarial cost method and,
- amortization methodology for the unfunded actuarial accrued liability.

The specific actuarial methods used for MSRS, PERA and TRA are specified in state statute. Mercer recommended continued use of all of the methods, i.e. entry age normal, five year smoothing of actual versus expected return and level percent of payroll amortization of the UAAL over a closed amortization period. We agree that these are reasonable methods which are commonly used in the funding of retirement benefits. We do suggest the Commission consider a different approach on the amortization of the UAAL. It would be beneficial to obtain the input of the retained actuary and the Fund Administrators before moving forward with any change.

Comments

Asset Valuation Method

One key goal for most public retirement systems is a stable contribution rate. The volatility that exists in the market value of assets translates directly to volatility in actuarial contribution rates. Therefore, most systems use an asset valuation method that smoothes out market value fluctuations in order to create more stable contribution rates. The asset valuation method is expected to produce values which are related to current market value, but which will produce more stable contribution rates. The particular smoothing method is a matter of balancing fit (as measured against market value) with smoothness (more stability in contribution rates). The longer the smoothing period, the less there is a fit to market value. Asset smoothing methods are used by most large public retirement systems, with five years being the most common smoothing period, as shown in the National Association of State Retirement Administrator (NASRA) Public Fund Survey results below.

Distribution of Smoothing Period

The asset valuation method used by MSRS, PERA, and TRA to determine the actuarial value of assets (AVA) smoothes asset gains and losses by reflecting the dollar amount of the difference between the actual market value and the expected value of assets, equally over a five year period. The expected value is based on last year's market value of assets, actual contributions and benefit payments, and earnings at the assumed rate. This is a commonly used method and, as noted earlier, the five-year smoothing period is also the most commonly used period.

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There has been some movement by public retirement systems toward longer smoothing periods. We believe this is in reaction to the extreme market volatility and the corresponding increases in contribution rates we have seen in the past decade. While there has been some movement to longer smoothing periods by public plans, the reverse is true in the private sector. The Governmental Accounting Standards Board (GASB) has a research project underway to review the current rules for financial reporting for retirement plans (GASB No. 25 and 27). GASB has often followed the actions of the Financial Accounting Standards Board (FASB), so there is at least some chance that GASB may change the current rules and limit the smoothing period. This project began last year and preliminary information is expected sometime this summer.

When a smoothing method is applied, the actuarial value of assets will deviate from the market value of assets. Some public retirement systems utilize the concept of a "corridor", which provides that once the initial determination of the actuarial value of assets is made it is compared to a corridor around market value. The purpose of a corridor is to keep the actuarial value of assets within a "reasonable range" of the market value. The current asset valuation method does not utilize a corridor. In the experience study, Mercer recommended "continued consideration of a corridor, such as 80% to 120%". They do not make a clear recommendation, which we would have expected.. The most common corridor is 20% around market value; that is, the actuarial value of assets must fall between 80% and 120% of the market value of assets. If the preliminary actuarial value of assets falls outside that range, the amount is adjusted back to the end point of the corridor range. See the example below for an illustration of how the corridor is applied:

An example of the application of an 80% to 120% corridor is illustrated below:

1. 7/1/09 Market value of assets: $6,897,118

2. 7/1/09 Initial Actuarial Value of Assets: $9,030,401

3. Corridor Values
   A. 120% of Market Value $8,276,542
   B. 80% of Market Value $5,517,694

4. 7/1/09 Final Actuarial Value of Assets: $8,276,542

   (2) but not more than (3A) nor less than (3B)

Historically, corridors have rarely impacted the actuarial value of assets until the dramatic investment losses in late 2008 and early 2009 occurred. Note that if a corridor of 20% had been applied in the 2009 valuations, it would have impacted the results of many of the valuations. The corridor would have forced more of the actuarial loss from the 2008-09 plan year to be recognized in the 2009 valuation.

	Actuarial Value	Market Value	Ratio
MSRS General	$ 9,030,401,000	$ 6,897,118,000	**131%**
MSRS Correctional	590,339,000	456,783,000	**129**
State Patrol	584,501,000	450,060,000	**130**
Elective State Officials	213,165	213,165	100
Legislator	28,663,000	28,663,000	100
Judges	147,120,000	114,690,000	**128**
PERA General	13,158,490,000	10,116,852,000	**130**
PERA Correctional	217,577,000	167,300,000	**130**
PERA P&F	5,239,855,000	4,001,046,000	**131**
TRA	17,882,408,000	13,813,826,000	**129**
DTRFA	279,255,559	179,933,200	**155**
SPTRFA	1,049,954,000	781,432,000	**134**
MERF	880,133,155	859,895,146	102

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The main purpose of an asset valuation method is to reduce volatility in the value of assets that is used in the valuation process thereby creating more stable contribution rates. Adding a corridor to the asset smoothing method actually works against the smoothing mechanism and can actually create more volatility in the contribution rate. The following graph from an actual public plan illustrates how the corridor actually created more volatility in contribution rates in the short term instead of less by accelerating the recognition of the calendar year 2008 investment loss.

Employer Contribution Rate
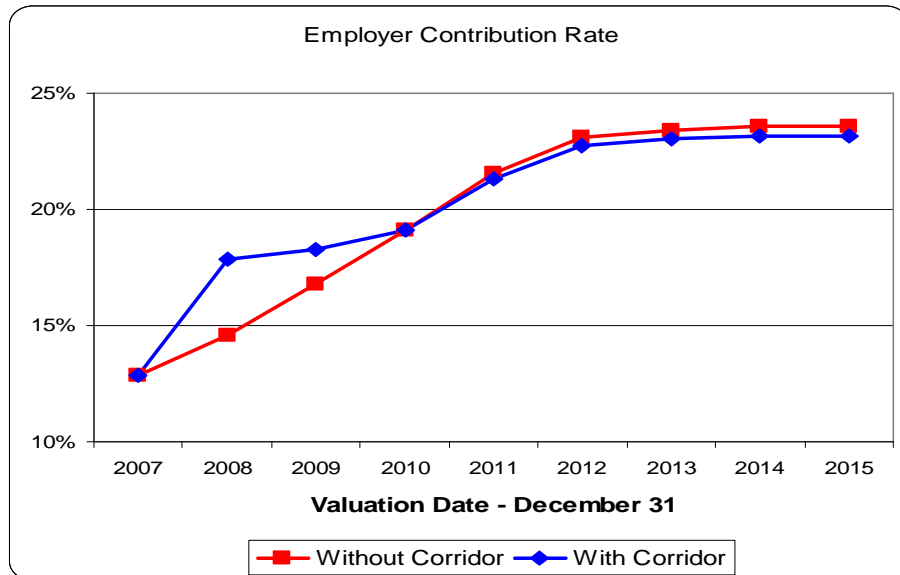
When a longer smoothing period is used, a corridor may be necessary to meet actuarial standards under ASOP 44 and also to preserve the system's credibility by ensuring the actuarial value of assets does not deviate too far from actual market value. The smoothing period used for MSRS, PERA and TRA is five years and we believe that is short enough to satisfy actuarial standards without a corridor. We do not believe that the addition of a corridor improves the asset valuation method, but the use of a corridor is common and certainly acceptable if the Commission wishes to implement one. We believe that the funded ratio, UAAL, and actuarial contribution rate should be reported on both a market value basis and an actuarial value basis in the valuation report and that forecast modeling should be part of the annual valuation process. We note that Mercer did include key measurements in the July 1, 2009 valuation reports on both an actuarial and market value basis.

Actuarial Cost Method

An actuarial funding method is a mathematical budgeting procedure for allocating the dollar amount of the actuarial present value of future benefits between future normal costs and actuarial accrued liability. The retained actuary uses the entry age normal cost method, which is characterized by:

1. Normal Cost – the level percent of payroll contribution, paid from each member's date of hire (entry age) to assumed date of retirement, which will accumulate enough assets at retirement to fund the member's projected benefits from retirement to death.

2. Actuarial Accrued Liability – the assets which would have accumulated to date had contributions been made at the level of the normal cost since the date of the first benefit accrual, if all actuarial assumptions had been exactly realized, and there had been no benefit changes.

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The entry age normal cost method is the most prevalent funding method in the public sector. The NASRA Public Funds Survey shows that nearly 75% of statewide systems are using the Entry Age Normal (EAN) cost method. It is appropriate for the public sector because it produces costs that remain stable as a percentage of payroll over time, resulting in intergenerational equity for taxpayers. Therefore, the actuarial cost method used in Minnesota is certainly in line with national trends.

Actuarial Cost Method
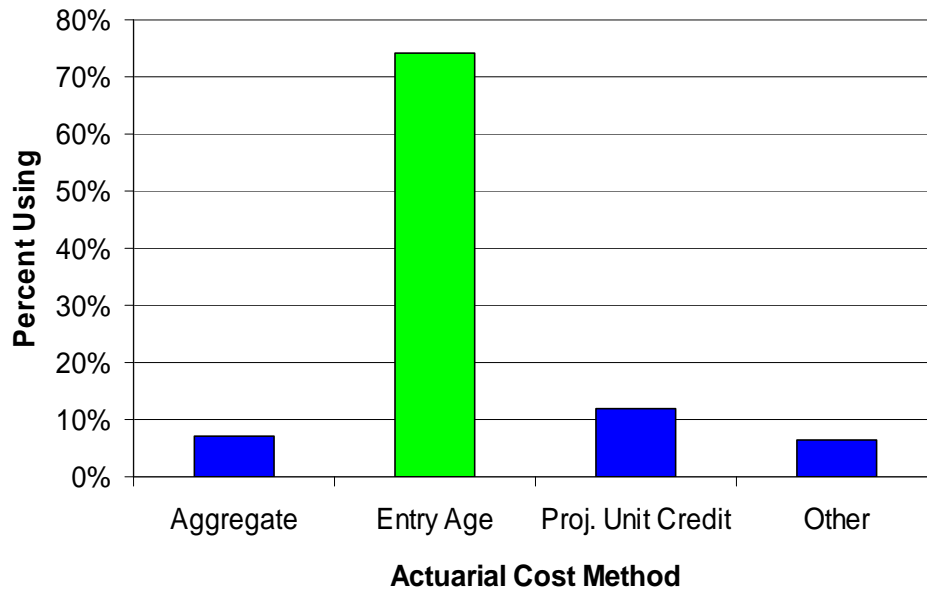
Amortization Method

The amount of any actuarial accrued liability in excess of the actuarial value of assets, defined to be the unfunded actuarial accrued liability (UAAL), is amortized over a specified period of time. By statute, the initial Unfunded Actuarial Accrued Liability for MSRS, PERA and TRA are amortized over the following periods:

MSRS: Period ending 6/30/2020*
PERA: Period ending 6/30/2031*
TRA: Period ending 6/30/2037*

   *A 30-year open period is used if there are surplus assets.

These bases use a fixed or closed amortization period, which means the period declines each year and the UAAL will eventually be paid off, if all assumptions are met.

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

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

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Statement No. 25 of the Governmental Accounting Standards Board (GASB) sets parameters for all of these characteristics for purposes of financial disclosures, which are also frequently used as funding benchmarks. Since GASB is revisiting Statement 25 it is possible that these guidelines will change in the next few years. However, currently the maximum period permitted for the amortization of the UAAL is 30 years and the amortization payment can be a level dollar amount or a level percentage of payroll. The UAAL may be amortized as one amount or components may be amortized separately.

Level dollar amortization is similar to the method in which a homeowner pays off a mortgage. The liability, once calculated, is financed by a constant fixed dollar amount, based on a predetermined number of years, until the liability is extinguished. Each payment is composed of interest on the debt and a principal payment. This approach to funding the UAAL results in the liability steadily decreasing while the payments, though remaining level in dollar terms, in all probability decrease as a percentage of payroll. (Even if a plan sponsor's population is not growing or even slightly diminishing, inflationary increases will usually be sufficient to increase the aggregate payroll).

The rationale behind the level percentage of payroll amortization method is that since normal costs are calculated to be a constant percentage of pay, unfunded actuarial liabilities should be paid off in the same manner. When this method of amortizing the unfunded actuarial liability is adopted, the initial amortization payments are lower than they would be under a level dollar amortization payment method but the payments increase at a fixed rate so that ultimately the annual payment far exceeds the level dollar payment. The expectation is that total payroll will increase as rapidly so that the amortization payments will remain constant, as a percentage of payroll. In the initial years, the level percentage of payroll amortization payment is often less than the interest accruing on the unfunded actuarial accrued liability meaning that even if there are no experience losses, the unfunded actuarial accrued liability will grow (see graph below). The increasing unfunded actuarial accrued liability may be troubling at first glance, but should not be worrisome unless the remaining UAAL is actually increasing as a percentage of total covered payroll. Amortizing the UAAL as a level percent of payroll is more common in public sector plans and is the current amortization methodology. It conforms to actuarial standards and is commonly used by public plans.

Level Dollar vs Level Percent Amortization

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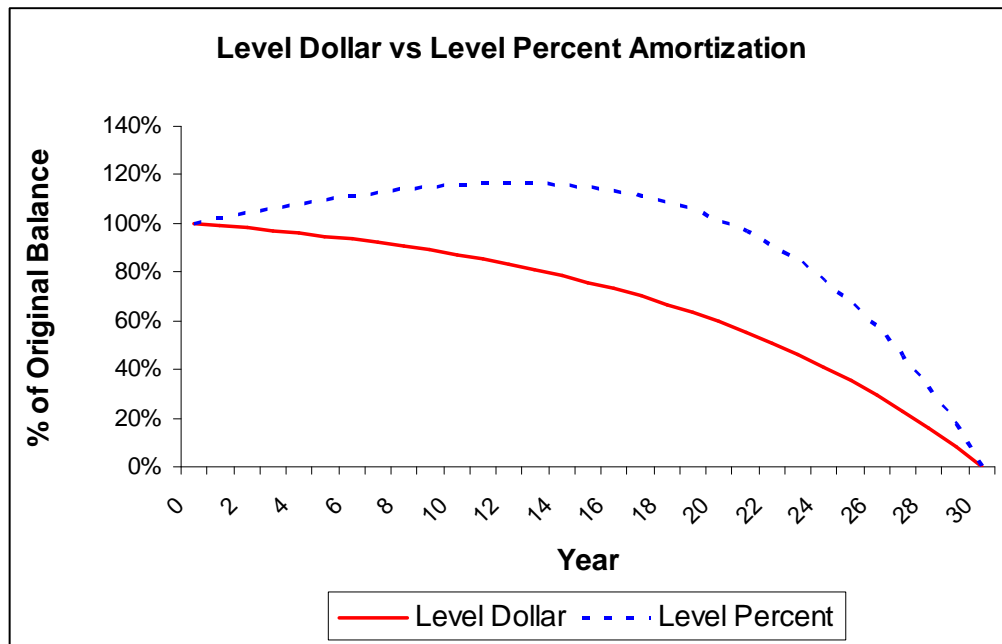
It is most common for public retirement systems to recalculate the UAAL each year in the actuarial valuation and then amortize that amount over the open or closed amortization period as is currently done for MSRS, PERA and TRA. The use of a closed period can be problematic when the period declines and eventually becomes short. This will lead to volatility in the contribution rate and generally the amortization period is reset at that time. On the other hand, if the amortization period is open there is no progress toward full funding and the UAAL often continually increases.

Another option for amortizing the UAAL is to use a "layered" approach in which each year's surplus/deficit is separately amortized. Once the Fund reaches the 100% funded target, all layers are reset. Using the layered approach, the plan is expected to ultimately reach the 100% funded goal. It also provides transparency, in that the current UAAL is isolated and paid off over a fixed period of time (as compared to using an open amortization period). On the negative side of using layered approach, it can create some discontinuities in contribution rates when UAAL layers are fully paid off.

We believe that the use of a layered approach may be a reasonable alternative to the use of an open or closed period and may eliminate the need to reset the amortization period. Further study should be done on the impact of this approach on the contribution rates and funded status. In addition, in our opinion the retained actuary and Fund Administrator for MSRS, PERA and TRA should be included in the discussion before a decision is made.

Audit Conclusion

The economic assumptions used in the valuation of a defined benefit plan are a critical component of the actuarial process. Since Mercer is the retained actuary for all three of the systems, the recommendations for economic assumptions in each of the experience studies were consistent. The specific assumptions addressed in this section include:

- Price inflation
- Wage inflation (general wage increase) and
- Investment return.

These assumptions are used to develop the total salary increase assumption and the payroll growth assumption. We would note that Mercer included the total salary increase assumption as an economic assumption, but Milliman views the general wage growth assumption as an economic assumption and the merit scale as a demographic assumption. Since total salary growth has some characteristics of both economic and demographic assumptions, this is not surprising. In our review of the experience studies, we will address the merit salary assumption separately in the demographic assumption section for each Fund.

In our opinion, the analysis of the economic assumptions in Mercer's experience studies is reasonable and consistent and was developed in accordance with ASOP No. 27. In general, the experience study also meets the requirements of the Commission's Standards for Actuarial Work with respect to experience studies. The Standards for Actuarial Work require that the actual annual investment return during the Study period be calculated on both an actuarial and market value basis. This information was not included in the experience study.

There were two specific findings that were significant:

Investment Return Assumption: With respect to the investment return assumption, Mercer's modeling indicated that, while the use of the current 8.5% assumption is within actuarial standards of practice, there is less than a 50% chance of a 8.5% return occurring over a 20-30 year timeframe, based on their assumptions. Using SBI's capital market assumptions, the 50th percentile shows a return of 9.1%, indicating there is more than a 50% chance the return will be 8.5% or higher. Based on Mercer's modeling, the 8.5% assumption would be considered on the more aggressive end of the "best estimate" range, while it appears conservative when looking at the analysis using SBI's assumption. Milliman's modeling produced results that were comparable to Mercer's. There is no right answer as no one knows what the future holds. Because the investment return assumption is the single most important assumption in the valuation process, any change in this assumption should be accompanied with considerable discussion as it will have a significant impact on the long-term funding of the plans. . We are aware that both Mercer and SBI made presentations regarding the rate of return assumption after the experience study was issued and consensus could not be reached. It is clear that there are differing opinions on the subject. Because the 8.5% assumption is in statute, there is no urgency to make a decision immediately as it will not impact the current valuation. However, due to its importance further analysis should not be deferred until the next experience study, but should transpire over the next six to nine months. Given the differences of opinion and the importance of this assumption we believe an unbiased opinion from a totally independent third party with specific investment expertise could be very valuable to the Commission.

Payroll Growth Assumption: The payroll growth assumption (used in calculating the UAAL amortization payment) currently used in the valuation is 4.50%. Mercer recommended that the assumption be lowered to 4.0%, the same rate as the general wage growth assumption. The payroll growth assumption is typically set equal to the wage growth assumption. However, the recommended merit salary scale for all three Funds includes negative merit rates for years of service above a certain number (varies somewhat by Fund). Given the recommended assumption, we are concerned that the payroll growth assumption is too high. The negative merit scale, which applies to a large number of active members and an even greater portion of total payroll, is likely to result in covered payrolls that do not increase at the general wage growth assumption (4%) even if all other assumptions are met. If Mercer's recommended salary

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assumption is adopted, we suggest further analysis be performed by Mercer to determine if a 4.0% payroll growth assumption is too high.

Our in-depth analysis for each economic assumption is included below.

Detailed Comments

In our work, actuaries are guided by the Actuarial Standards of Practice (ASOP) adopted by the Actuarial Standards Board (ASB). One of these standards is ASOP No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations.* This standard provides guidance to actuaries giving advice on the selection of economic assumptions to be used to measure benefit obligations under defined benefit plans. We used this standard as the basis for our review of the economic assumptions developed in the experience studies for MSRS, PERA and TRA.

As no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment. The standard suggests that the actuary should consider a number of factors, including the purpose and nature of the measurement, and appropriate recent and long-term historical economic data. However, the standard explicitly advises the actuary not to give undue weight to recent experience. Recognizing that there is not one "right answer", the standard calls for the actuary to develop a best estimate range for each economic assumption, and then recommend a specific point within that range. The best estimate range is defined as "the narrowest range within which the actuary reasonably anticipates that the actual results, compounded over the measurement period, are more likely than not to fall". The standard does state that the actuary is not required to identify the explicit best-estimate range before selecting the specific point, provided that the actuary is satisfied that the selected point would be within the best-estimate range had such range been explicitly identified.

In the experience study reports for all three systems, Mercer developed and disclosed a best estimate range and then selected a specific assumption from within that range. Another requirement of ASOP 27 is that each economic assumption should be consistent with every other economic assumption over the measurement period. The set of economic assumptions recommended by Mercer also meet this requirement.

Since economic assumptions are subjective in nature, the Commission, and the respective Boards should understand the implications of the assumptions, particularly the investment return assumption. There is an "actuarial or liability risk" associated with the set of economic assumptions just as there is an investment risk associated with a given portfolio mix. To the extent the assumptions are on the more aggressive end of the "best estimate range", it is more likely there will be unfavorable experience resulting in increasing contribution rates and decreasing funded ratios. Likewise, if the assumptions are on the more conservative side of the "best estimate range", it is more likely there will be favorable experience and decreasing contribution rates. It is important to note that the assumptions do not affect the actual long-term cost of a plan, which will emerge in accordance with the benefits and expenses that are actually paid.

A summary of the current economic assumptions and those recommended by Mercer, as a result of the experience study, is shown below:

	Current	**Recommended**
Investment Return	8.50%	8.00%
Inflation	3.00%	3.00%
General Wage Growth		
Price Inflation	3.00%	3.00%
Productivity	1.50%	1.00%
Total	4.50%	4.00%

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INFLATION:

Use in the Valuation: Inflation as referred to in this discussion means price inflation. The inflation assumption has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return, general wage growth, and payroll growth assumption.

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

The effect of inflation is more direct on wages than on investment return. An individual's wages are affected by:

(1) Promotion and longevity (merit scale)
(2) Productivity
(3) Inflation

For actuarial purposes, productivity and inflation are often combined into a single assumption for salaries: the rate of increase in the general wage level of the membership, also called the wage growth assumption or wage inflation. The actuarial assumption for salary increases is composed of a merit scale assumption, which reflects the effects of promotion and longevity, and the general wage growth assumption.

The current assumption for price inflation is 3.0% per year.

In the experience studies for MSRS, PERA and TRA, Mercer considered historical inflation from 1935 to 2008, as measured by the CPI-U as well as the assumptions used by the Social Security Administration in their projections under the intermediate assumption. The inflation assumed by the State Board of Investment (SBI) and Mercer Investment Consulting were also considered.

These are typically the same factors we consider when setting the inflation assumption. As set out in ASOP27, Mercer developed a best estimate range of 2.3% to 3.3% and then selected the assumption within that range. Mercer recommended maintaining the 3% inflation assumption and we concur with that recommendation.

INVESTMENT RETURN

Use in the Valuation: The investment return assumption is one of the primary determinants in the calculation of the expected cost of the System's benefits, providing a discount of the estimated future benefit payments to reflect the time value of money. This assumption has a direct impact on the calculation of liabilities and contribution rates. The valuation interest rate should represent the long-term rate of return on the actuarial value of assets, considering the fund's asset allocation policy, expected long term real rates of return on the specific asset classes, the underlying inflation rate, and any expenses expected to be paid from the investment earnings.

The current investment return assumption is 8.50% per year, net of all investment-related expenses. Administrative expenses are included separately in the contribution rate determination, so they are not included in this discussion.

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Historical Perspective: One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the time frame used, particularly when the year-to-year results vary widely. Even though history provides a valuable perspective for setting this assumption, the economy of the past is not necessarily the economy of the future, nor is recent experience necessarily a good predictor for future long term experience. The asset allocation also has a critical role in returns, so results achieved under other asset allocations are not necessarily meaningful. Therefore, we believe the preferred approach is prospective in nature.

The Commission's Standards for Actuarial Work require the actual annual investment return be calculated and reported in the experience study on both the market and actuarial value of assets. This information was not included in the experience studies prepared for MSRS, PERA or TRA, but was recently provided in a separate document.

The historical rates of return on a market value basis, since 1994, as provided by SBI, for the Combined Fund are shown in the graph below. The geometric rate of return over this 16-year period was 6.9%
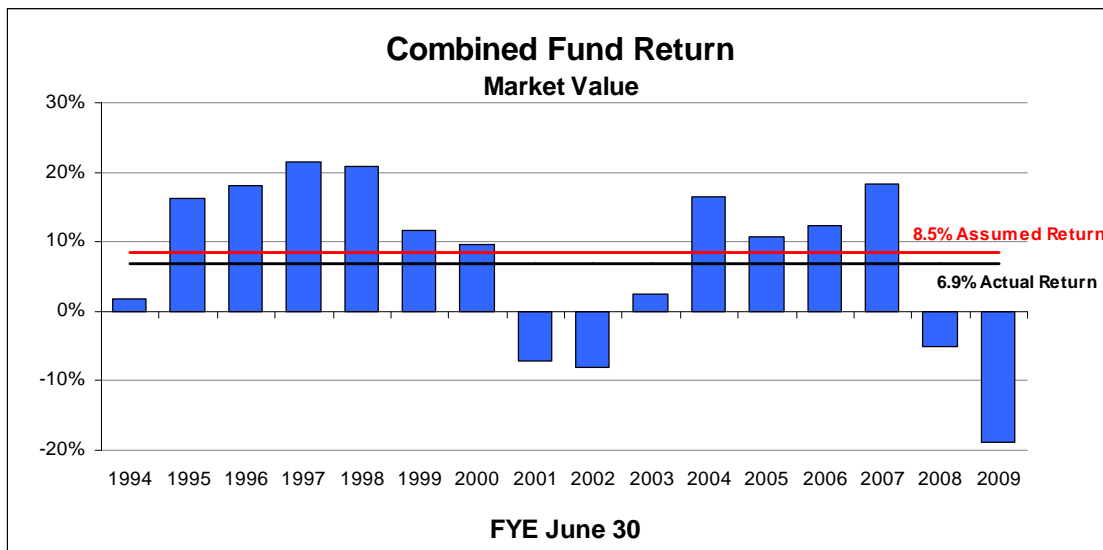
Method to Determine Best-Estimate Range for Investment Return

Milliman's investment consulting practice uses a standard method to determine the best-estimate range for the investment return based upon capital markets assumptions and the target asset allocation. We believe this approach is similar to that used by Mercer's in the experience studies. This method is used to provide the range of assumptions appropriate for compliance with Actuarial Standard of Practice No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations.* This standard defines the Best-Estimate Range as "the narrowest range within which the actuary reasonably anticipates that the actual results, compounded over the measurement period, are more likely than not to fall".

By assuming the portfolio is re-balanced annually and that annual returns are lognormally distributed and independent from year to year, we can develop expected percentiles for the long-term distribution of annualized returns. Using properties of the lognormal distribution, we calculate the 25th and 75th percentiles of the long-term total return distribution. Under ASOP 27, this becomes our best-estimate range because 50% of the outcomes are expected to fall within this range and it is centered about the mean.

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The current target asset allocation is a key component in developing the investment return assumption. The asset allocation, as shown in the 2009 Annual Report issued by SBI, is summarized in the following chart:

Asset Class	Target Asset Allocation
Domestic Stocks	45%
International Stocks	15%
Alternative Assets	20%
Bonds	18%
Cash	2%
Total Portfolio	100%

Best-Estimate Range for Investment Return (Based on SBI Capital Market Assumptions)

The capital market assumptions provided by SBI were combined with the target asset allocation policy to generate expected rates of returns. The rate of return is subject to significant year-to-year volatility as measured by the standard deviation. Volatility over time will lower the mean rate of return, but diversification by asset class will reduce the volatility and narrow the range of expected returns for the entire portfolio.

The expected rate of return, using the capital market assumptions provided to us by SBI, is 9.3%. The results are summarized, as follows, using SBI's capital market assumptions, including a 3.0% inflation assumption:

Expected Return – SBI Assumptions

Horizon In Years	Percentile Results for Real Rate of Return				
	5th	25th	50th	75th	95th
1	-9.6%	1.1%	9.3%	18.1%	32.1%
5	0.4%	5.5%	9.3%	13.1%	18.9%
10	2.9%	6.6%	9.3%	12.0%	16.0%
20	4.7%	7.4%	9.3%	11.2%	14.0%
30	5.5%	**7.7%**	9.3%	**10.8%**	13.1%

The geometric mean return is 9.3%, but due to the volatility associated with the asset allocation, the range of probable outcomes is quite large. For example, in the first year there is a 5% chance the rate of return will be less than -9.6% and a 5% chance it will be greater than 32.1%. As the time horizon lengthens, the range of the cumulative average results narrows.

Over a 30-year time horizon, we estimate there is a 25% chance the rate of return will be less than 7.7% and a 25% chance the return will be greater than 10.8% (bold numbers on the bottom line in the table above). Therefore, we can say the return is just as likely to be within the range from 7.7% to 10.8% as not.

To determine the best-estimate range for the investment return assumption, Milliman typically uses the 25th to 75th percentiles. The expected nominal returns are reduced by expected investment expenses to obtain a net return assumption.

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Net Expected Return – SBI Assumptions

Components of Return	Percentile Results		
	25th	50th	75th
Expected Return	7.7%	9.3%	10.8%
Investment Expenses	-0.2%	-0.2%	-0.2%
Net Investment Return	7.5%	9.1%	10.6%

Best-Estimate Range for Investment Return (Based on Mercer's Capital Market Assumptions)

Mercer's development of the best estimate range uses capital market assumptions developed by Mercer as of January 1, 2009. They also used the 35th to the 65th percentile to develop a slightly narrower best estimate range under ASOP 27. Mercer's analysis produced very different results than those obtained using the capital market assumptions provided to us by SBI. Mercer expected return (50th percentile) was 8.1% (this calculation was verified by Milliman) while the expected return using SBI assumptions was 9.1%. We believe this difference in the expected return is attributable to the difference in the capital market assumptions. A direct comparison is difficult because Mercer's asset allocation is broken down into various components within certain asset classes while SBI's are not.

Most investment consulting practices revise their capital market assumptions at least annually and sometimes even more often. Given the financial turmoil in the stock market and the general economy at the beginning of 2009, we wanted to provide updated information using Mercer's current (2010) capital market assumptions. It is our understanding that the capital market assumptions used by SBI have not changed. Based on the 2010 capital market assumptions provided by Mercer, we recalculated the expected returns, as summarized below:

Net Expected Return – Mercer 2010 Assumptions

	Percentile Results		
	25th	50th	75th
Expected Return	7.4%	8.4%	9.4%
Investment Expenses	-0.2%	-0.2%	-0.2%
Net Investment Return	7.2%	8.2%	9.2%

There was very little change in the expected return using Mercer's 2010 capital market assumptions. A significant difference still exists between the expected return using Mercer and SBI assumptions.

Best-Estimate Range for Investment Return (Milliman's 2010 Assumptions)

In order to provide some additional insight, we performed the analysis on the investment return assumption using the 2010 capital market assumptions developed by Milliman's investment consulting practice. Our results are shown below:

Net Expected Return – Milliman 2010 Assumptions

	Percentile Results		
	25th	50th	75th
Expected Return	6.3%	8.0%	9.8%
Investment Expenses	-0.2%	-0.2%	-0.2%
Net Investment Return	6.1%	7.8%	9.6%

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Our results produced an expected return that was closer to Mercer's results than SBI's. In fact, our assumptions resulted in a rate of 7.8%, which was 0.4% lower than Mercer's results.

Evaluation of the Findings

The expected return (50th percentile) results, using the various capital market assumptions, are summarized below:

SBI	Mercer 2010 Assumptions	Milliman 2010 Assumptions
9.1%	8.2%	7.8%

Typically we would give more weight to the assumptions used by the Fund's investment consultant. However, SBI's assumptions produce a result that is much higher than Mercer's or Milliman's, which is a concern. It also appears that they have not been formally updated since the summer of 2008.

The results of both Mercer and Milliman's modeling indicates that the current 8.5% assumption has less than a 50% chance of occurring over a 20 to 30 year timeframe, based on their respective assumptions. Please note that 8.5% is not outside of the "best estimate range" so it still falls within acceptable limits for actuarial standards. However, based on Mercer's modeling, the 8.5% assumption would be considered on the more aggressive end of the range, while it looks conservative when based on the analysis using SBI's assumption. There is no knowable right answer as no one knows what the future holds. In addition, the regular adjustment of capital market assumptions can lead to volatility in the analysis. We are aware that both Mercer and SBI made presentations regarding the rate of return assumption after the experience study was issued and consensus could not be reached. It is clear that there are differing opinions on the subject. Because the 8.5% assumption is in statute, there is no urgency to make a decision immediately as it will not impact the current valuation. However, due to its importance further analysis should not be deferred until the next experience study, but should transpire over the next six to nine months. Given the differences of opinion and the importance of this assumption we believe an unbiased opinion from a totally independent third party with specific investment expertise could be very valuable to the Commission.

Analysis / Selecting an Assumption

While there is not one right answer when selecting an investment return assumption, a specific value needs to be selected for use in the valuation. Under the actuarial standards of practice, any point from within the best-estimate range may be selected, but that is a very wide range. The following are some key factors, which should be considered when selecting a specific investment return assumption. This is not a comprehensive list of topics, but rather a place to start the discussion. In addition, different parties may have a different view than Milliman on some or all of these topics, which is why a dialogue between interested parties should occur before any action is taken.

Conservatism

We generally believe some degree of conservatism should be built into the assumption because the upside and downside risk are not equal. Therefore, we usually recommend the investment return assumption be set between the 25th and 50th percentiles. It is much easier to deal with actual returns exceeding the assumption in the future than lagging it, particularly given the Funds' current funded status and financial projections.

This is particularly true for MSRS, PERA and TRA, since they are essentially fixed contribution rate plans. In their current situation, all three plans currently need additional funding. If this additional funding is obtained, but actual returns in the future fall short of the investment return assumption, it is likely the contribution rate will again be insufficient. By setting a more conservative investment return assumption,

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the targeted contribution rate is more likely to be sufficient in the long term. That being said, the lower the investment return assumption is set, the harder it may be to have the full actuarial contribution rate contributed.

Underperforming the Assumption

A small amount of future underperformance of the assumption can be absorbed without preventing some positive progress in the funded status, if adequate financing is obtained. However, if actual long-term performance is materially less than the assumption, additional contributions will be needed.
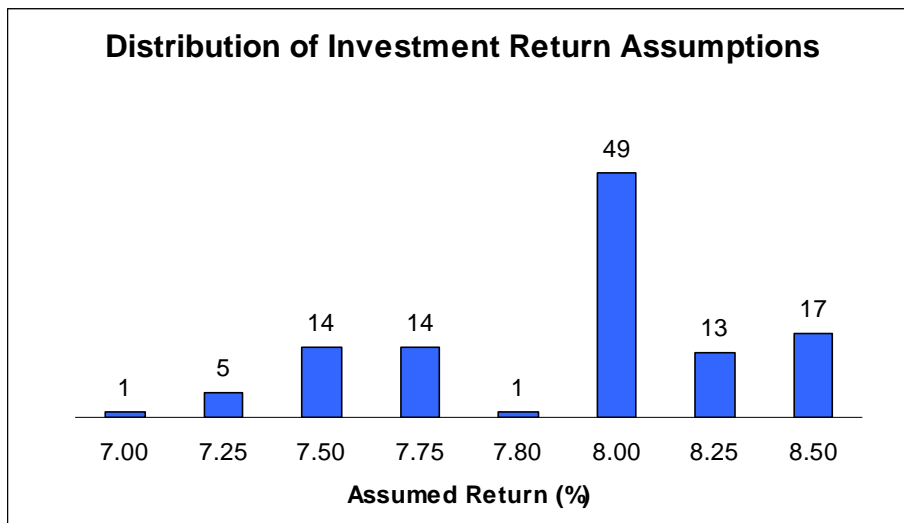
Stability

It is appropriate to take into account what the current investment return assumption is. Changing the investment return assumption every time the capital market assumptions change would lead to additional instability in the funded status and actuarial contribution rate. That being said, if there is a material change in the capital market assumptions or asset allocation, a change in the investment return assumption should be considered.

Financial Impact of Assumption

Small changes in the investment return assumption can create significant changes in the liabilities and costs. If the impact is so dramatic that the actuarial contribution rate is completely unfeasible, it may be appropriate to review the amount of conservatism included.

Other Systems

Although the assumption should not be set based on what other systems are doing, it does give some context to see how the assumption for the Minnesota systems relates to other large, public systems. Based on the NASRA Public Fund Survey, an assumption of 8.0% is the most common for other statewide systems. About 15% of the plans are using an assumption of 8.5% and none are using a rate higher than 8.5%.

Distribution of Investment Return Assumptions

Assumed Return (%)	Count
7.00	1
7.25	5
7.50	14
7.75	14
7.80	1
8.00	49
8.25	13
8.50	17

We would also note that the Colorado Public Employees Retirement Association recently lowered their investment return assumption from 8.5% to 8.0%. In addition, CALPERS has also indicated that they are reviewing their current investment return assumption of 7.75% to determine whether it should be lowered.

WAGE GROWTH

Use in the Valuation: Estimates of future salaries are based on two types of assumptions. Rates of increase in the general wage level of the membership are directly related to inflation while individual salary increases due to promotion and longevity (referred to as the merit scale) occur even in the absence of inflation. The merit scale will be reviewed with the other demographic assumptions.

The current wage growth assumption is 1.50% above the price inflation rate, or 4.50% per year. Mercer recommended that the wage growth assumption be lowered to 4.00%.

Mercer considered historical changes in the National Average Wages based on statistics gathered by the Social Security Administration. In our experience analysis we also use this dataset for analysis, much as the CPI data is used for analyzing price inflation. There has been debate on the issue of whether public sector employees will receive, over the long term, the same rewards for productivity as employees in the private sector, where productivity is more readily measurable. To our knowledge, no definitive research has been completed on this topic. Nevertheless, it is our opinion that public sector employees must be rewarded, even if there is a time lag, with the same productivity increases as those participating in the remainder of the economy.

Another benchmark that we often use is the projections performed by the Office of the Chief Actuary of the Social Security Administration. They produce three sets of assumptions: low, intermediate and high. In the May 2009 report the annual increase in the National Average Wage Index over the next 30 years under the intermediate cost assumption was 3.9%, 1.1% higher than the Social Security intermediate inflation assumption of 2.80% per year. The range for the assumed real wage inflation in the 2009 Trustees report was 0.5 to 1.7% per year.

In accordance with ASOP27, Mercer developed a best estimate range of 0.50% to 1.50% and then selected the recommended assumption of 1.0% from within the range. We believe Mercer's recommended of a 1.0% real wage growth (productivity) assumption is reasonable.

PAYROLL INCREASE ASSUMPTION

The UAAL (or Surplus) is amortized as a level percentage of payroll in determining the actuarial contribution rate. This means that the dollar amount of the UAAL payment is assumed to increase at the same rate as covered payroll is assumed to increase. The result, if all assumptions are met, is that the UAAL contribution rate will be a level rate over time. The aggregate covered payroll is generally expected to increase, without accounting for the possibility of an increase in membership.

Payroll growth increases lower than expected have a negative effect on determining the UAAL contribution rate, as a greater percentage of pay will be required to fund the UAAL over a smaller expected payroll. Likewise, payroll growth increases greater than expected have a positive effect on determining the UAAL contribution rate, as a lower percentage of pay will be required to fund the UAAL over a larger expected payroll.

The payroll growth assumption currently used in the valuation is 4.50%. Mercer recommended that the assumption be lowered to 4.0%, the same as the general wage growth assumption. It is most common for the payroll increase assumption to be set equal to the wage growth assumption. However, the current merit salary scale assumption includes negative merit rates for certain durations (varies somewhat by Fund). Given this assumption, we are concerned that the proposed assumption of 4.0% is too high, i.e. the payroll growth assumption may not increase as fast as the general wage increase. The negative merit scale, which applies to a large number of active members and an even greater portion of total payroll, is likely to result in covered payrolls that do not increase at the general wage growth assumption (4%) even if all other assumptions are met. We recommend Mercer perform further analysis for each Fund to determine what payroll growth assumption is appropriate if the recommended salary scale is adopted.

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Demographic Assumptions

Demographic assumptions relate to events such as the probability of an active member leaving employment (death, disability, termination, or retirement) and the promotional rate component of the salary increase assumption (called the merit scale). Studies of demographic experience typically involve a detailed comparison of actual and expected experience. Judgment is required to predict future experience from past trends and current evidence, including a determination of the amount of weight to assign to the most recent experience. Therefore, different opinions may exist regarding the use of an assumption even given the same underlying experience.

While we have tested the data used in the experience study for reasonableness, we have not independently reproduced the results in the experience study. Therefore, we have relied on the accuracy of the calculations presented in the experience studies and make our observations about the appropriateness of the assumptions based on the available information.

Studies of demographic experience generally involve three steps:

- First, the number of members changing membership status, called decrements, during the study is tabulated by age, duration, sex, group, and membership class (active, retired, etc.).

- Next, the number of members expected to change status is calculated by multiplying certain membership statistics, called exposure, by the expected rates of decrement.

- Finally, the number of actual decrements is compared with the number of expected decrements. The comparison is called the actual to expected ratio (A/E Ratio), and is expressed as a percentage.

Our specific comments on each of the demographic assumptions for each Fund (MSRS, PERA, and TRA) are discussed on the following pages. As previously noted, there is no "right" answer when it comes to setting assumptions as no one knows what the future holds. In addition, we are trying to set long term assumptions, but the experience is measured and reported over a short, four year period. In addition, the Fund actuary may have access to information and historical experience that Milliman does not have at this point in time. Last, but not least, the preference and conservatism of each actuary is different and will result in different recommendations even when viewing the same data. We have tried to explain the thought process behind our comments, but these should be viewed in a positive manner with the purpose of creating the best set of assumptions that are consistent with the goals of funding the plans. Undoubtedly, additional discussion will need to occur before final assumptions can be determined.

In general, we are more comfortable with an approach to setting demographic assumptions that moves part of the way toward the observed experience rather than all of the way. Mercer's general approach appears to be to recommend assumptions that closely mirror the actual, observed experience. We realize that the Commission's Standards for Actuarial Work require the actual experience to be recognized when setting assumptions, but we believe there is still room for professional judgment. In addition, we typically review the results of the prior experience study and take that experience into account when reviewing the current set of assumptions. At times, it appears that Mercer took prior experience into account, but at other times prior experience is not discussed. When reading our comments on the assumptions recommended by Mercer, it is important to keep in mind that we do not believe any of Mercer's recommendations are unreasonable or inappropriate. However, there are a number of assumptions where we believe additional analysis or discussion could prove beneficial, particularly with respect to the degree of conservatism desired in the assumptions.

Audit Conclusion

We found that the general methodologies used to prepare the experience study were appropriate and that the assumptions developed generally comply with the guidance provided by Actuarial Standard of Practice No. 35 *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations.*

While all of the assumptions recommended by Mercer are reasonable and changes are generally consistent with the observed experience, there are some assumptions that we feel merit additional discussion and analysis. In addition, there are some significant differences in the findings of this (2009) Study compared to the prior (2005) Study which make us uncomfortable unless they can be explained. The specific assumptions impacted in this last category are discussed below:

- The A/E ratio for postretirement mortality for males dropped from 139% in the prior study to 101% in the current study. This is a dramatic change in a very short period and is not typical of mortality changes, yet there was no discussion of this in the experience study report. In follow-up conversations with Mercer about this issue, they indicated that they didn't match the male experience in the last experience study and questioned Segal's results. However, the issue was never resolved. A review of the male deaths in the 1996 – 2000 Experience Study indicated that there were 1,266 deaths, which is more in line with Mercer's results. Based on this information, we believe the number of male deaths and, therefore ,the A/E ratio in the Segal 2005 Experience Study were overstated. We believe that this information should have been included and discussed in the written report.

  While the overall A/E ratio for males and females using the recommended assumption was 105% and 99%, we are concerned with the fit of the recommended assumptions at certain key ages. The A/E ratio at age 65 to 80 is 92% which means that mortality rates are higher than the actual experience at those ages, resulting in a shorter expected benefit payment period and lower liabilities. Given that a large portion of the exposure is in this age group, this may be cause for concern. We support the use of generational mortality, as recommended by Mercer, but want to be sure the starting mortality rates are a good fit. We suggest Mercer revisit the mortality assumption in light of the findings in this report and evaluate whether or not it is appropriate to modify the rates in the standard RP 2000 Table.

- There was a significant difference in the number of members decrementing from termination of employment between the prior (2005) and current (2009) Study. The current study showed a much larger number of terminations (14,097 compared to 10,047). This is rather unusual and was not addressed in the current experience study report. Because of this material difference in the observed experience between the two studies, we are uncomfortable making a significant change in the approach to this assumption. Mercer recommended moving to an assumption based on both age and service for all years of service. Because of the new approach, the recommended assumption would be based only on the actual experience in the current study period. Since the data for this experience study seems very different from that in the prior study (without explanation), we would prefer not to make a material change to the termination of employment assumption at this time. When the next study is performed there will be more data upon which to base this assumption and most of the data will be that used by Mercer in their valuations so the reliability of that data should be better.

  We would note that Mercer's recommended approach "slices and dices" the data into many groupings. As a result, there are small numbers of members at some of the age groupings (older age with higher service) which can cause volatility in the observed rates and make it more difficult to develop rates that will provide a reasonable estimate of future experience. Rather than moving

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to a full age and service assumption for all ages and years of service, it may make sense to remain with the select and ultimate assumption and extend the select period.

- Mercer commented that the observed salary increases had a stronger correlation to service than age in general and recommended moving to a service based table. We agree that the change to a service-based table is reasonable and in line with common actuarial practice for public retirement systems, but we are concerned that the proposed salary scale is based on only four years of experience and the results in this study period may not be representative of long term salary increases.   In addition, the way the salary increase assumption was developed does not directly address the separate components of the assumption, i.e. the total salary assumption includes a merit scale and the general wage growth assumption.   Wage increases, in general, have been below the 4.0% recommended assumption over the last decade and we believe this overall economic trend could have impacted the salary experience in the study period and resulted in lower overall salary increases. These factors make us less comfortable with the recommended change in the assumption. In our opinion, the salary assumption being proposed provides little conservatism and contains a negative merit scale which, in our experience, is uncommon. We believe the salary assumption should be studied further to determine the appropriate change, particularly if a new service based assumption is to be implemented.

  We note that the MSRS Board adopted a salary increase assumption that is 25 basis points higher at all ages than the recommended rates in the experience study report. In our opinion, this was a prudent move although we would like to see even more conservatism in the rates. The salary assumption adopted by the Board provides some conservatism but not a lot. In addition, it contains a negative merit scale, which in our experience is not common. We believe the salary assumption should be studied further to determine the appropriate change, particularly if a new service based assumption is to be implemented.

The assumptions where our approach or philosophy differs from Mercer's include the following:

- The proposed retirement rates are lower than the current assumption and closely follow the actual experience. Given that the rates for Rule of 90 were lowered in the last study (with a resulting A/E ratio of 103%) and experience in this study seems unusually low (72%), we would prefer to move only part of the way toward the actual experience and maintain some conservatism in the retirement rates for Rule of 90. Also, we would suggest that some conservatism be introduced into the non-Rule of 90 retirement rates by moving only part of the way toward the observed experience.

- The disability rates were just increased in the last study with a resulting A/E ratio of 101%, indicating a close fit to the actual observed experience in that study. The A/E ratio for males in the current study was 85%. Due to the small number of disabilities, there is a tendency for variability in the A/E ratios.   Since the assumption was just increased in the last study and the aggregate results of the combined 2005 and 2009 study period is an A/E ratio of 93%, we would leave the current assumption for males in place.

Detailed Analysis

Mortality

A summary of the current and recommended mortality assumptions from the MSRS Experience Study is shown on the following page:

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Assumption	Current	Recommended
Healthy Postretirement Mortality	1983 Group Annuity Mortality Table	RP2000 Annuitant Generational Mortality, White Collar Adjustment
Males	Set back 2 years	No set back
Females	Set back 1 year	No set back

Disabled Retiree Mortality	1965 RRB rates through age 54. For ages 55 to 64, graded between 1965 RRB rates and the healthy postretirement mortality table. Ages 65 and later, healthy postretirement mortality table.	RP2000 Disabled Mortality White Collar Adjustment
		    No set back for males
		    Set forward 5 years for females

Healthy Preretirement Mortality	1983 Group Annuity Mortality Table	RP2000 Non-Annuitant Generational Mortality, White Collar Adjustment
Males	Set back 5 years	Set forward 3 years
Females	Set back 2 years	Set back 1 year

The post-retirement mortality assumption is one of the most important demographic assumptions because it impacts how long pension payments are expected to be paid, which directly impacts the plan's liabilities.

It is an established trend that people are living longer and most people believe this trend will continue. As a result, we believe it is appropriate to address future mortality improvements in the valuation of benefits. ASOP 35 states that actuaries "should consider…the likelihood and extent of mortality improvements in the future".

As Mercer explained in their report, there are two ways to factor future mortality improvements into the valuation process. One is to use a single mortality table that predicts fewer deaths than are actually occurring at the present time which results in an Actual/Expected Ratio of over 100% (which is called a "margin"). With this method, the same probability of death at age 65 would apply to any member who is projected to reach age 65 whether they reach age 65 in the current year or 40 years from now. The second approach is to use a mortality table that reflects the current experience of the membership (and hence an A/E ratio close to 100%) and then projects anticipated future mortality improvements on a "generational" basis, i.e. mortality rates are set by the year in which a member reaches a particular age. In this case, a different probability of death would be used for a person reaching age 65 in the current year versus one reaching age 65 in 40 years (lower rates would apply in future years). This latter approach actually results in a set of mortality tables that are used in the valuation and mortality rates that are based on when a member reaches a particular age.

Although the first approach is still common, we prefer the second approach (the use of generational mortality). It avoids the debate about how much "margin" should be maintained in the A/E ratio, it more directly reflects expected mortality improvements for the applicable members and it should require less dramatic adjustments for updated mortality tables in future years. Mercer recommended changing to the RP2000 Mortality Table on a generational basis and we concur with this recommendation in general. After our review of the data, we believe some further analysis might be beneficial.

The A/E Ratios in the current and prior experience study, <u>based on the current assumption</u>, are summarized below:

| Healthy Postretirement	Actual Deaths		Expected Deaths		A/E Ratios	
	Current	Prior	Current	Prior	Current	Prior
Males	1,516	1,869	1,500	1,348	101%	139%
Females	1,610	1,340	1,394	1,172	115%	115%

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The number of actual deaths in the two experience studies was dramatically different as shown above. The number of deaths of males actually decreased and the number of deaths of females increased from the prior study. In addition, the A/E ratio for males dropped significantly. This unusual and troubling result is not discussed in Mercer's report. The exposure on which the expected counts were based was not included in the Segal report so we were unable to analyze whether the number of deaths was reasonable based on the number of retirees reported in the valuations during the study period. While the exposure in the Mercer experience study is reasonable based on the number of members receiving benefits shown in the valuation report for the years in the study, we noticed that the exposure count included more than just retirees. We asked Mercer and were told that both current retirees and survivors were included in the exposure in the experience study. Typically, we analyze these groups separately, in case there is a difference in the underlying mortality exhibited by each group. This could be masked if analyzing the data in aggregate. This is less of a issue in a system covering state employees where both the members and spouses' mortality is likely to be similar (as compared to a teacher plan where that likely is not the case). While we prefer to analyze the experience separately for the two groups, Mercer's approach is not unreasonable. We do believe that the fact that experience is aggregated for retirees and survivors should be disclosed in the discussion of the mortality experience in the report.

Typically mortality changes in a population unfold rather gradually over time. However, the A/E ratio for males changed dramatically from 139% in the 2005 study to 101% in the 2009 study. Even though some statistical volatility might be expected, this dramatic change was unusual. In follow-up conversations with Mercer about this issue, they indicated that they didn't match the male experience in the last experience study and questioned Segal's results at that time. The issue was never resolved. A review of the number of male deaths in the 1996 – 2000 Experience Study indicated that there were 1,266 deaths, which is more consistent with Mercer's results. Based on this information, we believe the number of deaths, and therefore the A/E ratio, in the Segal 2005 Experience Study were overstated. We believe that Mercer should have discussed the situation in the written report..

As mentioned earlier, Mercer recommended changing to the RP2000 Generational Mortality Table with White Collar adjustment. Given that generational mortality is being used, the A/E ratios would normally be set near 100%. The A/E ratios on the proposed assumption for both males and females are reasonable (males: 105%, females: 99%), but these ratios reflect the aggregate experience for all members age 55 and older. In order to more closely analyze the experience and the recommended change in the assumption, we split the experience into smaller age groups. Of particular interest was the "fit" of the recommended mortality assumption for the core retirement ages of 65 to 80. These are important because they are the ages at which much of the exposure exists.

	Males			Females	
	A/E Ratio			A/E Ratio	
Age	Current	Proposed		Current	Proposed
55-64	128%	155%		224%	159%
65-80	88%	104%		110%	92%
81-94	110%	103%		113%	98%
95+	122%	97%		116%	115%

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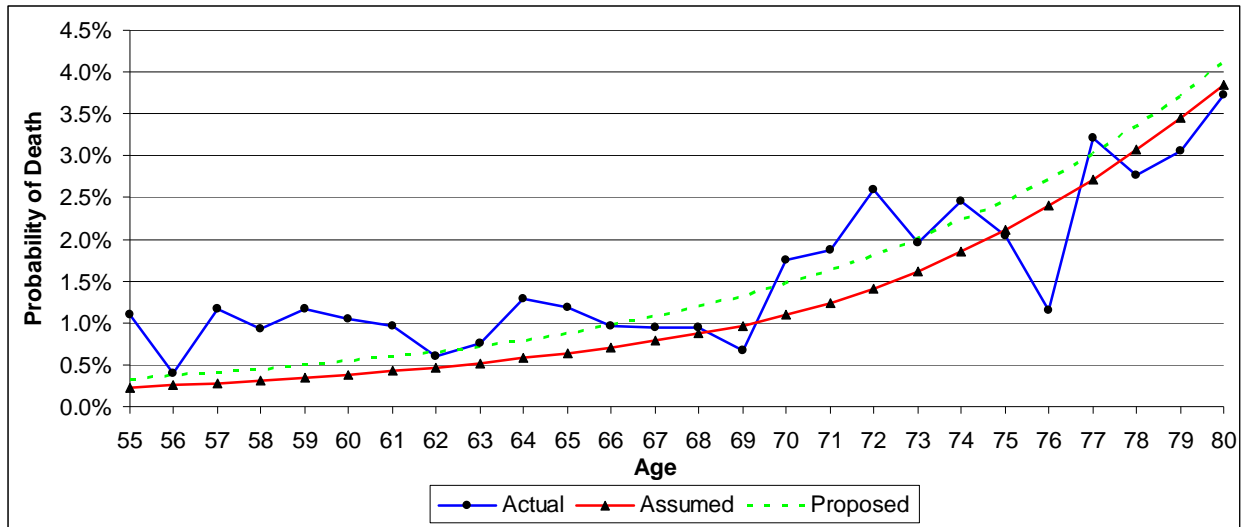
This analysis shows that the proposed assumption generally improves the fit of actual to expected experience at most ages. The fit for males is generally reasonable at all age grouping. However, the lower A/E ratio for females at age 65 to 80 is of particular concern because (1) a high number of retirees are in the age 65 to 80 age band and (2) it may include more recent retirees whose average benefit amount is higher and who are younger (thus have a higher liability). Although the A/E ratios at age 55 to 64 and 95+ are greater than 100%, this doesn't automatically mean the overstatement at these ages and understatement of mortality rates at ages 65 to 80 will exactly offset each other when the liabilities are calculated.

While we agree with Mercer's recommendation to move to the RP2000 generational mortality table, it appears some adjustment to the basic table may be appropriate. Four years of experience is a relatively short period to set mortality rates. Ideally, the experience from the prior period could be aggregated with the results of the current study period to develop a recommended assumption. However, given that data is not readily available and at least some of that experience is of questionable reliability, we do not believe this is feasible. We would recommend the mortality rates for females be reviewed and consideration be given to adjusting the rates for ages 65 to 80. Adjustments at ages 55 to 64 and ages 95+ would also be appropriate. We recognize that some actuaries prefer not to make adjustments to a standard table because the standard table is based on significantly more data than the experience study and is therefore, more statistically reliable.   We are likely influenced by our work for the states of Kansas and Iowa where the observed mortality rates were not a good fit to the standard RP-2000 Table at all ages even with the use of age adjustments (use of age set back or set forward) to improve the fit. The choice of whether or not to make adjustments to the standard table is a professional preference, but the Commission's Standards for Actuarial Work clearly indicate a preference to closely match actual experience.   Therefore, we believe it is reasonable to make adjustments to the table to more closely match actual experience.

Based on the information in the experience study, we concur with Mercer's recommendations for the pre-retirement mortality and disabled retiree mortality assumptions given the experience observed in the study period.

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Retirement

The valuation uses retirement assumptions to anticipate when benefit payments will commence. Separate assumptions are used for retirement directly from active status and inactive vested status. The eligibility requirements for unreduced retirement benefits vary depending on the member's hire date. A summary of the retirement provisions is shown below:

Hire Date	Normal Retirement Age	Early Retirement Age	Unreduced Retirement
Before July 1, 1989	Age 65 and 3 years	Age 55 and 3 years, or 30 years	Rule of 90 or Age 62 with 30 years
July 1, 1989 or later	Social Security Normal Retirement Age, but not later than 66 years, and 1 year of service	Age 55 and 3 years	N/A

Rule of 90

In the last experience study, the retirement experience for members eligible to retire under Rule of 90 was much lower than expected (A/E ratio of 72%). As a result, the rates were lowered from 25% to 20% at ages 55 to 60, with a resulting A/E Ratio of 103%. The A/E Ratio of 103% indicates the new rates were a relatively close fit to the actual observed experience from 2000-2004. Despite lowering the rates after the last study, the experience in the current study indicated an A/E ratio of 66%. Such a dramatic shift in experience in a short four year period without special circumstances makes it difficult to give full credibility to this experience.

The retirement rates recommended by Mercer closely match the actual experience during the study period, with an A/E ratio of 97% (see following graph):

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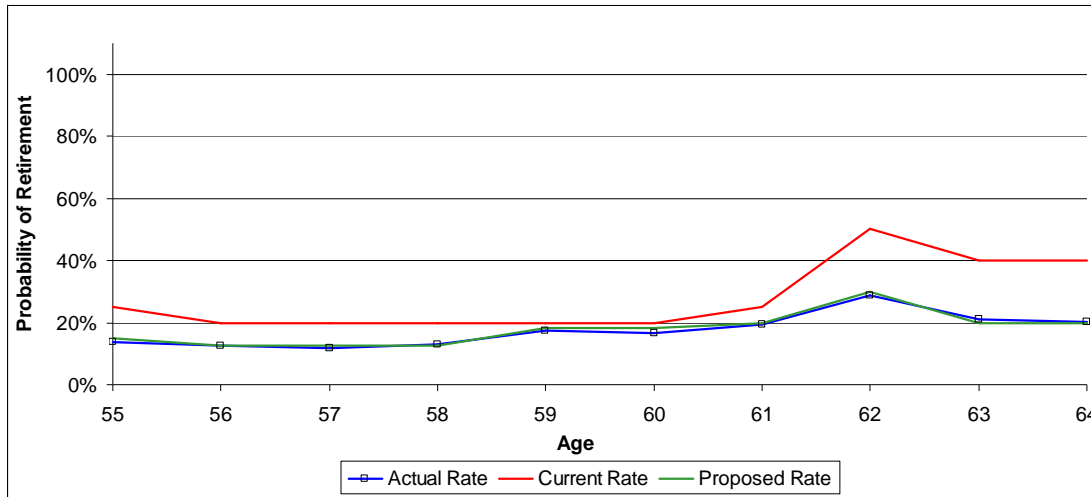
Given the fact that the retirement rates were lowered in the last study to match observed experience in that study period and the experience in this study period seems unusually low, we would suggest moving only part of the way toward the observed experience rather than all the way. If the next experience study shows the same trend, the rates could be reduced further. If the retirement rates observed in the next study are higher, the rates may not need to be increased. The goal of this approach is to provide some conservatism and to try to avoid "whipsaw" in the assumptions when they are increased in one study and decreased the next.

Often when retirement eligibility is based on a "Rule of" criteria, higher retirement rates occur when the member first reaches the unreduced retirement age. In order to reflect this, retirement rates are developed on a select and ultimate basis. The assumption used for the first eligibility period is called the "select" period. The period of time after the select period is called the "ultimate" period. Retirement rates are usually higher in the select period. Mercer did not analyze the Rule of 90 experience on this basis, but we suggest this be studied in the next experience study.

Non-Rule of 90

The following graph shows the actual retirements and the expected retirements under both the current and proposed assumptions.
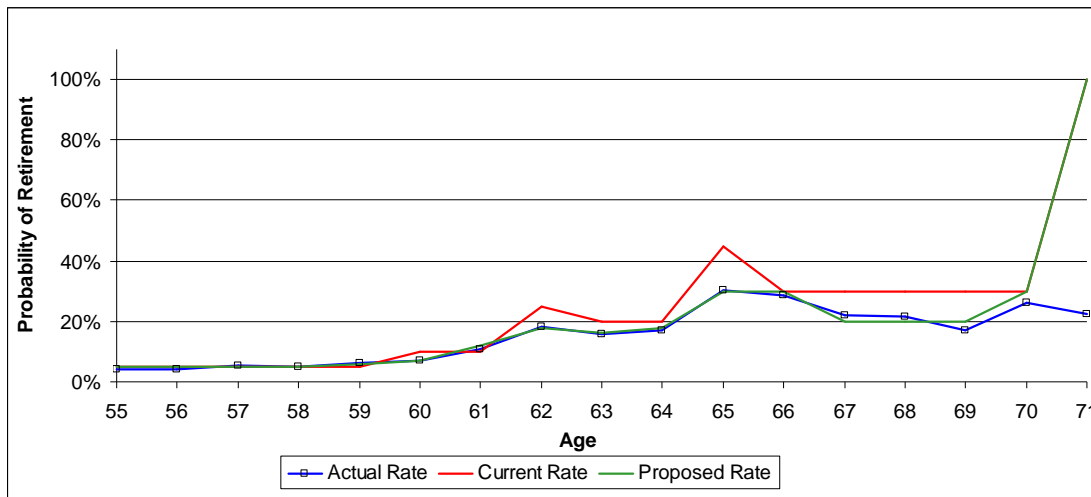
The A/E ratio in the current study is 82% as compared to 86% in the prior study. No change was made to the retirement rates after the last study. Since there have been fewer retirements in the last two studies, we agree with Mercer that some adjustment to the rates is appropriate. Mercer's recommended rates are very close to actual experience. The changes are most significant at ages 62 (18% proposed vs. 25% current) and 65 (30% proposed vs. 45% current). Most members are eligible for a normal (unreduced) retirement benefit between ages 65 and 66 so rates at those ages are important in the valuation of liabilities. As discussed above for the Rule of 90 retirement assumption, our preference would be to introduce more conservatism in changing assumptions and raise the rate at ages 62 and 65. While Mercer's changes are supported by the experience, our preference would be to only move part of the way from the current assumption to the actual observed rates, but not all the way.

Retirement from Inactive Vested Status

The law requires that the greater of the value of the deferred benefit or the refund amount be valued for any member who is vested and terminates employment prior to being eligible for benefits. The current assumption for these inactive vested members is that the benefit will start at normal retirement age (when unreduced benefits are available). This assumption was not included in the experience study analysis, but we believe it should have been.

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Other Retirement Related Assumptions

The valuation utilizes assumptions as to the percent of retiring members who are married, the form of payment elected, and the age difference between the member and the joint annuitant. Mercer recommended lowering the percent of retiring members who are married from 85% to 70% for females (no change to males). Based on the data in the study, this change seems reasonable.
The age difference for those electing a joint and survivor form of payment was reviewed to determine if the current age difference of females being three years younger than males was still appropriate. While the data supported the three year age difference for male members, it showed that there is a smaller difference in age between female members and male joint annuitants. Mercer recommended that the age difference for female members and male joint annuitants be lowered from 3 to 2. We concur with this recommendation based on the data in the experience study.

Certain optional forms of payment are not actuarially equivalent to the normal form, so if a member elects to retire under that form, the cost to the System is higher. In order to reflect the higher liability associated with this occurrence, the valuation uses an assumption regarding the probability that a member will elect a particular form of payment. Based on the data observed, Mercer's recommended changes are reasonable.

Termination of Employment Assumption

The MSRS valuation currently uses a "select" and "ultimate" assumption for termination of employment. Rates also vary by gender. The use of a select period is used because the rates of termination of employment observed tend to vary by service as well as age, at least initially for a certain number of years (referred to as the select period). Theoretically, after the three year select period the rates of termination do not vary significantly by service, e.g. the rate of termination for someone age 40 would be about the same whether they had 4 or 24 years of service.

Mercer commented in the report that the actual experience showed that termination rates vary by age and also service, but the variations extended well beyond the current three year select period. We agree with Mercer that three years is a relatively short period for the select assumption. Based on the observed data, Mercer recommended using a termination of employment assumption that varies based on both age and service, as well as gender. While we generally agree with their comment, the report did not necessarily demonstrate the variation of termination rates at longer durations based on actual experience. We were provided with supplementary information by Mercer which did generally support this statement. We believe this information should have been in the report to substantiate the recommended assumption.

In comparing the study results from the Mercer study (2009) and the Segal Study (2005), the total number of terminations is dramatically different as shown below:

	Select (< 3 Years)			Ultimate (>= 3 Years)		
	2009	**2005**	**Increase**	**2009**	**2005**	**Increase**
Males	3,017	2,252	34%	2,240	1,452	54%
Females	5,326	3,889	37%	3,514	2,454	43%
Total	8,343	6,141	36%	5,754	3,906	47%

We would not expect to see such a dramatic difference in the number of terminations without some reason to explain it. There is very little detail on the underlying data in the Segal report. In particular, the exposure is not shown. A review of the 1996-2000 Experience Study showed the number of terminations for males in the select period was 4,639 and in the ultimate period was 2,706 for a total of 7,345. For females the select and ultimate counts were 7,325 and 5,586, for a total of 12,911. These counts are higher than the actual experience in last two studies, but are more in line with Mercer's observed experience than Segal's. We believe that there must be some underlying difference in how members were counted in the exposure and decrement for termination of employment in the 2005 and 2009 study.

In addition to the significant difference in the number of terminations, the A/E ratios changed dramatically over the four-year study period, particularly for the Ultimate period, as shown below (based on the current assumption):

	Select		Ultimate	
	2009	**2005**	**2009**	**2005**
Males	107%	88%	160%	96%
Females	111%	95%	143%	97%

The dramatic difference in the experience observed in the 2009 study compared to the 2005 study with no explanation would indicate to us that caution should be used in making any change in the termination assumption. In particular, it may not be the time to introduce a new approach to the assumption.

We would note that Mercer's recommended approach "slices and dices" the data into many groupings. As a result, there are small numbers of members at some of the age groupings (older age with higher service) which can cause volatility in the observed rates and make it more difficult to develop rates that will provide a reasonable estimate of future experience. Rather than moving to a full age and service assumption for all ages and years of service, it may make sense to remain with the select and ultimate assumption and extend the select period.

Based on Mercer's recommended age and service assumption, the A/E ratio was 112% for males and 108% for females. For the termination of employment assumption, more terminations than expected usually create favorable experience (lower liabilities) so Mercer's recommendation does include some conservatism. This leaves some room for actual experience in the future to decrease over that observed in the current period without requiring the adjustment of termination rates in the next study. In order to be totally comfortable with the recommended assumption, the difference in the observed experience from the prior study needs to be explained.

Disability Assumption

The disability assumption is used to determine the probability that an active member will become totally and permanently disabled after three years of service, but before normal retirement age and will draw a disability retirement. Disability rates are typically very low, particularly at the younger ages. The small probability means that usually there are not very many disability retirements in the study period. For MSRS, the total number of disability retirements in the four year study period was 431. It is also fairly typical to see volatility in number of disability retirements between study periods, which we observed in the 2009 study. In the 2005 study, the disability rates were increased for both males and females at ages over 50. The resulting A/E Ratios were 101% for males and 106% for females, demonstrating a close fit to actual experience during that study period, particularly for males.

The 2009 Study showed A/E Ratios of 85% and 93% for males and females, respectively. Mercer recommended lowering the male rates across the board by 10% (current rates times 90%) and making no change to female rates. While we understand why the recommendation was made, due to the small number of disabilities and the tendency toward variability, we would have aggregated the experience for the two study periods with resulting A/E Ratios of 93% for males and 99% for females. This is another situation where the recommended assumption from Mercer is reasonable, but we would have arrived at a different recommendation, i.e. to make no change and wait to see what next study shows.

Merit Salary Scale

The salary increase assumption is actually the combination of the general wage growth assumption and the merit salary scale. While we consider the general wage growth assumption an economic assumption, the merit scale is a demographic assumption. The general wage growth assumption was discussed earlier with the other economic assumptions. The merit scale is discussed here as part of the demographic assumptions.

The current salary increase assumption is a five year select and ultimate scale, which anticipates higher salary increases in the first five years of employment (changed from a ten year to a five year select period in the 2005 experience study so the change is fairly recent). This is a commonly used approach in setting the salary increase assumption. The actual salary increases were higher than expected in the select period (7.49% versus 6.84%) and lower than expected in the ultimate period (3.89% versus 4.98%). Overall the actual increase was 4.63% compared to an expected increase of 5.36%. In the prior study, actual salary increases were lower than expected for both the select and ultimate period. The salary increases observed in the data for this study period are much higher in the select period. Insufficient detail in the 2005 report makes it impossible to compare experience in the ultimate period.

Developing the merit salary assumption creates a challenge because the data provides only total salary increases, i.e. it does not separately report general wage increases and merit scale. However, we typically attempt to "carve out" the actual general wage increase during the study period by considering salary increase for years of service over 25 or 30 as indicative of the general wage increase (this assumes there is no merit scale at that point in a person's career). By subtracting the general wage increase for the study period from the total salary increase, the merit scale for the study period can be isolated and analyzed. Once the merit scale is developed, it is added to the general wage increase to create the total salary increase assumption. Using this approach there is no salary increase that is lower than the general wage increase. Although the merit scale might be 0%, it is never negative.

Because increases in salary are usually directly related to economic conditions, we believe the total salary experience observed should be evaluated in light of recent economic conditions. There often is a lag before the events in the general economy manifest themselves in the salary increases granted by employers. Consequently, we reviewed the change in the CPI and the National Average Wage during the current study period and the prior four year period (to address the potential delay in recognizing economic conditions). The results are shown below:

Period	Change In CPI	Change in National Average Wage
2004 – 2008	2.5%	3.8%
2000 – 2004	2.3%	2.9%

Based on Mercer's report, the actual observed experience during the study period indicated an overall salary increase of about 4.8%. We believe it is very likely that the lower price inflation and general wage increase in the period of 2000 to 2004 impacted the observed salary experience rather than the economic experience which actually occurred during the study period. If this is the case, the overall merit scale would be about 1.8% (4.8% minus 3.0%). When the merit scale is added to the general wage growth assumption of 4.0%, the total overall salary increase assumption would be 5.8% rather than the recommended assumption which produces an overall salary increase of 4.8%. We believe that either the total salary scale is reasonable, but the general wage growth assumption is too high or the total salary scale is too low given the general wage growth assumption.

Mercer commented that the observed salary increases had a stronger correlation to service than age in general and they recommended moving to a pure service based table. We agree that the change to a service-based table is reasonable and in line with common actuarial practice for public retirement systems, but we are concerned that the proposed salary scale is based on only four years of experience and may not be representative of long term salary increases. In addition, the way the salary increase assumption was developed does not directly address the separate components of the assumption, i.e. the total salary assumption includes a merit scale and the general wage growth assumption. As discussed above, wage increases, in general, have been below the 4.0% recommended assumption over the last decade and we believe this overall economic trend could have impacted the salary experience in the study period. These factors make us less comfortable with the recommended change in the assumption. In our opinion, the salary assumption being proposed does not appear to provide much conservatism. We believe the salary

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assumption should be studied further to determine the appropriate change, particularly if a new service based assumption is to be implemented.

Mercer's salary increase assumption has a negative merit scale for service over 12 years. In our experience with public pension plans, it is uncommon to see negative merit salary assumptions, particularly commencing at relatively low service durations. Although it may work mathematically, we find it difficult to get comfortable with the concept.. At a minimum, it raises a question as to whether the payroll growth assumption of 4.0%, which is used to calculate the amortization of the unfunded actuarial liability, is too high when a large portion of the members are assumed to receive a salary increase less than the 4.0% general wage growth assumption. We recommend the assumption used to amortize the unfunded actuarial liability be revisited if the proposed salary increase assumption is adopted. The MSRS Board adopted a higher salary increase assumption than the recommended assumption shown in the Experience Study report. The rates at all ages are 0.25% higher than the rates shown in the Experience Study report. As a result, the overall salary increase rate in the Board's assumption is 5.06% compared to 5.36% for the current assumption. Overall observed experience was 4.63%.

Mercer provided us with the cost impact of each assumption change. The change to the salary increase assumption had the most significant impact in reducing costs. The estimated decrease in the contribution rate, based on the July 1, 2008 actuarial valuation, was 0.85%. We recommend there be further discussion on the salary increase assumption before any change is finalized.

Audit Conclusion

We found that the general methodologies used to prepare the experience study were appropriate and that the assumptions developed generally comply with the guidance provided by Actuarial Standard of Practice No. 35 *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations.*

While all of the assumptions recommended by Mercer are reasonable and changes are generally consistent with the observed experience, there are some assumptions that we feel merit additional discussion and analysis. In addition, there are some significant differences in the findings of this (2009) Study compared to the prior (2005) Study which makes us uncomfortable.   The specific assumptions impacted in this last category are discussed below:

- The A/E ratio for postretirement mortality for males dropped from 102% in the prior study to 90% in the current study. For females, the A/E ratio dropped from 104% to 91% from the 2005 to the 2009 study. This is a significant change and we believe it should have been addressed in the experience study report. While the overall A/E ratio on the proposed assumption was 103% for males and 96% for females, we are concerned with the fit at certain ages. The A/E ratio for females at ages 55 to 64 is 91% and at ages 65 to 80 is 95% which means that mortality rates are higher than the actual experience at those ages (which produces a shorter life expectancy). Because a large portion of the exposure is in these age groups, there may be reason for concern. We support the use of generational mortality, as recommended by Mercer, but want to be sure the starting mortality rates are a good fit. We suggest Mercer revisit the mortality assumption in light of the findings in this report and evaluate whether or not it is appropriate to modify the rates in the standard RP 2000 Table.

- There was a significant difference in the number of members decrementing from termination of employment between the prior (2005) and current (2009) Study. While the number of terminations in aggregate in the current study was similar to that observed in the prior study, the split into the select and ultimate period was very different. The current study showed far fewer in the select period (30,115 compared to 41,038 in the 2005 Study) and more in the ultimate period (19,604 compared to 10,797 in the 2005 Study). This is rather unusual and we believe it should have been discussed in the report. Because of this material difference in actual experience, which has not been explained, we are uncomfortable making a significant change in the approach used in the valuation. Mercer is recommending moving to an assumption based on both age and service for all years of service. The new approach would require that the rates be set only using the actual experience in the current study period. Since the data for this experience study seems very different from the prior study without any explanation, we would prefer not to make a material change to the termination of employment assumption at this time. When the next study is performed there will be more data upon which to base this assumption and most of the data will be that used by Mercer in their valuations so the reliability of that data will be higher.

  We would note that Mercer's recommended approach "slices and dices" the data into many groupings. As a result, there are small numbers of members at some of the age groupings (older age with higher service) which can cause volatility in the observed rates and make it more difficult to develop rates that will provide a reasonable estimate of future experience. Rather than moving to a full age and service assumption for all ages and years of service, it may make sense to remain with the select and ultimate assumption and extend the select period.

- Mercer commented that the observed salary increases had a stronger correlation to service than age in general and they recommended moving to a service based table. We agree that the change to a service-based table is reasonable and in line with common actuarial practice for public retirement systems, but we are concerned that the proposed salary scale is based on only four years of experience In addition, the way the salary increase assumption was developed does

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not directly address the separate components of the assumption, i.e. the total salary assumption includes a merit scale and the general wage growth assumption. Wage increases, in general, have been below the 4.0% recommended assumption over the last decade and we believe this overall economic trend could have impacted the salary experience in the study period and resulted in lower overall salary increases. These factors make us less comfortable with the recommended change in the assumption. . In our opinion, the salary assumption being proposed does not appear to provide much conservatism and contains a negative merit scale which, in our experience, is uncommon. We believe the salary assumption should be studied further to determine the appropriate change, particularly if a new service based assumption is to be implemented.

The assumption where our approach or philosophy differs from Mercer's include the following:

- The proposed retirement rates are lower than the current assumption and closely follow the actual experience. Given that the rates for Rule of 90 were lowered in the last study, we would prefer to move only part of the way toward the actual experience and maintain some conservatism in the retirement rates for Rule of 90. If the proposed rates are adopted, we suggest some minor adjustments at age 57, 58, 63 and 64. We also would suggest that some conservatism be introduced into the non-Rule of 90 retirement rates by moving only part of the way toward the observed experience or at least changing the retirement rates at ages 65 and 66.

The Commission's Standards for Actuarial Work require that the experience study report show the results by each year and also combined for all years. The individual yearly results did not show results for the select period separately from the ultimate period. While the combined results were shown by year, we believe that, based on the Standards, the results should be shown for both select and ultimate by year.

Detailed Analysis

Mortality

A summary of the current and recommended mortality assumptions from the PERA Experience Study is shown below:

Assumption	Current	Recommended
Healthy Postretirement Mortality	1983 Group Annuity Mortality	RP2000 Annuitant Generational Mortality, White Collar Adjustment
Males	Set back 1 year	No adjustment
Females	Set back 1 year	Set back 2 years
Disabled Retiree Mortality	1965 RRB rates through age 54. For ages 55-64, graded between 1965 RRB rates and the healthy postretirement mortality table. For ages 65 and later, the healthy postretirement mortality table.	RP2000 Disabled Retiree Mortality Table
Male		Set back 4 years for males
Female		Set forward 7 years for females
Healthy Preretirement Mortality	1983 Group Annuity Mortality Table	RP2000 Non-Annuitant Generational Mortality, White Collar Adjustment
Male	Set back 8 years	Set forward 5 years
Female	Set back 7 years	Set back 3 years

The post-retirement mortality assumption is one of the most important demographic assumptions because it impacts how long pension payments are expected to be paid. It is an established trend that people are living longer and most people believe this trend will continue in the future, at least to some degree. As a result, we believe it is appropriate to address future mortality improvements in the valuation of benefits.

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ASOP 35 states that actuaries "should consider…the likelihood and extent of mortality improvements in the future".

As Mercer explained in their report, there are two ways to factor future mortality improvements into the valuation process. One is to use a single mortality table that predicts fewer deaths than are actually occurring at the present time (which results in an Actual/Expected Ratio of over 100% which is called a "margin"). With this method, the same probability of death at age 65 would apply to any member who is projected to reach age 65 whether they reach age 65 in the current year or 40 years from now. The second approach is to use a mortality table that reflects the current experience of the membership (and hence an A/E ratio close to 100%) and then projects anticipated future mortality improvements on a "generational" basis, i.e. mortality rates are set by the year in which a member reaches a particular age. In this case, a different probability of death would be used for a person reaching age 65 in the current year versus one reaching age 65 in 40 years (lower rates would apply in future years). This latter approach actually results in a set of mortality tables that are used in the valuation and mortality rates that are based on the year in which a member reaches a particular age.

Although the first approach is still common, we prefer the second approach (the use of generational mortality). It avoids the debate about how much "margin" should be maintained in the A/E ratio, more directly reflects expected mortality improvements for the applicable members and should require less dramatic adjustments for updated mortality tables in future years. Mercer recommended changing to the RP2000 Mortality Table on a generational basis and we concur with this recommendation. To better fit the actual experience to the standard mortality table, Mercer recommended using a two-year set back for females (no adjustment for males).

The A/E Ratios in the current and prior experience study, based on the current assumption, are summarized below:

Healthy Postretirement	Actual Deaths		Expected Deaths		A/E Ratios	
	Current	Prior	Current	Prior	Current	Prior
Males	2,805	2,833	3,122	2,784	90%	102%
Females	4,099	3,326	4,480	3,212	91%	104%

A drop in the A/E ratio of more than 10% in a four-year period is a rather significant change in observed experience. It is unusual for long-term trends in mortality to unfold this quickly. The drop in the A/E ratio could be random statistical variation or a difference in the data processing in the two studies. This finding is not discussed in Mercer's report and is not explained by anything in either the current or prior experience study reports. The exposure on which the expected counts were based was not included in the Segal report so we were unable to analyze whether the number is reasonable or not. Our review of the exposure and deaths used by Mercer in the current study indicates the data is reasonable based on the valuation data for those years. While the exposure in the Mercer experience study is reasonable based on the number of members receiving benefits shown in the valuation report for the years in the study, we noticed that the exposure count included more than just retirees. We asked Mercer and were told that both current retirees and survivors were included in the exposure in the experience study. Typically, we analyze these groups separately, in case there is a difference in the underlying mortality exhibited by each group. This could be masked if analyzing the data in aggregate. This is less of a issue in a system covering public employees in local entities where both the members and spouses' mortality is likely to be similar (as compared to a teacher plan where that likely is not the case). While we prefer to analyze the experience separately for the two groups, Mercer's approach is not unreasonable. We do believe that the fact that experience is aggregated for retirees and survivors should be disclosed in the discussion of the mortality experience in the report.

Typically mortality changes in a population unfold rather gradually over time. However, the A/E ratio changed by over 10% from the 2005 study to the 2009 study. Even though this is a small group from the perspective of statistical reliability, this level of change is unusual. We would have expected discussion to be included in the report along with Mercer's evaluation of the findings.

The experience in this study period indicates that the current assumption is predicting too many deaths. Given this experience, we concur with Mercer's recommendation to move to a more recent table. It is very common to use an age adjustment (forward or back) with a standard mortality table to obtain a better fit with the deserved experience. Mercer recommended a two-year age set back for females, but none for males. This is a common approach, however the rates should be studied at various age groupings to be sure the fit is reasonable at all ages.

Overall the A/E ratios on the proposed assumption for both males and females are reasonable (males: 103%, females: 96%). However, this includes experience at ages 55 and up. In order to more closely analyze the experience we studied the experience in four age groupings. The fit of experience at the core retirement ages of 65 to 80 is very important as these are the ages at which most of the exposure and liability exist.

	Males		Females	
	A/E Ratio		A/E Ratio	
Age	**Current**	**Proposed**	**Current**	**Proposed**
55-64	111%	149%	106%	91%
65-80	78%	102%	93%	95%
81-94	98%	100%	92%	98%
95+	140%	118%	83%	96%

This analysis shows that using the proposed assumption, overall actual deaths are close to those expected, but for females at the core retirement ages of 55 to 80 the assumed mortality rates are higher than the actual experience so liabilities could be understated. We believe it would be helpful to consider an adjustment to the proposed table in order to provide a better fit at ages 55 to 80 for females.
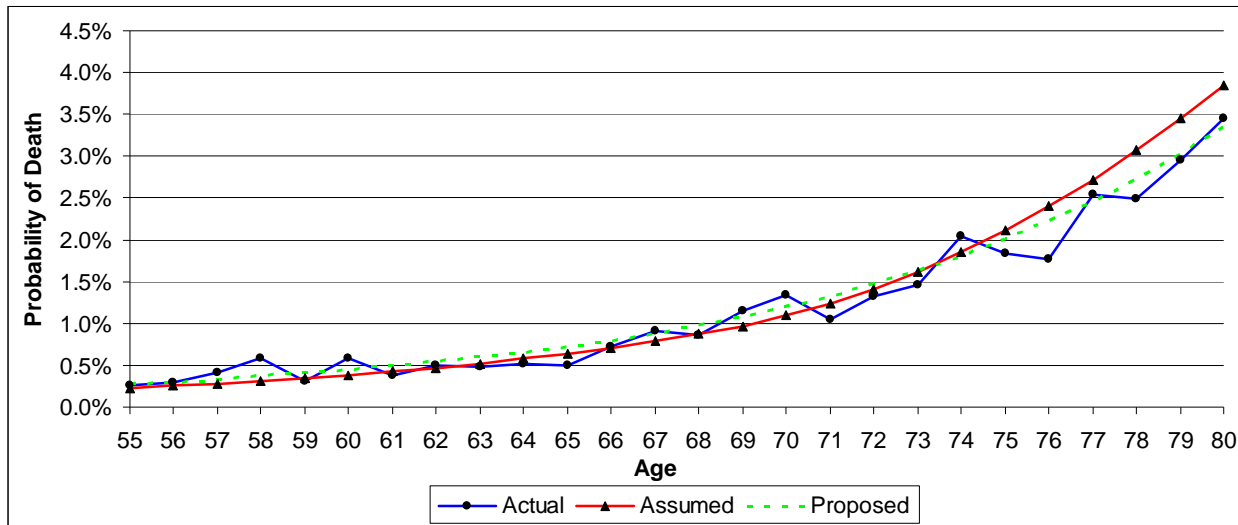
While we agree with Mercer's recommendation to move to the RP2000 generational mortality table, it appears some adjustment to the basic table may be appropriate for females. Four years of experience is a relatively short period to set mortality rates. Ideally, the experience from the prior period could be aggregated with the results of the current study period to develop a recommended assumption. However, given that data is not readily available, we do not believe this is feasible. We would recommend the mortality rates for females be reviewed and consideration be given to adjusting the rates for ages 55 to 80. We recognize that some actuaries prefer not to make adjustments to a standard table because the standard table is based on significantly more data than the experience study and is therefore, more

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statistically reliable. We are likely influenced by our work for the states of Kansas and Iowa where the observed mortality rates were not a good fit to the standard RP-2000 Table at all ages even with the use of age adjustments (use of age set back or set forward) to improve the fit. The choice of whether or not to make adjustments to the standard table is a professional preference, but the Commission's Standards for Actuarial Work clearly indicate a preference to closely match actual experience. Therefore, we believe it is reasonable to make adjustments to the table to more closely match actual experience.

We concur with Mercer's recommendations for pre-retirement mortality and disabled retiree mortality given the observed experience.
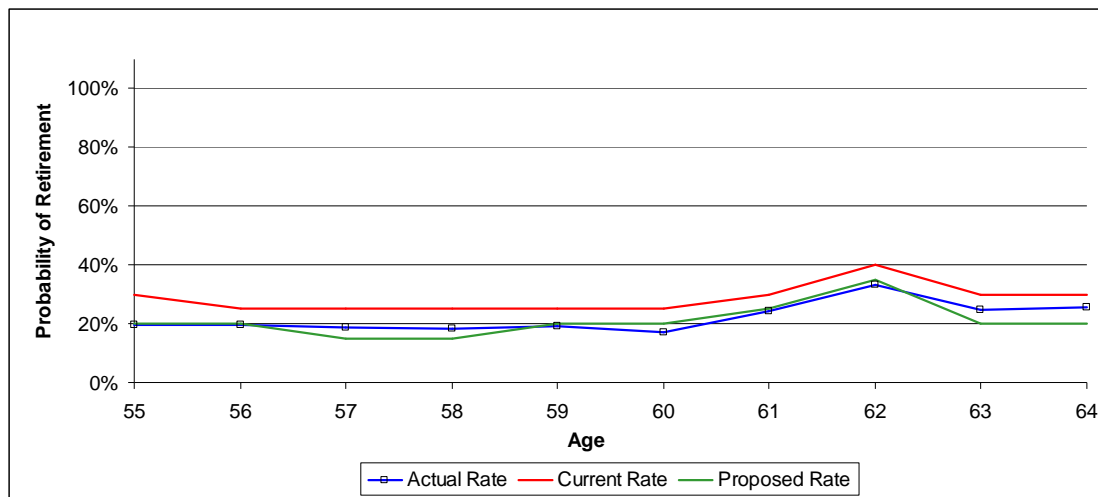
Retirement

The eligibility requirements for unreduced retirement benefits vary depending on the member's hire date. A summary of the retirement provisions is shown below:

Hire Date	Normal Retirement Age	Early Retirement Age	Unreduced Retirement
Before July 1, 1989	Age 65 and 3 years	Age 55 and 3 years, or 30 years	Rule of 90 or Age 62 with 30 years
July 1, 1989 or later	Social Security Normal Retirement Age, but not later than 66 years, and 1 year of service	Age 55 and 3 years	N/A

Rule of 90

In the last experience study, the retirement experience for members eligible to retire under Rule of 90 was much lower than expected (A/E ratio of 61%). As a result, the rates were lowered at ages before age 65, with a resulting A/E Ratio of 76%. This A/E Ratio indicates the new rates were still higher than the actual observed experience from 2000-2004. The A/E ratio in the current study which used the lower rates from the last study to determine the expected number of retirements was 78%, which is consistent with the findings of the prior study.

The recommended rates generally match the actual experience during this period with a resulting A/E ratio 104%. However, the recommended rates at ages 57, 58, 63 and 64 are actually lower than the observed experience (see graph below):

If the retirement rates are going to be lowered from the current assumption, we would prefer that the recommended rate not be below the actual observed rate. We recommend the retirement rates at ages 57 and 58 be set to 20% and rates at 63 and 64 be set to 25%. Based on our calculations, the resulting A/E ratio would be about 95%.

With retirement eligibility that is based on a "Rule of" criteria, we often see higher retirement rates in the member's first year of eligibility and often a specific assumption is used for this "select" period. The period that occurs after the select period is called the "ultimate" period. Retirement rates are usually lower in the ultimate period. Mercer did not analyze the Rule of 90 experience on this basis. At this point, it would likely take a fair amount of time for Mercer to analyze the retirement experience in this way. We recommend this be considered for the next experience study.

Non-Rule of 90

The graph below shows the actual retirements and the expected retirements under both the current and proposed assumptions.
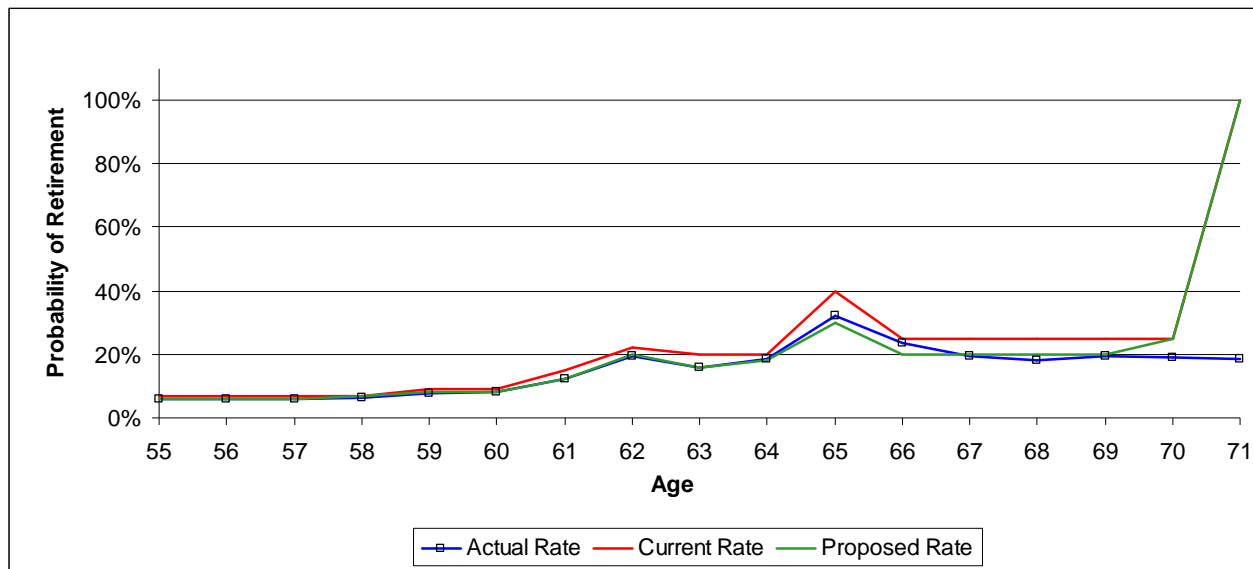
Minor changes were made to the retirement rates after the last experience study with a resulting A/E ratio of 72%. Based on those revised rates, the A/E ratio in the current study is 80%, indicating actual retirements were closer to the number expected than based on the current assumption in the 2005 study. Since there have been fewer retirements in the last two studies, we agree with Mercer that some adjustment to the rates is appropriate. Mercer's recommended rates are, in general, very close to actual experience in the current study. However, the recommended rates at several ages are actually below the observed experience. If rates are being lowered due to actual experience, our preference would be to set the rate equal to or slightly above actual experience. This provides a small margin of conservatism. Consideration should be given to reducing the rates even less to provide more conservatism. At age 65, which is the highest probability of retirement, we recommend using a 35% rates rather than 30% and at age 66 we recommend using 25% instead of 20%. It also appears a 20% retirement rate at age 70 might be a better fit with actual experience.

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We wish to point out that the changes recommended in the last two experience studies have significantly reduced the retirement rates (as shown below):

	Rule of 90 Retirement Assumption				Non Rule of 90 Retirement Assumption		
Age	2000	2009 Recommended	Percent Reduction	Age	2000	2009 Recommended	Percent Reduction
55	40%	20%	50%	55	7%	6%	14%
56	40%	20%	50%	56	7%	6%	14%
57	40%	15%	63%	57	7%	6%	14%
58	40%	15%	63%	58	7%	7%	0%
59	40%	20%	50%	59	9%	8%	11%
60	40%	20%	50%	60	9%	8%	11%
61	40%	25%	38%	61	20%	12%	40%
62	40%	35%	13%	62	20%	20%	0%
63	40%	20%	50%	63	20%	16%	20%
64	40%	20%	50%	64	20%	18%	10%
				65	40%	30%	25%
				66	25%	20%	20%
				67	25%	20%	20%
				68	25%	20%	20%
				69	25%	20%	20%
				70	25%	25%	0%
				71	100%	100%	0%

Retirement experience frequently varies with economic conditions. There have been a number of events in the last decade that could have resulted in lower retirements. The question is how much credibility to assign to the experience in the current period,   By significantly lowering the retirement rates the implicit statement is that the lower observed experience is a long-term trend. If that is not the case, the retirement rates will have to be increased in the future with an associated increase in costs. From our perspective, the retirement assumptions are reasonable, but provide little conservatism.

Retirement From Inactive Vested Status

For inactive members who are entitled to a future benefit, the current assumption is that the benefit will start at normal retirement age (unreduced benefits). While Mercer recommended this assumption be retained, there was no analysis of actual experience to support this recommendation. The assumption seems reasonable, but its continued use should be supported or explained as required in the Standards for Actuarial Work.

Other Retirement Assumptions

The valuation utilizes assumptions as to the percent of retiring members who are married, the form of payment elected, and the age difference between the member and the joint annuitant (usually the spouse). Mercer recommended lowering the assumption for the percent of retiring members who are married from 85% to 75% for males and increasing the assumption from 65% to 70% for females. Based on the data in the study, this change seems reasonable.

The age difference for those electing a joint and survivor form of payment was reviewed to determine if the current age difference of females being four years younger than males was still appropriate. Mercer recommended that the age difference for male members and female joint annuitants be changed from 4 years to 3 years. They also recommended the assumption for female members and male joint annuitants be lowered from 4 to 2. We concur with these recommendations based on the supporting data.

Certain optional forms of payment are not actuarially equivalent to the "normal form", so if a member elects to retire under that form, the cost to the System is higher. In order to reflect this in the valuation an assumption is used as to the probability that a member will elect a particular form of payment. Based on the data observed, Mercer's recommended changes are reasonable.

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Termination Assumption

The PERA valuation currently uses a "select" and "ultimate" assumption for termination of employment. Rates also vary by gender. A select period is used because the rates of termination of employment observed tend to vary by service as well as age, at least for a certain number of years (the select period). Theoretically, after the three year select period the rates of termination are assumed not to vary significantly by service, e.g. the rate of termination for someone age 40 would be about the same whether he had 4 or 24 years of service.

Mercer commented that the actual experience showed that termination rates vary by age and also service, but the variations extend well beyond the current three year select period. Use of select and ultimate rates is very common. We would agree with Mercer that three years is a relatively short period for the select assumption. As a result, Mercer recommended using a termination of employment assumption that is based on both age and service as well as gender. While we generally agree with their comment, the report did not demonstrate the variation of termination rates at longer durations based on actual experience. We asked for and were provided with supplementary information by Mercer which did support this statement. We believe that this information should have been in the report to substantiate the recommended assumption.

Comparing the results from the Mercer Study (2009) and the Segal Study (2005), the number of terminations in the select and ultimate periods is dramatically different as shown below:

	Select			Ultimate		
	2009	**2005**	**Change**	**2009**	**2005**	**Change**
Males	8,811	12,683	(31%)	4,845	2,776	75%
Females	21,304	28,355	(25%)	14,759	8,021	84%
Total	30,115	41,038	(27%)	19,604	10,797	82%

While the total number of terminations in the 2009 Study (49,719) is similar to that observed in the 2005 Study (51,835), the split between select and ultimate is very different. Mercer did not comment on this in their report but we believe they should have addressed it. In reviewing the 2005 Experience Study, there is very little detail on the underlying data in the Segal report. In particular, the exposure is not shown. A review of the 1996-2000 Experience Study showed the number of terminations for males in the select period was 8,802 and in the ultimate period was 5,770 for a total of 14,572. For females the select and ultimate counts were 20,828 and 14,892, for a total of 35,720. These counts are consistent with Mercer's observed experience, which leads us to discount the results in the Segal report. We believe that there must be some underlying difference in how members were categorized as "select" or "ultimate" in the 2005 Study compared to the 2009 Study.

The dramatic difference in the experience observed in the 2009 Study compared to the 2005 Study with no explanation would indicate to us that caution should be used in making any change in the termination assumption. In particular, it may not be the time to introduce a new approach to the assumption.

We would note that Mercer's recommended approach "slices and dices" the data into many groupings. As a result, there are small numbers of members at some of the age groupings (older age with higher service) which can cause volatility in the observed rates and make it more difficult to develop rates that will provide a reasonable estimate of future experience. Rather than moving to a full age and service assumption for all ages and years of service, it may make sense to remain with the select and ultimate assumption and extend the select period.

Based on Mercer's recommended age and service assumption, the A/E ratio was 110% for males and 106% for females. For the termination of employment assumption, more terminations than expected usually creates favorable experience (lower liabilities) so Mercer's recommendation provides some conservatism . If actual experience in the future decreases over that observed in the current period the

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termination rates would not have to be adjusted or less adjustment would be necessary. In order for us to be totally comfortable with the recommended assumption, the difference in the observed experience from the prior study needs to be explained.

Disability Assumption

The disability assumption is used to determine the probability that an active member will become totally and permanently disabled after three years of service but before normal retirement age and will draw a disability retirement. Disability rates are typically very low, particularly at the younger ages. The small probability means that usually there are not very many disability retirements in the study period and some volatility in experience is expected from study to study. In the 2005 study, the A/E ratios for males and females were 91% and 98%, respectively. Consequently, no change was made to the disability rates.

The 2009 Study showed A/E Ratios of 74% and 73% for males and females, respectively. Mercer recommended lowering both the male and female rates across the board by 20% (current rates times 80%) with resulting A/E ratios of 93% and 91%. Mercer's recommendation is consistent with the observed experience and in fact, only moves part of the way toward actual experience. We believe the recommended change is reasonable and still leaves some room for experience to increase in the next study without further adjustment to the rates.

Merit Salary Scale

The salary increase assumption is actually the combination of the general wage growth assumption and the merit salary scale. While we consider the general wage growth assumption an economic assumption, the merit scale is a demographic assumption. The general wage growth assumption was discussed earlier with the other economic assumptions. The merit scale is discussed here as part of the demographic assumptions.

The current salary increase assumption is a five year select and ultimate scale, which anticipates higher salary increases in the first five years of employment (changed from a ten year select period to five in the 2005 experience study). This is a commonly used approach in setting the salary increase assumption. The actual salary increases were higher than expected in the select period (8.59% versus 6.16%) and lower than expected in the ultimate period (3.98% versus 4.46%). Overall the actual increase was 5.16% compared to an expected increase of 4.87%.

Developing the merit salary assumption creates a challenge because the data provides only total salary increases, i.e. it does not separately report general wage increases and merit scale. However, we typically attempt to "carve out" the actual general wage increase during the study period by considering salary increase for years of service over 30 as indicative of the general wage increase (this assumes there is no merit scale at that point in a person's career). By subtracting the general wage increase for the study period from the total salary increase, the merit scale for the study period can be isolated and analyzed. Once the merit scale is developed, it is added to the general wage increase to create the total salary increase assumption. Using this approach there is no salary increase that is lower than the general wage increase. Although the merit scale might be 0%, it is never negative.

Because increases in salary are usually directly related to economic conditions, we believe the total salary experience observed should be evaluated in light of recent economic conditions. There often is a lag before the events in the general economy manifest themselves in the salary increases granted by employers. Consequently, we reviewed the change in the CPI and the National Average Wage during the current study period and the prior four year period (to address the potential delay in recognizing economic conditions). The results are shown below:

Period	Change In CPI	Change in National Average Wage
2004 – 2008	2.5%	3.8%
2000 – 2004	2.3%	2.9%

Based on Mercer's report, the actual observed experience during the study period indicated an overall salary increase of about 5.2%. We believe it is very likely that the lower price inflation and general wage increase in the period of 2000 to 2004 impacted the observed salary experience rather than the economic experience which actually occurred during the study period. If this is the case, the overall merit scale would be about 2.2% (5.2% minus 3.0%). When the merit scale is added to the general wage growth assumption of 4.0%, the total overall salary increase assumption would be 6.2% rather than the recommended assumption which produces an overall salary increase of 5.3%. We believe that either the total salary scale is reasonable, but the general wage growth assumption is too high or the total salary scale is too low given the general wage growth assumption.

Mercer developed a salary increase assumption that has negative merit scale for service above 12 years. In our experience, it is uncommon to see negative merit salary assumptions, particularly commencing at such low service levels. Although it may work mathematically, we find it difficult to get comfortable with the concept. At a minimum, it raises a question as to whether the payroll growth assumption of 4.0%, which is used to calculate the amortization of the unfunded actuarial liability, is too high when a portion of the members are assumed to receive a salary increase less than the 4.0% general wage growth assumption. We recommend the assumption used to amortize the unfunded actuarial liability be revisited if the proposed salary increase assumption is adopted.

Mercer commented that the observed salary increases had a stronger correlation to service than age in general and they recommended moving to a pure service based table. We agree that the change to a service-based table is reasonable and in line with common actuarial practice for public retirement systems, but we are concerned that the proposed salary scale is based on only four years of experience and the results in this study period may not be representative of long term salary increases. In addition, the way the salary increase assumption was developed does not directly address the separate components of the assumption, i.e. the total salary assumption includes a merit scale and the general wage growth assumption. As discussed above, wage increases in general have been below the 4.0% recommended assumption over the last decade and we believe this overall economic trend could have impacted the salary experience in the study period. These factors make us less comfortable with the recommended change in the assumption. In our opinion, the salary assumption being proposed does not provide much conservatism. We believe the salary assumption should be studied further to determine the appropriate change, particularly if a new service based assumption is to be implemented .

Given the importance of this assumption, we recommend there be further discussion on the general wage growth assumption and the merit scale.

Audit Conclusion

We found that the general methodologies used to prepare the experience study were appropriate and that the assumptions developed generally comply with the guidance provided by Actuarial Standard of Practice No. 35 *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*.

While we believe that all of the assumptions recommended by Mercer are reasonable and the proposed changes are generally consistent with the observed experience, there are some assumptions that we feel merit additional discussion and analysis. In addition, there are some significant differences in the findings of this (2009) Study compared to the prior (2005) Study which make us uncomfortable unless they can be explained:

- The A/E ratio for postretirement mortality for males changed from 94% in the prior study to 114% in the current study. This significant drop, which is unusual, was not discussed in the experience study report. While the overall A/E ratio for males and females using the recommended assumption is 104% and 107% respectively, we are concerned about the fit at certain key retirement ages. The A/E ratio for females at ages 55 to 64 is 80% and at ages 65 to 80 is 82% which means that assumed mortality rates are higher than the actual experience at those ages (which produces a shorter life expectancy and lower liabilities). Because a large portion of the exposure is in these age groups, this may be a concern. We support the use of generational mortality, as recommended by Mercer, but want to be sure the starting mortality rates are a good fit. We suggest Mercer revisit the mortality assumption in light of this report and evaluate whether or not it is appropriate to modify the rates in the standard RP 2000 Table.

- There was a significant difference in the number of members decrementing from termination of employment between the prior (2005) and current (2009) Study. The current study showed far fewer in the select period (12,582 compared to 16,729 in the 2005 Study) and more in the ultimate period (5,769 compared to 4,702 in the 2005 Study). This is rather unusual and the results of the current study were not discussed or compared to the experience in the prior study in the report. Because of this material difference in actual experience, which has not been explained, we are uncomfortable making a significant change in the approach to this assumption. Mercer recommended moving to an assumption based on service. Because of the new approach, the recommended assumption would be based only on the actual experience in the current study period. Since the data for this experience study seems very different from the prior study (without explanation), we would prefer not to make a material change to the termination of employment assumption at this time. When the next study is performed there will be more data upon which to base this assumption and most of the data will be that used by Mercer in their valuations so the reliability of that data will be higher.

- Mercer commented that the observed salary increases had a stronger correlation to service than age in general and they recommended moving to a service based table. We agree that the change to a service-based table is reasonable and in line with common actuarial practice for public retirement systems, but we are concerned that the proposed salary scale is based on only four years of experience. In addition, the way the salary increase assumption was developed does not directly address the separate components of the assumption, i.e. the total salary assumption includes a merit scale and the general wage growth assumption.   Wage increases, in general, have been below the 4.0% recommended assumption over the last decade and we believe this overall economic trend could have impacted the salary experience in the study period and resulted in lower overall salary increases. These factors make us less comfortable with the recommended change in the assumption.   In our opinion, the salary assumption being proposed does not appear to provide much conservatism and contains a negative merit scale, which in our experience is uncommon. We believe the salary assumption should be studied further to

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determine the appropriate change, particularly if a new service based assumption is to be implemented.

The assumption where our approach or philosophy differs from Mercer's include the following:

- The retirement rates were increased for age 56 and 57 with a resulting A/E ratio of 107%, indicating the actual retirements were still greater than the number assumed. The A/E ratio in the current study, using the retirement assumption adopted after the last study, is 72%. Because of the significant drop since the last study, we believe some conservatism should be retained in the retirement rates in case the experience in this study period is unusual and not a long-term trend. The recommended rates very closely match the actual experience during the study period as the resulting A/E ratio of 101% indicates. We would suggest moving only part of the way toward the observed experience for Rule of 90 retirements rather than all the way as recommended by Mercer. We also would suggest that some conservatism be introduced into the non-Rule of 90 retirement rates by moving only part of the way toward the observed experience.

Detailed Analysis

Mortality

A summary of the current and recommended mortality assumptions from the TRA Experience Study is shown below:

Assumption	Current	Recommended
Healthy Postretirement Mortality	1983 Group Annuity Mortality Table	RP2000 Annuitant Generational Mortality, White Collar Adjustment
Males	Set back 6 year	Set back 2 years
Females	Set back 3 year	Set back 3 years
Disabled Retiree Mortality	1965 RRB rates through age 54. For ages 55-64, graded between 1965 RRB rates and the healthy postretirement mortality table. Ages 65 and later, healthy postretirement mortality table.	RP2000 Disabled Retiree Mortality Table, no adjustment
Healthy Preretirement Mortality	1983 Group Annuity Mortality Table	RP2000 Non-Annuitant Generational Mortality, White Collar Adjustment
Males	Set back 12 years	Set back 5 years
Females	Set back 10 years	Set back 7 years

The post-retirement mortality assumption is one of the most important demographic assumptions because it impacts how long pension payments are expected to be paid. It is an established trend that people are living longer and most people believe this trend will continue. As a result, we believe it is appropriate to address future mortality improvements in the valuation of benefits. ASOP 35 states that actuaries "should consider…the likelihood and extent of mortality improvements in the future".

As Mercer explained in their report, there are two main ways to factor future mortality improvements into the valuation process. One is to use a single mortality table that predicts fewer deaths than are actually occurring at the present time which results in an Actual/Expected Ratio of over 100% (which is called a "margin"). With this method, the same probability of death applies to a member who is age 65 whether they reach age 65 in the current year or 40 years from now. The second approach is to use a mortality table that reflects the current experience of the membership (and hence the A/E ratio is 100%) and then projects anticipated future mortality improvements on a "generational" basis, i.e. mortality rates are set by

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the year in which a member reaches a particular age. In this case, a different probability of death would be used for a person reaching age 65 in the current year versus one reaching age 65 in 40 years (lower rates in future years). This latter approach actually results in a set of mortality tables that are used in the valuation based on when a member reaches a particular age.

Although the first approach is still common, we prefer the second approach (the use of generational mortality). It avoids the debate about how much "margin" should be maintained in the A/E ratio, more directly reflects expected mortality improvements for the applicable members and should require less dramatic adjustments for updated mortality tables in future years. Mercer recommended changing to the RP2000 Mortality Table on a generational basis and we concur with this recommendation. Mercer recommended using age adjustments to better fit the observed experience.

The A/E Ratios in the current and prior experience study, based on the current assumption are summarized below:

Healthy Postretirement	Actual Deaths		Expected Deaths		A/E Ratios	
	Current	Prior	Current	Prior	Current	Prior
Males	1,504	1,085	1,325	1,152	114%	94%
Females	2,004	1,720	1,735	1,436	116%	120%

An increase in the A/E ratio of 20% in a four-year period for males is a rather significant change in observed experience. Long term trends in mortality typically do not unfold this quickly. This unexpected result is not discussed in Mercer's report and is not explained by anything we could find in the experience study reports. The 1996-2000 Experience Study showed 923 deaths for males which appears to be more in line with the Segal report than the observed experience in the Mercer report. The drop in the A/E ratio could be random statistical variation or a difference in the data processing in the two studies. The exposure on which the expected counts were based was not included in the Segal report so we are unable to analyze whether the number is reasonable based on the number of retirees reported in the valuations during the study period. While the exposure in the Mercer experience study is reasonable based on the number of members receiving benefits shown in the valuation report for the years in the study, we noticed that the exposure count included more than just retirees. We asked Mercer and were told that both current retirees and survivors were included in the exposure in the experience study. Typically, we analyze these groups separately, in case there is a difference in the underlying mortality exhibited by each group. This could be masked if analyzing the data in aggregate. This is more important with a teacher retirement plan as teachers have historically exhibited much better mortality than the rest of the working population(including their spouses). Since not all members receive benefits as a joint and survivor benefit, anticipating the member's mortality is very important in obtaining a good estimate of the plan liabilities. While we prefer to analyze the experience separately for the two groups, Mercer's approach is not unreasonable. We do believe that the fact that experience is aggregated for retirees and survivors should be disclosed in the discussion of the mortality experience in the report. In the next experience study, we recommend the retiree liability be analyzed separately from the retired member mortality.

The experience in this study period indicates that the current assumption is predicting too few deaths. Given this experience, we concur with Mercer's recommendation to move to a more recent table. It is very common to use an age adjustment (forward or back) with a standard mortality table to obtain a better fit with the deserved experience. Mercer recommended a two-year age set back for males, and a three year set back for females. This is a common approach to provide a better fit to the observed experience, however the rates should be studied at various age groupings to be sure the fit is reasonable at all ages.

Overall the A/E ratios on the proposed assumption for both males and females are reasonable (males: 104%, females: 107%). In order to more closely analyze the experience we studied the A/E ratio (actual divided by expected deaths) at various age groupings as shown below:

Age	Males A/E Ratio		Females A/E Ratio	
	Current A/E Ratio	Proposed	Current A/E Ratio	Proposed
55-64	84%	88%	103%	80%
65-80	104%	101%	93%	82%
81-94	138%	114%	122%	119%
95+	148%	102%	154%	150%

The recommended assumption for males is a good fit for the core retirement ages of 65-80. Some adjustment at ages 81-94 might be desirable, but is not a pressing issue as more deaths occurring than anticipated results in favorable experience and there is lower exposure at the higher ages.

The analysis for females shows that using the proposed assumption anticipates significantly more deaths than actually occurred at ages 55 to 80 (A/E ratios around 80%). This is of concern for two reasons: (1) the highest number of retirees are in this age groupings and (2) these tend to include more recent retirees so their average benefit amount is higher and they are younger (thus, higher liability).
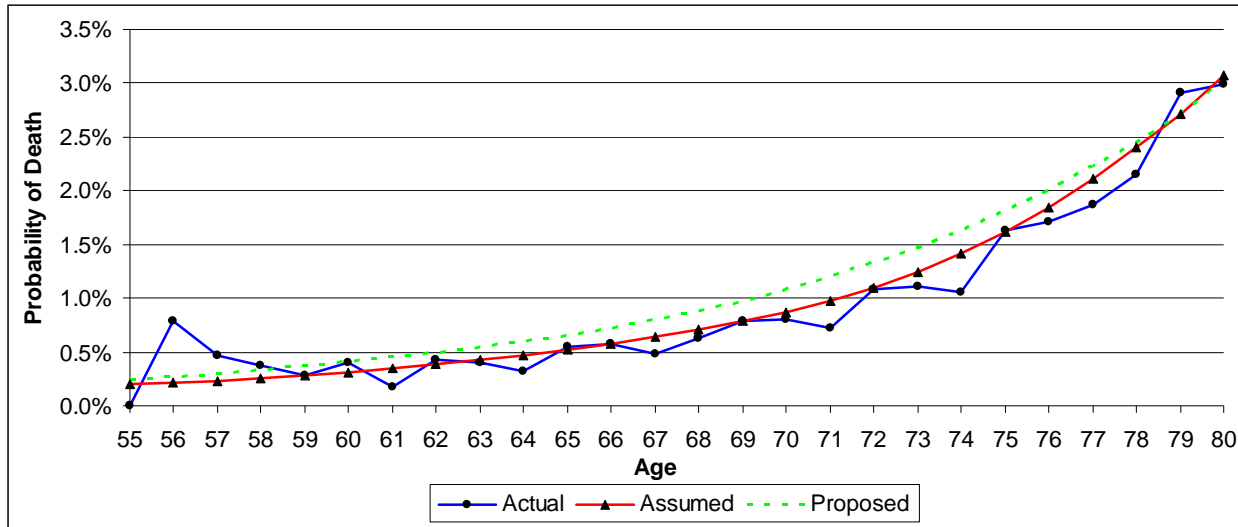
While we agree with Mercer's recommendation to move to the RP2000 generational mortality table with age adjustments, it appears some adjustment to the proposed table may be appropriate to create rates that are more representative of actual experience. Four years is a relatively short period to set mortality rates. Ideally, the experience from the prior period could be aggregated with the results of this study period. However, given the fact the underlying data may not be consistent with this study period, we do not believe this is feasible. We suggest Mercer revisit the assumption with particular attention to the fit of the assumption at core retirement ages.

We recognize that some actuaries prefer not to make adjustments to a standard table because the standard table is based on significantly more data than the experience study and is therefore, more statistically reliable.   We are likely influenced by our work for the states of Kansas and Iowa where the observed mortality rates were not a good fit to the standard RP-2000 Table at all ages even with the use of age adjustments (use of age set back or set forward) to improve the fit. The choice of whether or not to make adjustments to the standard table is a professional preference, but the Commission's Standards for Actuarial Work clearly indicate a preference to closely match actual experience.   Therefore, we believe it is reasonable to make adjustments to the table to more closely match actual experience.

Based on the information in the experience study, we concur with Mercer's recommendations for the pre-retirement mortality and disabled retiree mortality.
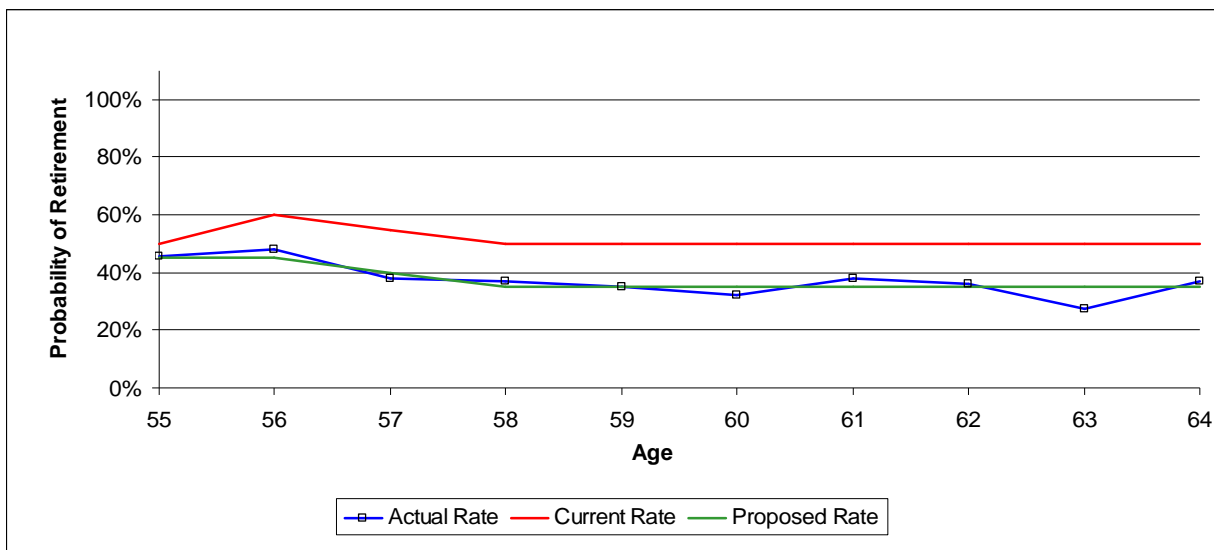
Retirement

The eligibility requirements for unreduced retirement benefits vary depending on the member's hire date. A summary of the retirement provisions is shown on the following page:

Hire Date	Normal Retirement Age	Early Retirement Age	Unreduced Retirement
Before July 1, 1989	Age 65 and 3 years	Age 55 and 3 years, or 30 years	Rule of 90 or Age 62 with 30 years
July 1, 1989 or later	Social Security Normal Retirement Age, but not later than 66 years, and 1 year of service	Age 55 and 3 years	N/A

It is common to observe different retirement patterns for members who are eligible for Rule of 90 unreduced benefits. Mercer analyzed the retirement experience separately for the Rule of 90 eligible group. We believe this is appropriate given the retirement provisions.

Rule of 90

In the last experience study, the retirement rates for members eligible to retire under Rule of 90 were increased for ages 56 and 57, with a resulting A/E Ratio of 107%. This A/E Ratio of 107% indicates the new rates still anticipated fewer retirements than the actual observed experience from 2000-2004. The experience in the current study indicated an A/E ratio of 72%, which is a dramatic drop from the 107% observed in the last study.


Because of the significant drop since the last study, we believe some conservatism should be retained in the retirement rates in case the experience in this study period is unusual and not a long-term trend. The recommended rates very closely match the actual experience during the study period as the resulting A/E ratio of 101% indicates. We would suggest moving only part of the way toward the observed experience rather than all the way as recommended by Mercer.

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With retirement eligibility that is based on a "Rule of" criteria, we often see higher retirement rates in the member's first year of eligibility and often a specific assumption is used for this "select" period. The period that occurs after the select period is called the "ultimate" period. Retirement rates are usually lower in the ultimate period. Mercer did not analyze the Rule of 90 experience on this basis. At this point, it would likely take a fair amount of time for Mercer or Milliman to analyze the retirement experience in this way. We recommend this be considered for the next experience study.

Non-Rule of 90

The graph below shows the actual retirements and the expected retirements under both the current and Mercer's proposed assumptions:
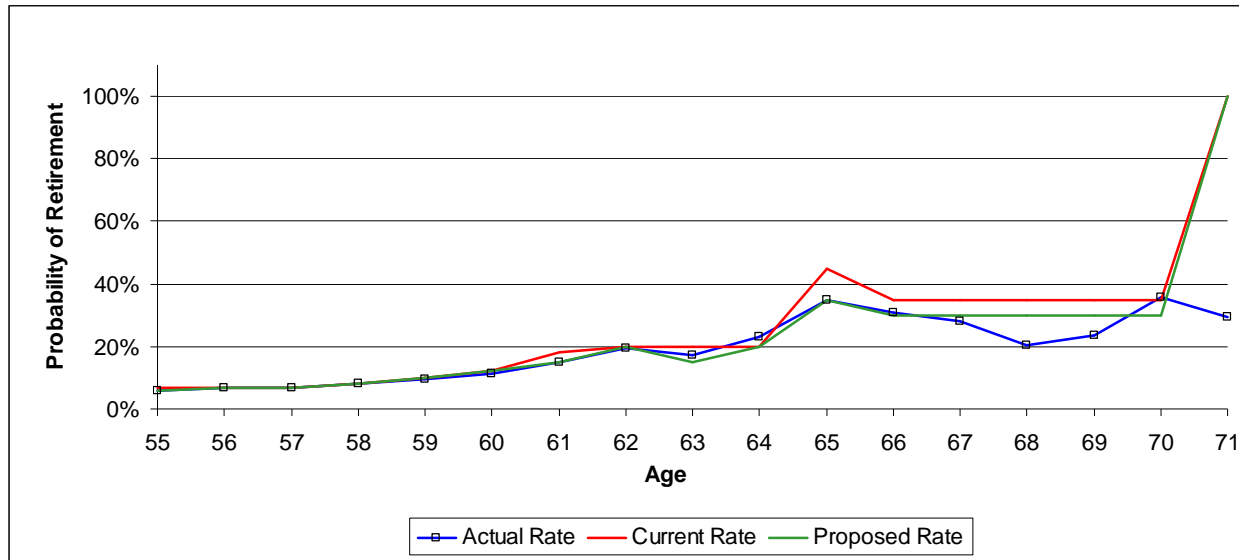
Retirement rates were decreased in the last experience study with a resulting A/E ratio of 77%. The A/E ratio in the current study, which is based on the same retirement rates, is 89%. The fit of the assumption improved, but was still lower than expected. Note, however, that the A/E ratio in the four year period increased from 77% to 89%. Mercer's recommended rates are very close to actual experience with a resulting A/E ratio of 97%. Given the current funding situation, our preference is to be more conservative in changing assumptions. While Mercer's changes are supported by the experience, our approach would be to move part of the way from the current assumption to the actual observed rates, but not completely to the actual rates, particularly given the fact that the assumptions were decreased in the last experience study and the experience in this study showed higher retirement rates than in the last study.

In addition, Mercer's report mentions that recent legislation raised the salary amount that retired members can earn without affecting the payment of their retirement benefit. They note that this legislation could affect retirement patterns (presumably resulting in higher retirement rates). Anticipating that higher retirement rates are likely in the future, it seems more proactive to keep some conservatism in the retirement rates.

We discussed this with Mercer and the retained actuary is of the opinion that retirement rates in the long term will likely be even lower than the observed experience due to improvements in mortality so the rates are justified. We are not convinced that longer life expectancy will automatically cause members to work longer especially when they are covered by a defined benefit plan. In addition, particularly in the teaching

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profession there seems to be a strong desire to retire earlier and supplement income with a second job or career. For the next 10 to 20 years, we believe that teachers will continue to put high value on their ability to retire earlier. Although the assumptions are intended to be long term estimates, the impact of the short term is more critical with respect to the Plan's funding as much of the active liability lies with members who are closer to retirement (the 40 and 50 year olds as compared to the 20 and 30 year olds). Therefore, higher retirement rates would provide more conservatism regarding future retirement experience, particularly on a liability weighted basis.

Retirement from Inactive Vested Status

For inactive members who are entitled to a future benefit, the current assumption is that the benefit will start at normal retirement age (unreduced benefits). If benefits begin before normal retirement age, they are actuarially reduced. Mercer recommends that the benefit commencement age remain at normal retirement age and we agree this assumption is appropriate.

Other Retirement Assumptions

The valuation utilizes assumptions as to the percent of retiring members who are married, the form of payment elected, and the age difference between the member and the joint annuitant. The data reported to Mercer does not contain marital status and beneficiary date of birth is only reported for those retirees that elect a joint and survivor form of payment. We agree with Mercer that there is insufficient information to analyze the marital status of members so the retention of the current assumptions is reasonable. Please note that Mercer did recommend that this data be provided by TRA so the appropriate analysis could be included in the next experience study.

The age difference for those electing a joint and survivor form of payment was reviewed to determine if the current age difference of females being three years younger than males was still appropriate. Based on the data Mercer recommended that the age difference for be lowered from 3 to 2 . We concur with this recommendation based on the data.

Certain optional forms of payment are not a pure actuarially equivalent to the "normal form", so if a member elects to retire under that form, the cost to the System is higher. In order to reflect this in the valuation an assumption is used as to the probability that a member will elect a particular form of payment. Based on the data observed, Mercer's recommended changes are reasonable.

Termination Assumption

The TRA valuation currently uses a "select" and "ultimate" assumption for termination of employment. Rates also vary by gender. A select period is used because the rates of termination of employment observed tend to vary by service as well as age, at least for a certain number of years. Theoretically, after the three year select period the rates of termination do not vary significantly by service, e.g. the rate of termination for someone age 40 would be about the same whether they had 4 years of service or 24.

Mercer commented that the actual experience showed that service has a strong influence on terminations, not only during the first three years of employment but well beyond that.   As a result, they recommended using a termination of employment assumption that is based on service and gender. While we generally agree with their comment, the report did not demonstrate the variation of termination rates at longer durations based on actual experience. We were subsequently provided with supplementary information by Mercer which did support this statement. We believe this information should have been in the report to substantiate the recommended assumption.

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Comparing the study results from the Mercer study (2009) and the Segal Study (2005), the number of terminations seems too dramatically different, particularly in the select period, as summarized below:

	Select			Ultimate		
	2009	**2005**	**Change**	**2009**	**2005**	**Change**
Males	3,148	4,470	(30%)	1,342	1,105	21%
Females	9,434	12,259	(23%)	4,427	3,597	23%
Total	12,582	16,729	(25%)	5,769	4,702	23%

We would not expect to see such a dramatic difference in the number of terminations without some reason to explain it. There is very little detail on the underlying data in the Segal report. In particular, the exposure is not shown. A review of the 1996-2000 Experience Study did not provide any insight into the situation. We believe that there must be some underlying difference in how members were counted in the exposure and decrement for termination of employment in the 2005 and 2009 study. The dramatic difference in the experience observed in the 2009 study compared to the 2005 study with no explanation would indicate to us that caution should be used in making any change in the termination assumption. In particular, it may not be the time to introduce a new approach to the assumption.

Based on Mercer's recommended assumption, the A/E ratio was 100% for both males and females. For the termination of employment assumption, more terminations than expected usually creates favorable experience (lower liabilities) so Mercer's recommendation contains no margin of conservatism. Consequently, if actual experience in the future is lower than assumed, it will create experience losses in the valuation reports. In order to be comfortable with the recommended assumption, the difference in the observed experience from the prior study needs to be explained or some conservatism could be introduced in the recommended assumption.

Disability Assumption

The disability assumption is used to determine the probability that an active member will become totally and permanently disabled after three years of service but before normal retirement age and will draw a disability retirement. Disability rates are typically very low, particularly at the younger ages. The small probability means that usually there are not very many disability retirements in the study period. For TRA, the total disability retirements over the four-year study period were 216. It is also fairly typical to see variance in disability rates between study periods, which we observed in the 2009 study as compared to the 2005 study. In the 2005 study, the A/E ratios for male and female were 100% and 126%, respectively.

The 2009 Study showed A/E Ratios of 73% and 103% for males and females, respectively. Mercer recommended using the female rates for both males and females as the data did not show a significant difference by gender. Aggregating the experience from the prior study would result in an A/E ratio of 86% for males and 114% for females. We believe Mercer's recommended change to male rates is reasonable based on the experience in both the current and prior study.

Merit Salary Scale

The salary increase assumption is actually the combination of the general wage growth assumption and the merit salary scale. While we consider the general wage growth assumption an economic assumption, the merit scale is a demographic assumption. The general wage growth assumption was discussed earlier with the other economic assumptions. The merit scale is discussed here as part of the demographic assumptions.

The current salary increase assumption is a five year select and ultimate scale, which anticipates higher salary increases in the first five years of employment (changed from a ten year select period to five in the 2005 experience study). This is a commonly used approach in setting the salary increase assumption. The actual salary increases were higher than expected in the select period (7.95% versus 6.80%) and

slightly lower than expected in the ultimate period (4.48% versus 4.77%). Overall the actual increase was 6.20% compared to an expected increase of 5.72%.

Developing the merit salary assumption creates a challenge because the data provides only total salary increases, i.e. it does not separately report general wage increases and merit scale. However, we typically attempt to "carve out" the actual general wage increase during the study period by considering salary increase for years of service over 30 as indicative of the general wage increase during the study period(this assumes there is no merit scale at that point in a person's career). By subtracting the general wage increase for the study period from the total salary increase, the merit scale for the study period can be isolated and analyzed. Once the merit scale is developed, it is added to the general wage increase to create the total salary increase assumption. Using this approach there is no salary increase that is lower than the general wage increase. Although the merit scale might be 0%, it is never negative.

Because increases in salary are usually directly related to economic conditions, we believe the total salary experience observed should be evaluated in light of recent economic conditions. There often is a lag before the events in the general economy manifest themselves in the salary increases granted by employers. Consequently, we reviewed the change in the CPI and the National Average Wage during the current study period and the prior four year period (to address the potential delay in recognizing economic conditions). The results are shown below:

Period	Change In CPI	Change in National Average Wage
2004 – 2008	2.5%	3.8%
2000 – 2004	2.3%	2.9%

Based on Mercer's report, the actual observed experience during the study period indicated an overall salary increase of about 6.2%. We believe it is very likely that the lower price inflation and general wage increase in the period of 2000 to 2004 impacted the observed salary experience rather than the economic experience which actually occurred during the study period. If this is the case, the overall merit scale would be about 3.2% (6.2% minus 3.0%). When the merit scale is added to the general wage growth assumption of 4.0%, the total overall salary increase assumption would be 7.2% rather than the recommended assumption which produces an overall salary increase of 6.2%. We believe that either the total salary scale is reasonable, but the general wage growth assumption is too high or the total salary scale is too low given the general wage growth assumption.

Mercer developed a salary increase assumption that has negative merit scale for service above 20 years. In our experience, it is uncommon to see negative merit salary assumptions, particularly commencing at that service level. Although it may work mathematically, we find it difficult to get comfortable with the concept. At a minimum, it raises a question as to whether the payroll growth assumption of 4.0%, which is used to calculate the amortization of the unfunded actuarial liability, is too high when a portion of the members are assumed to receive a salary increase less than the 4.0% general wage growth assumption. We recommend the assumption used to amortize the unfunded actuarial liability be revisited if the proposed salary increase assumption is maintained.

Mercer commented that the observed salary increases had a stronger correlation to service than age in general and they recommended moving to a pure service based table. We agree that the change to a service-based table is reasonable and in line with common actuarial practice for public retirement systems, but we are concerned that the proposed salary scale is based on only four years of experience and the results in this study period may not be representative of long term salary increases. In addition, the way the salary increase assumption was developed does not directly address the separate components of the assumption, i.e. the total salary assumption includes a merit scale and the general wage growth assumption. As discussed above, wage increases in general have been below the 4.0% recommended assumption over the last decade and we believe this overall economic trend could have impacted the salary experience in the study period. These factors make us less comfortable with the

recommended change in the assumption. In our opinion, the salary assumption being proposed does not provide much conservatism. We believe the salary assumption should be studied further to determine the appropriate change, particularly if a new service based assumption is to be implemented.

Given the importance of this assumption, we recommend there be further discussion on the general wage growth assumption and the merit scale.

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Audit Conclusion

In our opinion, the contents of the experience study reports for MSRS, PERA and TRA meet actuarial standards with respect to the information required to be included. In fact, significantly more information was provided than is required by Actuarial Standards of Practice (ASOPs). The reports were much more comprehensive than those we have seen that were prepared by other firms. While part of reason is the Commission's Standards for Actuarial Work, not all of it is required. Mercer should be recognized for the quality of the experience study reports. Without much of the detail included in the report, we would have been unable to provide the in-depth analysis included in this report.

Comments

We found the reports to be well organized and results presented in a useable fashion with summary results in the body of the report and detailed results in the appendices. We have a couple of recommendations for the next experience study report:

1. While the use of an A/E ratio is very common and is required by the Standards for Actuarial Work, we find it very helpful to also provide graphs that display the actual rates, current assumption and proposed assumption. The visual presentation makes it easier to understand the results and recommendations.

2. The investment return assumption should include analysis using SBI's capital market assumptions since they invest the money for all of the Funds. We believe including both SBI and Mercer's assumptions provides insight and context for evaluation of the investment return.

3. The actual rate of return on the market value and actuarial value of assets should be included as provided in the Standards for Actuarial Work.

4. The results of the prior experience study for each assumption should be reviewed and commented upon. Where appropriate and possible, the results should be combined to provide more data upon which to base the assumption.

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